Clear Creek Fire Authority

Clear Creek COUNTY, COLORADO

2025

Community Wildfire Protection Plan

Clear Creek Fire Authority
Community Wildfire Protection Plan
2025 Update

Prepared by CLEAR CREEK FIRE AUTHORITY

681 CR 308, Dumont, CO 80436

The Clear Creek Fire Authority would like to thank The Ember Alliance for providing the template on which this document is based, along with all the guidance provided at the CWPP Best Practices session at the Sixth National Cohesive Wildland Fire Management Strategy Workshop in Santa Fe, New Mexico.

Table of Contents

How to use the CCFA CWPP

This document is designed for everyone that lives, works, and manages land within and around the CCFA. Different sections will be most helpful to different people; please use this guide to direct you to the resources most relevant to you.

I want to learn the basics about wildfires, my local fire districts, and what a CWPP is.	**Look for:** •Section 1.a to learn about CWPPs •Section 2 to learn about wildfire threats in your local fire district •Section 3.a to learn what your next steps can be •Appendix A for an introduction to fire behavior
I'm a resident / homeowner and want to learn about protecting my family, home, and property from wildfires.	**Look for:** •Section 3.a to learn about the actions you can take, including detailed recommendations and research-backed guidance for protecting your home and family •Section 3.b to find detailed hazard ratings and recommendations for your neighborhood
I want to learn about community-led wildfire mitigation actions for the CLRRA.	**Look for:** •Sections 3.b, 3.d, and 3.e to learn about the actions communities can take together to better protect everyone, including funding opportunities •Section 3.c to find detailed hazard ratings and recommendations for your neighborhood
I'm with a government agency or cross-boundary organization and want to learn about landscape-scale wildfire mitigation.	**Look for:** •Section 2.d and 2.e to learn about fire history and treatment history in the area •Section 4.b to learn about priority fuel treatment projects for this community •Sections 4.c and 4.d for general recommendations for stand-level and roadside fuel treatments •Section 4.d to learn about pros and cons of different slash management options
I want to learn about the science behind these recommendations and how priorities were made.	**Look for:** •Appendix B to learn about methodology for assessing fire behavior and evacuation, on-the-ground hazard assessments, and treatment prioritization

Acronyms

CCFA	Clear Creek Fire Authority Fire Protection District
CR	County Road
CSFS	Colorado State Forest Service
CWDG	Community Wildfire Defense Grant
CWPP	Community Wildfire Protection Plan
DFPC	Division of Fire Prevention and Control
FAC	Fire Adapted Community
FEMA	Federal Emergency Management Agency
HIZ	Home Ignition Zone
HOA	Homeowner's Association
IIBHS	Insurance Institute for Business & Home Safety
IRPG	Incident Response Pocket Guide
ISO	Insurance Services Office
CCSO	Clear Creek County Sherriff's Office
NFPA	National Fire Protection Association
NWCG	National Wildfire Coordinating Group
RAWS	Remote Automatic Weather Stations
USFS	U.S. Forest Service
WUI	Wildland-Urban Interface

1. Introduction

1.a. Purpose and Need for a Community Wildfire Protection Plan

Community Wildfire Protection Plans (CWPPs) help communities assess local hazards and identify strategic investments to mitigate risk and promote preparedness (Figure 1.a.1). Assessments and discussions during the planning process can assist fire protection districts with fire operations in the event of a wildfire and help residents prioritize mitigation actions. These plans also assist with funding gaps for fuel mitigation projects since many grants require an approved CWPP.

Figure 1.a.1. Elements of a holistic and actionable CWPP.

Clear Creek County developed its original CWPP in August of 2008, further developing community-level CWPIPs from 2013 to 2015. The county portion within the 2020 Evergreen Fire Rescue CWPP has been excluded from this update. The Clear Creek Fire Authority CWPP will update and replace the original 2008 Clear Creek County CWPP while consolidating the information in each CWPIP into a single actionable document. Clear Creek Fire Authority covers approximately 347.5 square miles of the 396 square miles within Clear Creek County. This document explains the current wildland fire risks while providing direction for mitigation actions in the next five years.

The 2008 CWPP, along with each of the CWPIPs, was evaluated to determine what projects had been outlined and the priorities for each area. The project areas were then evaluated to determine what work had been accomplished and the current risks associated with each project area. It was determined that several landscape-scale projects had been completed in partnership with the USFS. The local-level risk reduction projects outlined in the individual implementation plans had not been accomplished. Each of these projects was field evaluated to determine if the project could be accomplished and if the project would result in a risk reduction. Each project that was determined to be viable was then reviewed with the stakeholders responsible for the individual area. This process produced a project list to be incorporated into the updated plan and the following risk reduction priorities:

- Increase defensible space within 30 feet of all structures within the plan area.
- Implement home hardening actions at the neighborhood or individual structure level.
- Perform roadside mitigation actions to improve residents' ability to evacuate effectively.
- Perform landscape-scale mitigation projects to link existing, mitigated areas together in alignment with USFS risk reduction goals.

Complex interactions among wildland fuels, weather, and topography determine how wildfires behave and spread. Many aspects of wildfires are predictable based on known scientific research on the physical processes driving fire. Much of the work in this CWPP is based on scientific research and computer models of wildfire behavior. A basic understanding of fire behavior aids in interpreting the findings and recommendations reported herein. See **Appendix A. Introduction to Wildfire Behavior and Terminology** and the **Glossary** on page 110 for the definition of key terms.

Why is the CWPP relevant to me?

Becoming a fire adapted community that can safely coexist with wildland fire takes a concerted, ongoing effort by everyone who lives, owns property, protects, or manages land in and around this community. Conditions in Clear Creek County share some risk factors common to past catastrophic wildfires across the country. This CWPP provides recommendations for how to prepare your family to safely evacuate during a wildfire, how to mitigate your home ignition zone to give your house a fighting chance at surviving wildfires and protect the lives of firefighters engaged in protecting your community.

Work you do to reduce fire risk on your property can amplify the work that your neighbors do on theirs, resulting in greater protection for everyone. Removing trees from along roadways can increase the visibility of your property to firefighters, increase the accessibility of your property for fire engines, and reduce the chance that non-survivable conditions can develop and entrap residents and first responders during wildfires.

This CWPP is a call to action to do your part to continue making Clear Creek a beautiful and safe community. Land management partners and Clear Creek Fire Authority are here to support your individual efforts, and they are committed to taking action to reduce wildfire risk and increase emergency preparedness for the benefit of this amazing community.

Virginia Canyon looking south above Idaho Springs.

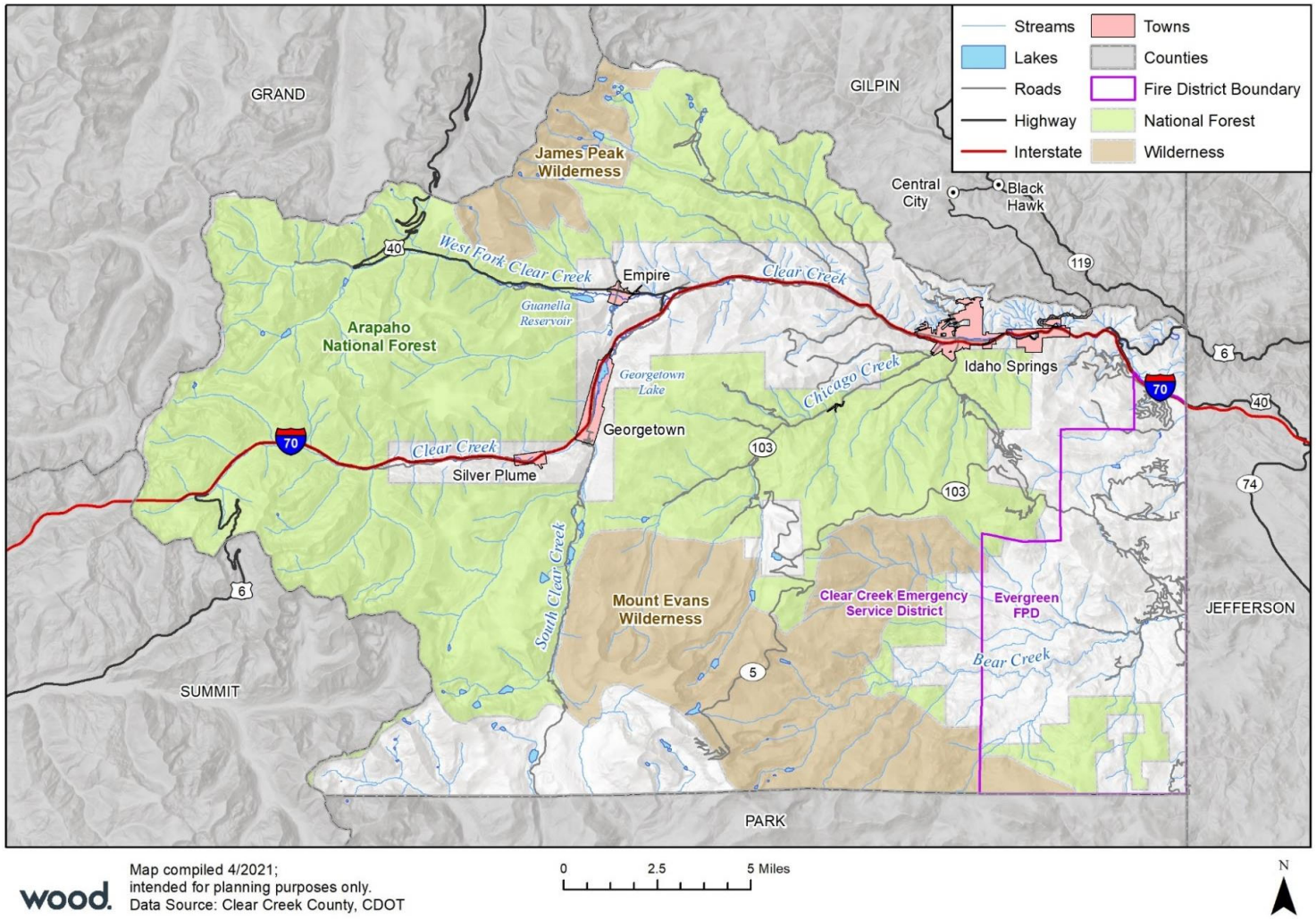


Figure 1.a.2. The Clear Creek Fire Authority boundary in Clear Creek County, Colorado].

Source: CCC Hazard Plan

1.b. Community and Partner Engagement

Collaboration is a crucial component of CWPPs. Community engagement, partner commitment, and follow-through make a CWPP successful. Clear Creek Fire Authority representatives engaged partners from across the district and neighboring districts to develop the recommendations outlined in this CWPP.

The Core Team would like to thank the following partners for their time and effort in developing, providing data, providing feedback, and planning implementation projects for this CWPP:

- Town of Georgetown
- Georgetown Historical Society
- Town of Silver Plume
- Town of Empire
- Clear Creek County Board of Commissioners
- City of Idaho Springs
- Colorado State Forest Service Golden District
- USFS Clear Creek Ranger District
- USFS Arapahoe National Forest Fire Management
- Evergreen Fire Rescue
- Clear Creek Watershed and Forest Health Partnership
- Clear Creek Open Space Commission
- Clear Creek County Public Works

1.c. Accomplishments Since Previous CWPP

Clear Creek Fire Authority

- Silver Dale Historic Area Phase One Mitigation.
- Sawmill Gulch access road mitigation.
- Dumont Cemetery hazard tree removal and mitigation.
- Silver Plume Cemetery defensible space project.
- York Gulch roadway hazard tree removal.

USFS

- Bard Creek Mitigation
- Blue Creek Mitigation
- Stevens Gulch Mitigation
- Fall River Mitigation

Blue Creek Mitigation above Empire

1.d. Integrations with Other Plans

Clear Creek County Hazard Mitigation Plan

The risk reduction actions are designed to align with the hazards identified in the 2022 Hazard Mitigation Plan. This included evaluating the overall natural disaster risk levels for each individual wildland plan unit and developing mitigation actions that best support the overall risk reduction goals.

Upper Clear Creek Watershed Pre-Wildland Fire Planning Study

The risk reduction actions must support the overall watershed goals of reducing sedimentation, wildland fire burn intensity, and protecting riparian areas. Wildland mitigation project prioritization from the plan was integrated into the future project design and prioritization process.

The forest action plan's risk profiles and priorities were integrated into developing plan unit risk profiles and mitigation action plans.

2. Clear Creek Fire Authority: Background

2.a. General Description

The Clear Creek Fire Authority district covers 347 square miles of Clear Creek County's 396 square miles. The western portion of the district consists of socially vulnerable communities (SVI) with limited financial resources to conduct home hardening or property fuel reductions. Nine mobile home communities within this SVI area are at an increased risk of property loss due to adjacent fuel loading and increased building density. 24% of the community members are 65 or older compared to the national average of 17%. This could result in an increase in difficulty during community evacuations. Eighty percent of community members own and occupy their homes.

Clear Creek Fire Authority's district is bordered by Summit Fire Rescue and East Grand Fire Protection District on the west, along the continental divide. The Timberline Fire Protection District and Central City Fire Rescue share the northern border. The district's east side borders Evergreen Fire Rescue, and Platte Canyon Fire Rescue covers the southern border. Evergreen Fire Rescue provides coverage for the 49 square miles of Clear Creek County that is not within the boundaries of Clear Creek Fire Authority. Mutual and automatic aid agreements are in place with each agency to provide enhanced fire response capabilities.

The land within the Clear Creek Fire Authority ranges from an elevation of 6900 feet in the east to 14,278 feet in the west on Grays Peak. Thirty-one miles of Interstate 70 within the district span the eastern border to the Eisenhower/Johnson Memorial tunnel on the western border. US 6 Clear Creek Canyon is on the east side, while the Loveland Pass portion crosses the Continental Divide on the west. US 40 Berthoud Pass crosses the Continental Divide in the northwest portion of the district. These routes are the primary east-west commerce routes in the central part of Colorado. These routes are critical to supporting emergency response within the district and facilitating community-level emergency evacuations in the case of a wildfire (**Figure 2.a.1**). Georgetown, Idaho Springs, and Silver Plume municipalities have National Historic Districts at risk of damage or loss due to wildland fire. The Cabin Creek hydroelectric power plant supplies a substantial portion of the community's electricity.

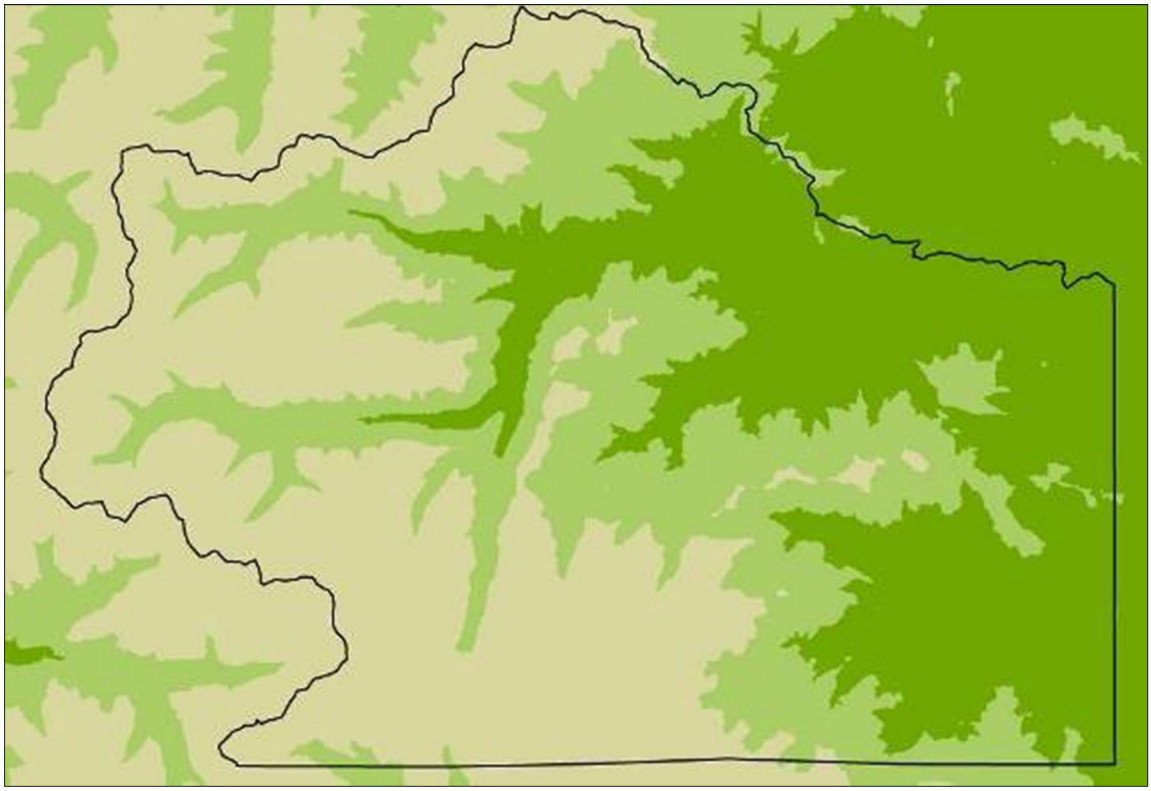
Although the community lacks a hospital, the Clear Creek County Health Center in Idaho Springs offers primary medical care and other community health services. The Georgetown Community School, Carlson Elementary School, and Clear Creek High School offer community sheltering opportunities in addition to their primary educational responsibilities.

The district encompasses the South Platte watershed in the southeastern portion and the Clear Creek watershed in the northwestern portion. Both watersheds are primary water sources for the communities in the Denver metro area, providing water to the four municipalities within the district and the Evergreen area of Jefferson County. Pre- and post-fire watershed protection is critical to supporting the communities within the district. The district lies within the Arapahoe-Roosevelt National Forests, specifically the Clear Creek Ranger District. The USFS federally manages sixty-eight percent of the land (**Figure 2.a.2**).

The region encompasses three unique elevation ecosystems: the Montane, the Subalpine, and the Alpine. Variation in vegetation communities is related to elevation and slope, slope aspect, drainage, available moisture, exposure to wind, type of soil, occurrence of fire or other major disturbances, and other factors.

Ecosystem boundaries are typically characterized by gradual species transitions rather than clear-cut points. However, each ecosystem has some plants and animals that are usually found within its limits.

Existing vegetation serves as the primary fuel source for wildland fires and significantly impacts fire behavior. Accurately mapping vegetative ground cover is critical to fuel modeling and fire behavior modeling. Understanding the fire behavior characteristics of particular fuel types facilitates effective fuel treatment strategies on a local and landscape level.



Distribution of Montane, Subalpine, and Alpine ecosystem zones within Clear Creek County

The **Montane Ecosystem** occurs at elevations between approximately 5,600 and 9,500 feet. Dry, south-facing slopes often have open stands of large ponderosa pines. The spacing of ponderosa pines is somewhat related to the availability of soil moisture. Grasses and shrubs may grow between the widely spaced trees on dry slopes.

North aspects of the Montane ecosystem retain more soil moisture and support denser stands of conifer that are less drought-resistant. The trees may be a mixture of Douglas fir, Lodgepole pine, Ponderosa pine, and an occasional Engelmann spruce. Shade-tolerant plants may grow on the forest floor.

Montane soils with high moisture content may support quaking aspen groves, whose leaves turn golden-yellow in the autumn and whose whitish bark is easily recognizable. Other water-loving small trees may be found along streams or the shores of lakes. These include various willows, mountain alder, and water birch with dark-colored bark. Blue spruce may grow near streams in a few places and sometimes hybridize with Engelmann spruce. Flat Montane valleys often have waterlogged soil and are unable to support the growth of evergreen forests.

Trees common to the Montane Ecosystem include Ponderosa pine, Douglas fir, Lodgepole pine, and Quaking aspen. Common shrubs include Antelope Bitterbrush, Kinnikinnick, Common Juniper, Holly Grape, Wax Currant, Big Sage, and Rocky Mountain Juniper.

The **Subalpine Ecosystem** occupies elevations between 9,000 and 11,000 feet. A typical subalpine forest may consist mainly of Subalpine fir and Engelmann spruce. However, previously burned or disrupted areas may contain varying amounts or even almost pure stands of Lodgepole pine. Lodgepole seedlings thrive in sunlight and are often abundant following a stand-replacement event, such as fire or deforestation. However, once the forest is re-established, plant succession may result in increasing amounts of spruce and Subalpine fir.

Ground cover in a previously burned forest area often includes two species of huckleberry. Limber pine may also be a part of subalpine forests. Engelmann spruce and Subalpine fir, which grow straight and tall in the lower subalpine forests, become shorter and deform nearer the tree line. At the tree line, tree seedlings may germinate on the left side of rocks and grow only as high as the rock, providing wind protection. Further growth is more horizontal than vertical, and additional rooting may occur where branches come into contact with the soil. The resulting low growth of dense trees is called krummholz. Well-established krummholz trees may be several hundred to a thousand years old.

Trees common to the Subalpine Ecosystem include Subalpine fir, Engelmann spruce, and Limber pine. Shrubs common in the Subalpine zone include Blueberry, Cinquefoil, Wax Currant, Elder, and Wood's Rose.

The **Alpine Ecosystem**, starting at elevations of 11,000 to 11,500 feet, completes the county's suite of vegetation ecosystems. While wildfire is rare at these high elevations, mentioning its associated plant types is warranted. Extreme weather conditions with strong, frequent winds and cold temperatures help limit what plants can grow there. Most alpine plants are perennial grasses and forbs, but willows may be found in protected ravines and shallow drainages. Cushion plants, looking like ground-hugging clumps of moss, escape the strong winds blowing a few inches above them. Where tundra soil is well-developed, grasses and sedges are common. Non-flowering lichens cling to rocks and soil.

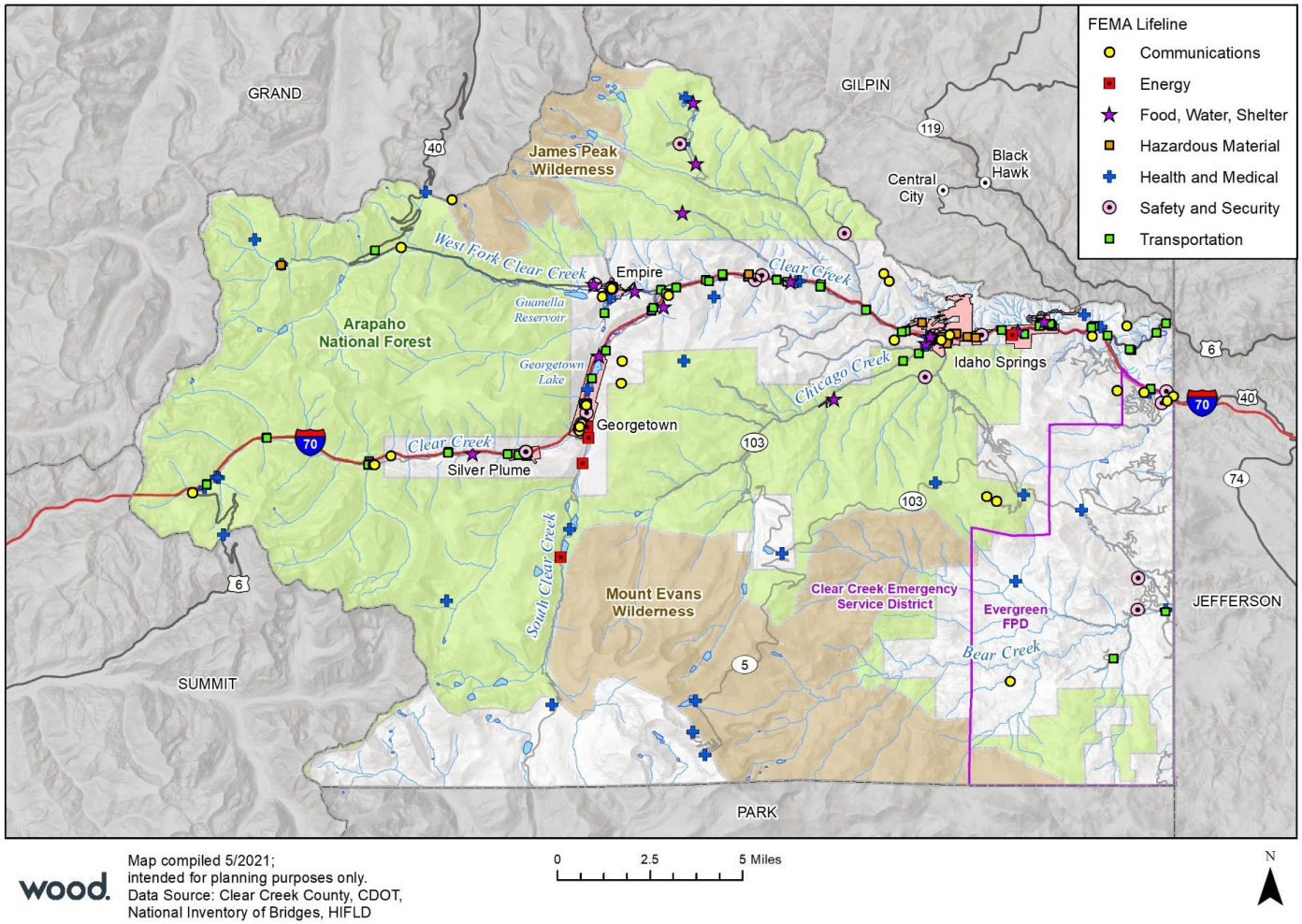


Figure 2.a.1. *Non-residential values at risk within and around Clear Creek Fire Authority.*

Sources: . CCC Hazard Plan

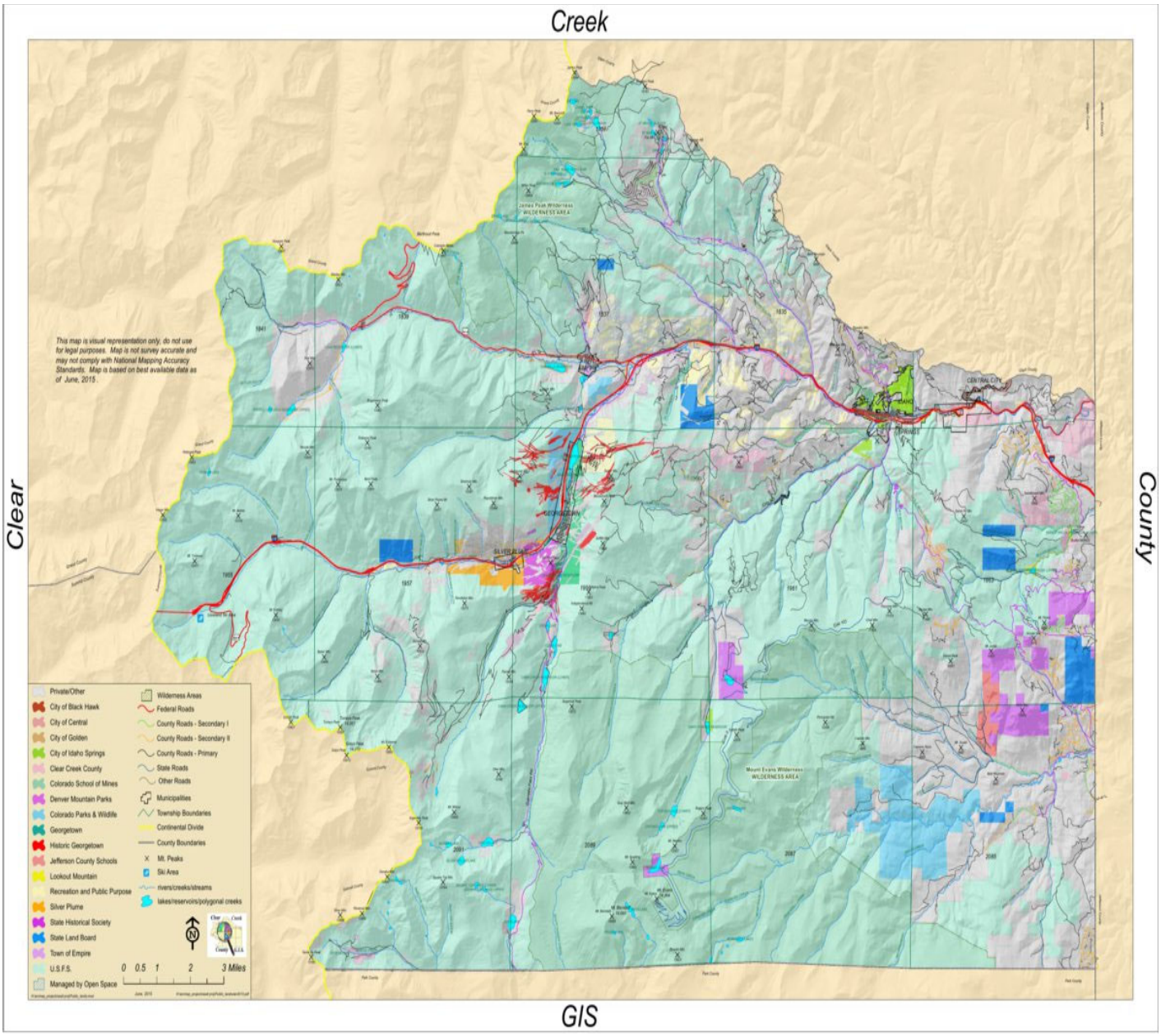


Figure 2.a.2. Publicly owned land across Clear Creek Fire Authority.

Source: Clear Creek County GIS

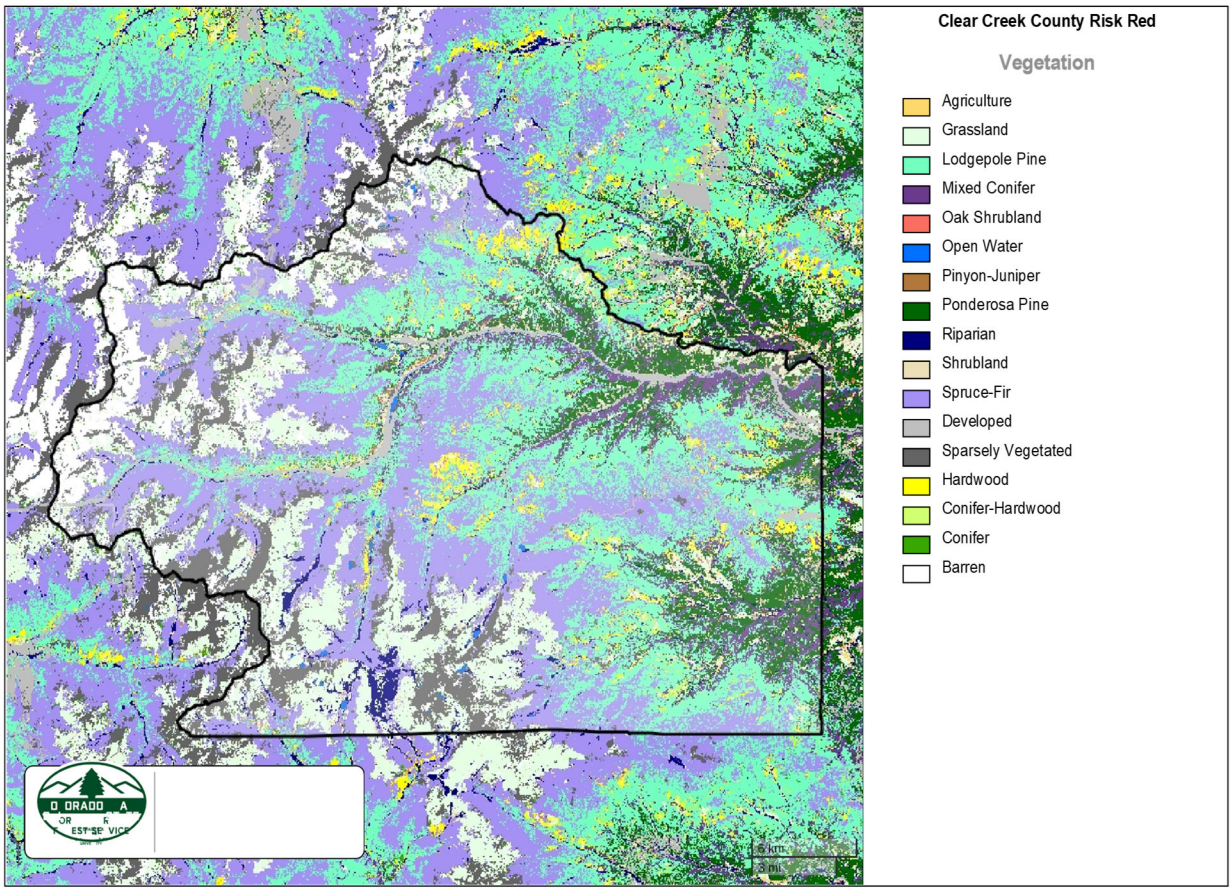


Figure 2.a.3. Map of vegetation across Clear Creek Fire Authority.

Source: CSFS Forest Atlas.

2.b. District Capacity

Clear Creek Fire Authority operates eight stations strategically located throughout the district. The Idaho Springs, Dumont, and Georgetown stations have 24/7 staffing that consists of both career and volunteer members. Stations in Empire, Floyd Hill, and Saint Mary's have resident quarters for six firefighters who reside in the district. The department has sixteen career firefighters: one Fire Chief, one Assistant Fire Chief, one Special Operations Captain, one Training Captain, one Shift Captain, five Shift lieutenants, and six firefighters. In addition to career staffing, the department has forty volunteer personnel, including one operations captain, one special operations lieutenant, one shift lieutenant, and thirty-seven firefighters. In addition to the above staffing, the department maintains a four-person seasonal mitigation crew, consisting of one supervisor and three wildland firefighters. This crew works twenty-six weeks each year, beginning in May, to provide additional wildland response capabilities while reducing risk through wildland mitigation projects in the community.

The Authority has thirty-five National Wildfire Coordinating Group (NWCG) qualified wildland firefighters. The qualifications range from Task Force Leader/Type 4 Incident Commander to the primary Type 2 Firefighter. This allows the agency to conduct simultaneous operations by integrating additional mutual aid resources from local, state, and federal partner agencies. The Clear Creek Sheriff transferred responsibility for wildland fire suppression to the agency in 2016, including the responsibility of maintaining the Marmots Type 2 initial attack crew. The crew was reconfigured to be a Type 2 wildland suppression module in 2019. The module can be configured as a ten-person hand crew or a combination of hand crew and engine configurations. This allows for the module to be configured to match the mission best and for two modules to be assembled and deployed to different incidents.

Apparatuses are strategically placed into the following stations:

Station 1 Dumont:

One Type 4 Engine/Tender with 1000-gallon water capacity

One Type 6 Wildland Engine

Two Polaris UTVs with patient transport capabilities

One 4x4 Utility support truck

Station 2 Idaho Springs:

One 75ft Quint Ladder Truck

One Type 4 Engine/Tender with 1000-gallon water capacity

One Type 6 All-hazard response engine

One Technical Rescue truck

One Water Rescue/ Hazardous Materials Truck

One Type 6 Wildland response engine

One 4x4 Utility support truck

Station 3 Empire:

One Type 4 Engine/Tender with 1000-gallon water capacity

One Type 2 Tender with a 2000-gallon water capacity

Station 4 Georgetown:

One 100ft Quint Ladder Truck

One Type 4 Engine/Tender with 1000-gallon water capacity

One Type 6 All-hazard response engine

Station 6 Floyd Hill:

Two Type 4 Engine/Tender with 1000-gallon water capacity

Station 7 Saint Mary's:

One Type 4 Engine/Tender with 1000-gallon water capacity

One Type 2 Tender with a 2000-gallon water capacity

One 4x4 Utility support truck

Station 8 Silver Plume:

One Type 4 Engine/Tender with 1000-gallon water capacity

Station 9 York Gulch:

One Type 4 Engine/Tender with 1000-gallon water capacity

Insurance Service Office Fire Hazard Ratings

The Insurance Service Office (ISO) provides fire and wildfire hazard assessment services for residential and commercial property insurers to help establish a standardized basis for appropriate fire insurance premiums. Over 44,000 fire-response jurisdictions are regularly assessed for up-to-date information

concerning a community's fire protection services. The Fire Suppression Rating Schedule provides a standardized methodology for reviewing the firefighting capabilities of individual communities. The schedule assesses major elements of a community's fire-suppression capacity and assigns a numerical rating, known as the Public Protection Classification. Ratings range from 1 (best) to 10 (worst). These ratings are established based on the following factors and are developed independently of any findings developed in the CWPP process:

- **Fire alarms**

Ten percent of the grading is based on how well the fire department receives fire alarms and dispatches its firefighting resources.

- **Engine companies**

Fifty percent of the overall grading is based on the number of "engine companies" and the amount of water a community needs to fight a fire. This includes the distribution of suppression resources, equipment maintenance, availability of personnel, and training.

- **Water supply**

Forty percent of the grading is based on the community's water supply. In urban interface settings where a municipal water supply is available, the water supply is assessed for fire suppression capacity beyond daily maximum consumption and the distribution of fire hydrants. In rural areas, documenting the ability to provide a continuous water supply to firefighting apparatus through a water tender relay may suffice.

The current ISO ratings for various areas within the Clear Creek Fire Authority range from 4, in areas serviced by a municipal water supply, to 9X, in isolated subdivisions with no available emergency water resources.

2.c. Wildland-Urban Interface

The WUI is an area where the built environment meets wildfire-prone areas—places where wildland fire can move between natural vegetation and the built environment and result in negative impacts on the community (Forge, 2018). People who live and work in the WUI must be aware of the effect that ecosystem processes and disturbances, such as wildland fires, have on their lives. WUI exists along a continuum of wildland to urban densities (**Figure 2.c.1**). Wildland-urban intermix refers to areas where housing and wildland vegetation intermingle, while wildland-urban interface refers to areas where housing is in the vicinity of a large area of dense wildland vegetation (Martinuzzi et al., 2015).

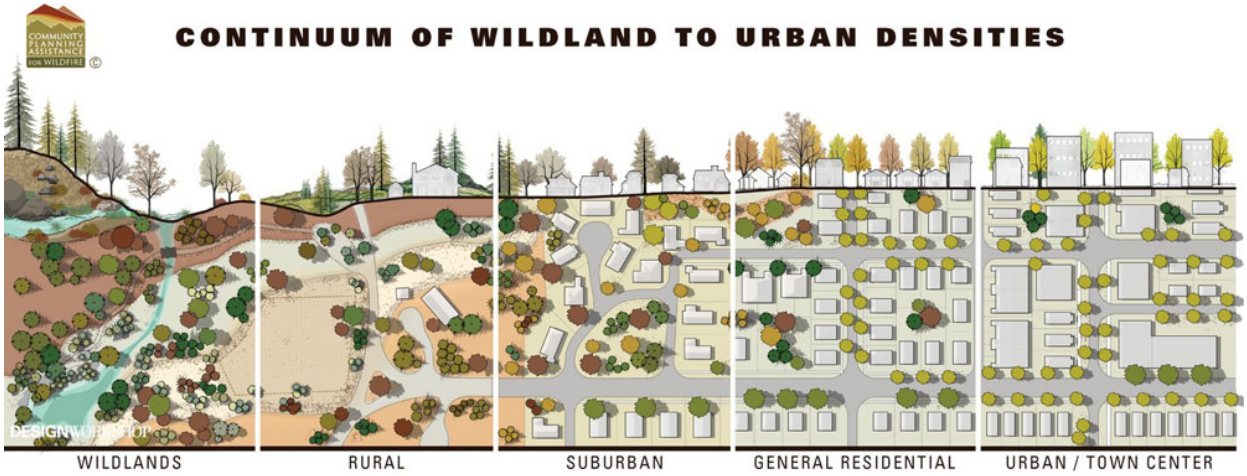


Figure 2.c.1*. The wildland-urban interface exists along a continuum of wildland to urban densities. Source: Community Planning Assistance for Wildfire.*

Due to the topography, the residents within the Clear Creek Fire Authority borders primarily reside within the valley floors of the drainages or adjacent to the valley floor. All community areas are either adjacent to forested areas or constructed within a forested area. These conditions put 99% of the residents within the wildland-urban interface (WUI) risk areas. (**Figure 2.c.2**). According to the 2020 Wildfire Risk to Communities analysis by the U.S. Forest Service, homes in Clear Creek Fire Authority and the surrounding areas have a higher risk of fire than 95% of the communities in the United States (USFS, 2021a)The number of available buildable properties has steadily decreased over the last ten years, forcing new development to move farther out from the valley floor. This has increased the wildfire risk in some portions of the community.

The Wildland-Urban Interface (WUI) Risk Index layer is a rating of the potential impact of a wildfire on people and their homes.

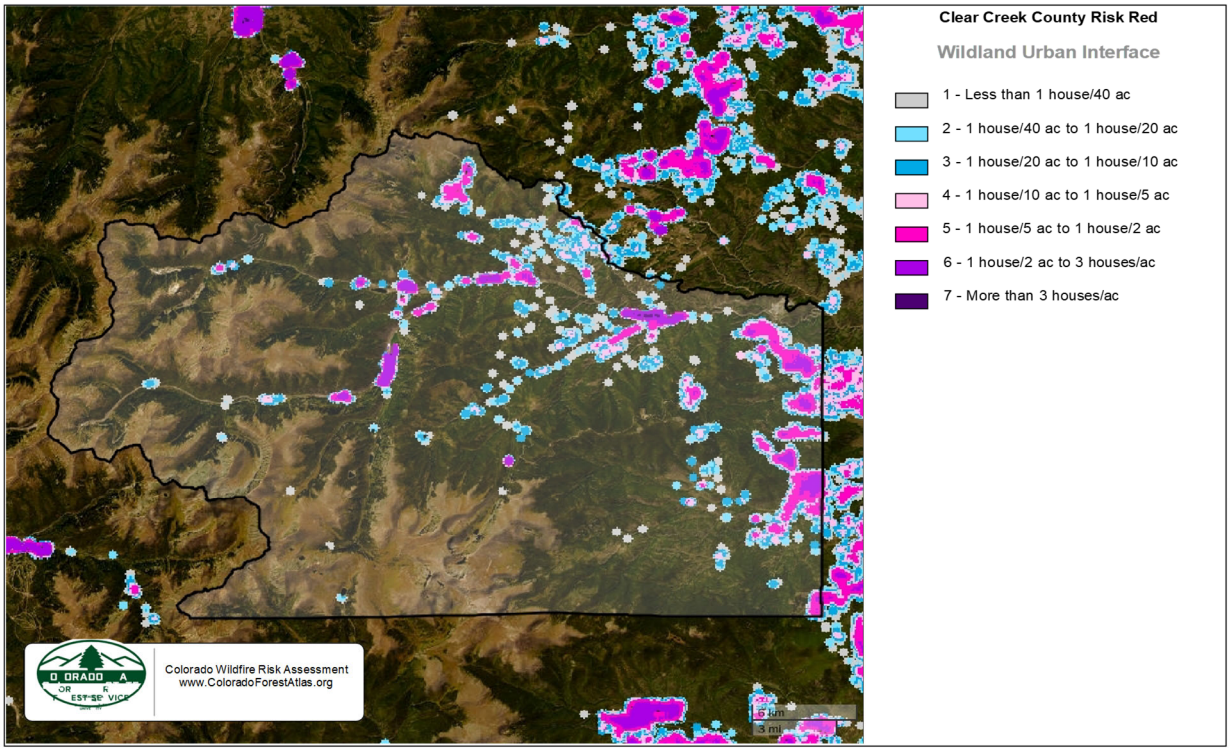
The key input, WUI, reflects housing density (houses per acre) consistent with Federal Register National standards. The location of people living in the wildland-urban interface and rural areas is essential for defining potential wildfire impacts to people and homes.

The WUI Risk Index is derived using a response function modeling approach. Response functions are a method of assigning a net change in the value to a resource or asset based on susceptibility to fire at different intensity levels, such as flame length.

To calculate the WUI Risk Index, the WUI housing density data were combined with flame length data, and response functions were defined to represent potential impacts. The response functions were defined by a team of experts led by Colorado State Forest Service mitigation planning staff. By combining flame length with the WUI housing density data, it is possible to determine where the greatest potential impact on homes and people is likely to occur. Customized urban encroachment algorithms were used to ensure that those fringe urban areas were included in the WUI Risk outputs. Encroachment distances into urban areas were based on the underlying fuel models and their fuel types and propensity for spotting and spreading.

The WUI Risk Index has been consistently calculated for all areas in Colorado, allowing for comparison and ordination of areas across the entire state. Data is modeled at a 20-meter cell resolution, which is consistent with other CO-WRA layers.

For the purpose of this CWPP, the WUI boundary includes all of Clear Creek County, the surrounding landscape that could transmit wildland fire into the Clear Creek Fire Authority, and the area along important evacuation routes (**Figure 2.c.2**; see methodology in **Appendix B**. Strategic wildfire mitigation across the WUI can increase the safety of residents and wildland firefighters and can reduce the chances of home loss.



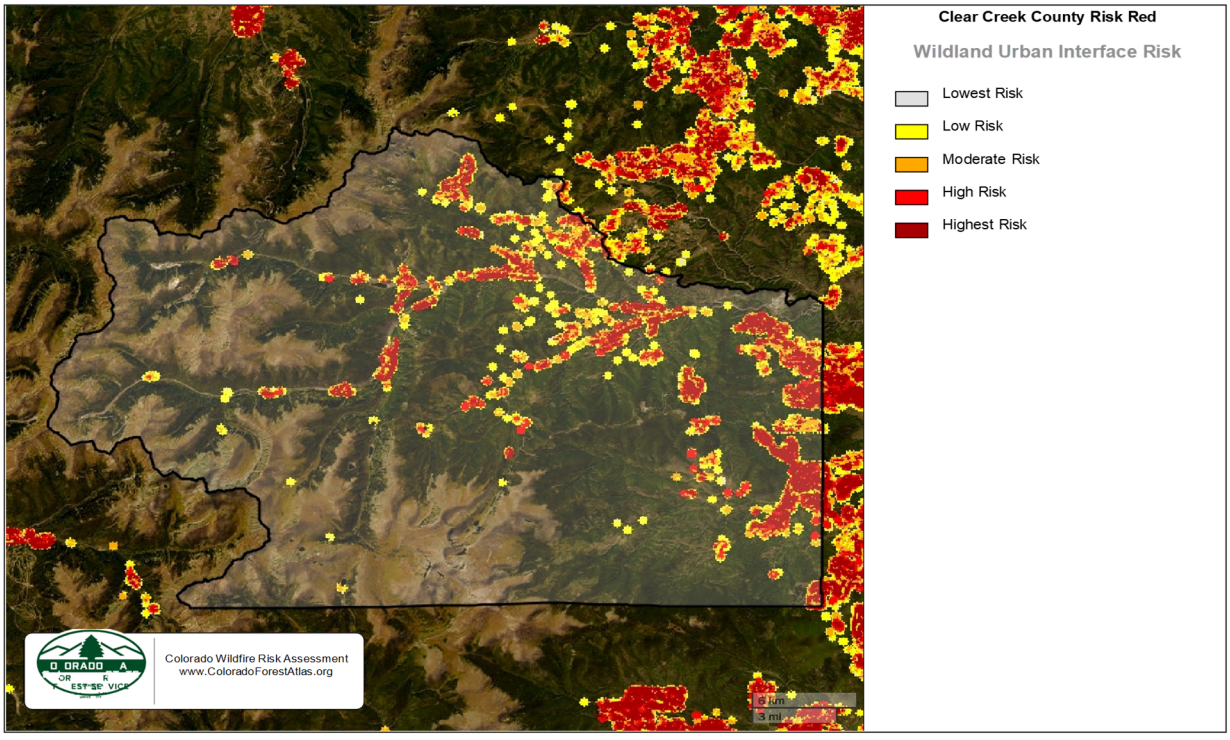


Figure 2.c.2. *Residents in the Clear Creek Fire Authority Wildland-Urban Interface and/or Intermix are exposed to elevated wildfire risk. For this CWPP, the WUI boundary was determined to be population areas within the forest or adjacent to forested areas in Clear Creek County (see methodology in* ***Appendix B****). Source: CSFS Forrest Atlas*

2.d. Fire History

Members of the Ute tribe inhabited Clear Creek during the United States' westward expansion. Fire was used to manage the forest, limiting fire growth while supporting the traditional hunting grounds. The discovery of gold in what is now Idaho Springs in the winter of 1859 began sixty years of human-caused

fires combined with rapid deforestation due to increased mining activity. The drawdown of mining in the 1920s reduced timber demand. The reforestation of large parts of the county consisted of lodgepole pine stands replacing areas previously mixed conifer stands.

The era of reforestation was combined with the public policy to suppress all wildland fires, whether human or naturally caused. These policies have produced a landscape with limited fire impact over the previous century, resulting in increased tree density and large amounts of timber litter throughout the county. Most fires over the last twenty years have been five acres in size or less due to rapid fire suppression actions. While this tactic has limited the impact of these fires, it has not reduced the overall fire risks within these timber stands.

Historic Named Fire History from 2002-2024

Fire	Month/Year	Acres Burned	Comments
North Spring Fire	June 2002	9	
Fountain Gulch	June 2002	200	
Fox Gulch Fire	May 2004	1.5	
Benchmark 263 Fire	June 2004	5	USFS Lands
Closet Fire	August 2004	<1	
Hidden Valley Fire	August 2004	<1	
Naylor Lake Fire	July 2005	1	
Three Valley Tree Fire	August 2005	<1	
Dumont East Fire	September 2005	<1	
Devil's Gate Fire	June 2006	<1	
Hwy 103 MM 12 Fire	June 2006	<1	
York Gulch Road Fire	June 2006	<1	
Devil's Tongue Fire	July 2006	<1	USFS Lands
Standley 236 Fire	September 2007	<1	
Alvarado Fire	November 2007	25	
Devil's Canyon	June 2008	14	USFS Lands
Red Elephant Fire	June 2019	10	
Miners Candle	December 2021	20	
Note: OEM - Office of Emergency Management Source: 2008 Community Wildfire Protection Plan for Clear Creek County, CO Forest Atlas			

2.e. Potential Fire Behavior and Exposure in Clear Creek Fire Authority

Many neighborhoods in the Clear Creek Fire Authority could experience extreme fire behavior that could put the lives of residents, visitors, and firefighters at risk. Residents are exposed to steep slopes, dense forests, limited road access in and out of neighborhoods, and flammable buildings, contributing to this dangerous situation.

Canopy fires are very dangerous, destructive, and difficult to control due to their increased fire intensity. From a planning perspective, it is important to identify where these conditions are likely to occur on the landscape so that special preparedness measures can be taken if necessary. The Fire Type layer shows the footprint of where these areas are most likely to occur. However, it is essential to note that canopy fires are not restricted to these areas. Under the right conditions, it can occur in other canopied areas.

There are two primary fire types – surface fire and canopy fire. Canopy fire can be further subdivided into passive canopy fire and active canopy fire. A short description of each of these is provided below.

- Surface Fire - A fire that spreads through surface fuel without consuming any overlying canopy fuel. Surface fuels include grass, timber litter, shrub/brush, slash, and other dead or live vegetation within about 6 feet of the ground.
- Passive Canopy Fire – A type of crown fire in which the crowns of individual trees or small groups of trees burn, but solid flaming in the canopy cannot be maintained except for short periods (Scott & Reinhardt, 2001).
- Conditional Crown Fire – A type of crown fire in which an active crown fire is possible, but one would not be predicted to initiate. Two outcomes are likely in that situation: surface fire if the fire starts as a surface fire, or active crown fire if the fire enters the stand as an active crown fire.
- Active Canopy Fire - A crown fire in which the entire fuel complex (canopy) is involved in flame, but the crowning phase remains dependent on heat released from surface fuel for continued spread (Scott & Reinhardt, 2001).

The fire-type map is derived at a 20-meter resolution and was estimated based on the extreme weather scenario (percentile 97th). This scale of data was chosen to be consistent with the accuracy of the primary surface fuels dataset used in the assessment. While not appropriate for site-specific analysis, it is appropriate for regional, county, or local planning efforts.

Quantifies the potential fire intensity by order of magnitude.

The Fire Intensity Scale (FIS) specifically identifies areas where significant fuel hazards and associated dangerous fire behavior potential exist. Like the Richter earthquake scale, FIS provides a standard scale to measure potential wildfire intensity. FIS consists of five (5) classes, with an order of magnitude between classes tenfold. The minimum class, Class 1, represents very low wildfire intensities, and the maximum class, Class 5, represents very high wildfire intensities.

1. Class 1, Lowest Intensity:

Very small, discontinuous flames, usually less than 1 foot in length; very low rate of spread; no spotting. Fires are typically easy to suppress by firefighters with basic training and non-specialized equipment.

2. Class 2, Low:

Small flames, usually less than two feet long; a small amount of very short-range spotting is possible. Fires can be easily suppressed by trained firefighters using protective equipment and specialized tools.

3. Class 3, Moderate:

Flames up to 8 feet in length; short-range spotting is possible. Trained firefighters will find these fires difficult to suppress without support from aircraft or engines, but dozer and plows are generally effective. Increasing potential for harm or damage to life and property.

4. Class 4, High:

Large Flames, up to 30 feet in length; short-range spotting common; medium range spotting possible. Direct attack by trained firefighters, engines, and dozers is generally ineffective, indirect attack may be effective. Significant potential for harm or damage to life and property.

5. Class 5, Highest Intensity:

Very large flames up to 150 feet in length; profuse short-range spotting; frequent long-range spotting; strong fire-induced winds. An indirect attack is marginally effective at the head of the fire. Great potential for harm or damage to life and property.

Burn Probability and Fire Intensity Scale are designed to complement each other. Unlike Wildfire Threat, the Fire Intensity Scale does not incorporate historical occurrence information. It only evaluates the potential fire behavior for an area, regardless if any fires have occurred there in the past. This additional information allows mitigation planners to quickly identify areas where dangerous fire behavior potential exists in relationship to nearby homes or other valued assets. Since all areas in Colorado have a fire intensity scale calculated consistently, it allows for comparison and ordination of areas across the entire state. For example, a high-fire-intensity area in Eastern Colorado is equivalent to a high-fire-intensity area in Western Colorado. The fire intensity scale is a fire behavior output, which is influenced by three environmental factors - fuels, weather, and topography – and the spread itself (back, flank, or head fire influences fire behavior for a given pixel for a specific fire simulation). Weather is by far the most dynamic variable as it changes frequently. Thus, each pixel may burn many times with different fire spread patterns based on the aforementioned factors. The fire intensity scale maps represent an average fire intensity map. The fire intensity scale map is derived at a 20-meter resolution. This scale of data was chosen to be consistent with the accuracy of the primary surface fuels dataset used in the assessment. While not appropriate for site-specific analysis, it is appropriate for regional, county, or local planning efforts.

Unless structural density is high, existing vegetation is the primary fuel source for wildland fire and has a direct effect on fire behavior. Understanding the fire behavior characteristics of particular vegetation types is paramount in predictive fire behavior modeling. There are several systems for classifying fuel models. This analysis utilizes the most commonly used fuel modeling methodology as developed by Hal E. Anderson (1982). Thirteen FBFMs are presented in four fuel groups: grasslands, shrublands, timber litter and understory, and logging slash. Each group comprises three or more fuel models.

Fire Behavior Fuel Model Descriptions Found in Clear Creek County

FBFM	Description
1 Short Grass	**Grass Group** – Fire spread is determined by the fine, very porous, and continuous herbaceous fuels that have or are nearly cured. These are surface fires move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one-third cover of the area. Annual and perennial grasses occur in this model. Fire ROS can exceed 300 chains per hour with flame lengths over 8 feet.
2 Grass with Timber/Shrub Overstory	**Grass Group—**Fire spread occurs through curing of dead herbaceous fuels. These are surface fires in which downed woody debris from the shrub and tree component adds to fire intensity. Open shrublands, pine stands, or oakbrush stands that cover one- to two-thirds of the area generally fit this model.

4 Mature Brush	**Shrub Group** – High-intensity and fast-spreading fires involve the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory.
5 Young Brush	**Shrub Group** – Fire is generally carried in the surface fuels made up of litter cast by the shrubs and grasses or forbs in the understory. The live vegetation produces poor burning qualities.
6 Intermediate or Dormant Brush	**Shrub Group** – Fire spreads through the shrub layer with flammable foliage but requires moderate winds to maintain the foliage fire. Fire will drop to the ground in low-wind situations. Shrubs are mature, with heights less than 6 feet. These stands include oak brush and mountain mahogany less than 6 feet tall. The fire rate of spread can be rapid, with flame lengths of 6 to 10 feet.
8 Closed or Short-Needle Timber Litter–Light Fuel Load	**Timber Group—**These fuels produce slow-burning ground fires with low flame lengths. Occasional "jackpots" in heavy fuel concentrations may occur. These fuels pose a fire hazard only under severe weather conditions with high temperatures, low humidity, and high winds. They are mixed conifer stands with little undergrowth. The fire rate of spread is up to 106 feet per hour, and flame lengths are 1 foot.
9 Hardwood or Long-Needle or Timber Litter–Moderate Ground Fuel	**Timber Group** – Fires run through the surface litter faster than in FBFM 8 and have longer flame lengths. These are semi-closed to closed canopy stands of long-needle conifers, such as ponderosa pine. The compact litter layer consists mainly of needles and occasional twigs. Concentrations of dead-down woody material contribute to tree torching, spotting, and crowning. The fire rate of spread is up to 27 chains per hour with flame lengths of 5 feet.
10 Mature/Overmature Timber and Understory	**Timber Group** – Surface fires burn with greater intensity than the other timber litter models. Dead and down are heavier than other timber models, and the stands are more prone to hard-to-control fire behavior such as torching, spotting, and crown runs.

Source: (Anderson,1982)

FBFM 1 – Short Grass

Characteristics: Grassland and savanna vegetation are dominant. Very little shrub or timber overstory is present, generally less than 30 percent of the area. Western perennial and annual grasses such as western wheatgrass, buffalograss, blue grama, and little bluestem that characterize short- to mid-grass prairie are common. Cheatgrass, medusahead, ryegrasses, and fescues occur at slightly higher elevations. Grass/shrub combinations that meet the above criteria are also represented.

Fire Behavior: Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires burn as surface fires that move rapidly through the cured grass and associated material.

FBFM 2 – Grass with Timber/Shrub Overstory

Characteristics: FBFM 2 defines surface fuels found in open conifer, shrub, or riparian stands. Ground cover generally consists of grasses, needles, and small woody litter. Conifers are typically mature and widely spaced. Limited shrub or regeneration may be present. This model favors mature conifer in the foothill to montane zones. Open shrubland, pine stands, or Rocky

Mountain juniper that cover one-third to two-thirds of the area may generally fit this model. Such stands may include clumps of fuels that generate higher fire intensities that may produce firebrands (embers that stay ignited and aloft for great distances).

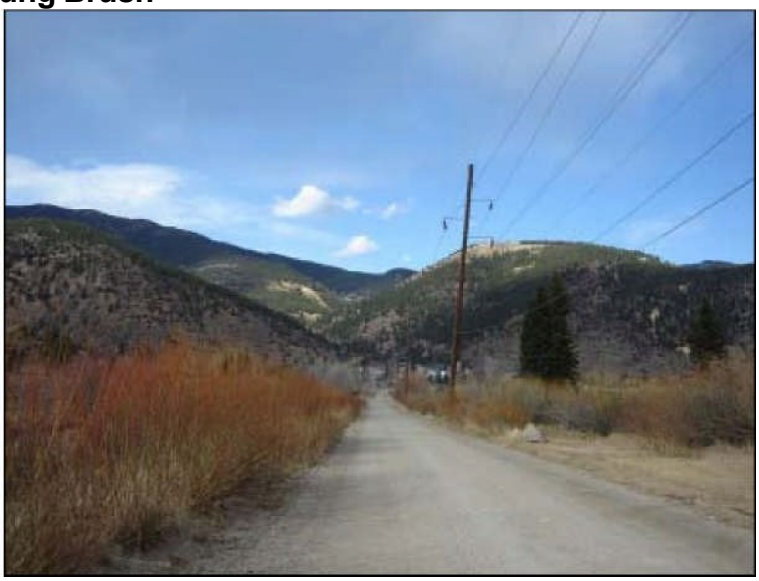
Fire Behavior: Fire is spread primarily through fine herbaceous fuels, either curing or dead. These are surface fires in which the herbaceous material, in addition to litter and dead-down stem wood from the open shrub or timber overstory, contributes to the fire intensity.

FBFM 4 – Mature Brush

Characteristics: Stands of mature shrubs 6 or more feet in height, local oak brush, and tall western sage with flammable foliage and a significant dead component fit this model (Figure 3). A deep litter layer may also be present. Actual brush height qualifying for this model varies and depends on local conditions.

Fire Behavior: High fire intensity and fast-spreading fires involve the foliage and live and dead fine woody material in the crowns of a nearly continuous secondary overstory.

FBFM 5 – Young Brush



Characteristics: Shrubs in FBFM 5 are younger than in FBFM 6, not as tall as in FBFM 4, and do not contain as much fuel as in FBFMs 4 and 6. Shrub height is less than 6 feet tall, and shrubs cover most of area. Young green stands with no dead wood qualify for this FBFM. Fuel situations would include young stands of oak and mountain mahogany.

Fire Behavior: Fire is generally carried on the surface fuels, which are litter cast by the shrubs, grasses, and forbs in the understory. Live vegetation produces poor burning qualities.

FBFM 6 – Intermediate or Dormant Brush

Characteristics: Shrubs in FBFM 6 are older than in FBFM 5, not as tall as in FBFM 4, and do not contain as much fuel as in FBFM 4. Fuel situations to be considered include intermediate stands of chamise, chaparral, oak brush, mountain mahogany, and juniper shrublands.

Fire Behavior: Fires carry through the shrub layer where the foliage is more flammable than in FBFM 5; however, this requires moderate winds (greater than 8 mph at midflame height). Fire will drop to the ground at low wind speeds or break in continuous stands.

Source: Anderson 1982C-5

FBFM 8 – Closed or Short-Needle Timber Litter – Light Fuel Load

Characteristics: Closed canopy stands of short-needle conifers or hardwoods that have leafed out support fire in the compact litter layer. This layer is mainly needles, leaves, and twigs because little undergrowth is present in the stand. Representative conifer types are white pine, Lodgepole Pine, spruce, and fir. Ponderosa pine can also be included if the understory reflects these characteristics.

Fire Behavior: Fires associated with this model are generally slow-burning, low-intensity ground fires, although a fire may encounter an occasional area of heavy fuels concentration that can flare up (jackpot). Only under severe fire weather conditions does this fuel model pose a significant fire hazard, and this is typically due to fire becoming active in the crowns of trees.

FBFM 9 – Hardwood or Long-Needle or Timber Litter – Moderate Ground Fuel Load

Characteristics: Both long-needle conifer and hardwood stands, especially the oak-hickory types, are characterized by FBFM 9. Closed stands of long-needle pine such as ponderosa pine are grouped in this model.

Fire Behavior: Fires run through the surface litter faster than in FBFM 8 and have longer flame lengths. Fall fires in hardwoods are predictable; however, high winds will actually cause higher rates of spread than predicted because of spotting caused by rolling or blowing embers and fire brands. Concentrations of dead-down woody material will contribute to possible torching, crowning, and spotting.

Source: Anderson 1982C-7

FBFM 10 – Mature/Over Mature Timber and Understory

Characteristics: Any forest type may be considered FBFM 10 if heavy downed woody material is present. Locally, this model is represented by dense stands of over-mature ponderosa pine, Lodgepole Pine, mixed conifer, and continuous stands of Douglas fir. Examples include insect or disease-ridden stands, wind-thrown stands, over-mature situations with deadfall, and aged light thinning or partial-cut slash. Dead-down fuels include large quantities of 3-inch or larger limb wood resulting from over-maturity or natural events that create a large load of dead material on the forest floor.

Fire Behavior: Fire will burn in the surface and ground fuels more intensely than the other timber litter models. Crowning out, spotting, and torching of individual trees is more frequent in this fuel situation, leading to potential fire control difficulties.

Source: Anderson 1982C-8

Grasslands, FBFMs 1 and 2

Grass fuels are most common on south-facing slopes and valley meadows. On many forested slopes with a south-facing aspect, grasses may mix with open ponderosa pine and shrubs to form a vegetative understory. The short- and mid-grass species common to this area include blue grama, western wheatgrass, needle-and-thread, and prairie June grass. These western annual grasses are adapted to the relatively frequent disturbance of fire and benefit from fast-moving, "cool" fire because it removes excess dried biomass and adds nutrients to the soil. In the absence of these periodic fires, the accumulation of thatch and woody material and the encroachment of brush increases surface fuel loads, increasing the probability of high-intensity surface fires and compromising grassland health.

Historic fire return intervals for these grasslands range from approximately 10 to 35 years, allowing for a rapid departure from the historic fire regime conditions when fire is excluded. Fire exclusion also

encourages shrub and noxious grass and weed encroachment. Cheatgrass, also known as downy brome, is an aggressive invasive grass species now common throughout the state and region. It exhibits higher fire intensity than other native grasses. Despite its early growth and rich color, cheatgrass provides poor nutrition for livestock, deer, and elk.

Although brush and timber fires are known for their intense behavior, the potential impact of grass fires should not be underestimated. These light, flashy fuels can be resistant to suppression, producing incredibly rapid rates of spread and flame lengths in excess of 10 feet. They can pose a real risk to firefighter safety and a serious threat to untreated homes.

Open prairie, grassy slopes, and irrigated meadows and lawns are characterized as FBFM 1. A grassy understory of ponderosa pine mixed with other herbaceous fuels that would carry a surface fire is defined as FBFM 2.

Fire Behavior is generally lower intensity but fast-moving.

Shrublands, FBFMs 4, 5, and 6

Shrub stands are most common on south slope aspects and meadow margins throughout the District. Mountain mahogany is the dominant shrub species in the northern two-thirds and oakbrush is dominant in the southern one-third of the District. Areas where conifer is aggressively regenerating are also classified as shrublands based primarily on the density and height of the growth. Deciduous riparian zones along creek beds and slope drainages are common throughout the area and also support shrub growth. Cottonwood, scrub willow, chokecherry, and alder are common in these zones.

Shrub stands in the region are classified as FBFM 4 (mature brush, greater than 6 feet tall, dense woody surface fuel), FBFM 5 (young brush, less than 6 feet tall, clean litter), and FBFM 6 (intermediate brush, older than FBFM 5, less dense than FBFM 4).

It should be noted that shrub vegetation typically constitutes higher-moisture woody plants associated with low to moderate fire behavior. However, prolonged drought experienced in recent years lowers the live fuel moisture content in plant stems, producing extreme fire behavior under favorable weather conditions.

Timber Litter and Understory, FBFMs 8, 9, and 10

Forest composition in the county is strongly influenced by elevation and slope aspects, which are directly related to the available soil moisture. Ponderosa pine favors drier south-facing aspects, while Douglas fir, Lodgepole pine, and spruce favor moister and cooler north-facing aspects. Lodgepole pine is more common in elevations above 8,000 feet, but species commonly mix on transitional slope aspects. Fire exclusion has allowed Douglas fir to become disproportionately dominant in some areas. The continuous forest canopy, most common at higher elevations and north-facing aspects, often prohibits live surface fuels from taking hold. In some mature and over-mature closed canopy conifer stands, the understory is devoid of live surface fuel but thick with woody timber litter from downed trees and ladder fuels.

FBFMs in timber are classified according to the surface fuels that accumulate in the absence of a dominant live understory. FBFM 8 is associated with all short-needle conifer species including Douglas fir, Lodgepole pine, and a variety of spruce; the long needles of ponderosa pine characterize FBFM 9; and FBFM 10 is associated with forest floors that are thick with naturally occurring downed timber in a mature or overmature stand.

In normal weather conditions, fire behavior in these timber fuel models at higher elevations is generally characterized by understory surface fires fueled by timber litter. Occasional isolated torching or crown runs may occur, but fire behavior is generally present on the ground. Under extreme weather conditions, these same fuel models have the capacity to “go nuclear.” Crown runs through dense, unbroken canopy that may extend for miles.

Mountain Pine Beetle

The following mountain pine beetle information was presented to the Front Range Fuels Treatment Partnership Roundtable, Golden, CO, January 23, 2008.

More than a dozen leading research experts from the western US and Canada met over three days last week, to assess the status of our scientific knowledge of Lodgepole pine ecology and fire behavior about the mountain pine beetle epidemic. Their focus was on Colorado and southern Wyoming, but they also examined knowledge from many other Lodgepole pine areas where mountain pine beetle epidemics occur.

The science team, led by Dr. Merrill R. Kaufmann (emeritus scientist, Rocky Mountain Research Station) and Mike Babler (fire initiative program manager, The Nature Conservancy), reached consensus on a series of points:

- Not all Lodgepole pine forests are the same. Some forests are pure Lodgepole pine established after large fires decades or centuries ago. Others are mixtures with subalpine species such as Engelmann spruce, subalpine fir, and aspen at higher elevations or with mixed conifer species such as Ponderosa pine, Douglas-fir, and aspen at lower elevations. Each type of forest has unique features of ecology and fire behavior. And Lodgepole pine trees in all three types are vulnerable to attack by mountain pine beetles.

- Forests are living systems subject to constant change. It is normal and expected that many natural agents change our forests over time, including mountain pine beetles, fire, and wind. While forests losing many trees to insect attack will never look the same in our lifetime, healthy and vigorous forests will undoubtedly return in most locations.

- Lodgepole pine will not disappear from the southern Rocky Mountains. The make-up of our forests will change where mountain pine beetle causes high mortality. But we will continue to have forests dominated by or including Lodgepole pine, and these forests will provide valuable ecological services and aesthetic and recreational benefits.

- Active vegetation management is unlikely to stop the spread of the current mountain pine beetle outbreak, because the beetles are so numerous and spreading so rapidly that they may simply overwhelm any of our efforts. However, judicious vegetation management between outbreak cycles may help mitigate future bark-beetle caused tree mortality in local areas.

- Though they are infrequent, large intense fires with extreme fire behavior are characteristic of Lodgepole pine forests, especially during very dry and windy conditions. Such fires are a natural way for Lodgepole pine to be renewed and are largely responsible for extensive pure Lodgepole pine forests.

- In forests killed by mountain pine beetles, future fires could be more likely than fires before the outbreak. Large intense fires with extreme fire behavior are again possible. While more research is needed to learn in what ways and how long the fuels and fire environment are altered by the beetles, the protection of communities and other values at risk continues to be imperative.

- Mountain pine beetle outbreaks are not likely to cause increased erosion, because they do not disturb the soils or reduce protective ground cover. In areas of high tree mortality, streamflow may increase, and the timing of water delivery may be changed for decades because of reduced canopy interception of precipitation and reduced water uptake by the trees.

- Climate changes will most likely contribute to substantial forest changes in the decades ahead. Given the climate changes in the last 20 years and projected changes for the next several decades, large fires and other natural disturbances are anticipated in many forests of Colorado and southern Wyoming. These large disturbances and other changes in growing conditions will likely contribute to restructuring many forest lands

The effects of Weather, fuel type, and topography on fire behavior

Fire hazards present a considerable risk to vegetation and wildlife habitats. Short-term loss caused by a wildfire can include the destruction of timber, wildlife habitat, scenic vistas, and watersheds. Long-term effects include smaller timber harvests, reduced

access to affected recreational areas, and destruction of cultural and economic resources and community infrastructure. Vulnerability to flooding increases due to the destruction of watersheds. The potential for significant damage to life and property exists in areas designated as wildland urban interface (WUI) areas, where development is adjacent to densely vegetated areas.

Generally, there are three major factors that sustain wildfires and predict a given area's potential to burn. These factors are fuel, topography, and weather.

- **Fuel** – Fuel is the material that feeds a fire and is a key factor in wildfire behavior. Fuel is generally classified by type and by volume. Fuel sources are diverse and include everything from dead tree needles, leaves, twigs, and branches to dead-standing trees, live trees, brush, and cured grasses. Structures such as homes and associated combustibles are also potential fuel sources. The type of prevalent fuel directly influences the behavior of wildfire. Light fuels such as grasses burn quickly and serve as a catalyst for fire spread. "Ladder fuels" are fuels low to the ground that can spread a surface fire upward through brush and into treetops. These fires, known as crown fires, burn in the upper canopy of forests and are nearly impossible to control. The volume of available fuel is described in terms of fuel loading. Many parts of the planning area are extremely vulnerable to wildfires, as a result of dense vegetation combined with urban interface living. Non-native species have become invasive in the area, specifically, Tamarisk and Russian Olive. These species burn readily and pose a threat to homes and other structures in the lower reaches of the county and into municipalities.

- **Topography** – An area's terrain and land slopes affect its susceptibility to wildfire spread. Both the fire intensity and the rate of spread increase as slope increases due to the tendency of heat from a fire to rise via convection. The arrangement and types of vegetation throughout a hillside can also contribute to increased fire activity on slopes. In addition, topography impacts the ability of firefighters to combat the blaze by hampering access for equipment, supplies, materials and personnel.

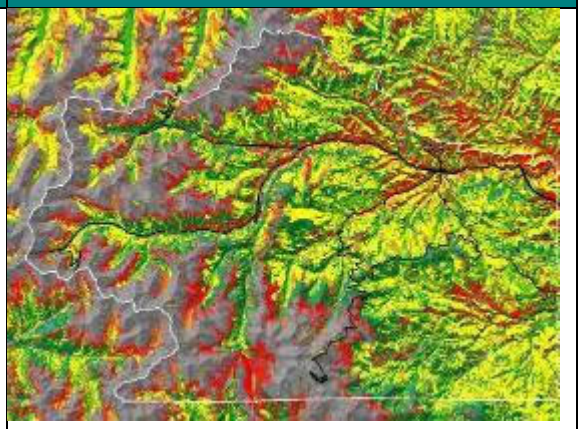
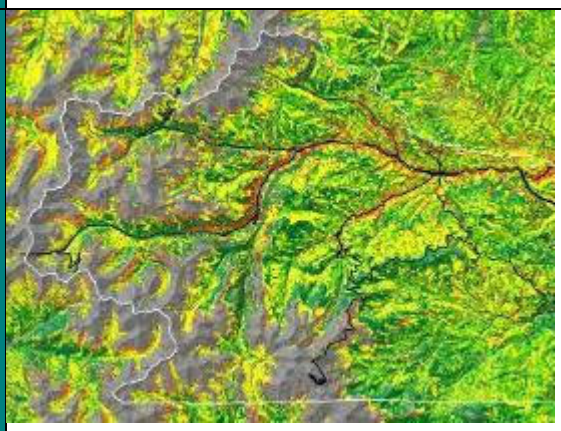
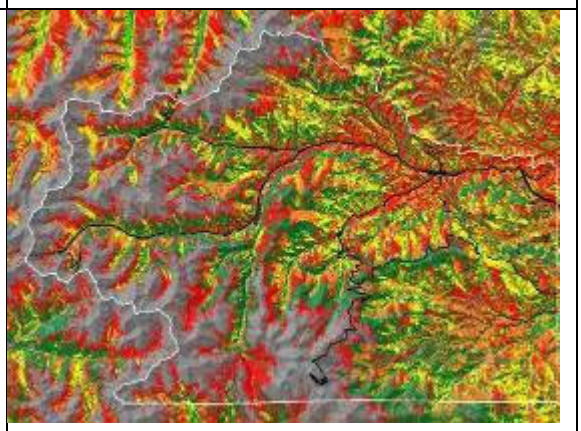
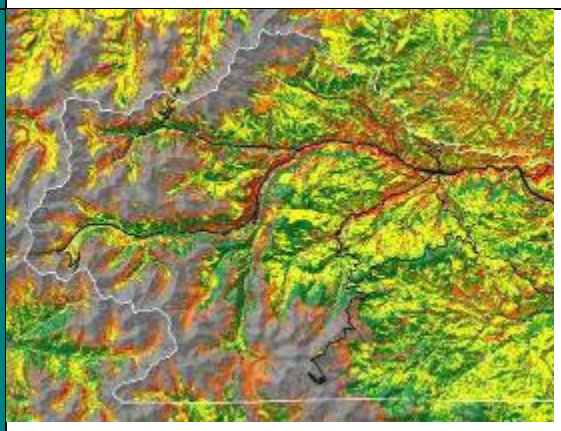
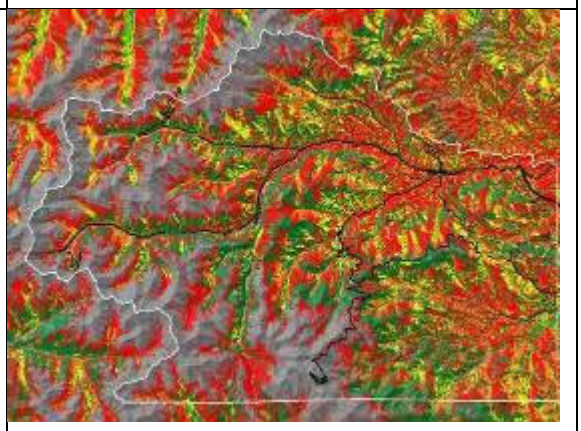
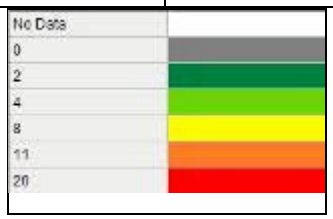
- **Weather** – Weather components such as temperature, relative humidity, wind, and lightning also affect the potential for wildfires. High temperatures and low relative humidity dry out the fuels that feed wildfire, increasing the odds that fuel will more readily ignite and burn more intensely. Wind is the most treacherous weather factor. The greater the wind, the faster a fire will spread and the more intense it will be. In addition to wind speed, wind shifts can occur suddenly due to temperature changes or wind interaction with topographical features such as slopes or steep hillsides. Lightning also ignites wildfires, which are often in terrain that is difficult for firefighters to reach. Drought conditions contribute to wildfire vulnerability and susceptibility. During periods of drought, low fuel moisture and lack of precipitation increase the threat of wildfire. There are no known effective measures for human mitigation of weather conditions. Careful monitoring of weather conditions that drive the activation and enforcement of fire-safety measures and programs, such as bans on open fires, are ongoing weather-related mitigation activities.

Wildfires are of significant concern throughout Colorado. According to the Colorado State Forest Service, vegetation fires occur annually; most are controlled and contained early with limited damage. Damage can be extensive for ignitions that are not readily contained and become wildfires. According to the 2018 State of Colorado Hazard Mitigation Plan, a century of aggressive fire suppression combined with drought cycles and changing land management practices has left many of Colorado's forests, including those in Clear Creek County, unnaturally dense and ready to burn. Further, the threat of wildfire and potential losses is constantly increasing as human development and population increase, and the Wildland Urban Interface (WUI) expands. Another contributing factor to fuel loads in the forest is standing trees killed by pine bark beetles, which have been affecting the forests of Colorado since 2002, becoming more widespread and a serious concern. According to the 2021 Clear Creek County Hazard Mitigation Community Survey, Clear Creek County residents believe that wildfire is the greatest threat to their safety.

Wind is an important weather element in fire behavior, as even small changes in wind speed can significantly impact fire intensity, spread rate, and potential for crown fire development. Two wind scenarios were used for modeling fire behavior for CCC. One was based on typical summer conditions where surface wind direction is diurnal, flowing upslope and up-canyon during the day. The other wind scenario assumed a strong downslope wind that overpowered the weaker diurnal winds, such as what happens when a Chinook wind situation develops in the Front Range of Colorado. Three predictive fire behavior output models are generated from the analysis:

- Flame Length (FL)
- Rate of Spread (ROS)
- Crown Fire (CF)

Flame length (FL) is the distance from the base of the flame (the fuel bed) to the tip of the flame in a fire burning in surface fuels (surface fire) (Figures 15, 16, 17).

	Diurnal Winds	Chinook WInds
50th Percentile Weather		
90th Percentile Weather		
97th Percentile Weather		
Legend	 (In feet)	

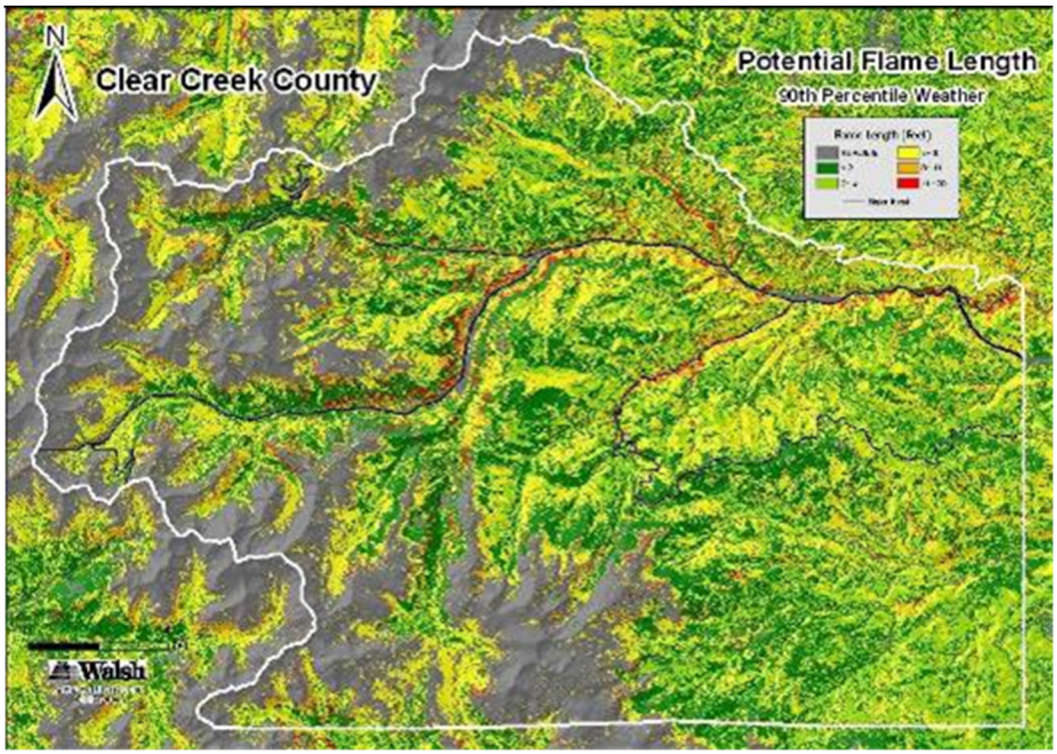


Figure 16. Potential Flame Length, 90th Percentile Weather, Diurnal Winds

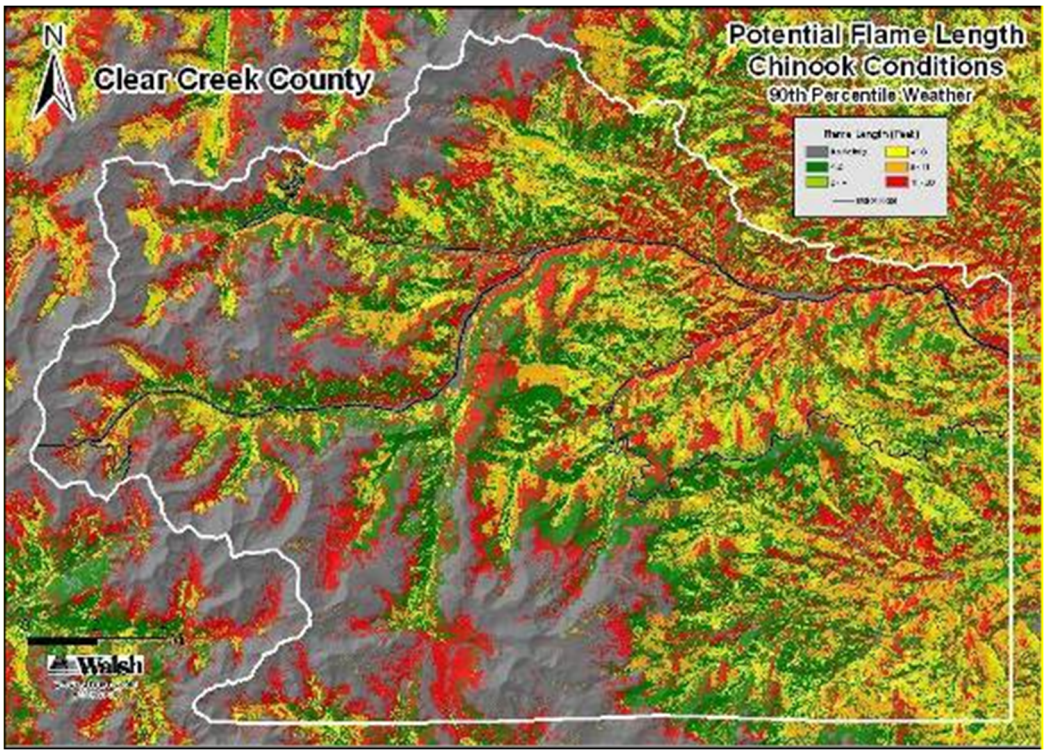


Figure 17. Potential Flame Length, 90th Percentile Weather, Chinook Winds

The **rate of spread** (ROS) is the forward rate of movement at the active front (head) of a surface fire (Figures 18, 19, 20).

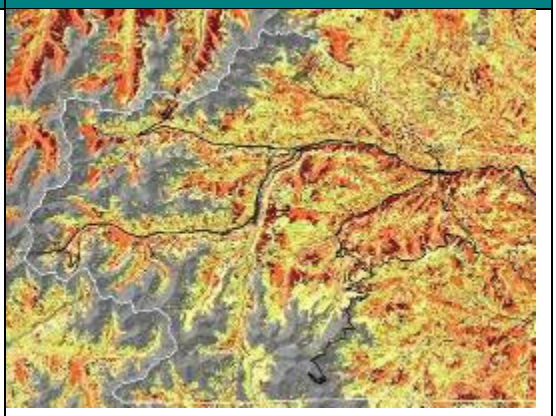
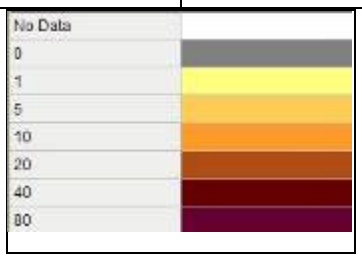
	Diurnal Winds	Chinook Winds
50th Percentile Weather		
90th Percentile Weather		
97th Percentile Weather		
Legend	 **(In Chains per hour)**	

Figure 18. Rate of Spread

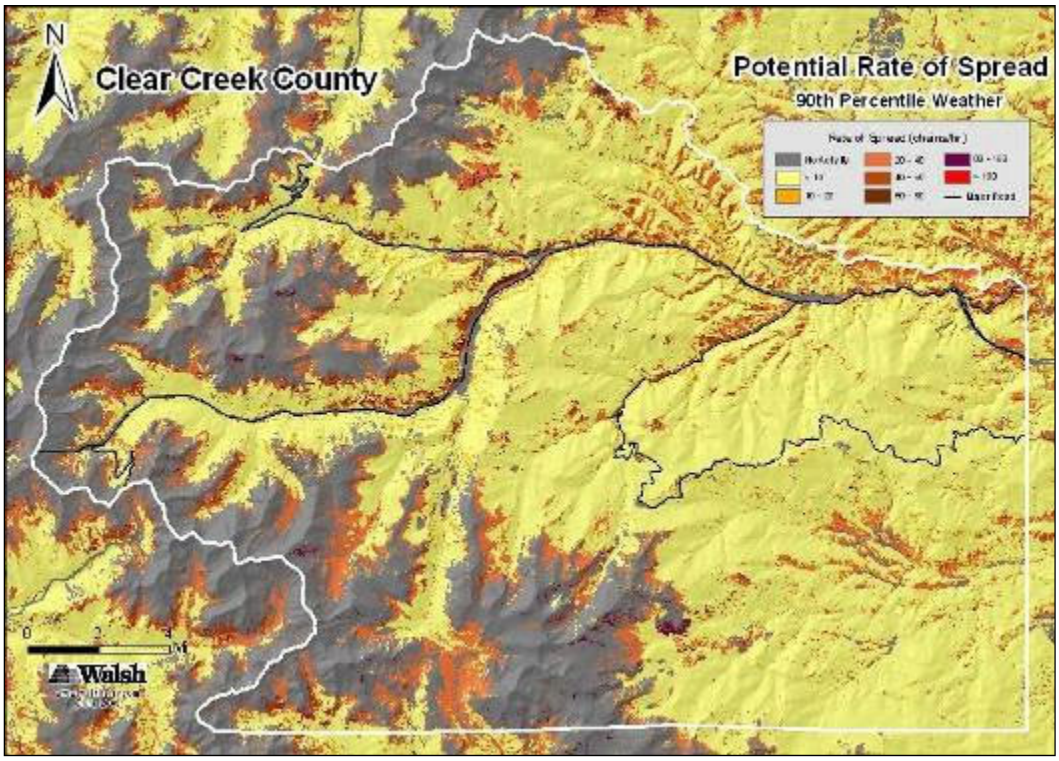


Figure 19. Rate of Spread, 90th Percentile Weather, Diurnal Winds

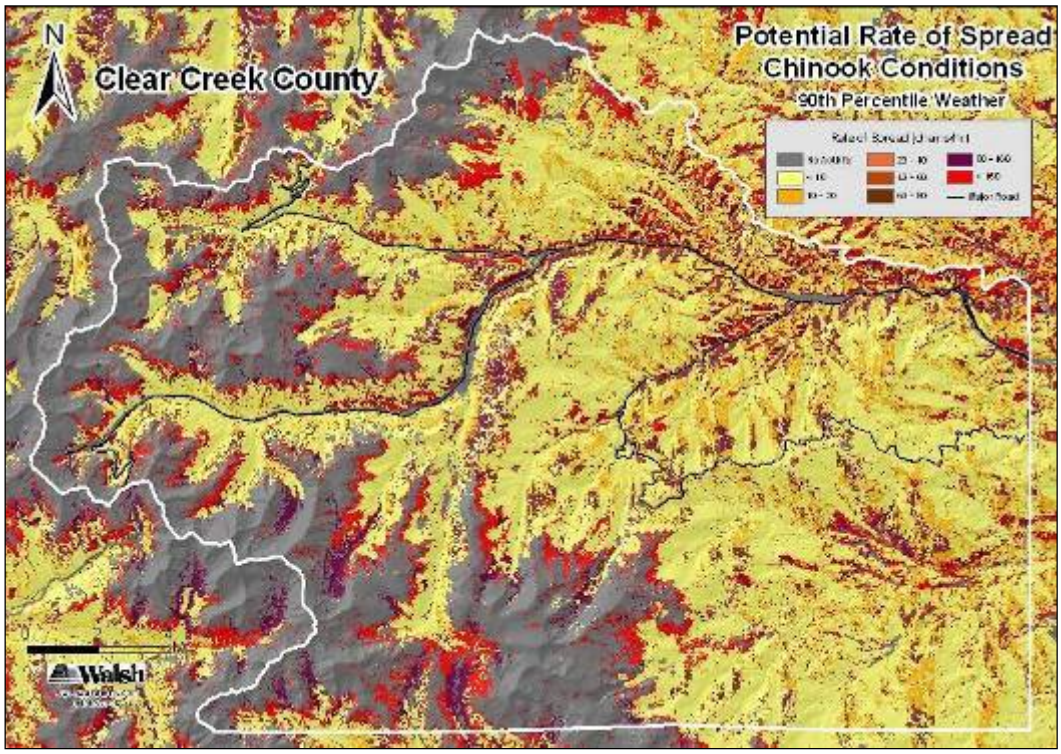
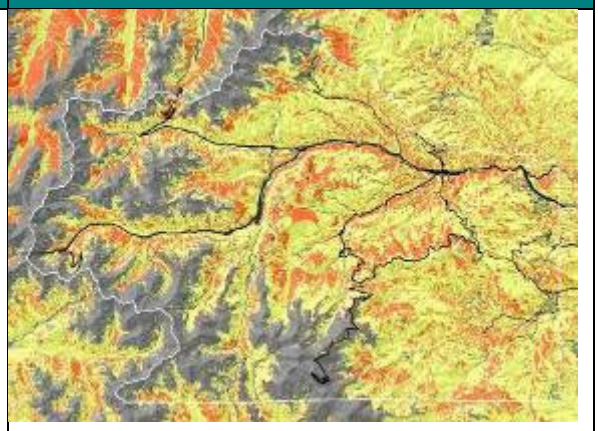
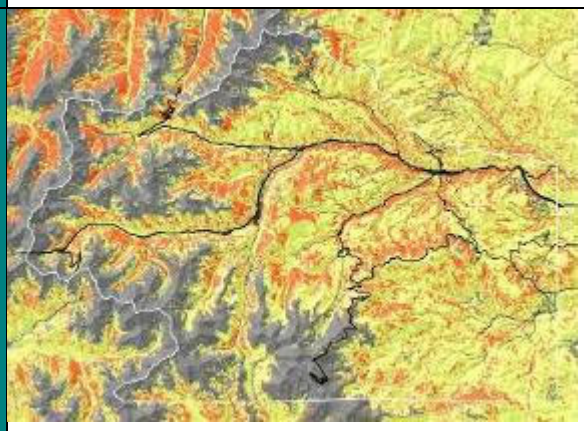
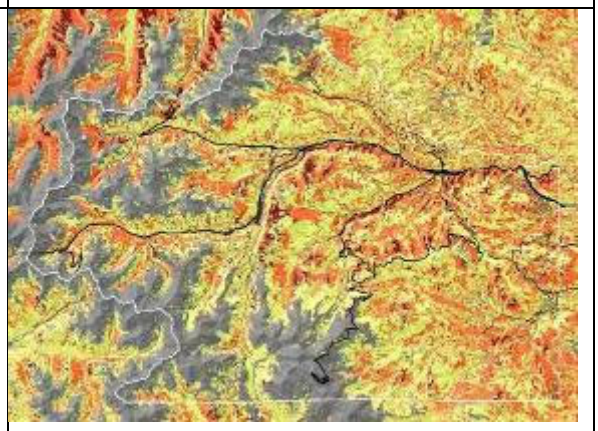
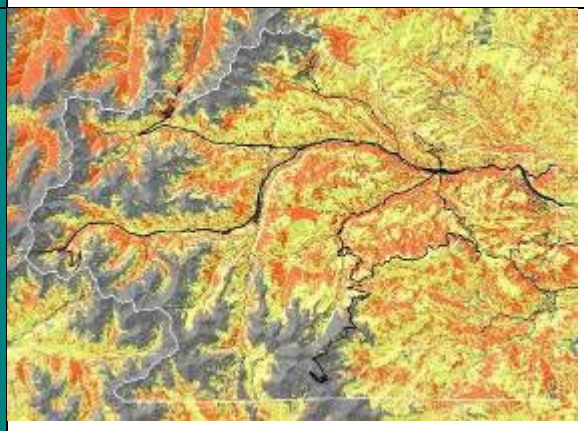
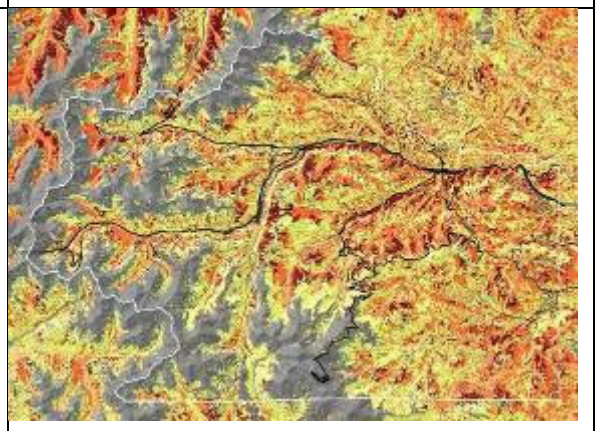
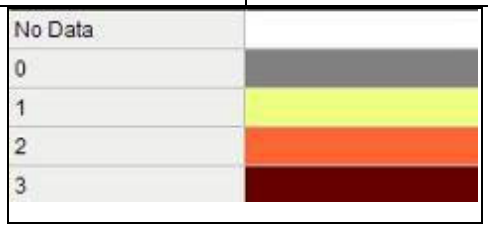


Figure 20. Rate of Spread, 90th Percentile Weather, Chinook Winds

Crown fire (CF) potential is the movement of fire into and through the tree canopy. Crown fires typically move rapidly, and are very intense, with flaming fronts up to 100-200 feet in height (Figures 21, 22, 23).

	Diurnal Winds	Chinook Winds
50th Percentile Weather		
90th Percentile Weather		
97th Percentile Weather		
Legend		

(1-surface, 2-passive, 3-active)

Figure 21 Crown Fire Potential

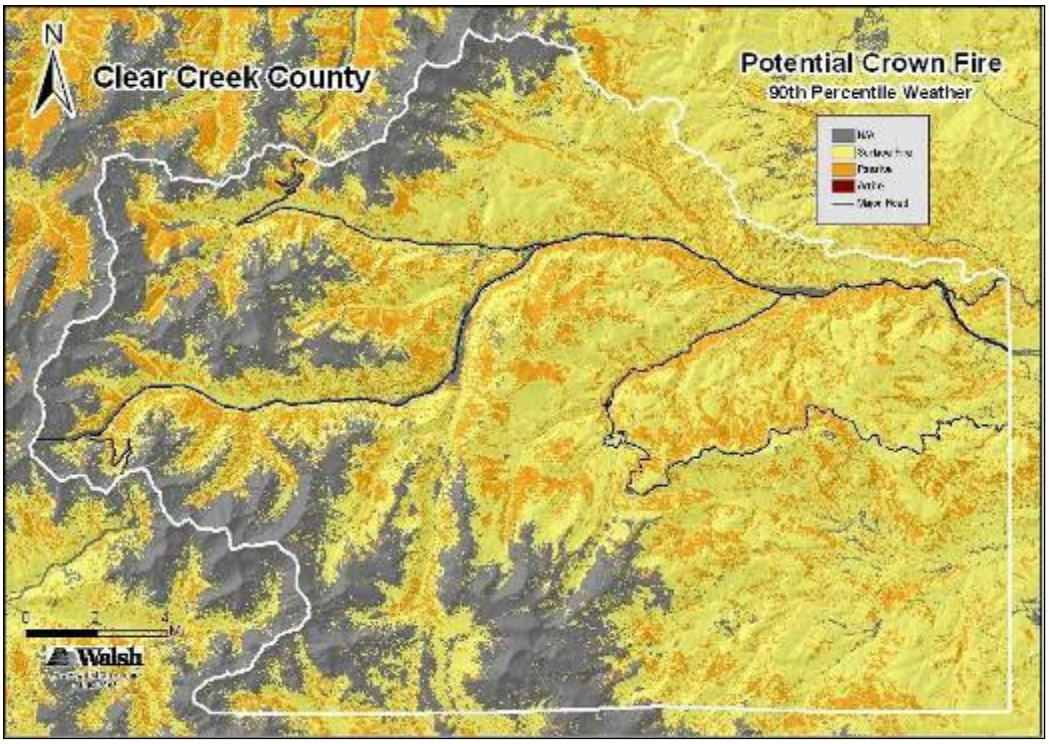


Figure 22. Potential Crown Fire, 90th Percentile Weather, Diurnal Winds

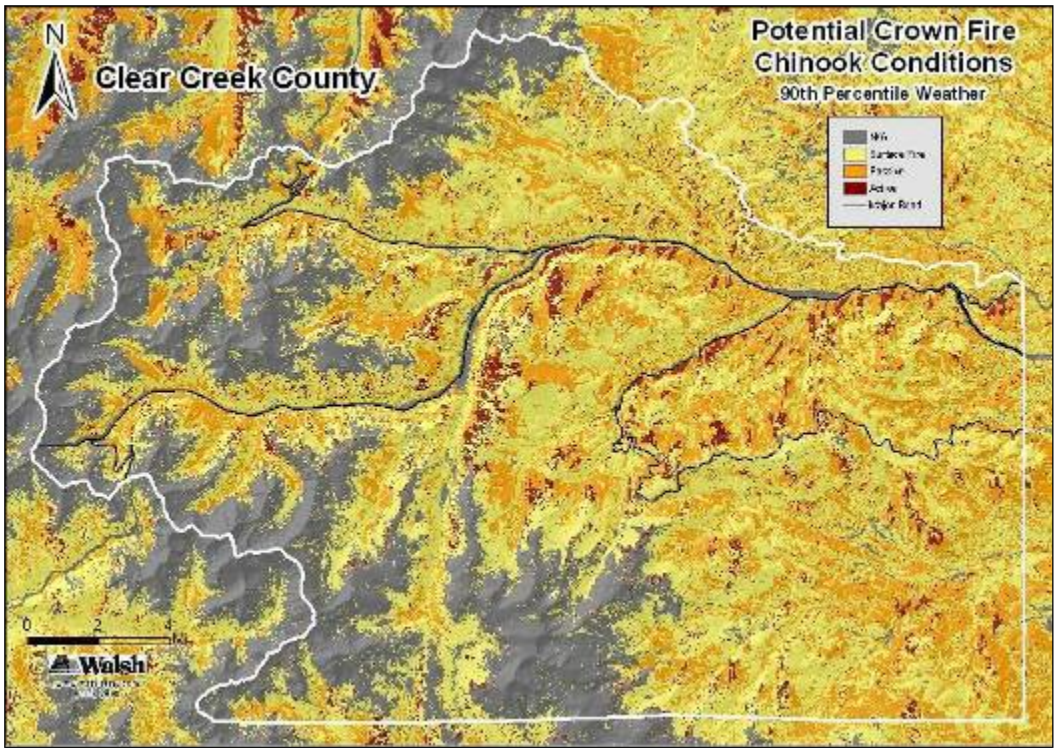
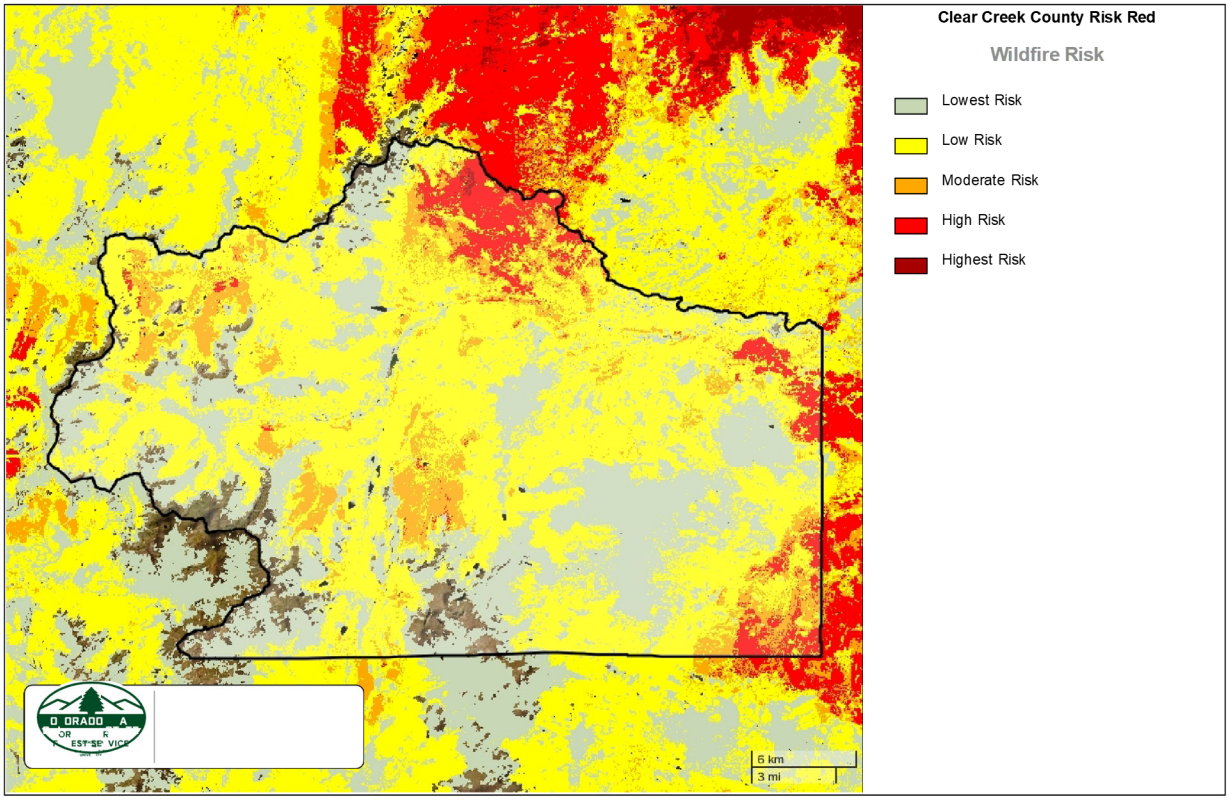
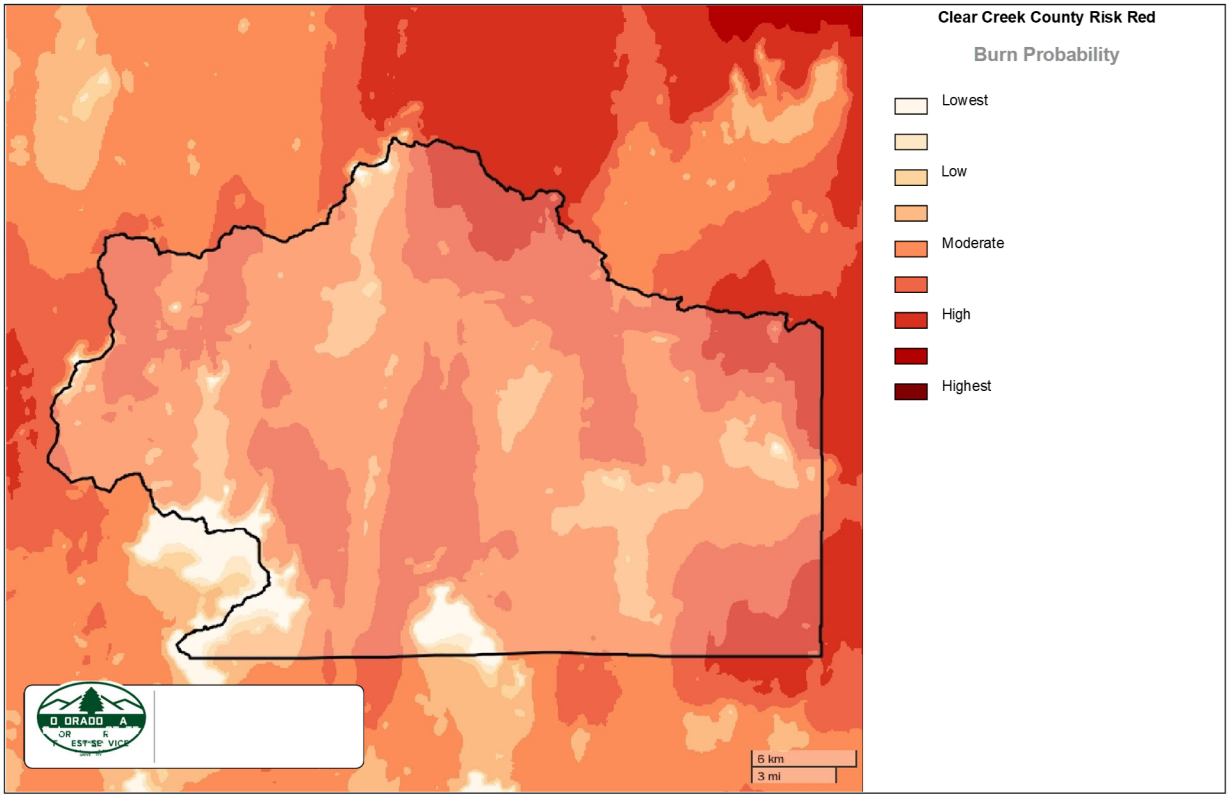


Figure 23 Potential Crown Fire, 90th Percentile Weather, Chinook Winds

Figure 2.e.1. *Fuel type and fuel loads greatly influence fire behavior, intensity, and rate of spread. Fuel loads are variable across Clear Creek Fire Authority, ranging from these examples above. [Options for pictures: Dense forests with abundant ladder fuels, An open ponderosa pine forest with widely spaced trees and few ladder fuels, Grasslands with when vegetation is continuous and dry, etc.]*

Photo credit: CCFA


Clear Creek County Risk Red
Wildfire Risk
Lowest Risk
Low Risk
Moderate Risk
High Risk
Highest Risk
6 km
3 mi


Clear Creek County Risk Red
Burn Probability
Lowest
Low
Moderate
High
Highest
6 km
3 mi

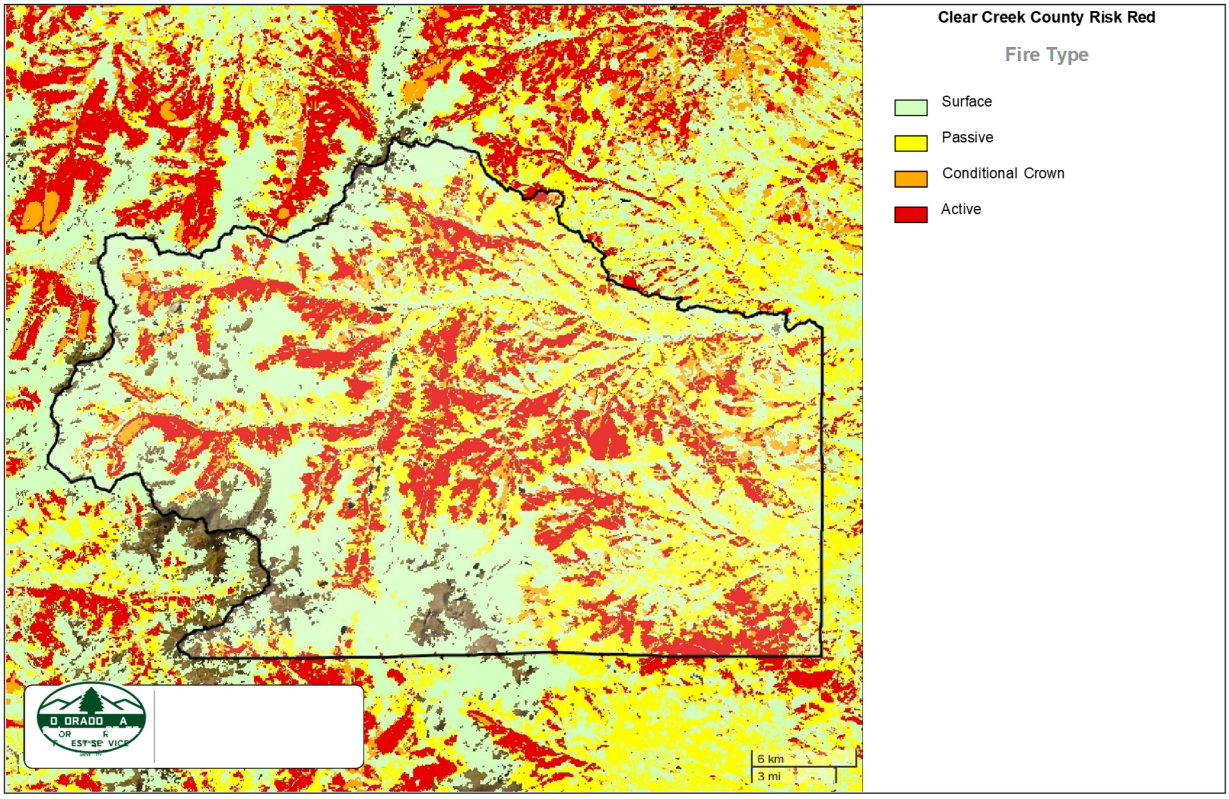


Figure 2.e.2. Map of Wildfire Risk, Burn Probability, and Fire Type (CSFS Forest Atlas)

Take Away Message

Clear Creek is at risk for large, high-severity wildfires due to dense forest conditions, ground fuel loading, dry and hot weather, and strong, gusty winds. Increasing drought and warming temperatures exacerbate wildfire risk in the area. **Residents in Clear Creek must prepare for large wildfire events. Proactive work is imperative to protect lives and property.**

2.f. Fuel Treatment History in and Around Clear Creek Fire Authority

Fuel treatments reduce the amount of fuel in strategic locations, reducing fire risk to nearby communities and creating tactical opportunities for wildland firefighters to engage with wildland fires. (**Figure 2.f.1**).

An important component of this CWPP was identifying locations for fuel treatments to protect the community. **Section 4** outlines these priority locations and the land management agency that will lead these efforts in the coming years.

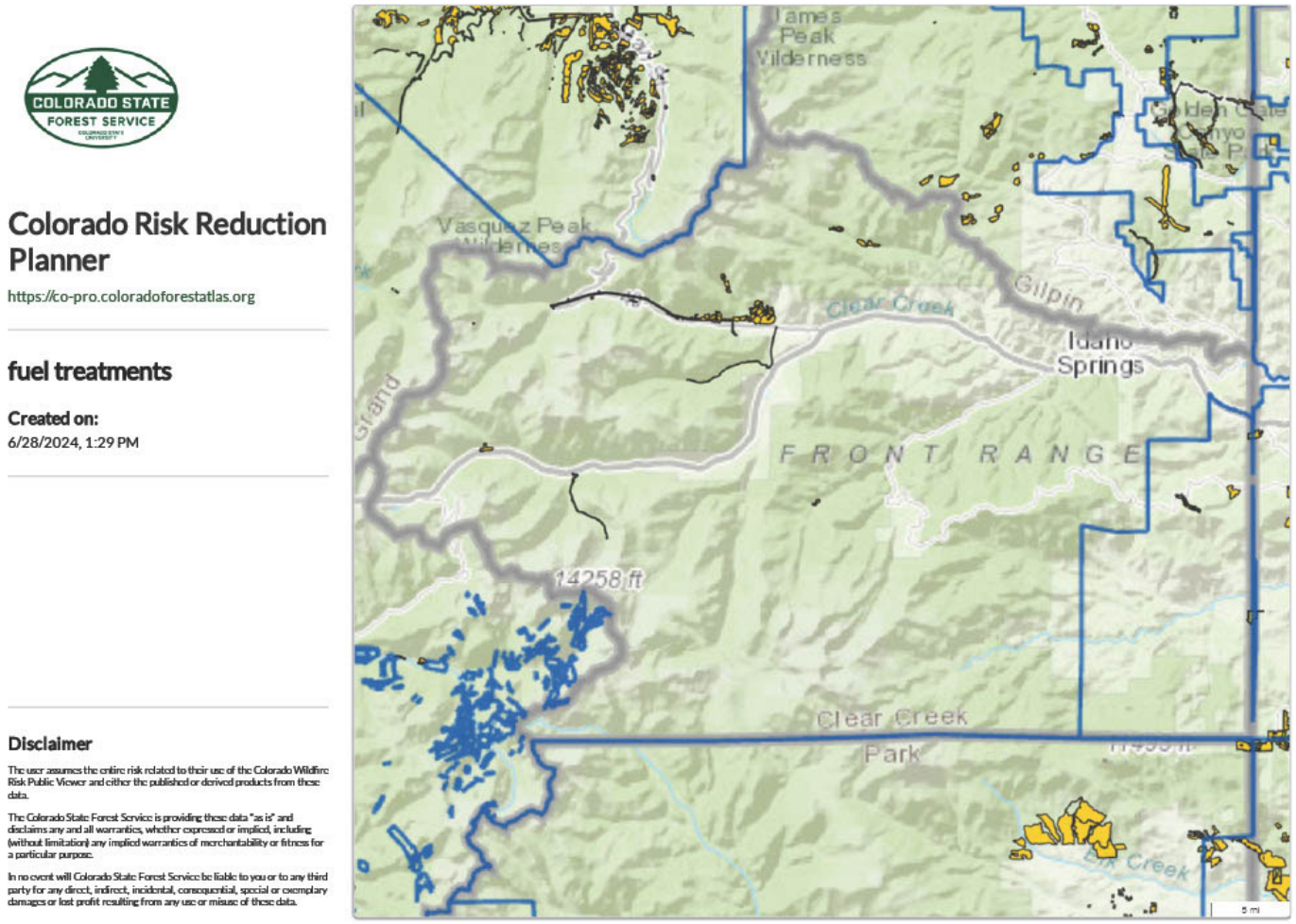


Figure 2.f.1. Locations of forest management treatments and wildfires in and around Clear Creek Fire Authority from [insert time span] conducted by [ex: Colorado Parks and Wildlife, Colorado State Forest Service, etc.]

Source: Colorado Forest Service

3. Becoming a Fire Adapted Community

It is recommended that Clear Creek Fire Authority, HOAs, and residents embrace the concept of Fire Adapted Communities (FAC), which is defined by the National Wildfire Coordinating Group as "a human community consisting of informed and prepared citizens collaboratively planning and taking action to safely coexist with wildland fire". This concept can guide residents, fire practitioners, and communities through a holistic approach to become more resilient to fire (**Figure 3.1.**).

Your community's CWPP sets the stage for fire adaptation, and the next step is on-the-ground action and an ongoing commitment to risk mitigation at all levels of the community, from individual homeowners to neighborhoods and HOAs to Clear Creek Fire Authority, to land managers and other partners. This section of the CWPP includes recommendations and resources for mitigating wildfire risk and enhancing emergency preparedness. Clear Creek Fire Authority and public land managers have an important role to play in implementing the recommendations in this CWPP, and they have made commitments to take on-the-ground action as outlined in **Section 4.**

Individual homeowners, neighborhoods, and HOAs also have a vital role to play in addressing shared wildfire risk. Action and community-building centered around mitigation have reduced wildfire risk and increased community resilience across the Mountain West. Mitigation work by residents can spur mitigation by their neighbors (Brenkert-Smith et al., 2013). The cumulative impact of linked defensible space across private properties can improve the likelihood of home survival and protect firefighters during wildfire events (Jolley, 2018; Knapp et al., 2021).

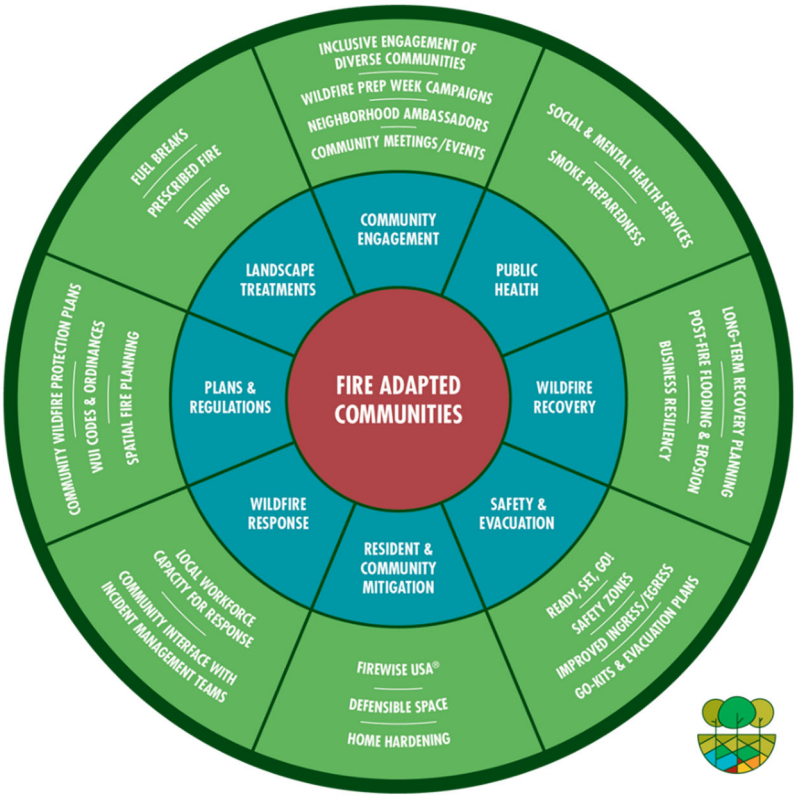


Figure 3.1. *The Fire Adapted Communities graphic provides specific programs and activities that communities can take to reduce their wildfire risk and increase their resilience*

Source: Fire Adapted Community Learning Network.

3.a. Individual Recommendations

Mitigate the Home Ignition Zone

During catastrophic wildfires, property loss happens mostly due to conditions in the **home ignition zone** (HIZ). The home ignition zone includes your home and other structures (e.g., sheds and garages) and the area within 100 feet of each structure. Firefighter intervention, adequate defensible space, and home hardening measures were common factors for homes that survive major wildfires (IIBHS, 2019; Maranghides et al., 2022) Research following the 2018 CA Camp Fire showed that homes were more likely to burn down when they were close to other structures that had also burned, when they had vegetation within 100 meters of the home, and when they had combustible materials (firewood or propane tanks) near the home (Knapp et al., 2021).

You can increase the likelihood that your home will survive a wildfire and help protect the safety of firefighters by creating defensible space, replacing, or altering building materials to make your home less susceptible to ignition, and taking steps to increase firefighter access along your driveway.

Residents need to work together as a community to mitigate shared wildfire risk in the HIZ. Structure-to-structure ignition is a major concern in WUI communities and can cause substantial property loss. Neighbors can increase their homes' chances of survival during a wildfire if they work together to reduce hazards in their overlapping defensible space.

Defensible space is the area around a building where vegetation, debris, and other types of combustible fuels have been treated, cleared, or reduced to slow the spread of fire and reduce exposure to radiant heat and direct flame. It is encouraged that residents develop defensible space so that during a wildfire their home can stand alone without relying upon limited firefighter resources due to the great reduction in hazards they have undertaken.

Defensible space allowed firefighters to protect this home during the 2016 Cold Springs Fire near Nederland, CO. Photo credit: Wildfire Partners.

Home hardening is the practice of making a home less likely to ignite from the heat or direct contact with flames or embers. It is important to remember that embers can ignite homes even when the flaming front of a wildfire is far away. Home hardening involves reducing this risk by changing building materials, installation techniques, and structural characteristics of a home. Home hardening

measures are particularly important for WUI homes; 50% to 90% of homes ignite due to embers rather than radiant heat during wildfires (Babrauskas, 2018; Gropp, 2019).

Fortunately, many Clear Creek Fire Authority residents have already started taking actions to mitigate their home ignition zone. (**Figure 3.a.1**) [*Ex.: Over X% of residents who responded to the CWPP survey have removed trees or low limbs on their property, and about two-thirds of residents annually remove debris around their homes. Only a third have replaced their roofs with less flammable materials, but most newer homes in Clear Creek Fire Authority already have ignition-resistant roofs.]* Residents should follow the defensible space and home hardening recommendations outlined below to continue increasing their home's chances of surviving a wildfire.

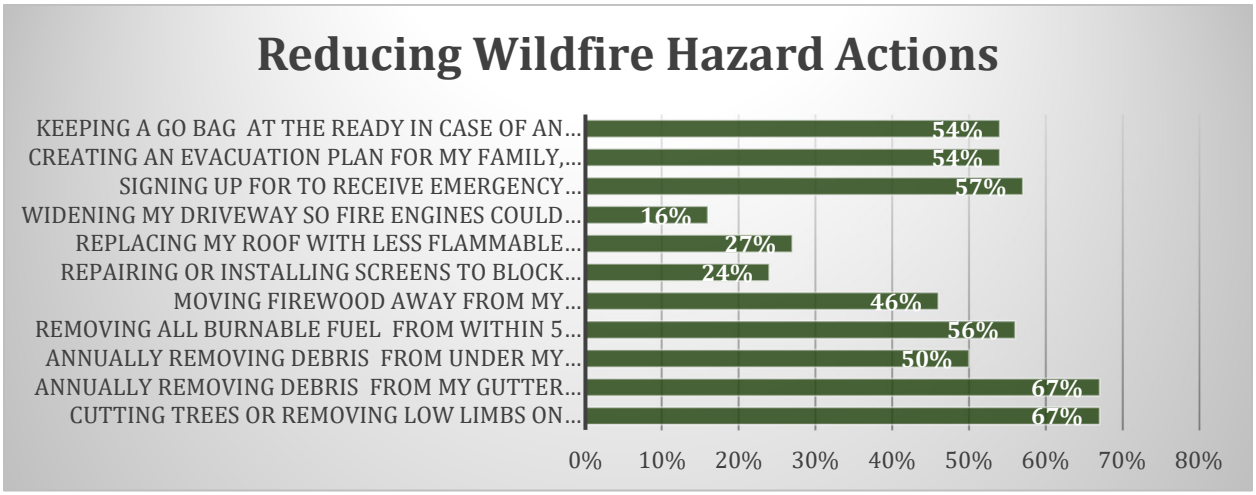


Figure 3.a.1. *Percentage of Clear Creek Fire Authority residents who responded to the CWPP survey and have completed different actions to mitigate risk in their home ignition zone.*

See Appendix C for a full summary of survey findings.

s

Defensible Space

Defensible space creates a buffer between your home and grass, trees, and shrubs that could ignite during a wildland fire. Defensible space can slow the spread of wildfire, prevent direct flame contact, and reduce the chance that embers will ignite material on or near your home (Hakes et al., 2017). Substantially reducing vegetation within the HIZ and removing vegetation that overhangs decks and roofs can reduce structure loss, especially for homes on slopes (Syphard et al., 2014).

Do not count on firefighters staying to defend your home—your home should be able to survive a wildfire on its own. There are never enough firefighters to stay and defend every single home during large incidents. Properties that are not defensible will not often receive firefighter resources due to unsafe conditions and the higher likelihood of home loss.

Defensible space is divided into multiple zones around a home, and recommended practices vary among zones. The Colorado State Forest Service (CSFS) defines zone one as 0 to 5 feet from the home, zone two as 5 to 30 feet from the home, and zone three as 30 to about 100 feet from the home [**Figure 3.a.2**.]. Some organizations call zone one the "noncombustible zone" (0 to 5 feet from the home) and zone two the "lean, clean, and green zone" (5 to 30 feet from the home).

Property owners should establish defensible space around each building on their property, including campers / RVs, detached garages, storage buildings, barns, and other structures. RVs are highly

flammable and can emit embers that might ignite nearby homes and vegetation. Removing all vegetation under and around campers in HIZ 1 is crucial. Campers / RVs, boats, detached garages, storage buildings, barns, and other large structures should be placed at least 50 feet away from primary structures to prevent structure-to-structure fire spread (Maranghides et al., 2022).

A 2021 study from the University of Colorado-Boulder showed that homeowners living in the WUI in Bailey, CO, typically underestimated the level of risk their home is at due to wildfire, and tended to overestimate the amount of work they have done to protect their property (Simpkins, 2021). Make sure you are informed about best practices for protecting your home. See **Table 3.a.1** and the CSFS publication The Home Ignition Zone for recommendations. **Section 4.c.** includes specific defensible space recommendations by forest type for HIZ zone 3.

Some homes in the Clear Creek Fire Authority have exemplary defensible space with [ex.: mowed grass near structures, trees limbed and not overhanging roofs, non-flammable barriers, etc.] within Zone 1.

Photo credit: CCFA.

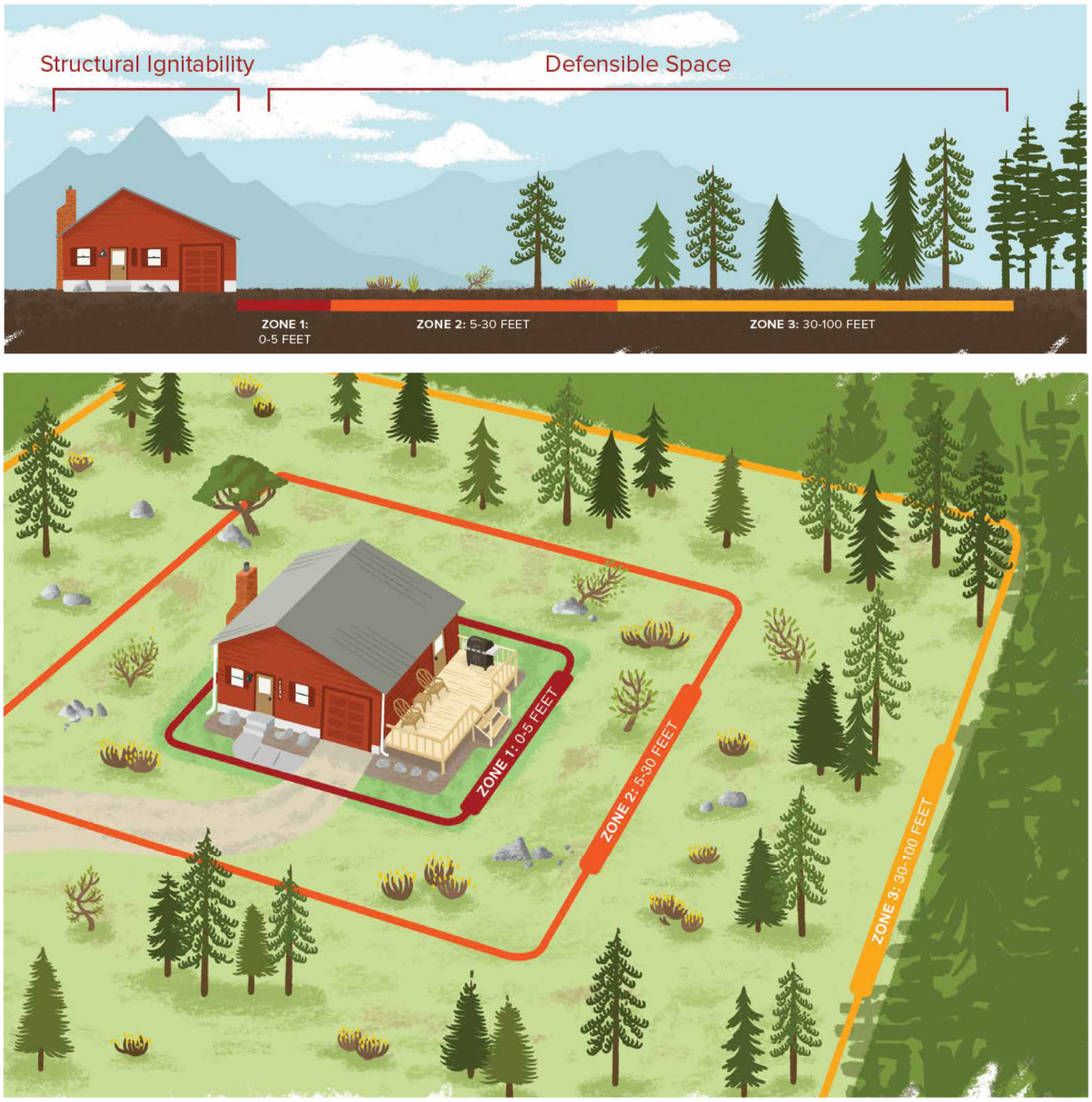


Figure 3.a.2. *Home ignition zones recommended by the Colorado State Forest Service. Using ignition-resistant building materials and removing burnable fuel around primary structures, outbuilding such as sheds, and campers / RVs is crucial for increasing your home's chance of surviving a wildfire and creating safe conditions for wildland firefighters.*

Source: Colorado State Forest Service, The Home Ignition Zone.

Table 3.a.1. *Home ignition zone recommendations based on the CSFS publication The Home Ignition Zone. This is not an all-inclusive list of activities.*

Zone 1: 0 to 5 feet from your home – the noncombustible zone.
Goal: Prevent flames from having direct contact with your home.
• Create a noncombustible border 5 feet around your home (aka, hardscaping). Replace flammable wood chips with alternatives like dirt, stone, or gravel. • Remove branches that hang over your roof and drop needles onto your roof and remove all fuels within 10 feet of the chimney. • Remove combustible materials (dry vegetation, wooden picnic tables, juniper shrubs, etc.) from underneath, on top of, or within 5 feet of decks, overhangs, windows, and doors. • Annually remove dead or dry leaves, pine needles, and dead plants withing 5 feet of your home and off your deck, roof, and gutters. Farther than 5 feet from structures, raking material will not significantly reduce the likelihood of ignition and can negatively affect other trees. • Move firewood or other combustible materials to Zone 3. • Do not use space under decks for storage.
Zone 2: 5 to 30 feet from your home – the lean, clean, and green zone.
Goal: Slow the movement of flames approaching your home and lower the fire intensity.
• Irrigate and mow grasses to 4 inches tall or less. If you are unable to irrigate, replace dry grasses with Firewise Plant Materials that are more drought tolerant and less flammable. • Remove any accumulated surface fuels such as logs, branches, slash, and mulch. • Remove all common junipers because they are highly flammable and tend to hold a layer of flammable material beneath them. Landscape with plants that have more fire-resistant attributes, like short-statures, deciduous leaves, and higher moisture content. See Firewise Plant Materials from Colorado State University Cooperative Extension for suggestions. • Remove enough trees to create at least 10 feet* of space between crowns. Measure from the outermost branch of one tree to the nearest branch on the next tree. Create even more space between trees if your home is on a slope. See **Figure 3.a.3** for how to measure crown spacing. • Favor the retention of aspen trees because this species naturally has high fuel moisture, no low branches, and smooth bark, making them less likely to ignite than conifer trees. • Remove ladder fuels under remaining trees. This is any vegetation that can bring fire from the ground up into taller fuels. • Remove limbs so branches do not hang below 6 feet above the ground, ideally not below 10 feet above the ground. See **Figure 3.a.3** for a depiction of how to measure limb height. • Keep spacing between shrubs at least 2-3 times their height. • Relocate wood piles and propane tanks to Zone 3. • Remove stressed, diseased, dead, or dying trees and shrubs. This reduces the amount of vegetation available to burn and improves forest health. • Keep shrubs at least 10 feet* away from the edge of tree branches.

Zone 3: 30 to 100 feet from your home

If you live on a slope, this zone should be larger due to the greater potential for extreme fire behavior.

Goal: Slow movement of flames, move fire to the ground, reduce ember production.

- Store firewood and propane tanks at least 30 feet away and uphill from your home and away from flammable vegetation. Store even farther away if your home is on a slope.
- Move campers / RVs, boats, detached garages, storage buildings, barns, and other large structures at least 50 feet away from your home.
- Mow or trim grasses to maximum height of 6 inches. Grasses can be taller in zone 3 than zone 2 because of the greater distance from your home, but shorter grass is always better for reducing potential flame lengths and therefore radiant heat exposure.
- Remove enough trees to create at least 6- to 10-foot spacing* between the outermost branches of remaining trees. Create even more space between trees if your home is on a slope (Error! Reference source not found.). See **Figure 3.a.3** for a depiction of how to measure crown spacing.
- Favor the retention of aspen trees because this species naturally has high fuel moisture, no low branches, and smooth bark, making them less likely to ignite than conifer trees.
- Remove limbs so branches do not hang below 6 feet above the ground, ideally not below 10 feet above the ground. See **Figure 3.a.3** for a depiction of how to measure limb height.
- Remove shrubs and saplings that can serve as ladder fuels.
- Remove heavy accumulations of dead trees and branches and piles of fallen leaves, needles, twigs, pinecones, and small branches. Thin trees to increase spacing and remove ladder fuels to reduce the likelihood of torching, crown fires, and ember production.
- Consult with a qualified forester to develop a plan to manage your property to achieve fuel reduction and other goals, such as creating wildlife habitat. Follow principles of ecological restoration as outlined in **Section 4.c.**

In Clear Creek Fire Authority there are Aspen trees that naturally have high fuel moisture, no low branches, and smooth bark, making them less likely to ignite than conifer trees.] Homeowners retain small groups of [aspen trees] in HIZ 2, and are sure to rake up dry leaves that fall onto their roof or on the ground within 5 feet of their homes.

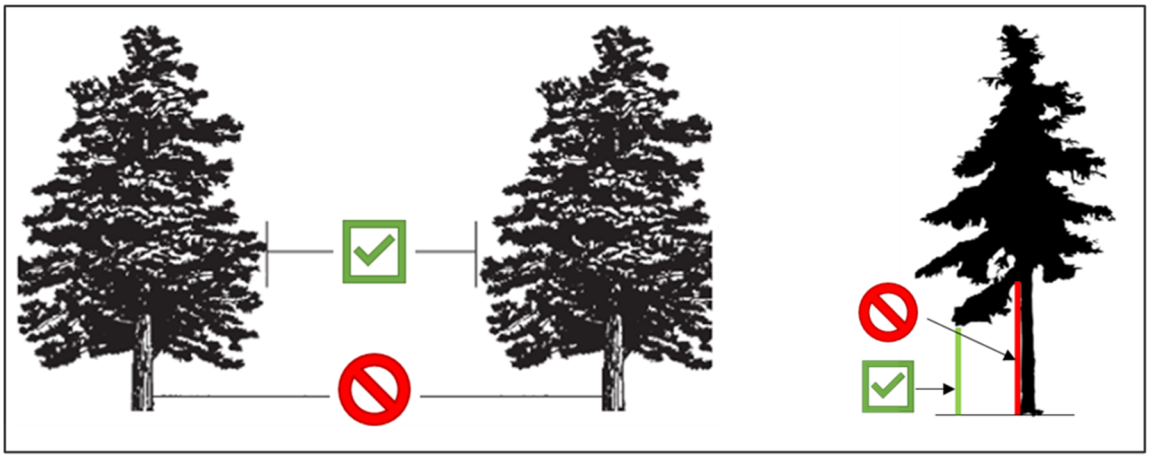


Figure 3.a.3. *Spacing between tree crowns is measured from the edge of tree crown to tree crown, NOT from tree stem to tree stem (left). Height of limbs above the ground is measured from the ground to the lowest point of the limb, NOT from where the limb attaches to the tree (right).*

Some homeowners in the WUI are concerned that removing trees will destroy the forest and reduce the aesthetic and monetary value of their property. In the Clear Creek Fire Authority, there are many dense [*ex: ponderosa pine forests that are unhealthy and greatly diverged from historical conditions that were maintained by frequent wildfires*.] The reality is that nothing will decrease the aesthetic and monetary value of your home as much as a high-severity wildfire burning all the vegetation in the community, even if your home survives the fire. Forest management can look messy and destructive in the first years following treatment; however, grasses, shrubs, and wildflowers will respond to increased light availability after tree removal and create beautiful ecosystems with lower fire risk (**Figure 3.a.4**). It might even be said that the more trees you cut, the more trees you save from wildfire.

Many property owners enjoy their land even more after conducting effective fuel treatments. Removing trees can open incredible views of mountains, rivers, and rock formations, and wildlife are often attracted to forests with lower tree densities and a greater abundance of understory plants. Reducing fuel loads and increasing the spacing between trees increases the chance that your home and your neighbors' homes will survive a wildfire, and most importantly, it increases the safety of wildland firefighters working to protect your community**.**

Figure 3.a.4. *Grasses, shrubs, and wildflowers quickly respond to increased light availability after tree removal, resulting in beautiful ecosystems with lower fire risk. The green star in each photo indicates the same tree. Image sizes vary due to the use of different cameras over the years.*

Photo credit: Jefferson Conservation District.

Home Hardening

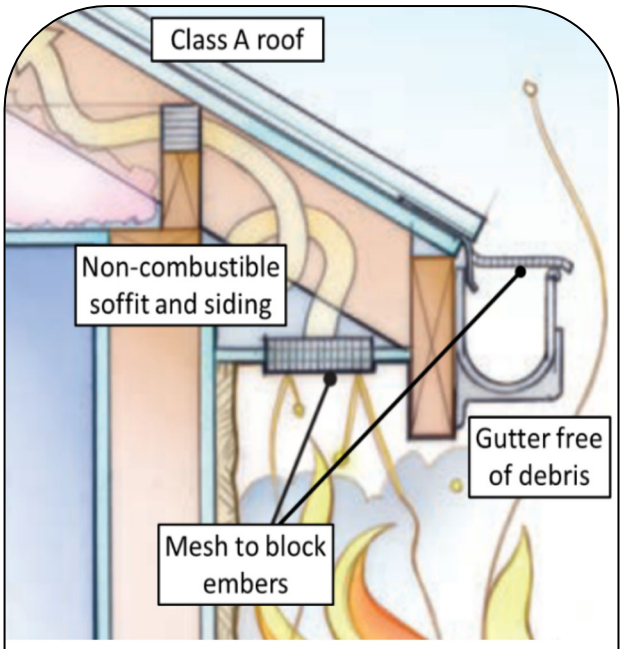
Home hardening involves modifying your home to reduce the likelihood of structural ignition. Fire not immediate to a home can still threaten the structure as long-range embers travel. Homes in denser neighborhoods are also at risk of short-range embers from nearby homes, which could lead to structure-to-structure ignitions.

Buildings cannot be made fireproof, but the chance of your home surviving wildfires increases when you reduce structural ignitability through home hardening in tandem with the creation and maintenance of defensible space. Figure 3.a.5 depicts important home hardening measures.

Roofs, vents, windows, exterior siding, decks, and gutters are particularly vulnerable to wildfires. Research on home survival during wildfires demonstrates that enclosed eaves and vent screens can reduce the penetration of wind-born embers into structures (Hakes et al., 2017; Syphard and Keeley, 2019). According to the CWPP survey, **[Discuss if residents in the area have taken these precautions].**

Multi-pane windows have greater resistance to radiant heat. Windows often fail before a home ignites, providing a direct path for flames and airborne embers to enter a home (CSFS, 2021).

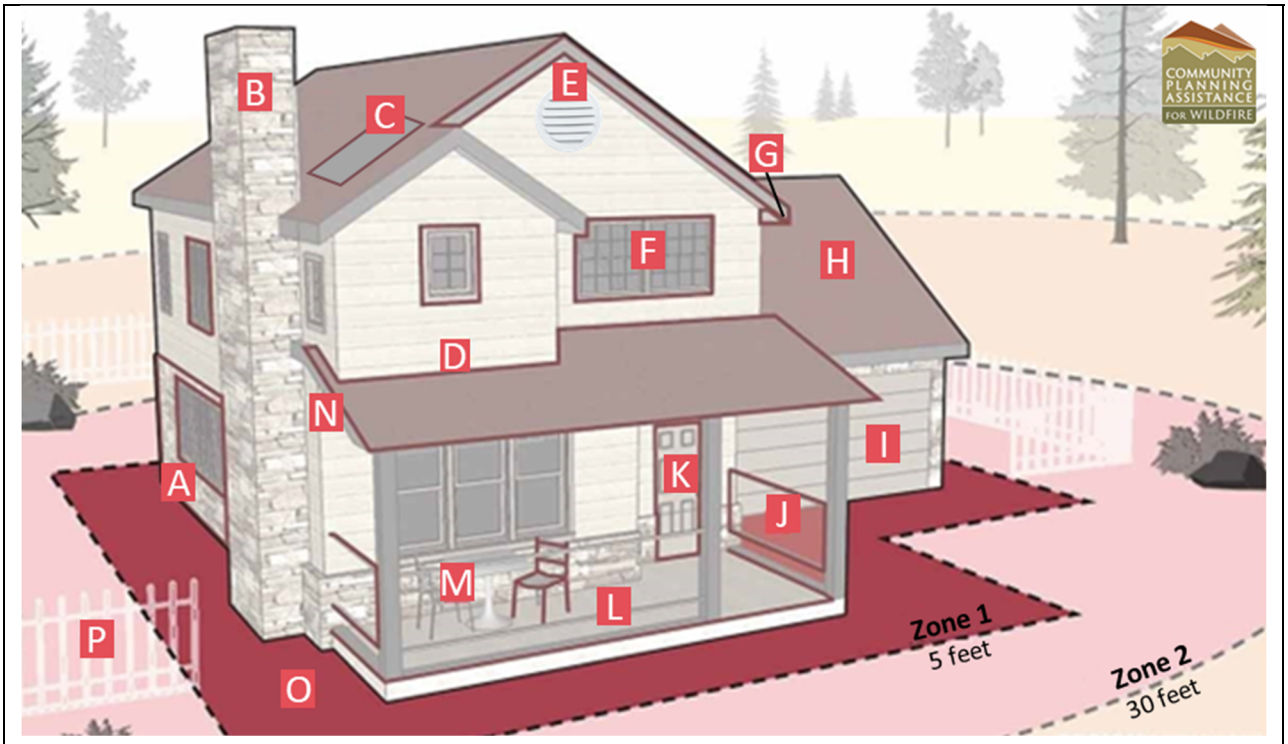
It is important to replace wood or shingle roofs with non-combustible materials[1] such as composite, metal, or tile. Ignition-resistant or noncombustible siding and decking further reduce the risk of home ignition, particularly when homes also have a 5-foot noncombustible border of dirt, stone, or gravel. Non-wood siding and decking are often more durable and require less routine maintenance.



Residents can increase their homes' chance of survival by making it harder for embers to enter and ignite their homes (image from *Healthy Building Science*).

There are many low-cost actions you can start with to harden your home (see **Table 3.a.2**). Keep home-hardening practices in mind and use ignition-resistant materials if you replace a hail-damaged roof or remodel your home.

[1] See the **Glossary** on page 106 for the definition of terms used to describe the performance of building materials when exposed to fire (e.g., wildfire-resistant, ignition-resistant, and noncombustible).



Low-cost actions:

- Cover chimneys and stovepipe outlets with 3/8th to ½ inch corrosion-resistant metal mesh.
- Minimize debris accumulation under and next to solar panels.
- Cover vent openings with 1/16th to 1/8th inch corrosion-resistant metal mesh. Install dryer vents with metal flappers and keep closed unless in use.
- Clear debris from roof and gutters regularly.
- Install metal flashing around and under garage doors that goes up at least 6 inches inside and outside the door.
- Use noncombustible lattice, trellis, or other decorative features.
- Install weather stripping around and under doors.
- Remove combustible materials from underneath, on top of, or within 5 feet of deck.
- Use noncombustible patio future.
- Cover all eaves with screened vents.
- Establish and maintain a 5-foot noncombustible buffer around the home.

Actions to plan and save for:

B. Use noncombustible or ignition resistant siding and trim (e.g., stucco, fiber cement, fire-retardant treated wood) at least 2 feet up around the base of your home.
E. Use multipaned glass for skylights, not materials that can melt (e.g., plexiglass), and use metal flashing.
F. Install a 6-inch vertical noncombustible surface on all gables above roofs.
G. Install multi-pane windows with at least one tempered-glass pane and metal mesh screens. Use noncombustible materials for window frames.
H. Install noncombustible gutters, gutter covers, and downspouts.
I. Install ignition-resistant or noncombustible roofs (composite, metal, or tile).
J. Install 1-hour fire rated garage doors.
A. Install a 1-hour fire rated doors.
B. Use ignition-resistant or noncombustible decking. Enclose crawl spaces.
C. Use noncombustible eaves.
F. Replace wooden fences with noncombustible materials and keep at least 8 feet away from the home. Keep double combustible fences at least 20 feet away from the home.

Figure 3.a.5. *A home can never be made fireproof, but home hardening practices decrease the chance that flames, radiant heat, and embers will ignite your home. Infographic by Community Planning Assistance for Wildfire with modifications to include information from CALFIRE 2019 and Maranghides et al. 2022.*

Annual Safety Measures and Home Maintenance in the WUI

Reviewing safety protocols, creating defensible space, and hardening your home are not one-time actions, but part of *annual* home maintenance when living in the WUI. During a wildland fire, homes that have clear defensible space are identified as sites for wildland firefighters to engage in structure protection, and homes that are not safely defensible will not usually receive firefighter resources.

The **Colorado State Forest Service** provides the following recommendations for annual activities to mitigate risks and increase your wildfire preparedness:

- ✓ Check fire extinguishers to ensure they have not expired and are in good working condition.
- ✓ Review your family's evacuation plan and practice family fire and evacuation drills.
- ✓ Verify that your home telephone number, cell phone, and/or email are properly registered for emergency notifications. Visit the *Clear Creek* https://www.jeffcom911co.gov/emergency-notification-system/ website on emergency notifications for more information.
- ✓ Review the contents of your "go-bag" and make sure it is packed and ready to go. Visit the https://www.rotarywildfireready.com/ to learn about preparing go-bags. Your go-bag should include supplies to last at least three days, including cash, water, clothing, food, first aid, and prescription medicines for your family and pets. Keep important documents and possessions in a known and easily accessible location so you can quickly grab them during an evacuation.
- ✓ Pay attention to red flag-day warnings from the National Weather Service and stay vigilant. Ensure your family is ready to go in case of an emergency.
- ✓ Walk your property to identify new hazards and ways to maintain and improve current defensible space. Take pictures of your defensible space to help you monitor regrowth and determine when additional vegetation treatments are necessary.
- ✓ Clear roofs, decks, and gutters of pine needles and other debris. Remove all pine needles and flammable debris from around the foundation of your home and deck. Remove trash and debris accumulations within 30 feet of your home. Repeat throughout the year as necessary.
- ✓ Properly thin and prune trees and shrubs that have regrown in home ignition zones 1 and 2 (0-5 feet and 5-30 feet from your home). Remove branches that overhang the roof and chimney. Prune trees and shrubs that are encroaching on the horizontal and vertical clearance of your driveway.
- ✓ Mow grass to a height of 4 inches or less within 30 feet of your home, camper / RV, sheds, and barns. If possible, keep your lawn irrigated, particularly within 30 feet of your home. Consider replacing dry grasses with Firewise Plant Materials that are more drought tolerant and less flammable.
- ✓ Check the visibility of your address and remove vegetation that obscures it.
- ✓ Check screens over chimneys, eaves, and vents to make sure they are in place and in good condition.
- ✓ Ensure that an outdoor water supply is available for responding firefighters. Put a hose and nozzle in a visible location. The hose should be long enough to reach all parts of your home.

Mitigation Barriers and Opportunities

Homeowners and residents in the WUI share concerns about mitigating risk and maintaining safe conditions in their home ignition zone. **Table 3.a.2**. Proposes several opportunities to address these challenges.

Table 3.a.2. *Common concerns from residents in the WUI, and potential solutions to encourage mitigation measures in the home ignition zone.*

Concern	Potential solutions
I don't have the resources to invest in defensible space.	Creating adequate defensible space can take years and a significant financial investment. Fortunately, there are **effective, low-cost measures** that residents can start with: ✓ Annually remove leaves, needles, and other vegetation from roofs, gutters, decks, and around the base of homes. ✓ Use hand tools like a pole saw to remove tree branches that hang less than 10 feet above the ground. ✓ Remove combustible materials (dry vegetation, wooden picnic tables, juniper shrubs, etc.) from underneath, on top of, or within 5 feet of decks. ✓ Remove downed logs and branches within 30 feet of all structures. ✓ Apply for cost-sharing grants with your neighbors to subsidize the creation of defensible space (see **Section 3.g.** for potential funding sources). ✓ Research tax credits that will offset the costs or the work you want to do.
I am afraid that removing trees will destroy the forest and reduce the aesthetic and monetary value of my property.	The reality is that nothing will decrease the value of your home as much as a high-severity wildfire burning all the vegetation in the community, even if your home survives the fire. Drive around the community and look for homes that have followed the guidelines in **Figure 3.a.2** and **Table 3.a.1**. Some properties in Clear Creek Fire Authority have exemplary defensible space and beautiful landscaping at the same time. Read Firewise Plant Materials from Colorado State University Cooperative Extension and Firescaping from FIRESafe MARIN for suggestions on beautiful, fire-resistant landscaping. As an added benefit, fire-resistant landscaping is often more drought tolerant. [Insert resource that outlines the role of fire in local ecosystems] Restored ecosystems can be aesthetically pleasing, benefit wildlife and light-loving wildflowers and grasses, and protect your home from high-severity wildfires.
My neighbors haven't mitigated risk on their property.	Some residents in Clear Creek Fire Authority are rightfully concerned about high hazards on their *[ex: neighbors' properties, surrounding public land, HOA open space, etc.*] Your home ignition zone might overlap with your neighbor's property. Given the high fire risk in the area, it is important that residents across Clear Creek

Fire Authority create defensible space and harden their homes. Ideas to inspire action by your neighbors include:

- ✓ Working with your Community Ambassador, your HOA, and other community groups to help educate your community about the benefits of defensible space and home hardening.
- ✓ Organizing walking tours to visit the property of residents with exemplary defensible space. Witnessing the type of work that can be done, and seeing that a mitigated property can still be aesthetically pleasing, can encourage others to follow suit.
- ✓ Inviting your neighbors over for a friendly conversation about the risk assessment in this CWPP. Review resources about defensible space together, discuss each other's concerns and values, and develop joint solutions to address shared risk.

Fire-resistant landscaping in zone 1 can be aesthetically pleasing and more drought tolerant, requiring less watering during the summer. Limbed and thinned trees in zone 2 (as seen in the background of this photo) can create beautiful, open conditions that allow understory vegetation to flourish under higher light conditions and provide habitat for wildlife.

Photo credit: Washinaton State Universitv Master Gardener Proaram.

Evacuation Preparedness

The best way to get out quickly and safely during an evacuation is to be prepared with a go-bag and have a family emergency plan **before** the threat of wildfire is in your area. Talk to children and elderly family members about what they are expected to do and make necessary plans for pets and/or livestock. Visit the https://csfs.colostate.edu/live-wildfire-ready/ for information on go-bags and evacuation planning. Signing up for local emergency notifications can also help you leave quickly. Residents should register their cell phones and email addresses through Lookout Alert, the

official emergency notification system for Clear Creek County. See the Clear Creek Sheriff's Office website on Emergency Management for more information.

Evacuation preparedness is the responsibility of each resident in Clear Creek Fire Authority. Unfortunately, only 54% of respondents to the CWPP survey have evacuation plans for their families, and only 54% have go-bags at the ready. These are simple and crucial actions that can save lives.

Understand the types of emergency communications you might receive during an incident. The following definitions are provided by the Clear Creek Sheriff's Office.

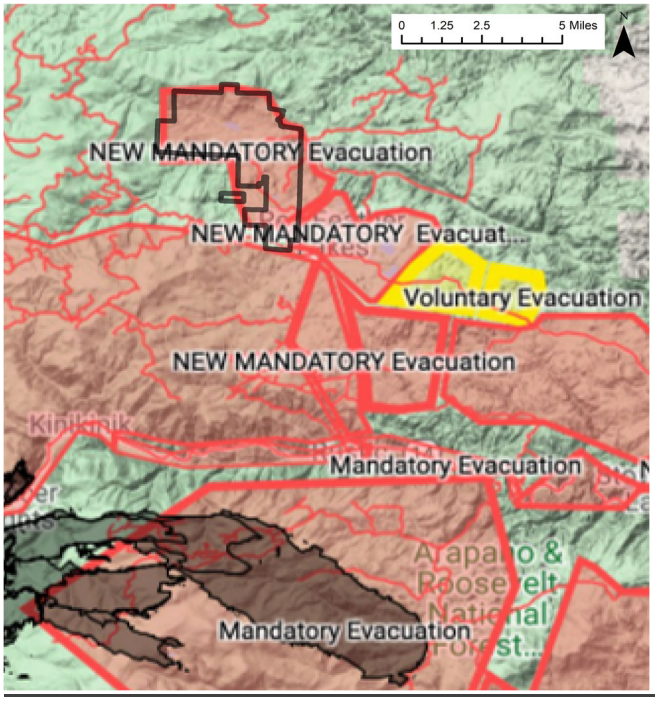
> ***Advisory messages*****:** will [*provide information but do not require any action on your part*].
>
> ***Instruction messages*****:** provide information and require you to take some action to be safe. There are three types of standard instructions:
>
> - ***Shelter in place:*** *There is a hazard in your area, and you should remain or go indoors; you should not go outdoors and not evacuate the area. This may be the safest strategy for hazardous materials, law enforcement, or other incidents wherein an evacuation could increase the danger to you and others.]*
> - ***Pre-evacuation:*** *A hazard in your area may require you to evacuate soon. Everyone should be prepared to leave at a moment's notice. Do so if you feel you are in danger and want to leave. If you need additional time to evacuate, you should consider leaving now. If you need to arrange for transportation assistance, you should do so immediately. If you have livestock or other large animals, you should consider removing them from the hazard area now.]*
> - ***Evacuation:*** *Your area has a hazard, and you have been ordered to evacuate immediately. If you need assistance evacuating yourself or need help evacuating animals, call 911. You will be provided with what the emergency is and its location, so make sure you understand where the emergency is and that your primary evacuation routes may be closed or unpassable. You will also be told where an evacuation point has been established to provide information and a safe place if you have nowhere else to go.* ***Do not delay – evacuation means you need to leave immediately!]***

Some residents have family members or neighbors with physical limitations who might struggle to evacuate in a timely manner. Family members or individuals living alone also need to address the unique needs and vulnerabilities that arise from mobility or hearing impairments during an evacuation. Other residents are concerned about school-aged children who might be home alone during an evacuation. Parents should work with their neighbors to develop a plan for how their children would evacuate if they were to be home alone. Families with these concerns should put extra time into having go bags ready and using the earliest evacuation warnings to leave in the event of a wildfire, rather than waiting for mandatory evacuation orders. Having a plan in place ahead of time can ensure prompt evacuations and save lives during wildfires.

Residents with livestock trailers or large camper vehicles should plan to leave during voluntary evacuation notices to allow time for their preparations and create more space on the roads for other residents during a mandatory evacuation. It is important to have a plan for where to take livestock to reduce some of the chaos and uncertainty created by wildfire evacuations.

Follow evacuation etiquette *to increase the chance of everyone exiting the CCFA in a safe and timely manner during a wildfire incident:*

- Our county uses [*insert local emergency notification system here]* and asks residents to register for emergency notifications through Lookout Alert for timely information about evacuations.
- See the https://www.clearcreekcounty.us/761/Clear-Creek-County-Sheriffs-Office for details.
- Leave as quickly as possible after receiving an evacuation notice.
- Have a go-bag packed and ready during the wildfire season, especially on days with red flag warnings.
- Leave with as few vehicles as necessary to reduce congestion and evacuation times across the community.
- Drive safely and with headlights on. Maintain a safe and steady pace. Do not stop to take pictures.
- Yield to emergency vehicles.



Clear Creek Fire Authority residents experienced mandatory and voluntary evacuations during the 2021 Miners Candle Fire. Following Clear Creek County Sheriff's Office orders during evacuations is critical to keep residents and first responders safe.]

Photo credit: Denver7 News (left) and Blaine Howerton/North Forty News (right).

Accessibility and Navigability for Firefighters

Address signs

Installing reflective address numbers can save lives by making it easier for firefighters to navigate to your home at night and under smokey conditions. Mount reflective address signs on noncombustible posts, not on stumps, trees, wooden posts, or chains across driveways. Chains across driveways might be removed during wildfire suppression to facility access to your property. Make sure the numbers are clearly visible from both directions on the roadway.

Driveways

It is important to ensure emergency responders can locate and access your home. Narrow driveways without turnarounds, tree limbs hanging over the road, and lots of dead and down trees by the road may make firefighters choose to not defend your home during a wildfire event (Brown, 1994).

Some Clear Creek Fire Authority roads have accessibility and navigability issues, such as steep grades, limited clearances, no available turnarounds, and heavy fuel loading adjacent to road edges. These unsafe road and driveway conditions could prevent firefighters from attempting to defend homes. According to the National Fire Protection Association, driveways and roads should have a minimum of 20 feet of horizontal clearance and 13.5 feet of vertical clearance to allow engines to access the roads safely (O'Connor, 2021).

Many driveways within unincorporated Clear Creek do not meet current access requirements and pose safety issues that are difficult to mitigate. Driveways that are steeper than 10% grade, long without pullouts, terminate without turnaround space can create challenges for emergency response vehicles during wildfires. Home hardening and fuel mitigation are particularly important to reduce wildfire risk around homes with accessibility issues.

Where possible, residents should improve roadway access, and where this is not feasible, it is vital that homeowners take measures to harden their home and create defensible space. Some actions to increase access to your home are simple, such as installing reflective address numbers, and others take time and investment, such as widening driveways to accommodate fire engines.

Private Water Resources

In areas not served by a municipal water system, the installation of cisterns can provide an equivalent water supply. These systems must be located within 1000 feet of the homes, hold a minimum of 10,000 gallons, and have a 6-inch draft connection. There should be sufficient space to either pull alongside or back up to the tank location.

Most importantly, create defensible space around your home and buildings so that water resources can be used effectively. Maintaining a property that requires less water and resources to defend is more likely to survive a fire. See **Table 3.a.1** and **Figure 3.a.5** for guides on defensible space and home hardening recommendations.

Steps to enhance firefighter safety and access to your home:

- Install reflective address numbers on the street to make it easier for firefighters to navigate to your home under smokey conditions and at night. Make sure the numbers are clearly visible from both directions on the roadway. Use noncombustible materials for your address sign and sign supports. **Installing reflective address numbers can save lives and is inexpensive and easy to accomplish.**
- Address roadway accessibility for fire engines. Long, narrow, steep, and curving private drives and driveways without turnarounds significantly decrease firefighter access to your property, depending on fire behavior.
- Fill potholes and eroded surfaces on private drives and driveways.
- Increase fire engine access to your home by removing trees along narrow private drives and driveways so the horizontal clearance is 20 feet wide, and prune low-hanging branches of remaining trees so the unobstructed vertical clearance is at least 13.5 feet per the National Fire Protection Association (O'Connor, 2021).
- Park cars in your driveway or garage, not along narrow roads, to make it easier for fire engines to access your home and your neighbors' homes.
- Clearly mark septic systems with signs or fences. Heavy fire equipment can damage septic systems.
- Clearly mark wells and water systems. Leave hoses accessible for firefighters to use when defending your home, but **DO NOT** leave the water running. This can reduce water pressure to hydrants across the community and reduce the ability of firefighters to defend your home. Read this post by FIRESafe Marin about why it is dangerous to leave water running when you evacuate during a wildfire.
- Post the load limit at any private bridges or culverts on your property.
- Leave gates unlocked during mandatory evacuations to facilitate firefighter entrance to your property.
- Leave exterior lights on to increase visibility.

If time allows, leave a note on your front door confirming that all parties have evacuated and providing your contact name and phone number.

3.b. Neighborhood Recommendations

The CWPP is a useful planning document, but it will only affect real change if residents, neighbors, Clear Creek Fire Authority, other community groups, and agency partners come together to address shared risk and implement strategic projects. This section of the CWPP discusses the concept of linked defensible space and mosaic landscapes and provides relative hazard ratings and specific recommendations for CWPP plan units in Clear Creek Fire Authority. CWPP plan units are groups of neighborhoods with shared fire risk. We encourage residents within CWPP plan units to organize and support each other to effectively reduce wildfire risk and enhance emergency preparedness.

Linked Defensible Space

The home ignition zone of individual residents can overlap that of their neighbors, so wildfire hazards on one property can threaten adjacent properties. Structures that are on fire can emit significant radiant heat and embers and endanger homes and structures near them.

Neighbors can increase their homes' chances of survival during a wildfire if they work together to create linked defensible space. Linked defensible space also creates safer conditions

and better tactical opportunities for wildland firefighters. [*According to James White, the Prescribed Fire and Fuels Specialist for the Arapaho/Roosevelt National Forests, "Broadcast burning, mechanical thinning, and other treatments are proven to mitigate wildfire risk, but they are even more effective when we work together to integrate treatments across the landscape, across borders and ownerships" (Avitt, 2021).]* Defensible space projects that span ownership boundaries are better candidates for grant funding due to their strategic value.

How can you help inspire action by your neighbors? Start by creating defensible space and hardening your own home. Then try the ideas below:

- Invite your neighbors over for a friendly conversation about the risk assessment in this CWPP. Review resources about defensible space together, discuss each other's concerns and values, and develop joint solutions to address shared risk.
- Volunteer with [*ex: specific community groups]* to help educate your community about the benefits of defensible space and home hardening.
- Help organize walking tours in your neighborhood to visit the property of residents with exemplary defensible space. Witnessing the type of work that can be done, and seeing that a mitigated property can still be aesthetically pleasing, can encourage others to follow suit.

Mosaic Landscapes

Varied fuel types are known to slow the spread of fire, and heterogeneous landscapes (landscapes with multiple fuel types and trees of different sizes and ages) are more typical of historical forest conditions (Duncan et al., 2015). Creating a mosaic landscape in neighborhoods can help slow fire spread by changing the fuel types as it moves across a hill or valley. A mosaic landscape can be created in many ways. For example, a neighborhood could have a few acres of old-growth conifer trees next to a couple acres of aspen stands and a few acres of young regenerating conifer trees by a large grassy meadow. This can be arranged in many ways for aesthetic and tactical purposes, and will resemble a patchwork quilt or mosaic art (**Figure 3.b.1**).

The homes in these patches still need adequate defensible space, but this would create a more diverse landscape where fire may move slower as it transitions between forest types and unforested locations like shrublands or meadows. A slower fire movement means firefighters have time to defend more homes in the neighborhood. It also creates a diversity of biomes that both residents and wildlife enjoy.

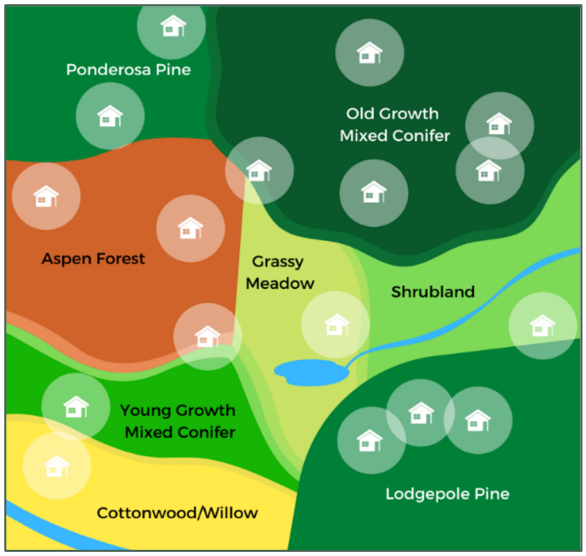


Figure 3.b.1. *Example of a mosaic landscape in a neighborhood. Each home has defensible space around it, and the landscape is varied throughout, providing tactical opportunities for firefighters working to defend homes. Source: The Ember Alliance*

Relative Risk Ratings by CWPP Plan Unit

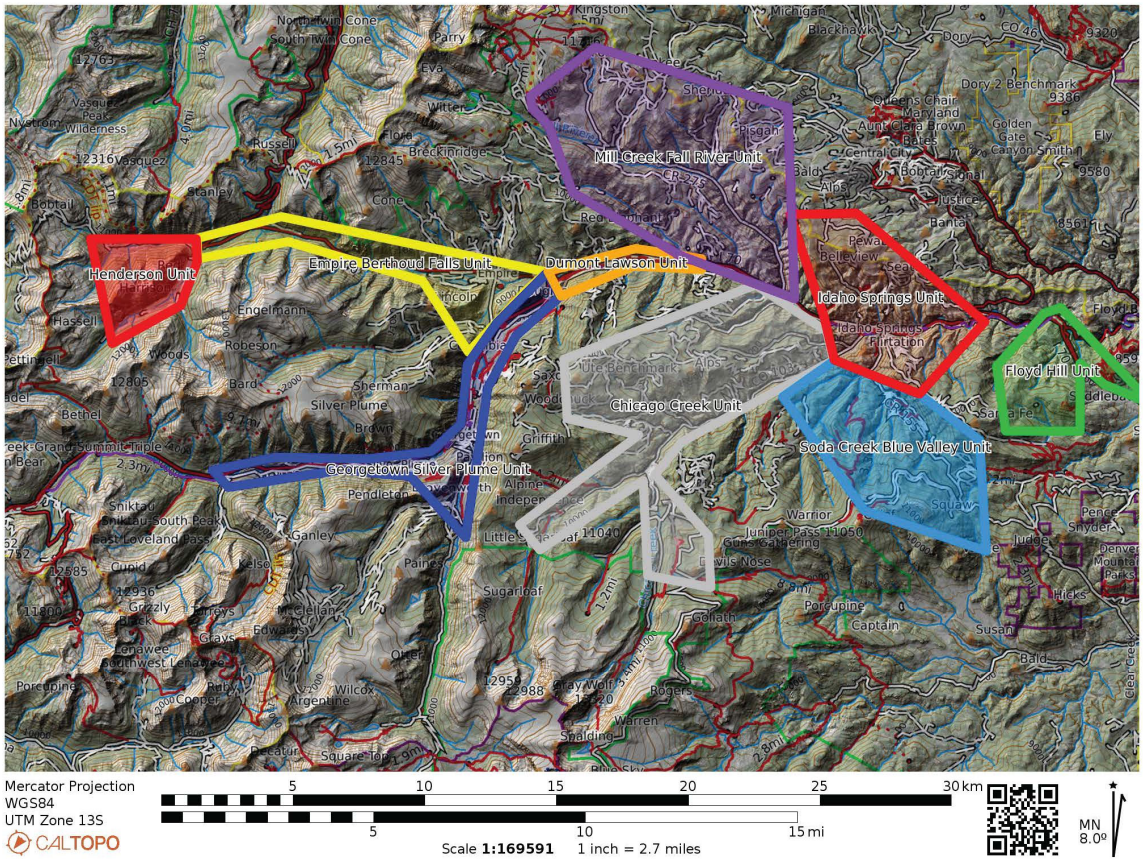
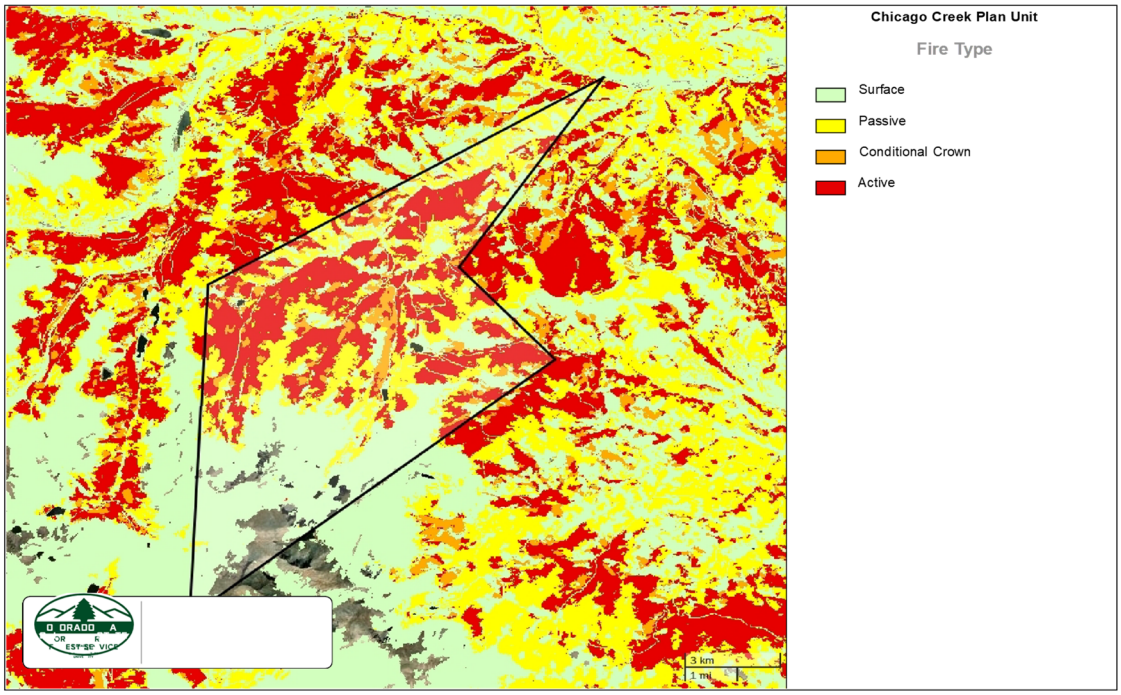


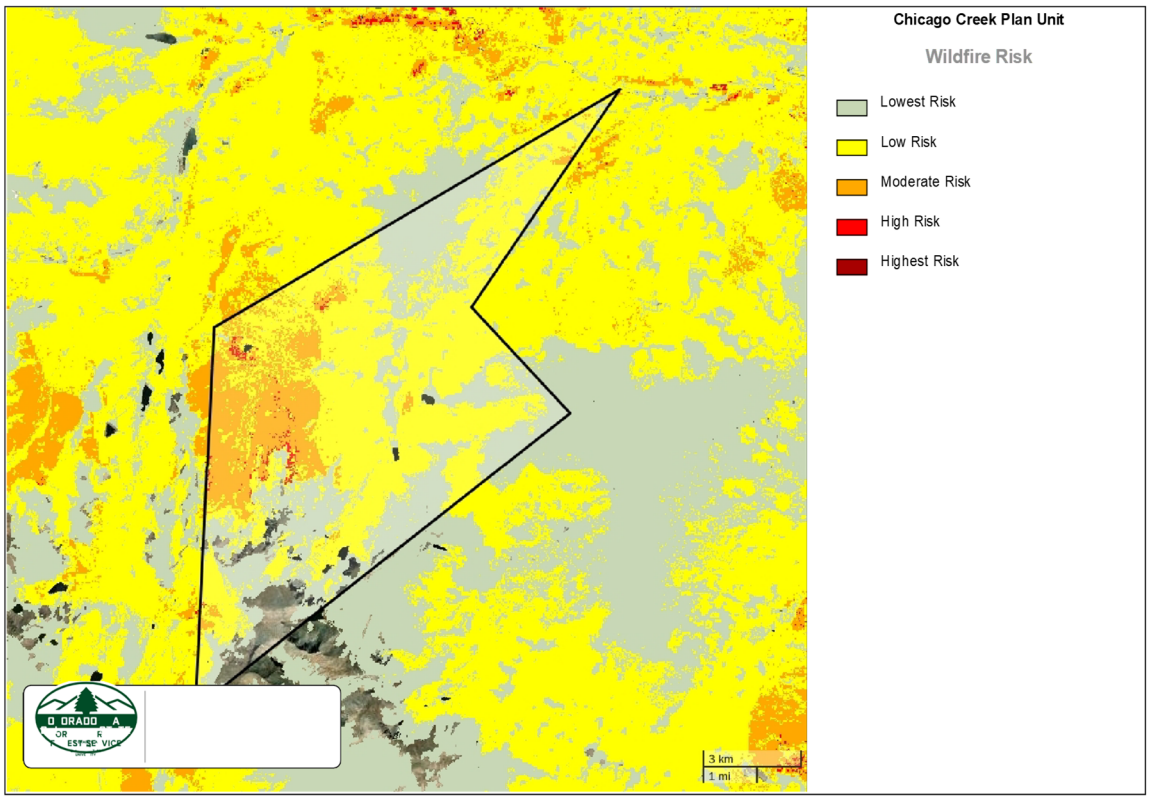
Figure 3.b.2. CWPP plan units in Clear Creek Fire Authority.

Wildfires' potential to threaten lives and property is moderate to high across the Clear Creek Fire Authority, but the risk is relatively higher in some parts of the district than others. Plan units with higher relative risk are strong candidates for immediate action to mitigate hazardous conditions. However, plan units with moderate relative risk still possess conditions concerning protecting life and property in the case of a wildfire. Most plan units have limited road access that follows the valley floors. Only four units have an interstate highway or state highway traveling through the unit to provide enhanced vehicle access and support evacuation efforts.

The plan units were designed to capture most residential structures within each operational area. They were geographically delineated by drainage, access availability, fuel type, or special hazards.

Chicago Creek – Low to moderate relative risk rating





The vegetation in the unit consists of a lodgepole pine-spruce fir mixed forest with a timber understory consisting of large quantities of timber litter and young trees.

The plan unit has 226 structures distributed throughout the valley floor, with a limited number dispersed within the adjacent valley sides. All structures are in the wildland-urban interface risk category.

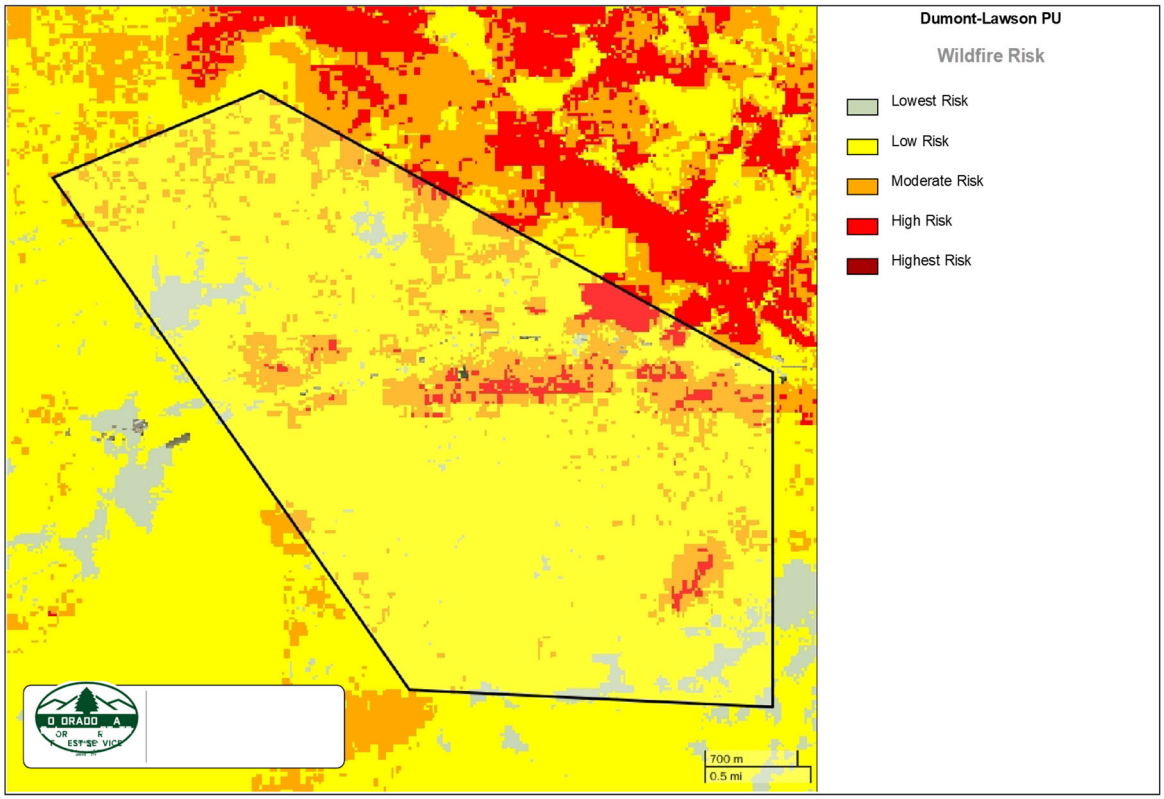
Highway 103 is a two-lane state highway providing primary access to this unit. The road is in good condition and has sufficient pullout areas supporting evacuation activities while emergency response units enter the area and are survivable in a wildfire event. The secondary roads within the unit are improved dirt-surfaced roadways with continuous fuels adjacent to both sides of the road surface. These roads have limited pullouts and narrow areas that would not allow two-way traffic. Homes in the unit do not have address markers at the start of the driveways; this forces responders to utilize the response map book to locate homes.

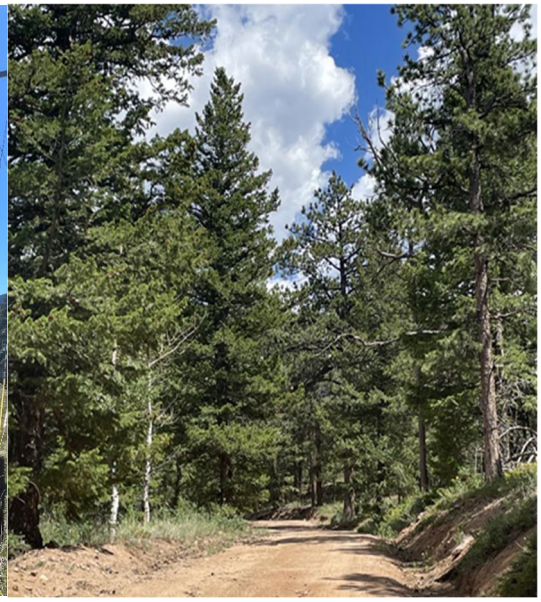
Recommendations for collective action in the Chicago Creek Plan Unit:

- Perform Home Hardening to reduce the home ignition potential from embers and structure to structure ignitions.
- Mitigation of private property to the property lines. (The lot size can limit the ability to mitigate beyond 150 feet from the structure).
- Perform roadside mitigation, including shaded fuel breaks, complete fuel removal to 50 Feet on each side of the road surface, or a combination of both.
- Perform evacuation planning and education with the residents of the unit. Install evacuation signs in selected areas to assist in evacuating visitors.
- Work with private landowners and USFS personnel to develop mitigation actions to improve the POD lines in Ute Creek, Cascade Creek, South Spring Gulch, and Trail Creek drainages.
- Mitigate the area adjacent to the Idaho Springs Reservoir to limit post-fire impacts on the water supply.
- Mitigate the area adjacent to the Idaho Springs Water Treatment Plant and its associated water intake infrastructure to protect critical infrastructure and minimize post-fire impacts on water quality.

The fire danger in the unit is low to moderate. Due to fuel and topography, fires within the drainages in the unit have the potential to reach flame lengths exceeding 12 feet. The high-intensity fire will support passive and active crown fires throughout the unit. The rate of spread potential is 60 chains per hour or greater. Fires in the unit can produce debris flows post-fire that will directly affect water quality in Idaho Springs and the downstream water users in the metro area. Crown fire activity can produce ember showers up to two miles ahead of the approaching fire front. The embers pose more risk than passing the crown fire to the structure. Home hardening and mitigating the areas within 30 feet of the structure are crucial to reducing the probability of ignition.

Dumont-Lawson – Low to Moderate relative risk rating





The vegetation in the unit consists of a predominantly lodgepole pine stands with a mixed conifer and spruce-fir forest. The timber understory consists of large quantities of timber litter and young trees. Small areas of ponderosa pine are mixed with large open grass fields.

The plan unit has 336 structures distributed throughout the valley floor, with a limited number dispersed within the adjacent valley sides. All structures are in the wildland-urban interface risk category. The unit contains six mobile home parks with a high building density and limited options for home hardening.

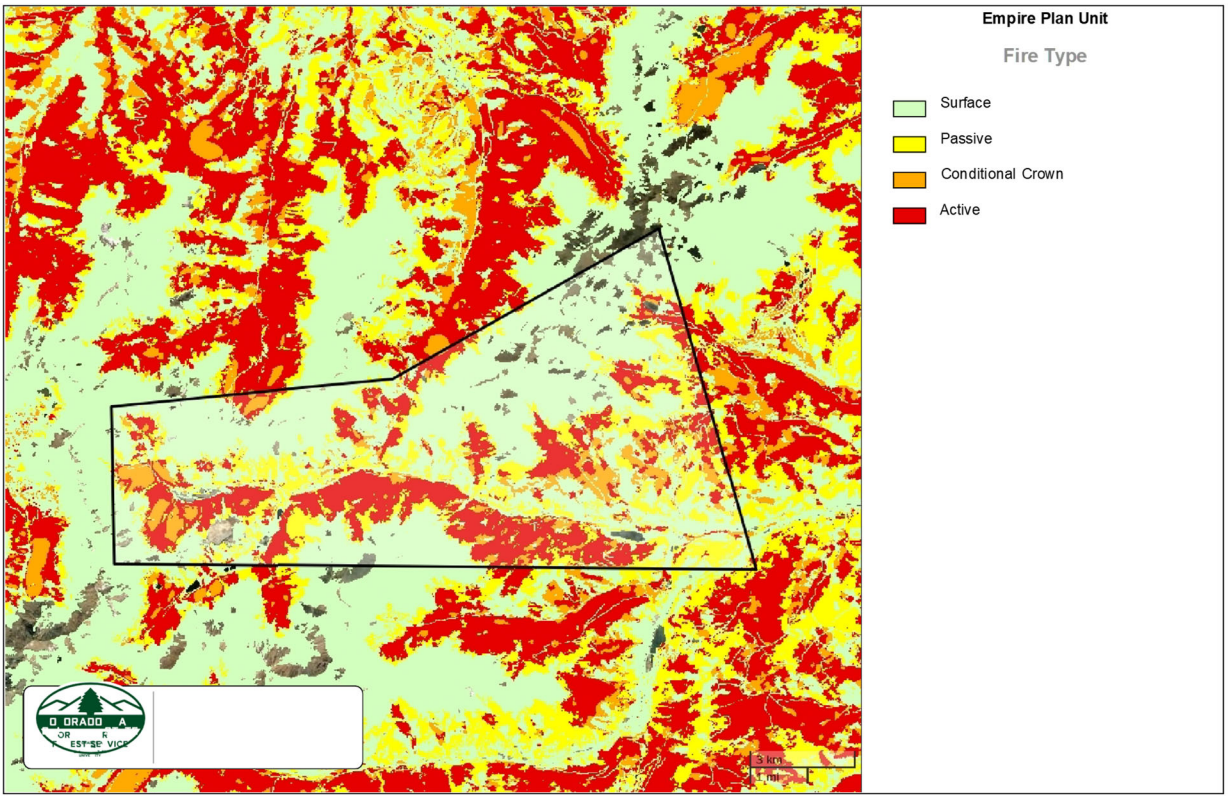
Interstate 70 is a four-lane interstate that runs through the plan unit. There are two exits and onramps within the unit that access I-70. County road 308 is a two-lane, providing primary access to this unit. The road is in good condition and has sufficient pullout areas supporting evacuation activities while emergency response units enter the area and are survivable in a wildfire event. The secondary roads within the unit are improved dirt-surfaced roadways with continuous fuels adjacent to both sides of the road surface. These roads have limited pullouts and narrow areas that would not allow two-way traffic. Homes in the unit do not have address markers at the start of the driveways; this forces responders to utilize the response map book to locate homes.

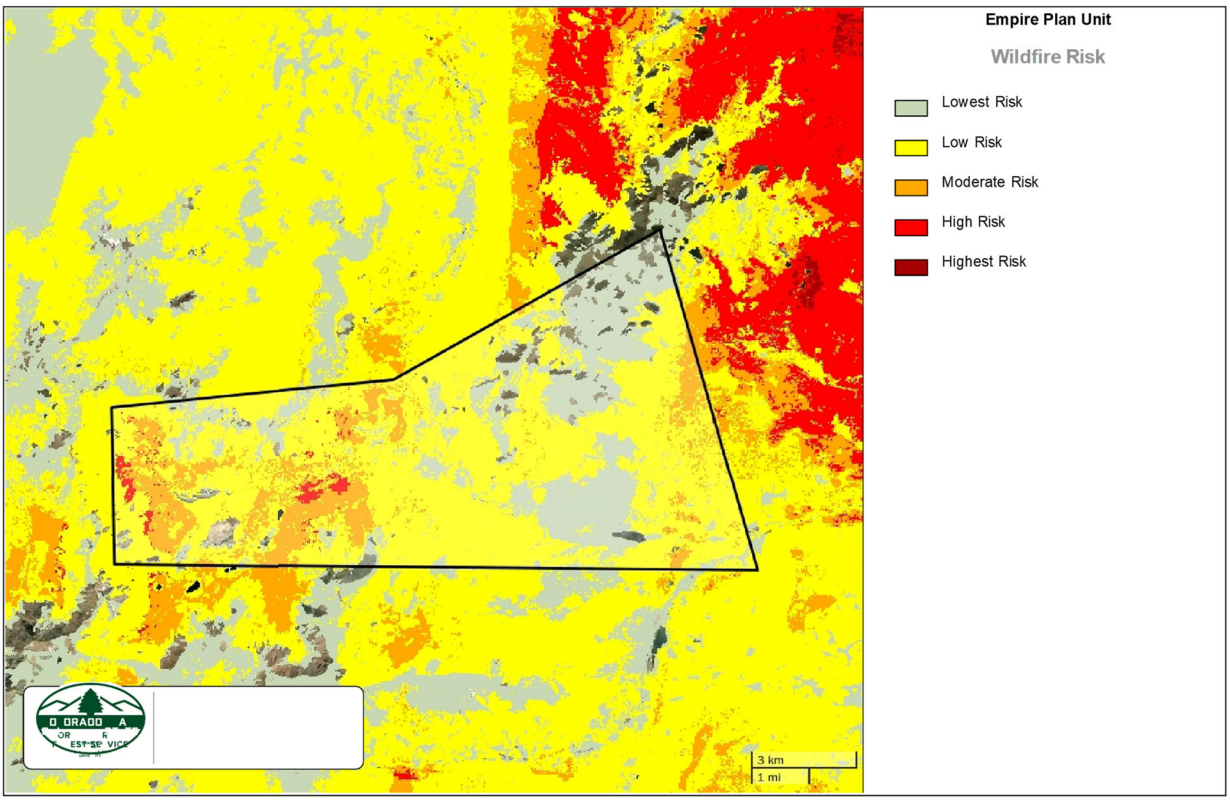
Recommendations for collective action in the Dumont-Lawson Plan Unit:

- Perform Home Hardening to reduce the home ignition potential from embers and structure to structure ignitions.
- Mitigation of private property to the property lines. (The lot size can limit the ability to mitigate beyond 150 feet from the structure).
- Perform roadside mitigation, including shaded fuel breaks, complete fuel removal to 50 Feet on each side of the road surface, or a combination of both.
- Plan and educate the residents of the unit about evacuation. Install evacuation signs in selected areas to assist visitors in evacuating.
- Remove all dead standing conifer trees that are adjacent to homes north of Dumont Lane.

The fire danger in the unit is low to moderate. Due to fuel and topography, fires within the drainages in the unit have the potential for flame lengths over 12 feet. The high-intensity fire will support passive and active crown fires throughout the unit. The rate of spread potential is 60 chains per hour or greater. Fires in the unit can produce debris flows post-fire that will directly affect water quality in the City of Blackhawk and the downstream water users in the metro area. Crown fire activity can produce ember showers up to two miles ahead of the approaching firefront. The embers pose more risk than passing the crown fire to the structure. Home hardening and mitigating the areas within 30 feet of the structure are crucial to reducing the probability of ignition.

Empire –Berthoud Falls- Moderate to high relative risk rating






The vegetation in the unit consists of spruce fire timber stands, smaller areas of lodgepole, and open grass areas. There are large areas of brush spread throughout the unit. The primary ground fuels are grass, along with a timber understory consisting of large quantities of timber litter and young trees.

The plan unit has 533 structures distributed throughout the valley floor, with a limited number dispersed within the adjacent valley sides. All structures are in the wildland-urban interface risk category.

US 40 is a two-lane state highway providing primary access to this unit. The road is in good condition and has sufficient pullout areas supporting evacuation activities while emergency response units enter the area and are survivable in a wildfire event. The secondary roads within the unit are improved and unimproved dirt-surfaced roadways with continuous fuels adjacent to both sides of the road surface. These roads have limited pullouts and narrow areas that would not allow two-way traffic. Most homes in the unit do not have address markers at the start of the driveways; this forces responders to utilize the response map book to locate homes. The area has a large population of visitors recreating the North Empire areas. The recreation areas will require additional effort to evacuate effectively during an event.

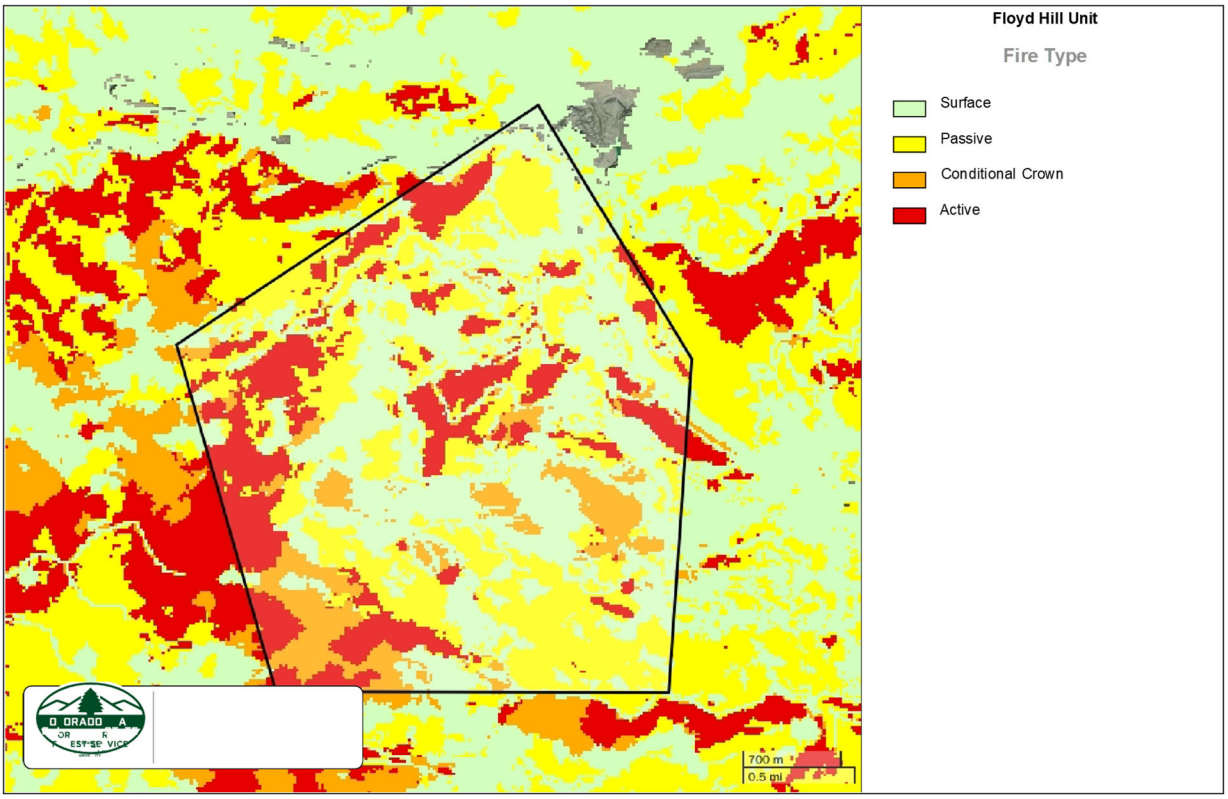
Recommendations for collective action in the Empire-Berthoud Falls Plan Unit:

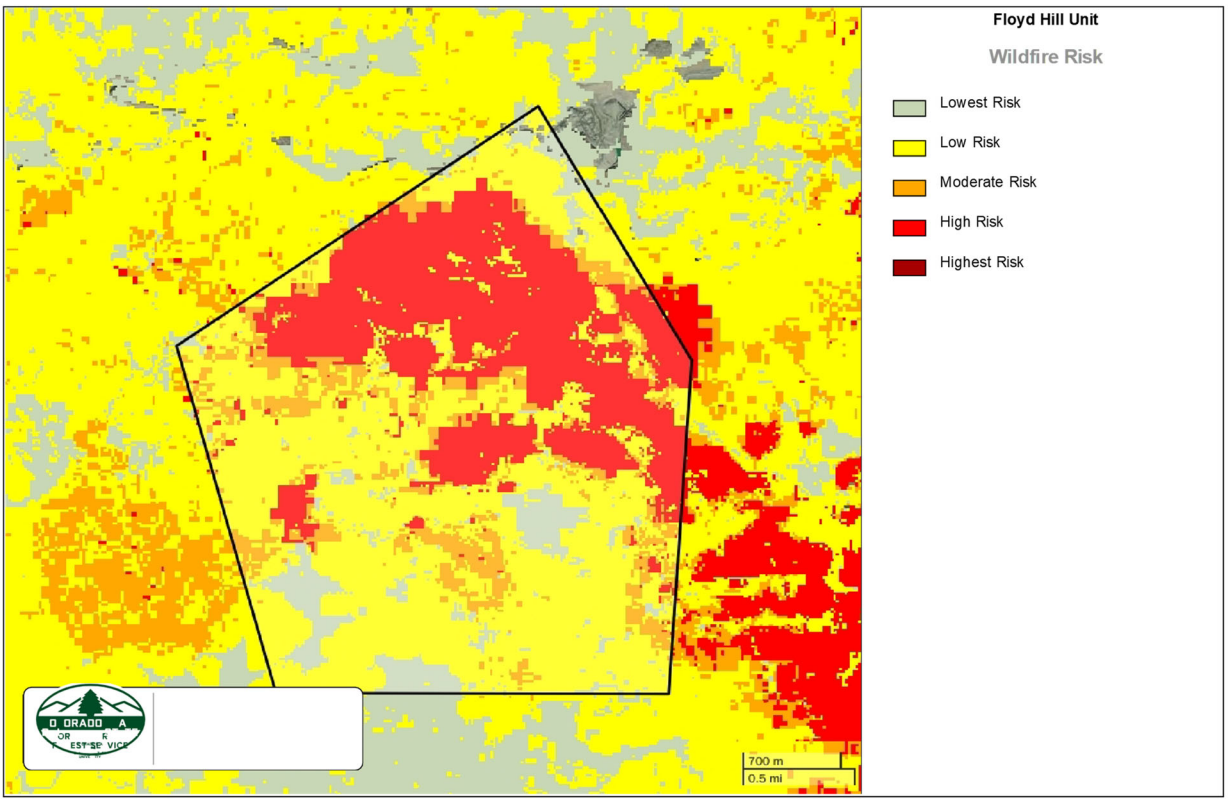
- Perform Home Hardening to reduce the home ignition potential from embers and structure to structure ignitions.
- Mitigation of private property to the property lines. (The lot size can limit the ability to mitigate beyond 150 feet from the structure).
- Perform roadside mitigation, including shaded fuel breaks, complete fuel removal to 50 Feet on each side of the road surface, or a combination of both.
- Plan and educate the unit's residents about evacuation. Install evacuation signs in selected areas to assist visitors in evacuating. Evaluate the areas adjacent to Guanella Ranch Reservoir and the Empire Ball Fields as possible evacuation staging areas.
- Work with private landowners, Clear Creek County, and USFS personnel to develop mitigation actions to improve the POD lines in the north Empire area, including fuel breaks that would connect into the Mill Creek drainage.
- Partner with Clear Creek County, USFS, and Colorado Division of Wildlife to plan and implement future large-scale fuel breaks that will support the migration of Bighorn Sheep through the unit.
- Mitigate the area adjacent to the Town of Empire Water Treatment Plants and associated water intake infrastructure to protect critical infrastructure and limit the post-fire impacts on water quality.

- Work with property owners in the historic downtown to harden all buildings.

The fire danger in the unit is moderate to high. Due to fuel and topography, fires within the drainages in the unit have the potential for flame lengths over 12 feet. The high-intensity fire will support passive and active crown fires throughout the unit, while surface fires are the primary fire type in the unit. The rate of spread potential is 60 chains per hour or greater. Fires in the unit can produce debris flows post-fire that will directly affect water quality in the Town of Empire and the downstream water users in the metro area. Crown fire activity can produce ember showers up to two miles ahead of the approaching firefront. The embers pose more risk than passing the crown fire to the structure. Home hardening and mitigating the areas within 30 feet of the structure are crucial to reducing the probability of ignition.

Floyd Hill – High relative risk rating





The vegetation in the unit consists of lodgepole pine, ponderosa pine, and mixed conifer forest with a timber understory comprised of large quantities of timber litter and young trees.

The plan unit has 535 structures distributed throughout the mountainside south of Interstate 70. The neighborhood homes are adjacent to a road network that travels cross-slope. This configuration places most homes above the heavy fuels adjacent to the drainage bottoms. A limited number of structures adjacent to US 40 are above the fuels at the bottom of the drainages and in line with the expected direction of travel for fires that start below the homes. All structures are in the wildland-urban interface risk category.

Interstate 70 is a four-lane highway running through the unit's center. US 40 and US 6 are two-lane state highways that provide primary access to the northern section of the unit. The Saddleback neighborhood is accessed via improved paved two-lane county roads and improved dirt two-lane county roads. The main paved roads are in good condition and have sufficient pullout areas supporting evacuation activities. At the same time, emergency response units enter the area, which may be survivable in a wildfire event. The secondary roads within the unit are improved dirt-surfaced roadways with continuous fuels adjacent to both sides of the road surface. These roads have limited pullouts and narrow areas that would not allow two-way traffic. Homes in the unit have address markers at the start of the driveways.

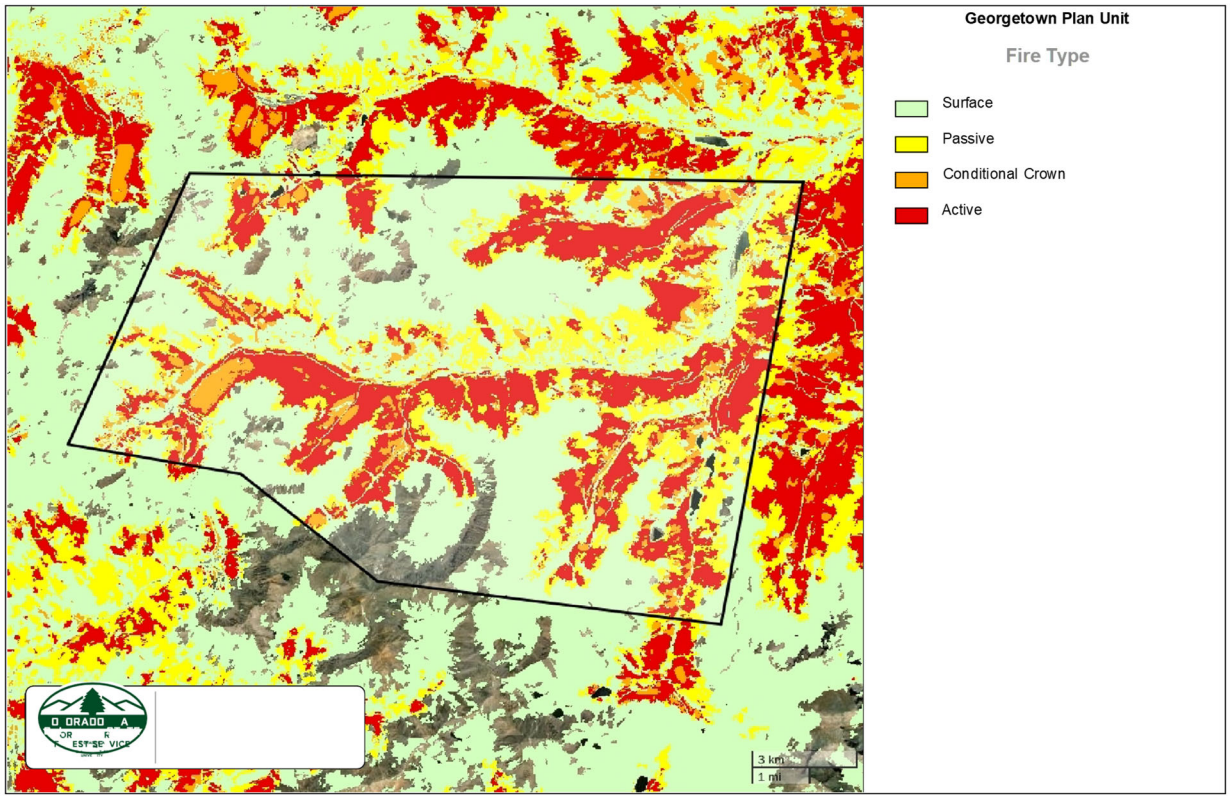
Recommendations for collective action in the Floyd Hill Plan Unit:

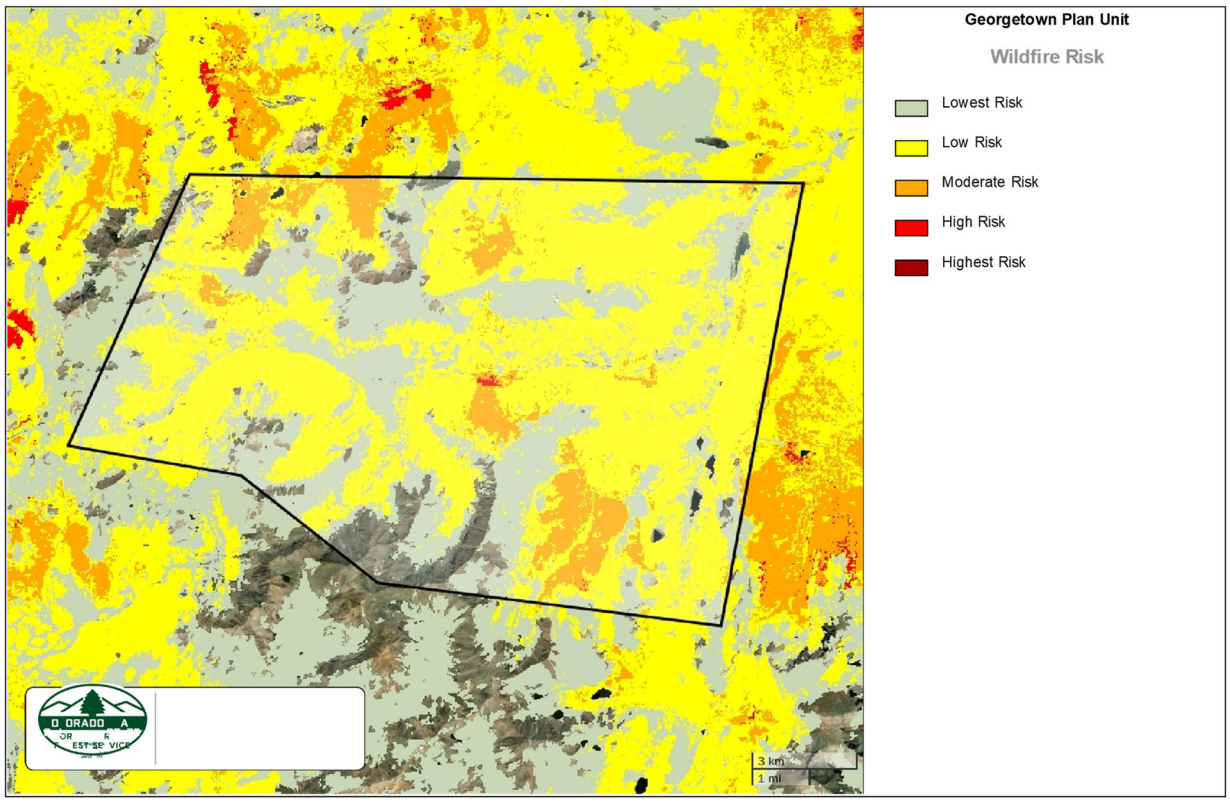
- Perform Home Hardening to reduce the home ignition potential from embers and structure to structure ignitions.
- Mitigation of private property to the property lines. (The lot size can limit the ability to mitigate beyond 150 feet from the structure).
- Perform roadside mitigation, including shaded fuel breaks, complete fuel removal to 50 Feet on each side of the road surface, or a combination of both.
- Plan and educate the residents of the unit about evacuation. Install evacuation signs in selected areas to assist visitors in evacuating.
- Mitigate the fuels within the drainages below the homes to reduce the ground fuels while increasing the canopy spread to a minimum of ten feet.
- Mitigate the areas below the high-voltage power lines that travel through the Saddleback Neighborhood. The regeneration trees below these lines are twelve to fifteen feet tall and directly below adjacent homes.
- Work with private property owners, Clear Creek County, and CDOT to develop secondary evacuation routes from the Saddleback Neighborhood, including a traffic management plan addressing the limited I-70 access.

- Improve the emergency access road between Saddleback neighborhood and Beaver Brook Canyon Road. Improvements include mitigating the fuels adjacent to the road surface and improving the road surface to support large-scale evacuation efforts.

The fire danger in the unit is high due to the location of the homes in relation to the fuels and the increased risk of human-caused fires occurring along I-70 and within the Saddleback Neighborhood. Due to fuel and topography, fires within the drainages in the unit have the potential for flame lengths over 12 feet. The high-intensity fire will support passive and active crown fires throughout the unit. The rate of spread potential is 4 to 60 chains per hour, with small areas with the potential for spread rates greater than 60 chains per hour. Fires in the unit can produce debris flows post-fire that will directly affect water quality for the downstream water users in the metro area. Crown fire activity can produce ember showers up to two miles ahead of the approaching firefront. The embers pose more risk than passing the crown fire to the structure. Home hardening and mitigating the areas within 100 feet of the structure are crucial to reducing the probability of ignition.

Georgetown-Silver Plume – Low to moderate to high relative risk rating






The vegetation in the unit consists of a lodgepole pine-spruce fir mixed forest with a timber understory comprised of large quantities of timber litter and young trees. There is a significant brush component in the Guanella Pass area and a grass component on the east side of the unit. The unit has a large number of blown-over trees throughout.

The plan unit has 1380 structures distributed throughout the valley floor, with a limited number dispersed within the adjacent valley sides. 97% of structures are in the wildland-urban interface risk category.

Interstate 70 is a four-lane highway that travels through the unit's center and is the primary access road. Alverado Road is a two-lane paved roadway that runs parallel to I-70. Guanella Pass is a paved two-lane road connecting the town of Georgetown with Grant in Park County. Loveland Pass is a two-lane state highway providing access to the southwestern portion of the unit. The roads are in good condition and have sufficient pullout areas supporting evacuation activities while emergency response units enter the area. The roads will be survivable in a wildfire event. The secondary roads within the unit are improved dirt-surfaced roadways with continuous fuels adjacent to both sides of the road surface. These roads have limited pullouts and narrow areas that would not allow two-way traffic. Homes in the unit do not have address markers at the start of the driveways; this forces responders to utilize the response map book to locate homes. Recreation in the unit adds a significant number of visitors hiking or using off-highway vehicles. These additional visitors will have limited access to cell coverage and could be challenging to notify or evacuate. The Georgetown Loop Railroad adds additional risk to the unit through steam locomotives and the risks associated with rail equipment failures.

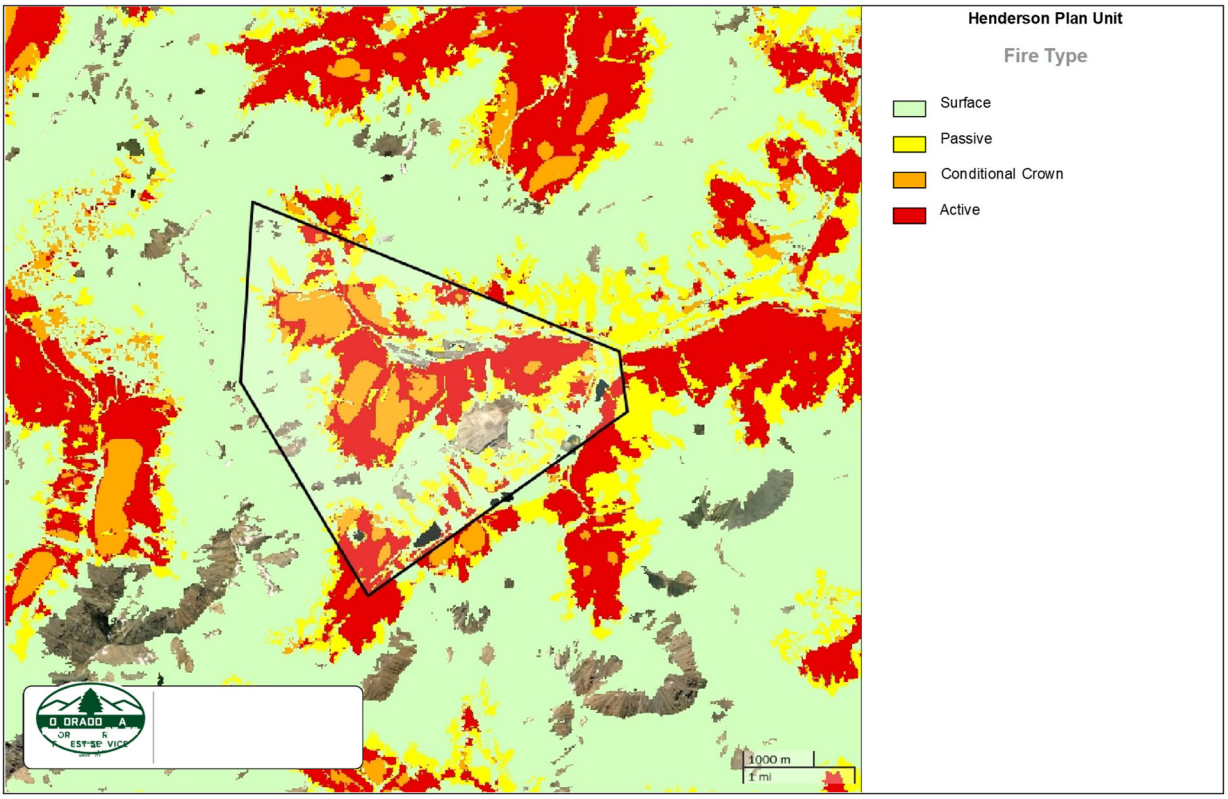
Recommendations for collective action in the Georgetown-Silver Plume Plan Unit:

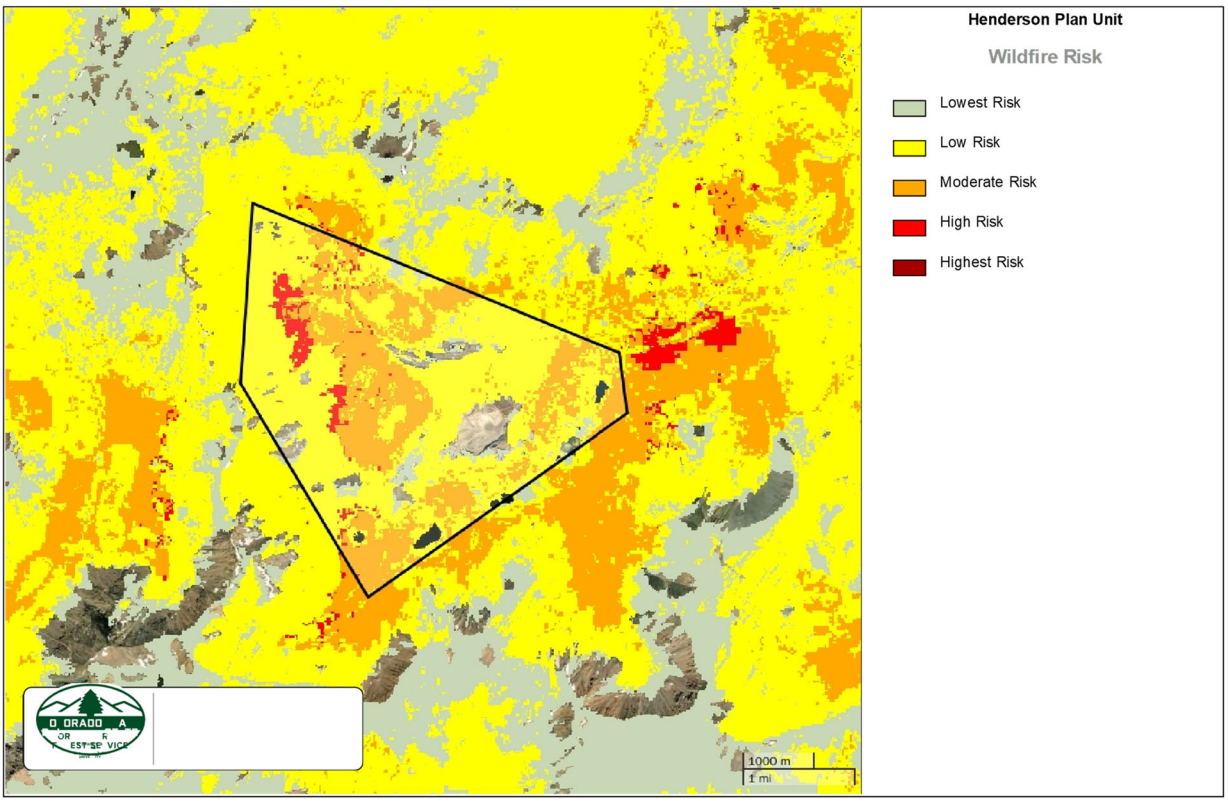
- Perform Home Hardening to reduce the home ignition potential from embers and structure-to-structure ignitions. (Work within the historic preservation requirements)
- Mitigation of private property to the property lines. (The lot size can limit the ability to mitigate beyond 150 feet from the structure.)
- Perform roadside mitigation, including shaded fuel breaks, complete fuel removal to 50 Feet on each side of the road surface, or a combination of both.
- Perform evacuation planning and education with the residents of the unit. Install evacuation signs in selected areas to assist in evacuating visitors.
- Continue to mitigate the area adjacent to the Georgetown Reservoir to limit post-fire impacts on the water supply.
- Mitigate the area adjacent to the Town of Georgetown Water Treatment Plant and associated water intake infrastructure to protect critical infrastructure and limit the post-fire impacts on water quality.

- Work with private property owners, the Town of Georgetown, and Clear Creek County to develop mitigation projects on the Guanella Pass switchbacks adjacent to the town.
- Develop a community chipping program to facilitate mitigation within Georgetown and Silver Plume.
- Work with property owners in the historic downtown area to harden all buildings.

The overall fire danger in the unit is low to moderate. The alignment of the Georgetown Valley with the prevailing winds and abundant ground fuels raises the risk in this area to an unacceptable level. Guanella Pass is included in this high-risk zone. Due to fuel and topography, fires within the drainages in the unit have the potential for flame lengths over 12 feet. The high-intensity fire will support passive and active crown fires throughout the unit. The rate of spread potential is 60 chains per hour or greater. Fires in the unit can produce debris flows post-fire that will directly affect water quality in the Town of Silver Plume, the Town of Georgetown, the City of Blackhawk, and the downstream water users in the metro area. Crown fire activity can produce ember showers extending up to two miles ahead of the approaching fire front. The embers pose more risk than passing the crown fire to the structure. Home hardening and mitigating the areas within 30 feet of the structure are crucial to reducing the probability of ignition.

Henderson – Low to Moderate relative risk rating





The vegetation in the unit consists of a spruce-fir forest with a timber understory consisting of large quantities of timber litter and young trees. The high meadows on the upper valley floors have a grass brush fuel component.

The plan unit has structures of 27 Henderson Mine, Denver Water, and Urad Water Treatment facilities. The structures have a low wildland-urban interface risk.

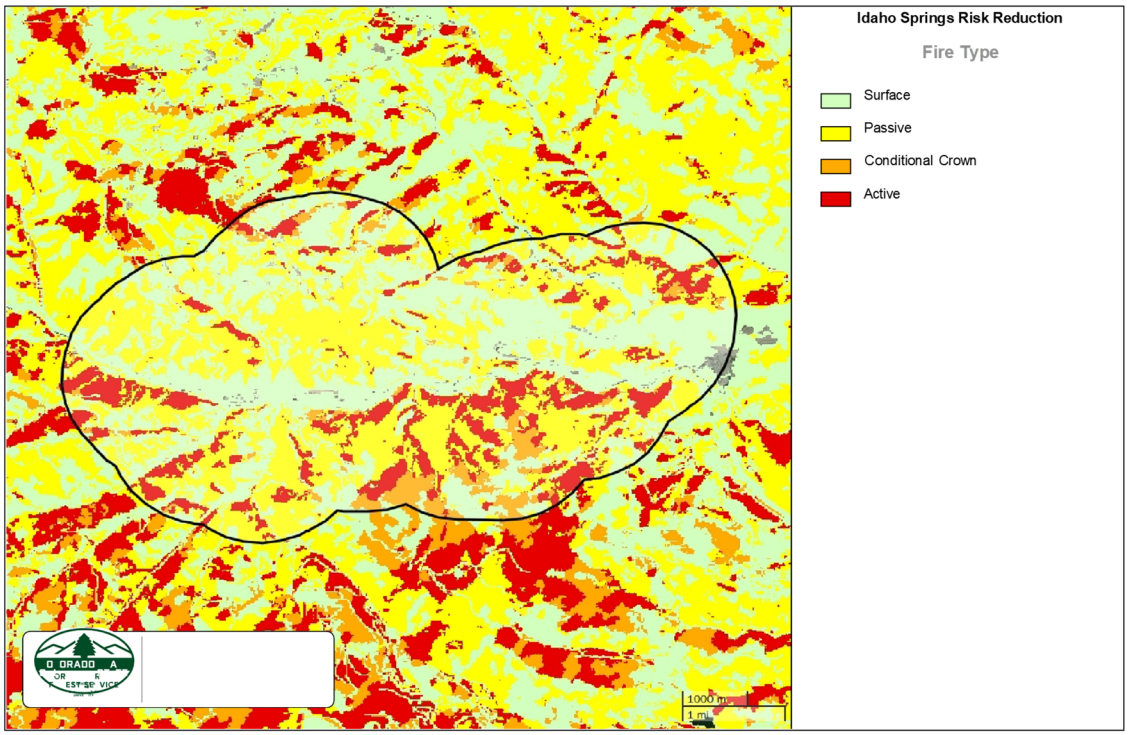
A two-lane paved county road provides primary access to this unit. The road is in good condition and has sufficient pullout areas to support evacuation activities while emergency response units enter the area and are survivable in a wildfire event. The secondary roads within the unit are improved dirt-surfaced roadways with continuous fuels adjacent to both sides of the road surface in small areas. These roads have limited pullouts and narrow areas that would not allow two-way traffic.

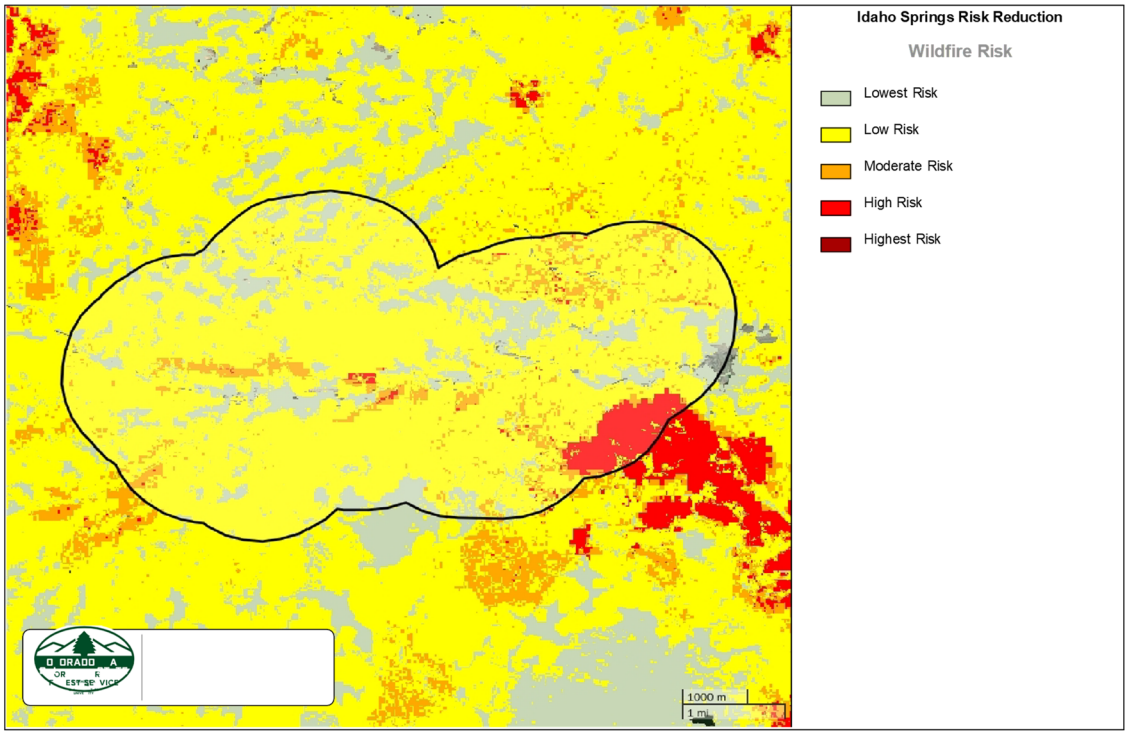
Recommendations for collective action in the Henderson Plan Unit:

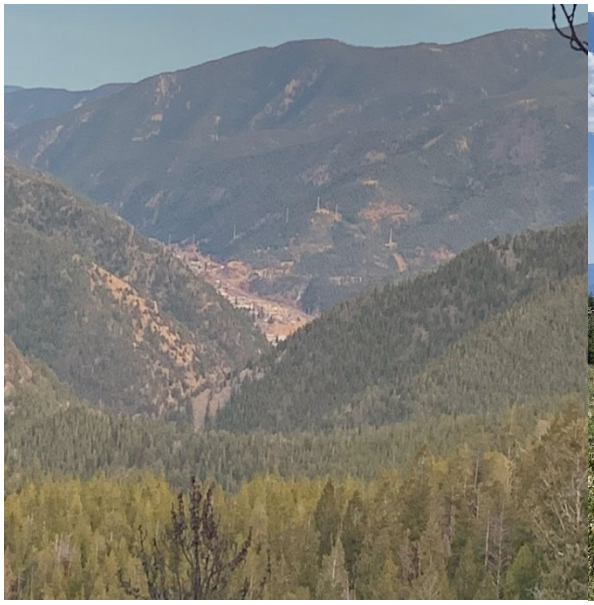
- Perform Building Hardening to reduce the ignition potential from embers and structure-to-structure ignitions.
- Perform roadside mitigation, including shaded fuel breaks, complete fuel removal to 50 Feet on each side of the road surface, or a combination of both.
- Perform evacuation planning and education with Henderson Operations. Install evacuation signs in selected areas to assist visitors in evacuating.
- Work with USFS personnel to develop mitigation actions in Woods Creek, Jones Pass, and Butler Gulch drainages.
- Work with Freeport McMoran, City of Golden, and USFS to develop projects to mitigate the area adjacent to the Urad Lakes and ponds to protect critical infrastructure and limit the post-fire impacts on water quality.

The fire danger in the unit is low to moderate. Due to fuel and topography, fires within the drainages in the unit have the potential for flame lengths over 12 feet. The high-intensity fire will support passive and active crown fires throughout the unit. The rate of spread potential is 60 chains per hour or greater. Fires in the unit can produce debris flows post-fire that will directly affect water quality for the downstream water users in the metro area. Crown fire activity can produce ember showers extending up to two miles ahead of the approaching fire front. The embers pose more risk than passing the crown fire to the structure.

Idaho Springs – Low to moderate relative risk rating








The vegetation in the unit consists of ponderosa pine, lodgepole pine, and mixed conifer forests, with a timber understory characterized by large quantities of timber litter and young trees. The south-facing slopes have brush and grass fuel types. The area has pockets of juniper, mainly on north-facing slopes.

The plan unit has 2015 structures distributed throughout the valley floor, along with homes dispersed within the adjacent valley sides and drainages. All structures are in the wildland-urban interface risk category.

Interstate 70 is a four-lane highway that provides primary access to this unit. The road is in good condition and has sufficient pullout areas to support evacuation activities while emergency response units enter the area, ensuring survivability in a wildfire event. The secondary roads within the unit are paved or improved dirt-surfaced roadways with continuous fuels adjacent to both sides of the road surface. These roads have limited pullouts and narrow areas that would not allow two-way traffic. Homes in the unit do not have address markers at the start of the driveways; this forces responders to utilize the response map book to locate homes.

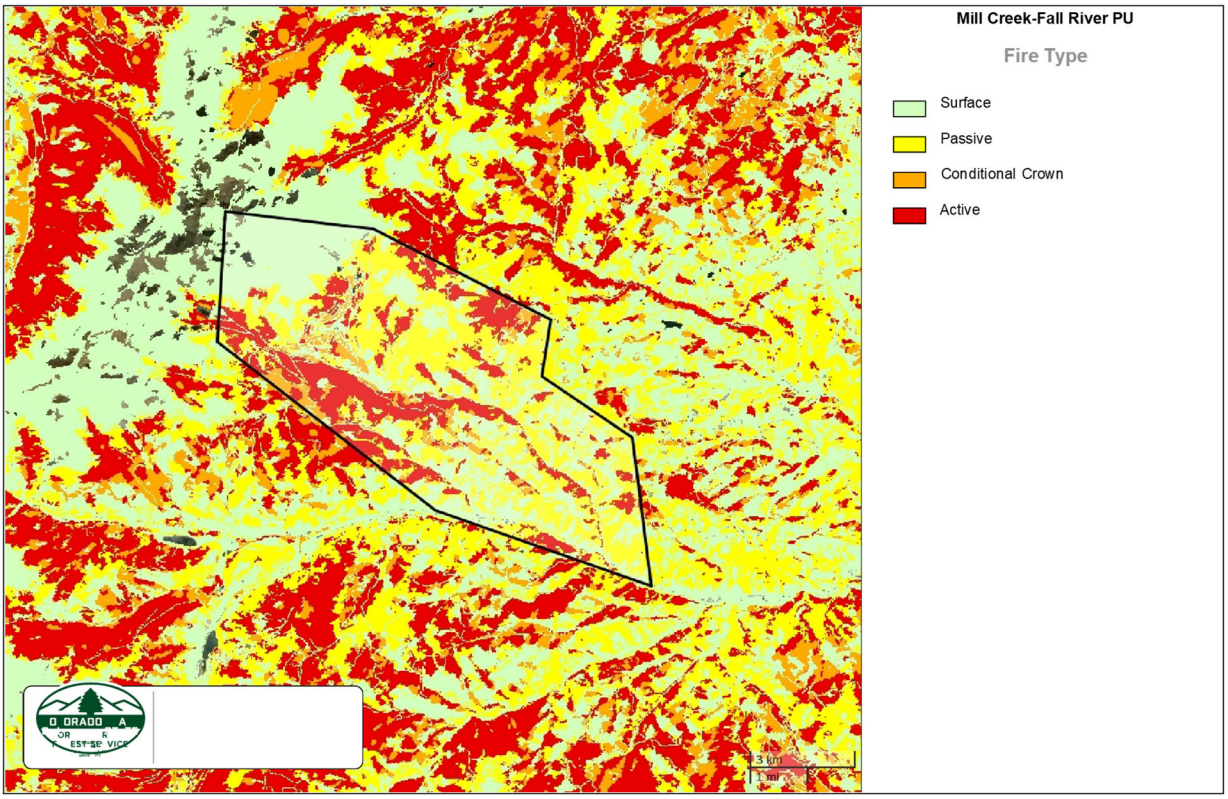
Recommendations for collective action in the Idaho Springs Plan Unit:

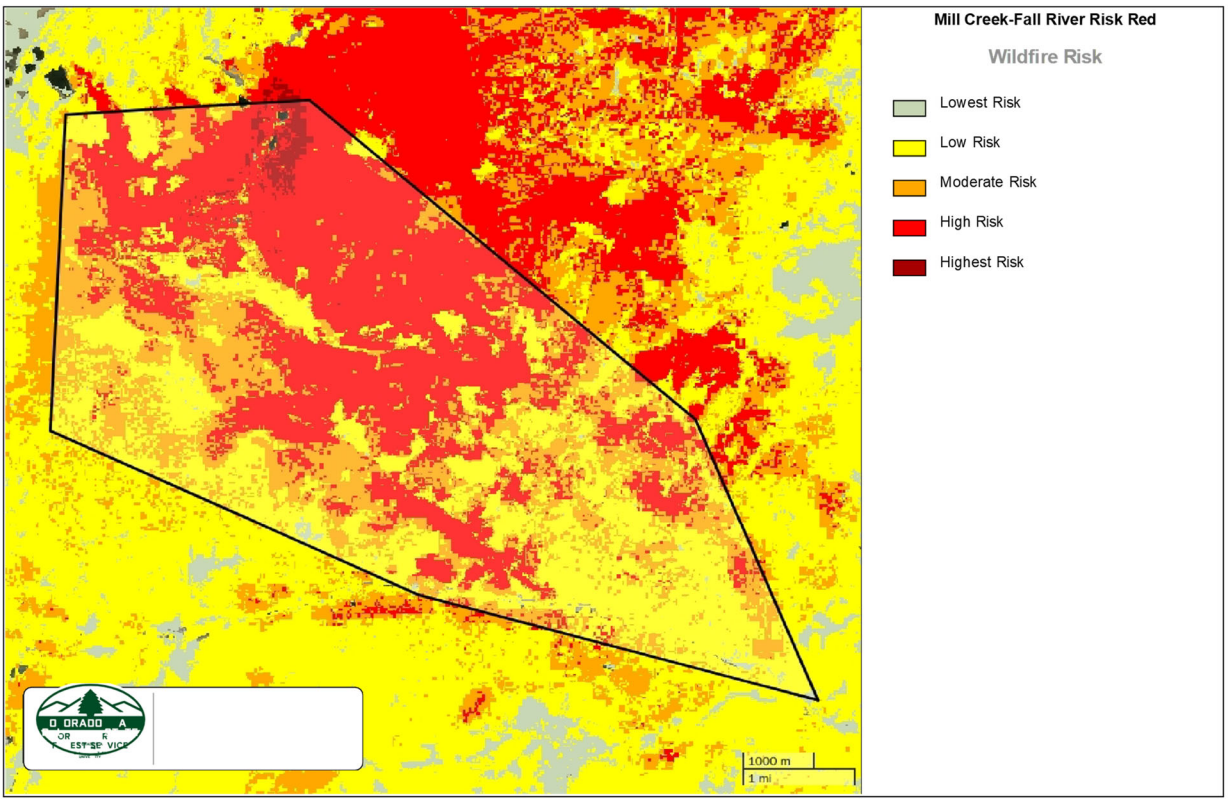
- Perform Home Hardening to reduce the home ignition potential from embers and structure-to-structure ignitions.
- Mitigation of private property to the property lines. (The lot size can limit the ability to mitigate beyond 150 feet from the structure.)
- Perform roadside mitigation, including shaded fuel breaks, complete fuel removal to 50 Feet on each side of the road surface, or a combination of both.
- Perform evacuation planning and education with the unit's residents. Install evacuation signs in selected areas to assist visitors in evacuating. Develop evacuation mapping to be shared with residents and visitors.
- Work with private landowners and USFS personnel to develop mitigation actions to improve road access into Hidden Wilderness and create fuel breaks in the Santa Fe Mountain area.
- Mitigate the area adjacent to the Idaho Springs water storage tanks on Pine Slope and Montane Park to limit post-fire impacts on the water supply.
- Mitigate the area adjacent to the Idaho Springs Reservoir and the Water Treatment Plant.
- Work with private property owners to remove dead-standing trees throughout the unit.
- Work with property owners in the historic downtown area to harden all buildings.
- Remove dead standing trees adjacent to homes in Montane Park, Soda Creek, and Pime Slope neighborhoods.

- Remove Dead Standing trees within Virginia Canyon Mountain Park and increase canopy spread in the remaining forest.
- Collaborate with private property owners for the removal of dead standing trees south of the greenway bike path

The fire danger in the unit is low to moderate. Due to fuel and topography, fires within the drainages in the unit have the potential for flame lengths over 12 feet. The high-intensity fire will support passive and active crown fires throughout the unit. The rate of spread potential is 60 chains per hour or greater. Fires in the unit can produce debris flows post-fire that will directly affect water quality for the downstream water users in the metro area. Crown fire activity can produce ember showers up to two miles ahead of the approaching firefront. The embers pose more risk than passing the crown fire to the structure. Home hardening and mitigating the areas within 30 feet of the structure are crucial to reducing the probability of ignition.

Mill Creek-Fall River – High relative risk rating






The vegetation in the unit consists of lodgepole pine, spruce-fir, and ponderosa pine mixed forest, with a timber understory characterized by large quantities of timber litter and young trees. In York Gulch and Lower Fall River, large areas of grass are mixed with brush.

The plan unit has 834 structures distributed throughout the valley floor and dispersed within the adjacent valley sides. All structures are in the wildland-urban interface risk category. Saint Mary's Glacier/Alice and Mill Creek Park have the highest housing densities within the unit. Both locations are at or near the top of the drainages.

Mill Creek and Fall River are two-lane county roads providing primary access to this unit. The road is in good condition but has limited pullout areas to support evacuation activities while emergency response units enter the area. Both roads have large sections that are not survivable in a wildfire event. The secondary roads within the unit are improved dirt-surfaced roadways with continuous fuels adjacent to both sides of the road surface. These roads have limited pullouts and narrow areas that would not allow two-way traffic. Homes in the unit do not have address markers at the start of the driveways; this forces responders to utilize the response map book to locate homes. The extensive secondary road system is primarily maintained by the property owners that utilize the roads or are not formally maintained. Mill Creek and Fall River are the only evacuation routes for these drainages. Evacuation traffic could limit or preclude emergency vehicle access.

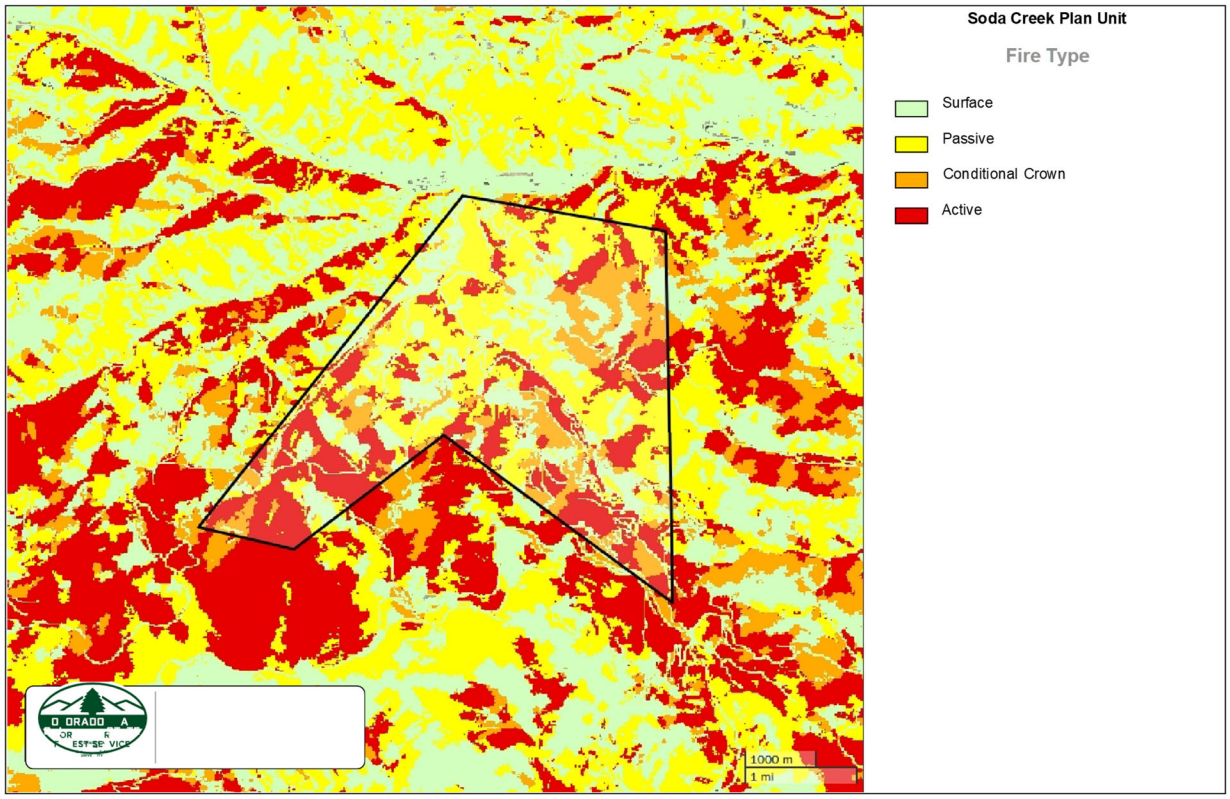
Recommendations for collective action in the Mill Creek-Fall River Plan Unit:

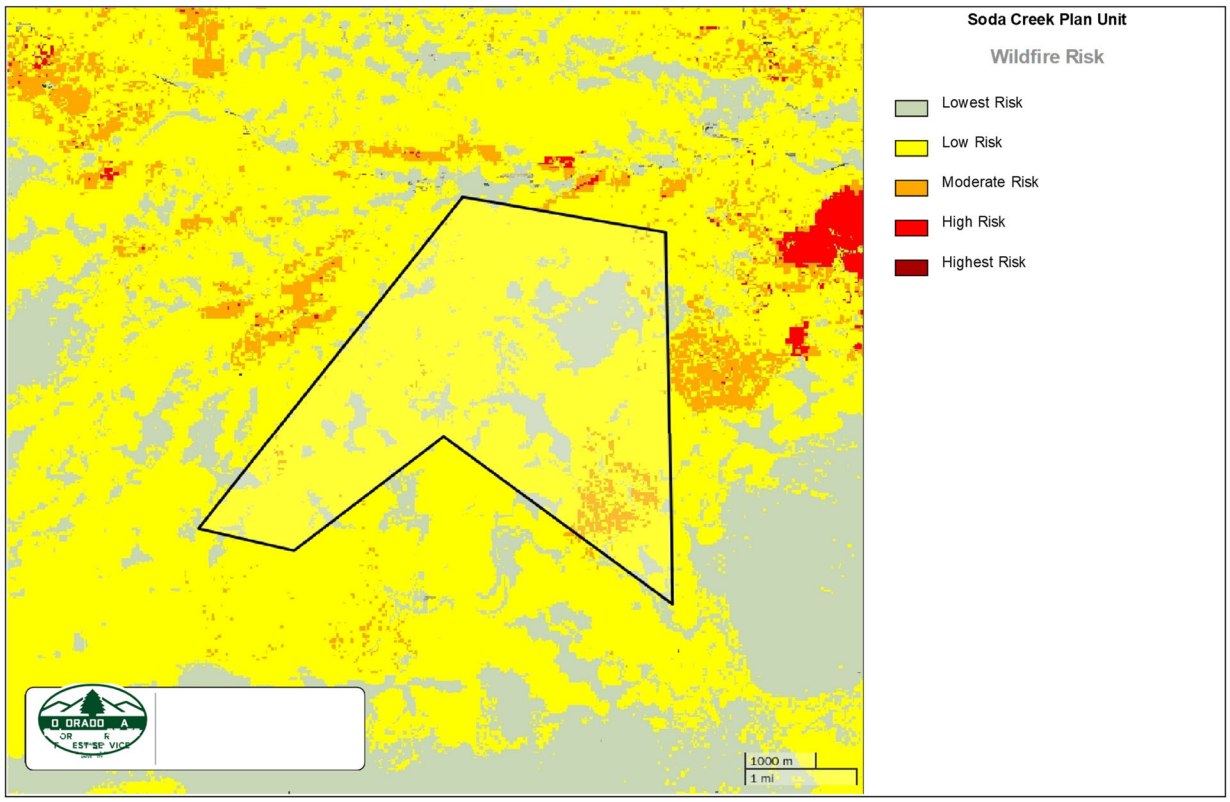
- Perform Home Hardening to reduce the home ignition potential from embers and structure-to-structure ignitions.
- Mitigation of private property to the property lines. (The lot size can limit the ability to mitigate beyond 150 feet from the structure.)
- Perform roadside mitigation, including shaded fuel breaks, complete fuel removal to 50 Feet on each side of the road surface, or a combination of both.
- Perform evacuation planning and education with the residents of the unit. Install evacuation signs in selected areas to assist in evacuating visitors.
- Work with private landowners and USFS personnel to develop mitigation actions to improve the POD lines in Mill Creek, Fall River, and York Gulch drainages. These mitigation actions should connect with the North Empire projects and existing mitigation areas in Gilpin County.
- Work with private property owners, USFS, and Gilpin County to develop and implement roadside mitigation actions on Bald Mountain Road.

- Perform roadside mitigation on the county road between Saint Mary's neighborhood and Rainbow Road to allow emergency crews to access the area during evacuation operations.
- Work with private property owners to remove the dead-standing trees at the base of the Mill Creek Drainage.
- Perform mitigation adjacent to the Clear Creek Open Space trail in Mill Creek to act as a fire break.

The fire danger in the unit is high. Due to fuel and topography, fires within the drainages in the unit have the potential for flame lengths over 12 feet. The high-intensity fire will support passive and active crown fires throughout the unit. The rate of spread potential is 60 chains per hour or greater. Fires in the unit can produce debris flows post-fire that will directly affect water quality for the downstream water users in the metro area. Crown fire activity can produce ember showers extending up to two miles ahead of the approaching fire front. These events can start spot fires in the next adjacent drainage. This would cause fire growth to continue from west to east with the prevailing winds and directly threaten the City of Central City, Russel Gulch Neighborhood, Blackhawk City, and Idaho Springs. The embers pose more risk than passing the crown fire to the structures. Home hardening and mitigating the areas within 50 feet of the structure are crucial to reducing the probability of ignition.

Soda Creek-Blue Valley – Low to Moderate relative risk rating





The vegetation in the unit consists primarily of lodgepole pine, with a timber understory composed of large quantities of timber litter and young trees. Ponderosa, spruce-fir, and mixed conifer are also present.

The plan unit comprises 261 structures, distributed throughout the valley floors, in the Blue Valley neighborhood on the mountain above the drainages, and scattered within the adjacent valley sides. All structures are in the wildland-urban interface risk category.

Soda Creek is a two-lane paved county road providing primary access to this unit. The road is in good condition and has limited pullout areas to support evacuation activities while emergency response units enter the area. The roads within the unit may have limited survivability in the event of a wildfire. The secondary roads within the unit are improved and unimproved dirt-surfaced roadways with continuous fuels adjacent to both sides of the road surface. These roads have limited pullouts and narrow areas that would not allow two-way traffic. Homes in the unit do not have address markers at the start of the driveways; this forces responders to utilize the response map book to locate homes.

Recommendations for collective action in the Soda Creek-Blue Valley Plan Unit:

- Perform Home Hardening to reduce the home ignition potential from embers and structure-to-structure ignitions.
- Mitigation of private property to the property lines. (The lot size can limit the ability to mitigate beyond 150 feet from the structure.)
- Perform roadside mitigation, including shaded fuel breaks, complete fuel removal to 50 Feet on each side of the road surface, or a combination of both.
- Perform evacuation planning and education with the residents of the unit. Install evacuation signs in selected areas to assist in evacuating visitors.

The fire danger in the unit is low to moderate. Due to fuel and topography, fires within the drainages in the unit have the potential for flame lengths over 12 feet. The high-intensity fire will support passive and active crown fires throughout the unit. The rate of spread potential is 40 to 60 chains per hour. Fires in the unit can produce debris flows post-fire that will directly affect water quality in Idaho Springs and the downstream water users in the metro area. Crown fire activity can produce ember showers extending up to two miles ahead of the approaching fire front. The embers pose more risk than passing the crown fire to the structure. Home hardening and mitigating the areas within 50 feet of the structure are crucial to reducing the probability of ignition.

3.c. Community-Wide Recommendations

Slash Management Recommendations

Residents in the Clear Creek Fire Authority have experienced difficulties with slash management, like many other communities in Colorado. During the community engagement process for this CWPP, residents shared that access to inexpensive/easy slash disposal would help them do more work to reduce wildfire risk on their property. Clear Creek Fire County currently accepts slash at the Transfer Station. However, residents must pay to drop off the slash, and the current site is not sufficiently staffed to handle the volume of slash that will be created by implementing the recommendations outlined in this CWPP.

The Authority provides two woodchippers for district residents to use. This allows residents to process the small-diameter slash generated during mitigation. Wood products larger than the residents utilize the chipper capacity as firewood. In cases where the resident does not desire to utilize the wood, it is collected by the Authority and processed into firewood to support the Low-Income Firewood Program.

The Authority has a burn pile collection area at the Dumont station that allows residents to remove slash from their property to be burned during the winter. Saint Mary's neighborhood and the Town of Empire have provided community collection sites to support winter pile burning in the past. This program allows for no-cost fuel reductions that do not produce wood products that require future disposal.

WUI Building Regulations

Should property or home improvements involve the county permitting process, the County's Wildfire Hazard Mitigation Plan Building Code amendment (1995) provides a framework for required improvements that directly address the importance of reducing wildfire hazards around each home.

The Defensible Space Plan will be developed by the Site Development Inspector and explained in detail in the Department's information packet. The Inspector will also determine whether the Wildfire Hazard Point System Agreement will be required at the time of the homeowner's driveway permit site visit. The Building Department is then notified, and the Agreement is initiated and mailed to the property owner or to the general contractor to be completed and later submitted with the building permit documents (Clear Creek County Site Development Department).

Adopting the International Wildland Urban Interface Code at the municipal and county levels to support home hardening. Consider adopting and amending the code recommendations to match current research recommendations (Maranghides et al., 2022):

- Home and structure setbacks should be structure-centric, not parcel-centric. Cross-boundary structure separation should always be a consideration.
- Existing high-density housing areas should prioritize home hardening instead of defensible space.
- New high-density developments should have complete defensible space and buildings that are extremely resistant to ignition. They should have HOAs or other forms of financial and regulatory collaboration set up to maintain community wildfire protection.
- Combustible fences should not be double-wide or placed less than 3 feet apart in parallel.

This program should be replaced by the adoption of the International Code Council Wildland Urban Interface Code at the county and municipal level.

Evacuation Planning and Capacity

There is a high likelihood of evacuation congestion and long evacuation times during a wildfire in Clear Creek Fire Authority. The community areas accessed through a single two-lane county road will experience congestion during evacuations that could slow travel to a crawl. Interstate 70 will be critical for

In the event that the CCC Sheriff orders a community to evacuate because of a threatening wildfire, residents should leave in an orderly manner. The Sheriff would proclaim the area that is required to be evacuated. The

need for evacuation can occur without notice when conditions for wildfire are favorable. Homeowners should be prepared to evacuate without formal notice. Human safety is the number one concern in an evacuation.

District residents should have a predetermined action plan for the eventuality of a wildfire. This plan should include closing windows and doors while leaving a backdoor unlocked, placing a ladder to the roof for firefighter access, and leaving porch lights on so the home can be seen at night. Families should have meeting locations and phone numbers if family members are separated. A plan to leave quickly with essential items should be included. Some refer to these items as the "Four Ps:" Pets, Papers, Pills (medications), and Photos.

Evacuation procedures vary according to subdivision. CCC and its emergency response agencies should ensure that every resident has the opportunity to become familiar with these procedures. Evacuation plans should outline available evacuation centers and procedures to activate them. Large-animal evacuation centers and assistance teams, including the CCSO Animal Control Division, must also be identified. These procedures should be addressed in public or HOA meetings, with information eventually being distributed door-to-door.

Upon returning to a home after a fire, residents should be told to monitor the exterior for smoke for several days. Embers may lodge in small cracks and crevices and smolder for several hours or days before flaming.

(**Figure 3.c.1**). **Mitigation actions along sections of road with high risk for non-survivable conditions during a wildfire can increase the chances of survival for residents stranded in their vehicles during and decrease the chance that roadways become impassable due to flames.**

Survivable Roadways	Potentially Non-Survivable Roadways
	
	

Figure 3.c.1*.Few roads in Clear Creek Fire Authority have been well mitigated by removing tall trees and saplings, removing limbs on the remaining trees, and keeping grass mowed (left images). Most roads could experience*

potentially non-survivable conditions because thick forests line them with an abundance of ladder fuels (right images).

Reliable technology that provides warnings and information about evacuations can help residents feel confident in their ability to evacuate during a wildfire. Clear Creek uses Lookout Alert HOAs, and residents should actively extend awareness about Lookout Alert to neighbors unaware of the program. Residents should enroll their cell phone numbers, email addresses, and landline numbers into the system. The ability to receive emergency alerts can be compromised during wildfire events due to loss of power or communication equipment damage.

We recommend the following steps for residents, HOAs, community groups, Clear Creek Fire Authority, and the Clear Creek County Sherriff's Office to address evacuation concerns in Clear Creek Fire Authority:

- Conduct tree removal, cut low limbs, and mow grass along roadways to increase the likelihood of survivable conditions during a wildfire. Prioritize the roads with the most traffic and congestion and work out to the less congested roads. See **Section 4.d.** for recommended approaches to reduce wildfire risk along roadways.
- Coordinate with the Clear Creek] County Sheriff's Office to conduct evacuation drills to practice safe and effective evacuation for the entire Clear Creek Fire Authority.
- Coordinate with Clear Creek County Office of Emergency Management to increase participation in the local emergency alert system, Lookout Alert, across Clear Creek Fire Authority. Unfortunately, only 57% of respondents to the CWPP survey indicated that they have signed up for Lookout Alert, but this number should ideally be 100%.
- Regularly test Lookout Alert to ensure timely and accurate communication could occur during an evacuation.
- Educate residents about warning systems, protocols for evacuation orders, and evacuation etiquette prior to the need to evacuate the community. Communicate the importance of following evacuation orders; **failing to leave the community promptly during a wildfire emergency can put first responders at risk.**
- Encourage residents to leave with one vehicle per household to reduce congestion for everyone.
- Encourage all households to develop family evacuation plans and to pack go-bags that are ready. Currently, 54% of respondents to the CWPP survey have evacuation plans for their families, and 54% have go-bags ready.
- Encourage residents to work with their neighbors to develop a plan for helping each other with evacuation if a resident is not at home, school-aged children or pets might be home alone, or residents have mobility impairments and need special assistance.
- Encourage residents to evacuate whenever they feel unsafe, even before receiving mandatory evacuation orders. All residents should leave promptly when they receive a mandatory evacuation order. This means having a family emergency plan already in place and having go- bags prepacked.
- Evaluate the efficacy of alternate methods of warnings and alerts, such as warning sirens. Research suggests that individuals trust and are more likely to respond to sirens than other warning systems like social media (National Academies of Sciences, Engineering, and Medicine, 2018).
- Ensure that warnings and alerts are understood by all residents, including those with English as a second language and hearing impairments.

Accessibility and Navigability for Firefighters

Shared Driveways and Community Roads

Residents, Clear Creek Fire Authority, HOAs, and Clear Creek County can work together to ensure emergency responders can locate and access everyone's home. Narrow roads without turnarounds, tree limbs hanging over the road, and lots of dead and down trees by the road may make firefighters choose not to defend your home during a wildfire event (Brown, 1994). More than half of the plan units in Clear Creek Fire Authority have some roads inaccessible to fire engines.

Where feasible, Clear Creek Fire Authority and HOAs should improve roadway access by widening road networks in filing with narrow roads and creating turnarounds and pullovers to accommodate fire engines and two-way traffic during evacuation. The community can apply for grants and work with the Clear Creek County Office of Emergency Management each spring to remove trees from along roads to reduce the chance of non-survivable conditions occurring during wildfires. Residents can remove trees along driveways and prune low-hanging branches to increase horizontal and vertical clearance. According to the National Fire Protection Association, driveways and roads should have a minimum of 20 feet of horizontal clearance and 13.5 feet of vertical clearance to allow engines to access the roads safely (O'Connor, 2021).

3.d. Outreach and Education

Clear Creek Fire Authority should continue to engage with community members using various methods, including community ambassadors, social media, and education materials for visitors of short-term rentals. The following priority recommendations may fall to different entities or partners within and around Clear Creek Fire Authority. Community informational Kiosk locations will provide a consistent location to relay fire danger information along with risk reduction information.

As your community makes progress on the top-priority actions outlined below, refer to the fire adapted communities' "wheel" (**Figure 3.1**) and seek additional ideas and resources from the Fire Adapted Community Learning Network and local state resources such as, [*ex: Fire Adapted Colorado (FACO)*]. Visit their websites for more information on their programs and upcoming events.

Firewise Community

While Clear Creek Fire Authority currently does not have any current Firewise communities within its borders, working to develop all neighborhoods into a Firewise neighborhood is the future direction. The Saddleback-Floyd Hill neighborhood had previously been a Firewise community and will need to recertify. This is a great foundation to build for planning community outreach and education events. The Clear Creek Fire Authority hosts educational days throughout the summer to talk to residents about wildfire preparedness and mitigation. Visit https://www.clearcreekfire.com for more information about when and where this event will occur in 2025. Additional information can be found at https://www.nfpa.org/education-and-research/wildfire/firewise-usa

Neighborhood Ambassador Program

Clear Creek Fire Authority intends to develop a Neighborhood Ambassador Program to expand community outreach while providing resources. The Neighborhood Ambassador Program could help residents better understand wildfire risks and spark coordinated action that effects positive change in Clear Creek Fire Authority. The neighborhood ambassador approach requires engaged volunteer ambassadors and a dedicated lead coordinator. See

Table 3.d.1 from the guide *Fire adapted communities neighborhood ambassador approach: Increasing preparedness through volunteers* for effective activities that neighborhood ambassadors can undertake (Wildfire Adapated Partnership, 2018).

***Table 3.d.1**. Potential activities for the neighborhood ambassador program. Table adapted from (Wildfire Adapated Partnership, 2018).*

Example activity	Ambassador responsibility	Coordinator responsibility
Educational programs about defensible space and home hardening	Gauge the interest of neighbors and select topics. Find a meeting location. Encourage neighbors to attend.	Arrange for specialists to make presentations. Advertise the program through HOA newsletters, social media, etc.
Emergency planning	Organize an event for people to ask firefighters and law enforcement personnel about emergency planning and evacuation. Encourage residents to work with their neighbors to develop a plan for evacuation if a resident is not at home, school-aged children or pets might be home alone, or residents have mobility impairments and need special assistance.	Provide information to residents about emergency planning and go-bags. Arrange for specialists to make presentations. Advertise the program through HOA newsletters, social media, etc.
Community chipping day	Secure HOA buy-in and request financial support. Select a date and organize event logistics. Encourage neighbors to attend.	Secure fuels module availability and grants or other financial support. Address liability and safety concerns. Advertise the program through HOA newsletters, social media, etc.
Defensible space projects	Work with neighbors to identify high-priority project locations using insights from this CWPP. Secure HOA buy-in and request financial support. Select contractors and solicit bids. Oversee project completion.	Work with a certified forester for insights about effective treatment location and prescriptions, following guidelines in this CWPP. Identify potential contractors. Write the scope of work for the contract. Inspect the project upon completion. Celebrate success through social media posts and newspaper articles.

3.e. Considerations for Vulnerable Populations

Social factors influence how impacted an individual or a community may be during wildfire. This so-called social vulnerability is due to a lack of access to resources. The resources that are lacking can include infrastructure, social support, health, and financial means (Cutter et al., 2003). While Clear Creek Fire Authority at large may be well prepared for wildfire after engaging in this CWPP planning process, there is potential for some to fall through the cracks or struggle to engage in necessary mitigation and preparation work, which makes them more at risk in the event of a fire.

Poverty, racial and ethnic discrimination, age, and physical ability are frequently factors that are associated with social stratification and result in resource inequity (Crowley, 2020; Cutter et al., 2003; Davies et al., 2018; Emrich et al., 2020; Hewitt, 2013; Ojerio et al., 2008). Thus, it is important to consider ensuring that all community members can participate in the wildfire preparedness actions outlined in this CWPP.

Pre-fire

Before a fire, it is important to ensure that preparation and potential evacuation communication materials are available in other languages spoken by Clear Creek Fire Authority. The sole use of English in materials makes it difficult for people with lower proficiency in English to understand. This includes children, people with low literacy, and people who primarily speak other languages. Materials that use images and diagrams rather than words can ensure that the broadest audience can understand any materials that Clear Creek Fire Authority distributes about wildfire.

Another significant barrier is the ability to do the work recommended in this plan. Populations that this may impact include those in lower income brackets who don't have the resources to harden their homes (i.e., by replacing their roofs, siding, and decks with non-combustible construction materials) and those with physical disabilities or impairments that keep them from doing the physical labor often involved in preparation and mitigation actions themselves. This CWPP is a great way to begin addressing economic disparity because it can provide a basis for Clear Creek Fire Authority to apply for grant funding to support mitigation work on behalf of the community.

To indeed reduce the economic barrier at a community level, community leaders must design programs that are accessible for all income brackets. For example, providing mitigation services such as a community chipping program free for residents who fall within lower income brackets can encourage them to mitigate their properties when they may have otherwise found it inaccessible. Similarly, volunteer days can help those who are not physically able to engage in pre-fire protection of their home by connecting physically able community members with them to help do home-hardening work.

Post-fire

Following a fire, households are often solely responsible for their recovery. While challenging for everyone, this is a particular issue for those without equal access to the social aid that is available, like FEMA recovery funds, information on the internet, and claims for insurance (Laska and Morrow, 2006; Méndez et al., 2020). Groups impacted by this can include older adults, undocumented folks, and those who speak English as a second language or not at all.

The focus during the post-fire period needs to be on the following critical tasks:

- Account for all impacted residents.
- Ensure the area is safe for residents to return (Hazard trees mitigated, roads are passable, power lines are inspected, and hazards mitigated, and the area has been determined not at risk for secondary fires)
- Conduct FEMA damage assessments.
- Evaluate the risk to the watershed and begin mitigation actions.
- Assist impacted residents with obtaining support services.

3.f. Recommendations to Enhance District Capacity

District Capacity Assessment

The district has mutual aid and auto-aid agreements with Central City Fire Rescue, Evergreen Fire Rescue, Foothills Fire Rescue, Summit Fire Rescue, Timberline Fire Rescue, and East Grand Fire Rescue. These agreements enable the departments to provide and receive apparatus and firefighters to support the growing number of wildland fire incidents. In addition to local agreements, the Colorado Division of Fire Prevention and Control (DFPC) can provide hand crews, aircraft, and apparatus through the Colorado Mutual Aid System. Federal fire resources are available through the Wildland Annual Operating Plan (AOP).

The district needs to add full-time wildland personnel to perform project planning and pile-burning operations during winter. This will allow for additional community outreach and project implementation. Increasing the average daily number of career firefighters will provide a stronger foundation for fire response, which can be supplemented with volunteer personnel. The volunteer firefighters are critical to the department's success, but they may have limited availability during periods when they are not on duty. These personnel may also experience delayed response times due to traffic and long travel distances.

Recommendations

- Recruit and train community members to function as wildland firefighters.
- Increase the number of NWCG-qualified Incident Commander Type 4 personnel.
- Increase the number of NWCG-qualified Crew Boss and Engine Boss personnel.
- Hire a Wildland Mitigation Program Manager to coordinate the community mitigation actions, property assessments, and community chipping programs.
- Hire an Assistant Emergency Manager for the Clear Creek Sheriff's Office to increase planning and post-event recovery capabilities.
- Transition of the seasonal mitigation crew to year-round to complete winter project planning and pile burn operations

3.g. Post-Fire Plan

The recovery process for the community is critical to return the community to its pre-fire state. The focus during the post-fire period needs to be on the following critical tasks:

- Account for all impacted residents.
- Ensure the area is safe for residents to return (Hazard trees mitigated, roads are passable, power lines are inspected, and hazards mitigated, and the area has been determined not at risk for secondary fires)
- Conduct FEMA damage assessments.
- Evaluate the risk to the watershed and begin mitigation actions.
- Assist impacted residents with obtaining support services.

3.h. Funding Opportunities for Wildfire Hazard Mitigation and Emergency Preparedness

There are many funding opportunities from federal, state, and local agencies, as well as non-profits, to assist in forest health and wildfire mitigation projects. These funds can increase capacity but cannot cover all the costs of fire mitigation needed within the valley. Residents and partners must contribute funds and time to complete this work.

Opportunities from Local and State Agencies in Colorado

- **Forest Restoration & Wildfire Risk Mitigation** grants reduce the risk of wildfire to people, property, and infrastructure and promote forest health and restoration.
- **Colorado IRA Urban & Community Forestry** grants support actions to grow the tree canopy in disadvantaged areas of Colorado.
- **Wildfire Mitigation Incentives for Local Government** grants match revenue raised by local governments for forest management and fuels reduction or expand existing programs.
- **Wildfire Mitigation Outreach** grants support outreach among landowners in high wildfire hazard areas.

Funding from Federal Agencies

- **Building Resilient Infrastructure and Communities (BRIC) grant program** supports states, local communities, Tribes, and territories as they undertake large-sale projects to reduce or eliminate risk and damage from future natural hazards. Homeowners, business operators, and non-profit organizations cannot apply directly to FEMA, but they can be included in sub-applications submitted by an eligible sub-applicant (local governments, Tribal governments, and state agencies).
- **Hazard Mitigation Assistance Grants Program (HMGP)** provides funding to state, local, Tribal, and territorial governments so they can rebuild in a way that reduces, or mitigates, future disaster losses in their communities. This grant funding is available after a presidentially declared disaster.
- **Assistance to Firefighters Grants (AFG)** help firefighters and other first responders obtain critical resources necessary for protecting the public and emergency personnel from fire and related hazards.
- **Fire Prevention & Safety (FP&S) Grants** support projects that enhance the safety of the public and firefighters from fire and related hazards.
- **Staffing for Adequate Fire and Emergency Response (SAFER)** grants directly fund fire departments and volunteer firefighter organizations to help increase their capacity.
- **Community Wildfire Defense Grants** (CWDG) are funded annually through the National Forest Service and help communities take action on implementation projects outlined in recent CWPPs.

Opportunities from Non-Governmental Organizations

- Coalitions and Collaboratives, Inc. manages the **Action, Implementation, and Mitigation Program (AIM)** to increase local capacity and support wildfire risk reduction activities in high-risk communities. AIM provides direct support to place-based wildfire mitigation organization with pass-through grant funding, on-site engagement, technical expertise, mentoring, and training on mitigation practices to help high-risk communities achieve their wildfire adaptation goals.

Supporting the Fire Protection District

- The **Staffing for Adequate Fire and Emergency Response (SAFER)** grants can help fund staff capacity for fire departments.
- The **Assistance to Firefighters Grants (AFG)** can provide critical response resources for firefighters and emergency responders.
- Community support is also vital to the success of the fire stations:
    - Clear Creek Fire Authority is supported by [*ex: volunteer responders]* who respond to fires, medical emergencies, and rescues every day of the year. Learn more about how you can [*ex: volunteer*] by contacting your local fire department.
    - Financial support in the form of [*ex: monetary donations or support of local ballot measures that provide tax revenue*] for Clear Creek Fire Authority is vital to their success in responding to residents in their time of need.
    - Attend events hosted by Clear Creek Fire Authority. Seeking out information to protect your home from fire danger can also help protect your local firefighters. Sharing this information within your community can build community resilience and help lower implementation costs for individual homeowners for many projects.

4. Implementation Recommendations for Fuel Treatments and Ecological Restoration

4.a. Objectives and Benefits of Fuel Treatments and Ecological Restoration

Fuel Treatments

Fuel treatments are a land management tool for wildfire hazard by decreasing the amount and altering distribution of wildland fuels. Common goals of stand-treatments are to reduce the risk of active or passive fires and to reduce fire intensity. This is achieved by trees, increasing the distance between tree crowns, small trees, shrubs, and low branches to increase the between surface fuels and tree crowns, and removing trees and other dead vegetation (Agee and Skinner, Fuel treatment methods include tree thinning, pruning, burning, broadcast prescribed burning, and fuel mastication.

> "Given the right conditions, wildlands will inevitably burn. It is a misconception to think that treating fuels can 'fire-proof' important areas... Fuel treatments in wildlands should focus on creating conditions in which fire can occur without devastating consequences, rather than on creating conditions conducive to fire suppression" (Reinhardt et al. 2008).

reducing the scale fuel crown removing removing distance downed 2005). pile

Strategically located, high-quality fuel treatments can create tactical options for fire suppression (Jolley, 2018; Plucinski, 2019; Reinhardt et al., 2008). Fuel treatments along trails, ridgelines, and other features can allow firefighters opportunities to use direct or indirect suppression techniques to contain fire spread. The USFS Blue Creek project, adjacent to the Town of Empire, provides a fuel break to limit west-to-east fire spread down the valley while improving wildlife habitat.

Ecological Restoration

Ecological restoration is the process of assisting the recovery of an ecosystem damaged, degraded, or destroyed. (SER, 2004). Many forests in the western United States have been damaged, degraded, or destroyed because of changes to their historical fire regimes following Euro-American colonization.

The area has sedimentation issues due to the historic mining activities and the construction of Interstate 70. These conditions increase sedimentation within the Clear Creek Watershed, impacting water quality for 450,000 end users. In addition to water quality issues, the current stream conditions throughout the watershed are prone to flooding due to limited channel size and obstructions within the waterways resulting from timber litter. Mitigating these issues will require both pre-fire and post-fire actions to be performed. The 2021 Upper Clear Creek Watershed Pre-Wildland Fire Planning Study outlines the current conditions and the suggested risk reduction strategies to be implemented.

Fuel treatments can sometimes achieve both ecological objectives and wildfire risk reduction. Restoration treatments in dry-mixed conifer and ponderosa pine forests tend to achieve both fuel treatment and ecological restoration objectives. In contrast, a treatment that creates a forest with widely, evenly spaced trees could be an effective fuel treatment, but would not achieve ecological objectives in most forest types.

Treatment Types Covered in the CWPP

This CWPP covers fuel treatments in the home ignition zone 3, stand-level fuel treatments, and roadside fuel treatments, each with its own objectives and benefits:

Fuel Treatment Category	Primary Objectives and Benefits
Defensible space in home ignition zone 3 (30-100 feet away from the home)	Reduce surface fuels, reduce tree density, and increase the distance between surface and canopy fuels. Moderate fire behavior near structures increases their chance of surviving a wildfire. Increase safety and access for wildland firefighters. Increase the visibility of structures from roadways to assist wildland firefighters with locating and accessing your home. Coordinate with partners when home ignition zone 3 overlaps neighboring properties to address shared wildfire risk. Linked defensible space creates safer conditions and better tactical opportunities for wildland firefighters. Due to their strategic value, defensible space projects that span ownership boundaries are better candidates for grant funding.
Stand-level ecological restoration/fuel treatments	Reduce surface fuels, reduce tree density, and increase the distance between surface and canopy fuels. Restore ecological conditions to create more fire-resilient ecosystems. Reduce the likelihood of high-severity wildfires near communities. Create tactical opportunities for fire suppression.
Roadside fuel treatments	Dramatically reduce or eliminate surface and canopy fuels. Reduce the likelihood of non-survivable conditions along roadways during wildfires. Create tactical opportunities for fire suppression. Increase the visibility of structures from roadways to assist wildland firefighters.

4.b. Priorities for Ecological Restoration and Roadside Fuel Treatments in Clear Creek Fire Authority

Altering potential wildfire behavior and restoring ecological conditions requires a landscape-scale approach to treatments across ownership boundaries. We located and prioritized project areas for roadside fuel treatments, ecological restoration, and/or stand-level fuel treatments within and around the Clear Creek Fire Authority to be implemented in the next five years. These project areas cross ownership boundaries and require community-wide commitment, coordination, and collaboration among private landowners, public land managers, and forestry professionals to create successful outcomes.

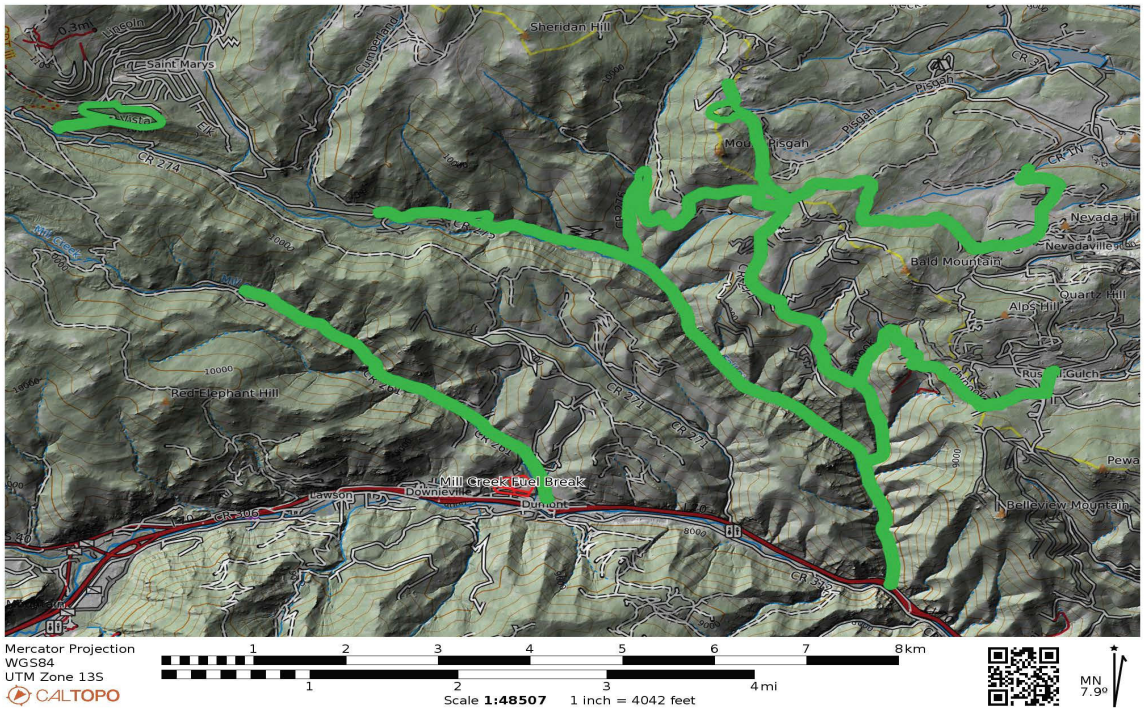
The projects proposed in the 2008 Clear Creek County CWPP and the subsequent local CWPIPs were evaluated from 2020 to 2023 to determine which projects had been completed and whether they were feasible to complete. This process identified that all the projects outlined in the respective plans, with the exception of two USFS large-scale projects, had not commenced. The Silverdale Historic District and Sawmill Gulch mitigation projects were identified to be completed during the evaluation period, with a 2024 completion. The Mill Creek-Fall River drainages were identified as high risk due to limited evacuation routes, the potential for extreme fire conditions, the risk to the watershed, and the potential for fires to leave the drainages and threaten areas to the east. A mitigation implementation plan was developed in 2023 to make this area the primary focus for 2025-2030.

The Clear Creek Wildland Partnership was formed in October 2022 to bring representatives from municipal and county governments and local, state, and federal fire agencies together to reduce the wildfire risk within the community. This group reviewed the existing plans and determined a path forward that would result in the completion of mitigation projects and risk reduction actions with individual property owners. This group has conducted monthly meetings since its inception and will continue to meet with the goal of completing the actions outlined in this updated CWPP while coordinating with the surrounding communities to complete their CWPP goals.

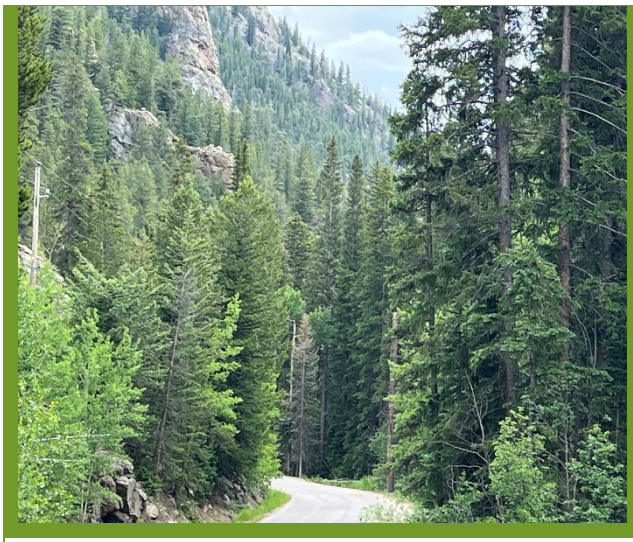
The section below describes the current conditions in each CWPP project area, treatment objectives and benefits, potential treatment types, project leads, and relative importance. The relative importance and feasibility of treatments is reflected in their timeline—partners aim to conduct treatments for immediate action in the next 1-2 years, short-term treatments are targeted for the next 3-4 years, and mid-term projects for the for the next 5-10 years. Mid-term projects will require more coordination, funding, and other enabling conditions before implementation can begin.

The CWPP implementation plan for stand-level and roadside treatments focuses on high-priority locations, but this does not discourage ecological restoration and fuel mitigation in other areas. If multiple neighbors collaborate to mitigate fire risk across ownership boundaries, it could attract funding and increase the priority and effectiveness of addressing those areas. Clear Creek Fire Authority, HOAs, residents, and land managers should reevaluate fire risks and reprioritize treatment units as conditions change over time.

Mill Creek-Fall River Risk Reduction



Mill Creek-Fall River encompasses 5924 acres of Clear Creek and Gilpin County land. This area was selected for a priority project because it consists of two drainages served by a single access road. The project area includes 973 homes. The property owners in these communities have been engaged in mitigating their individual properties while expressing concerns about being unable to evacuate the area effectively due to possible non-survivable road conditions.



Mill Creek-Fall River Wildland Risk Reduction

The Clear Creek County, Colorado communities of Mill Creek, Fall River, York Gulch, and St Mary's Glacier are served via a single county road access that limits emergency evacuation of residents and emergency services access into the area in the event of a wildland fire. The fuels within the area consist of moderate timber litter, moderate brush, and mixed conifer forest (MCFRYG, 2023). The area has received limited fuel reductions and currently has a large quantity of high-risk fuels directly adjacent to the road edge for eleven of the twelve miles of county access roads. The outlined risk reduction actions will reduce the risk of a wildland fire crossing the county roads, maintain road access during a fire event, improve area evacuation efficiencies, and reduce risk to homes within the project area.

Area Wildland Fire Risk

The project area has a moderate level of timber litter throughout that would support ground fire and areas of increased fuel density that will support limited crown fire development (MCFRYG, 2023). The average canopy spacing in untreated areas is 5-7 feet. In addition to the areas of timber litter, there are limited areas of moderate brush and large grass areas. The existing fuels are directly adjacent to the existing road edge throughout the project area. The proximity of the fuels combined with the available quantity adjacent to the roads directly increases the possibility of a fire resulting from the mechanical failure of a vehicle or as a direct result of a competent ignition source being thrown from a vehicle.

The current canopy configuration will support a limited canopy fire with isolated pockets that could support a running crown fire event (MCFRYG, 2023). Some areas of the National Forest have completed fuel reduction projects. These areas only provide limited risk reductions due to adjacent private property's ability to support fire movement around the treatment areas (FRCWPIP, 2013). The movement of fire on the continuous private land within the project area directly reduces the benefits of the risk reductions on the federal lands.

Risk Reduction Actions

Road Adjacent Fuels Reduction

The project will focus on Mill Creek, Fall River, York Gulch, and Bald Mountain Lane County roads. The ground fuel will be removed within twenty feet of the road edges and taken to an area of the project to be processed. The trees within the reduction will be thinned to produce an average canopy spread of fifteen feet. Brush will be removed from the project areas except for riparian brush adjacent to the river in both drainages.

Property Risk Evaluations and Risk Reduction Assistance

The area includes 895 structures at varied risk levels due to fire (MCFRYG, 2023). The homes with the highest degree of risk for loss, restricting safe egress, or posing a significant threat to the forest or other structures due to fire will be identified. The top two hundred high-risk homes will be the focus of receiving a wildland fire risk assessment and associated risk reduction plan. The agency personnel will work with the property owner to develop and implement risk-reduction actions (COCO, 2023). In cases where the resident does not have the physical ability and the means to fund risk reductions, agency assistance will be provided. The assistance will be provided as manpower is available.

Area Emergency Evacuation Planning and Implementation

The St Mary's Glacier subdivision evacuation planning and associated signage were completed in 2022. In 2023, an evacuation traffic plan was developed for the York Gulch subdivision to utilize the three available county roads that provide egress from the area. Evacuation planning for the areas of Mill Creek, Wild Wagner, and Fall River will begin in 2025 with a completion goal of September 2026. determine Travel distances from each residential unit to develop a primary and secondary evacuation route for each. The evacuation routes will be designated on an area map to include known hazards or travel restrictions.

Community meetings will be held with the area residents and emergency responders to review the proposed routes and elicit community input (COCO, 2023). The final plan and maps will be distributed to all residents and emergency agencies. The maps will include a QR code to facilitate the use of electronic mapping software and to allow for updates to be made. All evacuation routes will be marked with reflective signage that includes all intersections. A dry hydrant was installed in the area to support engine and aircraft water operations. The site is able to support a 5000-gallon helicopter dip site using a self-supporting tank.

Community Risk Reduction Partners

Successful completion and maintenance of the tasks contained in this plan will require coordination from the following groups and organizations:

Clear Creek Sheriff's Department, Gilpin County Sheriff's Department, Clear Creek County Public Works, Clear Creek Fire Authority, Timberline Fire Protection District, Fall River Homeowners Association, York Gulch Homeowners Association, St Mary's Glacier Property Owner Association, Colorado State Forest Service (Golden Office), and USFS Arapahoe and Roosevelt National Forest.

Implementation

Fuels Reduction

The Mill Creek area will be the focus for the 2025 working season. This work will begin in June 2025, with a projected completion date of September 2026. The crews will then move to Fall River between mile markers two and three. The crews will focus on completing the first three miles of Fall River and then move to York Gulch. The crews will spend the remainder of 2026 completing the risk reductions in York Gulch and assisting residents as time allows. The area from mile three to mile nine on Fall River will be the focus of the 2027 season.

Property Evaluations

Property risk reduction evaluations will be performed as manpower is available. If additional funding were to become available there would be two dedicated property evaluators hired. The evaluators would work with the property owners of the identified two hundred highest-risk structures to complete evaluations. This would continue each year until the identified homes have been completed. A new list of the next two hundred homes would then be developed, and the inspectors would work through that list in the subsequent years.

Evacuation Planning

The department dedicated one employee to completing the York Gulch Emergency Evacuation Plan in June 2023. The travel distance mapping was completed and verified with the assistance of Sheriff's Department employees. The initial maps were presented to the residents in July 2023 and then verified through community

volunteers. The community volunteers worked with the department to finalize the evacuation mapping and associated plans in August 2023 (COCO, 2023). The final evacuation signs will then be installed.

Resources and Funding Limitations

The program currently has a project crew of three personnel along with a community risk reduction specialist that manages the risk reductions. The evacuation planning and implementation will be performed by one agency person, York Gulch HOA members, and assistance from Gilpin and Clear Creek Sheriff's deputies. The property evaluations and associated risk reduction plan development are currently not staffed. The completion of these evaluations is a key part of the total risk reduction plans.

Current Available Funding

The program currently has funding for a three-person mitigation crew that works for twenty-two weeks a year. Two additional department personnel will provide project management, evacuation planning and implementation, and limited property evaluations.

Additional Funding Needs

The program requires a minimum of $50,000 additional yearly funding to fund the two property risk evaluation personnel. Additional funding beyond that level would allow for additional mitigation crew personnel to complete the risk reduction actions in a shorter period.

Program Progress Tracking

The areas mitigated will be marked on project maps using Cal Topo software. These maps will be made available to stakeholders monthly through a QR code. Before and after pictures of all project work will be taken to develop annual progress reports (COCO, 2023). These pictures will also be used as a reference for future project maintenance activities. The homes that have received a property risk reduction evaluation will be marked on the project maps to include their respective level of risk. The risk levels can be updated after risk reductions have been completed. The risk reduction evaluations will be uploaded to the department's records management system for future reference.

Future Project Area Maintenance

Clear Creek Public Works, Clear Creek Fire Authority employees, Timberline Fire Protection District employees, and community volunteers will maintain the completed risk reductions.

4.c. General Recommendations for Home Ignition Zone 3 and Stand-scale Treatments

Local knowledge and professional expertise are needed to design effective, site-specific fuel treatments based on the best available science. Specific fuel treatment recommendations depend on forest type, tree density, fuel loads, terrain, land use, and management objectives. The location and purpose of treatments also matter. Treatments in large, forested areas can include the retention of individual trees and groups of trees. Evenly and widely spaced trees might be reasonable in the home ignition zone 3, but this arrangement would not be appropriate for restoration-style fuel treatments.

Treatments in the home ignition zone 3 (30-100 feet away from the home) can restore historical forest structure. However, it is most important to focus on reducing wildfire risk to the home, creating safe conditions for firefighters, and increasing the visibility of your home from the road for firefighters. Homeowners often enjoy the more open forest around their homes because it allows more light, which encourages understory grasses and shrubs to grow, and in turn, can increase wildlife sightings near their homes. Home ignition zone 3 often overlaps neighboring properties and requires residents to work together to address shared wildfire risk.

For all fuel treatments, it is essential to address surface fuels. Forest management operations often increase surface fuel loads and can fail to achieve fire mitigation objectives if fuels created by the harvest activities (also known as slash) are not addressed (Agee and Skinner, 2005). Slash can include small trees, limbs, bark, and treetops. See **Section 4.e. Approaches to Slash Management** for pros and cons of different slash management options.

Mitigating the impacts of tree removal on soil compaction and erosion is also essential when treatments occur near streams and riparian ecosystems. The Colorado State Forest Service recommends streamside management zones of at least 50 feet. (CSFS, 2010). Treatments should be monitored for colonization of invasive, weedy plants that might require control through integrated weed management. Taking pictures of treatments before and after is always a good idea to help evaluate effectiveness and monitor changes over time.

4.d. General Recommendations for Roadside Fuel Treatments

Treatments along roadways require dramatically reducing fuels to create safe and survivable conditions. This includes removing most trees adjacent to the roadway, limbing remaining trees, and regularly mowing grass and shrubs (**Figure 4.d.1**). Treatments along roadways are often described as shaded fuel breaks (Dennis, 2005).

The width of an effective roadside fuel treatment (distance to the left and right of a road) is dependent on slope. Treatments are recommended to extend 150 to 240 feet off the downhill side of the road and 100 to 150 feet off the uphill side. Wider treatments are necessary on the downhill side on steeper slopes due to the exacerbating effect of slope on fire intensity when fires travel uphill (Dennis, 2005). Important aspects of all roadside fuel treatments include:

- Removing limbs overhanging the road to create ***at least*** 13.5-feet of vertical clearance. See **Figure 3.a.3** for a depiction of how to measure limb height.

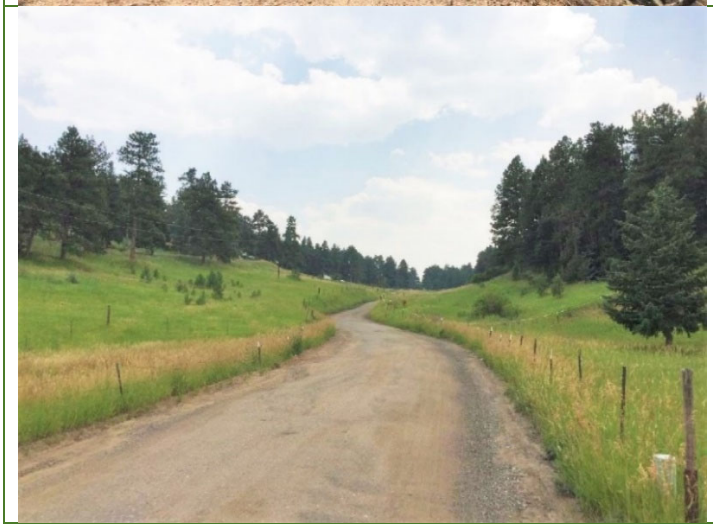
- Removing trees alongside the road to create ***at least*** 20-feet of horizontal clearance.
- Removing trees to create ***at least*** 10-feet crown spacing between remaining trees within the roadside treatment zone specified in **Error! Reference source not found.**. See **Figure 3.a.3** for a depiction of how to measure crown spacing.
- Removing shrubs and regeneration that can serve as ladder fuels.
- Mowing grasses adjacent to the road.
- Remove the slash following fuel treatments. See **Section 4.e. Approaches to Slash Management** for pros and cons of different slash management options.

Along important evacuation routes that could experience extreme congestion, roadside treatments should be more aggressive and consist of nearly removing all trees within at least 30 feet of the roadways. Clearcutting along roads when surrounding forests remain dense can cause problems with snow drifting. Therefore, shaded fuel breaks might be more suitable in areas where drifting is more likely, or snow fences may need to be installed.

Some residents find roadside fuel treatments aesthetically displeasing because so many trees have been removed. Still, these treatments are vital for increasing the safety of residents and firefighters in this community. Roadside treatments must dramatically reduce fuel loads to mitigate the risk of non-survivable conditions developing during wildfires effectively.

Figure 4.d.1. *Effective roadside fuel treatments remove enough trees to result in widely space crowns, remove ladder fuels (seedlings, saplings, shrubs, and low limbs), and reduce surface fuels. More dramatic tree removal along roadways can create even safer roadside conditions where appropriate. Photo credits: Genesee Foundation (top) and USDA/FPAC/GEO/Google Earth (bottom).*

Table 4.d.1*. Examples of conditions occurring along roadways in the Clear Creek Fire Authority and suggestions for treatment and improvement*

Roadway example	Suggestions for improvement
	• Clear trees and tall shrubs away from the roadways • Clear extra space on the downhill side • Create regular pullouts and turnaround locations for engines
	• Mowing along the side of the road is recommended for the tall grasses. • The trees along this roadway are back from the road and upslope of the road. Trees should be removed to further away, but this would be lower priority than other roadways.

- Remove trees that are leaning over the roadway because they could fall and trap residents during an evacuation
- Clear all trees on the sides of the roadways
- Install mirrors on switchbacks to improve visibility

4.e. Approaches to Slash Management

Forest management operations often increase surface fuel loads and can fail to achieve fire mitigation objectives if fuels created by the harvest activities (also known as slash) are not addressed (Agee and Skinner, 2005). Slash can include small trees, limbs, bark, and treetops. Slash management is a critical step in the forest management process. It is unwise, ineffective, and even dangerous to conduct poor-quality fuels treatments that fail to reduce canopy fuels, result in increased surface fuel loads, and do not receive maintenance treatments. Such treatments can lead to a false sense of security among residents and fire suppression personnel (Dennis, 2005), and they divert limited funds away from more effective, strategic projects.

Leaving untreated slash within roadside fuel treatments is particularly counterproductive. The risk of active crown fire might be lower after a thinning operation, but untreated slash in fuel treatments can burn at high intensities and endanger the lives of residents stuck on roadways during a wildfire. Slash is easier and cheaper to manage along roadways due to access, and roads can serve as highly effective holding features for controlled burning of grass in the spring and fall and pile burning in the winter.

Methods for managing slash come with different benefits and challenges (***Error! Reference source not found.***). For example, lop-and-scatter and mastication do not remove surface fuels from the site, they only rearrange them. It can take a decade or more for slash to decompose to a point where it no longer poses a significant fire hazard. Broadcast prescribed burning and pile burning are more effective at removing surface fuels, but they require extensive planning and expertise to conduct properly.

Clear Creek Fire Authority and HOAs should work together to develop a slash management strategy for the area. This can and should include a combination of the following slash management techniques.

- Pile burning during the winter on the property or at a neighborhood collection site.
- Chipping the slash and spreading the chips on the property.
- Haul away the timber and slash

5. The Future of the CWPP and Implementation Plan

Below are strategic actions for residents, Clear Creek Fire Authority, other community groups, public land managers, county, state, and federal agencies, and non-profit conservation groups to accomplish in the short, mid, and long term (see definitions below). Some activities have low financial costs but require a fundamental shift in attitudes and behavior to prioritize wildfire risk mitigation. Other actions are more substantial and require commitment and collaboration across the community to pool resources, apply for grants, and make incremental steps toward meaningful change.

5.a. Implementation Phases

Short-term actions	Mid-term actions	Long-term actions
• Can be implemented within the remainder of 2025 • This can be accomplished within the current funding capacity for the fire district and its residents. • Can occur within the context of the current Clear Creek Fire Authority volunteer base, with modest expansion. • Can capitalize on current relationships with emergency response partners and land managers.	• Can be implemented within 18-24 months, generally in 2026 and 2027. • Will require expansion of the current [partner organization] volunteer base. • Requires new cooperative relationships with emergency response partners, land managers, and non-profit organizations. • Actions are already in the planning stages and have some portion of funding already identified.	• Require planning to start within 18-24 months so implementation can occur after 2027. • Requires multi-year planning and funding. • Requires extensive grant funding. • Requires local staffing beyond volunteers.

5.b. Implementation Activities and Responsibilities

Recommendation	Responsibility	Timeline
Category: Fire Adapted Communities		
Adopt the Fire Adapted Communities as the overarching vision and strategy for CWPP implementation.	Clear Creek Fire Authority, HOAs, and residents	Short-term
Volunteer annually during the Clear Creek Fire Authority Firewise Education Day during the	Residents	Shor to mid term

summer to encourage residents to implement home hardening and defensible space.		
Recommendation	**Responsibility**	**Timeline**
Category: District Capacity and Outreach		
Form a volunteer group called the CWPP Implementation Committee or another mutually agreeable name to continue the momentum developed by the CWPP. Create a regular meetup schedule to discuss progress.	Clear Creek Fire Authority	Short to mid term
Collaborate with adjacent fire protection districts to establish a cooperative paid outreach or mitigation position to increase capacity. They could be full-time or part-time, but they must be able to work directly with residents on mitigation.	Clear Creek Fire Authority	Long-term
Category: Home Ignition Zone		
Complete annual maintenance of your home's ignition zone. Add 1-2 new mitigation actions each year.	Residents	Short-term
Conduct 150 home assessments to provide specific recommendations to individual homeowners.	Clear Creek Fire Authority volunteers	Mid-term
Category: Linked Defensible Space and Fuel Treatments		
Focus initial efforts on mitigating fire risk in CWPP plan units with High fire risk, Mill Creek-Fall River, and Floyd Hill. Have formal conversations about each area within six months of this document being signed.	Clear Creek Fire Authority, HOAs, residents, and other partners	Short- to mid-term
Work together to pool financial and other resources and pursue grants. Apply for 3-5 grants annually.	Clear Creek Fire Authority, HOAs and residents	Mid- to long-term
Recommendation	**Responsibility**	**Timeline**
Category: Slash Management		
Develop a slash management strategy within 1 year, including judiciously relaxing slash-burning prohibitions.	Clear Creek Fire Authority and HOAs	Short to mid-term
Implement a community chipping program.	Clear Creek Fire Authority and HOAs	Mid-term
Category: Evacuation Preparedness		

Develop a family evacuation plan and go-bags. Plans should include considerations of pets and livestock if applicable.	Residents	Short to mid-term
Sign up for emergency notifications through the Lookout Alert system.	Residents	Short-term
Category: Firefighter Access and Evacuation Safety		
Improve driveway access for firefighters.	Residents and HOAs	Mid-term
Coordinate efforts to mitigate hazardous conditions along private and HOA roadways.	Clear Creek Fire Authority and local land managers	Mid- to long-term

5.c. CWPP as a Living Document

It is recommended that they be updated every 5 years, at a minimum. CWPPs older than 10 years are outdated and can exclude communities from successfully applying for competitive funding opportunities.

Community Wildfire Protection Plans are authorized and defined in Title I of the Healthy Forests Restoration Act (HFRA), which was passed by Congress on November 21, 2003, and signed into law by President Bush on December 3, 2003.

Plans must comply with the requirements outlined in the 2022 Colorado State Forest Service Minimum Standards for Developing Community Wildfire Protection Plans.

The update to this plan can either be a preface to this document or a new document that integrates with this one. The update to this plan should include:

- A description of progress made since the CWPP was created.
- A description of demographic changes in the community and other important infrastructure changes.
- Identification of new risks in the community.
- Updated risk analysis if major changes have happened between revisions.
- Updated and prioritized projects for the community with maps and descriptions

The review process involves:

- Reviewing the existing CWPP
- Engaging partners that have a vested interest in the plan
- Hosting collaborative meetings
- Documenting completed projects and demographic and landscape changes
- Developing updated wildfire risk reduction priorities
- Updating maps
- Distributing updated drafts to key partners for review and input prior to final approval
- Finalizing with core team signatures and submitting to Colorado State Forest Service (CSFS)

This CWPP is a **call to action!** Becoming a fire adapted community and decreasing wildfire risk takes concerted effort, time, and coordination. Use it to spark action on your property and across your neighborhood and entire community. The need to protect lives, safety, and property from wildfire is too great to wait.

6. Glossary

20-foot wind speed: The rate of sustained wind over a 10-minute period at 20 feet above the dominant vegetation. The wind adjustment factor to convert surface winds to 20-foot wind speeds depends on the type and density of surface fuels slowing down windspeeds closer to the ground (NWCG, 2021).

Active crown fire: Fire in which a solid flame develops in the crowns of trees and advances from tree crown to tree crown independently of surface fire spread (NWCG, 2018b).

Basal area: Cross sectional area of a tree measured at breast height (4.5 feet above the ground). Used as a method of measuring the density of a forest stand in units such as ft^2/acre (USFS, 2021b).

Broadcast prescribed burning (aka, prescribed burn, controlled burn): A wildland fire originating from a planned ignition in accordance with applicable laws, policies, and regulations to meet specific objectives (NWCG, 2018b).

Canopy cover: The ground area covered by the crowns of all trees in an area as delimited by the vertical projection of their outermost crown perimeters (NWCG, 2019).

Canopy fuels: The stratum of fuels containing the crowns of the tallest vegetation (living or dead), usually above 20 feet (NWCG, 2018b).

Canopy height: The average height of the top of the vegetated canopy (NWCG, 2019).

Canopy: The more or less continuous cover of branches and foliage formed collectively by adjacent tree crowns (USFS, 2021b).

Canyon: A long, deep, very steep-sided topographic feature primarily cut into bedrock and often with a perennial stream at the bottom (NRCS, 2017).

Chain: Chains are commonly used in forestry and fire management as a measure of distance. 1 chain is equivalent to 66 feet. Chains were used for measurements in the initial public land survey of the U.S. in the mid-1800s.

Chute: A steep V-shaped drainage that is not as deep as a canyon but is steeper than a draw. Normal upslope air flow is funneled through a chute and increases in speed, causing upslope preheating from convective heat, thereby exacerbating fire behavior (NWCG, 2008).

Community Wildfire Protection Plan (CWPP): A plan developed in the collaborative framework established by the Wildland Fire Leadership Council and agreed to by state, Tribal, and local governments, local fire departments, other partners, and federal land management agencies in the vicinity of the planning area. CWPPs identify and prioritize areas for hazardous fuel reduction treatments, recommend the types and methods of treatment on Federal and non-Federal land that will protect one or more at-risk communities and essential infrastructure, and recommend measures to reduce structural ignitability throughout the at-risk community. A CWPP may address issues such as wildfire response, hazard mitigation, community preparedness, and structure protection (NWCG, 2018b).

Convection: A type of heat transfer that occurs when a fluid, such as air or a liquid, is heated and travels away from the source, carrying heat along with it. Air around and above a wildfire expands as it is heated, causing it to become less dense and rise into a hot convection column. Cooler air flows in to replace the rising gases, and in some cases, this inflow of air creates local winds that further fan the flames. Hot convective gases move up slope and dry out fuels ahead of the flaming front, lowering their ignition temperature and increasing their susceptibility to ignition and fire spread. Homes located at the top of a slope can become preheated by convective heat transfer. Convection columns from wildfires carry sparks and embers aloft.

Crown (aka, tree crown): Upper part of a tree, including the branches and foliage (USFS, 2021b).

Defensible space: The area around a building where vegetation, debris, and other types of combustible fuels have been treated, cleared, or reduced to slow the spread of fire and reduce exposure to radiant heat and direct flame. It is encouraged that residents develop defensible space so that during a wildfire their home can stand alone without relying upon limited firefighter resources due to the great reduction in hazards they have undertaken. The Colorado State Forest Service defines three zones of defensible space: zone 1 (HIZ 1) as 0 to 5 feet from the home, zone 2 (HIZ 2) as 5 to 30 feet from the home, and zone 3 (HIZ 3) as 30 to about 100 feet from the home (CSFS, 2021).

Direct attack: Any treatment applied directly to burning fuel such as wetting, smothering, or chemically quenching the fire or by physically separating the burning from unburned fuel (NWCG, 2018b).

Draws: Topographic features created by a small, natural watercourse cutting into unconsolidated materials. Draws generally have a broader floor and more gently sloping sides than a ravine or gulch (NRCS, 2017).

Ecological restoration: The process of assisting the recovery of an ecosystem that has been damaged, degraded, or destroyed (SER, 2004). In ponderosa pine and dry mixed-conifer forests of the Colorado Front Range, ecological restoration involves transforming dense forests into a mosaic of single trees, clumps of trees, and meadows similar to historic forests that were maintained by wildfires and very resilient to them (Addington et al., 2018).

Ember: Small, hot, and carbonaceous particles. The term "firebrand" is also used to connote a small, hot, and carbonaceous particle that is airborne and carried for some distance in an airstream (Babrauskas, 2018).

Fire adapted community (FAC): A human community consisting of informed and prepared citizens collaboratively planning and taking action to safely coexist with wildland fire (NWCG, 2018b). There is not a checklist or one silver bullet to become a FAC; there are many strategic actions and tools that should be used together to reduce shared risk. Risk mitigation is the responsibility of everyone who lives and works in the community—residents, community groups, fire protection districts, agency partners, non-governmental organizations, etc. Fire adaptation is an ongoing process of collaborative action to identify risk, mitigate it, and maintain the work overtime.

Fire behavior: The manner in which a fire reacts to the influences of fuel, weather, and topography. Characteristics of fire behavior include rate of spread, fire intensity, fire severity, and fire behavior category (NWCG, 2018b).

Fire history: A general term referring to the historic fire occurrence in a specific geographic area (NWCG, 2018b).

Fire intensity (aka, fireline intensity): (1) The product of the available heat of combustion per unit of ground and the rate of spread of the fire, interpreted as the heat released per unit of time for each unit length of fire edge, or (2) the rate of heat release per unit time per unit length of fire front (NWCG, 2018b).

Fire regime: Description of the patterns of fire occurrences, frequency, size, and severity in a specific geographic area or ecosystem. A fire regime is a generalization based on fire histories at individual sites. Fire regimes can often be described as cycles because some parts of the histories usually get repeated, and the repetitions can be counted and measured, such as fire return interval (NWCG, 2018b).

Fire severity. Degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time (NWCG, 2018b). Fire severity is determined by visually inspecting or measuring the effects that wildfire has on soil, plants, fuel, and watersheds. Fire severity is often classified as low-severity (less than 20% of overstory trees killed) and high severity (more than 70% of overstory trees kills). Moderate-severity or intermediate fire severity falls between these two extremes (Agee, 1996). Specific cutoffs for fire severity classifications differ among researchers. For example, Sherriff et al. (2014) define high-severity fires as those killing more than 80% of overstory trees.

Fire weather conditions: Weather conditions that influence fire ignition, behavior, and suppression, for example, wind speed, wind direction, temperature, relative humidity, and fuel moisture (NWCG, 2018b).

Firebreak: A natural or constructed barrier where all vegetation and organic matter have been removed down to bare mineral soil. Firebreaks are used to stop or slow wildfires or to provide a control line from which to work (Bennett et al., 2010; NWCG, 2018b).

Fireline: (1) The part of a containment or control line that is scraped or dug to mineral soil, or (2) the area within or adjacent to the perimeter of an uncontrolled wildfire of any size in which action is being taken to control fire (NWCG, 2018b).

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). Flame length is measured on an angle when the flames are tilted due to effects of wind and slope. Flame length is an indicator of fire intensity (NWCG, 2018b).

Fuel reduction: Manipulation, combustion, or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage from wildfires and resistance to control (NWCG, 2018b).

Fuelbreak: A natural or manmade change in fuel characteristics which affects fire behavior so that fires burning into them can be more readily controlled. Fuelbreaks differ from firebreaks due to the continued presence of vegetation and organic soil. Trees in shaded fuelbreaks are thinned and pruned to reduce the fire potential but enough trees are retained to make a less favorable microclimate for surface fires (NWCG, 2018b).

Fuels mitigation / management: The act or practice of controlling flammability and reducing resistance to control of wildland fuels through mechanical, chemical, biological, or manual means, or by fire, in support of land management objectives (NWCG, 2018b).

Fuels: Any combustible material, most notably vegetation in the context of wildfires, but also including petroleum-based products, homes, and other man-made materials that might combust during a wildfire in the wildland-urban interface. Wildland fuels are described as 1-, 10-, 100-, and 1000-hour fuels. One-hour fuels are dead vegetation less than 0.25 inch in diameter (e.g., dead grass), ten-hour fuels are dead vegetation 0.25 inch to 1 inch in diameter (e.g., leaf litter and pine needles), one hundred-hour fuels are dead vegetation 1 inch to 3 inches in diameter (e.g., fine branches), and one thousand-hour fuels are dead vegetation 3 inches to 8 inches in diameter (e.g., large branches). Fuels with larger diameters have a smaller surface area to volume ratio and take more time to dry out or become wetter as relative humidity in the air changes (NWCG, 2018b).

Handcrews: A number of individuals that have been organized and trained and are supervised principally for operational assignments on an incident (NWCG, 2018b).

Handline: Fireline constructed with hand tools (NWCG, 2018b).

Hazards: Any real or potential condition that can cause injury, illness, or death of personnel, or damage to, or loss of equipment or property (NWCG, 2018b).

Home hardening: Steps taken to improve the chance of a home and other structures withstanding ignition by radiant and convective heat and direct contact with flames or embers. Home hardening involves reducing structure ignitability by changing building materials, installation techniques, and structural characteristics of a home (California Fire Safe Council, 2020). A home can never be made fireproof, but home hardening practices in conjunction with creating defensible space increases the chance that a home will survive a wildfire.

Home ignition zone (HIZ): The characteristics of a home and its immediate surroundings within 100 feet of structures. Conditions in the HIZ principally determine home ignition potential from radiant heat, convective heat, and ember cast (NWCG, 2018b).

Ignition-resistant building materials: Materials that resist ignition or sustained flaming combustion. Materials designated ignition-resistant have passed a standard test that evaluates flame spread on the material (Quarles, 2019; Quarles and Pohl, 2018).

Incident Response Pocket Guide (IRPG): Document that establishes standards for wildland fire incident response. The guide provides critical information on operational engagement, risk management, all hazard response, and aviation management. It provides a collection of best practices that have evolved over time within the wildland fire service (NWCG, 2018a).

Indirect attack A method of suppression in which the control line is located some considerable distance away from the fire's active edge. Generally done in the case of a fast-spreading or high-intensity fire and to utilize natural or constructed firebreaks or fuelbreaks and favorable breaks in the topography. The intervening fuel is usually backfired; but occasionally the main fire is allowed to burn to the line, depending on conditions (NWCG, 2018b).

Insurance Services Office (ISO) rating: ISO ratings are provided to fire departments and insurance companies to reflect how prepared a community is for fires in terms of local fire department capacity, water supply, and other factors (see more information online at https://www.isomitigation.com/ppc/fsrs/).

Ladder fuels: Fuels that provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees with relative ease. Ladder fuels help initiate torching and crowning and assure the continuation of crowning. Ladder fuels can include small trees, brush, and lower limbs of large trees (NWCG, 2018b).

Lop-and-scatter: Cutting (lopping) branches, tops, and unwanted boles into shorter lengths and spreading that debris evenly over the ground such that resultant logging debris will lie close to the ground (NWCG, 2018b).

Mastication: A slash management technique that involves using a machine to grind, chop, or shred vegetation into small pieces that then become surface fuel (Jain et al., 2018).

Mitigation actions: Actions that are implemented to reduce or eliminate (mitigate) risks to persons, property, or natural resources. These actions can be undertaken before and during a wildfire. Actions before a fire include fuel treatments, vegetation modification in the home ignition zone, and structural changes to increase the chance a structure will survive a wildfire (aka, home hardening). Mitigation actions during a wildfire include mechanical and physical tasks, specific fire applications, and limited suppression actions, such as constructing firelines and creating "black lines" through the use of controlled burnouts to limit fire spread and behavior (NWCG, 2018b).

Mosaic landscape: A heterogeneous area composed of different communities or a cluster of different ecosystems that are similar in function and origin in the landscape. It consists of 'patches' arranged in a 'matrix', where the patches are the different ecosystems and the matrix is how they are arranged over the land (Hansson et al., 1995).

National Wildfire Coordinating Group (NWCG): An operational group established in 1976 through a Memorandum of Understanding between the U.S. Department of Agriculture and Department of the Interior to coordinate programs of the participating agencies to avoid wasteful duplication and to provide a means of constructively working together. NWCG provides a formalized system and agreed upon standards of training, equipment, aircraft, suppression priorities, and other operational areas. More information about NWCG is available online at https://www.nwcg.gov/.

Noncombustible building materials: Material of which no part will ignite or burn when subjected to fire or heat, even after exposure to moisture or the effects of age. Materials designated noncombustible have passed a standard test (Quarles, 2019; Quarles and Pohl, 2018).

Non-survivable road: Portions of roads adjacent to areas with predicted flame lengths greater than 8 feet under severe fire weather conditions. Potentially non-survivable flame lengths start at 8 feet according to the Haul Chart, which is a standard tool used by firefighters to relate flame lengths to tactical decisions (NWCG, 2019). Drivers stopped or trapped on these roadways would have a low chance of surviving radiant heat from fires of this intensity. Non-survivable conditions are more common along roads that are lined with thick forests, particularly with trees that have limbs all the way to the ground and/or abundant saplings and seedlings.

Overstory: Layer of foliage in a forest canopy, particularly tall mature trees that rise above the shorter immature understory trees (USFS, 2021b).

Passive crown fire: Fire that arises when surface fire ignites the crowns of trees or groups of trees (aka, torching). Torching trees reinforce the rate of spread, but passive crown fires travel along with surface fires (NWCG, 2018b).

Pile burning: Piling slash resulting from logging or fuel management activities into manageable piles that are subsequently burned during safe and approved burning conditions (NWCG, 2018b).

Radiation: A method of heat transfer by short-wavelength energy through air (aka, infrared radiation). Surfaces that absorb radiant heat warm up and radiate additional short-wavelength energy themselves. Radiant heat is what you feel when sitting in front of a fireplace. Radiant heat preheats and dries fuels adjacent to the fire, which initiates combustion by lowering the fuel's ignition temperature. The amount of radiant heat received by fuels increases as the fire front approaches. Radiant heat is a major concern for the safety of wildland firefighters and can ignite homes without direct flame contact.

Rate of spread: The relative activity of a fire in extending its horizontal dimensions. It is expressed as rate of increase of the total perimeter of the fire, as rate of forward spread of the fire front, or as rate of increase in area, depending on the intended use of the information. Rate of spread is usually expressed in chains or acres per hour for a specific period in the fire's history (NWCG, 2018b).

Ravine: Topographic features created by streams cutting into unconsolidated materials and that are narrow, steep-sided, and commonly V-shaped. Ravines are steeper than draws (NRCS, 2017).

Risk: (1) The chance of fires starting as determined by the presence and activity of causative agents (e.g., lightning), (2) a chance of suffering harm or loss, or (3) a causative agent (NWCG, 2018b).

Roadside fuel treatment: A natural or manmade change in fuel characteristics along a roadway which affects fire behavior so that fires burning into them can be more readily controlled, survivable conditions with shorter flame lengths are more likely during a wildfire, and firefighter access is enhanced (NWCG, 2018b).

Saddle: A low point on a ridge or interfluve, generally a divide or pass between the heads of streams flowing in opposite directions. The presence of a saddle funnels airflow and increases windspeed, thereby exacerbating fire behavior (NRCS, 2017).

Safety zones: An area cleared of flammable materials used by firefighters for escape in the event the line is outflanked or spot fires outside the control line render the line unsafe. In firing operations, crews progress so as to maintain a safety zone close at hand, allowing the fuels inside the control line to be consumed before going ahead. Safety zones may also be constructed as integral parts of fuelbreaks; they are greatly enlarged areas which can be used with relative safety by firefighters without the use of a fire shelter (NWCG, 2018b).

Shaded fuelbreak: Fuel treatments in timbered areas where the trees on the break are thinned and pruned to reduce fire potential yet enough trees are retained to make a less favorable microclimate for surface fires (NWCG, 2018b).

Slash: Debris resulting from natural events such as wind, fire, or snow breakage or from human activities such as road construction, logging, pruning, thinning, or brush cutting. Slash includes logs, bark, branches, stumps, treetops, and broken understory trees or brush (NWCG, 2018b).

Smoldering combustion: The combined processes of dehydration, pyrolysis, solid oxidation, and scattered flaming combustion and glowing combustion, which occur after the flaming combustion phase of a fire; often characterized by large amounts of smoke consisting mainly of tars (NWCG, 2018b).

Spot fire: Fire ignited outside the perimeter of the main fire by an ember (NWCG, 2018b). Spot fires are particularly concerning because they can form a new flaming front, move in unanticipated directions, trap firefighters between two fires, and require additional firefighting resources to control.

Spotting: 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 (NWCG, 2018b).

Stand: An area of forest that possesses sufficient uniformity in species composition, age, size, structural configuration, and spatial arrangement to be distinguishable from adjacent areas (USFS, 2021b).

Structure protection: The protection of homes or other structures from an active wildland fire (NWCG, 2018b).

Structure triage: The process of inspecting and classifying structures according to their defensibility or non-defensibility, based on fire behavior, location, construction, and adjacent fuels. Structure triage involves a rapid assessment of a dwelling and its immediate surroundings to determine its potential to escape damage by an approaching wildland fire. Triage factors include the fuels and vegetation in the yard and adjacent to the structure, roof environment, decking and siding materials, prevailing winds, topography, etc. (NWCG, 2018b).

There are four categories used during structure triage: (1) defensible – prep and hold, (2) defensible – stand alone, (3) non-defensible – prep and leave, and (4) non-defensible – rescue drive-by. The most important feature differentiating defensible and non-defensible structures is the presence of an adequate safety zone for firefighters (NWCG 2018a). Firefighters conduct structure triage and identify defensible homes during wildfire incidents. Categorization of homes are not pre-determined; triage decisions depend on fire behavior and wind speed due to their influence on the size of safety zones needed to keep firefighters safe.

Suppression: The work and activity used to extinguish or limit wildland fire spread (NWCG, 2018b).

Surface fire: Fire that burns fuels on the ground, which include dead branches, leaves, and low vegetation (NWCG, 2018b).

Surface fuels: Fuels lying on or near the ground, consisting of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low stature living plants (NWCG, 2018b).

Torching: The burning of the foliage of a single tree or a small group of trees from the bottom up. Torching is the type of fire behavior that occurs during passive crown fires and can initiate active crown fires if tree canopies are close to each other (NWCG, 2018b).

Values at risk: Aspects of a community or natural area considered valuable by an individual or community that could be negatively impacted by a wildfire or wildfire operations. These values can vary by community and include diverse characteristics such as homes, specific structures, water supply, power grids, natural and cultural resources, community infrastructure, and other economic, environmental, and social values (NWCG, 2018b).

Watershed (aka, drainage basin or catchment): An area of land where all precipitation falling in that area drains to the same location in a creek, stream, or river. Smaller watersheds come together to create basins that drain into bays and oceans (NOAA, 2021).

Wildfire-resistant building materials: A general term used to describe a material and design feature that can reduce the vulnerability of a building to ignition from wind-blown embers or other wildfire exposures (Quarles, 2019; Quarles and Pohl, 2018).

Wildland-urban interface (WUI): Any area where the built environment meets wildfire-prone areas—places where wildland fire can move between natural vegetation and the built environment and result in negative impacts on the community (Forge, 2018). For the purpose of this CWPP, the WUI boundary is defined in **Figure 2.c.2**. Strategic wildfire mitigation across the WUI can increase the safety or residents and wildland firefighters and reduce the chances of home loss.

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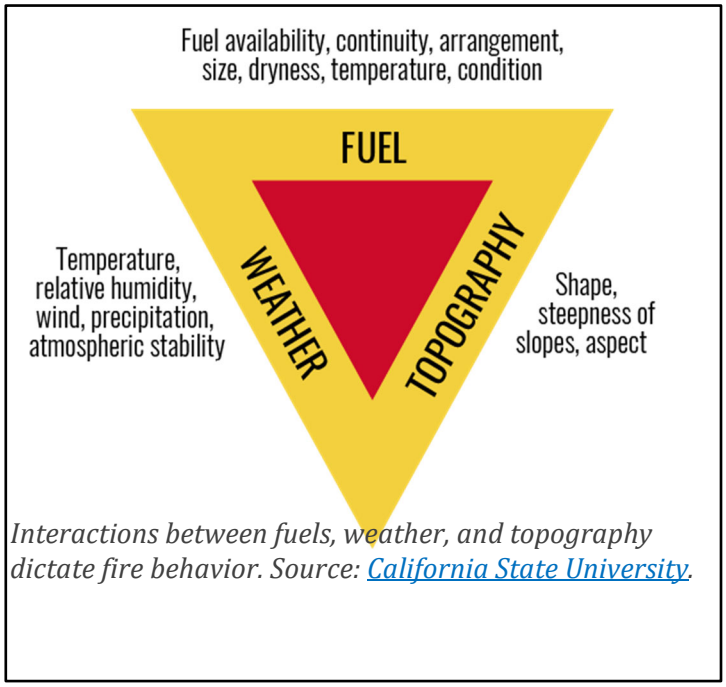
Appendix A. Introduction to Wildfire Behavior and Terminology

Fire Behavior Triangle

Complex interactions among wildland fuels, weather, and topography determine how wildfires behave and spread. These three factors make up the sides of the fire behavior triangle, and they are the variables that wildland firefighters pay attention to when assessing potential wildfire behavior during an incident (NWCG, 2019).



Interactions between fuels, weather, and topography dictate fire behavior. Source: California State University.

Fuels

Fuels include live vegetation such as trees, shrubs, and grasses, dead vegetation like pine needles and cured grass, and materials like houses, sheds, fences, trash piles, and combustible chemicals.

Grasses and pine needles are known as "flashy" fuels because they easily combust and burn the fastest of all fuel types. If you think of a campfire, flashy fuels are the kindling that you use to start the fire. Flashy fuels dry out faster than other fuel types when relative humidity drops or when exposed to radiant and convective heat[2]. Fires in grassy fuel types can spread quickly across large areas, and fire behavior can change rapidly with changes in weather conditions.

Dead branches on the surface dry out slower than flashy fuels, release more radiant heat when they burn, and take longer to completely combust. The rate of spread is fast to moderate through shrublands depending on their moisture content, and long flame lengths can preclude direct attack by firefighters. Shrubs and small trees can also act as ladder fuels that carry fire from the ground up into the tree canopy.

Dead trees (aka, snags) and large downed logs are called "heavy fuels", and they take the longest to dry out when relative humidity drops and when exposed to radiant and convective heat. Heavy fuels release tremendous radiant heat when they burn, and they take longer to completely combust, just like a log on a campfire. Fire spread through a forest is slower than in a grassland or shrubland, but forest fires release more heat and can be extremely difficult and unsafe for firefighters to suppress. An abundance of dead trees killed by drought, insects, or disease can exacerbate fire behavior, particularly when dead trees still have dry, red needles (Moriarty et al., 2019; Parsons et al., 2014).

Topography

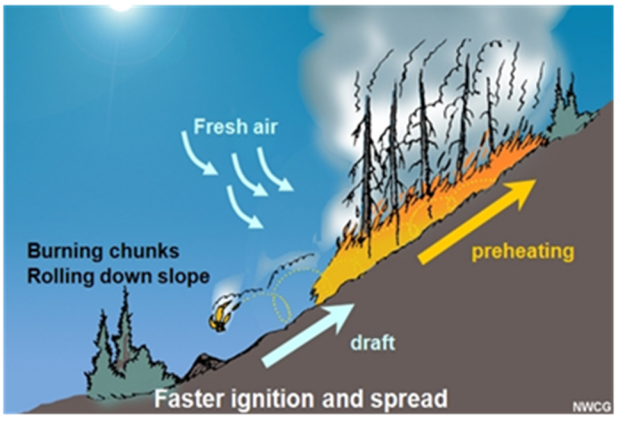
Topography (slope and aspect) influences fire intensity, speed, and spread. In the northern hemisphere, north-facing slopes experience less sun exposure during the day, resulting in higher fuel moistures. Tree density is often

[2] Radiant heat transfer occurs by short-wavelength energy traveling through air. Radiant heat is what you feel when sitting in front of a fire. Radiant heat preheats and dries fuels adjacent to a wildfire, which initiates combustion by lowering the fuel's ignition temperature. Convective heat transfer occurs when air is heated, travels away from the source, and carries heat along with it. Convective heat is what you would feel if you put your hand in the air above an open flame. Air around and above a wildfire expands as it is heated, causing it to become less dense and rise into a hot convection column. Cooler air flows in to replace the rising gases, and in some cases, this inflow of air creates local winds that further fan the flames. Hot convective gases move up slope and dry out fuels ahead of the flaming front, lowering their ignition temperature and increasing their susceptibility to ignition and fire spread.

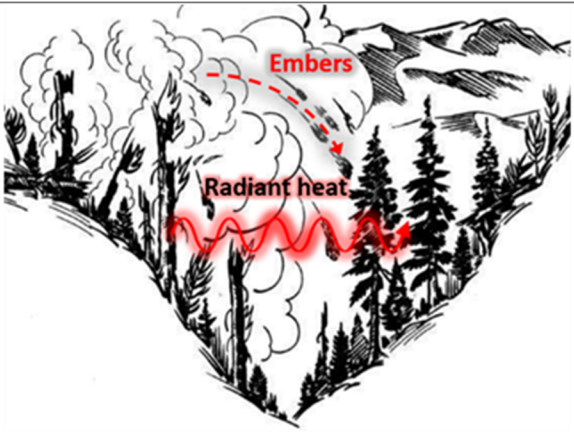
higher on north-facing slopes due to higher soil moisture. South-facing slopes experience more sun exposure and higher temperatures and are often covered in grasses and shrubs. The hotter and drier conditions on south-facing slopes mean fuels are drier and more susceptible to combustion, and the prevalence of flashy fuels results in fast rates of fire spread.

Fires burn more quickly up steep slopes due to radiant and convective heating. Fuels are brought into closer proximity with the progressing fire, causing them to dry out, preheat, and become more receptive to ignition, thereby increasing rates of spread. Steep slopes also increase the risk of burning material rolling and igniting unburnt fuels below.

Narrow canyons can experience increased combustion because radiant heat from fire burning on one side of the canyon can heat fuel on the other side of the canyon. Embers can easily travel from one side of a canyon to the other. Topography also influences wind behavior and can make fire spread unpredictable. Wildfires burning through steep and rugged topography are harder to control due to reduced access for firefighters and more unpredictable and extreme fire behavior.



Slope increases fire spread through radiant and convective heating (source: NWCG).



Fires can easily cross narrow canyons (source: U.S. Forest Service).

Steep slopes and topographic features such as narrow canyons exacerbate fire behavior.

Weather

Weather conditions that impact fire behavior include temperature, relative humidity, precipitation, and wind speed and direction. The National Weather Service uses a system called a red flag warning to indicate local weather conditions that can combine to produce increased risk of fire danger and behavior. Red flag warning days indicate increased risk of extreme fire behavior due to a combination of hot temperatures, very low humidity, dry fuels, strong winds, and the presence of thunderstorms (**Table A.1**).

Direct sunlight and hot temperatures impact how ready fuels are to ignite. Warm air preheats fuels and brings them closer to their ignition point. When relative humidity is low, the dry air can absorb moisture from fuels, especially flashy fuels, making them more susceptible to ignition. Long periods of dry weather can dehydrate heavier fuels, including downed logs, increasing the risk of wildfires in areas with heavy fuel loads.

Wind influences fire behavior by drying out fuels (think how quickly your lips dry out in windy weather), increasing the amount of oxygen feeding the fuel, preheating vegetation through convective heat, and carrying embers more than a mile ahead of an active fire. Complex topography, such as chutes, saddles, and draws, can funnel winds in unpredictable directions, increasing wind speeds and resulting in erratic fire behavior.

***Table A.1**. Red flag days are warnings issued by the National Weather Service using criteria specific to a region.*

National Weather Service – Denver/Boulder Forecast Office Red Flag Warning Criteria	
Criteria	
Relative humidity less than or equal to 15%	Widely scattered dry thunderstorms LAL 6
Wind gusts greater than or equal to 25 mph	Haines Index of 5 or 6
Dry fuels	Poor relative humidity recovery overnight (RH remains 40% or lower)

Ready, Set, Go!

GET SET: Red Flag Warning

Powered by the IAFC

What is a Red Flag Warning?

A Red Flag Warning is issued by the National Weather Service when low humidity, warm temperatures, dry fuels and strong winds could combine to produce extreme fire behavior that is either occurring or will occur within 24 hours. These are some of the criteria* considered prior to issuing a Red Flag Warning:

- Sustained wind speeds averaging 15 mph or greater
- Relative humidity of 25% or less
- Temperature over 75 degrees F
- Ten hour fuel moisture at 8% or less for one day

**specific weather criteria can vary by region*

During a Red Flag Warning you should **ALWAYS** follow the instructions provided by your local fire department and be prepared to take action if a fire develops in your area.

Red Flag Warning Safety Tips

Equipment

- Avoid using lawn mowers on dry vegetation.
- Follow all local fire restrictions on the use of chainsaws, mowers and other equipment during high risk times.

Outdoor Fires

- Be mindful of any burn bans in your area and obtain a permit if needed.
- Extinguish outdoor fires properly, never leave them unattended. Always drown them with plenty of water.
- Soak ashes and charcoal in water and dispose of them in a metal can. These materials can re-ignite days after a fire or BBQ is extinguished.
- Report unattended outdoor fires immediately to 911.

Property

- Keep your lawn green and mowed all season.
- Create at least 100 feet of defensible space around your home by removing leaves, weeds, brush, firewood and other flammables. Make sure to clean roof and gutters too.
- Make sure access roads to your property are cleared and properly labeled.

Vehicles

- Do not throw cigarettes or matches out of a vehicle. They can ignite grass on the side of the road and start a wildfire.
- Do not pull your vehicle over in dry grass.
- Ensure that trailer chains don't drag on the ground.

Set — **Always Maintain Situational Awareness**

Watch weather reports and make sure you are signed up for state and local emergency alerts.

During a warning, your local fire department can:

- Send text alerts, post information on social media and notify media outlets.
- Suspend open burning.
- Increase staffing and patrol highly vulnerable areas.
- Staff reserve equipment.
- Discuss allied resources with community stakeholders.
- Change fire threat signs to extreme.

For more information, **contact your local fire department.**

The Ready, Set, Go! Program seeks to share information with residents on what they can do to successfully prepare for a wildland fire. Residents are encouraged to be "Ready" by taking personal responsibility for their themselves, their family and their property, to be "Set" with situational awareness and to "Go" and act early. Speak with your local fire department about your area's threat for wildland fire and learn more about the wildland urban interface (WUI).

Ready, Set, Go! Wildland Fire Action Plan

Ready (Before the warning occurs)

- Create at least 100 feet of defensible space around your home. Clear flammable vegetation by trimming trees and removing pine needles and leaves from roofs, eaves and gutters. Box in vents with 1/8th inch metal mesh to block embers.
- Complete and practice your Personal Wildland Fire Action Plan.
- Become familiar with area roads, including all exit routes from your immediate area.
- Make a plan to accommodate animals or pets in case of wildfire or evacuation.
- Sign up with local agencies to receive emergency notifications.

Set (During the warning)

- Maintain good situational awareness by following weather reports and the news from your local media outlets.
- Have your "Go" kit packed and near your door in case you need to evacuate quickly. Suggested items to pack include:
  - Your Personal Wildland Fire Action Plan.
  - Prescription medications and any medical devices you may need.
  - Emergency first-aid supplies.
  - Important documents including your passport, birth certificate, driver's license, marriage license, insurance policy and any other legal documents.
  - Pet medications.
  - Personal electronics including cell phone, laptops and any charging cables you may need.
  - A week's worth of clothing and two pairs of shoes.
- Make sure your car is fueled and parked right outside your house so you can leave quickly.

Go! (Act early when a wildfire threatens)

- Get your '"Go" kit and leave well before the threat approaches, following an accessible exit route.
- Use your personal action plan for guidance.
- Cooperate with local authorities during evacuation & re-entry processes.

Remember: An evacuation can occur anytime, day or night. Be prepared you can evacuate quickly and safely.

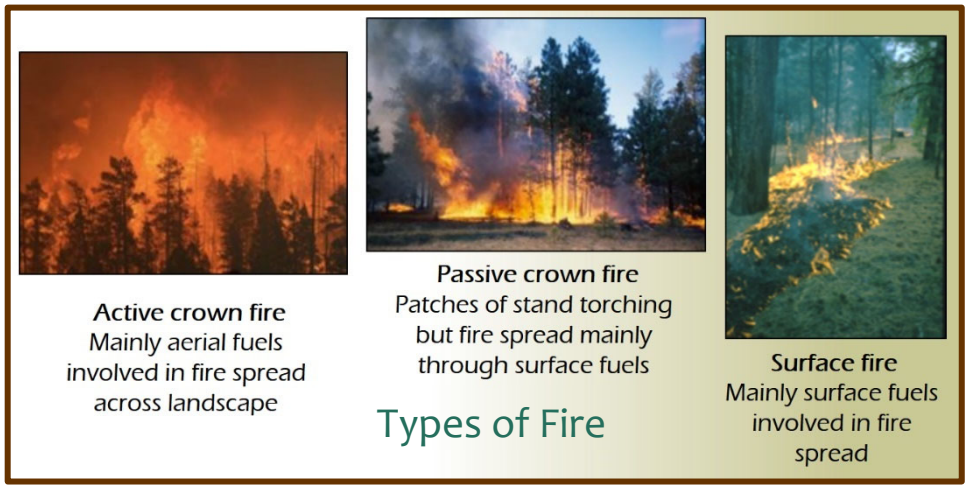
www.wildlandfirersg.org

Categories of Fire Behavior

Weather, topography, and fuels influence fire behavior, and fire behavior in turn influences the tactical options available for wildland firefighters and the risks posed to lives and property. There are three general categories of fire behavior described throughout this CWPP: surface fire, passive crown fire, and active crown fire.

- **Surface fire –** Fire that burns fuels on the ground, which include dead branches, leaves, and low vegetation. Surface fires can be addressed with direct attack using handcrews when flame lengths are less than four feet and with equipment when flame lengths are less than eight feet. Surface fires can emit significant radiant heat, which can ignite nearby vegetation and homes.
- **Passive crown fire –** Fire that arises when surface fire ignites the crowns of trees or groups of trees (aka, torching). Torching trees reinforce the rate of spread, but passive crown fires travel along with surface fires. Firefighters can sometimes address passive crown fires with indirect attack, such as dropping water or retardant out of aircraft or digging fireline at a safe distance from the flaming front. The likelihood of passive crown fire increases when trees have low limbs and when smaller trees and shrubs grow below tall trees and act as ladder fuels. Radiant heat and ember production from passive crown fires can threaten homes during wildfires.
- **Active crown fire –** Fire in which a solid flame develops in the crowns of trees and advances from tree crown to tree crown independently of surface fire spread. Crown fires are very difficult to contain, even with the use of aircraft dropping fire retardant, due to long flame lengths and tremendous release of radiant energy. The likelihood of active crown fires increases when trees have interlocking canopies. Radiant heat and ember production from active crown fires can threaten homes during wildfires.

Passive and active crown fires can result in short- and long-range ember production that can create spot fires and ignite homes. Spot fires are particularly concerning because they can form a new flaming front, move in unanticipated directions, trap firefighters between two fires, and require additional firefighting resources to control. Crown fires are generally undesirable in the wildland-urban interface (WUI) because of the risk to lives and property; however, passive and active crown fires are part of the natural fire regime for some forest types and result in habitat for plant and animal species that require recently disturbed conditions (Keane et al., 2008; Pausas and Parr, 2018). Passive and active crown fires historically occurred in some lodgepole pine forests and higher-elevation ponderosa pine and mixed-conifer forests on north-facing slopes (Addington et al., 2018; Romme, 1982).



Wildfire Threats to Homes

Wildfires can ignite homes through radiant heat, convective heat, and direct contact with flames or embers. The ability for radiant heat to ignite a home is based on the properties of the structure (i.e., wood, metal, or brick siding), the temperature of the flame, the ambient air temperature, and the distance from the flame (Caton et al., 2016). Ignition from convective heat is more likely for homes built along steep slopes and in ravines and draws. To ignite a structure, flames must directly contact the building long enough to cause ignition. Flames from a stack of firewood near a home could cause ignition, but flames that quickly burn through grassy fuels are less likely to ignite the home (although the potential still exists). Fires can also travel between structures along fuel pathways, such as a fence or row of shrubs connecting a shed and a home (Maranghides et al., 2022). Some housing materials can burn hotter than the surrounding vegetation, thereby exacerbating wildfire intensity and initiating home-to-home ignition (Mell et al., 2010).

Homes built mid-slope and at the top of steep slopes and within ravines and draws are at greater risk of convective heat from wildfires. A wildfire could rapidly spread up this steep slope and threaten the home above. Photo credit: The Ember Alliance

Homes can be destroyed during wildfires even if surrounding vegetation has not burned. During many wildland fires, 50 to 90% of homes ignite due to embers rather than radiant heat or direct flame (Babrauskas, 2018; Gropp, 2019). Embers can ignite structures when they land on roofs, enter homes through exposed eaves, or get under wooden decks. Embers can ignite nearby vegetation and other combustible fuels, subsequently igniting a home via radiant heating or direct flame contact. Burning homes can release embers that land on and ignite nearby structures, causing destructive home-to-home ignitions, as evidenced by the destructive 2021 Marshall Fire in Boulder County. Structural characteristics of a home can increase its exposure to embers and risk of combustion, such as wood shingle roofs and unenclosed eaves and vents (Hakes et al., 2017; Syphard and Keeley, 2019). Embers can also penetrate homes if windows are destroyed by radiant or convective heat. See your community's CWPP for specific recommendations on how to harden your home against wildfires.

Resources for More Information on Fire Behavior

- Introduction to Fire Behavior from the National Wildfire Coordinating Group (9:57 minute video)
- The Fire Triangle from the National Wildfire Coordinating Group (7:26 minute video)
- Understanding Fire Behavior in the Wildland/Urban Interface from the National Fire Protection Association (20:51 minute video)
- Understanding Fire from California State University (website)
- S-190 Introduction to Wildland Fire Behavior Course Materials from the NWCG (PowerPoints, handouts, and videos)

Appendix B. Community Risk Assessment Methodology

WUI Delineation

Delineating the wildland-urban interface is a critical component of CWPPs in compliance with the Healthy Forest Restoration Act (HFRA) of 2003. Communities can extend the WUI boundary into adjacent areas that pose a wildfire threat to their community, can serve as a strategic location for wildland firefighting, and are adjacent to evacuation routes for the community (HFRA 4 U.S.C. §101.16). Strategic wildfire mitigation across the WUI can increase the safety or residents and wildland firefighters and reduce the chances of home loss.

Colorado is one of the fastest-growing states in the Nation, with much of this growth occurring outside urban boundaries. This increase in population across the state will impact counties and communities located within the Wildland Urban Interface (WUI). The WUI is the area where structures and other human improvements meet and intermingle with undeveloped wildland or vegetative fuels.

Population growth within the WUI substantially increases the risk of wildfire. The Wildland Urban Interface (WUI) layer reflects housing density, depicting where humans and their structures meet or intermix with wildland fuels. In the past, conventional wildland-urban interface data sets, such as USFS SILVIS, have been used to reflect these concerns. However, USFS SILVIS and other existing data sources did not provide the level of detail needed by the Colorado State Forest Service and local fire protection agencies, particularly reflecting encroachment into urban core areas. The new WUI data set is derived using advanced modeling techniques based on the Where People Live (housing density) data set and 2021 LandScan USA population count data available from the Department of Homeland Security, HSIP data. WUI is simply a subset of the Where People Live data set. The primary difference is that populated areas surrounded by sufficient non-burnable areas (i.e., interior urban areas) are removed from the Where People Live data set, as these areas are not expected to be directly impacted by a wildfire. Fringe urban areas, i.e., those on the edge of urban areas directly adjacent to burnable fuels, are included in the WUI. Advanced encroachment algorithms were used to define these fringe areas.

Data is modeled at a 20-meter grid cell resolution consistent with other CO- WRA layers. The WUI classes are based on the number of houses per acre. Class breaks are based on densities, are well understood, and are commonly used for fire protection planning.

Fire Behavior

The information in the 2022 Colorado Forest Atlas, along with information from the RMA Dash Board, was used to develop risk profiles for each of the plan units and the county as a whole. This information regarding fuel types and concentration was verified through field assessments in each of the units. The prior fire history and behavior were incorporated into the final risk assessments. While each plan unit has the potential to support extreme fire behavior when the environmental conditions, fuels, and topography align, the average expected fire behavior was used to determine the risk levels.

Evacuation

The road conditions, road type, and number of access roads were considered in determining the evacuation difficulty for each plan unit. The total number of residents and the expected number of visitors to the area were also included in evacuation planning.

Roadway Survivability

The topography, fuel adjacent to the roadway, and expected average fire behavior were considered when determining roadway survivability. Roads that would have slowed or stopped traffic during an evacuation and had high fuel loading adjacent to the road surface were classified as nonsurvivable.

Risk Assessment

CWPP Plan Units

The district was divided into nine plan units incorporating all the major drainages structures. The plan unit delineations were made for areas with access changes, fuel type changes, alignment with wind changes, or unique hazard areas.

On the Ground Hazard Assessments

Clear Creek Fire Authority personnel completed the on-the-ground assessments. The risk profiles, fuel types, and fuel concentrations were compared to the on-the-ground conditions. The NFPA Wildland Fire Risk and Hazard Severity Assessment Form was used to evaluate each plan unit.

Risk Rating Approach

The relative risk levels were determined using the type of fire within the unit and the likelihood of a fire occurring. The WUI concentration, evacuation difficulty, and location of homes relative to the drainages were considered for all units.

Fuel Treatment Prioritization

Roadside Fuel Treatments

Most county roads within the district have fuels directly adjacent to the road surface, which is compounded by the steep topography adjacent to the road surface. Roadside fuel treatments are recommended for all county and private roads in the district.

Stand-Scale Fuel Treatments

The suggested stand-level fuel treatments were developed as part of the USFS POD line development project. They are based on previous fires crossing from the west side of the continental divide to receptive fuels on the east side of the continental divide. These fires could have fuel, topography, and wind alignment on the east side of the divide and spread to the front range or Denver metro area.

Appendix C. Community Survey Methodology and Results

Clear Creek Fire Authority CWPP Resident Questionnaire

2024 update to our Community Wildfire Protection Plan

Clear Creek Fire Authority is embarking on an update of the 2008 Community Wildfire Protection Plan (CWPP). We will use up-to-date information and fire modeling to assess local hazards and identify strategic investments to mitigate risk and promote preparedness. An updated CWPP will improve the ability of the FPD to respond to wildfires and direct emergency operations, including evacuations.

Community engagement in CWPP development

Community engagement is a vital aspect of CWPP development and implementation. Please take this online questionnaire to share your insights and help us learn about your values, needs, and concerns related to wildfire risk and community preparedness.

The questionnaire is only intended for residents within the Clear Creek Fire Authority Fire Protection District and individuals who own businesses in the area. The map below shows the boundary of the Fire Protection District. The questionnaire will take about 20 minutes to complete. Questions developed by the Wildfire Research group (WiRē; https://wildfireresearchcenter.org/) were instrumental in conducting the survey. We welcome all adults in your household / business to complete the survey. Your answers will be kept confidential, and insights we gather from your responses will be aggregated and not identifiable to a single individual.

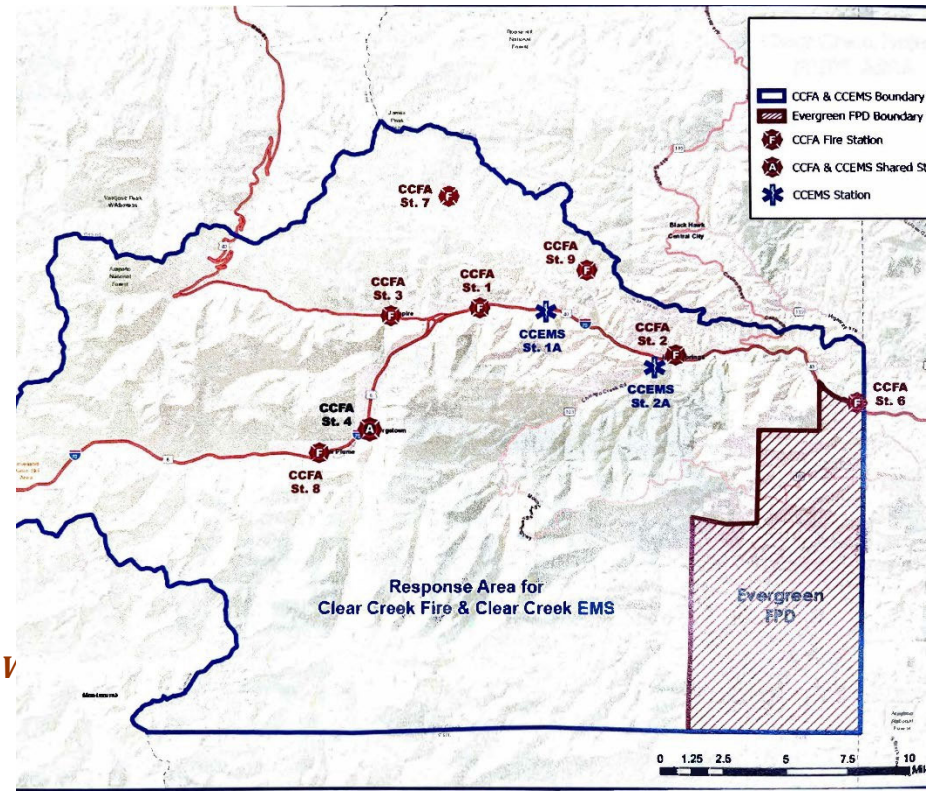
Please contact Jeremy Jones at jjones@clearcreekfire.com with questions and concerns regarding this questionnaire.

Please scan and email your completed questionnaire to jjones@clearcreekfire.com or mail / drop off at the office:

681 CR 308

PO Box 507

Dumont, CO 80436



Thank you for your time! W

8. Section 1: About you and your home/property/business

1. In what part of the community/Fire Protection District do you live or own a business in? Check all that apply.

- ○ Chicago Creek Unit
- ○ Dumont-Lawson Unit
- ○ Empire-Berthoud Falls Unit
- ○ Floyd Hill Unit
- ○ Georgetown Unit
- ○ Idaho Springs Unit
- ○ Mill Creek-Fall River Unit
- ○ Soda Creek-Blue Valley Unit
- ○ Home in another area: _____
- ○ Business in the Georgetown area
- ○ Business in the Idaho Springs area
- ○ Business in the Empire area
- ○ Business in another area: _____

2. Do you rent or own the place where you live / operate your business in the community/Fire Protection District? Check all that apply.

- ○ I rent the place I live in
- ○ I own the place I live in
- ○ I rent my business location
- ○ I own my business location(s)

3. How would you describe your residence or business in community/Fire Protection District?

- ○ Single-family home
- ○ Multi-family dwelling (e.g., townhouse, condo)
- ○ Standalone business structure
- ○ Multi-business structure
- ○ Other: _____

4. What is your residency status in the community/Fire Protection District? Check all that apply.

- ○ Full time resident
- ○ Seasonal resident
- ○ Non-resident
- ○ Short-term rental owner
- ○ Long-term rental owner
- ○ Owner of undeveloped lots
- ○ Business owner
- ○ Other: _____

5. How long have you lived in or owned a business in the community/Fire Protection District?

- ○ Less than 2 years
- ○ More than 2 years to less than 5 years
- ○ More than 5 years to less than 10 years
- ○ More than 10 years

If you would like to receive email notifications regarding updates and events related to the Community Wildfire Protection Plan, please provide your email address:

9. Section 2: Wildfire knowledge and concerns

6. Please read each statement and select the degree to which you agree or disagree with it.

	Strongly agree	Agree	Disagree	Strongly disagree
I understand the degree to which our community is at risk from wildfires.				
I know steps I can take to reduce wildfire hazards on and around my home / business / property.				
I would consider cutting trees for wildland fire protection on my own property.				
I support cutting of trees for wildland fire protection on open spaces across the community.				
I support cutting of trees along roads to enhance the safety of roads in case of an evacuation.				
I support land managers such as the U.S. Forest Service cutting trees to mitigate wildfire risk on public land around the community/FPD.				
I support pile burning to eliminate woody material created by fire mitigation actions.				
I support prescribed (controlled) burning to reduce wildfire risk in open spaces around or adjacent to the community.				

7. How concerned are you about the following issues if a wildfire were to occur in this community?

	Not concerned	Only slightly concerned	Moderately concerned	Very concerned
Receiving timely and accurate information about the incident				
Evacuating safely and promptly				
Damage to my home / business / property				
Loss of life				
Impacts to my livelihood				
Damage to wildlife habitat				
Loss of recreational opportunities				
Decreased beauty of my property and open spaces across the community				
Loss of insurance coverage due to wildfire risk				
Reduced air quality due to smoke				
Post-fire erosion and flooding				

8. Do you have any additional concerns in the case that a wildfire were to occur in the Clear Creek Fire Protection Authority District?

10. Section 3: Reducing wildfire hazards

9. I have completed the following work to my home/business/property to lessen the risk of wildfire and prepare for potential evacuations: Check all that apply.

- ○ Cutting trees or removing low limbs on trees near my home/business
- ○ Annually removing debris (dead vegetation, pine needles) from my gutter and roof
- ○ Annually removing debris (dead vegetation, pine needles, mulch) from under my balcony, deck, or porch
- ○ Removing all burnable fuel (mulch, grass, flammable furniture) from within 5 ft around the base of my home
- ○ Moving firewood away from my home/business and not storing it under my balcony, deck, or porch
- ○ Repairing or installing screens to block embers from entering vents, eaves, gutters, or crawlspace
- ○ Replacing my roof with less flammable materials
- ○ Widening my driveway so fire engines could access my property
- ○ Signing up for [local emergency alerts] to receive emergency notifications during wildfire incidents
- ○ Creating an evacuation plan for my family, pets, and livestock.
- ○ Keeping a Go Bag with important documents, survival gear, medications, etc. at the ready in case of an evacuation
- ○ Other:

10. Which of the following factors keep you from undertaking actions to reduce the wildfire risk on your property? Check all that apply.

- ○ Lack of knowledge about effective methods to reduce hazards
- ○ Lack of financial resources
- ○ Lack of tools to complete the work
- ○ Lack of time to complete the work
- ○ Physical inability to complete the work
- ○ Limited means to dispose of downed trees, limbs, and other slash material
- ○ Desire to keep trees near homes/businesses for aesthetic reasons, shading, or privacy
- ○ Local ordinances and regulations that prohibit certain modifications to homes/ businesses and surrounding property
- ○ Other:

11. Which of the following would encourage and enable you to reduce the wildfire risk on your property? Check all that apply.

- ○ Financial assistance
- ○ Access to inexpensive/easy means of disposing vegetation from mitigation work
- ○ Specific information about what needs to be done
- ○ Information on the effectiveness of different strategies to reduce the wildfire risk

- ○ Help doing the work (e.g., someone to thin trees and vegetation and/or remove debris)
- ○ A list of recommended contractors that could be hired to do the work
- ○ None of the above--I am not interested in these actions
- ○ Other:

12. Does your family have an evacuation plan for if a wildfire were to occur in the community?

- ○ Yes, for people in my household
- ○ Yes, for people and pets in my household
- ○ Yes, for people, pets, and livestock in my household and on my property
- ○ No

13. If there were an evacuation in the community because of wildfire, how concerned are you about the following issues?

	Not concerned	**Only slightly concerned**	**Moderately concerned**	**Very concerned**
I or my family members have physical limitations that would make it difficult for us to evacuate promptly				
My neighbors have physical limitations that would make it difficult for them to evacuate promptly				
I have children that might be home alone when an evacuation occurs				
My neighbors have children that might be home alone when an evacuation occurs				
My community does not have enough roads to handle evacuation traffic				
I do not know where to go if asked to evacuate				
I might not receive timely information about the need to evacuation				
It would take me over 20 minutes to gather my personal belongings and pets to evacuate				

11. Section 4: Education and Resources

14. If you have received information about wildfire issues facing this area, who has provided this information to you? Check all that apply.

- ○ Local State Forest Service
- ○ local Conservation District
- ○ Your HOA/POA
- ○ local Fire Protection District
- ○ local Watershed Coalition
- ○ Your insurance agency
- ○ Your neighbors
- ○ Social club or community organization: _____
- ○ I have never received information about wildfire issues in this area
- ○ Other: _____

15. What methods are best to communicate with you? Check all that apply.

- ○ Email
- ○ Paper mail
- ○ Flyers and ads in and around town
- ○ Facebook/social media
- ○ Newspapers
- ○ Next Door
- ○ Other:

16. Do you have any other thoughts or concerns relating to wildfire hazards and community preparedness?

"What actions have you taken on your property to protect your home from wildfire?" and have a graph with all the responses. Feel free to add quotes in for people that responded with additional information. Also use and reference these graphs throughout the document to support statements of community feelings or needs]

Appendix D. Community Wildfire Incident Functional Exercise

2024

Clear Creek Fire Authority Wildfire Tabletop Exercise

After Action Report

EXERCISE DATE: MARCH 5, 2024

CRAIG DAUGHERTY- FACILITATOR- FIRE.EDGE.CD@GMAIL.COM

INTERNATIONAL ASSSOCIATION OF FIRE CHIEFS: COMMUNITY WILDFIRE PROTECTION PLAN (CWPP) ASSISTANCE PROGRAM

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12. Contents

13. Executive Summary

On March 5, 2024, the International Association of Fire Chiefs (IAFC) Community Wildfire Protection Plan (CWPP) Program, in partnership with Clear Creek Fire Authority, held a discussion-based tabletop exercise to prepare for a large-scale wildland fire incident that would impact multiple communities in Clear Creek County, Colorado. The tabletop exercise was designed to assist the Clear Creek Fire Authority in the rewrite of their CWPP. The CWPP in turn will assist the community in preparation for wildfire events occurring within the county. The exercise was funded through an FY2021 Department of Homeland Security/Federal Emergency Management Agency/Assistance to Firefighters Grant/Fire Prevention and Safety Grant (DHS/FEMA/AFG/FPS) that was awarded to the IAFC. The exercise design team was composed of IAFC staff and contractors.

Clear Creek Fire Authority was selected as one of six departments to receive CWPP Program assistance through the FEMA grant and was selected for additional support through a tabletop exercise. Initial planning for the exercise began in July ‘23 after a preliminary discussion with local stakeholders.

The exercise design team created a wildland fire scenario under Red Flag conditions. The initial wildland fire began along Highway 40 two miles West of the community of Empire and eventually burned toward the communities of Saint Mary’s and Upper Mill Creek. A second fire was then introduced South of Idaho Springs and eventually would threaten critical infrastructure. The exercise took participants through a progression of fire growth into multiple communities and various fire and law enforcement jurisdictions, eventually involving multiple structures and other critical values at risk. The scenario was developed in accordance with the goals and objectives outlined by the IAFC and locally involved stakeholders.

Goal: To work together as emergency response agencies and partners, dealing with a catastrophic wildland fire scenario impacting communities. Identify the roles and responsibilities of each agency that will ultimately lead to better preparation and preparedness for a real-world event.

Objectives:

- Gather emergency responders together for a tabletop exercise involving a rapidly evolving wildland incident.
- Evaluate agency roles and responsibilities in a catastrophic wildland fire scenario impacting the community and how each agency will collaborate with other organizations.
- Define and understand each agency’s role in the incident and how they fit within the organization of incident command or the Emergency Operations Center.
- Identify blind spots that need to be addressed to be successful with future events.
- Document key outcomes and follow-up actions of the tabletop.

After Action Report/Recommendations for Wildfire Planning

The purpose of this report is to provide an overview of the tabletop exercise, summarize and analyze exercise findings, identify strengths that should be maintained and built upon, identify areas for further improvement, and support the development of recommendations.

After reviewing written participant feedback gathered at the conclusion of the tabletop exercise, much of the group thought the tabletop exercise was beneficial. The majority of participants indicated that they strongly agreed or agreed with the assessment factors listed below.

- The exercise was well structured and organized.
- The exercise scenario was plausible and realistic.
- The multimedia presentation helped the participants understand and become engaged in the scenario.
- The facilitator was knowledgeable about the material, kept the exercise on target, and was sensitive to group dynamics.
- The PPT Scenario used during the exercise was a valuable tool throughout the exercise.
- Participation in this exercise was appropriate for someone in my position.
- The participants included the right people in terms of level and mix of disciplines.
- The exercise provided a good test of knowledge/skills.

For more details, see Appendix A.

The participating organizations will use this report moving forward with recommendations from the exercise and work collaboratively to create a framework for their CWPP planning.

Major Strengths

A major strength observed throughout the exercise was the foundation already established for relationships across the emergency services agencies in the area. Participants had working relationships and ongoing collaboration with each other and there was a solid foundation of networking and partnerships which was obvious.

Additionally, previous regional incidents such as the Marshall and East Troublesome Fires along with recent national wildfires created a point of reference to draw upon strengths and lessons learned across agencies and lead to a strong understanding of the potential of a WUI fire in this area. This helped many participants reference these previous incidents and bring reality to the scenario which led to stronger and more in-depth conversations.

Primary Areas for Improvement

Throughout the exercise, opportunities for improvement in Clear Creek County's ability to coordinate evacuation and response to an emerging WUI fire were identified. The focus areas of improvement fell into several categories:

1) Collaboration/Partnerships

2) Planning

3) Communications

4) Training

1) Collaboration/Partnerships

While the greater Clear Creek County area already has strong working partnerships, a greater understanding of the abilities of Jeffcom 911 Dispatch was discussed since

they are new to providing these services to Clear Creek County. More engagement with private/other sectors (schools, assisted living facilities, private rafting companies, utility providers, large animal rescue organizations, Red Cross, etc.) on resources and collaboration during times of crises, were recognized as areas for improvement. Also, the integration of Mutual Aid partners and state and Federal Resources was recognized as an area where more collaboration is important.
Future tabletop exercises with additional organizations included were suggested to build upon the momentum established through this exercise.

2) Planning

Discussions during the exercise identified several areas requiring additional planning across organizations. Several of these areas were planning for the Emergency Operations Center (EOC), Joint Information Center (JIC), evacuation zones, and management action points, as well as evacuation notifications and processes.
Evacuation language needs to be established and publicized within the County and a strong PIO group needs to be built so information is not slow to be released. More training in the EOC and Incident Command interface was discussed as a need for future training and planning.

3) Communications

To improve communications, both in terms of technology capabilities and processes, the participants discussed priority pre-emption, radio frequencies (the use of 800 MHz vs. VHF) interoperability or lack thereof between systems, and emergency alert notifications. While there are established communication abilities for internal and external communications, both need increased awareness for agency representatives and the public. There were discussions of the capabilities of Jeffcom dispatch that need further follow-up on their abilities with staffing to deal with this situation and how their processes work on evacuation warnings both through the Rave System and utilizing IPAWS for emergency notifications of the public.

4) Training

Several areas of training were identified as valuable for increasing preparedness for wildfire, including training focused on Incident Command System (ICS) specifically for elected officials, and basic fire behavior and ICS for non-emergency response agencies. Personal Protective Equipment (PPE) for non-fire responders should also be considered along with chainsaw training for all personnel.

14. Section 1: Exercise Overview

Exercise Details

Exercise Name: Clear Creek Fire Authority Wildfire Tabletop Exercise

Type of Exercise: Discussion-based tabletop exercise of a wildland fire requiring the implementation of community protection, partner collaboration, and coordination.

Exercise Date and Time: March 5th from 8:30 a.m. to 2:00 p.m.

Location: Clear Creek Fire Authority training room.

Goal: To work together as emergency response agencies and partners, dealing with a catastrophic wildland fire scenario impacting communities. Identify the roles and responsibilities of each agency that will ultimately lead to better preparation and preparedness for a real-world event.

Objectives:

- Gather emergency responders together for a tabletop exercise involving a rapidly evolving wildland incident.
- Evaluate agency roles and responsibilities in a catastrophic wildland fire scenario impacting the community and how each agency will collaborate with other organizations.
- Define and understand each agency's role in the incident and how they fit within the organization of incident command or the Emergency Operations Center.
- Identify blind spots that need to be addressed in order to be successful with future events.
- Document key outcomes and follow-up actions of the tabletop.

Capabilities: Target capabilities addressed within the exercise include:

- Interagency wildfire response and suppression
- Communications
- Evacuation

Exercise Design Team and Support

From the IAFC

- Craig Daugherty (Facilitator and scenario development)
- Marshall Braun (ArcGIS support and StoryMap creation)
- Lauren Holtzclaw (Wildland Programs Analyst-IAFC – support)
- Derek Bullington (Program Manager-IAFC – support)

Participating Organizations

Listed below are the organizations and agencies that participated in the Clear Creek Fire Authority Wildfire Tabletop Exercise:

- Clear Creek Fire Authority
- Clear Creek County Sheriff's Office
- Clear Creek County Office of Emergency Management
- Clear Creek County
- Central City Fire Department
- Evergreen Fire Department
- US Forest Service
- Colorado Department of Fire Prevention and Control
- Colorado State Forest Service
- Idaho Springs Police Department
- Gilpin County Sheriff's Office
- Empire Police Department
- Colorado Department of Transportation
- Clear Creek County EMS
- City of Georgetown
- Clear Creek Courant Reporter

A total of 30 people were in attendance for the tabletop. All participants and organizations were actively involved in the conversations and brought value to the exercise and the problem-solving that occurred.

15. Section 2: Exercise Design Summary

Exercise Structure and Guidelines

The TTX was a multimedia, facilitated exercise. Each module began with a multimedia update that summarizes key events occurring within that time. After the update, the facilitator engaged the various functional response agencies on their appropriate response issues, actions, concerns, and partners with whom they will collaborate. Dialog with all the represented organizations occurred to determine assistance that could be provided to a specific situation and how an interagency approach can best be accomplished.

Guidelines:

- The TTX will be held in an open, high-energy, low-stress, no-fault environment. Varying viewpoints, even disagreements, are expected.
- Respond based on your knowledge of current plans and capabilities (utilize only your existing assets) and insights derived from your experience and training.
- Decisions are not precedent-setting and may not reflect your organization's final position on a given issue. This exercise is an opportunity to discuss and present multiple options and possible solutions. **Do what's right!**
- Issue identification is not as valuable as suggestions and recommended actions that could improve response and preparedness efforts. Critical thinking and problem-solving should be the focus.

Scenario Summary

This tabletop exercise used a major wildland fire event as the scenario to set the stage for both wildland fire response, coordination, and evacuation discussions. The agenda for the exercise included multiple discussion sets that incorporated scenarios within the fire staged at different points in time. The timeline for the scenarios starts with the initial attack and progresses with fire growth and then a second wildfire occurring within the county. All events, discussion sets, and questions asked can be found in the full Situation Manual found in Appendix B.

Members of the exercise design team recorded observations, issues, concerns, ideas, and recommendations expressed by participants during the discussions.

16. Section 3: Analysis of Capabilities

This section of the report reviews the performance of the exercised capabilities, activities, and tasks. In this section, observations are organized by category and the corresponding activities.

Partnerships

Participating organizations recognized early in the tabletop the importance of establishing unified command and an EOC for the incident. This echoed throughout the tabletop and a strong level of cooperation among agencies was evident. Public information was a reflective topic, and one area of improvement was identified. The county has a PIO, and a discussion was held on the possibility of organizing a Public Information Officers working group, this could streamline the Joint Information Center (JIC) portion of the EOC during an incident and give capacity to all agencies in a situation such as this scenario. Discussions were also held about the need for more cross-agency communication and training, to ensure that unified command can be set up quickly at the onset of an incident. Interoperability between 800 MHz and VHF frequencies was highlighted as a concern during the exercise, and it was noted that more training needs to occur to integrate these two systems and become more streamlined in communications for all types of incidents and to train new folks and stay up on the system operations.

More involvement of private sector resources in the EOC and during the response was noted as another potential gap. Conversations with utility providers, rafting companies, and review of master plans for updating contacts, maps, and processes need to occur more frequently especially after the Dispatch has moved to Jeffcom. It was noted that there was a notebook with a lot of this information, that was previously at the old dispatch and the whereabouts of this information is unknown after the move to Jeffcom.

Future tabletops were identified as a need, these exercises would need to include some of the agencies such as the State Patrol who were not in attendance and there was a suggestion to bring in mutual aid partners as well. Smaller tabletops, including the public, were also discussed as educational as well as functional tools.

Preplanning

Preplanning has occurred in some functional areas, but most of the information is held within the individual response or functional organizations. Discussions were held about establishing management action points along with clarifying evacuation zones, to assist decisions during wildfire evacuation situations and to bring partners together in a non-stressful environment to determine the best course of action for various situations. Again, discussions need to occur with Jeffcom dispatch to confirm they have this information and have the ability to push out messaging as needed. Messaging to the public was another topic of concern due to the transfer of alerting systems to Jeffcom dispatch and the need for a public information campaign to get more buy-in to the alerting system used by the county through Jeffcom dispatch. The recommendation in the county is that there is a need for public information on the alerting system, the evacuation language used to describe the various levels of evacuation

implementation, and public understanding of the shortfalls of alerting due to limited or no cell service in many parts of the county. All this public information should be focused continually across the county to be prepared for all types of emergencies. QR codes were discussed to allow people to sign up for the alert systems and depending on the alert program capabilities also allow for visitors or those staying in vacation homes to sign up for the alert systems for short terms during their visits.

Another area of preplanning that has been discussed in the past and needs continual attention is the evacuation and reunification of students and parents of schools in the area. Planning should be done with schools that could be threatened by wildfire. Along the same discussion was a conversation about other critical facilities and the potential to harden facilities that house at-needs populations. Once these are hardened a plan may include no evacuation but a shelter- in-place plan and protection of the facility and its occupants.

Other preplanning conversations had by participants centered around the need for more formal preplanning to identify Incident Command Post locations (and the need for a mobile command post), staging areas, safety zones, or temporary points of refuge that responders and the public could utilize in the case evacuation routes were cut off, as areas of last resort to protect individuals. It was also noted that the auto-aid system needs some maintenance and clean-up so that it can be more effective. Also, resource or IA packets, were discussed for incoming mutual or Auto Aid resources that included frequencies, maps, and other important information for responders not familiar with the area. This information could be tied to a QR code for quick download to a personal device.

Upgrades to the EOC were also discussed to include: More landlines, dedicated laptops tied to the EOC, backup power source (large generator), and more comfortable seating for long-duration incidents within the EOC.

Communications

The emergency alert notification system used by Clear Creek County is the Rave system. It was noted that there is a small percentage of the County's population who have opted-in to receive evacuation notifications. It was discussed that a more robust attempt needs to be made to get more of the public to subscribe to the system. There were also conversations about looking at other types of loud-area speakers or siren systems to notify the public of the need to evacuate for any emergency. This would require educating the public to search out information from trusted sources as to why the sirens are being activated. Discussions were also had into the use of helicopter-mounted loud speakers, and it was noted that this is dependent on other partners or mutual aid partners who might not be available. The Sheriff's office would need a helicopter with this capability if funds were found to purchase and maintain a platform.

Dispatch capacity was a concern with this scenario and discussions revolved around the need for more conversations with Jeffcom since they are a new entity providing dispatch for Clear Creek County. These discussions need to involve notifications of the public (Rave buy-in, IPAWS), capacity, public information, internal responder communication programs, and frequency management.

Concerns were raised about the inability to communicate across 800 MHz and VHF without having a trunking system. Further discussions will be had and further training on how to overcome communication challenges with various agencies who are responding to incidents

with different radio systems. This should be a priority as communication is vital during these types of incidents.

Equipment and Infrastructure

As the participants followed the scenario and completed an after-action review (AAR) there were several equipment and infrastructure needs identified that could increase preparedness, capacity, and firefighter and public safety. As previously mentioned, some sort of wide area alerting system (Loud area speakers or Sirens) should be explored due to the remote nature of the county and lack of cell service in many areas. Automation of this system should also be explored with input from Jeffcom dispatch.

EOC upgrades need to be pursued to look at having more landline phones hard-wired into the facility. A backup generator to power the facility when power from the electric grid is compromised. Building capacity by having a cache of laptop computers available for use by those in the facility. Use of Starlink to maintain connectivity or a FirstNet Cellular on Wheels (COW) to help maintain connection when losses occur to internet and cellular networks. As well as add some more comfortable seating for those spending extended time in the EOC. Along this same thought process and tied to incident response a mobile command unit was discussed for the county to help bring capacity to the EOC or at an incident scene or command post.

PPE for non-fire personnel was another area of conversation and if an opportunity for funding arises it should be considered for those responders. Communication always is a concern in these types of events and most of the agencies involved had some form of priority preemption for their agencies, however, some did not and some of the key partners had not heard of this. It is in the county's interest to make sure that some of the key partners (gas, water, electric, and public works) are included in these services. Starlink was also noted as a possible tool to overcome some of the communication shortfalls and is a tool that should be explored by the State, county, and respective agencies. Finally, a discussion occurred on having more responders, such as law enforcement, carry chainsaws in their cruisers to assist in getting roads open during imminent evacuation situations with downed trees. With this type of equipment proper PPE and training would also need to occur.

17. Section 4: Action Items and Conclusion

This tabletop exercise was a valuable step in building capacity for the completion of the Clear Creek Fire Authority's CWPP, planning and bringing light to the concerns a fast-spreading wildfire could have in this region. It helped capture the strengths already in place in the community as well as identify critical action items that will allow organizations to prepare for wildland fires and any other hazard that may require large-scale evacuations.

Participants in this exercise identified several action items to move forward with. This includes:

Collaboration/Partnerships

1. Continue to build upon the face-to-face relationships that have been built with the various agencies, neighboring departments, and interagency partners, as well as continue the positive collaboration that has been built through time.
2. Establish a county-wide public information officers' PIO working group.
3. Assess the role the private sector plays in wildland fires and periodically update the contact list for these types of resources (rafting companies, utilities, etc).
4. Continue to have tabletops with expanded participation to test capabilities. Consider inviting the public so they can understand the limitations of emergency response in these wildfire situations and for further public information sharing and education.

Preplanning

1. Consider establishing some management action points (trigger points) and firming up evacuation zones, utilizing GIS, in areas of the county that are at the highest risk of a wildland fire event.
2. Continuity of operations plans need to be reassessed or developed to consider a large wildfire event. Conversations with Jeffcom dispatch need to occur to determine what their capabilities are (notifications, IPAWS) and where they may have shortfalls for an event like this tabletop.
3. Work with schools and assisted living facilities to establish plans for evacuation, shelter-in-place, and reunification plans.
4. More Incident Command System (ICS) training for all responders with an emphasis on elected officials ICS training and non-fire agencies (DOT, Road and Bridge, etc.).
5. Formally identify safety zones and/or temporary refuge points for areas where evacuation points could be compromised for both responders and the public.
6. Explore the automatic aid system to find areas for improvement and look at resources to pass on to responders to aid in situational awareness.

Communications

1. Consider a public information campaign to increase the number of county residents utilizing the Rave system for receiving evacuation information.
2. Consider alternative systems for evacuation notifications, such as loud area speakers, sirens, NOAA radio, or IPAWS, and exercise with these systems.

3. Continue to work on interoperability between 800 MHz and VHF systems and find workarounds to gain vital communication links between various response organizations.
4. Increase wildfire evacuation public information during the pre-season.
5. Educate the public on defensible space and Firewise principles to give responders a chance to defend more communities.

Equipment and Infrastructure

1. Pursue equipment for other evacuation notification systems as mentioned. This could include the addition of a helicopter within the Sherrif's office with a load speaker.
2. EOC upgrades to be more resilient in times of emergencies. (backup power, additional landlines, laptop cache, mobile command unit, FirstNet Cellular on wheels, Starlink, and more comfortable chairs)
3. Consider wildland PPE for all responders not just fire to include chainsaws in law enforcement vehicles and training to go along with this equipment. Also, Ready, Set, Go! for Law Enforcement training.
4. Utilization of Messaging boards from partners for messaging and possibly purchasing extras for capacity in these large events.
5. Explore opportunities to improve communications by utilizing priority preemption with all involved in the emergency response to include key non-governmental stakeholders.

These steps can be undertaken by the respective agencies and organizations in the county and should be re-evaluated at the end of every fire season. Several planning items should be incorporated into 2025 pre-planning efforts and the community can determine if an annual or semi-annual tabletop exercise will be beneficial to continue preparedness enhancement.

In conclusion, this group has well-established relationships and the communication and planning to develop valuable partnerships, but these should be expanded and strengthened moving forward to improve large-scale response success for wildland fires. It is necessary to continue to capture lessons learned from any incidents or drills and re-evaluate the resources and capacities of all partners. Clear Creek County has an opportunity to build a strong CWPP and be a leader in wildfire preparedness along the front range region and across the state of Colorado.

18. Appendix A: Participant Feedback Summary

19. Exercise Feedback Form Results

Assessment of Exercise Design and Conduct

Assessment Factor	Strongly Disagree				Strongly Agree
a. The exercise was well structured and organized.	1	2	3	4	5
Responses	1				19
b. The exercise scenario was plausible and realistic.	1	2	3	4	5
Responses	2				18
c. The multimedia presentation helped the participants understand and become engaged in the scenario.	1	2	3	4	5
Responses	4				16
d. The facilitator was knowledgeable about the material, kept the exercise on target, and was sensitive to group dynamics.	1	2	3	4	5
Responses				1	19
e. The PPT Scenario used during the exercise was a valuable tool throughout the exercise.	1	2	3	4	5
Responses				3	17
f. Participation in this exercise was appropriate for someone in my position.	1	2	3	4	5
Responses	1				19
g. The participants included the right people in terms of level and mix of disciplines.	1	2	3	4	5
Responses	1			2	17
h. The exercise provided a good test of knowledge/skills.	1	2	3	4	5
Responses	1				19

What changes would you make to improve this exercise?
Please provide any recommendations on how the exercise could be improved or enhanced to better prepare emergency responders to safely and effectively respond to these types of incidents.

- Try to bring in representatives from power, gas etc. agencies to build relationships to work through these scenarios.
- Well done - kept things moving and engaging - realistic, practical, and just the right amount of challenges.
- A deeper conversation about communications and the 800 vs. VHF issues. Common practices financial concerns, resource orders, and when to contact interagency dispatch.
- Ability to type/ write all resources allocated/ assigned as a usual aid for the group to visually see who all is on scene.

- Local pictures of area for better visual representation.
- This was a fantastic exercise!!
- Better coordination to schedule may have increased participation of elected officials.
- Excellent and useful exercise.
- Maps - more zoomed out first, was hard to get oriented initially.

Any closing thoughts to help improve future exercises?

- Great exercise! Thank you.
- I appreciate the exercise and knowledge of the instructor.
- Great job of pulling all stakeholders.
- Facilitators did a great job involving all individuals of different agencies.
- Very valuable!
- Was a very good tabletop - I think this made some people think more about their rolls. Thank you!
- Great exercise.
- Encourage more participation from elected officials so they get an understanding of these challenges!
- Great training.

20. Appendix B: Exercise Situation Manual

"For Official Use Only"

Clear Creek Fire Authority

Wildfire Tabletop Exercise

Situation Manual

Facilitator: Craig Daugherty- (505) 634-6516- fire.edge.cd@gmail.com

March 5, 2024

"For Official Use Only"

Clear Creek Fire Authority Wildfire TTX

Preface

This tabletop exercise (TTX) is being provided by the International Association of Fire Chiefs (IAFC) through the Community Wildfire Protection Plan (CWPP) Assistance Program. The CWPP Assistance Program is being funded through an FY 2021 DHS/FEMA/AFG/Fire Prevention & Safety Grant. Through the grant, the IAFC and WUI subject matter experts are assisting in community wildfire risk reduction planning and engagement efforts with fire departments across the United States. Clear Creek Fire Authority applied for this grant and was selected as one of six departments nationwide to receive targeted assistance for the creation of a CWPP and assistance with a wildfire public education community day. In addition to the general assistance mentioned above, they were also selected to receive a wildfire tabletop exercise to assist the community in preparing for a wildfire and to support the creation of the CWPP.

All exercise participants should use appropriate guidelines to ensure proper control of TTX information within their area of expertise and protect this material per current jurisdictional directives. Public release of exercise materials to third parties is at the discretion of the Clear Cree Fire Authority and is based solely on the sharing of lessons learned.

Introduction

Background

The reality of destructive wildfires occurring in communities across the country is becoming more common every year. Examples such as the 2018 Camp Fire in Paradise, California, the 2021 Marshall Fire just to your East, and the 2023 Lahaina Fire in Maui County Hawaii, show how large fast-spreading wildfires can cause chaos to a community. Unfortunately, these fires proved to be deadly and overwhelmed emergency responders almost immediately with “unprecedented” fire behavior. All were driven by sustained strong winds and burned at record paces into inhabited areas, destroying multiple homes, businesses, and infrastructure, surprising even veteran emergency responders. The Lahaina Fire alone killed 100 people, making it the deadliest fire in more than a century. The Camp Fire killed 85 and destroyed close to 19,000 structures, with almost 14,000 of them being residential homes. Much of the destruction in both occurred within the first four hours.

As some of you may have experienced in the Marshall or East Troublesome Fires, fast-moving fires of significant magnitude quickly became a reality for this region. Given the alignment of fuels, weather, and topography these fires serve as great reminders of the need for continued preparedness for large wildfire events.

The mitigation work done in and around some of your communities will help firefighters in most situations; however, there are times when conditions line up to produce the potential of a catastrophic event. A fire like the Paradise Fire is an all too real scenario for many communities adjacent to wildland fuels. Environmental conditions supporting extreme fire growth (sustained drought, several days of low RH, low fuel moistures, hot temperatures, and high winds) happen many times yearly in this region. It is just a matter of time before these conditions meet up with an ignition, potentially causing a very catastrophic event.

Purpose

The purpose of this scenario-based exercise is to provide participants with an opportunity to critically review current response concepts, agency roles and responsibilities, plans, systems, and capabilities for response to a rapidly emerging WUI fire with an ongoing evacuation of the community. Aiming to learn from lessons from real-world incidents, this TTX is designed to be a pre-incident evaluation. The focus is on local emergency responder command and control, coordination, critical decisions, notifications, public information, and eventual integration of state and federal assets necessary to save lives and protect the health and safety of both responders and the public. Clear Creek Fire Authority has a history of interagency partners working well together, as demonstrated during previous incidents. We will work to maintain and enhance these existing collaborative processes and supporting systems, to prepare your community for the potential of fast-spreading wildland fire and help you bring focus to your CWPP efforts.

Exercise Design Goals and Objectives

Goal: To work together as emergency response agencies and partners, dealing with a catastrophic wildfire scenario impacting communities. Identify the roles and responsibilities of each agency that will ultimately lead to better preparation and preparedness for a real-world event.

Objectives:

- Gather emergency responders and partners together for a TTX involving a rapidly evolving wildland incident.
- Evaluate agency roles and responsibilities in a catastrophic wildfire scenario impacting the community and how each agency will collaborate with other organizations.
- Define and understand each agency's role in the incident and how they fit within the organization of incident command or the Emergency Operations Center.
- Identify blind spots that need to be addressed to be successful with future events.
- Document key outcomes and follow-up actions of the tabletop.

Exercise Structure and Guidelines

The TTX will be a multimedia, facilitated exercise. Each module will begin with a multimedia update that summarizes key events occurring within that time. After the update, the facilitator will engage the various functional response agencies on their appropriate response issues, actions, concerns, and partners with whom they will collaborate. Dialog with all the represented organizations will then occur to determine assistance that could be provided to a specific situation and how an interagency approach can best be accomplished.

Guidelines:

(2) The TTX will be held in an open, high-energy, low-stress, no-fault environment. Varying viewpoints, even disagreements, are expected.
(3) Respond based on your knowledge of current plans and capabilities (utilize only your existing assets) and insights derived from your experience and training.
(4) Decisions are not precedent-setting and may not reflect your organization's final position on a given issue. This exercise is an opportunity to discuss and present multiple options and possible solutions. **Do what's right!**
(5) Issue identification is not as valuable as suggestions and recommended actions that could improve response and preparedness efforts. Critical thinking and problem-solving should be the focus.

Assumptions and Artificialities

In any exercise, many assumptions and artificialities may be necessary to complete play in the time allotted. During the exercise, the following apply:

-Events are plausible and occur as they are presented.
-There are no hidden agendas or trick questions.
-All players receive information at the same time. Please don't look ahead in this manual.

Agenda

0830 - Introductions

- Purpose of tabletop
- Introductions of agencies: name and jurisdiction you are representing.
- Review the situation manual

0900 – Kick-off Tabletop scenario.

0900-1030 - Scenario inputs 1030sh

- Break

1045-1215 - Scenario inputs

1215-1230 - Finish up scenario.

1230 – On-site lunch

1315- After Action Review

What went right that we want to capitalize on or continue? What are our strengths?

What needs improvement, what were our challenges, and what solutions need to be pursued?

What needs to be changed in training, policies, procedures, SOP/SOGs, and interagency collaboration?

Any equipment or infrastructure shortfalls that need to be considered? What could help with your jobs?

Any unresolved issues?

Recommended actions to focus on moving forward. Who's responsible for carrying forward?

Notes:

Scenario

It's Saturday, June 29th. After months of below-average moisture, the US drought monitor shows most of Central Colorado in extreme to exceptional drought. Energy Release Components (ERC's) are above the 97th percentile which puts the fire danger at Extreme. Wildland fires have been occurring for over two months in Colorado with many of them requiring Interagency Incident Management Teams (IMT'S). Currently, all the IMT's in the region are committed to large or emerging fires. Local resources have been heavily involved in the regional response. The National Weather Service Boulder office issued the weather below the evening before including zones 212 and 216.

WEATHER DISCUSSION

A shallow mountain wave will be passing over the area tonight producing a strong wind event. Winds will begin peaking tonight and into Saturday. Hot, dry, and strong Southwesterly winds are expected starting late this evening, peaking overnight into Saturday morning before slowing Saturday afternoon. These winds have the potential to reach critical speeds. Winds are likely to initially reach speeds greater than 30 mph by midnight and will continue to increase through the day Saturday. Relative humidity is expected to reach critical levels overnight into Saturday with the influx of dry air. Conditions will be favorable for rapid fire spread which may threaten life and property. Use extra caution with potential ignition sources, especially in grassy areas. Outdoor burning is not recommended. A Red Flag warning has been issued for Western Colorado as this system approaches.

*****CRITICAL RED FLAG CONDITIONS FROM 1900 TODAY TO 1900 TOMORROW*****

TONIGHT: RED FLAG conditions and Wind Advisory in effect from 1900 this evening to 1900 tomorrow WEATHER:

Continued above-average temperatures and poor overnight humidity recovery.

MINIMUM TEMPERATURES: 58-63 degrees above 8500ft and 62-68 degrees below 8500ft.

MAXIMUM RELATIVE HUMIDITY: 15% to 17% above 8500ft / 13% to 16% below 8500ft.

-24 HOUR TREND- down 2 to 5%

20 FOOT WINDS: Southwest winds 10 to 15 mph with gusts to 25 in the early evening. Winds increasing to 15-25 mph with gusts to 30 after 2400. Winds gradually increase through the night and into the early morning.

CHANCE OF WETTING RAIN: 0% LAL:

1

SATURDAY: RED FLAG Warning and Wind Advisory in effect WEATHER:

Sunny, windy, and continued dry.

MAXIMUM TEMPS: Ranging from 70-75 above 8500ft and 78-83 below 8500ft

-24 HOUR TREND- little change.

MINIMUM RELATIVE HUMIDITY: 12-15% above 8500 ft. and 10% to 13% below 8500ft.

-24 HOUR TREND-down 2%

20 FOOT WINDS: Southwest to West winds 25 to 30 mph gusts to 40 before 1000 then increasing to 30 to 40 mph by mid to late morning, gusts to 40-50 changing out of the West. Winds decrease slightly mid-afternoon possibly shifting out of the Northwest 20-25 mph with an occasional gust to 30-35 mph possible.

CHANCE OF WETTING RAIN: 0%

At 0530 Chief Jones receives a text from one of the volunteer firefighters with the following video attached.

"Morning Chief, sorry it's so early, my brother was heading to work this morning at the Henderson Mine and sent me this video. It's about two miles West of Empire. Have we been called for this? I haven't seen anything on I Am Responding, he thinks it may have just started."

Chief texts the Forest Service FMO to see what's going on and at 0600 receives this text.

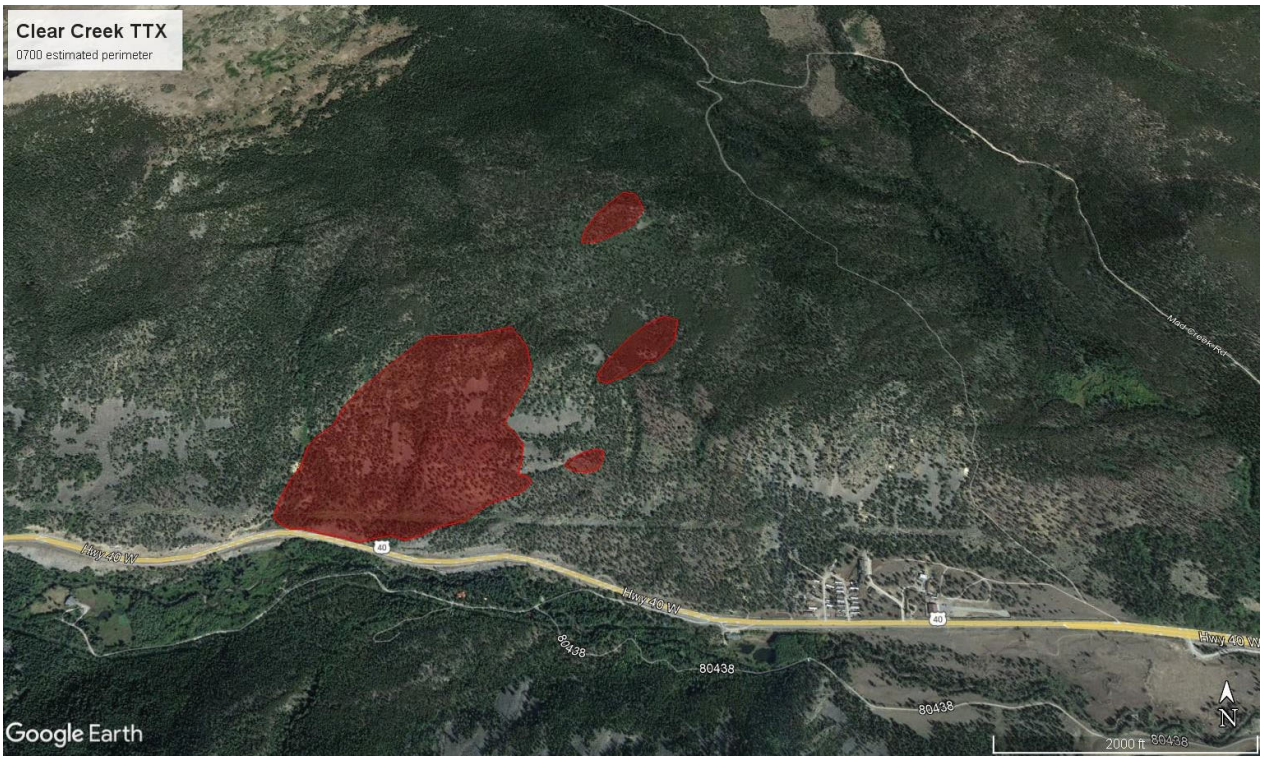
"Good morning, Chief, yes, Engine 612 is on scene they were on another fire this morning and were able to get there quickly. Sounds like it's about 5 acres and spreading fast. My crew is working on a hose lay but they are having issues getting around it in this wind. What resources do you have available to assist us? Winds are supposed to be brutal today!!"

This is an estimated location of the fire that he sent you.

Questions-Are you concerned about a fire in this area? What's your current thought process? What resources are you sending to help? Currently, are you informing anyone else of this situation?

Notes:_____

At 0700 you get an update; they are estimating the fire to be about 75 acres with several established spot fires and multiple small spots. They are reporting no containment but are anchoring along Highway 40 near the heel. Here is what the Incident Commander (IC) has drawn as a perimeter. IC states they are ordering resources, but they are stretched. Fire behavior is extreme and they are discussing the possibility of ordering an Incident Management Team (IMT) but no teams are available in the region.



Questions- Do you have a say in the decision to order an IMT? Have you established any management action points (Trigger Points) for a fire coming from this area? If so, what are they? How engaged are you in the management of this fire?

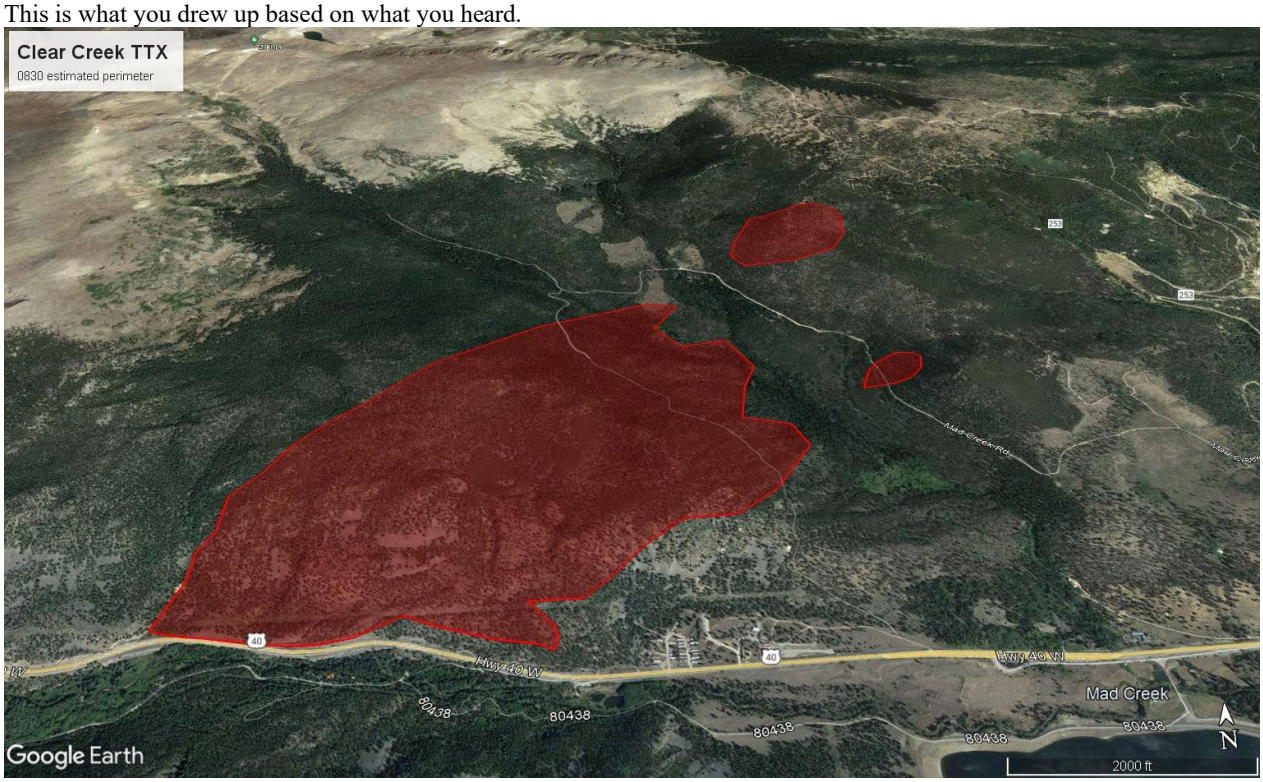
Notes:_____

As the morning goes on, this is the smoke column that is seen from Fall River Drainage.

What are your current thoughts? Who are you having discussions with? How are you informing the public about what's occurring? Visitors in the area? How have you historically organized multi-jurisdictional incidents?
Notes:_____

At 0830 you listen to air attack on your radio with his initial flight of the fire, this is what you hear as he's talking to the IC. "This fire is making a hard push to the Northeast; I'm having trouble seeing under the column at this time near the head of the fire, I can see it has made it down to Mad Creek but not sure if it has crossed it yet. As I fly near the heel it appears the fire may be holding along Highway 40, crews seem to be doing well with that piece of ground. However, there is a finger that is making a hard push toward the trailer park along 40…that'll need some structure protection fairly quickly. Along the West-Northwest flank, fire is very active but there may be some opportunities to run that up into some rock...Coming around this North side I do see quite a few vehicles and campers at Bill Moore Lake, they are probably in a safe spot but if they try to leave, they'll be right in front of this thing. I did get a quick look under the column, and you do have some very established spot fires across Mad Creek and Mad Creek Road. I do see what appears to be an occupied structure off Mad Creek Road, but I think you have fire-cutting-off access to that area. The one spot is well established and over the ridge into the upper Lion Creek area, I'm guessing anywhere from 40-50 acres on this spot… some structures up North Empire Creek will need evacuating soon…I am having trouble seeing under the column and through the smoke, but it appears there are numerous spot fires with several becoming well established...I see another spot that's at least 6-8 acres. Very rough air in here, we are going to have to pull back. I have air support on order but not sure how effective they'll be in this wind or if they can safely fly today. I'm estimating over 500 acres on the main fire, with high spread potential. I'm assuming you are in contact with the communities out in front of this thing?"

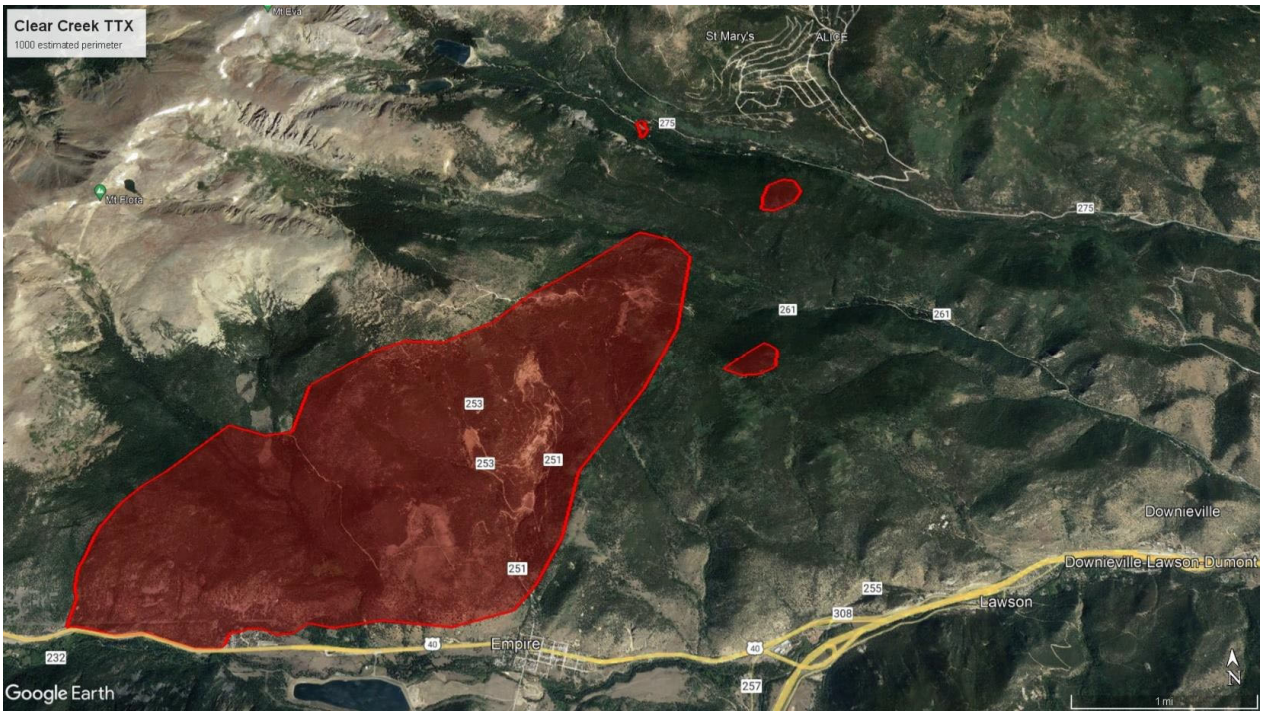
This is what you drew up based on what you heard.



What are your thoughts? Any areas of concern where you may need extra time to prepare?
Where are you at on evacuations? What is your message to the public? How do you get that message out?
Notes:

Responders are having issues with people refusing to evacuate. How do you handle this situation? Can you force them? What system do you have in place to document and keep accountability for this situation? Who has the statutory authority to issue an evacuation?
Notes:

Below is the estimated perimeter as of 1000, the fire is being called the West Fork Fire. Multiple structures are now on fire along Highway 40 and up North Empire Creek. The approximate acreage of the main fire is over 3000 acres with multiple small spot fires. Besides the many small spot fires, there are several large spot fires as seen on the map, the largest being about 30 Acres.



Does the current fire perimeter information change any of your evacuation protocols or routes? Who are the partners you are bringing together to be successful? What are each of your organization's current priorities? Do you have designated safety zones or temporary refuge areas identified?

Notes:

A Sheriff's deputy is reporting a spot fire around Rainbow Road and Mackinaw Lane. As she's reporting it, a tree comes down right in front of her, knocked down by the wind. She is trapped behind the down tree, towards the end of Kimberly Road, a one-way spur road, along with two civilian families she was evacuating. She reports no other way out and is concerned they are going to get burned over. She has no way to move the tree.

What are your actions? Who will you send to cut or move the tree? Do you currently have adequate resources? How are you tracking the accountability of responders?

Notes:

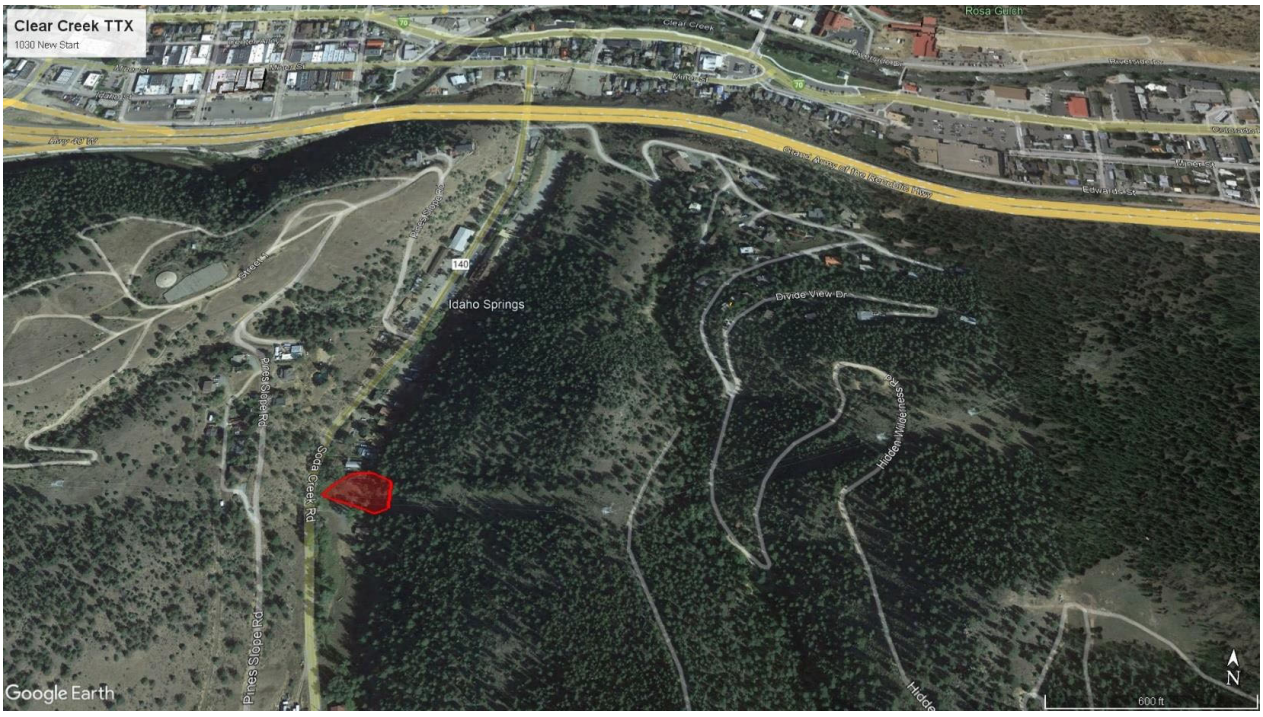
One of your local elected officials called, wanting to know why traffic isn't moving East on County Road 275, Fall River Road. They are trying to evacuate and are concerned that they are going to get burned over; they are in heavy smoke and see flames on the ridge to the West. How do you deal with this situation?

Notes:

At 1030 a mutual aid Engine responding West on I-80 reports a possible new start on Soda Creek Road. They will give a size-up once they are on the scene. Dispatch is receiving several calls for a new start where the power line crosses Highway 140 in the Soda Creek drainage. The reporting party says the fire is spreading fast along the power line right of way. The reporting party also reported a male was running from the area where the fire started jumped into a tan SUV and left the area. Law enforcement, what are your priorities with the information given? Fire, what does this change for you?

Notes:_____

The mutual aid unit arrives on the scene of the new fire and reports about ½ acre on fire with rapid-fire spread, one structure is already involved and three are imminently threatened. Below is an estimate of the fire's current location.



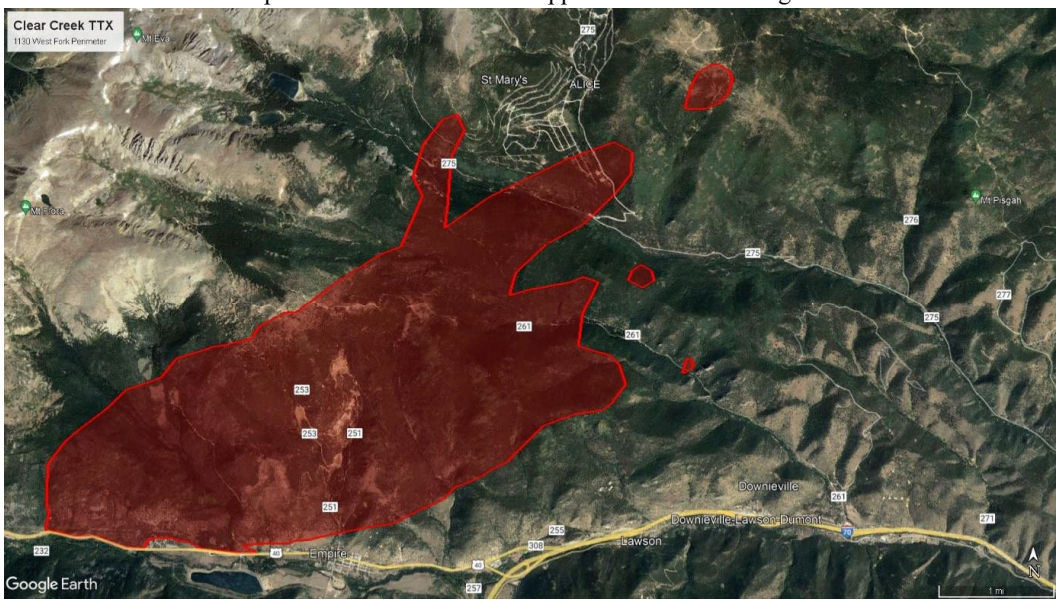
With everything going on at this point: What are your current concerns and priorities? What are your current resource needs and how are you dealing with them?

Notes:_____

You were just informed that your spouse called. They were on Facebook and a private individual has taken it upon themselves to be the "information clearinghouse". The private individual, however, is giving out wrong information on evacuations that could lead people into harm's way. The individual is also reporting that an ecoterrorism arsonist is starting all these fires. How would you handle this situation?

Notes:_____

At 1130 the Multi Mission Aircraft sends you maps of both fire perimeters. The approximate size of the West Fork Fire is 6,000 acres with well-established spot fires and erratic fire behavior. The new start, now named the Soda Fire, is around 10 acres with some smaller spot fires. Fire behavior is suppressed due to shading from other fires in the area.



You get a report from one of your units responding to spot fires off Divide View Road. "We have multiple spot fires that are becoming established near homes. We won't be able to handle it with the resources on hand. We grabbed a hydrant and there's no water pressure, can you check on that for us? We are about out of tank water….We are going to make sure that no one is in these homes that are immediately threatened." One of the firefighters snapped this picture on arrival.

What is your direction to the crew? How do you deal with the water situation?

Notes:_____

How is your working relationship with the various utility providers (Gas, Electric, Water, etc.)? Are they part of your unified command structure? How do you contact them? What if they are being evacuated?

Notes:_____

Around this same time a husband calls dispatch to say his wife and kid are trapped at home. He has their only working vehicle at work in Denver.

His wife works a night shift and was just woken up by their little boy because he heard sirens passing by on the road. They see smoke and fire outside the home located on Elk Court.

Above is a picture of the Elk Road and Silver Creek Road intersection. What is your plan to deal with this situation?

Notes:_____

A unit of yours is able to push through the spot fire on Mill Creek Road-261. When they get through, they find an elderly gentleman, his wife, and three dogs have a 41-foot travel trailer jack- knifed and stuck in the middle of the road, there are several families stuck behind them on the one-way road with no way to get around the vehicle. They are getting multiple spot fires in their immediate vicinity. Their escape route back to the Southeast is cut off by the fire and they can go no further North.

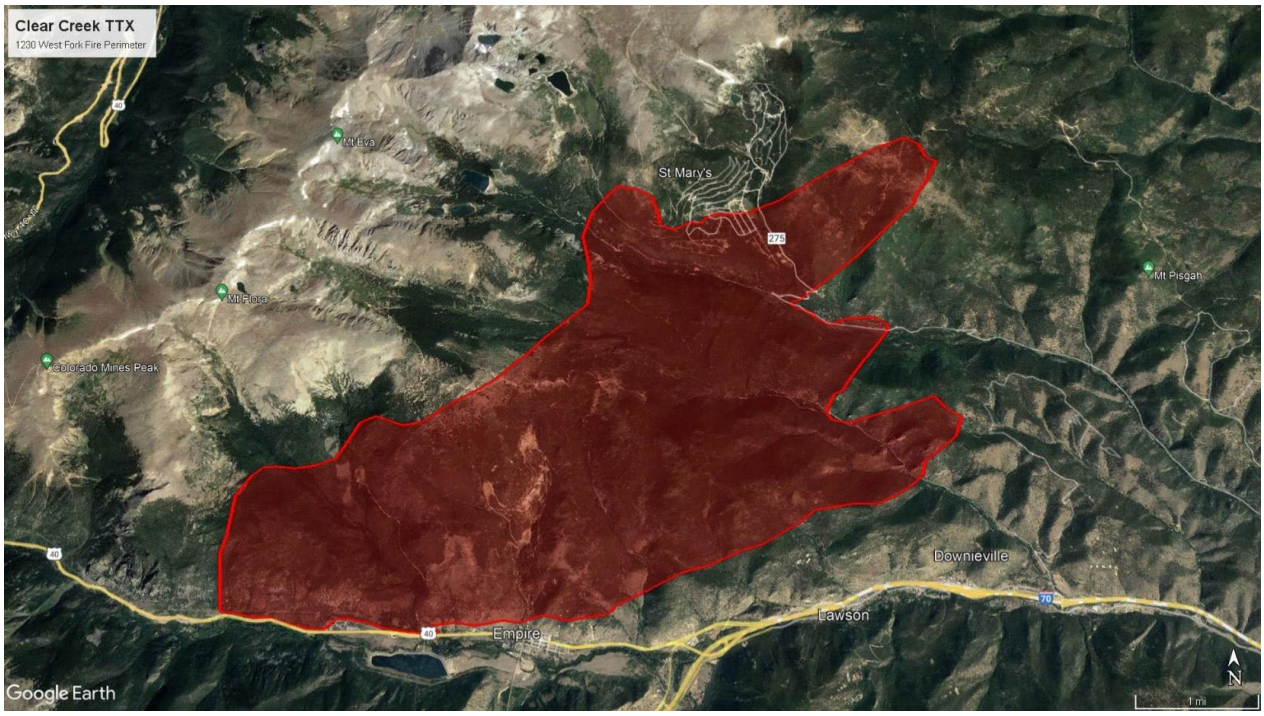
What is your direction to the crew? How would you remedy this situation?

Notes:

Several individuals have called and are requesting assistance with evacuating horses that someone let out along Fall River Road. They are concerned the horses will get run over, due to the low visibility with the smoke. What actions do you take?

Notes:

At 1230 the West Fork fire is estimated to be over 9,100 acres. Forward progress on the Soda Fire was stopped at 20 Acres.



With the current fire perimeter, what are your primary concerns? Are there any changes to how you are organizing? Any new partners that you are bringing together? What are your strategic thoughts?

Notes:

Are there at-needs populations that are a concern? Assume this is a weekday and parents are calling concerned about their kids at several of the schools. What's your plan for these locations that are threatened? Other Facilities?

Notes:

The fire perimeters are now impacting multiple points within several communities. You have just heard on the radio that a county road and bridge employee trying to clear a large tree along Mill Creek Road was hit with a large limb and appears to have a broken femur. At the same time, a deputy is flagged down a long Fall River Road by a woman and child, both are severely burned, requesting an ambulance. You only have one ambulance unit available; how do you resolve this issue? What are your options?

Notes:

The fire has taken down a primary communications site.
What if your communication towers go down? What if cell phones are taken out? What redundancies do you have in place to maintain communications?
Notes:

The frontal passage finally brings in some moisture and stops the fire spread, however, the fire has impacted a large portion of several community's infrastructure and homes.
At what point do you allow repopulation to occur? Who ultimately makes this decision? Who are the partners that need to be included? Who informs the public that their homes are lost? How do you handle your emergency services when many of your responders are personally affected?

Notes:

Are there, or should there be projects in your CWPP re-write that would help lessen the impacts of a similar fire here in Clear Creek County?

Notes:

END SCENARIO

Thank you for your time and participation. We hope you found utility in this tabletop and look forward to continuing to work with you, as your community works to be better prepared for a wildland fire.

Please take the time to fill out the attached evaluation form so we can continue improving our delivery of future tabletops.

Homeland Security Exercise Evaluation and Action Steps Clear Creek Wildfire Tabletop Exercise

Exercise Design and Conduct

1. What is your assessment of the exercise design and conduct? *Please rate, on a scale of 1 to 5, your overall assessment of the exercise relative to the statements provided below, with **1** indicating **strong disagreement** with the statement and **5** indicating **strong agreement.***

Rating of Satisfaction with

Exercise Assessment Factor	**Strongly Disagree**				**Strongly Agree**
a. The exercise was well structured and organized.	1	2	3	4	5
b. The exercise scenario was plausible and realistic.	1	2	3	4	5
c. The multimedia presentation helped the participants understand and become engaged in the scenario.	1	2	3	4	5
d. The facilitator(s) was knowledgeable about the material, kept the exercise on target, and was sensitive to group dynamics.	1	2	3	4	5
e. The story map used during the exercise was a valuable tool throughout the exercise.	1	2	3	4	5
f. Participation in the exercise was appropriate for someone in my position.	1	2	3	4	5
g. The participants included the right people in terms of level and mix of disciplines.	1	2	3	4	5
h. The exercise provided a good test of our knowledge/skills.	1	2	3	4	5

Column Totals:					
Grand Total:					

2. What changes would you make to improve this exercise?

Please provide any recommendations on how the exercise could be improved or enhanced to better prepare emergency responders to safely and effectively respond to these types of incidents.

_____

_____

_____

_____

3. Any closing thoughts to help improve future exercises?

_____

_____

_____