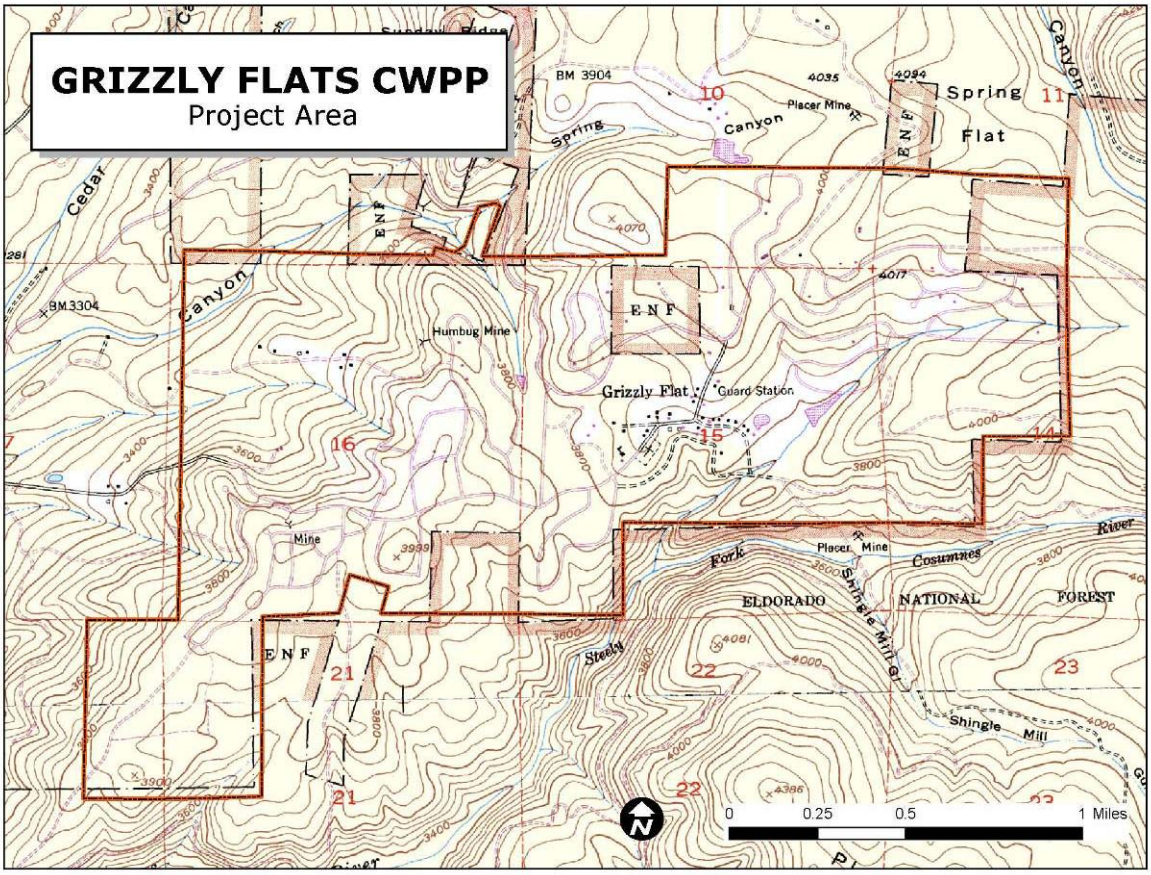
# Grizzly Flats Community Wildfire Protection Plan

**Prepared for the El Dorado County Fire Safe Council**
**And**
**Grizzly Flats Fire Safe Council**



# Signature Page

Grizzly Flats Fire Safe Council

---

El Dorado County Fire Safe Council

---

Pioneer Fire Protection District

---

Amador-El Dorado Unit, California Department of Forestry and Fire Protection

---

Eldorado National Forest, United States Department of Agriculture-Forest Service

---

Prepared By

Barry Callenberger
WILDLAND Rx

Robert Smart
Registered Professional Forester Lic. 300

# Table of Contents

# I Introduction

Community wildfire protection plans assist communities to define priorities for the protection of assets in the wildland urban interface (Healthy Forest Restoration Act 2003). The Grizzly Flats Community Wildfire Protection Plan will:

- Ensure that local efforts respond to and collaborate with federal, state, and regional direction and efforts
- Define treatment priorities
- Identify fuel treatments

Specifically this plan seeks to:

- Provide the residents with an external evacuation route that greatly improves the current situation
- Treat fuels along collector roads in such a manner so they can be used as evacuation routes
- Provide a greater degree of fire safety to their school and community water facilities
- Provide a shaded fuel break on the south, west, and northern flanks of the subdivision
- Provides a chipper program that allows the community to better plan their disposal efforts
- Work with the Pioneer Fire District to build a stronger Defensible Space (includes the LE-38) program that results in fire safe clearance on the individual lots
- Lay the foundation for greater supportive efforts between the Grizzly Flats Fire Safe Council and the Grizzly Flats Community Services District to provide additional water supplies for the community including water needed for fire suppression purposes

Grizzly Flats has been identified as a Community at Risk in the Federal Register. This document addresses the needs for protecting the community from a wildfire. The community is located at the end of a two lane El Dorado County road in the heart of a high fire hazard area. The county road is the lifeline for the community, and for the last six miles or more approaching the subdivision, it is flanked by heavy fuels. It is the only route many of the residents know or have used. Within the community, heavy fuels flank most of the interior roads in the subdivision. These roads are the primary evacuation routes for the community and unless they are treated, residents will be forced to evacuate to the east on national forest system roads that are minimally adequate. The community obtains its water from the Grizzly Flats Community Service District (CSD). The CSD has been very concerned about its ability to meet domestic water needs and knows it does not have the current supply to support a major fire fighting effort.

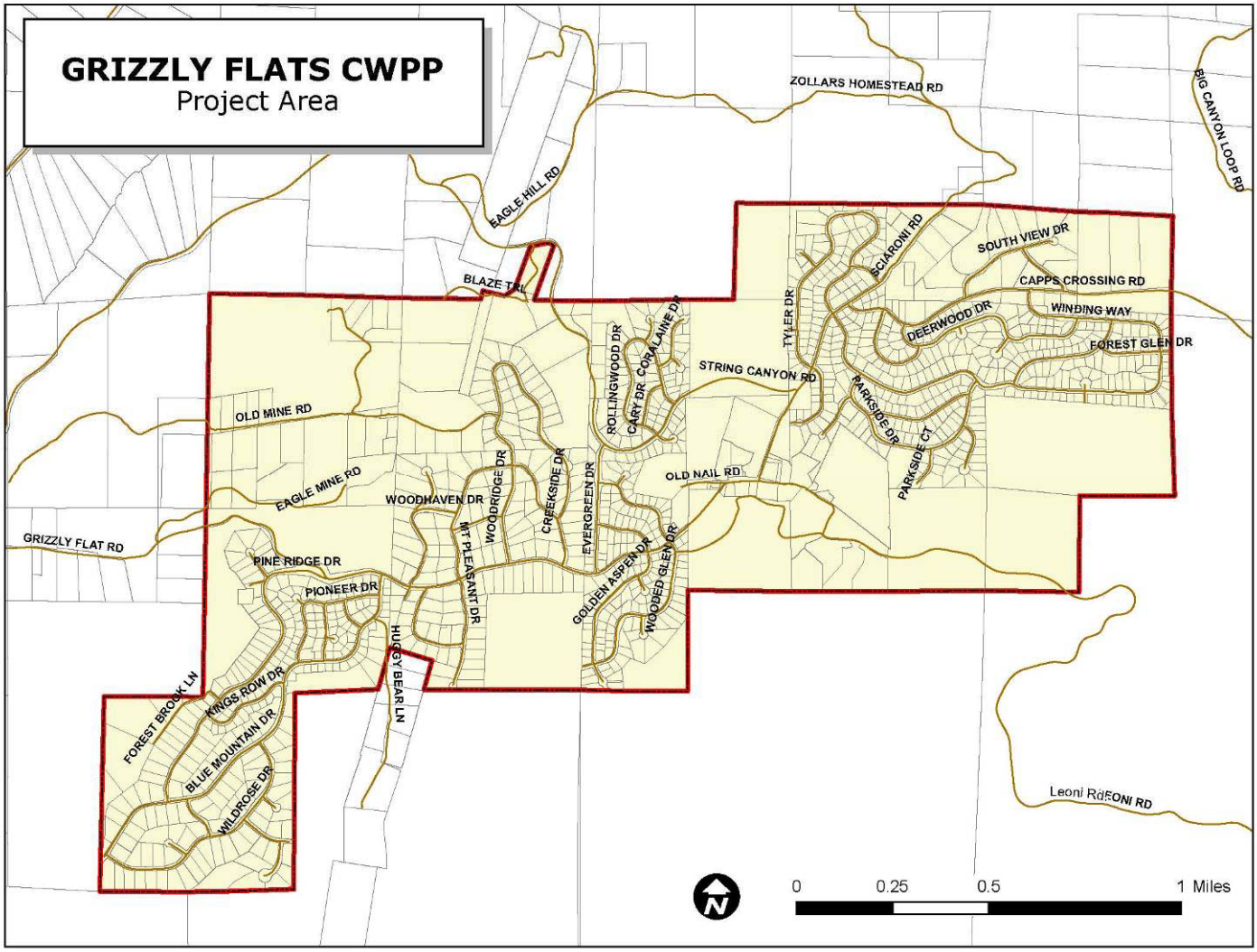
The US Forest Service, by implementing the Last Chance project (see map page 59), has begun the process of protecting the community by placing fuels treatments on their land adjacent to the community boundary.

.

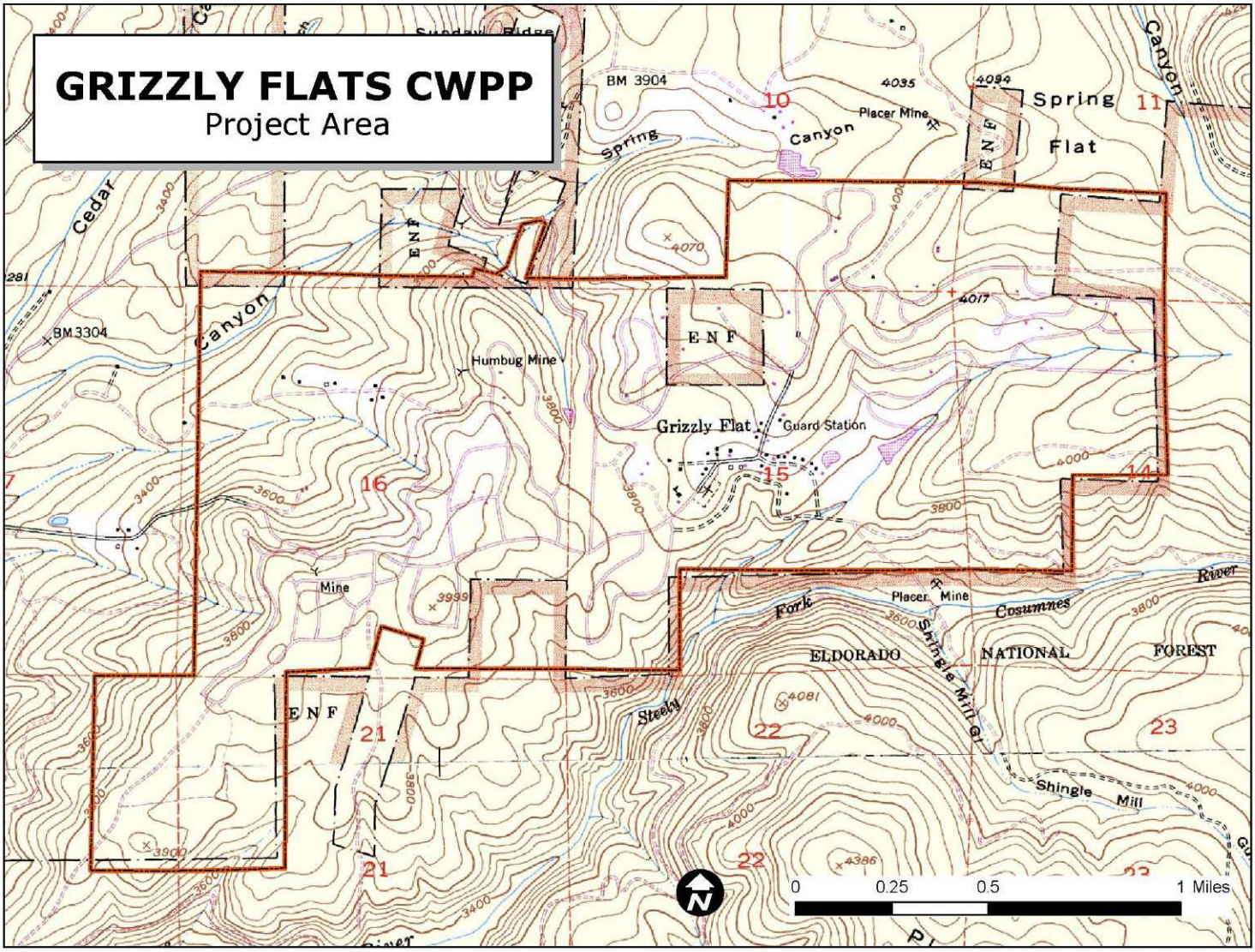
## Planning Area Boundaries

The planning area boundaries for the Community Base Map were established by the Grizzly Flats Fire Safe Council and are primarily the same as the Grizzly Flats Community Services District boundary. The entire community is surrounded by forested land and there are extensive forested areas within the subdivision. Grizzly Flats is a unique, isolated subdivision that shares a water system, road network, and is composed of small lots. Beyond the core community, there are homes that are at risk, and should be considered as located in the Wildland Urban Interface (WUI) areas. These homes are not in conventional subdivisions and generally have larger lots; they depend on wells for their water

The following maps display the boundary for the Grizzly Flats Community as described in this plan. These two maps have formed the base map for the Grizzly Flats Community and are the area considered as the Grizzly Flats Fire Safe Council boundary.




Grizzly Flats Base Map with parcels




Grizzly Flats Base Map with topography

# II. Planning Process

The Grizzly Flats Fire Safe Council, Eldorado National Forest (EDF), California Department of Forestry(CDF), Pioneer Fire Protection District (PFPD), and the El Dorado County Fire Safe Council have all played a major role in the development of this plan. The community of Grizzly Flats has a very active fire safe council with high interest in the community wildfire safety. The Grizzly Flats Community Wildfire Protection Plan (GFCWPP) has been developed in response to a recommendation in the 2004 Grizzly Flats Community Action Plan (CAP) prepared by Doug Leisz and Gene Murphy. (In the CAP, this plan was called a Fire Safe Plan for Grizzly Flats). The CAP and this document were prepared under contracts with the Fire Safe Council of El Dorado County and funded by grants from the U.S. Department of Agriculture-Forest Service. This document follows the Standard Outline and Checklist for Community Wildfire Protection Plans (CWPPs) found in the El Dorado County Wildfire Protection Plan.

The El Dorado County Fire Safe Council has developed an El Dorado County Wildfire Protection Plan. This county wide document prescribes an outline and checklist for the development of CWPPs. The following are excerpts from the county checklist:

- **Step One: Convene decision makers**
  Form a core team made up of representatives from the appropriate local governments, local fire authorities, and state and federal agencies responsible for management.
- **Step Two: Involve Federal, State and Local Agencies**
  Identify and engage local representative of the ENF, CDF, BLM, and other management agencies as appropriate.
- **Step Three: Engage Interested Parties**
  Contact and encourage active involvement in plan development from a broad range of interested organizations and stakeholders.

**The following narrative explains how these steps were addressed.**

During the development of this project, Bill Holmes, Unit Chief of the El Dorado-Amador Ranger Unit from the California Department of Forestry was contacted early in the process. John Berry, Forest Supervisor of the Eldorado National Forest and Frank Mosbacher participated in a special problem solving session. Jennifer Boyd, acting Forest Fire Staff participated in the problem solving session and was frequently in attendance at the County Fire Safe Council meetings where the GFCWFPP was discussed. Kathy Hardy, Placerville District Ranger, received intermittent briefings. Helen Baumann, El Dorado County Supervisor, participated in the development of the action plan.

The following persons functioned as members of the core group for the Grizzly Flats Wildfire Protection Plan. Vicki Yorty, El Dorado Fire Safe Council; Sandi Bush, Lee

Loney, Mary Lou Brown, Don Cherry, Walt Tyler, Jim King, Jack Fourie, and Lynn Shetley, the Grizzly Flats Fire Safe Council; Dick Dawdy, the Grizzly Flats Community Water Service District; Chief Bob Signor, the Pioneer Fire Protection District; Marty Hackett and Todd Crawford, El Dorado County Sheriff's Department (OES); Patrick McDaniels, Suzi Todd, and Phyllis Banducci, California Department of Forestry; and Sean Ferrell, Gary Humphrey, and Laura Heirholzer with the United States Forest Service.

On 7/9/05 a public meeting was hosted by the Grizzly Flats Fire Safe Council at the Grizzly Flats Church. The ENF, CDF, and Pioneer Fire were represented at the meeting. Barry Callenberger and Bob Smart explained how the GFCWPP would be developed and solicited public involvement. The three represented agencies explained their current situation in developing the plan. The El Dorado County Fire Safe Council was represented by Vicki Yorti, along with Rich Englefield and Walt Tyler. Five representatives from the Grizzly Flats Fire Safe Council were identified at the meeting and the representative from the Community Water Service District was identified shortly after the meeting. An article describing the efforts to develop the GFCWPP was included in the August 1 edition of the Grizzly Flats Fire Safe Council Newsletter.

The first core group meeting was held 8/19/05 at the church. The group reviewed the Community Action Plan prepared by Doug Leisz and Gene Murphy. The core group recommended that the Grizzly Flats Fire Safe Council continue to manage the following items from the Community Action Plan: 1. Expanded CSD Charter, 4. Evacuation Plan, 6. Water, and 7. Cooperative Fire Station Be Established. The following action items, while important, are no longer seen as needing work by the Grizzly Flats Fire Safe Council: 5. Firescaping Standards for Structures, 8. Biomass Utilization Be Studied, and 9. Insurance Services Office Fire Ratings. The core group also concurred and expanded on a proposed priority list of projects for the Community Wildfire Protection Plan.

The Grizzly Flats Fire Safe Council met on 9/10/05 and concurred with the core team recommendations from its 8/19/05 meeting. The Council was shown the results of various fire models that displayed how vulnerable Grizzly Flats is to a fire starting below the subdivision, particularly on lands to the west. A second newsletter article describing the progress on the plan was submitted 9/14/05.

The second core group meeting was held 10/7/05 at the Forest Service Guard Station at Grizzly Flats. This meeting focused on the development of the action plan items to be included in the Community Wildfire Protection Plan (CWPP). The core group agreed upon six items that were to be included in the GFCWPP. A third newsletter article describing the progress on the plan, particularly the proposed action plan was submitted 10/17/05. Because of space limitations, the second and the third newsletters were summarized by the newsletter editor.

The Grizzly Flats Fire Safe Council met on 11/5/05. This meeting was very well attended. The action plan developed by the core group on 10/7/05 was modified to add a seventh item. This action item calls for the Grizzly Flats Fire Safe Council to be strong supporters of the Community Service District's efforts to increase water supply for domestic and fire purposes. With the addition of the seventh item, the Grizzly Flats Fire Safe Board voted unanimously to accept the proposed action items for inclusion in the Community Wildfire Protection Plan. Several prospective grant writers were identified.

A final core group meeting was held on 11/29/05 where several adjustments were made to the draft plan. One significant change the group made was to change the title of Action Item VI from LE-38 to Defensible Space Program, which better captures the thrust of the item. Following the meeting, the core group agreed to individually review the plan and give any comments to Lee Loney to be forwarded to Barry Callenberger. Following this final comment period, the completed plan will be forwarded to the Grizzly Flats Fire Safe Council and the El Dorado County Fire Safe Council. Once the Plan is accepted by both Councils, grant writers will submit applications for funding.

# III. Community Description

The Grizzly Flats community is located in El Dorado County, established in the early 1850's as a gold rush town that evolved into a community around the timber industry in much of the 20th century. In 1852 Grizzly Flats was described by John Doble in his Journal as "…a beautiful rolling country before us but no vegetation except tall pine timber was visible."(Doble, 1999) John Doble's Journal and Letters From The Mines Volcano, Mokelumne Hill, Jackson and San Francisco 1851-1865, Volcano Press, Inc , 1999. This book gives the reader a good description of human impacts during the Gold Rush era and a view into vegetation and Native American use of fire.

Grizzly Flats encompasses approximately 1,670 acres made up of 1,235 parcels with 497 homes, and approximately 1250 people. Parcel size range from 1/4 to 40 acres. The community is located east of Diamond Springs, CA and adjacent to the Eldorado National Forest (ENF) western boundary. The main access roads are the Grizzly Flat and String Canyon County Roads. Elevations average about 4000 feet above sea level situated in the Sierra Nevada just above the foothills on the western boundary of the Eldorado National Forest.. The topography within the community is relatively gentle, but String Canyon to the west and the Steely Fork of Cosumnes River to the south form steep canyons with heavy fuel loading. The vegetation (fuels) is primarily a second growth stand of mixed conifers with understory fuels that form a fuel ladder.

The community has a Post Office, school, church, seasonal fire station and a Community Service District (CSD) which is the purveyor of water. The CSD water system stores, treats and distributes metered water. There is also an extensive fire hydrant system. The Pioneer Fire Protection District provides primarily the structure firefighting resources as well as wildfire protection for the community. The Eldorado National Forest provides wildfire protection for the State Responsibility Areas through and agreement with The California Department of Forestry and Fire Protection (CDF). (Grizzly Flats Community Action Plan, Leisz and Murphy, 2004).

The community falls under the local governmental administration of the County of El Dorado, and it is within Supervisor District 2. Helen Baumann is the current Supervisor.

## Emergency Services

Primarily structure fire protection is provided by the Pioneer Fire Protection District. There is a fire station in Grizzly Flat, and currently there is an unstaffed Type 4 engine located in the building. There is fire equipment based at Willow Station, Station 31. This is a volunteer station which is only periodically staffed. The next nearest station with personnel on duty is Station 38 near Mt Aukum approximately 45 minutes away. The Eldorado County Fire District has a structure fire fighting station and the closest ambulance located in Pleasant Valley approximately 45 minutes away. The Pleasant Valley station equipment can respond to Grizzly Flat at times beating Station 38 personnel to Grizzly Flat. The closest CDF stations are River Pines and Camino.

The Grizzly Flats Fire Safe Council is working with the Pioneer Fire Protection District and the Forest Service to establish a joint fire station in Grizzly Flats.

Wildfire protection is provided by the US Forest Service through an agreement with CDF. The U S Forest Service has a station in Grizzly Flats that is occupied during wildfire season from May until November depending on wildfire season length. The station is also occupied by a hand crew. The closest CDF stations are River Pines and Camino, approximately 60 minutes away from Grizzly Flats.

# IV. Community Hazard Assessment and Defensibility Analysis

## Existing Condition/ Area Description(Ferrell, 2003):

- The Steely Fork of the Consumnes River lies to the South of the project area. This river canyon can exert a strong effect on fire behavior. Because the canyon is aligned with the prevailing Southwest winds, they are funneled through the canyon with unimpeded speeds of 10 to 15 mph.
- GIS Fire History Layers show 12 Class C or larger fires between 1914 and 1996, with an average size of 113 acres, within 1 ½ miles of the project area. Between 1960 and 1992 there have been 55 Class A and B fires.
- Analysis shows that in one-third of the project area fires can develop flame lengths greater than 6 ft.
- Stand conditions vary throughout the project area. Along ridge tops manzanita and bear clover are ubiquitous, either occurring in patches or as a decadent part of the understory. Most of the stands have an over-abundance of conifer regeneration. A 3-foot crown base height is the norm.

## Condition Class Description

Condition classes are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire exclusion, timber harvesting, grazing, introduction and establishment of exotic plant species, insects and disease, or other past management activities. An explanation of condition classes can be found in Appendix III. When an evaluation of the condition class for the Grizzly Flats area was done it was determined based on the Fire Return Condition Class (FRCC) map prepared by CDF Fire and Resource Assessment Program (FRAP)

## Effects to Fuels

Fuel models were first determined using the CDF FRAP fuel model layer.

Surface fuels are all material lying on, or immediately above, the ground, including needles or leaves, duff, grass, small dead wood, downed logs, and large limbs. Fire is able to carry from surface fuels through convection into the crowns with relative ease. Ladder fuels are fuels that provide vertical continuity between the ground and the tree canopy. Ladder fuels are present as shrubs, mainly manzanita and conifer regeneration. All fuels affect flame length, which in turn affects scorch, torching, and mortality.

Canopy bulk density, a measure of available canopy fuels (all needles and 50% of the less than 0.25" diameter material), combined with continuous crown closure is needed for sustained crown fire. Single or multiple tree torching can occur whenever surface fire intensity (flame length) generates flames that can carry into the crowns. (Ferrell, 2003)

The following is a list of fuel models found in and adjacent to Grizzly Flats. These models came from CDF Fire and Resource Assessment Program (FRAP) and have been validated through on the ground visits to Grizzly Flats.

| **Fuel Model** | **Flame Length (ft)** | **Rate of Spread (feet/hour)** |
|---|---|---|
| FM 1 - Grasslands | 3.5-4.5 | 700-1050 |
| FM 2 Grass under timber | 6->8 | 360-500 |
| FM 4 Chaparral | >20 | 7500-> |
| FM 5 - Shrub (oak and manzanita) Less than 2 ft, | 5-7 | 880-1180 |
| FM 6 – Dormant Brush, Hardwood slash | 6-8 | 2100-3000 |
| FM 8 - Sparse forest with compact fuels | 1-2 | 50-66 |
| FM 9 - Closed forest overstory compact understory fuels | 2-3 | 178-250 |
| FM 10 - Forest with moderate understory fuels | 6-8 | 300-400 |

The predominate fuel models of concern in the fuel model map and surrounding Grizzly Flats are Fire Behavior Prediction System Fuel Models: Fuel model 2, Fuel model 5, Fuel model 6 and Fuel model 10. All four of these Models can exhibit high rates of spread and fires that are difficult to control once established. A more comprehensive description of each fuel model follows with photos from the area demonstrating the model. The other fuel models, found on the fuel model map, 4, 8, and 9 were considered but are of minor importance in the analysis. Fuel model 28 is a structure model, fuel model 98 is agricultural, and 99 barren land.

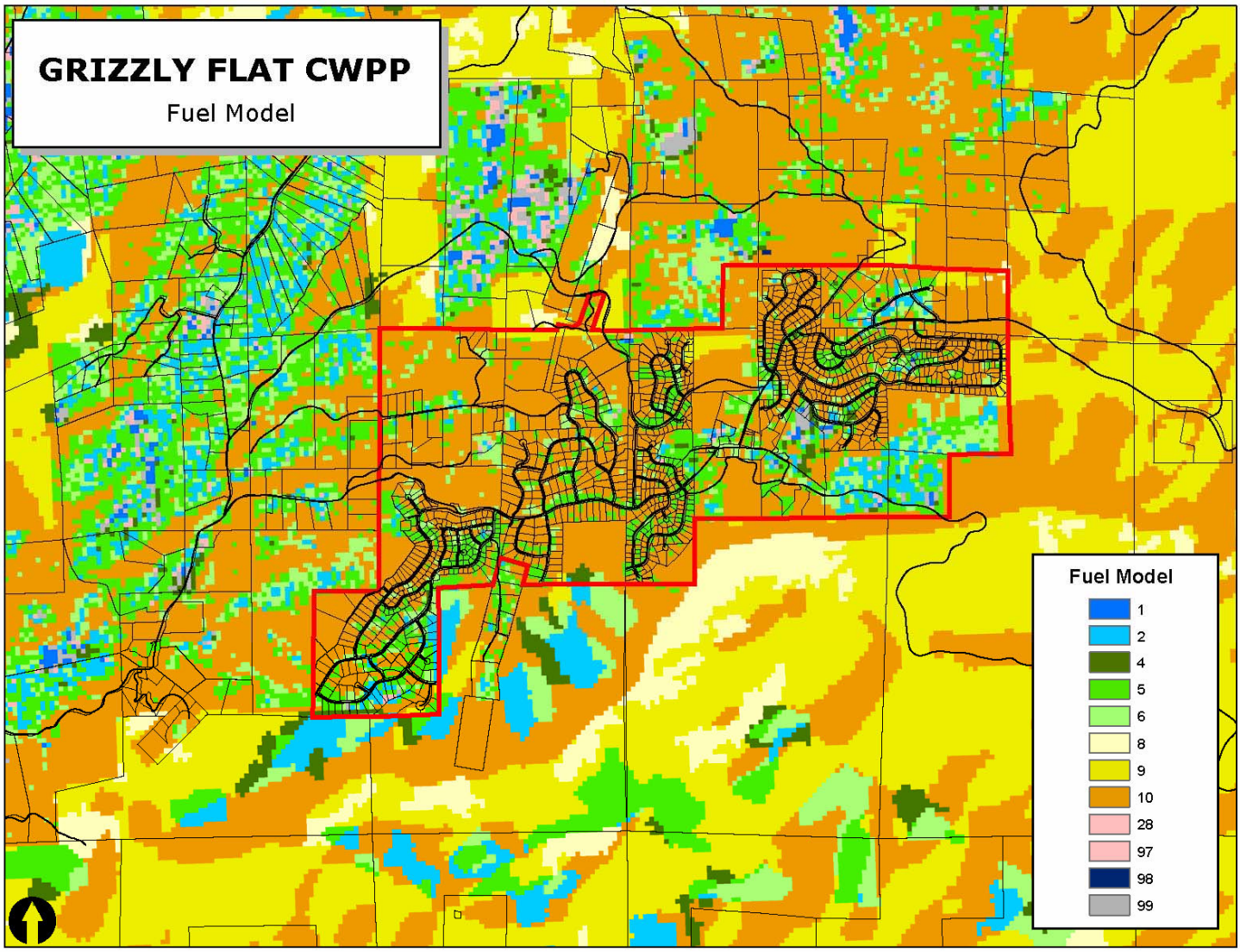
**Fuel Model Description**

Fuel Model 5 (Brush Model) Fire is generally carried in the surface fuels that are made up of litter cast by the shrubs and the grasses or forbs in the understory. The fires are generally not very intense because surface fuel loads are light, the shrubs are young with little dead material, and the foliage contains little volatile material. Usually shrubs are short and almost totally cover the area. Young, green stands with no dead wood would qualify: laurel, vine maple, alder, bear clover or even chaparral, manzanita, or chamise.

Fuel Model 6 (Brush Model) Fires carry through the shrub layer where the foliage is more flammable than fuel model 5, but this requires moderate winds, greater than 8 mi/h (13 km/h) at midflame height. Fire will drop to the ground at low wind speeds or at openings in the stand. A broad range of shrub conditions is covered by this model. Fuel situations to be considered include intermediate stands of chamise, chaparral, and oak brush. Even hardwood slash that has cured can be considered.

Fuel Model 10(Timber Model) The fires burn in the surface and ground fuels with greater fire intensity than the other timber litter models. Dead-down fuels include greater quantities of 3-inch (7.6-cm) or larger limb wood resulting from over maturity or natural events that create a large load of dead material on the forest floor. Crowning out, spotting and torching of individual trees is more frequent in this fuel situation, leading to potential fire control difficulties.

**Fuel Model Map (CDF FRAP)**

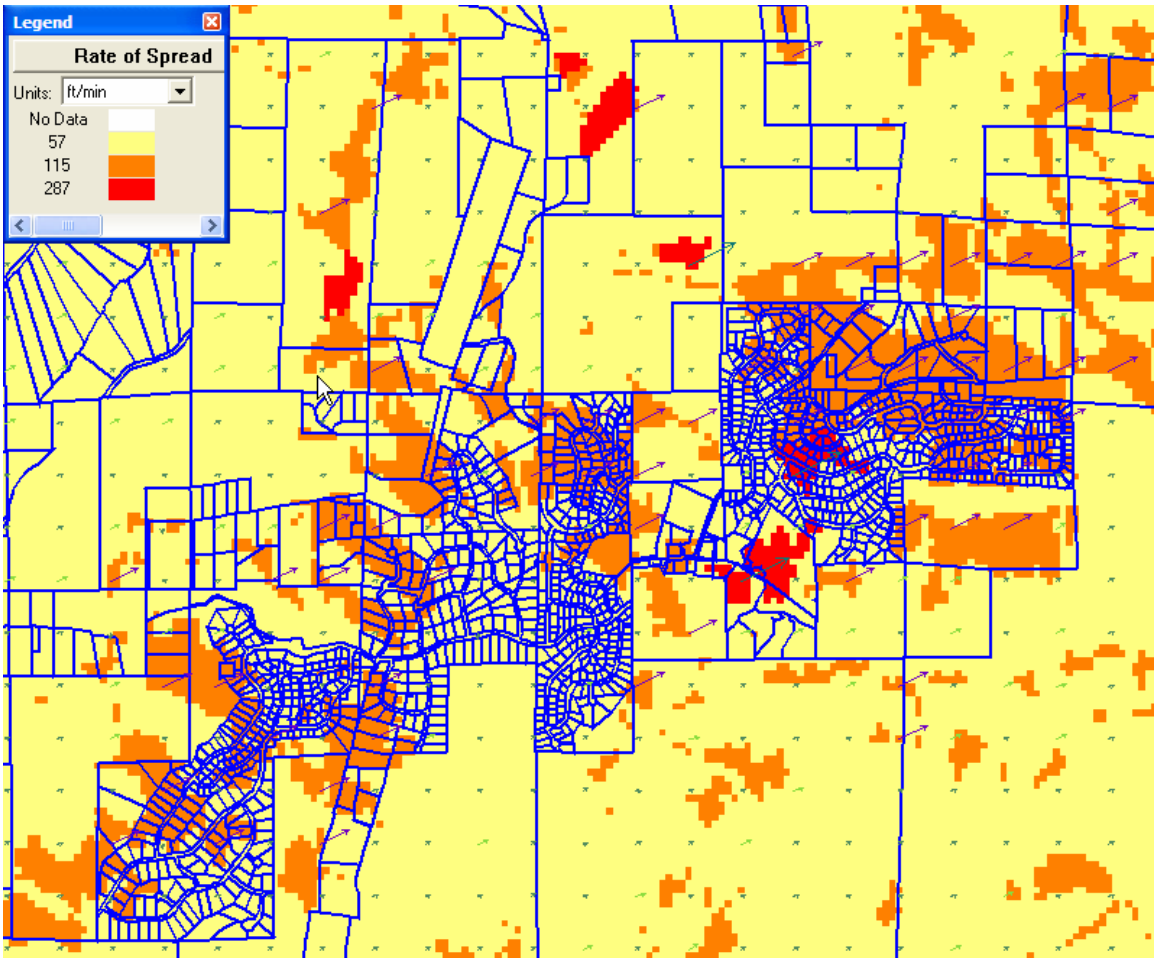


During Fire Behavior Modeling the following weather data was used and comes from analysis done by the Eldorado National Forest

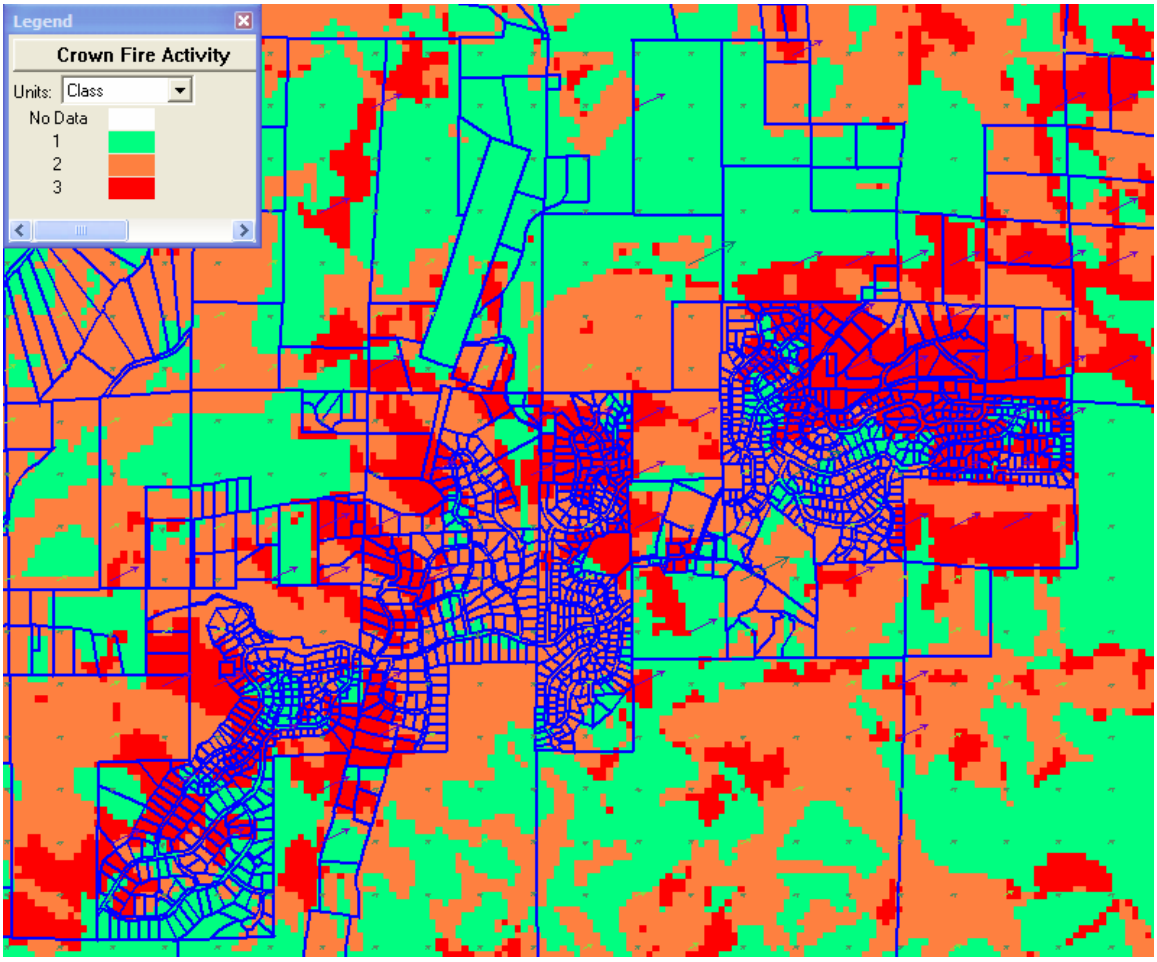
**Moderate fire weather conditions on the Eldorado National Forest 90th percentile weather parameters**
**NFDRS station= Bald Mountain with 25 mph 20 ft. wind speed**

| 1 hour fuel moisture | 10 hour fuel moisture | 100 hour fuel moisture | 1000 hour fuel moisture | 20 ft wind speed | Live fuel moisture |
|---|---|---|---|---|---|
| 5% | 6% | 8% | 10% | 25 | 70 |

**Flammap Rate of spread**



FLAMMAP Crown Fire Activity




Legend Description: 1 Surface fire, 2 Passive Crown Fire, 3 Active crown Fire

**Surface Fire**
A surface fire is one that burns only in the surface fuelbed.

**Passive Crown Fire**
A passive crown fire is traditionally called "torching." It is small scale, consuming single or small groups of trees or bushes. This stage of a crown fire reinforces the spread of the fire, but the main fire spread is still dependent upon surface fire behavior.

**Active Crown Fire**
An active crown fire is associated with a "pulsing" spread. The surface fire ignites crowns and the fire spread is able to propagate through the canopy. After a distance, the crown fire weakens due to a lack of reinforcing surface fire heat. When the surface fire catches up to where the crown fire died, the surface fire intensity again initiates a crown fire "pulse." (Fire Program Solutions)

The previous Crown Fire Potential maps are graphical outputs of potential landscape-scale fire behavior.

A technical description of FLAMMAP can be found in Appendix IV.

# V. Areas of Greatest Threat

The areas of greatest threat are divided into two primary areas, Internal and External.

Internal threats are:

- Lack of staffed structural fire suppression equipment and the need for a Community Fire Station in Grizzly Flats. Even though this was not addressed directly in this document it continues to be the biggest concern of the citizens. Chief Signor PFPD has made big steps to improve the protection capabilities for Grizzly Flats and the steps need to continue so that Grizzly Flats is properly protected.
- Fire cutting off evacuation routes and routes of travel for suppression equipment
- The Grizzly Pines elementary school not getting the opportunity to evacuate
- Failure of the residents to have adequate Defensible Space for their homes. (Violations of the California Public Resources Code (PRC) 4291)

PRC 4291 violations are a concern of Chief Signor, PFPD. He has proposed a program in this document that calls for education and enforcement. Along with the help of the Grizzly Flats Fire Safe Council this concern should be resolved.

The evacuation routes are of a primary concern and have been addressed in this document. The Grizzly Flats Projects 1, and 3 were developed to deal with the travel routes

The Grizzly Pines Schools has developed an evacuation plan but the bus that is to be used for evacuation must come from Pioneer Middle School and is 30 minutes away. This could lead to the need for the school to provide a safe area to protect the students until evacuation can be safely made. The project Grizzly Flats 2 (see page 36) is a project to provide a safer area for the school.

External threats:

- The threat of a wildfire coming from the Cosumnes River drainage to the south, which has been addressed by the Forest Service in the implementation of the Last Chance Project.
- Threat from the west and south west the predominate wind direction which can be mitigated by the proposed Project Grizzly Flats 4
- There is also a threat from the north and northeast from a strong northerly flow during the fall and late summer which will threaten the community from the north. The proposed projects to the north of Grizzly Flats will help to mitigate that threat Grizzly Flats 5, 6, and 7 (pages 43-50)

# VI. Community Preparedness for a Wildfire Emergency

The Grizzly Flats Fire Safe Council has been very aggressive at preparing the community for a wildfire. The Council has been proactive in educating the community of the hazards and is enthusiastic about continuing to prepare the community for a wildfire. The US Forest Service has implemented projects to prepare the southern boundary of the community for a wildfire by implementing a project to reduce the wildland fuels. The interior of the community and the western edge as well as the northern and eastern boundaries are what this plan addresses.

The evacuation routes are very important due to the location of the community and the difficulty of evacuation in the event of a wildfire near the community. The evacuation routes can be easily cut off due to the location of the only access to and from the community. The roads are narrow and located on ridge tops that can easily be overrun by a wildfire or clogged by responding suppression equipment. It is important that these routes be cleared in order to protect them from wildfire.

# VII. Community Partnership and Role of Pioneer Fire Protection District

The following are recommendations prepared by Bob Signor, Fire Chief Pioneer Fire Protection District for inclusion in the community wildfire protection plan.

## Community Exterior Fire Defenses

The Pioneer Fire Protection District is committed to the support and participation, to the extent possible, in the community wildfire protection plan efforts by the Grizzly Flats Fire Safe Council (GFFSC), United States Forest Service (USFS), California Department of Forestry and Fire Protection (CDF) and private property owners. An example of private property owners efforts is the fuel modifications made on Arctic Lane to develop defensible space within and adjacent to the Last Chance Fuel Break. Again, the District is committed to the cooperative effort and the partnerships that have been developed.

## Community Interior Fire Defenses

The Pioneer Fire Protection District not only has co-jurisdictional responsibility for the enforcement of Fire Safe Regulations (defensible space), but is committed to taking a leadership role and cooperative effort with partners within the community. Those partners are the GFFSC, Grizzly Flats Community Service District (GFCSD), USFS, Citizen Volunteers, El Dorado County Fire Safe Council (EDCFSC) LE 38 inspectors, CDF, El

Dorado County Department of Transportation (EDCDOT), Pacific Gas and Electric (PG&E) and Pioneer Fire Protection District (PFPD) career and volunteer firefighters.

## Defensible Space Compliance

The defensible space program will be comprised of three components: education, enforcement, and abatement.

The first step of the program is to develop a cooperative program to do homeowner education winter 2005 and 2006 in the nine units within Grizzly Park using volunteers from GFFSC and PFPD; and career PFPD personnel and EDCFSC LE 38 inspectors. Training will be provided by EDCFSC defensible space coordinator Susan McKenzie. In concert with premise inspections the fire protection district will be working with EDCDOT on roadside hazard reduction and PGE powerline clearances.

In the spring of 2006 partners will mail out self inspection forms to be returned by homeowners. In late spring of 2006 begin targeted inspections, and evaluation of self inspection results, The first home inspections are intended to be educational with emphasis on ground and ladder fuels compliance.
Summer and fall of 2006 all partners will participate in second inspections these inspections will be a follow up to the education component to determine if a third inspection will be necessary
.
Third inspections and possible citations will be completed by PFPD, CDF and USFS qualified personnel if necessary.

Winter 2006 education cycle begins again.

Late spring of 2007, if ground and ladder fuels are not a significant problem, begin addressing overstory and crowns closure.
If vacant lots continue to be a problem, consider an abatement ordinance and contract clearing.

### Community Water Supply

The community water supply and fire hydrant system is critical to effective community interior and exterior fire defenses. The PFPD has a vested interest in the GFCSD water delivery system and proposes a partnership to maintain and flow test fire hydrants with in the CSD. After receiving training from CSD staff, career and volunteer Firefighters will begin aggressive hydrant maintenance and testing in concert with the inspection teams. Future maintenance and testing will be done on a program scheduled basis coordinated by the Fire District.

# VIII. Action Plan

Most of the projects planned are located on private property therefore it is important that the property owners whose property will be treated are brought into the process early to gain there support for the work to be done. It is recommended that the names of the property owners be listed and letters with the proposed projects outlined be sent to them as soon as possible

I. Fuels treatment on primary evacuation route (Project GF-1)

Project will treat brush and small trees (less than 10 inches in diameter) for 100 feet on either side of String Canyon Road and Grizzly Flat Road. The project will extend from Sciaroni Road to Caldor Road. Trees will be pruned up to 8 feet. Approximately 120 acres will be treated. Maintenance by mastication, herbicides, goats and others will be discussed in final plan.

Estimated cost of $109,600

II. Fuels treatment on selected collector roads that feed into main evacuation routes Project GF-3

Except for Logan's Grade, the projects identified along collector roads overlap the 100 foot fuels treatment required of lot owners. This project should ensure some fuels treatment will occur in timely way once lot owner agreements are obtained.

A. Grizzly Flat Road

1. Logan's Grade from Blue Mountain to Eagle Mine Road—treat brush and small trees 30 feet on downhill side and 30 feet on uphill side.
2. Logan's Grade from Eagle Mine Road to the intersection with String Canyon Road—treat 30 feet on either side of the road.
3. Blue Mountain to the cemetery –treat 20 feet on either side of the road.
4. From cemetery to Leoni road (includes the narrow portions)25 feet on either side of the road with Sciaroni Road-

B. Sciaroni Road

1. From Grizzly Flat Road to String Canyon Road—treat 30 feet on either side of the road.
2. String Canyon to Grizzly Flats Community Service District—treat 20 feet on either side of the road.

C. Capps Crossing Road

Treat 30 feet on either side of the road to the Eldorado National Forest Boundary, and where the road crosses through the private property in Section 14 ( the old Gilbert's property).

D. Winding Way—Starting at each end of Winding way, treat 20 feet on either side of the road ~~to~~ Meadow Glenn.

E. Meadow Glenn-Treat 20 feet on either side

F. Forest Glenn will be treated on either side for 20 feet and lengthened to connect it with Capps Crossing Road. Winding Way will not be treated east of either end of Meadow Glenn (This route will require road construction and a special use permit from the Forest Service).

G. Tyler Road—Sciaroni Road to the School—treat 20 feet on either side of the road.

H. Blue Mountain Road—From Grizzly Flat Road to Pine Ridge Drive intersection—treat 20 feet on either side of the road.

I. Old Mine Road—treat 20 feet on each side down from Creekside Drive to the last house

J. Creekside Drive—From Old Mine Road to Mt. Pleasant Drive—treat 20 feet on each side

K. Woodridge Drive—From Mt. Pleasant Dr. to Grizzly Flat Road—treat 20 feet on either side of the road

L. Evergreen—From Grizzly Flat Road to String Canyon Road—treat 20 feet on either side.

Estimated cost of action item II is $58,065 (Does not include any costs for road construction of Forest Glenn construction).

III. Special Projects

A. Treat fuels to establish a 200 foot defense zone around the Grizzly Pines School. This project will be done through the leadership of the Grizzly Flats Fire Safe Council and work will be seen as a contribution by the community as part of grant applications. The school is located on Forest Service property and wil require permission and coordination with the Placerville Ranger District.

B. Treat fuels around the Community Water District Facilities--- (Estimated 7-15 sites). This work will be done by the Community and will be treated as a contribution toward grant applications.

Estimated value of contributed work needs to be established

IV Chipping /mulching program.

Assist lot owners in the community meet the State and County standards for fuels treatment by developing a chipping/mulching program.
The Grizzly Flats Fire Safe Council will work with the El Dorado County FireSafe Council to establish two chipping weeks where the chipper will be exclusively available for the residents of Grizzly Flats. A program to help economic disadvantaged or persons with physical limitations is currently being developed by the El Dorado County Fire Safe Council and will be supported by the Grizzly Fire Safe Council. The intent is for this to supplement the El Dorado County Fire Safe council chipping program

Estimated cost for the two chipping weeks is $6400.

V. Develop a series of shaded fuel break on the south, west and northern flanks of the lands within the community base plan.

Using the services of a registered professional forester, contact the identified landowners and develop and execute an intensive fuels treatment prescription within the timber harvest plan that will result in a shaded fuel break for the community.

If all four units are treated, the estimated cost is $685,900. In addition there will be an additional 25% cost to cover administration and coordination work. The priority areas will be units 1 and 2.

VI. Seek funding to strengthen the Defensible Space Program (includes LE-38 program).

The Grizzly Flats FireSafe Council will seek $6000 to enhance the Defensible Space Program which includes the LE-38 Program. Various proposals are expected that will enable the program to improve the defensible space situation within the subdivision; for example, the establishment of advisors.

VII. The Grizzly Flats Fire Safe Council will strongly support the efforts of the Grizzly Flats Community Service District to obtain additional water for domestic and fire suppression purposes.

No costs are associated with this action item.

## PROPOSED FUEL MANAGEMENT PROJECTS

Fuel management projects were developed based on site-specific evaluations of fuel conditions, discussions with representatives of the fire districts, and after considering the location of fuel reduction projects proposed or implemented by the Eldorado National Forest. The Eldorado National Forest has completed fuel treatment project on a large area within the wildland urban interface specifically the Last Chance Fuels reduction Project. Field reconnaissance activities carried out as a part of the present planning effort indicate that treatments will result in a substantial change in local fire behavior.

Proposed projects are strictly based on fuel hazards and operational constraints. Environmental and regulatory constraints have not been fully considered at this level of planning. Refined project descriptions based on environmental and regulatory constraints will be developed in the future.

Three types of fuel management projects are proposed: those in the wildland urban interface, those on open space lots within communities, and defensible space zone clearance as defined by the California Public Resources Code 4291, or Living with Fire requirements adopted by the El Dorado County Fire Safe Council

The wildland urban interface was established as a 0.25 mile buffer around all Community boundaries. Projects on open space lots include common areas owned by the homeowner or federal, state or local governments. The creation of defensible space by the landowner is critical because it represents the first zone of fire safety for an individual residence, and may provide the only margin of safety prior to the implementation of other fuel treatments.

## FUEL TREATMENT ISSUES

Numerous techniques and treatments will be required to reduce fuel hazards. Effective treatment design should reflect a consideration of vegetation, topography, environmental constraints, and proximity to residences. This discussion provides a summary of some of the issues that could affect individual projects.

### Program Issues

Regeneration, growth, and mortality affect current vegetation structure and diversity. Fuels treatment objectives should focus on establishing desired conditions and implementing strategies to achieve those conditions.

Effective fuel treatments can modify fire behavior under most weather conditions. However, the probability of affecting fire behavior declines substantially under extreme weather conditions. Therefore, treatment objectives should focus on reducing the likelihood of stand-replacement fires rather that protecting or preserving stands.

Projects should be strategically located to modify fire behavior and provide firefighters with safe environments. Strategic locations are generally along roads, on flat ground, the base of slopes, or along ridge tops. Mid-slope locations are rarely identified as strategic.

All fuel treatments should take into consideration surface or ground fuel loading. In forested areas, mid-story and crown structure also should be considered. Mid-story fuel ladders allow fire to move vertically, while crown density facilitates horizontal movement. In a review of four large fires in forested areas it was concluded that "while surface fire intensity is a critical factor in crown fire initiation, height to crown, the vertical continuity between fuel strata, is equally important" (Omi and Martinson 2002). Removing fuel ladders increases crown-base height, thereby reducing the potential for vertical movement into the canopy.

Reducing crown density can reduce the potential for horizontal movement. However, excessive reductions in crown density can affect surface fire behavior. Thinning opens the canopy thereby allowing more sunlight to reach the ground surface. As a result, the production of grasses, shrubs, and seedling trees increases. If these fuels are not treated, surface fuels and fire intensity increases. Thinning also increases mid-canopy and surface windspeed. Additional vegetation, higher windspeed, and drier summer conditions tend to increase surface fire behavior.

## Treatment Prescriptions

The following treatment techniques are typical of those currently used by the, private forest landowners, the U. S. Forest Service, and described in the Sierra Nevada Framework. It was assumed that no new roads would be constructed to implement the projects. The following is a brief description of potential treatment techniques that could be employed to accomplish fuels treatment in and around the Grizzly Flats community. A more detailed description of the treatments is found in Appendix II.

**Mechanical Thinning**: Thin stands from below by removing trees up to 30 inches in diameter at breast height (DBH). The thinning is done by starting with the smallest diameter class; removeing sufficient suppressed and intermediate trees to achieve an average crown base height (distance from the ground to the base of the leaf [needle] crown) of at least 20 feet and spacing of 10 feet between the crowns of residual trees. On drier sites and on southern aspects, favor the removal of white fir over all other conifer species.

Retain 2-5 snags per acre (minimum size of 24 inches dbh) and 3-7 large downed logs per acre (minimum size 14 inches dbh and 20 feet long). The trees are removed by whole tree yarding and or disposeing of slash in stands by hand piling and burning, or by chipping and scattering.

**Mastication**: Use rubber tired or low impact tracked vehicles to cut, chip, and scatter all shrubs and small trees up to 10 inches dbh on site. White fir should be the priority for tree removal. Brush cover should be reduced by creating a mosaic of treated and untreated shrubs. Openings between shrubs should be twice the height of the shrubs and 50-70% of the shrubs should be treated. Brush that is treated should be cut to the maximum stump height of 6 inches. No individual pieces of cut material should be greater than 4 feet long. All masticated stumps should be cut to within 6 inches of the ground. Debris should not average more than two inches in thickness over the entire project area. All cut vegetation should be kept within the unit boundaries. Any cut vegetation falling into ditches, roads, road banks, trails, or adjacent units should be removed immediately.

**Tractor Piling or Grapple piling:** Use of rubber tired or tracked machines to pile slash, brush and small trees. Where needed trees under 8" DBH will be thinned out to 20' spacing. Most trees over 8" DBH will not be piled. Live oak will be thinned out in many places. Generally Black oak will be left on site Protection of desirable residual trees from skin ups and damage is very important. Slash piles should not be piled near residual tress so when they are burned the piles will not damage trees remaining onsite. Contractor should create clean piles that are free of dirt and no larger then 15 feet tall and 15 feet in diameter. The piles should be partly covered with a 6'x6' piece of water proof material to allow them to be burned after significant rain fall.

**Prescribed Burning:** Low intensity broadcast burning should be used to reduce all 100-hour fuels (< 3 inches diameter) by 60-80%, the brush component by 50%, and 75% of trees less than 3 inches dbh. Use fire to prune ladder fuels by scorching the lower 1/3 of branches on 100% of trees less than 8 inches dbh. Retain large down logs (20 inches in diameter or greater) to a maximum density of five per acre. Maintain 60 to 70% of ground cover on slopes 35% or less. Additionally, acceptable standards for prescribed fires should include:

- 13 foot maximum scorch height; and,
- less than 10% mortality in conifers > 12 inches dbh.

Do not ignite fires in Steam Environmental Zones (SEZ). However, allow backing fires to enter SEZs affecting a maximum of 45% of the area in a mosaic pattern. No more than 50% of the 100-hour fuels (<3 inches diameter) should be consumed in SEZ's.

**Hand Thin and Pile Burn**: Hand thinning and pile burning should be accomplished using a ten person hand crew with chainsaws. Starting with the smallest diameter trees, remove trees up to 6 inches dbh to achieve spacing of 20 feet between residual crowns . All dead and down material greater than 3 inches in diameter and up to 8 inches in diameter and all cut material regardless of size should be piled for burning. Piles should be constructed compactly, beginning with a core of fine fuels and minimizing air spaces to facilitate complete combustion. Piles should be constructed away from trees to prevent damage when burning and should not be taller than 5 feet. If broadcast burning is not scheduled for the area, then a fire line should be surrounded around each pile. Piles will be covered with a 4x4 foot square of water resistant paper to cover the fine material in the center of the piles.

**Chipping:** Chipping may be used as an alternative to burning. It redistributes forest vegetation that is cut by mechanical thinning or hand thinning. The chips may be removed from the site and converted to energy for other products, or they can be scattered throughout the project area.

**Grazing:** Use of Goats sheep, horses or cows to reduce the small fuels such as grass, Black Berries and small brush

**Cost Estimates**

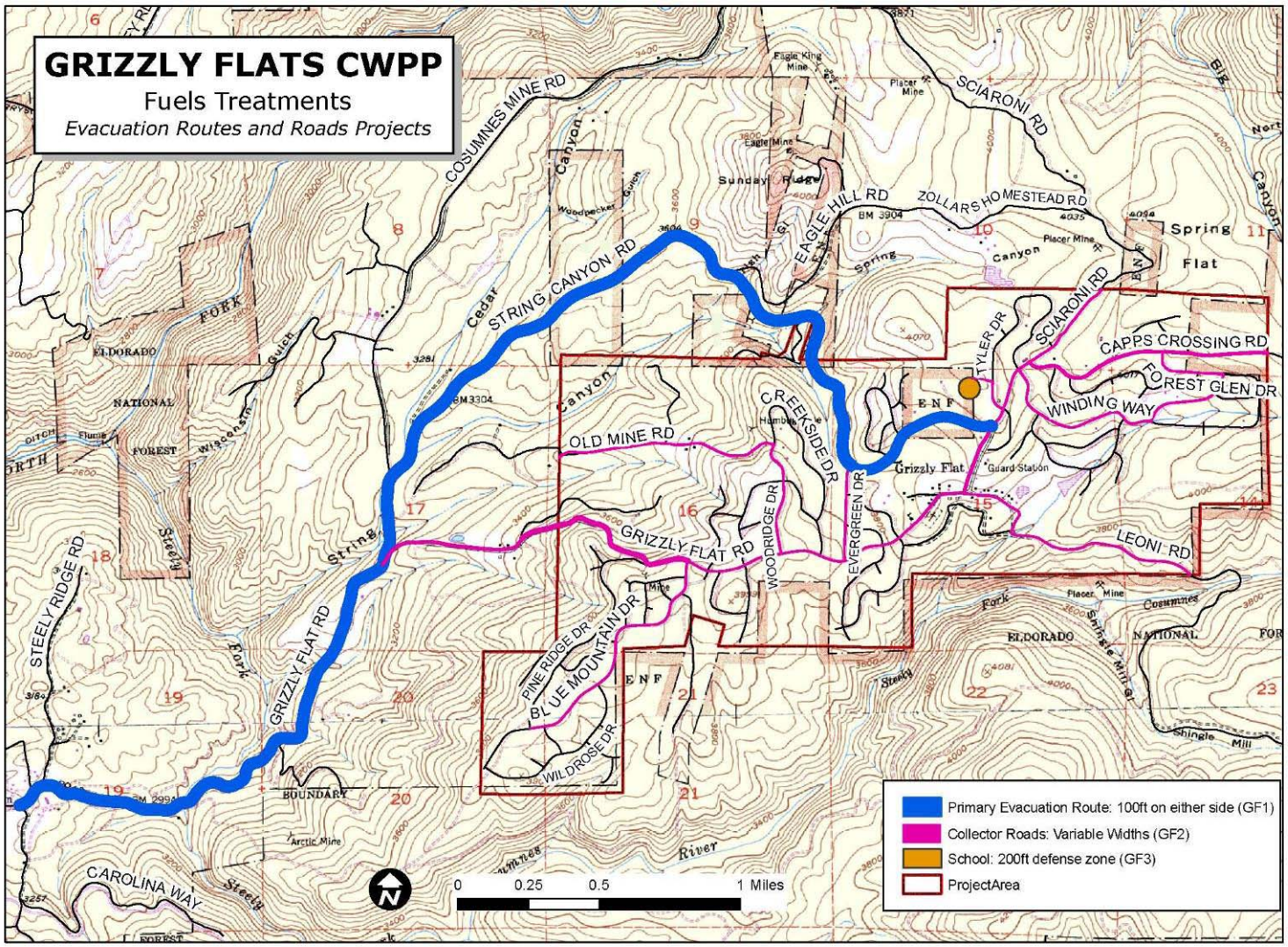
Cost estimates developed as part of this planning effort are based on data from the resource conservation district and costs for similar work in Amador County. Cost estimates vary widely because of fuel loadings, operational constraints, and crew capabilities. The costs are limited to the direct cost of project implementation. These cost estimates **do not include** offsetting revenue that may be generated by providing commercial products, costs associated with project planning or preparation of environmental compliance reports, or administrative overhead incurred during implementation.

Administrative cost are approximately 40% of the total project costs if the project is estimated to be $100,000 for on the ground implementation the administrative costs would be $40,000. Administrative costs would include environmental documentation, financial administration, project layout and contract administration.

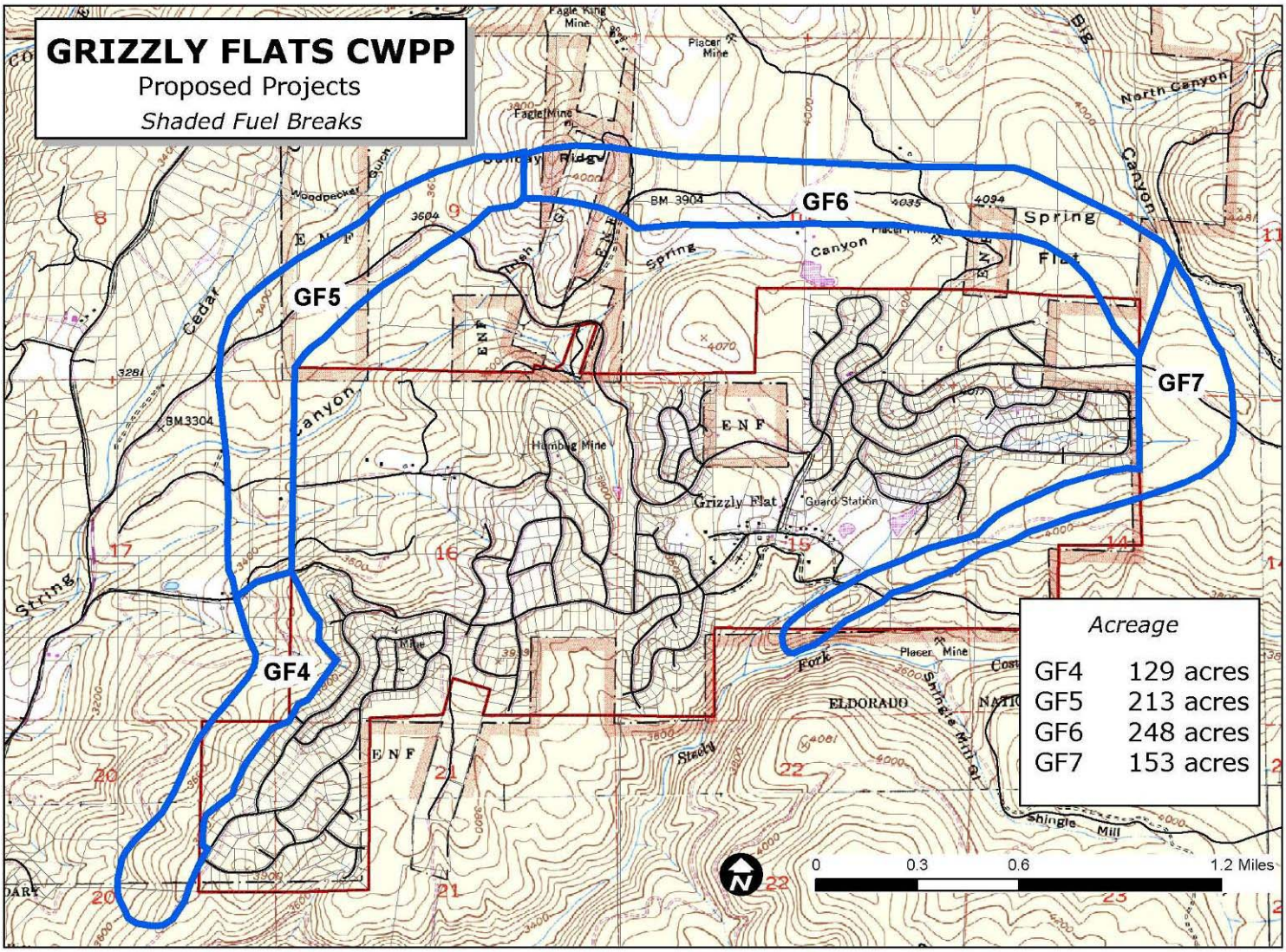
**Prescription specific cost estimates.**

| Fuel Reduction Treatment | Cost per acre |
|---|---|
| Mechanical thinning (urban interface) | $1,000-$3,200 |
| Mastication | $700 - $1,500 |
| Prescribed burning | $400-$900 |
| Hand thin and Chip | $850 - $1,350 |
| Pile Burn | $300 - $700 |
| Machine Pile | $185-$275 |

# IX. Projects and Prescription Recommendations and Project Maps




**Roadside Hazard Reduction Projects**




**Shaded Fuel Break Project Map**

| PROJECT | ROADSIDE CLEAR* | ACRES | DESCRIPTION | HAND CUT | PILING | CHIP | MASTICATION | Total | Administrative Cost** |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Costs | | | | | |
| GF 1 | 100 | 120 | String Canyon | $16,000 | | $3,600 | $90,000 | **$109,600** | $43,840.00 |
| | | | | | | | | | |
| GF 2 | | 1 | School Defense Zone | $800 | | $180 | | **$980** | $392.00 |
| GF 3 | 20 | 1.3 | Woodridge | $1,040 | | $234 | | $1,274 | $509.60 |
| | 20 | 1 | Tyler Rd | $800 | | $180 | | $980 | $392.00 |
| | | | | $0 | | $0 | | $0 | $0.00 |
| | 20 | 3.1 | Sciaroni Rd 2 (StrCanyonRd to GFCSD) | $2,480 | | $558 | | $3,038 | $1,215.20 |
| | 30 | 2 | Sciaroni Rd 1 (GrFlatsRd to StrCanyon Rd) | $1,600 | | $360 | | $1,960 | $784.00 |
| | 20 | 3.8 | Old Mine Rd | $3,040 | | $684 | | $3,724 | $1,489.60 |
| | 20 | 4.7 | Leoni Rd | $3,760 | | $846 | | $4,606 | $1,842.40 |
| | 20 | 1.2 | Grizzly Flats 4 (cemetery to Gr-Caldor) | $960 | | $216 | | $1,176 | $470.40 |
| | 20 | 4.8 | Grizzly Flats 3 (BlueMtRd to cemetery) | $3,840 | | $864 | | $4,704 | $1,881.60 |
| | 30 | 4 | Grizzly Flats 2 (EagleMine to StrCanyon) | $3,200 | | $720 | | $3,920 | $1,568.00 |
| | 30 | 15 | Grizzly Flats 1 (BlueMtRd to EagleMineRd) | $12,000 | | $2,700 | | $14,700 | $5,880.00 |
| | 20 | 1.7 | Evergreen Dr | $1,360 | | $306 | | $1,666 | $666.40 |
| | 20 | 0.75 | Creekside Dr | $600 | | $135 | | $735 | $294.00 |
| | 30 | 4.4 | Capps Crossing | $3,520 | | $792 | | $4,312 | $1,724.80 |
| | 20 | 4 | Blue Mountain Dr | $3,200 | | $720 | | $3,920 | $1,568.00 |
| | 20 | 7.5 | Winding Way | $6,000 | | $1,350 | | $7,350 | $2,940.00 |
| | | | **Collector Roads Total cost** | | | | | **$58,065** | $23,226.00 |
| GF 1 | | 120 | GF 1 Acreage | | | | | | |
| GF 2 | | 1` | GF 2 Acreage | | | | | | |
| GF 3 | | 59.25 | GF 3 Acreage | | | | | | |
| | | | | | | | | | |
| GF 4 | | 110 | GF 4 Acreage | | | | | **$144,100** | $57,640.00 |
| GF 5 | | 213 | GF 5 Acreage | | | | | **$191,700** | $76,680.00 |
| GF 6 | | 248 | GF 6 Acreage | | | | | **$223,200** | $89,280.00 |
| GF 7 | | 141 | GF 7 Acreage | | | | | **$126,900** | $50,760.00 |
| | | | | | | | | | |
| | | Cost/Acre | | | | | | | |
| | | $800 | Hand Cutting | | | | | | |
| | | $160 | Hand Piling | | | | | | |
| | | $180 | Chipping | | | | | | |
| | | $900 | Masticaion | | | | | | |
| | | $450 | Tractor Piling | | | | | | |
| | | $350 | Pile Burning | | | | | | |
| | | | | | | | | | |
| | | | * From the outside edge of the road | | | | | | |
| | | | | | | | | | |
| | | | **Administrative cost are an estimate of overhead for grant management, on the ground supervision, and Environmental documets (40% was used) | | | | | | |
| **Draft 12/08/05** | | | | | | | | | |

Table: Summary of Projects and Costs

## Project Description

**Roadside Clearing**: Roadside clearing can occur up to 200 feet from both sides of the road. Vegetation removal will follow the mastication prescription. Techniques may include both mastication and hand thinning. The object of the treatment is to reduce fuels along the primary road into Grizzly Flats for safe ingress and egress. This project is located on private property along the Grizzly Flat Road and String Canyon Road from Cole's Station to the intersection of String Canyon and Sciaroni Road.

## Prescription/Treatment

The treatments prescribed can be implemented based on slope and access considerations when requesting funding.

**Mastication:** The use rubber tired or tracked vehicles to cut, chip, and scatter all shrubs and small trees up to 10" dbh on site. White fir and cedar should be the priority for tree removal. Trees should be spaced approximately 20 feet between the boles. Brush cover should be reduced by creating a mosaic of treated and untreated shrubs. Openings between shrubs should be twice the height of the shrubs and 50-70% of the shrubs should be treated. Brush that is treated should be cut to the maximum of 6 inches in height. No individual pieces of cut material should be greater than 4 feet long. All masticated stumps should be cut to within 6 inches of the ground. No debris should average more than 6 inches in depth over the entire project area. All cut vegetation will be kept within the unit boundaries. Any cut vegetation falling into ditches, roads, road banks, trails, or adjacent units should be removed immediately.

**Hand Thin and Pile Burn**: Hand thinning and pile burning should be accomplished using a ten-person hand crew with chainsaws cutting material up to 6"dbh with 20'x20' spacing between leave trees. All dead and down material greater than 3 inches in diameter and up to 14 inches in diameter and all cut material regardless of size should be piled in piles for burning.

Piles should be constructed compactly beginning with a core of fine fuels and minimizing air spaces to facilitate complete combustion. Piles will be constructed no taller than 5 feet and away from trees to prevent damage when burning. If the areas will not be broadcast burned, then each pile will be lined with fire line. Piles will be covered with water resistant paper or plastic a 4'x4' square to cover the fine material in the center of the piles.

**Chipping.** Chipping may be used as an alternative to burning. It redistributes forest vegetation that is cut by mechanical thinning or hand thinning. The chips may be removed from the site and converted to energy for other products or scattered throughout the project area.

**Identification of Protected Species or Other Critical Resources:** Describe any measures that must be taken to protect critical wildlife habitat, historic or culturally sensitive sites, artifacts or other resources, and plant and animal species protected by statute.

Other wildlife habitat, critical species, and cultural resources may be present in the project area and require mitigation measures. Project planning should include implementation of surveys and mitigation measures as dictated by regulatory statutes.

With all environmentally sensitive areas, identification and avoidance during project implementation is important. Should any sensitive resources be found during project implementation, the area should be avoided until the appropriate agencies review the situation.

**Other Considerations:** Describe any other consideration that must be taken into account to successfully complete this project such as permits, clearances, approvals, etc.

Compliance measures for Environmental documentation state and or federal (NEPA, CEQU), or their functional equivalents will need to be addressed prior to project initiation.

If burning is chosen the appropriate permits must be acquired for the El Dorado County Air pollution Control District and the local CDF and/or Pioneer Fire Protection District.

## Implementation Cost

These costs only include actual treatment costs no administrative costs or environmental documentation costs are included.

Hand Cutting/Chipping or burning $980/acre= $19,600

Mastication $900/acre= $90,000

Total Cost = $109,600

**Project Maintenance Requirements:**

Brush and understory fuels should be treated with prescribed fire, hand cutting or the use of herbicides should be planned for every 5 – 7 years to remove ladder fuels and keep surface fuels at appropriate densities for desired fire behavior.

***Project Title: Grizzly Flats 2, GF 2*** **Date: November, 2005**

## Project Description

This project is to make the Grizzly Pines School a potential safe area if evacuation of the school is not possible. The project would involve permission from the Forest Service to increase the hazard reduction around the school to 200 feet.

This is the work the Grizzly Flats Firesafe Council will do as contributed work as well as clearing the community services district property

## Prescription/Treatment

**Hand Thin and Pile Burn**: Hand thinning and pile burning should be accomplished using a ten-person hand crew with chainsaws cutting material up to 6"dbh with 20'x20' spacing between leave trees. All dead and down material greater than 3 inches in diameter and up to 14 inches in diameter and all cut material regardless of size should be piled in piles for burning.

Piles should be constructed compactly beginning with a core of fine fuels and minimizing air spaces to facilitate complete combustion. Piles will be constructed no taller than 5 feet and away from trees to prevent damage when burning. If the areas will not be broadcast burned, then each pile will be lined with fire line. Piles will be covered with water resistant paper or plastic a 4'x4' square to cover the fine material in the center of the piles.

**Chipping.** Chipping may be used as an alternative to burning. It redistributes forest vegetation that is cut by mechanical thinning or hand thinning. The chips may be removed from the site and converted to energy for other products or scattered throughout the project area.

**Prescribed Burning:** Low intensity broadcast burning should be used to reduce all 10-hour fuels (< 3 inches diameter) by 60-80%, the brush component by 50%, and 75% of trees less than 3 inches dbh. Use fire to prune ladder fuels by scorching the lower 1/3 of branches on 100% of trees less than 8 inches dbh. Retain large down logs (20 inches in diameter or greater) to a maximum density of five per acre. Maintain 60 to 70% of ground cover on slopes 35% or less. Additionally, acceptable standards for prescribed fires should include the recommended affects. The following are prescribed fire standards but exceptions should be anticipated.

- 13 foot maximum scorch height; and,
- less than 10% mortality in conifers > 12 inches dbh.

**Identification of Protected Species or Other Critical Resources:** Describe any measures that must be taken to protect critical wildlife habitat, historic or culturally sensitive sites, artifacts or other resources, and plant and animal species protected by statute.

Other wildlife habitat, critical species, and cultural resources may be present in the project area and require mitigation measures. Project planning should include implementation of surveys and mitigation measures as dictated by regulatory statutes.

With all environmentally sensitive areas, identification and avoidance during project implementation is important. Should any sensitive resources be found during project implementation, the area should be avoided until the appropriate agencies review the situation.

**Other Considerations:** Describe any other consideration that must be taken into account to successfully complete this project such as permits, clearances, approvals, etc.

Compliance measures for Environmental documentation state and or federal (NEPA, CEQU), or their functional equivalents will need to be addressed priori to project initiation.

If burning is chosen the appropriate permits must be acquired for the El Dorado County Air pollution Control District and the local CDF and/or Pioneer Fire Protection District.

## Implementation Cost

These costs only include actual treatment cost no administrative costs or environmental documentation costs are included.

Hand Clearing and Chipping $980/acre

Total Cost $980 x 1 = $980

## Project Description

**Roadside Clearing**: Roadside clearing can occur up to 100 feet from each side of the road. Vegetation removal will follow the mastication prescription. Techniques may include both mastication and hand thinning. The object of the treatment is to reduce fuels along the road system within Grizzly Flats for safe ingress and egress on the primary feeder roads. This project is located on private property along the roads listed in the table below and on the map evacuation routes and roads projects.

| Project | Width each side of the Road (Feet) | Acreages | Work area |
|---|---|---|---|
| GF 1 | 100 | 120 | String Canyon |
| GF 3 | 20 | 1.3 | Woodridge |
| | 20 | 1 | Tyler Rd |
| | | | |
| | 20 | 3.1 | Sciaroni Rd 2 (StrCanyonRd to GFCSD) |
| | 30 | 2 | Sciaroni Rd 1 (Gr. Flat Rd to StrCanyon Rd) |
| | 20 | 3.8 | Old Mine Rd |
| | 20 | 4.7 | Leoni Rd |
| | 20 | 1.2 | Grizzly Flats 4 (cemetery to Gr-Caldor) |
| | 20 | 4.8 | Grizzly Flats 3 (BlueMtRd to cemetery) |
| | 30 | 4 | Grizzly Flats 2 (EagleMine to StrCanyon) |
| | 30 | 15 | Grizzly Flats 1 (BlueMtRd to EagleMineRd) |
| | 20 | 1.7 | Evergreen Dr |
| | 20 | 0.75 | Creekside Dr |
| | 30 | 4.4 | Capps Crossing |
| | 20 | 4 | Blue Mountain Dr |
| | 20 | 7.5 | Winding Way |
| | | | |
| | | 120 | GF 1 Acreage |
| | | 59.25 | GF 3 Acreage |

## Prescription/Treatment

The treatments prescribed can be implemented based on slope and access considerations when requesting funding.

**Mastication:** The use rubber tired or tracked vehicles to cut, chip, and scatter all shrubs and small trees up to 10” dbh on site. White fir and cedar should be the priority for tree removal. Trees should be spaced approximately 20 feet between the boles. Brush cover should be reduced by creating a mosaic of treated and untreated shrubs. Openings between shrubs should be twice the height of the shrubs and 50-70% of the shrubs should

be treated. Brush that is treated should be cut to the maximum of 6 inches in height. No individual pieces of cut material should be greater than 4 feet long. All masticated stumps should be cut to within 6 inches of the ground. No debris should average more than 6 inches in depth over the entire project area. All cut vegetation will be kept within the unit boundaries. Any cut vegetation falling into ditches, roads, road banks, trails, or adjacent units should immediately be removed.

**Hand Thin and Pile Burn**: Hand thinning and pile burning should be accomplished using a ten-person hand crew with chainsaws cutting material up to 6"dbh with 20'x20' spacing between leave trees. All dead and down material greater than 3 inches in diameter and up to 14 inches in diameter and all cut material regardless of size should be piled in piles for burning.

Piles should be constructed compactly beginning with a core of fine fuels and minimizing air spaces to facilitate complete combustion. Piles will be constructed no taller than 5 feet and away from trees to prevent damage when burning. If the areas will not be broadcast burned, then each pile will be lined with fire line. Piles will be covered with water resistant paper or plastic a 4'x4' square to cover the fine material in the center of the piles.

**Chipping.** Chipping may be used as an alternative to burning. It redistributes forest vegetation that is cut by mechanical thinning or hand thinning. The chips may be removed from the site and converted to energy for other products or scattered throughout the project area.

**Identification of Protected Species or Other Critical Resources:** Describe any measures that must be taken to protect critical wildlife habitat, historic or culturally sensitive sites, artifacts or other resources, and plant and animal species protected by statute.

Other wildlife habitat, critical species, and cultural resources may be present in the project area and require mitigation measures. Project planning should include implementation of surveys and mitigation measures as dictated by regulatory statutes.

With all environmentally sensitive areas, identification and avoidance during project implementation is important. Should any sensitive resources be found during project implementation, the area should be avoided until the appropriate agencies review the situation.

**Other Considerations:** Describe any other consideration that must be taken into account to successfully complete this project such as permits, clearances, approvals, etc.

Compliance measures for Environmental documentation state and or federal (NEPA, CEQU), or their functional equivalents will need to be addressed priori to project initiation.

If burning is chosen the appropriate permits must be acquired for the El Dorado County Air pollution Control District and the local CDF and/or Pioneer Fire Protection District.

## Implementation Cost

These costs only include actual treatment cost no administrative costs or environmental documentation costs are included.

Hand Cutting/Chipping or burning $980/acre

Total Cost $980 x 59.25 acres = $58,065

**Project Maintenance Requirements:**

Brush and understory fuels should be treated with prescribed fire, hand cutting or the use of herbicides should be applied every 5 – 7 years to remove ladder fuels and keep surface fuels at appropriate densities for desired fire behavior.

***Project Title: Grizzly Flats 4, GF 4*** **Date: November, 2005**

## Project Description

The project is located on ground with over 30% slope making it difficult to use mechanical equipment to treat the fuels and limb up the trees

**Shaded Fuel Break**: Shaded fuel breaks are constructed as linear features of varying width, 200-1,300 feet wide. They are generally constructed using a combination of the treatments described below. Mechanical thinning will be used most frequently to reduce the density of overstory trees and one of the other techniques described above will be used to reduce ground fuel loading. The object of the treatment is to reduce fuels in high surface fuel areas to protect structures from wildfire.

## Prescription/Treatment

**Hand Thin and Pile Burn**: Hand thinning and pile burning should be accomplished using a ten-person hand crew with chainsaws. Cutting material up to 10”dbh with 20’x20’ spacing between leave trees
All dead and down material greater than 3 inches in diameter and up to 14 inches in diameter and all cut material regardless of size should be piled in piles for burning. Piles should be constructed compactly beginning with a core of fine fuels and minimizing air spaces to facilitate complete combustion. Piles will be constructed no taller than 5 feet and away from trees to prevent damage when burning. If the areas will not be broadcast burned, then each pile will be lined with fire line. Piles will be covered with water resistant paper a 4’x4’ square to cover the fine material in the center of the piles. Costs are based on a fuel break 200 feet wide.

**Chipping:** Chipping may be used as an alternative to burning. It redistributes forest vegetation that is cut by mechanical thinning or hand thinning. The chips may be removed from the site and converted to energy for other products or scattered throughout the project area.

**Identification of Protected Species or Other Critical Resources:** Describe any measures that must be taken to protect critical wildlife habitat, historic or culturally sensitive sites, artifacts or other resources, and plant and animal species protected by statute.

Other wildlife habitat, critical species, and cultural resources may be present in the project area and require mitigation measures. Project planning should include implementation of surveys and mitigation measures as dictated by regulatory statutes.

With all environmentally sensitive areas, identification and avoidance during project implementation is important. Should any sensitive resources be found during project implementation, the area should be avoided until the appropriate agencies review the situation.

**Other Considerations:** Describe any other consideration that must be taken into account to successfully complete this project such as permits, clearances, approvals, etc.

Compliance measures for Environmental documentation state and or federal (NEPA, CEQU), or their functional equivalents will need to be addressed priori to project initiation.

If burning is chosen the appropriate permits must be acquired for the Eldorado County Air pollution Control District and the local CDF and/or Pioneer Fire Protection District.

## Implementation Cost

These costs only include actual treatment cost no administrative costs or environmental documentation costs are included.

Treatments Hand Thin Pile and burn $1310/acre

Total Cost $900 x 110 acres = $144,100

**Project Maintenance Requirements:**

Re-thin the forest stand at 15-20 year intervals to maintain the appropriate tree density. Tree spacing and desired residual basal area should dictate when the stand is re-thinned. Brush and understory fuels should be treated with prescribed fire or herbicide application every 5 – 7 years to treat ladder fuels and keep surface fuels at appropriate densities for desired fire behavior.

## Project Description

**Shaded Fuel Break**: Shaded fuel breaks are constructed as linear features of varying width, 200-1,300 feet wide. They are generally constructed using a combination of the treatments described above. Mechanical thinning will be used most frequently to reduce the density of overstory trees and one of the other techniques described above will be used to reduce ground fuel loading. The object of the treatment is to reduce fuels in high surface fuel areas to protect structures from wildfire.

## Prescription/Treatment

**Mechanical Thinning**: Thin stands from below by removing small trees up to 10 inches diameter at breast height (DBH). Starting with the smallest diameter class, remove sufficient trees to achieve an average crown base height (distance from the ground to the base of the leaf [needle] crown) of at least 20 feet and spacing of 20-30 feet between the bolls of residual trees. On drier sights and southern aspects, favor the removal of white fir, and cedar as well as suppressed Pines over all other conifer species. Retain enough snags per acre (minimum size is 14 inches dbh) and large downed logs per acre (minimum size 14 inches dbh and 20 feet long) to meet environmental concerns for soils and wildlife as identified in an environmental document. Whole tree yard or dispose of slash in stands by hand piling and burning or chipping and scattering should be required for surface fuel treatment.

**Chipping:** Chipping may be used as an alternative to burning. It redistributes forest vegetation that is cut by mechanical thinning or hand thinning. The chips may be removed from the site and converted to energy for other products or scattered throughout the project area.

**Mastication:** The use rubber tired or tracked vehicles to cut, chip, and scatter all shrubs and small trees up to 10” dbh on site. White fir and cedar should be the priority for tree removal. Trees should be spaced approximately 20 feet between the boles. Brush cover should be reduced by creating a mosaic of treated and untreated shrubs. Openings between shrubs should be twice the height of the shrubs and 50-70% of the shrubs should be treated. Brush that is treated should be cut to the maximum of 6 inches in height. No individual pieces of cut material should be greater than 4 feet long. All masticated stumps should be cut to within 6 inches of the ground. No debris should average more than 6 inches in depth over the entire project area. All cut vegetation will be kept within the unit boundaries. Any cut vegetation falling into ditches, roads, road banks, trails, or adjacent units should immediately be removed.

**Tractor Piling or Grapple piling:** The use of rubber tired or tracked machines to pile slash, brush and small trees. Where needed trees under 8” DBH will be thinned out to 20’ spacing. Most trees over 8” DBH will not be piled. Live oak will be thinned out in

many places. Generally Black oak will be left on site Protection of desirable residual trees from skin ups and damage is very important. Slash piles should not be piled near residual tress so when they are burned the piles will not damage trees remaining onsite. Contractor should create clean piles that are free of dirt and no larger then 15 feet tall and 15 feet in diameter. The piles should be partly covered with a 6'x6' piece of water proof material to allow them to be burned after significant rain fall.

**Identification of Protected Species or Other Critical Resources:** Describe any measures that must be taken to protect critical wildlife habitat, historic or culturally sensitive sites, artifacts or other resources, and plant and animal species protected by statute.

Other wildlife habitat, critical species, and cultural resources may be present in the project area and require mitigation measures. Project planning should include implementation of surveys and mitigation measures as dictated by regulatory statutes.

With all environmentally sensitive areas, identification and avoidance during project implementation is important. Should any sensitive resources be found during project implementation, the area should be avoided until the appropriate agencies review the situation.

**Other Considerations:** Describe any other consideration that must be taken into account to successfully complete this project such as permits, clearances, approvals, etc.

Compliance measures for Environmental documentation state and or federal (NEPA, CEQU), or their functional equivalents will need to be addressed priori to project initiation.

If burning is chosen the appropriate permits must be acquired for the El Dorado County Air pollution Control District and the local CDF and/or Pioneer Fire Protection District.

## Implementation Cost

These costs only include actual treatment cost no administrative costs or environmental documentation costs are included.

Treatment Cost $900/acre
Total cost 213* $900 = 191,700

**Project Maintenance Requirements:** Re-thin the forest stand at 15-20 year intervals to maintain the appropriate tree density. Tree spacing and desired residual basal area should dictate when the stand is re-thinned. Brush and understory fuels should be treated with prescribed fire or herbicide application every 5 – 7 years to treat ladder fuels and keep surface fuels at appropriate densities for desired fire behavior.

***Project Title: Grizzly Flats 6, GF 6*** **Date: November, 2005**

## Project Description

**Shaded Fuel Break**: Shaded fuel breaks are constructed as linear features of varying width, 200-1,300 feet wide. They are generally constructed using a combination of the treatments described above. With very little timber in the area of this project the treatment of surface fuels is the primary objective and the treatment of the Oak understory and grass. The object of the treatment is to reduce fuels in high surface fuel areas to protect structures from wildfire.

## Prescription/Treatment

**Mastication:** The use rubber tired or tracked vehicles to cut, mow, chip, and scatter all grass, shrubs, and small trees up to 10" dbh on site. Brush cover should be reduced by creating a mosaic of treated and untreated shrubs. Openings between shrubs should be twice the height of the shrubs and 50-70% of the shrubs should be treated. Brush that is treated should be cut to the maximum of 6 inches in height. No individual pieces of cut material should be greater than 4 feet long. All masticated stumps should be cut to within 6 inches of the ground. No debris should average more than 6 inches in depth over the entire project area. All cut vegetation will be kept within the unit boundaries. Any cut vegetation falling into ditches, roads, road banks, trails, or adjacent units should immediately be removed.

**Tractor Piling or Grapple piling:** The use of rubber tired or tracked machines to pile slash, brush and small trees. Where needed trees under 8" DBH will be thinned out to 20' spacing. Most trees over 8" DBH will not be piled. Live oak will be thinned out in many places. Generally Black oak will be left on site Protection of desirable residual trees from skin ups and damage is very important. Slash piles should not be piled near residual tress so when they are burned the piles will not damage trees remaining onsite. Contractor should create clean piles that are free of dirt and no larger then 15 feet tall and 15 feet in diameter. The piles should be partly covered with a 6'x6' piece of water proof material to allow them to be burned after significant rain fall.

**Identification of Protected Species or Other Critical Resources:** Describe any measures that must be taken to protect critical wildlife habitat, historic or culturally sensitive sites, artifacts or other resources, and plant and animal species protected by statute.

Other wildlife habitat, critical species, and cultural resources may be present in the project area and require mitigation measures. Project planning should include implementation of surveys and mitigation measures as dictated by regulatory statutes.

With all environmentally sensitive areas, identification and avoidance during project implementation is important. Should any sensitive resources be found during project

implementation, the area should be avoided until the appropriate agencies review the situation.

**Other Considerations:** Describe any other consideration that must be taken into account to successfully complete this project such as permits, clearances, approvals, etc.

Compliance measures for Environmental documentation state and or federal (NEPA, CEQU), or their functional equivalents will need to be addressed priori to project initiation.

If burning is chosen the appropriate permits must be acquired for the El Dorado County Air pollution Control District and the local CDF and/or Pioneer Fire Protection District.

## Implementation Cost

These costs only include actual treatment cost no administrative costs or environmental documentation costs are included.

Treatment Cost $900/acre

Total Cost $900 x 248 Acres = $223,200

**Project Maintenance Requirements:**

Brush and understory fuels should be treated with prescribed fire or herbicide application every 5 – 7 years to treat ladder fuels and keep surface fuels at appropriate densities for desired fire behavior. Since much of the project area is grass a program of grazing annually should be considered

***Project Title: Grizzly Flats 7, GF 7*** Date: November, 2005

## Project Description

**Shaded Fuel Break**: Shaded fuel breaks are constructed as linear features of varying width, 200-1,300 feet wide. They are generally constructed using a combination of the treatments described above. Mechanical thinning will be used most frequently to reduce the density of overstory trees and one of the other techniques described above will be used to reduce ground fuel loading. The object of the treatment is to reduce fuels in high surface fuel areas to protect structures from wildfire.

## Prescription/Treatment

**Mastication:** Use rubber tired or tracked vehicles to cut, chip, and scatter all shrubs and small trees up to 10" dbh on site. White fir should be the priority for tree removal. Trees should be spaced approximately 20 feet between the boles. Brush cover should be reduced by creating a mosaic of treated and untreated shrubs. Openings between shrubs should be twice the height of the shrubs and 50-70% of the shrubs should be treated. Brush that is treated should be cut to the maximum of 6 inches in height. No individual pieces of cut material should be greater than 4 feet long. All masticated stumps should be cut to within 6 inches of the ground. No debris should average more than 6 inches in depth over the entire project area. All cut vegetation will be kept within the unit boundaries. Any cut vegetation falling into ditches, roads, road banks, trails, or adjacent units should immediately be removed.

**Tractor Piling or Grapple piling:** Use of rubber tired or tracked machines to pile slash, brush and small trees. Where needed trees under 8" DBH will be thinned out to 20' spacing. Most trees over 8" DBH will not be piled. Live oak will be thinned out in many places. Generally Black oak will be left on site Protection of desirable residual trees from skin ups and damage is very important. Slash piles should not be piled near residual tress so when they are burned the piles will not damage trees remaining onsite. Contractor should create clean piles that are free of dirt and no larger then 15 feet tall and 15 feet in diameter. The piles should be partly covered with a 6'x6' piece of water proof material to allow them to be burned after significant rain fall.

**Identification of Protected Species or Other Critical Resources:** Describe any measures that must be taken to protect critical wildlife habitat, historic or culturally sensitive sites, artifacts or other resources, and plant and animal species protected by statute.

Other wildlife habitat, critical species, and cultural resources may be present in the project area and require mitigation measures. Project planning should include implementation of surveys and mitigation measures as dictated by regulatory statutes.

With all environmentally sensitive areas, identification and avoidance during project implementation is important. Should any sensitive resources be found during project implementation, the area should be avoided until the appropriate agencies review the situation.

**Other Considerations:** Describe any other consideration that must be taken into account to successfully complete this project such as permits, clearances, approvals, etc.

Compliance measures for Environmental documentation state and or federal (NEPA, CEQU), or their functional equivalents will need to be addressed priori to project initiation.

If burning is chosen the appropriate permits must be acquired for the El Dorado County Air pollution Control District and the local CDF and/or Pioneer Fire Protection District.

## Implementation Cost

These costs only include actual treatment cost no administrative costs or environmental documentation costs are included.

Treatment Costs $900/acre
Total $900 x 141 = $126,900

**Project Maintenance Requirements:** Brush and understory fuels should be treated with prescribed fire or herbicide application every 5 – 7 years to treat ladder fuels and keep surface fuels at appropriate densities for desired fire behavior.

## *Project Priorities*

The following priorities were presented at the last community meeting and agreed to as a group. These priorities will provide the best protection for the community and were developed in concert with the Grizzly Flats Fire Safe Council

1 Project GF 1
Defensible space enforcement program
Chipping Program
2 Project GF 2
3 Project GF 3
4 Project GF 4
5 Project GF 5
6 Project GF 6
7 Project GF 7

# X. Plan Monitoring and Update Procedures

This plan was developed by the El Dorado County Fire Safe Council in conjunction with the Grizzly Flats Fire Safe Council to provide the Grizzly Flats Community with a plan to reduce the threat from a wildfire. The Grizzly Flats Fire Safe Council is responsible for updating with assistance for the Eldorado County Fire Safe Council and the community in implementation of the plan. The Grizzly Flats Community Wildfire Protection Plan should be reviewed annually prior to grant submittal to be sure that the plan is up to date and still applies to the community. Project implementation is up to the Grizzly Flats Fire Safe Council with inputs from community members. The Grizzly Flats Fire Safe Council should amend its operations charter to reflect the need for updating and implementation of this plan.

This document needs to be a living document where new projects are added and others deleted as the situation changes. During the development of this plan in 2005, the following projects were discussed, but not developed:

1. Conduct timber operations and extensive fuel treatment activities in the area between String Canyon Road and Old Mine Road. This area contains large parcels that could be treated as California Forest Improvement Projects (CFIP). The California Department of Forestry (CDF) would have the lead in working with the private land owners.

2. Conduct heavy maintenance work on the very low standard Sciaroni Road from the ridge top down to the Cosumnes Mine Road. This route has severe limitations, but could provide an additional evacuation route.

## References


Anderson, Hal E. 1982. **Aids to determining fuel models for estimating fire behavior.** General Technical Report INT-122. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station; 22 p.

Agee J.K., Bahro, B., Finney, M.A., Omi, P.N., Sapsis, D.B., Skinner, C.N., van Wagtendonk, J.W., and C.P. Weatherspoon. 2000. **The use of shaded fuelbreaks in landscape fire management,** *Forest Ecology and Management* 127: 55-56

Agee, J.K. 1996. **The influence of forest structure on fire behavior**. In: Proceedings, 17th Annual Forest Vegetation Management Conference. Redding, CA. January 16-18, 1996:
52-68.

Albini, F. 1976. **Estimating wildfire behavior and effects.** USDA Forest Service Intermountain Forest and Range Experiment Station General Technical Report INT-30. Ogden, UT.

Andrews, P.L. 1986. **BEHAVE**: fire behavior prediction and fuel modeling system – BURN subsystem, part 1. USDA Forest Service Intermountain Forest and Range Experiment Station General Technical Report INT-194. Ogden, UT.

Graham, R.T., Harvey A.E., Jain, T.B., and Tonn, J.R. 1999. **The effects of thinning and similar stands treatments on fire behavior in western forests**. USDA Forest Service Pacific Northwest Research Station General Technical Report PNW-GTR-463: Portland, OR.

Graham, R.T., Sarah McCaffrey and Jain Theresa. 2004. **Science Basis for Changing Forest Structure to Modify Wildfire Behavior and Severity**, RMRS-GTR-120, April 2004

Omi, Philip, Martinson, Eric, 2002, **Effect of Fuels Treatment on Wildfire Severity,** Western Forest Fire Research Center, Colorado State University

Rothermel, R.C. 1983. **How to predict the spread and intensity of forest and range fires**. USDA Forest Service Intermountain Forest and Range Experiment Station General Technical Report INT-143. Ogden, UT.

Scott, Joe H.; Reinhardt, Elizabeth D. 2001. **Assessing crown fire potential by linking models of surface and crown fire behavior.** Res. Pap. RMRS-RP-29. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 59 p.

Skinner, C.N. and Chang, C. 1996. **Fire regimes, past and present. In Sierra Nevada Ecosystem Project: Final report to Congress**, vol. II chap. 38. University of California,

Centers for Water and Wildland Resources, Davis.

**John Doble's Journal and Letters From The Mines Volcano, Mokelumne Hill, Jackson and San Francisco 1851-1865**, Volcano Press, Inc , 1999

Ferrell, Sean, **Fuels Analysis from Last Chance USFS Project, Fuels & Fire Analysis**, Last Chance Fuels Reduction Project, Placerville Ranger District, March 5, 2003

Carlton, Donald, **Fuels Management Analyst Plus**, Fire Program Solutions,LLC/Acacia Services, 2005

# Appendix I: Fuels Analysis from Last Chance USFS Project

## Fuels & Fire Analysis
## Last Chance Fuels Reduction Project
## Placerville Ranger District

**March 5, 2003**
**Sean Ferrell**

### Existing Condition/ Area Description:

- The Middle Fork of the Consumnes River lies to the South of the project area. This river canyon can exert a strong effect on fire behavior. Because the canyon is aligned with the prevailing Southwest winds they are funneled through the canyon with unimpeded speeds of 10 to 15 mph (Fire weather Hand book, conversation w/Smith). Furthermore bends in the canyon cause erratic wind conditions, as observed in the Cleveland fire.
- GIS Fire History Layers show 12 Class C or larger fires between 1914 and 1996, with an average size of 113 acres, within 1 ½ miles of the project area. Between 1960 and 1992 there have been 55 Class A and B fires.
- Analysis shows that in one-third of the project area fires can develop flame lengths greater than 6 ft.
- Stand conditions vary through out the project area. Along ridgetops manzanita and bear clover are ubiquitous, either occurring in patches or as a decadent part of the under story. Most of the stands have an over-abundance of conifer regeneration. A 3-foot crown base height is the norm.
- The project area abuts the community of Grizzly Flats, identified as a community at risk under the National Fire Plan.

### Effects to Fuels

Fuel models were first determined using the forest GIS fuel model layer. Models were adapted after sight visits.

Surface fuels are all material lying on, or immediately above, the ground, including needles or leaves, duff, grass, small dead wood, downed logs, and large limbs. Fire is able to carry from surface fuels through convection into the crowns with relative ease. Ladder fuels are fuels that provide vertical continuity between the ground and the tree canopy. Ladder fuels are present as shrubs, mainly manzanita and conifer regeneration. All fuels affect flame length, which in turn affects scorch, torching, and mortality.

Canopy bulk density, a measure of available canopy fuels (all needles and 50% of the < 0.25” diameter material), combined with continuous crown closure is needed for

sustained crown fire. Single or multiple tree torching can occur whenever surface fire intensity (flame length) generates flames that can carry into the crowns.

## No Action

## Direct Effects

There are no known direct effects to fuels or change to surface loading in the short term by taking no action.

## Indirect Effects

Over time, in the absence of prescribed fire or any treatment that would reduce ladder or surface fuels, fuel loading would continue to increase. Debris is added to the forest floor annually.

As a stand becomes more dense, shrubs such as bearclover and manzanita could become less vigorous and eventually die out under increasing shade. The stand density index indicates that as the number of trees increases within a stand, shade intolerant species would die out. As this takes place surface fuel loading would increase. The shade tolerant species, white fir and incense cedar, are less fire resistant than the shade intolerant pines. This would cause an increase in the probability of mortality for the stand when a wild fire occurs. These stands would also experience greater mortality under less severe fire conditions.

In the event of a wildfire occurring under current conditions in the project area, initial attack costs would be similar to those shown in the following table. These National Fire Management Analysis System (NFMAS) costs are based on 20-year average for the Eldorado National Forest

| Size of Wildfire (Acres) | Cost per Acre |
|---|---|
| 0-0.25 | $9,297 |
| 0.26-10 | $5,709 |
| 11-100 | $2,178 |
| 101-300 | $1,777 |
| 301-1000 | $1,284 |
| 1001 + | $ 601 |

## Cumulative Effects

Fuels reduction has occurred on forest land. Fuels reduction work has occurred in connection with the Ridgerunner, Nelly, Lincoln Log and Tie Die Timber Sales, thinning ridge top stands, piling and burning brush, and using prescribed fire to reduce fuels in the harvest units. Additionally prescribed fire has been used to reduce fuels in the Caldor Burn Project. Further burning is planned in the Lincoln Log and Ridgerunner project Areas. The California Department of Forestry and Fire Protection (CDF), in conjunction with the El Dorado County Fire Safe Council, is planning fuels reduction on private land using grant money available through the National Fire Plan.

Currently these areas are in disconnected patches and do not provide strategic landscape-wide fuel treatment. The project area and the community of Grizzly Flats will continue

to be at high risk to wildfire damage from fire spreading into the area. Further the probability of CDF's proposed treatments being funded are lessened without the accompanying federal project.

## Proposed Action

## Changes in Threat and Defense Zones

Appendix A (pg A 10) of the ROD for the Sierra Nevada Forest Plan Amendment states: "Fuel reduction treatments are designed to protect human communities from wildland fires as well as minimize the spread of fires that originate in urban areas. The management objective in the urban wildland intermix zone is to enhance fire suppression capabilities by modifying fire behavior inside the zone and providing a safe and effective area for possible future fire suppression activities."

The existing threat and defense zones were based on the actual location of structures meeting the appropriate density standards. The Sierra Nevada Forest Plan Amendment also states that: "The actual boundaries of the urban wildland intermix zones are determined locally, based on the actual distribution of structures and communities adjacent or intermixed with national forest lands Strategic landscape features, such as, roads, changes in fuel types, and topography, are used in delineating the physical boundary of the urban wildland intermix zone."

Fire behavior in The Middle and North Fork of the Consumnes River Canyon and its immediate tributaries can be quite intense and erratic; there have been 12 C class fires on record in, or adjacent to, the project area. Unimpeded winds in canyons can range from 10 to15 mph. Turns in the canyon can cause these winds to be erratic. Observed fire behavior (Cleveland fire) shows that fires in canyons jump from one side to the other. This makes small isolated defense zones ineffective.

Analysis shows that in one-third of the project area fires can develop flame lengths greater than 6 ft. Analysis also shows that 65% of the area has a crown fire potential under moderate weather conditions.

Many of the current defense zones in the Last Chance project area are small mid-slope areas. These would be ineffective in the strategic suppression of a wildland fire. Access is limited and topography would make control unlikely and unsafe.

On the Last Chance Project it was decided to change the designation of units, or portions of units, which have ground suitable for mechanical fuels treatment, from threat to defense designation. These units fall within SPLATS and changes in Defense Zones identified in the landscape analysis of the North Fork of the Consumnes. These changes were based on topography, access, and fire behavior. This allows the project to tie in with existing work already completed by Eldorado National Forest.

By expanding the Defense zones to the major ridge tops they will become more effective in controlling the spread of a major fire coming out of the canyon. These ridges are roaded with easy access for equipment and personnel. Line production rates would be faster on ridges than on slopes, and application of aerial retardant would be safer and more effective. The same fuel modifications that would have been applied mid-slope

when applied to a ridge are more effective as the effect of slope on spread of fire is removed.

## Mechanically Treated Areas

Omi and Martinson (2002) state that Crown bulk density is significantly correlated to crown volume scorched and height to live crown has the strongest correlation to fire severity. This action proposes to mechanically thin understory and canopy trees to raise the live crown base height to 15 to 20 feet, masticate and/or cut and pile shrubs, and underburn. This alternative would treat the ladder and surface fuels, reduce canopy bulk density, raise canopy base height, and result in reduced fire behavior and potential for crown fire in the event of a wildfire.

## Direct Effects

Mechanical treatments would reduce the size of 3" diameter and larger surface fuels. Mechanized treatment will also change the arrangement of fuels by crushing shrubs and small trees, further reducing ladder fuels that can cause scorch and torching in prescribed burns and wildfire. Mastication of brush fields would reduce fuel bed bulk depth, thereby reducing flame height, from 6 down to 2 feet; the fire behavior would be similar to a light slash model. Thinning would remove ladder fuels resulting in a change in fire behavior, from a crown fire to a surface fire.

Modeling predicts that a prescribed backing fire using a hot prescription would cause nearly 80% mortality in the residual <10"diameter trees after mechanized treatment (Ref. FOFEM mortality tables). Mortality from prescribed fire in the >10" diameter trees would be less than 10%. This should not significantly increase surface fuel loading as the trees decay and fall to the ground. This is because stand density in the smaller diameter trees has been greatly reduced through the proposed mechanical treatments.

## Indirect Effects

Reductions in fuel loading and stand density, changes in species composition, and raising of the canopy base height would produce changes in the behavior and effects of wild fire. The mortality in trees 10" and greater in diameter would be reduced due to changes in species composition and the raising of the crown base height. Species remaining would tend to be the more fire resistant dominant pines and Douglas firs. The reduction in fuel loading and raising of the crown base height would reduce torching and the probability that a fire would move into the crowns.

These effects were demonstrated during the Cone fire on the Shasta National Forest in 2002. This severe wildfire burned into plots on the Black Mountain Experimental Forest. When the fire reached thinned and unburned plots it transitioned from a crown fire to a surface fire. Where the thinned units had been burned the fire could not burn through and stopped at the edge of the treatment. The burn treatments were 2 to 5 years old. (Skinner, personal communication 2003)

## Cumulative Effects

Fuels reduction work has occurred in connection with the Ridgerunner, Nelly, Lincoln Log and Tie Die Timber Sales, thinning ridge top stands, piling and burning brush, and

using prescribed fire to reduce surface fuels in the harvest units. Additionally prescribed fire has been used to reduce fuels in the Caldor Burn Project. The California Department of Forestry and Fire Protection (CDF) in conjunction with the El Dorado County Fire Safe Council are planning fuels reduction on private lands using grant money available through the National Fire Plan.

This project would connect these areas and produce a more strategic landscape-wide fuel treatment. The project area and the community of Grizzly Flats will continue to be at high risk to wildfire damage from fire spreading into the area. Further the probability of the CDF's proposed treatments being funded are lessened without the accompanying federal project.

**Moderate fire weather conditions on the Eldorado National Forest (90th percentile weather parameters**
**NFDRS station= Bald Mountain with 25 mph 20 ft. wind speed)**

| 1 hour fuel moisture | 10 hour fuel moisture | 100 hour fuel moisture | 1000 hour fuel moisture | 20 ft wind speed | Live fuel moisture |
|---|---|---|---|---|---|
| 5% | 6% | 8% | 10% | 25 | 70 |

**Comparison of predicted stand conditions and fire behavior in the event of a wildfire after treatment (Wildfire @ 90th percentile weather)**

| Stand Conditions | No Action | Proposed Action Mechanical Thin | Proposed Action Mastication | Proposed Action Prescribed Fire |
|---|---|---|---|---|
| Canopy Cover % | 20-70 | 20-70 | 20-70 | 50-70 |
| Height to Live Crown, ft. | 2-6 | 10-25 | 15-25 | 10 |
| Flame length, ft* | 1-18 | 1-4 | 1-4 | 1-3 |
| Rate of spread, ch/hr | 1-59 | 0-8 | 0-8 | 0-6 |
| Fire type | Active or Passive Crown | Surface | Surface | Surface |
| Fireline production | 6-15 Ch/hr | 7-28 Ch/hr | 7-28 Ch/hr | 7-28 Ch/hr |
| Mortality <10" trees | 95-100% | 66-78% | 66-78% | 66-78% |
| Mortality >10" trees | 40-100% | 40% | 40% | 40% |

* Flame lengths are for the surface fuels only the do not reflect Crown flame lengths.

## Proposed Action - Prescribed Fire Only Areas

## Direct Effects

Underburning alone in the units within the Threat Zone would reduce 0 to 3-inch surface fuel loading, burn bearclover, top-kill brush, and kill small conifers and hardwoods temporarily reducing fire behavior. Some preparatory hand treatment of trees less than 6" dbh may be required to reduce the ladder fuels prior to the implementation of the burn.

Mortality rates based on tables developed using FOFEM predict that a prescribed backing fire using a hot prescription would cause up to 68% mortality in the <10" diameter oaks and 70% mortality in conifers, thereby increasing the height to live crown base. Mortality for oaks greater than 10" diameter and less than 20" is predicted to be up to 40%, for conifers in this size range mortality could be as high as 15%. Oaks between 20" and less than 30" dbh would have mortality rates of 13 to 24%. For conifers in this size range mortality could is predicted to be 6%. While oaks 30" dbh and greater would have mortality rates of 13% or less and no mortality was predicted in conifers. Historically mortality rates have been observed to be much lower in oaks and conifers between 10" and 30" dbh on prescribed fires conducted on the Eldorado; generally oaks with a dbh of 6 inches and greater are fairly fire tolerant. Burning under cooler or moister fuel moisture conditions could reduce the amount of mortality in all sizes of trees, but may not reduce surface fuels nor create a sufficient crown base height to withstand additional mortality from a wildfire.

**Prescribed fire weather conditions – example of a "Hot" burning prescription**

| 1 hour fuel moisture | 10 hour fuel moisture | 100 hour fuel moisture | 1000 hour fuel moisture | 20ft wind speed mph | Mid flame wind mph | Live fuel moisture |
|---|---|---|---|---|---|---|
| 5% | 6% | 8% | 18% | 10 | 3 | 100 |

**Prescribed fire behavior – example of a backing fire**

| FBPS Fuel Model | Rate of Spread (ch/hr) | Heat per Unit Area (Btu/ft2) | Fireline Intensity (Btu/ft/sec) | Flame Length (ft) | Mid flame wind (mph) | Scorch Height (ft) |
|---|---|---|---|---|---|---|
| 11 | 0.4 | 779 | 5 | 1.0 | 3 | 1 |
| 35 | 0.6 | 1473 | 17 | 1.6 | 3 | 4 |

## Indirect Effects

Shrub species and hardwoods will re-sprout within one growing season but would have a lesser flame length for 5 to 10 years until plants reach full size and produce a significant amount of dead branches.

In the event of a wildfire 5-10 years after prescribed fire treatment, mortality is likely in larger (>10" diameter) trees. In this period of time surface fuel loading would recover to near current conditions due to the accumulation of dead material created from the single prescribed burn. Fire behavior and tree mortality could be similar to that before treatment.

## Cumulative Effects

On the High Meadow site, a ponderosa pine dominated site in the southern Rocky Mountains of Colorado, Omi and Martinson (2002) found that in one of the wildfires

sampled included areas where the only recent treatment was a single prescribed fire. They found fire severity reductions in that treated area that could not be correlated to differences in stand conditions. They also suggest from the results of the Cerro Grande fire that under extremely windy conditions it may be surface fuels that are of little importance.

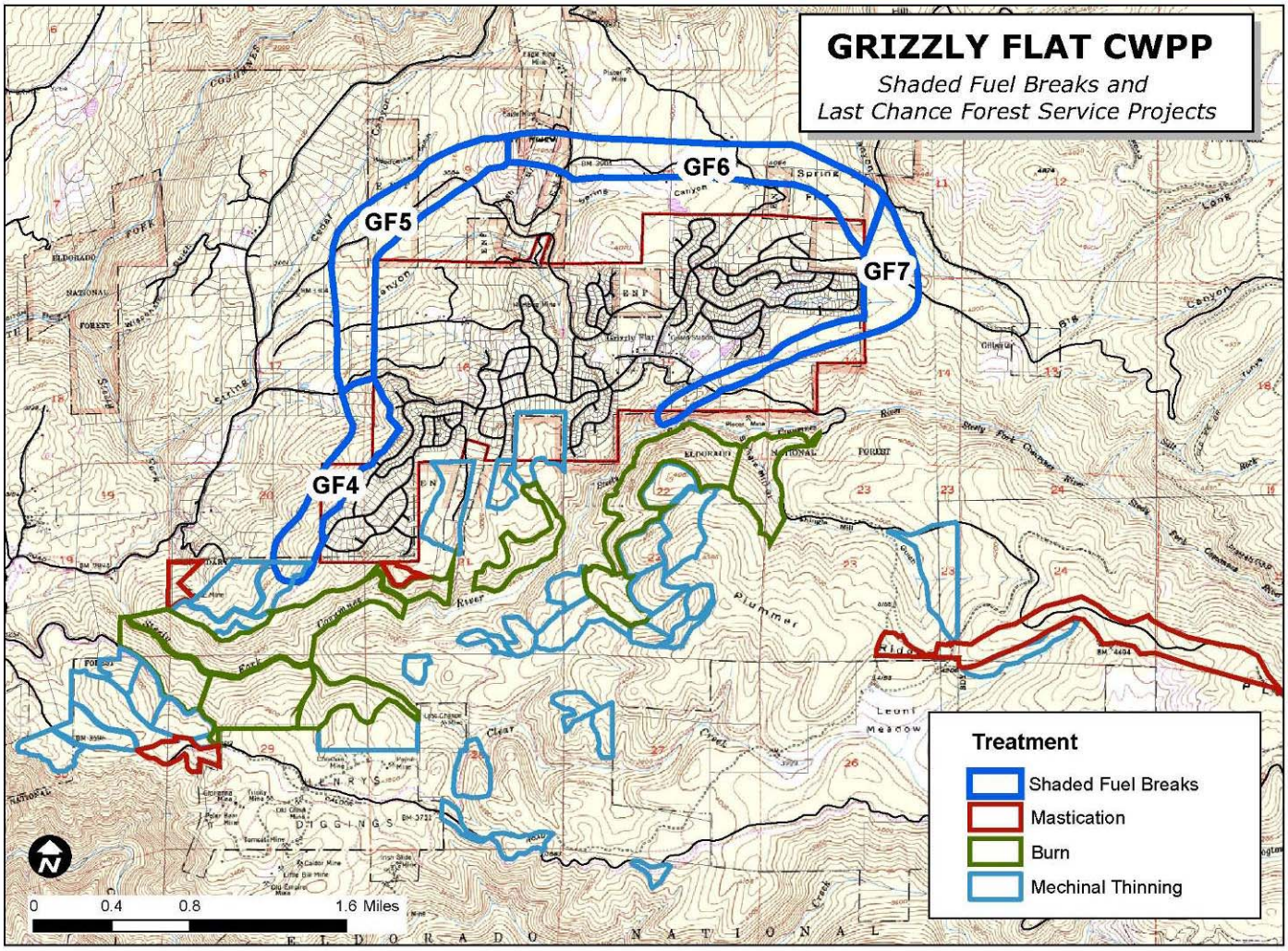
A single prescribed fire, by itself, does the least in reducing canopy base height and crown bulk density. Under more moderate weather conditions this treatment would reduce severity short term, 5-10 years, in these stands. In the long term, more than 10 years, these single treatments would have little effect, as ground fuels accumulate and fuel ladders are reestablished.

## Direct Effects of All Treatments to Fire Behavior and Suppression Capabilities

Fireline intensity, as measured by flame length, directly affects suppression tactics and capabilities. Fires with less than 4-foot flame lengths can be attacked directly with hand or engine crews. As intensity increases, changes in tactics and equipment are needed to slow or stop the spread of fire.

Fireline production is based on rates from Appendix A-20, Fireline Handbook, Jan. 1998, for initial attack line construction by a Type 1 20-person hand crew in Fuel Model 8, 9 and 10. Surface fuel loading and ladder fuels have a direct effect on amount of fireline that can be constructed in a given time and the rate of construction can vary.

Wind has a direct effect on fire behavior. Wind is also affected by vegetation and terrain and varies within an area for any given fire. Midflame wind speed is a function of 20 foot winds multiplied by a wind reduction factor. The reduction factor is calculated based on sheltering effect of the fuels from overstory and can change with landscape position. The Proposed Action removes vegetation to create a more open space between the ground and crown base. Modeling illustrates a slight increase in mid flame wind speed, but this does not significantly change flame lengths or rates of spread which affect suppression tactics.


GRIZZLY FLAT CWPP
Shaded Fuel Breaks and
Last Chance Forest Service Projects
GF4
GF5
GF6
GF7
Treatment
Shaded Fuel Breaks
Mastication
Burn
Mechinal Thinning
0
0.4
0.8
1.6 Miles
E L D O R A D O N A T I O N A L

# Appendix II: Treatment Descriptions

## Mechanical Thinning

Mechanical thinning utilizes heavy equipment with large hydraulically-driven saws to cut and remove trees (generally under 24 inches in diameter). The two major harvesting methods include "whole tree removal (WTR)" and "cut-to-length (CTL)". CTL machines use a "stroke delimber" to remove branches before automatically cutting a log to predetermined lengths (Figure 7). While whole tree removal is preferable from a fuels-reduction standpoint, CTL machines create a mat of slash on which they can operate, reducing impacts to the soil. The slash vs. soil disturbance tradeoff must be considered on a site-specific basis. It is possible to use an in-woods chipper to reduce surface fuels in concert with CTL. Mechanical thinning equipment is generally confined to slopes less than 30%. WTR projects require large landings than can accommodate a skidder operation, a large chipper, and semi-trucks. CTL operations require fewer and smaller landings.

**Mechanical Thinning using a cut-to-length harvesting system.**

Mechanical thinning has the ability to create a more precisely targeted stand structure than prescribed fire (van Wagtendonk 1996, Weatherspoon and Skinner 1996, Stephens 1998, Agee and others 2000, Miller and Urban 2000). The net effect of removing ladder fuels is that surface fires burning through treated stands are less likely to ignite the overstory canopy fuels. By itself, mechanical thinning with machinery does little to beneficially affect surface fuel loading. The only exception is that some level of surface fuel compaction, crushing, or mastication may occur during the thinning process. Depending on how it is accomplished, mechanical thinning may add to surface fuel loadings, thereby increasing surface fire intensity. It may be necessary to remove or treat fine fuels that result from thinning the stand (Alexander and Yancik 1977, Graham, 2004).

**Mastication**

Mastication requires machines to grind, rearrange, compact, or otherwise change fire hazard without reducing fuel loads. These treatments tend to be relatively expensive, and are limited to relatively gentle slopes and areas of high values (near homes and communities). Rocky sites, sites with heavy down logs, and sites dominated by large trees are difficult places in which to operate mastication equipment. Additionally, sparks from mastication heads have the potential to start fires and, when working on public land, these machines are subject to the same activity-level restrictions that apply to most other logging equipment.

The ecological and fire effects of mastication treatments vary depending on the size, composition, and location of the fuels left after treatment (Graham and others 2000). In many cases, mastication creates a window of 2-5 years in which surface fire intensity actually increases. While this may be offset by a decrease in crown fire potential, mastication tends to increase fuelbed continuity, and can increase fire rates of spread. Mastication is a useful tool in plantations and brushfields, and has applications in thinning small trees for fuelbreak maintenance.

**Mastication Soil Issues**

Thin layers of wood chips spread on the forest floor tend to dry and rewet readily. Deep layers of both chips and chip piles may have insufficient air circulation, making poor conditions for decomposition. Moreover, when layers of small woody material are spread on the forest floor and decomposition does occur, the decomposing organisms utilize large amounts of nitrogen reducing its availability to plants. Therefore, the impact of any crushing, chipping, or mulching treatment on decomposition processes and their potential contribution to smoldering fires needs to be considered (Graham, 2004).

## Prescribed Burning

Prescribed burning reduces the loading of fine fuels, duff, large woody fuels, rotten material, shrubs, and other live surface fuels (Figure 9). These changes, together with increased fuel compactness and reduced fuel continuity change the fuel energy stored on the site, reducing potential fire spread rate and intensity. Burning reduces horizontal fuel continuity (shrub, low vegetation, woody fuel strata), which disrupts growth of surface fires, limits buildup of intensity, and reduces spot fire ignition probability (Graham, 2004). Given current accumulations of fuels in some stands, multiple prescribed fires—as the sole treatment or in combination with thinning—may be needed initially, followed by long-term maintenance burning or other fuel reduction (for example, mowing), to reduce crown fire hazard and the likelihood of severe ecosystem impacts from high severity fires (Peterson and others in prep).

**Figure 9. Prescribed burn in progress.**

Opportunities to use prescribed fire are limited because of smoke management concerns.

## Hand Thinning and Chipping

Hand thinning and chipping is usually accomplished by a crew of persons using chainsaws and pole saws to thin and clear undesirable vegetation. Hand thinning is conducted with crews of approximately 10 individuals who cut trees with chainsaws. Hand thinning is generally used to cut smaller trees (less than 14 inches dbh), on steep slopes where machines cannot operate, or in environmentally sensitive areas where machines would have a significant environmental impact. Removal of smaller trees is generally limited to younger stands where the trees are smaller. Because hand thinning can only effectively remove smaller material, silvicultural and fuel management objectives may be more constrained than those achieved with mechanical thinning. Therefore, hand thinning may require more frequent treatments to maintain acceptable fuel loads than mechanical thinning and hand thinning may not be cost effective in forest stands with excessive ground fuel loading where mechanical thinning would remove or compact those fuels.

# Appendix III: Condition Class Descriptions:

Fire Regime Condition Class Definition
6/20/2003- 1 -

**FIRE REGIME CONDITION CLASS DEFINITION**

A natural fire regime is a general classification of the role fire would play across a landscape in the absence of modern human mechanical intervention, but including the influence of aboriginal burning (Agee 1993, Brown 1995). Coarsescale definitions for natural (historical) fire regimes have been developed by Hardy et al. (2001) and Schmidt et al. (2002) and interpreted for fire and fuels management by Hann and Bunnell (2001). The five natural (historical) fire regimes are classified based on average number of years between fires (fire frequency) combined with the severity (amount of replacement) of the fire on the dominant overstory vegetation. These five regimes include:

I – 0-35 year frequency and low (surface fires most common) to mixed severity (less than 75% of the dominant overstory vegetation replaced);

II – 0-35 year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);

III – 35-100+ year frequency and mixed severity (less than 75% of the dominant overstory vegetation replaced);

IV – 35-100+ year frequency and high (stand replacement) severity (greater than 75% of the dominant overstory vegetation replaced);

V – 200+ year frequency and high (stand replacement) severity.

As scale of application becomes finer these five classes may be defined with more detail, or any one class may be split into finer classes, but the hierarchy to the coarse scale definitions should be retained.

A fire regime condition class (FRCC) is a classification of the amount of departure from the natural regime (Hann and Bunnell 2001). Coarse-scale FRCC classes have been defined and mapped by Hardy et al. (2001) and Schmidt et al. (2001) (FRCC). They include three condition classes for each fire regime. The classification is based on a relative measure describing the degree of departure from the historical natural fire regime. This departure results in changes to one (or more) of the following ecological components: vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated disturbances (e.g. insect and diseased mortality, grazing, and drought). There are no wildland vegetation and fuel conditions or wildland fire situations that do not fit within one of the three classes. The three classes are based on low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) departure from the central tendency of the natural (historical) regime (Hann and Bunnell 2001, Hardy et al. 2001, Schmidt et al.

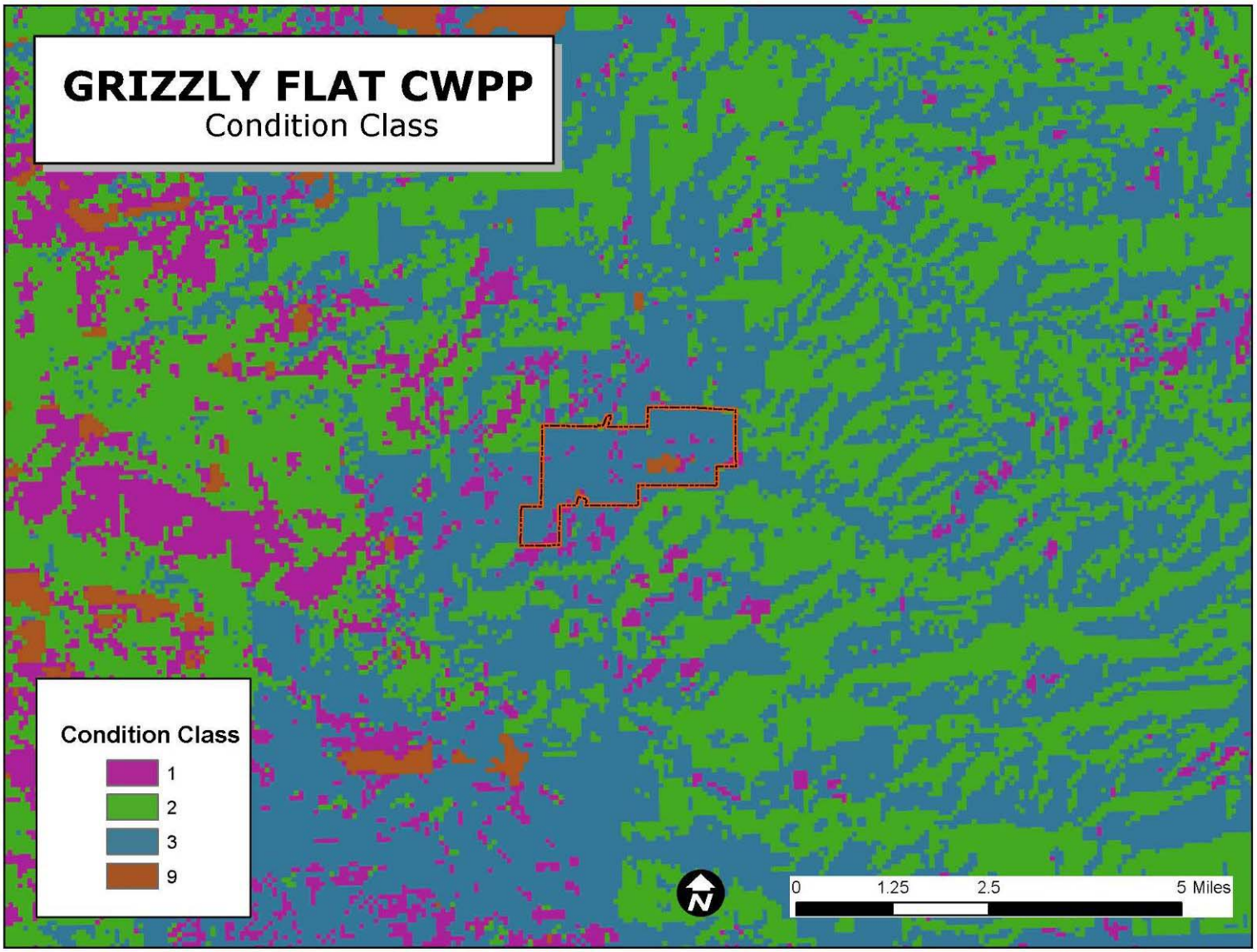
2002). The central tendency is a composite estimate of vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern); fuel composition; fire frequency, severity, and pattern; and other associated natural disturbances. Low departure is considered to be within the natural (historical) range of variability, while moderate and high departures are outside. Fire Regime Condition Class Definition

Characteristic vegetation and fuel conditions are considered to be those that occurred within the natural (historical) fire regime. Uncharacteristic conditions are considered to be those that did not occur within the natural (historical) fire regime, such as invasive species (e.g. weeds, insects, and diseases), "high graded" forest composition and structure (e.g. large trees removed in a frequent surface fire regime), or repeated annual grazing that maintains grassy fuels across relatively large areas at levels that will not carry a surface fire. Determination of amount of departure is based on comparison of a composite measure of fire regime attributes (vegetation characteristics; fuel composition; fire frequency, severity and pattern) to the central tendency of the natural (historical) fire regime. The amount of departure is then classified to determine the fire regime condition class.

Condition classes are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire exclusion, timber harvesting, grazing, introduction and establishment of exotic plant species, insects and disease, or other past management activities.

| **Condition class** | **Attributes** | **Example management options** |
|---|---|---|
| Condition Class 1 | Fire regimes are within or near an historical range.<br>The risk of losing key ecosystem components is low.<br>Fire frequencies have departed from historical frequencies by no more than one return interval.<br>Vegetation attributes (species composition and structure) are intact and functioning within an historical range. | Where appropriate, these areas can be maintained within the historical fire regime by treatments such as fire use. |
| Condition Class 2 | Fire regimes have been moderately altered from their historical range.<br>The risk of losing key ecosystem components has increased to moderate. | Where appropriate, these areas may need moderate levels of restoration treatments, such as fire use and hand or mechanical treatments, to be restored to |

| | | |
|---|---|---|
| | Fire frequencies have departed (either increased or decreased) from historical frequencies by more than one return interval. This results in moderate changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns.<br>Vegetation attributes have been moderately altered from their historical range. | the historical fire regime. |
| Condition Class 3 | Fire regimes have been significantly altered from their historical range.<br>The risk of losing key ecosystem components is high.<br>Fire frequencies have departed from historical frequencies by multiple return intervals. This results in dramatic changes to one or more of the following: fire size, frequency, intensity, severity, or landscape patterns.<br>Vegetation attributes have been significantly altered from their historical range. | Where appropriate, these areas may need high levels of restoration treatments, such as hand or mechanical treatments. These treatments may be necessary before fire is used to restore the historical fire regime. |


GRIZZLY FLAT CWPP
Condition Class
Condition Class
1
2
3
9
N
0
1.25
2.5
5 Miles

# Appendix IV: Technical Description of FLAMMAP:

*FlamMap* is a fire behavior prediction program that uses fuel type mapping, canopy information, topography and weather information to predict fire behavior. For this assessment, FlamMap was used with data from the US Forest Service to provide a snapshot of landscape influences on large fire behavior in the vicinity of Grizzly Flats. These influences were output as maps of potential wildfire flame lengths and crown fire potential.

A technical description of the FlamMap program Can be found in Appendix IV

- FlamMap software creates gridcell-based maps of potential fire behavior characteristics (Rate of Spread, flame length, crown fire activity, etc.) and environmental conditions (dead fuel moistures, mid-flame wind speeds, & solar irradiance) over an entire landscape. These maps can be viewed in FlamMap or exported for use in a GIS, image or word processor.
- FlamMap *is not* a fire growth simulation model. There is no temporal component in FlamMap. It uses spatial information on topography and fuels to calculate fire behavior characteristics at one instant.
- FlamMap uses the same spatial and tabular data as *FARSITE*; a Landscape (.LCP) File, Initial Fuel Moistures (.FMS) File, as well as optional Custom Fuel Model (.FMD), Weather (.WTR), and Wind (.WND) Files.
- FlamMap incorporates the following fire behavior models;
    - Rothermel's 1972 surface fire model,
    - Van Wagner's 1977 crown fire initiation model,
    - Rothermel's 1991 crown fire spread model,
    - Nelson's 2000 dead fuel moisture model.

Slope steepness, aspect (the direction that it faces), fuel model, foliar moisture, and crown base height are the most important factors driving fire behavior in FlamMap.

# Appendix V: Glossary

**Active crown fire**—A **crown fire** in which the entire **fuel complex** becomes involved, but the crowning phase remains dependent on heat released from the **surface fuels** for continued spread. Also called **running** and **continuous crown fire**.

**Available canopy fuel**—The mass of **canopy fuel** per unit area consumed in a crown fire. There is no post-frontal combustion in canopy fuels, so only fine canopy fuels are consumed. We assume that only the foliage and a small fraction of the branch wood is available.

**Available fuel**—The total mass of ground, surface and canopy fuel per unit area consumed by a fire, including fuels consumed in postfrontal combustion of duff, organic soils, and large woody fuels.

**Canopy base height**—The lowest height above the ground at which there is a sufficient amount of **canopy fuel** to propagate fire vertically into the canopy. Canopy base height is an effective value that incorporates ladder fuels such as shrubs and understory trees. See also **fuel strata gap** and **crown base height**.

**Canopy bulk density**—The mass of **available canopy fuel** per unit canopy volume. It is a bulk property of a stand, not an individual tree.

**Canopy fuels**—The live and dead foliage, live and dead branches, and lichen of trees and tall shrubs that lie above the **surface fuels**. See also **available canopy fuel**.

**Conditional surface fire**—A potential type of fire in which conditions for sustained active crown fire spread are met but conditions for crown fire initiation are not. If the fire begins as a surface fire then it is expected to remain so. If it begins as an **active crown fire** in an adjacent stand, then it may continue to spread as an active crown fire.

**Continuous crown fire**—See **active crown fire**.

**Crown base height**—The vertical distance from the ground to the bottom of the live crown of an individual tree. See also **canopy base height**.

**Crown bulk density**—The mass of available fuel per unit crown volume. In this paper it is a property of an individual tree, not a whole stand. See also **canopy bulk density**.

**Crown fire—**Any fire that burns in **canopy fuels**.

**Crown fire cessation**—The process by which a **crown fire** ceases, resulting in a **surface fire**.

**Crown fire hazard**—A physical situation (fuels, weather, and topography) with potential for causing harm or damage as a result of crown fire.

**Crowning Index**—The open (6.1-m) windspeed at which **active crown fire** is possible for the specified **fire environment**.

**Environmental conditions**—That part of the **fire environment** that undergoes short term changes: weather, which is most commonly manifest as windspeed and dead fuel moisture content.

# Appendix VI: Maps