Coal Creek Canyon Fire Protection District Community Wildfire Protection Plan

August 15, 2008
Walsh Project Number: 7404-070

Walsh

Jefferson County Sheriff Emergency Management

Colorado State Forest Service

Fire Dept.

Walsh
Environmental Scientists and Engineers, LLC

COAL CREEK CANYON
FIRE PROTECTION DISTRICT
COMMUNITY WILDFIRE PROTECTION PLAN

August 15, 2008

Prepared for: Jefferson County Division of Emergency Management
800 Jefferson County Parkway
Golden, Colorado 80419
(303) 271-4900

Prepared by: _____
George Greenwood
Wildland Fire Specialist

Prepared by: _____
Geoff Butler
Wildland Fire Specialist

Reviewed by: _____
Rocco Snart
Fire Management Officer
Jefferson County Sheriff's Office

Submitted by:
WALSH ENVIRONMENTAL SCIENTISTS AND ENGINEERS, LLC
4888 Pearl East Circle, Suite 108
Boulder, Colorado 80301
(303) 443-3282

WALSH Project Number: 7404-070

Community Wildfire Protection Plan

Coal Creek Canyon Fire Protection District
Jefferson County, Boulder County, Gilpin County, Colorado

August 15, 2008

Introduction

This Community Wildfire Protection Plan was developed for the Coal Creek Canyon Fire Protection District with guidance and support from the Jefferson County Division of Emergency Management, the Colorado State Forest Service, and the Coal Creek Canyon Fire Protection District. The Community Wildfire Protection Plan was developed according to the guidelines set forth by the Healthy Forests Restoration Act (2003) and the Colorado State Forest Service's Minimum Standards for Community Wildfire Protection Plans (2004). This Community Wildfire Protection Plan supplements the Jefferson County Annual Operating Plan and the Jefferson County Fire Plan.

Wildfire Prevention and Fire Loss Mitigation

The Jefferson County Division of Emergency Management, the Jefferson County Fire Council, and the Coal Creek Canyon Fire Protection District support and promote Firewise activities as outlined in the Jefferson County Fire Plan.

Protection Capability

Initial response to all fire, medical, and associated emergencies within the Coal Creek Canyon Fire Protection District is the responsibility of the Coal Creek Canyon Fire Department. Wildland fire responsibilities of local fire departments, Jefferson County, the Colorado State Forest Service, U.S. Forest Service, Bureau of Land Management, and the U.S. Fish and Wildlife Service are described in the current Jefferson County Annual Operating Plan. All mutual aid agreements, training, equipment, and response are the responsibility of the local fire department and the agencies listed above.

The following agencies have reviewed and agree to this Community Wildfire Protection Plan.

USDA Forest Service, Arapaho/Roosevelt National Forest

Golden District, Colorado State Forest Service

Boulder District, Colorado State Forest Service

Jefferson County Division of Emergency Management

Coal Creek Canyon Fire Protection District

Table of Contents

1 INTRODUCTION 1

1.1 COMMUNITY WILDFIRE PROTECTION PLAN PURPOSE 1
1.2 NEED FOR A COMMUNITY WILDFIRE PROTECTION PLAN 2
1.3 THE CWPP PROCESS 3
1.4 POLICY FRAMEWORK 4
1.5 CCCFPD CWPP GOALS AND OBJECTIVES 5

2 WILDLAND FIRE MANAGEMENT PRIMER 7

2.1 WILDLAND FIRE BEHAVIOR 7
2.2 HISTORY OF WILDFIRE 8
2.3 PRESCRIBED FIRE 9
2.4 WILDLAND URBAN INTERFACE (WUI) 9
2.5 HAZARDOUS FUELS MITIGATION 10

3 COAL CREEK CANYON FIRE PROTECTION DISTRICT PROFILE 11

3.1 COUNTY AND DISTRICT SETTING 11
3.2 CLIMATE 11
3.3 TOPOGRAPHY 12
3.4 WILDLAND VEGETATION AND FUELS 12
3.5 FBFM CLASSIFICATIONS OF THE CCCFPD 15
3.6 WATER RESOURCES 22
3.7 FIRE PROTECTION DISTRICT 22
3.8 VALUES AT RISK 23

4 WILDFIRE RISK ASSESSMENT 25

4.1 APPROACH TO THE WILDFIRE RISK ASSESSMENT 25
4.2 FIRE BEHAVIOR ANALYSIS 26
4.3 WILDFIRE OCCURRENCE 28
4.4 JEFFERSON COUNTY FIRE DANGER RATING SYSTEM AND LOCAL WEATHER INFORMATION 30
4.5 WILDFIRE RISK TO COMMUNITIES 31

5 WILDFIRE MITIGATION PLAN 35

5.1 APPROACH TO MITIGATION PLANNING 35
5.2 RECOMMENDED ACTIONS 36
5.3 TREATMENT OPTIONS 48
5.4 PROJECT SUPPORT 49

6 EMERGENCY OPERATIONS 53

6.1 WILDFIRE RESPONSE CAPABILITY AND RECOMMENDATIONS 53
6.2 EMERGENCY PROCEDURES AND EVACUATION ROUTES 54

7 CCCFPD CWPP MONITORING AND EVALUATION 57

7.1 CWPP ADOPTION 57
7.2 SUSTAINING COMMUNITY WILDFIRE PROTECTION PLAN EFFORTS 58
7.3 COMMUNITY WILDFIRE PROTECTION PLAN OVERSIGHT, MONITORING, AND EVALUATION 58

8 BIBLIOGRAPHY 61

List of Figures

FIGURE 1. FBFM 1 16
FIGURE 2. FBFM 2 17
FIGURE 3. FBFM 6 18
FIGURE 4. FBFM 8 19
FIGURE 5. FBFM 9 20
FIGURE 6. FBFM 10 21
FIGURE 7. USFS FIRE DATA, BOULDER AND CLEAR CREEK RANGER DISTRICTS (1983 – 2007) 29
FIGURE 8. JEFFERSON COUNTY STRUCTURE TRIAGE TAG 39
FIGURE 9. DEFENSIBLE SPACE GUIDELINES AND STANDARDS (DENNIS 2006) 40
FIGURE 10. SHADED FUELBREAK 41

List of Tables

TABLE 1. CWPP DEVELOPMENT PROCESS 3
TABLE 2. CCCFPD CWPP CORE TEAM MEMBERS 4
TABLE 3. CCCFPD CWPP GOALS AND OBJECTIVES 5
TABLE 4. HAULING CHART INTERPRETATIONS 7
TABLE 5. AVERAGE MONTHLY CLIMATE SUMMARY FOR THE CCCFPD 12
TABLE 6. FUEL MODELS COMMON TO THE CCCFPD 13
TABLE 7. FIRE BEHAVIOR FUEL MODELS OF CCCFPD 22
TABLE 8. REMOTE ACCESS WEATHER STATIONS 27
TABLE 9. AVERAGE AND SEVERE CASE FIRE WEATHER CONDITIONS NEAR CCCFPD 27
TABLE 10. BEHAVEPLUS PREDICTIONS OF FIRE BEHAVIOR 28
TABLE 11. SIGNIFICANT LOCAL AND REGIONAL WILDFIRES 30
TABLE 12. COMMUNITY HAZARD RATING AND CONTRIBUTING FACTORS 31
TABLE 13. RECOMMENDED ACTIONS BY CATEGORY 36
TABLE 14. COMMUNITY-BASED DEFENSIBLE SPACE PROJECT SCHEDULE 40
TABLE 15. COMMUNITY MITIGATION RECOMMENDATION SUMMARY 45
TABLE 16. TREATMENT METHODS 49
TABLE 17. WILDLAND FIRE PRODUCTION RATES VS. FIRE GROWTH 54
TABLE 18. STRUCTURAL PROTECTION RATES 54
TABLE 19. MONITORING AND EVALUATION TASKS 59

List of Appendices

APPENDIX A PROJECT MAPS
APPENDIX B NFPA WILDLAND FIRE RISK AND HAZARD SEVERITY ASSESSMENT FORM 1144
APPENDIX C COMMUNITY/NEIGHBORHOOD/SUBDIVISION HAZARD AND RISK SURVEY SUMMARIES
APPENDIX D COAL CREEK CANYON FIRE PROTECTION DISTRICT QUESTIONNAIRE
APPENDIX E COAL CREEK CANYON FIRE PROTECTION DISTRICT QUESTIONNAIRE FEEDBACK SUMMARY
APPENDIX F FUELBREAK GUIDELINES FOR FORESTED SUBDIVISIONS AND COMMUNITIES
APPENDIX G CREATING WILDFIRE DEFENSIBLE ZONES
APPENDIX H PRESCRIBED PILE BURNING GUIDELINES
APPENDIX I GRASS SEED MIXES TO REDUCE WILDFIRE HAZARD
APPENDIX J WILDFIRE HISTORY
APPENDIX K WEB REFERENCE GLOSSARY
APPENDIX L LIST OF PREPARERS

List of Maps

(Appendix A)

MAP 1. ASSESSMENT AREA
MAP 2. WILDLAND URBAN INTERFACE (WUI) HAZARD RATINGS
MAP 3. PUBLIC LANDS
MAP 4. FIRE BEHAVIOR FUEL MODEL - LANDFIRE
MAP 5. MITIGATION RECOMMENDATIONS
MAP 6. AGENCY TREATMENTS

List of Acronyms and Abbreviations

AOP	Annual Operating Plan
BTU	British thermal unit
CAPCD	Colorado Air Pollution Control Division
CCCFD	Coal Creek Canyon Fire Department
CCCFPD	Coal Creek Canyon Fire Protection District
CDPHE	Colorado Department of Public Health and Environment
CRWB	Crew Bosses
CSFS	Colorado State Forest Service
CWPP	Community Wildfire Protection Plan
DIVS	Division Group Supervisor
DMP	Denver Mountain Parks
DOI	Department of the Interior
ENGB	Engine Bosses
ERC	Energy Release Component
F	Fahrenheit
FBFM	Fire Behavior Fuel Model
FEMA	Federal Emergency Management Agency
FPD	Fire Protection District
GIS	Geographic Information System
HFRA	Healthy Forests Restoration Act
HOA	Homeowners Association
ICT	Incident Command Team
ICT3	Incident Commander Type 3
IMT	Incident Management Team
ISO	Insurance Service Office
JFDRS	Jefferson County Fire Danger Rating System
mph	miles per hour
NEPA	National Environmental Policy Act
NFDRS	National Fire Danger Rating System
NFPA	National Fire Protection Association
NWCG	National Wildfire Coordinating Group
PPE	Personal Protective Equipment
PTB	Position Task Books
RAWS	Remote Automated Weather Stations
STPS	Structure Protection Specialist
TFLD	Taskforce Leaders
USFS	U.S. Forest Service
WALSH	Walsh Environmental Scientists and Engineers, LLC
WFU	Wildland Fire Use
WUI	Wildland-Urban Interface

List of Fire Behavior Terms

Aerial Fuels All live and dead vegetation in the forest canopy or above surface fuels, including tree branches, twigs and cones, snags, moss, and high brush.

Aspect Direction a slope faces.

Chain A unit of linear measurement equal to 66 feet.

Chimney A steep gully or canyon conducive to channeling strong convective currents, potentially resulting in dangerous increases in rates of fire spread and fireline intensity.

Crown Fire The movement of fire through the crowns of trees or shrubs more or less independently of the surface fire.

Dead Fuels Fuels with no living tissue in which moisture content is governed almost entirely by atmospheric moisture (relative humidity and precipitation), dry-bulb temperature, and solar radiation.

Defensible Space An area either natural or manmade where material capable of causing a fire to spread has been treated, cleared, reduced, or changed to act as a barrier between an advancing wildland fire and values at-risk, including human welfare. In practice, "defensible space" is defined as an area a minimum of 30 feet around a structure that is cleared of flammable brush or vegetation.

Direct Attack A method of fire suppression where actions are taken directly along the fire's edge. In a direct attack, burning fuel is treated directly, by wetting, smothering, or chemically quenching the fire or by physically separating burning from unburned fuel.

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

Fire Danger The broad-scale condition of fuels as influenced by environmental factors.

Fire Front The part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified the fire front is assumed to be the leading edge of the fire perimeter. In ground fires, the fire front may be mainly smoldering combustion.

Fire Hazard The presence of ignitable fuel coupled with the influences of terrain and weather.

Fire Intensity	A general term relating to the heat energy released by a fire.
Fire Regime	The characterization of fire's role in a particular ecosystem, usually characteristic of particular vegetation and climatic regime, and typically a combination of fire return interval and fire intensity (i.e., high frequency low intensity/low frequency high intensity).
Fire Weather	Weather conditions that influence fire ignition, behavior, and suppression.
Flame Length	The distance from the base to the tip of the flaming front. Flame length is directly correlated with fire intensity.
Flaming Front	The zone of a moving fire where combustion is primarily flaming. Behind this flaming zone combustion is primarily glowing. Light fuels typically have a shallow flaming front, whereas heavy fuels have a deeper front.
Forest Improvement District	A special district created pursuant to Article 18 of the Colorado State Revised Statutes that protects communities from wildfires and improves the condition of forests in the District.
Fuel Loading	The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area.
Fuel Model	Simulated fuel complex (or combination of vegetation types) for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified.
Fuel Type	An identifiable association of fuel elements of a distinctive plant species, form, size, arrangement, or other characteristics that will cause a predictable rate of fire spread or difficulty of control under specified weather conditions.
Fuel	Combustible material that includes vegetation such as grass, leaves, ground litter, plants, shrubs, and trees that feed a fire. Not all vegetation is necessarily considered fuel. Deciduous vegetation such as aspen actually serve more as a barrier to fire spread and many shrubs are only available as fuels when they are drought-stressed.
Ground Fire	Fire that consumes the organic material beneath the surface litter ground, such as a peat fire.
Ground Fuel	All combustible materials below the surface litter, including duff, tree or shrub roots, punchy wood, peat, and sawdust that normally support a glowing combustion without flame.

Indirect Attack	A method of fire suppression where actions are taken some distance from the active edge of the fire due to intensity, terrain, or other factors that make direct attack difficult or undesirable.
Intensity	The level of heat radiated from the active flaming front of a fire, measured in British thermal units (BTUs) per foot.
Ladder Fuels	Fuels that provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. Ladder fuels help initiate and ensure the continuation of crowning.
Live Fuels	Living plants, such as trees, grasses, and shrubs, in which the seasonal moisture content cycle is controlled largely by internal physiological mechanisms, rather than by external weather influences.
National Fire Danger Rating System (NFDRS)	A uniform fire danger rating system that focuses on the environmental factors that control the moisture content of fuels.
One-Hour Timelag Fuels	(a.k.a. one-hour fuels) Fuels consisting of dead herbaceous plants and roundwood less than about ¼ inch (6.4 mm) in diameter. Also included is the uppermost layer of needles or leaves on the forest floor.
One-Hundred -Hour Timelag Fuels	(a.k.a. hundred-hour fuels) Dead fuels consisting of roundwood in the size range of 1 to 3 inches (2.5 to 7.6 cm) in diameter and very roughly the layer of litter extending from approximately ¾ of an inch (1.9 cm) to 4 inches (10 cm) below the surface.
One-Thousand -Hour Timelag Fuels	(a.k.a. thousand-hour fuels) Dead fuels consisting of roundwood 3 to 8 inches in diameter and the layer of the forest floor more than about 4 inches below the surface.
Prescribed Fire	Any fire ignited by management actions under certain predetermined conditions to meet specific objectives related to hazardous fuels or habitat improvement. A written, approved prescribed fire plan must exist, and National Environmental Policy Act (NEPA) requirements must be met prior to ignition.
Rate of Spread	The relative activity of a fire in extending its horizontal dimensions. It is expressed as a rate of increase of the total perimeter of the fire, rate of forward spread of the fire front, or rate of increase in area, depending on the intended use of the information. Usually it is expressed in chains or acres per hour for a specific period in the fire's history.

	Sometimes it is expressed as feet per minute; one chain per hour is equal to 1.1 feet per minute.
Risk	The probability that a fire will start from natural- or human-caused ignition.
Surface Fire	Fire that burns loose debris on the surface, which includes dead branches, leaves, and low vegetation.
Surface Fuels	Loose surface litter on the soil surface, normally consisting of fallen leaves or needles, twigs, bark, cones, and small branches that have not yet decayed enough to lose their identity; also grasses, forbs, low and medium shrubs, tree seedlings, heavier branchwood, downed logs, and stumps interspersed with or partially replacing the litter.
Ten-Hour Timelag Fuels	(a.k.a. ten-hour fuels) Dead fuels consisting of roundwood ¼ to l inch (0.6 to 2.5 cm) in diameter and, very roughly, the layer of litter extending from immediately below the surface to ¾ inch (1.9 cm) below the surface.
Topography	Referred to as "terrain." The term also refers to parameters of the "lay of the land" that influence fire behavior and spread. Key elements are slope (in percent), aspect (the direction a slope faces), elevation, and specific terrain features such as canyons, saddles, "chimneys," and chutes.
Torching	(a.k.a. passive crown fire) The burning of the foliage of a single tree or a small group of trees, from the bottom up.
Wildfire	An unplanned and unwanted wildland fire that is not meeting management objectives and thus requires a suppression response.
Wildland Fire	Any fire burning in wildland fuels, including prescribed fire, fire use, and wildfire.
Wildland Fire Use	The management of naturally ignited wildland fires to accomplish specific pre-stated resource management objectives in pre-defined geographic areas outlined in fire management plans.

Source: NWCG 1996

EXECUTIVE SUMMARY

The Community Wildfire Protection Plan (CWPP) is a strategic plan that identifies specific wildland fire hazard and risks facing communities and neighborhoods, and provides prioritized mitigation recommendations that are designed to reduce those hazards and risks. Once the CWPP is finalized and adopted, it is the responsibility of the community or neighborhood to move forward and implement the action items. This may require further planning at the project level, acquisition of funds, or simply motivating individual homeowners. It should be emphasized that the CWPP is a living document to be revisited on a regular basis and revised as needed.

This CWPP is not a legal document. There is no legal requirement to implement the recommendations herein. However, treatments on private land may require compliance with county land use codes, building codes, local covenants, and treatments on public lands will be carried out by appropriate agencies and may be subject to federal, state, and county policies and procedures such as adherence to the Healthy Forests Restoration Act (HFRA) and National Environmental Policy Act (NEPA).

The HFRA of 2003 provides the impetus for local communities to engage in comprehensive forest and wildfire management planning as well as incentive for public land management agencies to consider these recommendations as they develop their own strategic management plans. The HFRA provides communities with a flexible set of assessment procedures and guidelines that facilitate a collaborative standardized approach to identify wildfire risks and prioritize mitigation actions. The CWPP addresses such factors as:

- Stakeholder collaboration;
- Public agency and local interested party engagement;
- Mapping;
- Risk assessment – fuels, historical ignitions, infrastructure, structural ignitability, local resources, and firefighting capability;
- Hazard reduction recommendations; and
- Strategic action plans.

This CWPP provides wildfire hazard and risk assessments and mitigation recommendations for select neighborhoods and subdivisions within the Coal Creek Canyon Fire Protection District (CCCFPD), situated between 5,900 and 9,400 feet elevation in the Front Range foothills between Boulder and Golden, Colorado. The geography and vegetation within the district is extremely diverse with high plains and prairie grasses in the eastern portion and steep rugged topography with dense forest dominating the central and western portions. Of the 224 miles of roadway within the district, 85 percent are unpaved and a portion of these require 4-wheel drive. A major railway bisects the district through rugged and remote forested terrain. The district is home to over 7,000 residents as well as a significant number of daily tourist and

recreational visitors to the area's parks and open space lands. With a significant residential population, a high potential for ignition, a heavy fuel load, and challenging access, the CCCFPD typifies the high wildfire risk of the Front Range wildland-urban interface (WUI).

A WUI is defined as the area where development encroaches on undeveloped natural areas and represents the zone of greatest potential for loss resulting from wildfire. For the purposes of accurate CWPP community assessment surveys, the CCCFPD has been subdivided into a number of individual WUIs, each with common predominant construction, access, topography, and fuel type characteristics.

Natural resource management policies and changing ecological conditions have converged to create hazardous fuel situations throughout the assessment area. Decades of aggressive fire suppression practices have resulted in very dense and weakened timber stands. Years of drought have further stressed the forests, setting the stage for the devastating insect and disease infestations the area is experiencing today. Shrubs have expanded into traditional grasslands, resulting in accumulating hazardous amounts of woody surface fuel. The diversity of native grasses has succumbed to aggressive non-native plant species and noxious weeds. In many areas these fire-dependent ecosystems have grown unchecked by fire for more than a century. The collective result is a pronounced increase in the potential for catastrophic wildfire.

Field surveys, interviews with public lands managers, and close collaboration with the CCCFPD and other stakeholders were utilized for data collection, hazard identification, and treatment recommendations. All information was gathered, analyzed, and prepared in the CWPP format by Walsh Environmental Scientists and Engineers, LLC (WALSH) and Alpenfire, LLC. A project website (http://jeffco.us/sheriff/sheriff_T62_R191.htm) is maintained by Jefferson County Division of Emergency Management and provides access to CWPP reports for public review, project updates, meeting notices, and related project information.

The success of any CWPP hinges on community involvement. Although an important component during the drafting of the report, this type of involvement is especially critical when it comes to implementing recommended actions. Public meetings were convened to educate residents about the CWPP process, project goals and objectives, assessment methodology, and wildfire mitigation techniques. These meetings also provided an opportunity for the public to share concerns and ideas regarding wildfire with the Core Team and consultants, which were incorporated into the CWPP process.

Questionnaires were distributed to district residents by the CCCFPD in order to ascertain public opinion concerning the level of wildfire risk, evaluate values at risk, and assess mitigation practices needed to reduce risk. Colorado State Forest Service (CSFS) safety pamphlets and brochures explaining fire resistant home construction and landscaping practices designed to reduce the risk of wildfire were also made available. CWPP documentation is posted on Jefferson County's Emergency Management website to encourage public review and comment.

The National Fire Protection Association (NFPA) Form 1144, Standards for Protection of Life and Property from Wildfire, 2002 Edition, was utilized to assess the level of risk and hazard to individual neighborhoods. Form 1144 provides a means to assess predominant characteristics within individual neighborhood communities as they relate to structural ignitability, fuels, topography, expected fire behavior, emergency response, and ultimately human safety and welfare. Scores are assigned to each element and totaled to determine the overall level of risk. Low, moderate, high, and extreme hazard categories are determined based on the total score. This methodology provides a standardized basis for wildfire hazard assessment and a baseline for future comparative surveys. Fourteen subdivisions and neighborhoods were identified as areas of concern and were surveyed according to NFPA Form 1144 protocols during November, 2007 and May, 2008. A summary of the community hazard ratings is provided in Table ES-1.

Table ES-1. Community Hazard Rating Summary

NEIGHBORHOOD/ SUBDIVISION	HAZARD RATING
Burke	EXTREME
Wondervu	
Nadm	HIGH
Chute Road	
Lyttle Dowdle	
Camp Eden	
Coal Creek Heights	
Stanton	
Crescent Park	
Copperdale	
Miramonte	
Vonnie Claire	
Hilltop	MODERATE
Blue Mountain	

In addition to the larger-scale treatments recommended in this report, the most effective wildfire hazard reduction depends largely on the efforts of individual landowners making common sense modifications to their own homes and property. The creation of effective defensible space and the utilization of fire-resistant construction materials significantly reduce the risk of life and property loss in the event of a wildfire. The entire community benefits when these common-sense practices become the predominant model in a neighborhood.

Continued coordination with the Jefferson County Annual Operating Plan (AOP) is also recommended. This provides important information concerning county and regional fire

operations, policies, and procedure definitions. Information is available through the Jefferson County Department of Emergency Management website.

The CCCFPD CWPP is a strategic planning document, developed with and approved by the Core Team. An important component of the development process includes building a stakeholder group that will move the plan forward, implement prioritized recommendations, and maintain the CWPP as the characteristics of the WUI change over time. Organizing and maintaining this team is often the most challenging component of the CWPP process. It is, however, essential in the process of converting the CWPP from a strategic plan into action. This team will oversee the implementation and maintenance of the CWPP by working with fire authorities, community organizations, private landowners, and public agencies to coordinate and implement hazardous fuels treatment projects management and other mitigation projects. Building partnerships among neighborhood-based organizations, fire protection authorities, local governments, public land management agencies, and private landowners is necessary in identifying and prioritizing measures to reduce wildfire risk. Maintaining this cooperation is a long-term effort that requires the commitment of all partners involved. The CWPP encourages citizens to take an active role in identifying needs, developing strategies, and implementing solutions to address wildfire risk by assisting with the development of local neighborhood wildfire plans and participating in local fire prevention activities.

COAL CREEK CANYON FIRE PROTECTION DISTRICT COMMUNITY WILDFIRE PROTECTION PLAN

1 INTRODUCTION

1.1 Community Wildfire Protection Plan Purpose

The Community Wildfire Protection Plan (CWPP) is a strategic plan that identifies specific wildland fire hazards and risks facing communities and neighborhoods and provides prioritized mitigation recommendations that are designed to reduce those hazards and risks. Once the CWPP is adopted, it is the community's responsibility to move forward and implement the action items. This may require further planning at the project level, enhanced cooperation with other agencies, acquisition of funds, or simply motivating individual homeowners.

Decades of aggressive fire suppression practices in fire-adapted ecosystems have removed a critical natural cleansing mechanism from the vegetation regeneration cycle. Fire exclusion has altered historic forest and shrubland conditions and contributed to an unprecedented buildup of naturally occurring flammable woody fuels. Such management tactics have also led to an alteration of prairie habitats, supporting the invasion of aggressive and highly flammable noxious weeds and grasses that, in many areas, have entirely replaced naturally occurring species. In addition, years of persistent drought have resulted in weakened timber and regional epidemics of disease and insect infestation. At the same time, demographic trends have shifted the nation's population growth centers to western and southwestern states where these ecosystems are predominant. The region where human development is pushing into these stressed ecosystems is known as the wildland-urban interface (WUI) and represents the area where risk of loss due to wildfire is the greatest. The potential consequences are devastating and costly, and in recent years have drawn the attention of the U.S. Congress in the pursuit of an effective solution.

Precipitated by over a decade of increasing wildfire activity, related losses, and spiraling suppression costs, the National Fire Plan was developed by the federal government in 2000. The Healthy Forests Restoration Act (HFRA) of 2003 helps implement the core components of the plan and provides the impetus for wildfire risk assessment and planning at the county and community level. The HFRA refers to this level of planning as the CWPP process. This empowers the participating community to take advantage of wildland fire and hazardous fuel management opportunities offered under HFRA legislation. The CWPP includes a framework for hazard evaluation and strategic planning, prioritized access to federal grants supporting hazard reduction projects, and a basis for collaboration with local, state, and federal land management agencies.

1.2 Need for a Community Wildfire Protection Plan

This CWPP provides wildfire hazard and risk assessments and mitigation recommendations for select neighborhoods and subdivisions within the Coal Creek Canyon Fire Protection District (CCCFPD), situated between 5,900 and 9,400 feet elevation in the Front Range foothills between Boulder and Golden, Colorado. The geography and vegetation within the district is extremely diverse with high plains and prairie grasses in the eastern portion and steep rugged topography with dense forest dominating the central and western portions. Of the 224 miles of roadway within the district, 85 percent are unpaved and a portion of these require 4-wheel drive. A major railway bisects the district through rugged and remote forested terrain. The district is home to over 7,000 residents as well as a significant number of daily tourist and recreational visitors to the area's parks and open space lands. With a significant residential population, a high potential for ignition, a heavy fuel load, and challenging access, the CCCFPD typifies the high wildfire risk of the Front Range WUI.

Historically, natural wildfire would pass through these same areas these with relative frequency allowing forests, shrublands, and grasslands to adapt morphology, growth and reproductive patterns to a periodic cleansing by fire. Land management policies centered on fire suppression have altered this cycle and exacerbated the potential for high-intensity wildfire by allowing fuels to build up and facilitating the decline of forest health.

Weather plays a critical role in determining fire frequency and behavior. A dry climate and available fuels in an area prone to strong gusty winds can turn an ignition from a discarded cigarette, vehicle parked over dry grass, sparking brakes from a train, or lightning from a passing thunderstorm into a major wildfire in a matter of several minutes.

The combination of environmental esthetics, recreational opportunities, and proximity to a major metropolitan area make the CCCFPD a desirable location to live and work. However, the district is characterized by several factors that typify a hazardous WUI: development into fire-adapted ecosystems, steep topography, frequent natural and human-caused ignitions, hazardous fuels, prolonged drought, and dry, windy weather conditions. Each identified WUI neighborhood or subdivision represents a distinct area with a unique combination of wildfire fuels, predominant building construction materials, topography, access, available resources, as well as opportunities for fuels mitigation.

The CWPP provides a coordinated assessment of neighborhood wildfire risks and hazards and outlines specific mitigation treatment recommendations designed to make the CCCFPD a safer place to live, work, and play. The CWPP development process can be a significant educational tool for people who are interested in improving the environment in and around their homes. It provides ideas, recommendations, and guidelines for creating a defensible space around the house and ways to reduce structural ignitability through home improvement and maintenance.

1.3 The CWPP Process

The HFRA designed the CWPP to incorporate a flexible process that can accommodate a wide variety of community needs. This CWPP is tailored to meet specific goals as identified by the Core Team, following the standardized steps for developing a CWPP as outlined in "Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities" (Society of American Foresters 2004) and the Colorado State Forest Service Minimum Standards for Community Wildfire Protection Plans (CSFS 2004). Table 1 presents the CWPP development process.

Table 1. CWPP Development Process

Step	Task	Explanation
One	Convene Decision Makers	Form a Core Team made up of representatives from local governments, fire authorities, and the Colorado State Forest Service (CSFS).
Two	Involve Federal Agencies	Engage local representatives of the U.S. Forest Service (USFS) and other land management agencies as appropriate.
Three	Engage Interested Parties	Contact and encourage participation from a broad range of interested organizations and stakeholders.
Four	Establish a Community Base Map	Develop a base map of the District that provides a better understanding of communities, critical infrastructure, and forest/open space at risk.
Five	Develop a Community Risk Assessment	Develop a risk assessment that considers fuel hazards, community and commercial infrastructure, resources, and preparedness capability. Rate the level of risk and incorporate into the base map as appropriate.
Six	Establish Community Priorities and Recommendations	Use the risk assessment and base map to facilitate a collaborative public discussion that prioritizes fuel treatments and non-fuel mitigation practices to reduce fire risk and structural ignitability.
Seven	Develop an Action Plan and Assessment Strategy	Develop a detailed implementation strategy and a monitoring plan that will ensure long-term success.
Eight	Finalize the CWPP	Finalize the District CWPP and communicate the results to interested parties and stakeholders.

The initial step in developing the CCCFPD CWPP is to organize an operating group that serves as the core decision-making team (Table 2). At a minimum, the Core Team consists of representatives from local government, local fire authorities, and the CSFS. In addition, the Core Team should include relevant affected land management agencies and active community and homeowners association (HOA) stakeholders. Collaboration among agencies and with communities is an important CWPP component because it promotes sharing of perspectives, plans, priorities, and other information that is useful to

the planning process. Together these entities guide the development of the CWPP as described in the HFRA and must mutually agree on the plan's final contents.

Table 2. CCCFPD CWPP Core Team Members

Team Member	Organization	Phone Number
Dudley Butler	Coal Creek Canyon Fire Department	303-642-7273
Rocco Snart	Jefferson County Division of Emergency Management	303-271-4900
Allen Gallamore	Colorado State Forest Service	303-279-9757 x 302

As a strategic plan, the real success of any CWPP hinges on effective and long-term implementation of the identified objectives. The CWPP planning and development process should promote efforts to build a stakeholder group that serves as an implementation team and will oversee the execution of prioritized recommendations and maintain the plan as the characteristics of the WUI change over time. Specific projects may be undertaken by individual HOAs, while larger-scale treatments may require collaboration between multiple HOAs, local government, and public land management agencies. Original CWPP Core Team representatives may, but are not required to, assist in the implementation of the CWPP action plan. Continued public meetings are recommended as a means to generate additional support and maintain momentum.

A comprehensive CWPP utilizes relevant geographic information (e.g., Geographic Information System [GIS] data) to develop a community base map. Detailed risk assessment is conducted at the neighborhood or community level to determine relative levels of wildfire risk to better address hazard treatment prioritization. A standardized survey methodology is utilized to create an address-based rating benchmark for comparative future assessments and project evaluations.

CWPP fuel treatment recommendations derived from this analysis are prioritized through an open and collaborative effort with the Core Team and stakeholders. Prioritized treatment recommendations target wildfire hazard reduction in the identified WUI neighborhoods through structural and defensible space improvements, strategic hazardous fuel reduction, ingress/egress upgrades, and enhancements to emergency response capability. An action plan guides treatment implementation for recommended projects over the span of several years.

The finalized CWPP represents a strategic plan with Core Team consensus that provides prioritized wildfire hazard reduction treatment projects, preferred treatment methods, a base map of the WUI, defensible space recommendations, and other information relevant to the scope of the project.

1.4 Policy Framework

This CWPP is not a legal document. There is no legal requirement to implement the recommendations herein. Actions on public lands will be subject to federal, state, and county policies and procedures, such as adherence to the HFRA and National

Environmental Policy Act (NEPA). Action on private land may require compliance with county land use codes, building codes, and local covenants.

There are several federal legislative acts that set policy and provide guidance to the development of the CWPP for the CCCFPD:

- HFRA (2003) – Federal legislation that promotes healthy forest and open space management, hazardous fuels reduction on federal land, community wildfire protection planning, and biomass energy production;
- National Fire Plan and 10-Year Comprehensive Strategy (2001) – Interagency plan that focuses on firefighting coordination, firefighter safety, post-fire rehabilitation, hazardous fuels reduction, community assistance, and accountability; and
- Federal Emergency Management Agency (FEMA) Disaster Mitigation Act (2000) – Provides criteria for state and local multiple-hazard and mitigation planning.

The CSFS is a valuable resource that provides education and guidance to communities and individual landowners concerned with the threat of wildfire, as well as forest resource management in the WUI. The Coal Creek Canyon Fire Department (CCCFD) is another excellent resource for wildfire mitigation guidance within CCCFPD.

The Jefferson County Annual Operating Plan (AOP) outlines all management aspects of wildland fire within the county that includes reimbursement, operational responsibilities, financial responsibilities, and other general areas of interface between the organizations and agencies responsible for wildland fire response.

1.5 CCCFPD CWPP Goals and Objectives

Table 3 provides a brief summary of the primary goals and objectives for the CCCFPD CWPP process.

Table 3. CCCFPD CWPP Goals and Objectives

Goal	Objective
Facilitate and develop a CWPP	▪ Provide oversight for all activities related to the CWPP. ▪ Ensure representation and coordination among agencies and interest groups. ▪ Develop a long-term framework for sustaining CWPP efforts.
Conduct a wildfire risk assessment	▪ Conduct a district-wide wildfire risk assessment. ▪ Identify areas at risk and contributing factors. ▪ Determine the level of risk to structures that wildfires and contributing factors pose.
Develop a mitigation plan	▪ Identify and prioritize hazardous fuel treatment projects. ▪ Identify and prioritize non-fuel mitigation needs. ▪ Identify communities at highest risk and prioritize hazard reduction treatments. ▪ Recommend sustainable initiatives at the HOA level.
Facilitate emergency planning	▪ Develop strategies to strengthen emergency management, response, and evacuation capabilities for wildfire. ▪ Build relationships among county government, fire authorities, and communities.

Goal	Objective
Facilitate public outreach	▪ Develop strategies to increase citizen awareness and action for Firewise practices. ▪ Promote public outreach and cooperation for all fuel reduction projects to solicit community involvement and private landowner cooperation.

2 WILDLAND FIRE MANAGEMENT PRIMER

Wildland fire is defined as any fire burning in wildland fuels and includes prescribed fire, wildland fire use (WFU), and wildfire. Prescribed fires are planned fires ignited by land managers to accomplish specific natural resource improvement objectives. Fires that occur from natural causes, such as lightning, that are then used to achieve management purposes under carefully controlled conditions with minimal suppression costs are known as WFU. Wildfires are unwanted and unplanned fires that result from natural ignition, unauthorized human-caused fire, escaped WFU, or escaped prescribed fire. The CCCFD actively suppresses all wildfire ignitions within the district.

Wildland fires may be further classified as ground, surface, or crown fires. Ground fire refers to burning/smoldering materials beneath the surface including duff, tree or shrub roots, punchy wood, peat, and sawdust that normally support a glowing combustion without flame. Surface fire refers to loose fuels burning on the surface of the ground such as leaves, needles, and small branches, as well as grasses, forbs, low and medium shrubs, tree seedlings, fallen branches, downed timber, and slash. Crown fire is a wildland fire that moves rapidly through the crowns of trees or shrubs.

2.1 Wildland Fire Behavior

Fire behavior is the manner in which a fire reacts to the influences of fuel, weather, and topography. Fire behavior is typically modeled at the flaming front of the fire and described most simply in terms of fireline intensity (flame length) and in rate of forward spread. The implications of observed or expected fire behavior are important components of suppression strategies and tactics, particularly in terms of the difficulty of control and effectiveness of various suppression resources. The Hauling Chart (Table 4) is an excellent tool for measuring the safety and potential effectiveness of various fireline resources given a visual assessment of active flame length. It is so named because it infers the relative intensity of the fire behavior to trigger points where hauling various resources to or away from an incident should be considered.

Table 4. Hauling Chart Interpretations

Flame Length (Feet)	Fireline Intensity (BTU/Ft/Sec)	Interpretation
0-4	0-100	Persons using handtools can generally attack fires at the head or flanks. Handline should hold the fire.
4-8	100-500	Fires are too intense for direct attack on the head by persons using handtools. Handline can not be relied on to hold fire. Equipment such as dozers, engines, and retardant aircraft can be effective.
8-11	500-1,000	Fires may present serious control problems such as torching, crowning, and spotting. Control efforts at the head of the fire will probably be ineffective.
11+	1,000+	Crowning, spotting, and major runs are common, control efforts at the head of the fire are ineffective.

Source: Fireline Handbook 2007

Fire risk is the probability that wildfire will start from natural or human-caused ignitions. Fire hazard is the presence of ignitable fuel coupled with the influences of topography and weather, and is directly related to fire behavior. Fire severity, on the other hand, refers to the immediate effect a fire has on vegetation and soils.

The characteristics of fuels, topography, and weather conditions combine to dictate fire behavior, rate of spread, and intensity. Wildland fuel attributes refer to both dead and live vegetation and include such factors as density, bed depth, continuity, vertical arrangement, and moisture content. Structures with flammable materials are also considered a fuel source.

When fire burns in the forest understory or through grass, it is generally a surface fire. When fire burns through the canopy of vegetation, or overstory, it is considered a crown fire. The vegetation that spans the gap between the forest floor and tree crowns can allow a surface fire to become a crown fire and is referred to as ladder fuel.

For fire to spread, materials such as trees, shrubs, or structures in the flame front must meet the conditions of ignitability. The conditions needed are the presence of oxygen, flammable fuel, and heat. Oxygen and heat are implicitly available in a wildland fire. However, if the potential fuel does not meet the conditions of combustion, it will not ignite. This explains why some trees, vegetation patches, or structures may survive a wildland fire and others in the near vicinity are completely burned.

Potential surface fire behavior may be estimated by classifying vegetation in terms of fire behavior fuel models (FBFMs) and using established mathematical models to predict potential fire behavior under specific climatic conditions. In this analysis, FBFMs were determined through a combination of field evaluations and interpretation of satellite imagery. Climatic conditions were derived from local weather station records.

Weather conditions such as high ambient temperatures, low relative humidity, and windy conditions favor fire ignition and high-intensity fire behavior. Under no-wind conditions fire burns more rapidly and intensely upslope than on level terrain; however, wind tends to be the driving force in fire behavior in the most destructive WUI fires. The “chinook” winds common along the Front Range can rapidly drive wildfire downslope.

2.2 History of Wildfire

Lightning-induced fire is a historic component of Jefferson County ecosystems, and its occurrence is important to maintaining the health of forest and grassland ecosystems. Native Americans used fire as a tool for hunting, improving wildlife habitat, and land clearing. As such, many of the plant species and communities have adapted to recurring fire through phenological, physiological, or anatomical attributes.

European settlers, land use policy, and changing ecosystems have altered fire behavior and fuels accumulation from their historic setting. Euro-American settlers in Jefferson County changed the historic fire regime in several interrelated ways. The nature of vegetation (fuel) changed because of land use practices such as homesteading, livestock grazing, agriculture, water development, and road construction. Livestock grazing reduced the amount of fine fuels such as grasses and forbs, which carried low-intensity

fire across the landscape. Continuous stretches of forest and grassland fuels were broken up by land-clearing activities. The removal of the natural vegetation facilitated the invasion of non-indigenous grasses and forbs, some of which create more flammable fuel beds than their native predecessors.

In addition, more than a century of fire-suppression policy has resulted in large accumulations of surface and canopy fuels in western forests and brushlands. Fuel loads also increased as forests and brushlands encroached into grasslands as a result of fire exclusion. This increase in fuel loading and continuity has created hazardous situations for public safety and fire management, especially when found in proximity to communities. These hazardous conditions will require an array of mitigative tools, including prescribed fire and thinning treatments.

2.3 Prescribed Fire

Prescribed fire may be used as a resource management tool under carefully controlled conditions. This includes pre-treatment of the fuel load and close monitoring of weather and other factors. Prescribed fire ultimately improves wildlife habitat, helps abate invasive vegetation, reduces excess fuel loads, and lowers the risk of future wildfires in the treatment area. These and other fuel management techniques are employed to protect human life, economic values, and ecological values. The use of prescribed fire in the WUI is carefully planned and enacted only under favorable weather conditions, and must meet air quality requirements of the Colorado Department of Public Health and Environment (CDPHE) Air Pollution Control Division (CAPCD). Open burning permits are obtained from Jefferson County Environmental Health Services (www.co.jefferson.co.us/health/health_T111_R38.htm).

Prescribed fire may be conducted either in a defined area, as a broadcast burn, or in localized burn piles. Broadcast burns are used to mimic naturally occurring wildfire but only under specific weather conditions, fuel loads, and expert supervision. Burn piles are utilized to dispose of excess woody material after thinning if other means of disposal are not available or cost-prohibitive.

2.4 Wildland Urban Interface (WUI)

The WUI is the zone where communities and wildland fuel interface and is the central focus of this CWPP. Every fire season catastrophic losses from wildfire plague the WUI. Homes are lost, businesses are destroyed, community infrastructure is damaged, and, most tragically, lives are lost. Precautionary action taken before a wildfire strikes often makes the difference between saving and losing a home. Creating a defensible space around a home is an important component in wildfire hazard reduction. Providing an effective defensible space can be as basic as pruning trees, applying low-flammability landscaping, and cleaning up surface fuels and other fire hazards near a home. These efforts are typically concentrated within 75 feet of a home to increase the chance for structure survival or create an area for firefighters to work in the event of a wildfire (see Section 5.2).

While reducing hazardous fuels around a structure is very important to prevent fire loss, recent studies indicate that, to a great extent, the attributes of the structure itself determine ignitability. Experiments suggest that even the intense radiant heat of a crown fire is unlikely to ignite a structure that is more than 30 feet away as long as there is no direct flame impingement (Cohen and Saveland 1997). Studies of home survivability indicate that homes with noncombustible roofs and a minimum of 30 feet of defensible space had an 85-percent survival rate. Conversely, homes with wood shake roofs and less than 30 feet of defensible space had a 15-percent survival rate (Foote 1996).

2.5 Hazardous Fuels Mitigation

Wildfire behavior and severity are dictated by fuel type, weather conditions, and topography. Because fuel is the only variable of these three that can be practically managed, it is the focus of many mitigation efforts. The objectives of fuels management may include reducing surface fire intensity, reducing the likelihood of crown fire initiation, reducing the likelihood of crown fire propagation, and improving forest health. These objectives may be accomplished by reducing surface fuels, limbing branches to raise canopy base height, thinning trees to decrease crown density, and/or retaining larger fire-resistant trees.

By breaking up vertical and horizontal fuel continuity in a strategic manner, fire suppression resources are afforded better opportunities to control fire rate of spread and contain wildfires before they become catastrophic. In addition to the creation of defensible space, fuelbreaks may be utilized to this end. These are strategically located areas where fuels have been reduced in a prescribed manner, often along roads. Fuelbreaks may be strategically placed with other fuelbreaks or with larger-area treatments. When defensible space, fuelbreaks, and area treatments are coordinated, a community and the adjacent natural resources are afforded an enhanced level of protection from wildfire.

Improperly implemented fuel treatments can have negative impacts in terms of forest health and fire behavior. Aggressively thinning forest stands in wind-prone areas may result in subsequent wind damage to the remaining trees. Thinning can also increase the amount of surface fuels and sun and wind exposure on the forest floor. This may increase surface fire intensity if post-treatment debris disposal and monitoring are not properly conducted. The overall benefits of properly constructed fuelbreaks are, however, well documented.

3 COAL CREEK CANYON FIRE PROTECTION DISTRICT PROFILE

3.1 County and District Setting

Jefferson County was established in 1861 as one of the original 17 counties created by the Colorado Territorial Legislature with a land base of 774 square miles. The county population is currently estimated at 529,401 people with approximately 184,640 people living in the incorporated areas.

Coal Creek Canyon is located in the northwest corner of Jefferson County. Originally a route providing access to mines, the area was first homesteaded in the 1870s. The population grew slowly during the late nineteenth and early twentieth centuries. During the 1950's Colorado Highway 72 was paved, and the population grew more rapidly with the opening of the Rocky Flats facility.

This area is served by the Coal Creek Fire Protection District (CCCFPD) which covers approximately 45 square miles (29,000 acres) with a population of approximately 7,000 residents. The district extends from approximately 5,900 feet at its eastern end along Colorado Highway 93 to just over 9,400 feet on Miramonte Mountain at its western end. While the majority of the district lies within Jefferson County, it also covers the Gross Reservoir area of southern Boulder County and a thin band of Gilpin County's northeast corner (Appendix A, Map 1).

The district is characterized by a steep-sided canyon ascending to rolling forested terrain with canyons to the north and southwest. The vegetation consists of ponderosa pine stands with grass understory or litter understory intermixed with meadows. A mix of ponderosa pine and Douglas-fir can be found north and west facing slopes. A network of predominantly unpaved roads extends off of Colorado Highway 72 which extends up the center of the canyon. There are a wide variety home sizes and styles throughout the canyon.

In addition to spanning across the jurisdiction of three counties, the CCCFPD includes or is adjacent to lands of several agencies. Gross Reservoir and Denver Water Board lands occupy the northern end of the district. Eldorado Canyon and Golden Gate State Parks border the district to the north and the southwest respectively. USFS, Jefferson County Open Space, and Boulder County Open Space lands are also located within and adjacent to the district.

3.2 Climate

The Coal Creek Canyon climate is relatively dry with the majority of precipitation occurring with spring rains and summer monsoons (Table 5). Observations were taken from the Gross Reservoir weather station, located on the northern end of the district at approximately 7,300 feet. The area receives more than 220 days of sunshine per year and an average of 21.30 inches of annual precipitation. Winter high temperatures are typically in the mid 40s (degree Fahrenheit [F]) and summer highs are in the 70s and low

80s. The low precipitation months are typically December, January, and February. Lower elevations within the district may experience warmer and drier conditions. Fire weather conditions are discussed in Section 4.2.

Table 5. Average Monthly Climate Summary for the CCCFPD (1978-2005, Gross Reservior, CO)

Climate Attribute	Month												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average maximum temperature (^{o} F)	43	40	48	52	63	72	81	75	72	59	48	42	58
Average total precipitation (inches)	0.69	0.79	2.31	2.77	3.14	2.26	2.06	2.30	1.71	1.26	1.23	0.80	21.30

Source: High Plains Regional Climate Center (http://hprcc.unl.edu)

3.3 Topography

Topography and elevation play an important role in dictating existing vegetation, fuels, and wildland fire behavior. Topography also often dictates community infrastructure design, further influencing overall hazard and risk factors. The terrain of the Coal Creek Canyon is characterized by a steep-sided canyon ascending westward to rolling forested terrain where the majority of structures are located. This area is surrounded by canyons, south Boulder Creek to the north, Black Gulch to the west, and Beaver Creek to the south. Many homes are exposed to slopes exceeding 45%.

3.4 Wildland Vegetation and Fuels

The vegetation found in the district is typical of the Rocky Mountain Montane ecosystem which occurs between 5,600 and 9,500 feet. Vegetation type and distribution in this zone is controlled primarily by available soil moisture, which is closely related to elevation and slope aspect. Lower elevations in the CCCFPD are characterized by the alluvial outwash plain associated with historic erosional events out of Coal Creek Canyon. This low sloping high plain is dominated by high prairie grasses. Grass and shrubs are found interspersed with open stands of ponderosa pine on lower elevation slopes, as well as south facing slopes at higher elevations.

North-facing slopes of the Montane ecosystem retain more soil moisture and support denser stands of conifer that are less drought resistant. Typically these slopes support a mixture of Douglas-fir and ponderosa pine in lower elevations and lodgepole pine at higher elevations. Willows, mountain alder, water birch, and other water-loving trees may be found in riparian zones along creeks and streams. Blue spruce and Engelmann spruce may also be found in areas of higher moisture.

Existing vegetation is the primary fuel source for wildland fire and has a direct effect on fire behavior. Accurately mapping vegetative ground cover is a critical component of fuel modeling and fire behavior modeling. Understanding the fire behavior characteristics of particular fuel types facilitates effective fuels treatment strategies on a

local, as well as landscape, level. Map 4 (Appendix A) illustrates existing ground cover vegetation represented as FBFMs, based on LANDFIRE, the Landscape Fire and Resource Management Planning Tools Project, with data derived from Landsat multi-spectral satellite imagery. Satellite classification is also field-surveyed, ground-truthed, and photo-documented to verify results and further classify the characteristics of the understory surface fuels, a critical component in determining the FBFMs that are used in modeling potential fire behavior.

Predictive fire modeling is an important component in a variety of strategic and tactical applications including risk and hazard assessments, pre-attack planning, initial attack, extended suppression, prescribed fire planning, and predictive modeling of active wildfires.

BehavePlus Fire Behavior Prediction and Fuel Modeling software was utilized for this assessment. By inputting several user-defined parameters including FBFM, fuel moisture, weather, and slope, fire behavior parameters such as expected rates of spread, associated flame lengths, and fire intensity can be modeled. These are important factors in any tactical or strategic fire management decision. Fire behavior analysis is detailed in Section 4.2.

There are several systems for classifying fuel models. This CWPP 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. Of these 13 fuel models, FBFMs 1, 2, 6, 8, 9, and 10 are the most prevalent in the CCCFPD assessment area (Table 6).

Table 6. Fuel Models Common to the CCCFPD
(Fuel models most prevalent in CCCFPD are shaded)

Group	FBFM Number	Description
Grasslands	1	Short grass (1 foot)
	2	Grass with timber/brush overstory
	3	Tall grass (2.5 feet)
Shrublands	4	Mature brush 6 feet)
	5	Young brush
	6	Intermediate or dormant brush
	7	Southern rough
Timber Litter and Understory	8	Closed or short-needle timber litter – light fuel load
	9	Hardwood or long-needle or timber litter
	10	Mature/overstory timber and understory
Logging Slash	11	Light slash; closed timber with down woody fuel
	12	Medium slash (35 tons/acre)
	13	Heavy slash (200 tons/acre)

Source: Anderson 1982

Grasslands, FBFMs 1 and 2

Grass fuels are most common on south-facing slopes and the high plains in the area of Rocky Flats. Grass is found to be intermixed with shrub on some protected north-facing slopes in lower to moderate elevations. Even in areas where Ponderosa pine is prevalent, the surface fuels are often comprised of grasses. The short and mid-height grass species common to this area include blue grama, western wheatgrass, needle-and-thread, and prairie Junegrass. These western perennial grasses are adapted to the relatively frequent disturbance of fire and benefit from fast moving, "cool" fire because it removes excessive 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 shrub increases surface fuel loads, increasing the probability of high-intensity surface fires.

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 that is now common throughout the region. Cheatgrass provides forage for livestock but matures and dries out much earlier than native grasses. Due to this early dry-out it can exhibit higher fire intensity than native grasses. Because of its competitive ability, it often becomes the dominant species in overgrazed areas.

Although shrub and timber fires are better known for intense fire behavior, the potential impact of grass fires should not be underestimated. Fire burning in 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 very 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, though when well irrigated these fuels may be unavailable to combustion. A grassy understory of ponderosa pine mixed with other herbaceous fuels that would carry a surface fire is defined as FBFM 2.

Shrublands, FBFM 6

Shrubs and shrub stands may be found throughout the district but are most common on protected slopes of the lower and mid-elevation zones and in areas where shaded understory is established. Mountain mahogany is the dominant shrub species in the area and is generally represented by FBFM 6, "intermediate brush". Where shrub stands are less dense, mountain mahogany grows with a grass understory and is best represented by FBFM 2. Riparian zones along creek beds and slope drainages can support other shrub species such as scrub willow, chokecherry, and alder. Areas where conifer is aggressively regenerating may also be classified as shrublands based primarily on density and height of the growth.

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

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

Forest composition in the district is strongly influenced by elevation and slope aspect, which are directly related to the available soil moisture. Ponderosa pine favor drier south-facing aspects while Douglas-fir, lodgepole pine, and Engelmann spruce favor moister and cooler north-facing aspects. Lodgepole pine is more common in elevations above 8,000 feet but species will commonly mix on transitional slope aspects. In some areas fire exclusion has allowed Douglas-fir, an aggressive species, to become disproportionately dominant. 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; FBFM 9 is characterized by the long needles of ponderosa pine; and FBFM 10 is associated with forest floors that are thick with naturally occurring downed timber in a mature or over-mature stand.

This district is characterized by ponderosa pine in timber stands and woodlands with southern exposure and a mix of denser ponderosa pine and Douglas-fir on northern aspects. Ponderosa pine stands are best represented by FBFM 2 or FBFM 9 depending on presence of grass or needle litter as the surface fuel. The mixed stands are best represented by FBFM 8. A concern in timber stands throughout the district is the encroachment of unchecked conifer regeneration.

3.5 FBFM Classifications of the CCCFPD

This section details the predominant FBFMs observed in the CCCFPD, including their unique characteristics and expected fire behavior. Local photos of fuels are displayed with a narrative for each fuel model as described by Anderson (1982). This section can be used independently as a field reference.

FBFM 1 – Short Grass

Figure 1. FBFM 1

Characteristics: Grassland and savanna vegetation are dominant (Figure 1). 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, 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.

Fuel Model Values for Estimating Fire Behavior

Total Fuel Load, less than 3-inch dead and live	0.74 ton/acre
Dead Fuel Load, 0 to ¼ inch	0.74 ton/acre
Live Fuel Load, foliage	0.0 ton/acre
Fuel Bed Depth	1.0 foot

FBFM 2 – Grass with Timber/Shrub Overstory

Figure 2. FBFM 2

Characteristics: FBFM 2 defines surface fuels found in open conifer, shrub, or riparian stands (Figure 2). 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 the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, in addition to litter and dead-down stem wood from the open shrub or timber overstory, contribute to the fire intensity.

Fuel Model Values for Estimating Fire Behavior

Total Fuel Load, less than 3-inch dead and live	4.0 tons/acre
Dead Fuel Load, 0 to ¼ inch	2.0 tons/acre
Live Fuel Load, foliage	0.5 ton/acre
Fuel Bed Depth	1.0 foot

FBFM 6 – Intermediate or Dormant Brush

Figure 3. FBFM 6

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 oakbrush, mountain mahogany, and juniper shrublands (Figure 3).

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 miles per hour [mph] at midflame height). Fire will drop to the ground at low wind speeds or break in continuous stands.

Fuel Model Values for Estimating Fire Behavior

Total Fuel Load, less than 3-inch dead and live	6.0 tons/acre
Dead Fuel Load, 0 to ¼ inch	1.5 tons/acre
Live Fuel Load, foliage	0.0 ton/acre
Fuel Bed Depth	2.5 feet

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

Figure 4. FBFM 8

Characteristics: Closed canopy stands of short-needle conifers, hardwoods, and aspen that have leafed out support fire in the compact litter layer (Figure 4). This layer is mainly needles, leaves, and twigs because little undergrowth is present in the stand. Representative conifer types are lodgepole pine, blue spruce, Engelmann spruce and Douglas-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 (jackpot) that can cause a flare-up. 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.

Fuel Model Values for Estimating Fire Behavior

Total Fuel Load, less than 3-inch dead and live	5.0 tons/acre
Dead Fuel Load, 0 to ¼ inch	1.5 tons/acre
Live Fuel Load, foliage	0.0 ton/acre
Fuel Bed Depth	0.2 foot

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

Figure 5. FBFM 9

Characteristics: Closed stands of long-needle pine such as ponderosa pine are characterized by FBFM 9 (Figure 5

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.

Fuel Model Values for Estimating Fire Behavior

Total Fuel Load, less than 3-inch dead and live	3.5 tons/acre
Dead Fuel Load, 0 to ¼ inch	2.9 tons/acre
Live Fuel Load, foliage	0.0 ton/acre
Fuel Bed Depth	0.2 foot

FBFM 10 – Mature/Over Mature Timber and Understory

Figure 6. FBFM 10

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 (Figure 6). 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 with greater intensity 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.

Fuel Model Values for Estimating Fire Behavior

Total Fuel Load, less than 3-inch dead and live	12.0 tons/acre
Dead Fuel Load, 0 to ¼ inch	3.0 tons/acre
Live Fuel Load, foliage	2.0 tons/acre
Fuel Bed Depth	1.0 foot

FBFMs present in the district are summarized in Table 7.

Table 7. Fire Behavior Fuel Models of CCCFPD

FBFM	Description
1 Short Grass	**Grass Group** – Fire spread is determined by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. These are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one-third cover of the area. Annual and perennial grasses occur in this model. Fire rate of spread can exceed 3.5 miles per hour (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 where downed woody debris from the shrub and tree component adds to fire intensity. Open shrublands, pine stands, or oakbrush stands that cover from one- to two-thirds of the area generally fit this model.
6 Intermediate or Dormant Brush	**Shrub Group** – Fire spreads though 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 oakbrush and mountain mahogany less than 6 feet tall. 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. These are mixed conifer stands with little undergrowth. Fire rate of spread is up to 106 feet per hour with flame lengths of 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 is mainly needles and occasional twigs. Concentrations of dead-down woody material contribute to tree torching, spotting, and crowning. 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 surface timber litter is 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)

3.6 Water Resources

The fire district is supplied by static water sources such as ponds, reservoirs and cisterns. Four reservoirs are dispersed throughout the district and have been identified as potential helicopter dip sites. Five large cisterns are also located throughout the district and four others are planned for the western portion of the district. The eastern portion of the district has over two-million gallons of water storage planned in association with several new developments.

3.7 Fire Protection District

The CCCFPD is served by a volunteer fire department. The department has 40 active members who provide emergency fire, medical, hazardous materials and rescue services, and 20 members of a wildland team who respond only to local wildland fires. In addition

to the district's Fire Chief and Assistant Chief/Wildland Coordinator, the CCCFD maintains four battalion chiefs who oversee operations for each of the district's four stations. Current inventory includes five structural engines, two water tankers, three rescue trucks, one ambulance, two brush trucks, one wildland van, one utility vehicle, one zodiac boat (stationed at Gross Reservoir), one ATV, and one command vehicle.

3.8 Values at Risk

In any hazard and risk assessment, human life and welfare are the most important resources to protect. Homes, businesses, and the resident's desire to preserve and maintain the forested characteristics of the community are all important factors and certainly influence any recommendation; however, the safety and welfare of residents and emergency responders remains the top priority. The WUI has inherent risks including residential and commercial development in areas historically prone to fire, hazardous fuels, and limited access. The CCCFPD is characterized by mixed density residential development within a forested environment intermixed with large tracts of unmanaged and/or inaccessible timber.

Common values at risk for the district include:

- Homes
- Businesses
- Local economy
- Municipal water supply
- Community infrastructure
- Wildlife habitat
- Recreation
- Watershed health
- Water quality
- Air quality
- Forest health
- View shed
- Historic structures
- Tourism

4 WILDFIRE RISK ASSESSMENT

4.1 Approach to the Wildfire Risk Assessment

A comprehensive wildfire risk assessment takes into account a variety of critical factors that reflect predominant WUI characteristics and provide a strong basis for determining a relative hazard and risk level for a given neighborhood. This assessment surveys wildfire hazards and risk, as defined in Section 2, as well as and values-at-risk, which includes infrastructure, structures, improvements, and natural resources that are likely to suffer long-term damage from the direct impacts of a wildfire. Further, WUI hazard rankings provide quantifiable guidance in the determination of mitigation treatment project prioritization.

To better understand the nature and scope of the wildfire hazard that face the CCCFPD, a full spectrum of factors that influence potential fire behavior are evaluated including vegetation and fuels, topography, weather, and historical fire frequency. Community infrastructure is evaluated in terms of emergency response, defensibility, and structural flammability. Analyzing the relationship between expected fire behavior in the wildlands and the placement and design of neighborhoods and subdivisions proximate to those areas is at the core of an effective community wildfire risk assessment. This analysis guides targeted mitigation efforts that can greatly reduce the risk of loss from a wildfire for each homeowner as well as the community as a whole.

The primary assessment area for this CWPP is defined by the boundaries of the CCCFPD. Fourteen individual WUI's within the CCCFPD were identified as areas of critical concern and surveyed in detail using a standardized, nationally recognized methodology.

Vegetation and FBFMs were mapped 1 mile into surrounding regions utilizing LANDFIRE data which was ground verified and photo documented. LANDFIRE, the Landscape Fire and Resource Management Planning Tools Project, is an interagency vegetation, fire, and fuel characteristics mapping project. It is a shared project between the Department of the Interior (DOI) and Forest Service wildland fire management programs and is sponsored by the Wildland Fire Leadership Council. LANDFIRE is actively producing a comprehensive, consistent, scientifically credible suite of spatial data layers for the entire United States and has recently completed areas in central Colorado, including Jefferson County.

As part of the assessment, a concerted effort was made to solicit and include input from the public and local experts in fire and natural resource issues. Community meetings were held to explain the CWPP process and intent, present the findings and recommendations of the CWPP investigations to the public, and solicit input for the final CWPP.

Questionnaires were distributed at the meetings and through direct mailings in a further effort to measure public perception of risk and values-at-risk and to assess public tolerance for various mitigation practices. Appendix E provides a summary of the questionnaire responses.

Project information including maps and reports are posted and available on the Jefferson County Division of Emergency Management web site; http://www.jeffco.us/sheriff/sheriff_T62_R193.htm

4.2 Fire Behavior Analysis

Fire behavior is defined as the manner in which a fire reacts to the influences of fuel, weather, and topography. Two key measures of this behavior are the rate of spread and the intensity. Rate of spread is often expressed in chains per hour. A chain is 66 feet, and one chain per hour closely approximates a spread rate of 1.1 feet per minute. Fireline intensity is represented by flame length at the flaming front although it does not account for continued burning of fuels once the main fire front has passed.

BehavePlus was used to assess potential fire behavior given the identified FBFMs, local topography, and local weather conditions. The predicted fire behavior represents surface fire behavior only. Fire moving through the forest canopy (crowning) and other types of extreme fire behavior are not represented in this analysis.

Topography

Topography and elevation indirectly affect fire behavior through influencing sunlight, predominant vegetation, and the movement of wind. Because heat, and therefore fire, rises, topography also has a very direct influence on fire behavior.

The elevation of the CCCFPD ranges from 5,900 and 9,400 feet elevation along Colorado Highway 72 and is characterized by rolling mountainous terrain amidst steep sided valleys. Homes are concentrated in the higher terrain of the district's central western portion. While this area is more open and less steep than the rest of the district, it is exposed steep canyons on each side. Coal Creek Canyon approaches from the east, Beaver Creek is to the south, Black Gulch is to the west, and South Boulder Creek is to the north of this eight square mile area. The slopes rising from these valleys range from 25% to over 45%.

Fire Weather

Average and severe case weather and fuel moisture conditions were determined using records from two local remote access weather stations (RAWS). The Sugar Loaf RAWS is located in Boulder County at 6758 feet, approximately seven miles north of Coal Creek Canyon. The Pickle Gulch station is located at 9380 feet in Gilpin County, five miles beyond the western edge of the CCCFPD. These two stations capture weather data representative of the lower and upper elevations of the fire district. Sugar Loaf data was analyzed for 1983 through 2007, while Pickle Gulch data was analyzed to its establishment in 1995 (Table 8).

Table 8. Remote Access Weather Stations

Station	Elevation (feet)	Location Relative to Coal Creek Canyon	Years of Data
Sugar Loaf	6,758	7 miles north	1983-2007
Pickle Gulch	9,380	5 miles west	1995-2007

Percentile weather refers to historic occurrences of specified conditions. For example, 90th percentile conditions means that within the weather data examined from the RAWS stations, only 10 percent of the days had more extreme conditions. Fiftieth percentile is approximately average with half the records exceeding recorded conditions and half the records below recorded conditions. Weather was calculated for the typical summer fire season of May through September (Table 9) as defined by local fire occurrence. Mid-flame wind speeds of 8 and 4 mph were used for the modeling of 90th and 50th percentile conditions respectively.

Table 9. Average and Severe Case Fire Weather and Fuel Moisture Conditions for May - August near CCCFPD

Raws Station	Percentile	Max Temp	Relative Humidity	1-Hour Fuel Moisture	10-Hour Fuel Moisture	100-Hour Fuel Moisture	Herbaceous Fuel Moisture	Woody Fuel Moisture
Sugar Loaf 1983-2007	50th	79ºF	25%	6%	7%	10%	46%	108%
	90th	91ºF	11%	3%	4%	6%	29%	74%
Pickle Gulch 1995-2007	50th	71ºF	23%	6%	7%	11%	44%	92%
	90th	80ºF	11%	3%	4%	7%	29%	69%

Additional important fire and weather related resources include:

- Fort Collins Interagency Wildfire Dispatch Center Web index for Fire Intelligence, Fire Weather, Fire Danger/Severity, RAWS – http://www.fs.fed.us/r2/arnf/fire/fire.html
- RAWS index for the Rocky Mountain Geographic Coordinating Area – http://raws.wrh.noaa.gov/cgi-bin/roman/raws_ca_monitor.cgi?state=RMCC&rawsflag=2
- National Fire Weather Page – http://fire.boi.noaa.gov/

Potential Fire Behavior

Two key measures of fire behavior are the rate of spread and the intensity. Rate of spread is expressed in this analysis as chains per hour. Fireline intensity is reflected by flame length at the flaming front.

Fire behavior simulations were conducted for average (50th percentile) and severe (90th percentile) conditions for the critical months of the fire season, May through September (Table 10). The fuel moisture inputs were determined using an average of the two RAWS. Slope steepness was set to 20 percent.

BehavePlus software was used to generally illustrate the potential surface fire behavior given the prevailing fuel types, local topography, and local weather conditions. While any number of variables and assumptions will affect the modeled outputs, there are several significant general principles to focus on:

- Fire Activity (or intensity/rates of spread) increases under 90th percentile conditions (drier fuels, windier conditions) as compared to 50th percentile conditions. These differences are most pronounced in brush and grass fuels.
- This increase in fire activity is approximately two times for flame length and three to four times for rate of spread.
- Fire behavior for most fuel types under 90th percentile conditions exceeds the 4-foot flame lengths generally considered appropriate for direct line construction with hand crews.
- If FBFM 9 converts into the denser FBFM 10, the increases in fireline intensity and flame length are pronounced and conducive to the initiation of crown fire.

Table 10. BehavePlus Predictions of Fire Behavior on 20 Percent Slope for Average and Severe Climatic Conditions

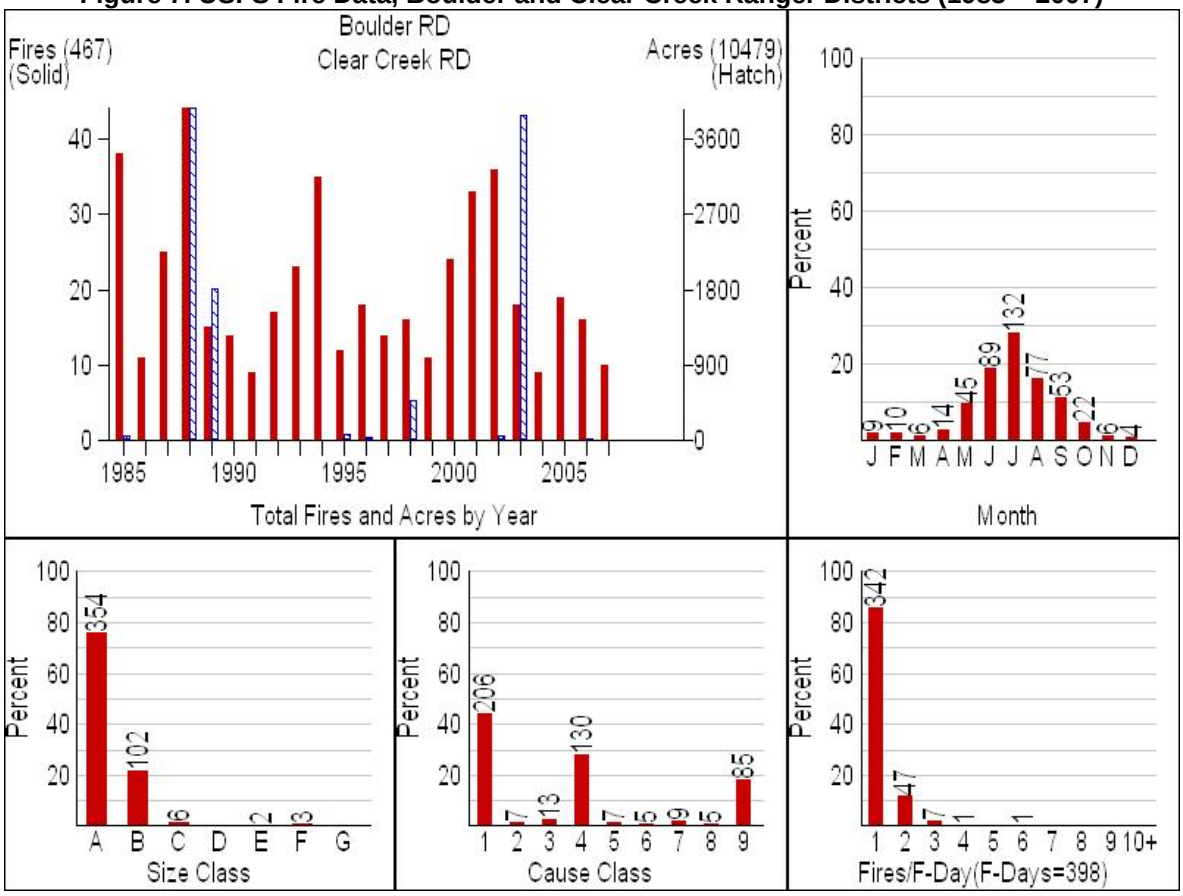
FBFM	Flame Length (feet) Average Conditions[a]	Rate of Spread (chains/hr)[c] Average Conditions	Flame Length, (feet) Severe Conditions[b]	Rate of Spread (chains/hr)[c] Severe Conditions
1 Short Grass	5	101	9	316
2 Grass with Timber/Shrub Overstory	7	46	13	133
6 Intermediate or Dormant Brush	6	36	10	86
8 Closed or Short-needle Timber Litter – Light Fuel Load	1	2	2	5
9 Hardwood or Long-Needle or Timber Litter – Moderate Ground Fuel	3	9	5	26
10 Mature/Overstory Timber and Understory	5	9	9	24

a. Average conditions based on 50th percentile weather and 4 mph midflame windspeed
b. Severe conditions based on 90th percentile weather and 8 mph midflame windspeed
c. Approximately one foot/minute as 1 chain = 66 feet

4.3 Wildfire Occurrence

The vegetation in the assessment area is diverse and typical for the Colorado Front Range. A mix of grass, shrub, and a variety of timber species are found throughout the CCCFPD. All of these vegetation types represent ecosystems that are fire-adapted to some degree. Fire regimes in the area include low, mixed, and high severity with fire return intervals ranging from less than 30 years to over 200 years.

Figure 7. USFS Fire Data, Boulder and Clear Creek Ranger Districts (1983 – 2007)



Fire size class: A<1/4 acre, B= 1/4 to 9 acre, C= 10 to 99 acre, D= 100 to 299 acre, E= 300 to 999 acre, F= 1,000 to 4,999 acre, G> 5,000 acre
Fire cause class: 1=lightning, 2= equipment, 3= smoking, 4= campfire, 5= debris burning, 6= railroad, 7= arson, 8= juveniles, 9= misc
Source: US Forest Service: http://famweb.nwcg.gov/kcfast.

Detailed fire records for CCCFPD were not available, but fire data for the adjoining USFS Clear Creek and Boulder district were analyzed (Figure 7). The typical fire season for CCCFPD is defined as May through September when eighty-five percent of the fires occur, although large fires are now becoming more common throughout the entire year. Forty-four percent of fires on these districts are caused by lightning while escaped campfires account for twenty-eight percent. Despite the large percentage of lightning

caused fires, the largest fires in the area over the last thirty years were human caused. Significant local fires are displayed in Table 11 and a comprehensive regional wildfire history is located in Appendix J.

Table 11. Significant Local and Regional Wildfires

Fire	Month/Year	Approximate Acres Burned	Fire Protection District
Centennial Cone	Jul 2006	22	Golden Gate, Jeffco OS
Ralston Creek	Jun 2006	26	Jeffco, Fairmount, Golden Gate
Rocky Flats	Apr 2006	1,200	4 Counties, multiple FPDs
Plainview	Jan 2006	2,700	Coal Creek
North Table Mountain	Jul 2005	300	Fairmount
Walker Ranch	Sep 2000	1,100	Cherrvale, Coal Creek, BOCO
Blue Mountain	Aug 2002	35	Coal Creek
Hayman	Jun 2002	138,000	4 Counties, multiple FPDs
Schoonover	May 2002	3,000	North Fork, USFS
Snaking	Apr 2002	3,000	Platte Canyon, USFS
Hi Meadow	Jun 2000	10,800	Platte Canyon, /Elk Creek, North Fork
Lininger Mountain	Feb 1999	35	Genesee/Foothills
Buffalo Creek	May 1996	10,400	North Fork, USFS
Elk Creek	May 1991	201	Golden Gate
Mount Falcon	Apr 1989	125	Indian Hills
Coal Creek	Sep 1988	Multiple fires 50 acres	Multiple, along train tracks

Source: Gallamore, 2007 (See Appendix J for a comprehensive wildfire history of the CSFS, Golden District)

4.4 Jefferson County Fire Danger Rating System and Local Weather Information

The Jefferson County Fire Danger Rating System (JFDRS) is based on the National Fire Danger Rating System (NFDRS) implemented in 1978. The JFDRS uses both RAWS and independent weather stations that are monitored with the data available from the Internet. Jefferson County limits the fire danger rating to NFDRS fuel models C (Pine-Grass Savanna) and G (Short-Needle [Heavy Dead]). The RAWS supply all necessary data used for fire danger rating; however, the independent stations require manual inputs to calculate fire danger such as state of the weather and calculation of 1-hour fuel moisture. After the weather data are collected the fire danger is calculated with an NFDRS calculator provided in the Fire Family Plus software. The energy release component (ERC) is then compared to the rating chart developed for Jefferson County, and an adjective fire danger value (extreme, very high, high, moderate, or low) is assigned. The Evergreen Communications Center emails completed forms for the RAWS and independent weather stations to the Jefferson County Sheriff, CSFS, and local fire agencies for distribution. The completed form with various components of the NFDRS is used for responders and an adjective fire danger for the public.

4.5 Wildfire Risk to Communities

CCCFPD assessment and neighborhood hazard and risk surveys were initiated in November, 2007 and completed in May, 2008. Detailed and collaborative analysis of the assessment area resulted in the identification of fourteen individual WUI communities within the assessment area. Each WUI represents a unique response area with identifiable predominant characteristics, resources, and hazards and risks. Based on these criteria, a single WUI may span multiple neighborhoods, or a single neighborhood or HOA may be subdivided in multiple WUIs. Homes, structures, or infrastructure sites not located within a designated WUI are typically best served through individual home and property hazard and risk assessments that are available through the county, CSFS, and the local fire department.

A standardized survey process defined by the National Fire Protection Association (NFPA) was utilized to assess the relative level of wildfire risk and hazard for each neighborhood. Appendix B contains an example of the NFPA Form 1144, *Standard for Protection of Life and Property from Wildfire*. Surveys assess predominant characteristics within individual communities and subdivisions as they relate to structural ignitability, fuels, topography, expected fire behavior, emergency response, and ultimately human safety and welfare. Scores are assigned to each element and then totaled to determine the community's relative level of risk. Low, moderate, high, and extreme hazard ratings may be assigned based on the total community score (Table 12). Detailed observations and survey results are provided in Appendix C.

Table 12. Community Hazard Rating and Contributing Factors

HAZARD RATING	WUI	1144 SURVEY SCORE	CONTRIBUTING FACTORS
EXTREME	Burke	112	▪ Single ingress/egress ▪ Steep terrain ▪ Inaccessibility of Fischer Rd. ▪ Emergency water supply ▪ Density of structures and proximity to slope ▪ Flammability of structures ▪ Defensible space ▪ Above ground utilities
	Wondervu	112	▪ Density of structures ▪ Community accessibility for emergency apparatus ▪ Home addressing and street signage ▪ Emergency water supply ▪ Flammability of structures ▪ Defensible space ▪ Above ground utilities

HAZARD RATING	WUI	1144 SURVEY SCORE	CONTRIBUTING FACTORS
HIGH	Nadm	109	▪ Single ingress/egress ▪ Timber stand density throughout subdivision ▪ Flammability of structures ▪ Defensible space ▪ Topography, road grade, and proximity of structures to slope ▪ Emergency water supply ▪ Above ground utilities
	Chute Road	107	▪ Dual ingress/egress subdivision but most homes located on single ingress/egress secondary road. ▪ Topography and steep slope ▪ Road grade ▪ Chimney access for emergency apparatus ▪ Timber stand density ▪ Flammability of structures ▪ Proximity to railroad ignition source ▪ Above ground utilities
	Lyttle Dowdle	104	▪ Single ingress/egress ▪ Topographic chimney and steep slopes ▪ Road grade ▪ Proximity of homes to slope ▪ Defensible space ▪ Flammability of structures ▪ Timber stand density throughout subdivision ▪ Emergency water supply ▪ Above ground utilities
	Camp Eden	96	▪ Housing density ▪ Timber stand density throughout subdivision ▪ Road infrastructure and accessablity ▪ Topography ▪ Road grade ▪ Defensible space ▪ Flammability of structures ▪ Emergency water supply ▪ Proximity to emergency resources ▪ Above ground utilities
	Coal Creek Heights	96	▪ Steep terrain and proximity of homes to slope ▪ Defensible space ▪ Road grade, tight switchbacks and accessibility ▪ Single ingress/egress for many residents ▪ Flammability of structures ▪ Timber stand density ▪ Emergency water supply ▪ Above ground utilities

HAZARD RATING	WUI	1144 SURVEY SCORE	CONTRIBUTING FACTORS
	Stanton	91	▪ Timber stand density throughout subdivision with areas of dead and down timber ▪ Dual ingress/egress but limited evacuation access ▪ Static emergency water supply. ▪ Flammability of structures ▪ Signage and confusing road network ▪ Above ground utilities
	Crescent Park	85	▪ Single ingess/egress for most homes in the upper portion of subdivision ▪ Topography; ridge top and chimney housing development ▪ Road grade ▪ Proximity to extensive steep and dense timber stand adjacent and upslope from railroad ignition source ▪ Structure density ▪ Flammability of structures ▪ Above ground utilities ▪ Static emergency water supply ▪ Above ground utilities
	Copperdale	82	▪ Structure density ▪ Topography and proximity of structures to slope ▪ Road grade ▪ Timber density ▪ Defensible space ▪ Flammability of structures ▪ Emergency water supply ▪ Above ground utilities
	Miramonte	81	▪ Topography; steep north facing slope ▪ Accessibility; forested approach over 1 mile, private gated ▪ Road grade ▪ Proximity to railroad ignition source ▪ Timber stand density throughout the area ▪ Condition of secondary evacuation route ▪ Flammability of structures ▪ Emergency water supply ▪ Above ground utilities
	Vonnie Claire	80	▪ Flammability of structures ▪ Timber stand density along subdivision margins ▪ Topography ▪ Road grade ▪ Emergency water supply ▪ Above ground utilities

HAZARD RATING	WUI	1144 SURVEY SCORE	CONTRIBUTING FACTORS
MODERATE	Hilltop	68	▪ Flammability of structures ▪ Emergency water supply ▪ Topography and emergency accessibility for the southwest portion ▪ Aging street signage ▪ Above ground utilities
	Blue Mountain	64	▪ Primary access single ingress/egress ▪ Gated secondary emergency access ▪ Static emergency water source ▪ Above ground utilities ▪ Some homes on ridge and steep east facing slope

Note: In addition to the listed factors, rating scores are also influenced by the region's high fire occurrence and potential for severe fire weather.

These comprehensive community assessments provide the basis for effective identification, prioritization, and implementation of specific mitigation and hazard reduction recommendations.

5 WILDFIRE MITIGATION PLAN

5.1 Approach to Mitigation Planning

Wildfire mitigation can be defined as those actions taken to reduce the likelihood of loss due to wildfire. Effective wildfire mitigation can be accomplished through a variety of methods including reducing hazardous fuels, managing vegetation, creating defensible space around individual homes and subdivisions, utilizing fire-resistant building materials, enhancing emergency preparedness and response capabilities, upgrading current infrastructure, and developing programs that foster community awareness and neighborhood activism. Once implemented, these actions will significantly reduce the risk of loss due to wildfire for an individual home, and on a larger implementation scale, for an entire community

The entire Front Range of Colorado is at significant risk of wildfire. Large scale wildfires are an annual occurrence in this region. The CCCFPD encompasses vast tracks of forest and rangeland that have experienced fire exclusion for many decades, resulting in fuel conditions that make them more prone to destructive wildfires. The mitigation recommendations in this CWPP focus largely on the safety and welfare of area's residents and emergency responders. As such, recommended fuel treatments will address hazards and risk directly facing the district's communities and subdivisions rather than the uninhabited forests and rangelands within the district.

Specific mitigation treatment recommendations for the CCCFPD were identified, in part, through detailed community wildfire hazard assessment surveys that evaluated predominant parameters such as vegetation and hazardous fuels, predicted fire behavior, topography, physical infrastructure, access, emergency response resources, home construction flammability, and defensible space characteristics around structures.

The highest-priority recommended actions focus on safety and welfare of the areas residents and emergency responders, and include the implementation of effective defensible space and reducing the likelihood of structural ignition. When properly implemented, these actions alone can make a huge positive impact to minimize fire behavior around a home. This critical mitigation component can be implemented immediately, dependent only on the incentive of the individual home owner.

In some neighborhoods, homes are constructed in sufficient density that coordinated defensible space efforts on adjacent smaller lots would help minimize the threat of loss on a much larger community scale. Priority defensible space zones have been identified throughout the district in these areas.

Securing identified evacuation routes for WUI subdivisions is a critical component of a community's strategic emergency plan. Individual community assessments included in this CWPP identify recommended primary routes that should be capable of supporting two way traffic flow and emergency apparatus access. Shaded fuelbreak zones are designated along forested stretches of these and other primary residential access routes. Road improvements may be suggested in areas that may restrict apparatus access due to

tight switchbacks, dead ends, or narrow single lane. Potential secondary emergency access routes are identified for neighborhoods with limited ingress/egress.

Forest thinning treatment areas have also been identified in strategic locations around populated areas. These treatment zones are strategically located in relation to populated areas based on ignition potential, expected fire behavior, timber density, fuel type, and topography. Other fuel break improvements are suggested for all power transmission line right-of-ways as an additional means of reducing continuous forest canopy cover.

Possible enhancements to existing emergency preparedness have also been assessed. This includes an inventory of existing emergency apparatus, incident response protocol, mutual aid agreements, as well as recommendations for the installation of additional strategic emergency water supplies throughout the district. Preferably these water supplies are large cisterns conveniently positioned above road grade for gravity feed and strategically located at subdivision entrances along main roads.

Recommendations were reviewed by the CCCFPD, county emergency response management, affected public land management agencies, and interested community stakeholders. Project prioritization is based on relative impact to community wildfire hazard and risk reduction, collaborative input, and professional judgment.

5.2 Recommended Actions

Action items include specific fuel reduction recommendations such as fuelbreaks along primary and secondary access roads, forest management programs, defensible space around structures, and homeowner assistance to reduce the combustibility of individual homes. Table 13 lists the recommended actions by category. Other recommended projects address infrastructure characteristics such as community access, signage, evacuation routing, and water resources. Community outreach and educational programs are also recommended. Table 15 summarizes recommendations for each WUI neighborhood.

Table 13. Recommended Actions by Category

Project	Actions
Outreach/Public Education	▪ Encourage stakeholder participation in community meetings. ▪ Distribute Firewise materials. ▪ Assess individual homes.
Defensible Space (Appendix G)	▪ Establish a Firewise fuel zone around homes. ▪ Establish a treated second zone that is thinned, pruned, and cleared of excess surface fuels. ▪ Extend treatment to property boundary to improve natural forest conditions and reduce excess hazardous vegetation. ▪ Where lots are small and housing is dense coordinate efforts between multiple homes to maximize effectiveness. ▪ Employ defensible space practices around identified resources such as cisterns, dip and draft sites, potential safety zones, or observation areas.
Firewise Building Improvements	▪ Replace shake roofs with fire resistant roofing material. ▪ Implement Firewise construction principals for all

Project	Actions
	remodels. ▪ Enclose exposed decks and gables. ▪ Screen vents and chimneys.
Shaded Fuelbreaks (Appendix F)	▪ Treat along primary and secondary evacuation routes. ▪ Improve/expand utility right-of-ways.
Access/Egress Improvements	▪ Improve hazardous primary access routes. ▪ Create/improve dead end turn arounds. ▪ Create/improve secondary evacuation routes where needed. ▪ Improve restricted switchbacks.
Strategic Fuelbreaks (Appendix F)	▪ Provide for fuelbreaks in identified treatment zones. ▪ Conduct removal where possible. ▪ Burn piles where needed. ▪ Coordinate with adjacent defensible space on private lots and treatments on public lands. ▪ Expand to address infestation where needed.
Supporting Actions	▪ Support grant funding acquisition actions. ▪ Involve Jefferson County in evacuation improvements. ▪ Revise county statutes addressing defensible space requirements for home sales. ▪ Coordinate with agency forest management plans.
Fire Department Preparedness	▪ Integrate project GIS ▪ Maintain and distribute map books ▪ Regularly update all water resource maps ▪ Survey potential dip sites and safety zones ▪ Develop and distribute community incident pre-plans ▪ Continue community education and outreach ▪ Continue recruitment, training, and certification ▪ Continue mutual aid strategic planning. ▪ Continue apparatus, facility, and personal protective equipment (PPE) upgrades

Outreach and Public Education

The most effective means to initiate local action is through community education and public outreach. Community education may target a number of goals and objectives including:

- Identify wildfire hazards and risks;
- Introduce the benefits of defensible space and Firewise construction principals;
- Urge homeowners to take action on their own property and influence neighbors, friends, and HOAs;
- Initiate creation of an oversight group to drive CWPP implementation and grant application;
- Increase awareness of current forest conditions and how hands-on management practices can help restore forest health and reduce wildfire risk; and
- Create awareness of the historical role fire has played in the regional ecosystem and forest and rangeland health.

Some parcels within subdivisions may be undeveloped and/or owned by absentee owners. A lack of fuels management on these lots can impact the entire community. An effort

should be made to contact these landowners and determine how to address their concerns and overcome potential obstacles to conducting hazard fuel mitigation on their land.

Action Item: All community meetings should include reminder information concerning the benefits of defensible space, recommended methods to reduce structural ignitability, forest health issues, as well as wildfire probability. Yard slash disposal opportunities should be coordinated on an annual basis. This may be coordinated with HOA spring cleanup activities and may include the coordination of a central disposal site, mobile chipping services, or a hauling service.

As an example, slash collection days could occur in the fall or at other locations to make it easy for all residents to participate. A community, HOA, or neighborhood would hire a contractor by the hour to chip the slash stacked along the main road by homeowners in front of each residence. Each landowner would pay for the time it took to chip his/her slash, but the equipment and scheduling costs would be carried/distributed among all participating landowners.

Defensible Space

Implementation of defensible space around individual homes is an action that can be taken immediately by motivated land and homeowners. It is recommended that defensible space be created following the CSFS guidelines as set forth in *Creating Wildfire Defensible Zones*, Bulletin No. 6.302 (Dennis 2003) (Appendix G), which is consistent with Jefferson County regulations. Effective defensible space in conjunction with non-combustible building materials and clean gutters is the most effective means to protect an individual home from wildfire loss.

Action Item: Creating and improving defensible space around individual homes is the most effective method to reduce hazard fuels and the threat of wildfire within the CCCFPD. It is suggested that the above outreach efforts be used to coordinate and spur implementation and slash disposal at the individual homeowner level. Broad participation on an individual basis ultimately leads to effective hazard reduction at the neighborhood or community level. In neighborhoods where lots are smaller and housing density is high, coordinating efforts between multiple adjacent lots may be necessary to achieve recommended zone dimensions. These areas are identified in the individual assessments as priority defensible space. Many homeowners with the highest need for defensible space are directly adjacent to public community open space properties. Coordinating fuel reduction activities between public, open space, and private lands creates a mutually beneficial solution. Establishing a procedure whereby homeowners who have established defensible space on their property to petition for fuels management on adjacent public lands would facilitate more effective fuels reduction and increase opportunities to enhance forest health.

Effective defensible space consists of a fuel-free zone adjacent to the home, a treated secondary zone that is thinned and cleaned of surface fuels, and, if the parcel is large enough, a transitional third zone that is basically a managed wildland or forest area. These components all work together in a proven and predictable manner. **Zone 1** keeps fire from burning directly to the home; **Zone 2** reduces the adjacent fire intensity and the

likelihood of torching, crown fire, and ember production; and **Zone 3** does the same at a broader scale, keeping the fire intensity lower by maintaining a more historic condition, which in turn reduces the risk of extreme/catastrophic fire behavior.

When this principle of defensible space is combined with fire-resistant construction the risk of structure loss is greatly reduced. Defensible space implemented on adjacent lots has a greater effect on reducing wildfire hazard than on in individual parcel. This is especially relevant where housing is dense and lots are small. Due to safety considerations of responding firefighters, homes and neighborhoods with defensible space are much more likely to be assigned structure defense crews than those without (Figure 8).

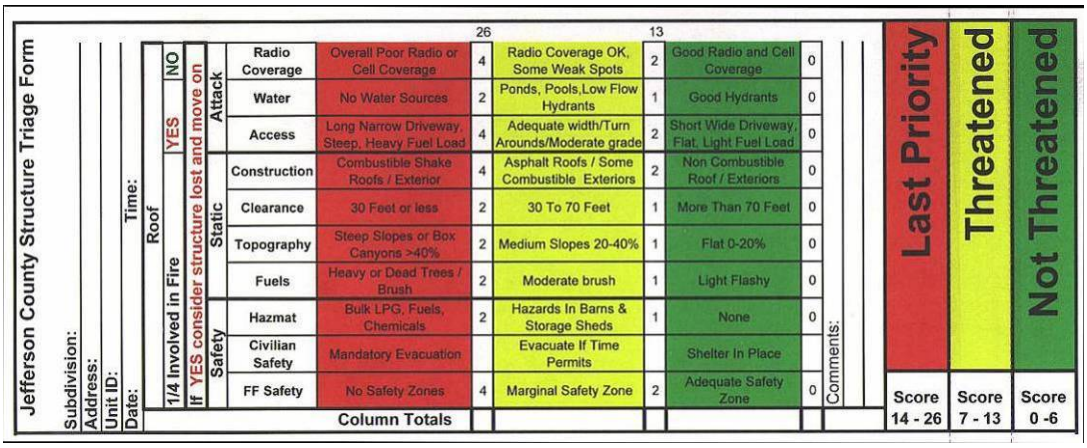


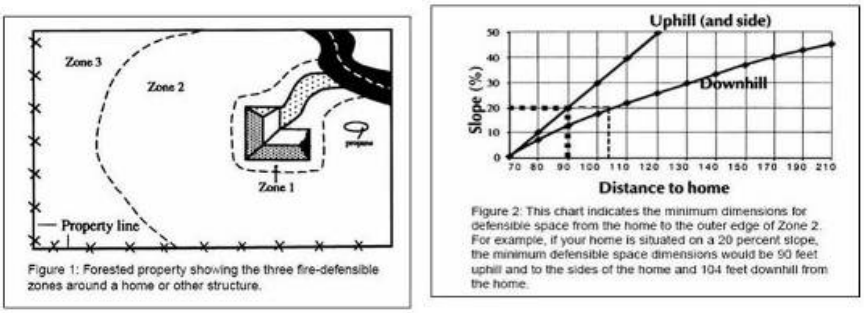
Figure 8. Jefferson County Structure Triage Tag
(for prioritizing structure defense in the event of an advancing wildfire)

Zone 1 (0 to 15 feet from structure): Within 3 to 5 feet of the structure, decorative rock or mowed, irrigated grass is recommended (Figure 10). Well-spaced and pruned, low-flammability plants (Appendix J) are acceptable if the structure has noncombustible siding. In the remainder of Zone 1, trees' lower branches should be pruned 5 to 10 feet above the ground (not to exceed one-third of the tree height). Dead wood, tall grass, and ladder fuels (low limbs, small trees, and shrubs that may carry fire into tree crowns) should be removed from this area. Leaves and overhanging branches should be removed from the roof and gutters. The 15-foot area should be irrigated as appropriate. Woodpiles should be removed and stored in Zone 2, preferably upslope from structures.

Zone 2 (typically from 15 feet out to 60-210 feet from Zone 1): The size of this zone is dependent upon slope. Treatment of surface fuels and ladder fuels is generally the same as for Zone 1. Trees (or small groups of trees) and shrubs should be thinned to provide 10 feet of clearance among crowns. Grasses should be mowed because they dry in late summer.

Zone 3 (beyond Zone 2 to property line): This area outside of Zone 2 should be managed for the appropriate land use objectives, such as forest health, aesthetics, recreation, and wildlife habitat (Figure 9).

Figure 9. Defensible Space Guidelines and Standards (Dennis 2006)



Efforts can be encouraged and coordinated annually through community meetings, planned spring cleanups, and organized disposal efforts. Although most of the work can be accomplished by individual homeowners in a phased approach over time, neighborhood cooperation and support is essential to help those who are unable, or to provide access to critical hazardous areas. Table 14 outlines a manageable phased implementation schedule.

Table 14. Community-Based Defensible Space Project Schedule

Year	Project	Actions
1	Annual spring outreach	▪ Contact and/or organize homeowners.
	Annual spring mitigation (defensible space)	▪ Clean roofs and gutters. ▪ Trim limbs/bushes within 3 to 5 feet of home. ▪ Rake yard. ▪ Help a neighbor. ▪ Organize debris disposal.
2	Annual spring outreach	▪ Contact and/or organize homeowners.
	Annual spring mitigation (defensible space)	▪ Clean up brush along property lines. ▪ Repeat basic yard cleanup. ▪ Organize debris disposal.
3	Annual spring outreach	▪ Contact and/or organize homeowners. ▪ Advise individual homeowners on needed improvements to construction features.
	Annual spring mitigation (defensible space)	▪ If necessary, coordinate defensible space efforts between homeowner groups who have created defensible space and adjacent open space land managers.
4	Annual spring outreach	▪ Contact and/or organize homeowners. ▪ Follow-up on construction feature recommendations.
	Annual spring mitigation (defensible space)	▪ Complete any outstanding projects from previous years. ▪ Begin maintenance phase. ▪ Initiate construction feature improvements.

Structural Flammability

Improving the fire-resistant characteristics of a structure goes hand-in-hand with the development of defensible space. Extensive recommendations can be found in CSFS publications available at http://csfs.colostate.edu/library.htm. The most significant improvement that can be made to many of the homes in the assessment areas is the replacement of wood shake roofing with noncombustible roofing material, as is required for all new and replaced roofs in both Jefferson and Boulder Counties. All homeowners

should keep roofs and gutters clear of leaves and pine needles. Screening of gutters and roof vents is recommended. Embers from a wildfire can become windborne and travel long distances before settling.

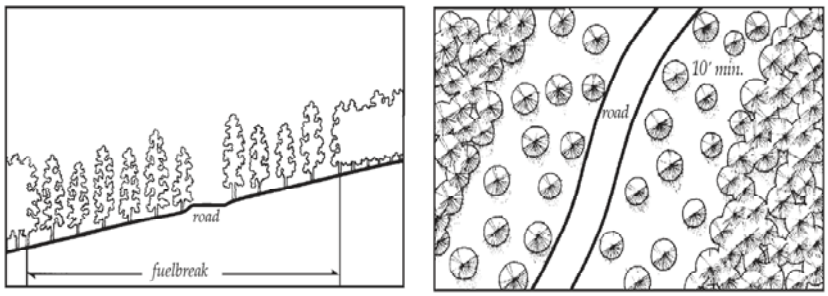
Common structural fuel hazards associated with homes in the WUI include:

- Combustible roofing and siding;
- Combustible decks with exposed undersides;
- Combustible material under decks;
- Open attic vents;
- Combustible fencing; and
- Woody debris in gutters.

Action Item: Provide for community education, outreach, and information distribution through HOAs and other neighborhood associations. Coordinate public education through existing spring cleanup programs. Grassroots action can be as simple and straightforward as coordinating with a local scout troop to distribute applicable CSFS flyers door-to-door.

Shaded Fuelbreaks

Shaded fuelbreaks have been identified along forested evacuation routes and other primary residential access routes. However, all forested access roads should be considered for shaded fuelbreak implementation, where possible. Reducing the forest canopy along access road margins enhances the effectiveness of the physical canopy break the road provides, as well as critical safety factors along likely evacuation and incident access routes. Roads with shaded fuelbreaks create a safer emergency ingress/egress scenario while greatly aiding potential tactical suppression efforts. Fuels treatment along roadways reduces removal costs of by-product as well as project complexity (Figure 10). Visit http://csfs.colostate.edu/library for fuelbreak guidelines (Appendix F).



Cross-section of a typical fuelbreak built in conjunction with a road.

Plan view of fuelbreak showing minimum distance between tree crowns.

Source: Dennis, undated

Figure 10. Shaded Fuelbreak

Action Item: All access roads within the CCCFPD with vegetation or timber encroachment should be considered for shaded fuelbreak treatment and/or seasonal mowing. Project priority should be given to the forested road margins of the primary evacuation routes and other primary residential access routes as identified in the individual community assessments.

Future treatments may be coordinated with property owners along adjoining private land and along public or community right-of-ways. Conifer regeneration and reproduction in previously mitigated areas and road margins should also be addressed. It is recommended that any mitigation projects that involve timber thinning be evaluated, coordinated and monitored by a mitigation specialist and/or certified forester. Appendix F, CSFS Fuelbreak Guidelines for Forested Subdivisions and Communities, has been included as procedural and methodology reference for all thinning projects.

Strategic Fuelbreaks

Thinning recommendations may also target timber stands that pose a specific wildfire threat to neighborhoods but are not directly adjacent to residential access or evacuation routes. These recommended strategic fuelbreaks are identified through remote sensing analysis and field surveys that examine such characteristics as topography, predominant fuel model, forest condition, expected fire behavior, as well as proximity to values at-risk. Strategic fuelbreak recommendations specific to each assessed subdivision are identified in Appendix C and prioritized in Table 15.

Strategic fuelbreaks may be designed with shaded fuelbreak characteristics or as a fuel-free buffer zone for more aggressive fuel reduction. Strategic fuelbreaks along neighborhood margins should mutually support adjacent defensible space efforts. Treatment locations are strategically positioned in forest stands that pose a significant threat to populated areas and are based on ignition potential, expected fire behavior, fuel type and density, and topography. As with shaded fuelbreaks these treatment areas are designed to slow an advancing wildfire by reducing the available fuel load and breaking forest canopy continuity. Stands are thinned, ladder fuels are pruned, and excess surface fuels are removed. Because of the inherent access issues associated with these strategic locations, slash pile burning is often the only feasible option for the removal of timber and slash.

Because treatment areas often span multiple ownership boundaries, planning and coordination with landowners and public agencies is critical.

Action Item: Treatment recommendations for each subdivision should be reviewed relative to ownership and areas where mitigation would be permitted should be identified. Treatment units should be surveyed and delineated and trees marked by CSFS staff or certified/professional forester. Refer to Appendix F, CSFS Fuelbreak Guidelines for Forested Subdivisions and Communities, for recommended thinning methods and procedures. Contract logging companies or certified fire department personnel may be utilized to cut.

Weeds

Integrated weed management will reduce fuel hazards around and within communities and improve the health of grasslands. Fire exclusion practices in meadow and shrub lands have allowed the encroachment of non-native and noxious species that have decreased effective foraging and in some cases have increased wildfire fire potential. In the event of a wildfire, rehabilitation treatment management such as the seeding of native grasses and spreading mulch is beneficial and may be necessary to reestablish a productive natural plant community.

Action Item: An ecological evaluation of the health and species status is recommended for meadow, prairie, and shrub lands within the assessment area. Historically these areas supported the foraging needs of large game and studies to assess the presence of noxious weeds and aggressive non-native species, as well as the condition of shrubs may be useful. Results may indicate the need for small-scale prescribed burning, application of herbicide, or foster modifications to county burned area rehabilitation seeding practices for future wildfire incidents.

Access

Access is an important component of any community's wildfire hazard and risk profile. Community access characteristics dictate the efficiency of emergency evacuation as well as the effectiveness of emergency response. Preferably community road design provides for multiple points of ingress/egress, supports two-way traffic flow, and offers adequate emergency apparatus turnaround radius on dead end roads and cul de sacs.

Each neighborhood or community within the fire district has unique access characteristics. The individual neighborhood assessments provided in Appendix C provide analyses of these characteristics and specific recommendations on ways to improve current conditions. Availability of ingress/egress, characteristics of road surface, road layout and design, treatment of dead ends, road grade, characteristics of switchbacks, and width all factor into access assessment and emergency planning.

Action Item: Existing turn arounds should be evaluated in regards to adequate turning radius for emergency apparatus. Existing dead ends should be identified and mapped and evaluated for turnaround construction. Serious consideration should be given to improving or constructing secondary evacuation routes where single a single access route serves a subdivision. Possible secondary evacuation or emergency access routes are identified in Appendix C.

Emergency Preparedness

CCCFPD maintains a full volunteer staff, four stations, and sufficient apparatus to cover most typical fire, trauma, and medical situations that may arise in the district. Mutual aid agreements are in place to guarantee support from adjacent fire districts as well as resources from three affected counties in the event of a larger scale incident or situations that require additional resources.

Action Item:

- Mutual Aid agreements should be reviewed and amended annually to reflect changing conditions.

- Tactical pre-suppression plans should be developed to provide a framework for tactical operations for initial attack within the district as well as larger scale incidents involving Type III, II or I Incident Management Teams. Community surveys provided through this CWPP may serve as the basis for individual community plans. Plans should be distributed to all agencies that provide mutual aid support.

- Continue the development of emergency water supplies throughout the district with strategic locations that support efficient and safe tactical water operations.

- Conduct surveys of all identified potential safety zones (Appendix C) for applicability supporting emergency operations. Surveys should address access, size, capacity, and maintenance considerations. Approved locations should be mapped and included in any district emergency operations plan.

- Conduct qualified surveys of identified helicopter dip sites (Appendix C) noting potential obstruction hazards and identify, negotiate, and resolve any potential water rights issues. Approved locations should be mapped and included in any district emergency operations plan.

- Conduct surveys of all community and subdivision access routes noting dead ends, restricted turnarounds, security gates, evacuation routes, etc. Results should be mapped and included with updated district mapbooks.

- Maintain district mapping information and coordinate with other surrounding jurisdictions.

- Emergency and evacuation plans should be coordinated with Jefferson County Division of Emergency Management, affected neighboring jurisdictions, and disseminated to residents through neighborhood association meetings or other local events.

Forest Health

Public land managers monitor forest health within public lands, and citizens should be encouraged to do the same on their property. The current mountain pine beetle epidemic has gravely impacted much of Colorado's lodgepole pine forests. Ponderosa pine may also be attacked by the mountain pine beetle, and diligence on the part of the property owner is warranted. Other forest pathogens, such as dwarf mistletoe, are observed at endemic levels in some areas of the CCCFPD.

Action Item: Residents should monitor the health of trees on their property and contact their local CSFS District Forester or a professional arborist with concerns. Further information is available at http://csfs.colostate.edu/iandd.htm.

CCCFPD Mitigation Recommendation Summary

Table 15 provides a summary of the community surveys and outlines a prioritized approach to specific mitigation and related hazard reduction recommendations.

Table 15. Community Mitigation Recommendation Summary

Hazard Rating	WUI	HAZARD REDUCTION RECOMMENDATIONS HIGHER PRIORITY LOWER					
EXTREME	Burke	Improve and maintain defensible space where needed. Coordinate efforts to increase effectiveness & compliment adjacent forest treatment units	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Improve emergency access improvements on Fischer Rd.	Seasonal road margin maintenance through mowing and conifer reproduction reduction	Timber thinning treatment units identified for stands north of Burke Rd. and along east margin of twin Spruce Rd.	Installation of emergency water supply at Joannie Rd. and Twin Spruce rd.
EXTREME	Wondervu	Improve and maintain defensible space where needed. Coordinate efforts to increase effectiveness & compliment adjacent forest treatment units	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Improve emergency access, grade and widen roads, establish turnarounds at dead ends	Seasonal road margin maintenance including mowing and conifer reproduction reduction	Timber thinning treatment units identified for stands around community margins	Install static emergency water supply in the Wondervu Café area
HIGH	Nadm	Improve and maintain defensible space where needed.	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Develop and maintain shaded fuelbreaks along primary and secondary evacuation routes and primary residential access routes	Timber thinning treatment units identified for stands for stands surrounding the subdivision	Investigate and establish secondary evacuation route to Camp Eden	Install static emergency water supply at Nadm and Twin Spruce Dr.

Hazard Rating	WUI	HAZARD REDUCTION RECOMMENDATIONS HIGHER PRIORITY LOWER					
	Chute Road	Improve and maintain defensible space where needed.	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Develop and maintain shaded fuelbreaks along forested portions of Gross Dam Rd. and railroad right of way	Timber thinning treatment units identified for stands upslope from railroad along Chute Rd. and Tunnel 19 Rd.	Potential safety zone survey in meadow off Gross Dam Rd. and railroad crossing	
	Lyttle Dowdle	Improve and maintain defensible space where needed. Coordinate efforts to increase effectiveness & compliment adjacent forest treatment units	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Develop and maintain shaded fuelbreaks along primary evacuation routes and primary residential access routes	Timber thinning treatment units identified for stands for stands surrounding the subdivision	Qualified helicopter dip site survey for pond northwest of subdivision	
	Camp Eden	Improve and maintain defensible space where needed. Coordinate efforts to increase effectiveness & compliment adjacent forest treatment units	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Develop and maintain shaded fuelbreaks along primary and secondary evacuation routes and primary residential access routes	Survey emergency access restrictions and improve turnarounds where needed	Install static emergency water supply near Camp Eden Rd. and Coal Creel Canyon D	Qualified helicopter dip site survey for lake near Highlander Rd..
	Coal Creek Heights	Improve and maintain defensible space where needed. Coordinate efforts to increase effectiveness & compliment adjacent forest treatment units	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Develop and maintain shaded fuelbreaks along primary and secondary evacuation routes and primary residential access routes	Timber thinning treatment units identified for stands for several stands surrounding and within the subdivision	Survey emergency access restrictions and improve turnarounds where needed	Investigate and formalize if possible secondary emergency evacuation to the Hilltop subdivision
	Stanton	Improve and maintain defensible space where needed. Coordinate efforts to increase effectiveness & compliment adjacent forest treatment units	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Develop and maintain shaded fuelbreaks along primary and secondary evacuation routes and primary residential access routes	Timber thinning treatment units identified for stands for several stands west and northwest of the subdivision	Investigate and formalize if possible secondary emergency evacuation to the Hilltop subdivision	Potential safety zone survey in meadows north of subdivisionand meadows south of Gap Rd.

Hazard Rating	WUI	HAZARD REDUCTION RECOMMENDATIONS HIGHER PRIORITY LOWER					
	Crescent Park	Improve and maintain defensible space where needed. Coordinate efforts to increase effectiveness & compliment adjacent forest treatment units	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Develop and maintain shaded fuelbreaks along upper Spruce Canyon Dr., forested portions of Gross Dam Rd., and forested residential access routes	Timber thinning treatment units identified for stands for stands north and east of Spruce Canyon Dr. and Butte Dr.	Investigate and formalize if possible secondary emergency evacuation from Seaver Dr. to Hollings Dr.	Potential safety zone survey in meadow at Hollings Dr. and Gross Dam Rd.
	Copperdale	Improve and maintain defensible space where needed. Coordinate efforts to increase effectiveness & compliment adjacent forest treatment units	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Develop and maintain shaded fuelbreaks along primary evacuation routes and primary residential access routes	Timber thinning treatment units identified for stands for stands along subdivision margins and stands between areas of high density homes		
	Miramonte	Improve and maintain defensible space where needed.	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Develop and maintain shaded fuelbreaks along upper and lower Miramonte Rds. and forested portions of the railroad right of way	Timber thinning treatment units identified for stands for stands adjacent to the subdivision and in the vicinity of the railroad tunnel		
	Vonnie Claire	Improve and maintain defensible space where needed. Coordinate efforts to increase effectiveness & compliment adjacent forest treatment units	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Develop and maintain shaded fuelbreaks along forested portions of evacuation routes and primary residential access routes	Timber thinning treatment units identified for stands for stands along subdivision margins	Establish emergency access from Vonnie Claire to Crescent Lake Rd.	Potential safety zone survey in meadow central to the subdivision
Moderate	Hilltop	Improve and maintain defensible space where needed. Coordinate efforts to increase effectiveness & compliment adjacent forest treatment units	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Seasonal road margin maintenance through mowing and conifer reproduction reduction	Develop and maintain shaded fuelbreaks along forested portions of Ranch Elsie Rd. and Hilltop Dr.	Timber thinning treatment units identified for stands on the north and west margins of the subdivision	

Hazard Rating	WUI	HAZARD REDUCTION RECOMMENDATIONS HIGHER PRIORITY LOWER					
	Blue Mountain	Improve and maintain defensible space where needed. Coordinate efforts to increase effectiveness & compliment adjacent forest treatment units	Reduce structural ignitability through phased building improvements, new construction, and seasonal maintenance	Seasonal road margin maintenance through mowing and conifer reproduction reduction	Secondary emergency access/evac preplanning and access improvements	Shaded fuelbreak along ridge on Eastridge Rd	Timber thinning treatment units identified for stands at south end of valley

5.3 Treatment Options

Fuel treatment recommendations for the CCCFPD focus primarily on reducing structural ignitability, developing defensible space around structures, creating shaded fuel breaks along primary access routes and strategic thinning in timber stands that pose a threat to subdivisions. Timber stand thinning and shaded fuelbreaks have also been recommended along forest portions of the railroad that bisects the district to better guard against the constant threat of accidental ignition along that extensive right of way. Power line right of ways are also identified as existing fuels breaks that should be improved to serve as a more effective wildfire buffer. Each of the recommended fuel mitigation projects can be achieved by a variety of methods (Table 16).

Selecting the most appropriate, cost-effective option is an important planning step. This brief synopsis of treatment options and cost estimates is provided to assist in this process. Cost estimates for treatments should be considered as very general guidelines. Timber treatment costs can vary tremendously based on project complexity, but generally run $300 to $1,200 per acre depending upon:

- Type of fuel;
- Diameter of materials;
- Acreage of project;
- Steepness of slope;
- Density of fuels;
- Proximity to structures;
- Access; and
- Transportation costs.

It is imperative that implementers plan for the long-term monitoring and maintenance of all treatments. Post-treatment rehabilitation including seeding with native plants and erosion control may be necessary.

Table 16. Treatment Methods

Treatment	Estimated Cost	Comments
Machine Mowing	$90 - $200 per acre	▪ Appropriate for large, flat grassy areas on relatively flat topography.
Prescribed Fire	$75 - $300 per acre	▪ Can be very cost effective. ▪ Ecologically beneficial. ▪ Can be used as training opportunities for firefighters. ▪ Cost varies with complexity. ▪ Carries risk of escape, which may be unacceptable in some WUI areas. ▪ Unreliable scheduling due to weather and smoke management constraints.
Brush Mastication	$300 - $500 per acre	▪ Brush species (Gamble oak in particular) tend to resprout vigorously after mechanical treatment. ▪ Follow-up treatments with herbicides, fire, grazing, or further mechanical treatments are typically necessary. ▪ Mastication tends to be less expensive than manual treatment and eliminates disposal issues.
Timber Mastication	$300 - $1,200 per acre	▪ Materials up to 10 inches in diameter and slopes up to 30 percent can be treated. ▪ Eliminates disposal issues. ▪ Environmental impacts of residue being left onsite are still under study.
Manual Treatment with Chipping or Pile Burning	$300 - $1,200 per acre	▪ Allows for removal of merchantable materials or firewood in timber. ▪ Requires chipping, hauling, and pile burning of slash.
Feller Buncher	$750 and up per acre	▪ Mechanical treatment on slopes over 30 percent of materials over 10 inches in diameter may require a feller buncher rather than a masticator. ▪ Costs tend to be considerably higher than mastication. ▪ May allow for removal of merchantable material.

5.4 Project Support

This section provides information that will be helpful in planning and preparing for fuels mitigation projects.

Funding and Grants: Grant funding support is often a necessary component of a fuels treatment project and can facilitate recommended mitigation on both private and public lands. In addition to opportunities that may be available through Jefferson County Division of Emergency Management, CSFS (Gallamore, 2008) has summarized the following available resources:

CSFS Eligible Landowner Assistance Programs and contingencies (5/23/07):

- Landowners apply through CSFS District Offices unless noted below;
- Applications approved when funds are available throughout the year;
- Matching expenses or in-kind activities by landowner are generally required; and
- Grant availability is subject to continued funding from Federal and State Government.

1. **WUI Incentives** – Wildland Urban Interface for fuels reduction.

2. **FLEP** – Forest Land Enhancement Program for multiple conservation practices *(applications are usually handled through local Soil & Water Conservation District).*
3. **I & D Prevention and Suppression** – Bark Beetle – Forest Health.
4. **FRFTP** – Front Range Fuels Treatment Partnership for fuels reduction.
5. **STEVENS'** – Stevens' or "Companion" funds for fuels reduction projects on non-federal lands that may be threatened by burning on US Forest Service lands *(these funds may be "no match" in some cases).*

CSFS Assistance Programs – Communities and Agencies and (3/20/08):

- Cooperators, communities, organizations, agencies – apply through CSFS District Offices;
- Applications received and approved during the identified funding windows;
- Matching expenses or in-kind activities by applicants are generally required
- Grant availability is subject to continued funding from Federal and State Government; and
- Applications for activities listed in current CWPPs are normally ranked highest for funding.

1. **WUI Incentives** – Wildland Urban Interface for fuels reduction – *Application period is August, for grants awarded the following May; grants are usually for a one-year period ending September 30th of year following award.*
2. **CWPP Implementation** (CSFS/SFA) - *Application period is January or May, for grants awarded that year; grants usually must be completed by September 30th of the awarded year.*
3. **Colorado Community Forest Restoration** *(HB 07-1130) - Application period is July-August, for grants awarded that year; grants are usually for a two-year period ending June 30th of 2nd year following award; subject to continued funding through Colorado Legislature.*
4. **FRFTP** – Front Range Fuels Treatment Partnership for fuels reduction - *Application period is January or May, for grants awarded that year; grants usually must be completed within one to two years of the award date.*
5. **STEVENS'** – Stevens' or "Companion" funds for fuels reduction projects on non-federal lands that may be threatened by burning on US Forest Service lands *(these funds may be "no match" in some cases) Application period is January or May, for grants awarded that year; grants usually must be completed within one to two years of the award date.*
6. **I & D Prevention and Suppression** – Bark Beetle – Forest Health - *Application period is January or May, for grants awarded that year; grants usually must be completed within one to two years of the award date.*

For additional grants and grant application assistance visit:
Rocky Mountain Wildland Fire Information - Grant Database:
http://www.rockymountainwildlandfire.info/grants.htm
Grant Writing Handbook: http://www.theideabank.com/freeguide.html

Public Land Planning: Public lands within the assessment area include those managed by Jefferson County Open Space, Boulder County Open Space, Denver Water Board, and Colorado Sate Parks. The CWPP development process is designed to facilitate dialog with these agencies and coordinate public and private wildfire and forest management strategies. As the CWPP strategic plan is implemented, dialogue and collaboration should be maintained with these agencies to coordinate strategies and treatments, and make adjustments if necessary.

Regulatory Support: One of the major issues confronting defensible space and hazardous fuels mitigation is the need for ongoing maintenance. Treatment projects in timber or brush fuels have an effective life span of approximately 10 to 15 years before regrowth fuel loads again become hazardous. On the other hand, defensible buffers and fuelbreaks mowed in grasslands are beneficial only through that growing season. For defensible space to be consistently successful some regulatory impetus is recommended. Jefferson County addresses the need for regulatory support of wildfire hazard reduction on forested lands through county zoning regulations. Subsection G addresses defensible space specification and maintenance;

Section 50: W-H Wildfire Overlay District (orig. 1-27-76; am. 7-11-06) provides basic landuse and mitigation guidelines; ***Subsection G. Maintenance Of Defensible Space and Associated Fuel Break Thinning;*** *Defensible space and fuel break thinning work must be completed and maintained to the standards described in the Colorado State University's Cooperative Extension Fact Sheet 6.302. The responsibility for maintaining defensible space and associated fuel break thinning lies with the landowner. Noncompliance with defensible space maintenance standards will be enforced as a Zoning Violation, as specified in the Enforcement and Administrative Exceptions Section of this Zoning Resolution. (orig. 6- 18-02; am. 7-11-06)*

6 EMERGENCY OPERATIONS

6.1 Wildfire Response Capability and Recommendations

The CCCFPD is served by an all-volunteer fire department. The department has 40 active members who provide emergency fire, medical, hazardous materials and rescue services, and 20 members of a wildland team who respond only to local wildland fires. In addition to the district's Fire Chief and Assistant Chief/Wildland Coordinator, the CCCFD maintains four battalion chiefs who oversee operations for each of the district's four stations. Current inventory includes five structural engines, two water tankers, three rescue trucks, one ambulance, two brush trucks, one wildland van, one utility vehicle, one zodiac boat (stationed at Gross Reservoir), one ATV, and one command vehicle.

In addition to the challenges inherent to serving large residential and recreational populations in a rugged high fire hazard area, the CCCFPD is additionally challenged by its unique tri-county location that includes Jefferson, Boulder, and Gilpin Counties. In order to alleviate possible conflicting 911 call dispatching, all 911 calls are forwarded to the Boulder County dispatch center and relayed to fire district personnel through pager activation on the Boulder county fire and medical emergency frequency.

Mutual Aid

The CCCFD is a participant in the Jefferson County Intergovernmental Mutual Aid Agreement (2/10/93), which provides a mutual aid agreement between most, but not all, fire districts in the Jefferson County, and includes the CSFS and USFS. Jefferson County maintains a certified Type 3 Incident Management Team (IMT) for additional overhead support in the event of a large-scale incident. CCCFD also maintains mutual aid agreements with adjacent fire districts in Boulder and Gilpin Counties including Rocky Mountain Fire Authority, and the Timberline Fire Authority, formerly the Colorado Sierra and High County Fire Districts.

Suppression Requirements

For illustration purposes, Table 17 compares initial attack capabilities for an average engine crew as determined from the "Line Production Rates for Initial Action by Engine Crews" charts (NWCG 2004) with predicted fire rates of spread under 50th percentile climatic conditions as determined from the Corral Creek RAWS data. These are generalized figures provided to illustrate that potential spread rates of fires in the district have the capacity to outpace the capabilities of the suppression resources that are typically available to the district.

Table 17. Wildland Fire Production Rates vs. Fire Growth

Initial Attack Fire Line Production Rates Using 3-Person Engine Crew			
FBFM	**Predicted Fireline Production Rates (chains/hr)**	**Fire Acreage and Perimeter (chains) After First Hour**	**Predicted Fire Spread (chains/hr) Under Average Conditions**
1 – Short grass	24	222 acres/183 chains	72
2 – Grass with Timber/Shrub Overstory	15	47 acres/84 chains	33
4 – Mature Brush	8	16 acres/157 chains	61
5 – Young Brush	12	15 acres/47 chains	19
6 – Intermediate or Dormant Brush	12	39 acres/77 chains	30
8 – Closed or Short-Needle Timber Litter – Light Fuel Load	15	0.1 acres/5 chains	2
9 – Hardwood or Long-Needle or Timber Litter – Moderate Ground Fuel	12	2 acres/18 chains	7
10 – Mature/Overstory Timber and Understory	12	2 acres/18 chains	7

1 chain = 66 feet. Source for fire size and rate of spread: BehavePlus Fire Behavior Modeling System

Table 18 is based on the time a crew can prepare a structure for a wildland fire using a Type-1 engine. The accepted standard is 20 minutes for a four-firefighter crew and 30 minutes for a three-firefighter crew.

Table 18. Structural Protection Rates

Structural Protection Rates Per Hour Using Type-1 Engine		
Firefighters	**Rates**	**Total Structures per Hour**
3	30 minutes/structure	2
4	20 minutes/structure	3

Source for production rates: NWCG 2004. *Fireline Handbook*

The aforementioned performance standards included in the plan are designed to address these suppression needs. As with the response targets, these production standards should be trained to and monitored for attainability.

6.2 Emergency Procedures and Evacuation Routes

In the event that the Jefferson County or Boulder County Sheriff orders a community to evacuate because of threatening wildfire, residents should leave in an orderly and timely

manner. The Sheriff would proclaim the preferred evacuation routes and safe destination sites. The need to evacuate may be communicated by telephone, media, and/or direct contact from emergency personnel. However, the need for evacuation can occur without notice when conditions for wildfire are favorable. Homeowners should be prepared in advance to evacuate without formal notice. Human safety is the number one concern in an evacuation.

Before residents leave they should take every precaution to reduce the chance of structure loss as time allows. Actions could include thoroughly irrigating the defensible space, watering down the roof, and removing all debris from rain gutters. Ensure all flammable materials are at least 30 feet from the house, such as woodpiles, leaves, debris, and patio furniture. Windows and doors should be closed but not locked. Other openings should be covered. A ladder should be placed for roof access by firefighters. A fully charged hose that reaches around the house should also be available for firefighter use. Porch lights should be left on to allow firefighters to find homes at night.

Families should have meeting locations in place and phone numbers to call in case family members are separated. Families should take with them important papers, documents, pets, food, water, and other essential items. The exterior of the house should be monitored for smoke for several days after residents return. Embers may lodge in small cracks and crevices and smolder for several hours or days before flaming.

Specific evacuation recommendations are proposed Section 5.2, Subsection – *Access* and in more detail in Appendix C. Approved evacuation plans should outline available evacuation centers and the procedures to activate them. Large animal evacuation centers also need to be identified. Finalized plans should be documented, coordinated with Jefferson County Division of Emergency Management, Boulder County Emergency Services and other affected FPDs, and conveyed to residents as a part of public outreach efforts.

7 CCCFPD CWPP MONITORING AND EVALUATION

7.1 CWPP Adoption

The CCCFPD CWPP is a strategic planning document that is developed and approved by the Core Team. An important component of the development process includes building a stakeholder group that will move the plan forward, implement prioritized recommendations, and maintain the CWPP as the characteristics of the WUI change over time. Organizing and maintaining this team is often the most challenging component of the CWPP process. It is, however, essential in the process of converting the CWPP from a strategic plan into action.

This team will oversee the implementation and maintenance of the CWPP by working with fire authorities, community organizations, private landowners, and public agencies to coordinate and implement hazardous fuels treatment projects management and other mitigation projects. Building partnerships among neighborhood-based organizations, fire protection authorities, local governments, public land management agencies, and private landowners is necessary in identifying and prioritizing measures to reduce wildfire risk. Maintaining this cooperation is a long-term effort that requires the commitment of all partners involved. The CWPP encourages citizens to take an active role in identifying needs, developing strategies, and implementing solutions to address wildfire risk by assisting with the development of local community wildfire plans and participating in county-wide fire prevention activities.

Public meetings are a planned component of the CWPP development process. Community meetings were held to explain the CWPP process and intent, present the findings and recommendations of the CWPP investigations to the public, and solicit input for the final CWPP.

Questionnaires were distributed at the meetings and through direct mailings in a further effort to measure public perception of risk and values-at-risk and to assess public tolerance for various mitigation practices. Questionnaire feedback is found in Appendix E.

CWPP documentation is posted on Jefferson County's Emergency Management website to encourage public review and comment.

The final draft of the CCCFPD CWPP was reviewed by the Core Team, composed of representatives from the CCCFD, Jefferson County Division of Emergency Management, and CSFS.

The CCCFPD CWPP provides the foundation and resources for understanding wildfire risk and presents opportunities to reduce potential losses from wildfire. Individual neighborhoods and private landowners can take action by developing specific fire plans or by participating in district-wide activities for prevention and protection.

The HFRA authority for the CWPP requires adoption of this plan, as does the FEMA Disaster Mitigation Act of 2000. With formal adoption by the Core Team, participating agencies and WUI neighborhoods will be competitive for available hazardous fuels and non-fuels mitigation funding that may assist with plan implementation. Furthermore, adoption of this plan highlights a collaborative planning and development process between the CCCFPD, local government, public agencies, and neighborhood organizations.

7.2 Sustaining Community Wildfire Protection Plan Efforts

A CWPP can serve as the foundation for a safer and healthier WUI through hazard assessment and strategic planning focusing on the threat of wildfire. The mitigation strategies outlined in this plan will greatly reduce that risk, but only if implemented. Converting strategy into action is the key to achieving this important goal.

Communities can be made safer, and this CWPP has outlined realistic measures to achieve that goal. The CWPP process encourages homeowners to take an active role as fuel treatment strategies are developed and prioritized. Ownership of CWPP implementation at that same local level is the most effective means to achieving successful results and sustaining the effort from year to year.

Proactive neighborhoods can seek support and guidance through a variety of local, state, and federal resources identified in this plan including the CSFS, Jefferson County Division of Emergency Management, and CCCFPD.

7.3 Community Wildfire Protection Plan Oversight, Monitoring, and Evaluation

Maintaining the momentum created by this process is critical to successful implementation and ongoing community wildfire hazard reduction. Ownership of this responsibility lies with each neighborhood and HOA identified in the CWPP.

As wildfire hazard reduction efforts are implemented over time and the characteristics of particular WUIs change, neighborhoods may wish to reassess particular areas and update the findings of the original CWPP. Monitoring the progress of project implementation and evaluating the effectiveness of treatments are important components of CWPP oversight and maintenance. The assessment methodology utilized in this plan is a standardized, well-documented hazard and risk survey approach that is designed to provide a benchmark against which future assessments can be compared. Successes, challenges, and new concerns should be noted and subsequently guide any modifications to the CWPP that better accommodate the changing landscape.

Stakeholders will be responsible for CWPP monitoring, evaluation, and modification through regular meetings, and coordination with CCCFPD, neighborhood communities, and HOAs. Monitoring is the collection and analysis of information acquired over time to assist with decision making and accountability and to provide the basis for change. Evaluation includes analysis of the effectiveness of past fuels reduction and non-fuels mitigation projects, as well as recent wildfire suppression efforts. Monitoring and

evaluation measures should progress over time in a way that will determine whether the CWPP goals and objectives are being attained (Table 19).

Table 19. Monitoring and Evaluation Tasks

Objective	Tasks	Timeline
Risk Assessment	▪ Use reliable data that is compatible among partner agencies. ▪ Update the CWPP as new information becomes available. ▪ Continue to asses wildfire risk to communities and private landowners.	Annual Annual Biennial
Fuels Reduction	▪ Identify and prioritize fuels treatment projects on public land through development of a 5-year plan. ▪ Track fuels reduction projects and defensible space projects on private land. ▪ Monitor fuels reduction projects on evacuation routes. ▪ Track grants and other funding sources and make appropriate application.	Annual Biennial Annual Ongoing
Emergency Management	▪ Review suitability and the need for fuels reduction along evacuation routes.	Annual
Public Outreach	▪ Plan and hold Firewise education week. ▪ Provide Firewise pamphlets at public events. ▪ Evaluate techniques used to motivate and educate private landowners.	Annual Annual Annual

8 BIBLIOGRAPHY

Anderson, H.D. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. General Technical Report INT-122, USDA Forest Service, Intermountain Forest and Range Experiment Station, Ogden, UT.

Arvi, J., R. Gregiry, D. Ohlson, B. Blackwell, and R. Gray. 2006. Letdowns, wake-up calls, and constructed preferences: People's Response to Fuel and Wildfire Risks. Journal of Forestry. June.

BLM. 1991. Inspecting Fire Prone Property P-110: Instructors Guide. NFES 2190, National Interagency Fire Center, Bureau of Land Management National Fire & Aviation Training Support Group, Boise, ID.

BLM. 1998. Wildfire Prevention Strategies. PMS 455 or NFES 1572, National Interagency Fire Center, Bureau of Land Management National Fire & Aviation Training Support Group, Boise, ID. March.

Brown, J.K. 2000. Ecological Principles, Shifting Fire Regimes and Management Considerations, In: Proceedings of the Society of American Foresters National Convention, September 18-22, 1994, Anchorage, Alaska. Society of American Foresters, Washington, D.C.

Cohen, J. 2000. What is the Wildland Fire Threat to Homes? Presentation to School of Forestry, Northern Arizona University, Flagstaff, AZ, April 10.

Cohen, J. and J. Saveland. 1997. Structure Ignition Assessment Can Help Reduce Fire Damages in the W-UI. Fire Management Notes 57(4): 19-23.

CSFS. 2006. Minimum Standards for Community Wildfire Protection Plans (CWPP). Colorado State Forest Service. August.

Dennis, F.C. Undated. Fuel Break Guidelines for Forested Subdivisions and Communities. Colorado State Forest Service. Fort Collins, Colorado.

Dennis, F.C. 2006. Creating Wildfire Defensible Zones. Bulletin No. 6.302. Colorado State University Cooperative Extension, Fort Collins, Colorado (Internet access at www.colostate.edu/library/).

Fire Regime Condition Class. Internet Access: http://www.frcc.gov/index.html.

Firewise. Internet access: http://www. Firewise.org.

Foote, Ethan I.D.; Gilless, J. Keith. 1996. Structural survival. In: Slaughter, Rodney, ed. California's I-zone. Sacramento, CA: CFESTES; 112-121.

Gallamore, A. 2007. Significant Wildfire History within Wildland-Urban Interface: CSFS Golden District and Immediate Vicinity. Colorado State Forest Service, Golden, Colorado.

Hann, W.J. and D.L. Bunnell. 2001. Fire and Land Management Planning and Implementation Across Multiple Scales. International J. Wildland Fire 10:389-403.

Hardy, C.C. et al. 2001. Spatial Data for National Fire Planning and Fuel Management. International J. Wildland Fire 10:353-372.

Jefferson County Zoning Resolution. Amended 12-17-2002. SECTION 50: W-H Wildfire Hazard Overlay District.

National Climate Data Center. Internet access: http://www.ncdc.noaa.gov.

National Firewise Communities Program. Undated video set. Wildland/Urban Interface Hazard Assessment Training (available at http://www.firewise.org).

National Wildfire Coordinating Group. 2004. Fireline Handbook. PMS 410-1. National Interagency Fire Center, Bureau of Land Management National Fire & Aviation Training Support Group, Boise, ID. March.

NFPA. 2002. Standards for Protection of Life and Property from Wildfire. National Fire Protection Association 1144, Quincy, MA.

Omi, P.N. and L.A. Joyce (Technical Editors). 2003. Fire, Fuel Treatments, and Ecological Restoration: Conference Proceedings. RMRS-P-29, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO.

Schmidt, K.M., et al. 2002. Development of Coarse-Scale Data for Wildland Fire and Fuel Management. General Technical Report, RMRS-GTR-87, U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO.

Society of American Foresters. 2004. Preparing a Community Wildfire Protection Plan: A Handbook for Wildland-Urban Interface Communities. Bethesda, MD.

Undated pamphlet. Communities Compatible With Nature (available at www.firewise.org).

U.S. Forest Service, Kansas City Fire Access Software. Internet access: http://famweb.nwcg.gov/kcfast