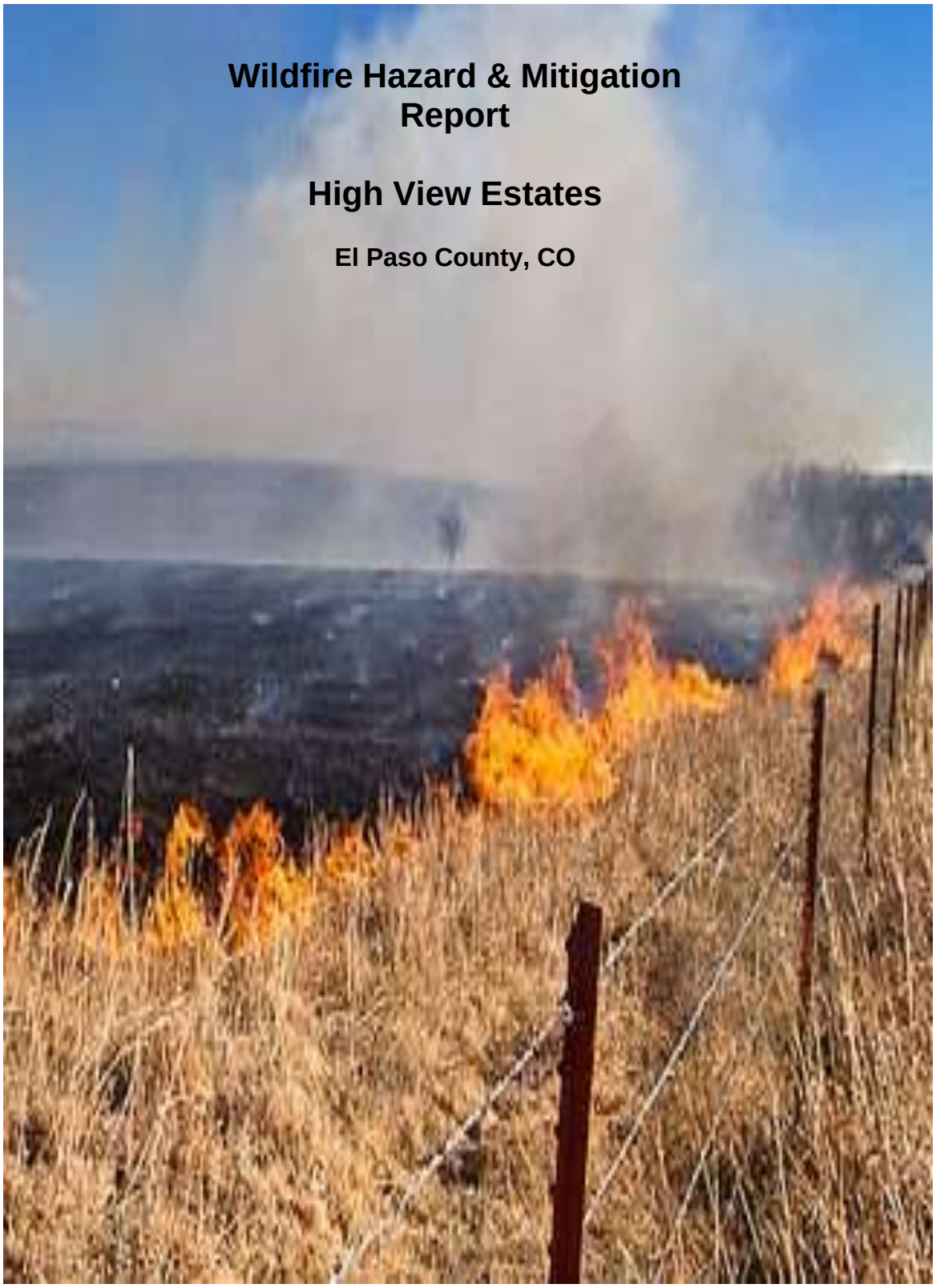
Wildfire Hazard & Mitigation Report

High View Estates

El Paso County, CO



Wildfire Hazard Evaluation Report

For

High View Estates

El Paso, CO

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Warning and Disclaimer: The degree of protection from wildfire hazards intended to be provided by this plan is considered reasonable for planning purposes. It is based on accepted forestry and fire science methodology. This plan is intended to aid the Forest Lakes development in minimizing the dangers and impacts from wildfire hazards. Fire is a natural force and a historical part of forest and native grassland ecosystems. Therefore, unforeseen or unknown wildfire conditions, natural or man-made changes in conditions such as climate, vegetation, fire breaks, fuel materials, fire suppression or protection devices, and ignition sources may contribute to future damage to structures and land uses even though properly permitted and mitigated within designated wildfire hazard areas.

January 18, 2022

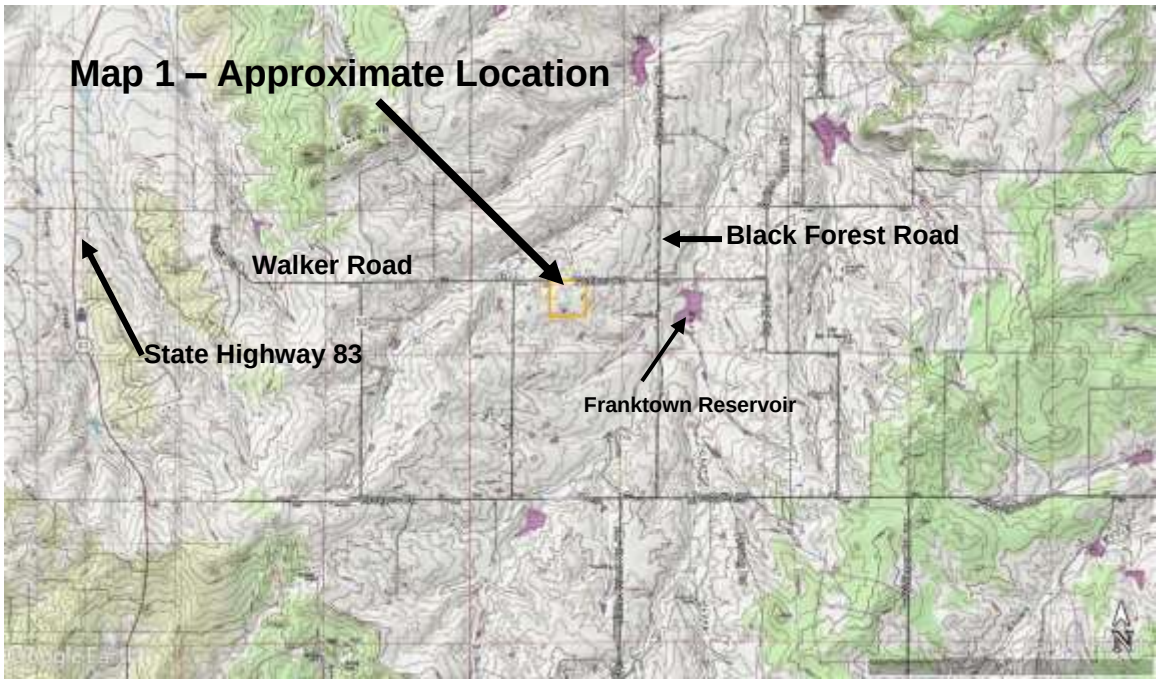
General Description

High View Estates is a private residential development planned for the northeast portion of El Paso County, Colorado. The development plan proposes the subdivision of forty (40) acres into five (5) lots. The lots range in size from 5.5 up to 11.5 acres. The property is located 0.5 miles west of Black Forest Road on the south side of Walker Road (see Map 1). The current address is listed as 6665 Walker Road.

Elevations within the property range from approximately 7,458 feet at the northwest boundary corner and rise to the south along the west boundary to 7,489 feet at the southwest corner. The general topography is a high ridge sloping to the north which drains to the northeast towards East Cherry Creek.

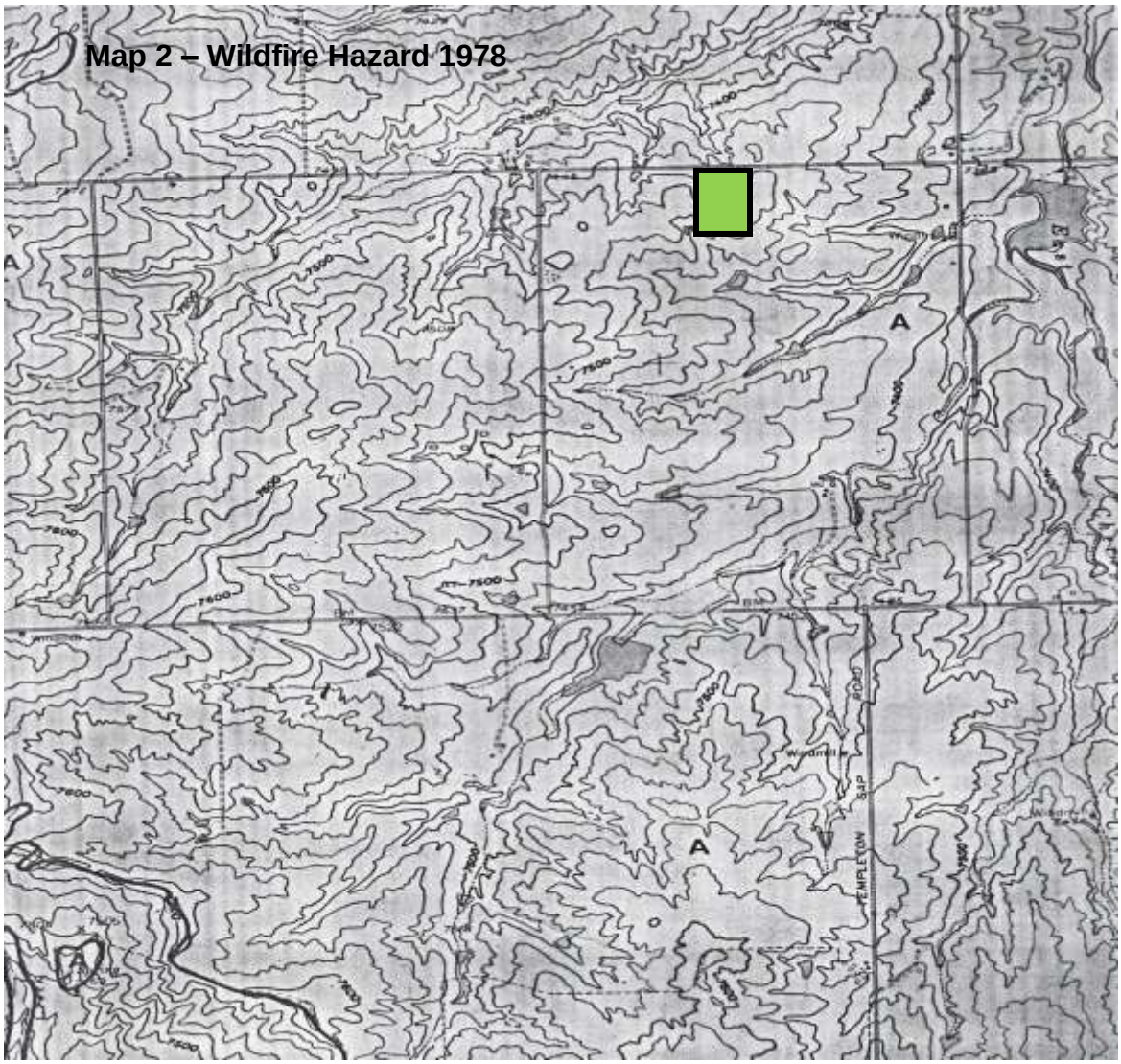
The slope running from the southwest corner to the northwest corner is 2.5%. Other slope profiles are even lower, for example, a south to north mid-property slope is less than 1%. Roads, beyond the main driveway, that exist within the property are simple dirt-track trails.

This area does have a significant wildfire event. The Black Forest Fire in June of 2013 burned 14,280 acres. The property is located 3.6 miles north of the burn perimeter.



Wildfire Hazard

Based upon the Wildfire Hazard Area Map (WHAM) developed by the Colorado State Forest Service (CSFS) in 1974, the site of the proposed 'High View Estates' subdivision contains a low hazard (A) for grasses (see Map 2).



Map 2 – Wildfire Hazard 1978

Since publication of these hazard maps, the CSFS developed a wildfire risk assessment tool in 2012 referred to as the Colorado Wildfire Risk Assessment Web Portal (CO-WRAP). This assessment was just recently updated to include events up to and including 2017.

Within the assessment report, the wildfire risk (see Map 3) to the property is classified as having a moderate risk. Wildfire risk is a composite rating which identifies the probability of loss or harm from a wildfire.

One plausible change to the wildfire risk from 1974 WHAM is an increase in the data accumulated from over the last 43 years. In addition, there is more residential development in the local area since the original assessment. There are two developments, Equine Meadows to the west and Cherry Creek Springs to the east. This results in a higher possibility for loss

This is also reflected in the Burn Probability rating. Burn Probability is the annual probability of any location becoming subject to a wildfire event. The assessment gives the development area a moderately high ranking in this regard. This is understandable as the dead grass fuel load level has likely increased over time as livestock grazing has decreased due to the changing land use.

Fire occurrence considers the likelihood of a wildfire starting based on historical records on a scale of 1 – 10. If the Black Forest Fire and other fires in the northern part of El Paso County are considered, one would expect a high rating. The actual rating is 5, not overly low or high. This reflects that grass fires normally occur, but initial attack efforts appear to be successful suppresion.

Map 3 – COWRAP Wildfire Risk

The assessment summary uses a Grass-Shrub (GS2) fuel model for the majority of the property. Fuel models attempt to determine which type of fuel will support a wildfire's spread across a landscape. This is a much more dynamic approach as fuel models do not differentiate between small changes in the fuel beds over a short distance but considers them across larger areas.

A field inspection was performed on Wednesday, January 12th to determine if any change should be made to the CO-WRAP wildfire hazard conclusions.

The fuel model delineated by the CO-WRAP assessment is not entirely correct. The assessment is misinterpreting a shrub presence within the grasses (see Photo 1.). The fuel model in and around the property is best represented by GR2, Low Load, Dry Climate Grass.

Photo 1. View of Property looking to the southeast from Walker Road. Note the absence of shrubs in the grassland.

The GS2 fuel model typically consists of just over one ton of fine dead fuels per acre. The surface area to volume ratio is 1820 which is low compared to other fuel models. This value assumes a 60% live grass fuel content. When dead fuel is solely considered, this value can rise to 2000. The higher the value, the faster a fuel responds to changes in environmental effects, such as temperature or moisture. Higher values are also correlated to shorter fuel ignition times, and hence faster fire spread rates.

Grass fires tend to spread quickly and have a high, but short intensity. It is predicted that the rate of spread will be high, ranging from 3300 up to 6,600 feet per hour. The flame length will be moderate, ranging from 3-7 feet.

Based on the CO-WRAP Assessment, the revised fuel model and the field observations made, the wildfire hazard should be considered as moderately high.

Wildfire Behavior

This hazard rating considers the role of the three major components that affect wildfire behavior: fuels, topography and weather. These three components will be examined in relation to 'High View Estates' development plan.

Fuels

The area was field checked, and the results in the CO-WRAP Risk Assessment summary were revised based upon the observed fuel models on the property. The USDA – Forest Service Intermountain Forest and Range Experiment Station in Ogden, Utah, developed these fuel model descriptions. They are used as aids in estimating fire behavior (see Appendix A).

The criteria for choosing a fuel model reflects that a wildfire will burn in that fuel type which best supports that fire. There may be more than one fuel model represented on any given area of land. In addition, current and expected weather conditions will influence the condition of these fuels.

The grassland is best described under Fuel Model 1 (see Appendix A). "The fine, very porous and continuous herbaceous fuels that have cured or are nearly cured govern fire spread. Fires are surface fires that move rapidly through the cured grass. Very little shrub or timber is present, generally less than one-third of the area."

Fuel Model 1 can be further refined to GR2, Low Load, Dry Climate Grass. This fuel model was developed by Scott & Brogan in 2005 (see Photo 2). The primary carrier of a fire is grass. Any brush or shrubs, if present, will not significantly affect fire behavior.

Caution needs to be expressed here if the dead grass moisture is very low. With a moderate wind speed of 10 – 13 miles per hour, the rate of spread of a wildfire can exceed 160 feet per minute, almost 2 miles per hour. . Flame length in this instance may exceed 10 feet in length making direct attack difficult.

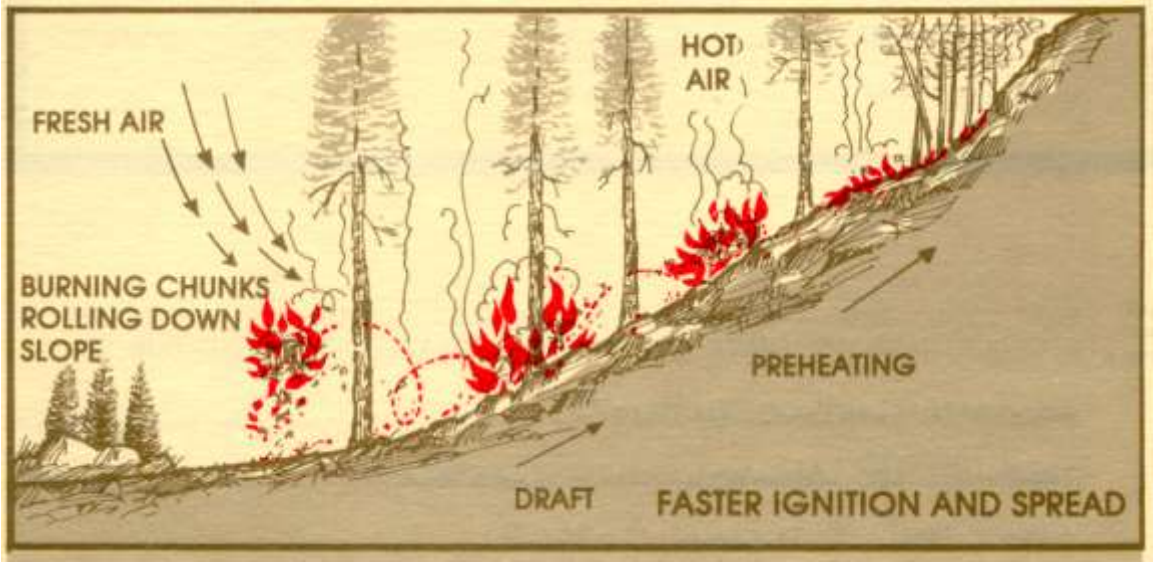
Photo 2. This photo depicts an example of Fuel Model 1 from Walker Road, looking to the south. The area west of the fence reflects the absence of grazing or mowing and is a closer representation of GR2.

Topography

The topography of the site is one of the main factors that will influence a fire spread. The aspect or compass direction that any slope faces influences the fuel type that exists and the amount of preheating these fuels receive by the sun. Aspect can also influence the effects of diurnal winds, as they move upslope during the daylight hours and down slope during the evening and early morning hours.

As the percent of slope increases, the rate of fire spread by convection increases. In other words, wildfires burn faster moving uphill (see Figure 1).

Figure 1. Slope Affects Fire Spread



The specific topography of the property is relatively flat. As mentioned previously, the slope ranges from 1 – 2 ½%. This should have negligible impact on a fire's spread assuming low wind conditions.

Slopes that are greater than 25% are considered extreme in their effect on wildfire behavior. This condition does not exist on or near the planned 'High View Estates'.

Weather

Weather is the most variable of all the factors. The accumulative effects of weather over time can influence vegetation curing and fuel moisture content.

Grasses are described as being one-hour time lag fuels. Time lag is a measure of the rate at which a given dead fuel gains or loses moisture. Hence grasses tend to be influenced by weather conditions on an hourly basis.

Winds can influence the direction and rate of spread of a wildfire. Of great concern is the spotting of the fire by embers transported by winds ahead of the main fire. This has been in no greater evidence than the 2021-2022 winter season.

The Four Corners Fire in western Kansas ignited on December 15th and consumed over 12,000 acres in one day. The cause of the fire was the result from downed power lines during a high wind event. Extremely dry conditions existed as no rainfall had been recorded since early November.

Several ranches were destroyed along with an unknown, but high number of livestock were killed.

The fire in Kansas was a precursor to the Marshall fire in Boulder County, Colorado on December 30th. This fire is estimated to have destroyed over 1,000 homes in just one day. Again, the fire ignited under high wind conditions during an extended period of above average temperatures and an absence of precipitation.

While the weather may contribute greatly to a wildfire event, it is immune to outside influences.

Predicted Fire Behavior

Based upon history, one would expect that if an ignition occurs, a wildfire may spread rapidly and quickly uphill from Walker Road towards the proposed development. Using the USDA – Forest Service Fuel Modeling System (Behave Plus 5.05), the following predictions can be made based upon an 80-degree temperature day with a relative humidity of 18% with little cloud cover at 1:00 p.m. in the month of July. The drainage used in this example is south of the property and that the ignition originates within the drainage.

The fire will spread very slowly as the moisture in the live grasses will prevent a rapid rate of spread. This result uses a one-hour dead fuel moisture of 16%. It is only at a dead fuel moisture of 14% that a wildfire starts to spread. A wildfire will move approximately 4,400 feet per hour with a flame length of just over one foot.

If the dead fuel moisture is reduced to 7% and the wind speed is increased to fifteen (15) miles per hour, the fire behavior increases dramatically. The rate of spread doubles to 8,850 feet per hour. The flame length grows to over eight (8) feet in length. This now hampers initial attack directly at the flame front. This type of weather condition could be perceived as common during a dry thunderstorm event or the passage of a cold front during the winter season.

It is predicted that local suppression forces should be able to contain the initial fire outbreak with mobile engines and hand constructed control lines within four hours of initial attack.

It should be noted that these predictions are based upon normal weather conditions prevailing over the course of a year. Weather conditions that were exhibited from the fall of 2001 through the present date are outside of normal conditions resulting in catastrophic losses experienced throughout the western United States. Again, the Marshall Fire and the fires in Kansas provide insight in what fire behavior might occur even in the winter season.

If such conditions are present on or in the vicinity of the proposed development site, any wildfire event can be expected to be more severe and resistant to initial suppresion efforts.

Wildfire Mitigation

It should be noted here that the occurrence of a wildland fire on this property and any subsequent spread of a wildfire to adjacent land can never be eliminated. In the Spaatz Fire, near Monument, suppression forces were able to arrive on scene in approximately four minutes after the fire was reported. Even with this quick response, the wildfire reached a size of 67 acres before it was controlled.

The potential for loss can be reduced and the odds can be improved that initial response forces can be successful in keeping a wildfire to the smallest size possible and structure loss to a minimum. But even with the best efforts of suppression forces, there will always exist a level of risk of loss to a wildfire.

The only way to reduce the risk of loss from a wildfire is to modify the factors that influence fire behavior. Of the three factors discussed previously, the only factor that could be modified prior to a wildland fire is the fuels. The efforts in modifying fuels can be targeted to their arrangement, continuity and availability.

- **Arrangement**

The arrangement of fuel considers the size, shape and compactness of the fuel itself. Smaller fuel sizes have a greater surface area exposure for preheating. If these smaller sized fuels are only lightly compacted in spacing this results in easier ignition and increased combustion.

One technique in reducing the readily ignitable fuel level would be to remove fuels, such as weeds and grasses from the site. However, it is not practical or reasonable to remove these types of fuels from the entire property.

During the construction phase of any residential structure, the most likely source of ignition will come from personnel and activities. These sources of ignition may come from flammable chemicals, improperly discarded cigarettes, shorts in electrical equipment, and other means.

It is suggested here that the reduction of the most ignitable fuel be done in areas that are within fifty feet of the pad of any proposed residential structures. This will reduce the amount of small, flashy fuel in proximity to the structure. It will also retard the spread of a fire towards adjacent property and provide suppression forces additional time to contain a fire quickly.

Once a residential structure is built, a wildfire safety zone should be established. Wildfire safety zones are intended to slow a fire down so that it may be controlled and extinguished. There are three zones that comprise a wildfire safety zone.

The first zone is the one that contains the most opportunity for modification. The minimum width recommended is thirty feet and is divided into three segments.

As these zones may be unique for each lot that is developed, it is difficult to make specific recommendations here. However, it is recommended that each lot be treated prior to completion of the structure and the issuance of the occupancy certificate. A simple and efficient technique would be to mow the grass that is present in the first zone or thirty feet.

Specific information on the development of wildfire safety zones are available through the Colorado State Forest Service in the Home Ignition Zone Guide at the following link: 2021_CSFS_HIZGuide_Web.pdf (colostate.edu)

- **Continuity**

The second factor affecting fuels that can be modified is their continuity. Is the fuel continuous or patchy in nature? Is the fuel layered in such a manner that it can leave the ground and spread into a vegetative canopy?

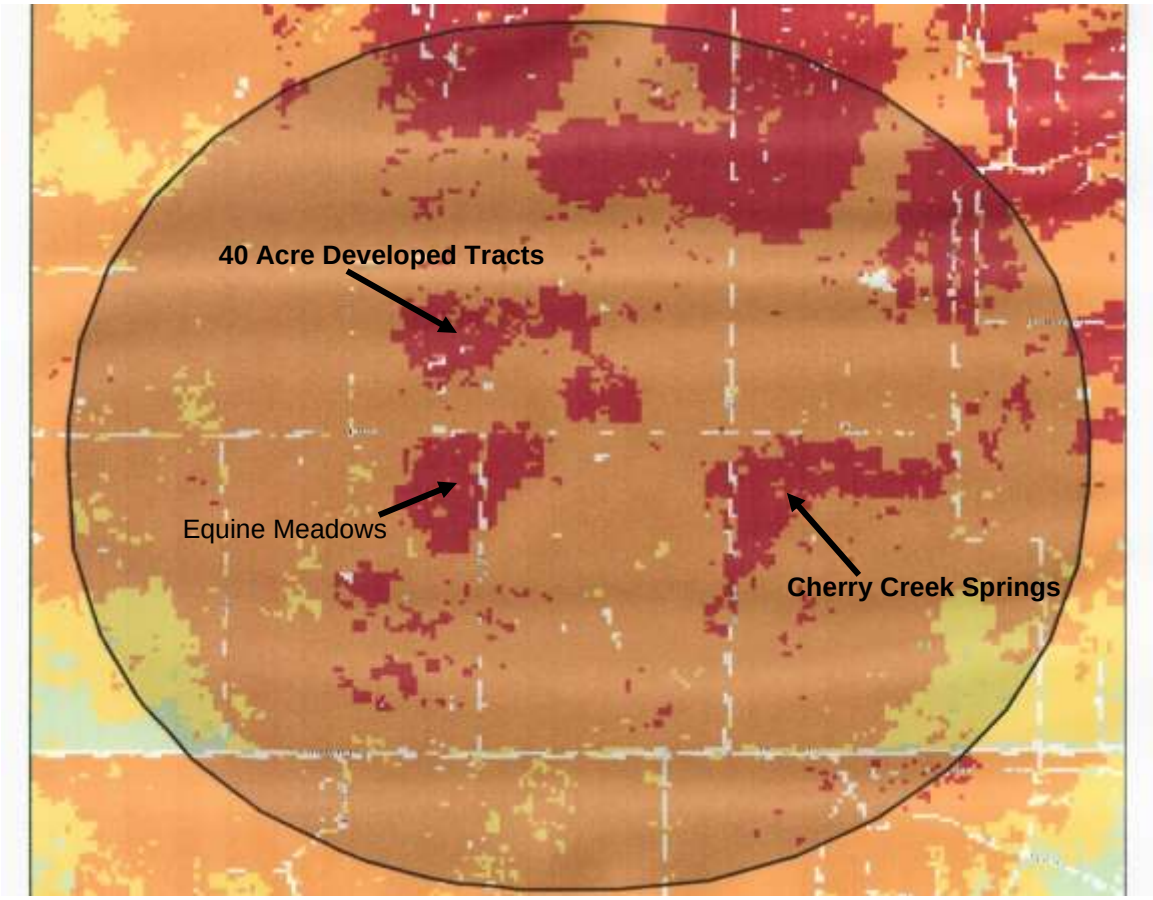
In this instance, the fuels in the Low Load Grass fuel model are continuous. While there may be patches of mid-sized grasses, these are insufficient to generate enough heat to increase the rate of spread.

Of increasing concern, is the larger landscape in which the property is situated. Using the CO-WRAP Assessment Tool, a two (2) mile radius was used to examine Wildfire Risk. While the overall risk did not change, the extent or continuity of the risk is very large in size (see Map 4).

The subject property is approximately located at the center of the circle. Red areas are locations of high wildfire risk and contain adjacent subdivisions or other rural landownerships with structures. Orange represents moderate risk in which the Low Load Dry Climate Grass fuel model is prevalent.

The reason for this visual is to show the similarity of this area to the Marshall Fire in Boulder County. That wildfire started along Marshall Road and travelled east for almost three (3) miles through a comparable fuel bed as seen in this area. So, while the grass fuel bed may appear benign and non-threating, in a worse case weather scenario, it may result in a catastrophic wildfire.

Map 4. COWRAP Wildfire Risk
Two (2) Mile Radius



- **Availability**

The final consideration is the availability of the fuel to physically burn. This factor is influenced by the weather on a daily or yearly basis and cannot be readily influenced.

As was mentioned earlier, the availability of this fuel type should be considered a year-round hazard and not limited to the summer months.

The current weather patterns have contributed to a long-term drought situation that has influenced the availability of the fuels to burn. The trend of above average day time temperatures and below normal precipitation levels have allowed fuels to reach a higher state of availability than might normally be the case, particularly during winter months. This may result in wildfire acting in a manner that might be more characteristic of late summer burning conditions.

Other Considerations

Firebrands & Secondary Ignitions

It is becoming more apparent that structure loss is not occurring during the passage of a burning wildfire front but from ignition of the structure by firebrands and secondary ignitions. Firebrands are burning materials or embers that are lifted into the air by convective wind currents. Firebrands can be cast hundreds of feet in advance of the fire front.

Research and case studies in Australia have found that there is a 50% probability of loss of structures that are 100 – 200 feet from the fire front. This would seem to indicate that firebrands are a major contributing factor of structure loss.

In the U.S., studies indicate there is 90% probability that a structure with a non-flammable roof and that is at least 100 feet from the fuel bed will not be lost during a wildfire. However, this statistic may be misleading as the Cedar Fire (CA) in 2003 indicated that 60% -70% of the structures lost were ignited by firebrands. This would also infer that solely relying on 'defensible space' for structure protection may not be adequate.

In a professional paper by Scott (2005), the exposure of a structure to embers and firebrands is discussed. In an inference to fuel mitigation in the 'defensible space' zones, Scott states that "In no case is complete removal of the forest canopy required to mitigate crown fire potential near a structure." This infers that 'defensible space', while a good starting point, may not be the whole solution in preventing structure loss.

Currently, fire-safe construction is the recommended protocol for fire brand risk reduction by the professional wildfire community.

Driveways

Driveways to individual lots or residential structure should be constructed in accordance with NFPA 1141, *Fire Protection for Planned Building Groups.*

Driveways should provide a minimum width of twelve feet and a minimum vertical clearance of fifteen feet. The grade of any driveway should not exceed 12%. There should be fire apparatus access to within 150 feet of any point of the exterior of any residence (NFPA 1141, 6.6.1).

All dead-end roads should have a turnaround at the closed end (cul-de-sac) of at least 100 feet in diameter.

Wildfires across the West have seen a growing trend of fatalities, especially during mega-events. This may be due to delays in making a prompt evacuation or when fleeing a fire. Panic, due to proximity of flames, could lead to poor decisions in the moment.

It is recommended here that the grass be mowed to height of less than six (6) inches along main entrance and any driveways that are subsequently built on each individual lot.

From a detailed wildfire hazard assessment performed in a local subdivision, a common discrepancy found was inadequate or poor visibility of individual residential address numbers. Letters and numbers indicating specific street addresses should be a minimum of 4 inches in height with a ½" stroke. The numbers or letters should be strongly contrasting with the background color to readily visible from the main access road into the subdivision and from Walker Road.

Landscaping

The vegetation that is used in the landscaping of the structure should be fire resistant. For example, ornamental junipers can be very flammable and easily ignited by aerial firebrands. Planting these shrubs near the exterior walls of any residential structures provide a readily available fuel source that could threaten the structure and divert suppression forces to protect the building instead of controlling the wildfire.

From the historical fire record of the region, the ignition of ornamental junipers around structures is a major contributor of damage and subsequent loss. **It is strongly recommended that the use of ornamental junipers in the landscape be prohibited within thirty feet of a structure's foundation.**

It is assumed that a native landscape will be prevalent. The use of periodic irrigation will help keep landscapes lush and green, thereby lowering their ability to ignite. There are many irrigation techniques available that can keep plants less susceptible to burning while still adhering to water conservation principles.

Another alternative to irrigated green space would be to line the footprint of the foundation of the structure with rock. If rock is used, it should be placed at a minimum width of five feet from the foundation. This will prevent most flame lengths from reaching the building.

There are many different sizes and types of rock available. It should be noted here that it would be necessary to remove needles, grasses and other litter from within this rock fuel break on an annual basis.

Construction Considerations

As the fuel in this subdivision is primarily grass and weeds, predictable sources of fuel that will burn and allow entry of a wildfire into the structure will be debris that is trapped under or next to the building or accumulation in the roof gutters. Porch, foundation, roof and attic openings should be screened off or enclosed to keep debris from accumulating and burning underneath. This is particularly important where wooden decks are planned at ground level. This was a factor in the loss of structures in the Waldo Canyon Fire. These location concerns were also expressed in a joint publication by Green Builder Media and the NFPA. This recently released e-book, 'Design with Fire in Mind', can be downloaded using the link. Go to the Resources tab and click on e-books.

During the 2012 Waldo Canyon Fire, there were wooden decks that ignited and subsequently allowed entry of the fire into the main residence. This was due to the accumulation of fine dead fuel, such s weeds and leaves, underneath the deck that were ignited by wind blown embers.

It is strongly recommended that all decks that are planned at ground level be required to be sealed off and enclosed to prevent the accumulation of flammable debris underneath them.

In a wildfire risk assessment in a local development, a significant entry point for fire into a house was through the eaves, overhangs or sofits. These locations can trap embers and combustible gas or heat, that can ignite the structure.

Based upon recommendations from FEMA, overhangs, if used, should be enclosed with a flat, horizontal sofit with a one-hour fire resistance rating. The fascia should be constructed of non-combustible material.

The combustibility of a roof is the one of the most important factors in determining the risk of a structure to damage or loss from a wildfire. The use of combustible materials such as wood shingles does not necessarily increase their susceptibility to fire. However, as a wood shingle roof ages and is influenced by the weather, individual shingles may start to warp, curl, and lose the tightness that was exhibited upon initial installation.

Siding materials, while not as critical as compared to roof, can help to lower the overall risk of a structure to damage from a wildfire. Grass fires tend to burn quickly and intensely in most instances. The exception is under very low fuel moisture conditions and wind over 10 m.p.h. There may be sufficient radiant heat to ignite combustible siding materials if the area adjacent to the structure is not mitigated. . The use of non-combustible siding may not significantly reduce the risk to wildfire, where a stone border is placed around the foundation.

It is strongly recommended that if a non-combustible border is not placed around a structure's foundation, the grass around the structure should be mowed to a maximum of height of six inches and a minimum distance of ten (10) feet from the foundation.

Water Supply

At the present time, there is no readily available water supply for ground suppression fire resources. The local fire protection districts will need to haul water into the site during a fire.

The property lies within unincorporated land of El Paso County. As the subject property is surrounded on three sides by the Black Forest FPD. It is assumed that the Black Forest Fire FPD would be the primary resource for initial attack on a wildfire. Station 2 is located less than two (2) miles away, south of the property on Black Forest Road.

The apparatus available is 1 – Type 1 Engine, 1 – Type 6 Brush Truck and a Water Tender. Additional support is located at Station 1 at Teachout Road, approximately eight (8) miles south.

Firewise

While the subject property can be viewed a minor subdivision, it is still important the residents work together to monitor their wildfire safety. The National Fire Protection Association (NFPA) sponsors the Firewise USA program which is an educational tool for homeowners. This allows community members to plan and take actions to reduce the threar of wildfire.

More information can be found at the Firewise web site at: NFPA - Firewise USA®

Appendix A

Fuel Model Descriptions

Fuel Model 1 Summary Page

Source: Anderson, Hal E. Aids to Determining Fuel Models for Estimating Fire Behavior, National Wildfire Coordinating Group, General Technical Report INT-122, April 1982.

"This report presents photographic examples, tabulations, and a similarity chart to assist fire behavior officers, fuel management specialists, and other field personnel in selecting a fuel model appropriate for a specific field situation. Proper selection of a fuel model is a critical step in mathematical modeling of fire behavior and fire danger rating."

Low Load, Dry Climate Grass (GR2) Summary Page

Source: Scott, Joe H. & Burgan, Robert E. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's (1972) surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153, Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

"This report describes a new set of standard fire behavior fuel models for use with Rothermel's surface fire spread model and the relationship of the new set to the original 13 fire behavior fuel models."

FUEL MODEL DESCRIPTIONS

Grass Group

Fire Behavior Fuel Model 1

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

Grasslands and savanna are represented along with stubble, grass-tundra, and grass-shrub combinations that met the above area constraint. Annual and perennial grasses are included in this fuel model. Refer to photographs 1, 2, and 3 for illustrations.

This fuel model correlates to 1978 NFDRS fuel models A, L, and S.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	0.74
Dead fuel load, ¼-inch, tons/acre	.74
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	1.0

Photo 1. Western annual grasses such as cheatgrass, medusahead ryegrass, and fescues.

Photo 2. Live oak savanna of the Southwest on the Coronado National Forest.

Photo 3. Open pine—grasslands on the Lewis and Clark National Forest

GR2 (102)

Low Load, Dry Climate Grass (Dynamic)

Description: The primary carrier of fire in GR2 is grass, though small amounts of fine dead fuel may be present. Load is greater than GR1, and fuelbed may be more continuous. Shrubs, if present, do not affect fire behavior.

Fine fuel load (t/ac)	1.10
Characteristic SAV (ft-1)	1820
Packing ratio (dimensionless)	0.00158
Extinction moisture content (percent)	15