Wildland Urban Interface
Ignition Resistant Construction Manual

A guide to smart construction and wildfire mitigation in the Wildland/Urban Interface

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Executive Summary

It is the mission of the Bernalillo County Fire Department to protect lives and property through proactive education, prevention, and response.

To accomplish this mission, the Fire Department has adopted the 2015 International Wildland Urban Interface Code, as part of the adoption of the 2015 International Fire Code. The objective of the Wildland Urban Interface code is to establish minimum regulations consistent with nationally recognized good practice for the safeguarding of life and for property protection. Regulations in the code are intended to mitigate the risk to life and structures from intrusion of fire from wildland fire exposures and fire exposures from adjacent structures and to mitigate structure fires from spreading to wildland fuels.

The East Mountain Area of Bernalillo County is one of the largest populated Wildland Urban Interface Areas in the State. The likelihood of a large complex and catastrophic wild fire increases every year. In adopting the Wildland Urban Interface Code; Bernalillo County Fire Department hopes to help reduce the likelihood of large complex and catastrophic wild fires, by requiring homeowner, property owners, and developers to create and maintain a defensible space around their properties and subdivisions.

The unrestricted use of property in Wildland-Urban interface areas is a potential threat to life and property from fire and resulting erosion. Safeguards to prevent the occurrence of fires and to provide adequate fire protection facilities to control the spread of fire in Wildland-Urban Interface areas shall be in accordance with the Wildland Urban Interface code.

The Wildland-urban interface areas within Bernalillo County are those areas East of Tramway Boulevard to the west face of the Sandia Mountains and from San Antonio north to the Sandia Indian Reservation, East Mountain Area, north, south, and east to the County line. Portions of the unincorporated areas to include the Rio Grande Bosque and Wildland areas extending 1000 feet from the outer edge of the Bosque, and the Pajarito Mesa areas west, and south to the County line.

This manual was developed to assist homeowner, property owners, developers, and contractors in understanding the requirements of the Bernalillo County Wildland Urban Interface Code.
Purpose

This manual is to be used in conjunction with Appendix P of the 2015 Bernalillo County Fire Code, which together serve to provide all users with both legal requirements, as well as recommended guidance for optimal ignition resistant construction features. All requirements found in Appendix M supersede or override less-restrictive Homeowner Association and Neighborhood Covenants and shall apply to all new building construction or reconstruction in the Wildland Urban Interface areas of Bernalillo County.

Scope

Wildland fires throughout the State of New Mexico and the Southwest over recent years have and will continue to be examined for lessons learned, not only by local residents, but also by distant neighbors, cite, states, governmental agencies, and more. As such all users of this manual need to understand that concerted effort was made by the contributors of this document to achieve a balance between common sense ignition resistant construction and landscaping, common construction methods, and homeowner desires.

The material found in this manual is intended to follow the provisions of the Wildland Urban Interface Code and provide the reader with a clear understanding as to why the code was adopted. In addition this document will provide the reader with information they can use in preparing their home against the threat of wildfire. The two primary sections of this document include ignition resistant construction and landscaping/vegetation management.

It is important to note and understand that All provisions included in this manual are intended to function as a system or design package. Eliminating just one element or feature from the system approach may increase a home’s vulnerability to a wildfire or urban conflagration event. For example, a home could be constructed with ignition resistant materials, but if vegetation is allowed to grow under decks or tree branches extend over the roof, then the construction materials may not be enough to protect the home from wildfire. Likewise if a home has good defensible space, but has combustible construction materials, then the home is still subject to ignition from fire embers and brands from open space or adjacent properties. In any case the provisions outlined in this document do no guarantee that every home will survive a wildfire event. Wildfire will always be a dynamic and unpredictable event influenced by several factors including fire weather, fuels, topography, and human activity.

Each of the provisions listed in this manual apply to new or reconstructed residential and commercial properties within the Wildland Urban Interface Areas as defined in the Ordinance. These provisions do not apply to small detached accessory structures such as storage sheds, dog houses, and children’s play houses.
Introduction

Bernalillo County is a wonderfully diverse community in terms of landscape, architecture, and topography. This diversity, the Sandia and Manzanita Mountains are a few of the things that entice people to call the County Home. Many people enjoy the opportunity reside in the East Mountain areas of the County as a way to embrace the beauty of nature and wildlife, while still having the convenience of city living. However, what most people don’t realize when they move in to the East Mountain areas of the County, is that they have chosen to reside in one of the largest Wildland Urban Interface zones in the State of New Mexico, and the County. In fact, well over 50,000 homes or addresses have been identified as at-risk of being affected by wildfire in the East Mountains of Bernalillo County.

Residing within a Wildland Urban Interface comes with some unique risks not generally found in other parts of the County. One such risk is the ever present threat of wildfire. Wildfire is an event nature uses to enhance the overall health of our forests. Fire removes dead, diseased, and overgrown vegetation, which in turn provides nutrients for new growth and improved wildlife habitat. It is impossible to prevent wildfires from impacting communities in the Wildland Urban Interface; as such, homeowners need to learn to live with that ever changing environment without increasing the risk or subjecting their homes to increased level of threat.

The Bernalillo County Fire Department has written this manual with the goal of reasonable design that will improve the likelihood of a home surviving a wildfire event with little or no firefighter intervention. In Bernalillo County, 12 firefighters respond on the initial dispatch of every reported house fire. Additional resources are called as needed based upon the severity of the fire. During a wildfire event, there are not enough resources available to protect each hose as we would for a single house fire. Firefighters must make difficult decisions as to how best deploy firefighting resources to provide the most effective fire attack. A home constructed with ignition resistant materials and adequate defensible space requires fewer resources to defend than a home that is more vulnerable to wildfire. It is everyone’s duty to Share the Responsibility in protecting the East Mountain Community.
Fire Suppression History

Over the years, most firefighting agencies adopted fire suppression as the proper means of protecting the nation from wildfire. Thus, for the better part of the last century, wildfires were suppressed, leading to the overcrowding, meadow encroachment, and reduced wildlife habitat that now characterize national forests. Over the last 10 years, wildfires have become increasingly dangerous, and more and more acres of forest have been burned.

Although fire suppression is still aggressively practiced, using fire as a management technique has also become more common. Because of the large number of people who essentially live in the East Mountain Areas, suppression will always have to be a priority. However, the more that fire is used in fuel and ecosystem management, the closer we can come to re-establishing a natural fire regime and reducing the chances of catastrophic wildfires.

Fire causes within the East Mountain Area are roughly split with 48 percent caused by human activities and 52 percent ignited by lightning. The Coyote Canyon fire, which started in the Withdrawal Area in 1999, burned 350 acres and created havoc for the nearby residents. The Cooper fire in 1998 burned 120 acres but did not threaten any homes.

Although the East Mountains have not experienced a large wildfire in several decades, we can look at the large catastrophic fires throughout the State, and see what the potential impact to homes, property, the forest, and infrastructure would be. All these fires have one thing in common, the homes that were lost, could have been saved if built of fire resistant materials, and had a maintained defensible space on the surrounding property.

The information and design provisions provided in this design manual are the result of many years of research, observations, and studies of actual fire events. In order to understand fire’s impacts on building construction, we must first have an understanding on basic fire behavior. During a wildfire event, fire propagates, or moves, through direct flame contact, radiant heat transfer from structure to structure, radiant heat transfer from vegetation to structure, and from fire brans and embers that ignite vegetation and structures. However the most prominent method of initial ignition is through fire brands and embers. The industry term for fire embers is “an ember storm” which can be compared to a snow storm with blizzard like conditions.
Wildland Urban Interface Fires

Wildland fire is a natural part of the environment in the East Mountain Areas of the County. It has assisted in developing the forests, woodlands, and grasslands valued by residents and visitors alike. These interface communities have been significantly altered by drought, infestation, suppression protocols, and encroachment, resulting in increased fuels and greater risk to humans and infrastructure. In addition, contemporary population growth has led to increased development close to the wildland urban interface and increased the number of residents and structures at risk from wildfire. The primary driving force behind the adopting of the Wildland Urban Interface Code was to reduce the likelihood of a large catastrophic wild fire event in the East Mountains.

In May 2012 the Whitewater-Baldy Complex fire occurred when two lighting caused fires burned into each other. When finally controlled, nearly 300,000 acres of valuable watershed had burned with an estimated cost of $100 million for fire suppression, resource and other damages. On June 4th another light caused fire had started, and when it was finally brought under control the fire burned 44,330 acres and destroyed 250 homes. The overall estimated cost of suppression, resource and other damage costs is $100 million. Both of these fires occurred right after each other in a small mountain community, and burnt almost 400,000 acres, and cost over $200 million for fire suppression, and resource and other damages.

On June 23, 2012 a wildfire was reported burning in a canyon west of the City of Colorado Springs. Within three days of ignition the fire was pushed into adjoining neighborhoods by high winds and severe weather. The Waldo Canyon fire ultimately destroyed 346 homes and significantly damaging 45 others.

If a fire like any of the three mentioned above would occur in the East Mountains, the losses would be drastically higher, with the possibility of being one of the worst Wildland Urban Interface fires in U.S. history with thousands of homes being destroyed. The cost of suppression would far exceed anything in recent history. And the loss of habitat, watershed, and vegetation will greatly affect the area for decades.
Fire Brands/Embers

Based upon the investigation findings, structural ignition from fire brands/embers accounted for more than half of all homes burned in the non-conflagration areas (See figure 1 below for an example of a roof ignited by brands/embers). As fires burn, they produce fire brands/embers that are pushed by the winds generated by the fire. It is not uncommon to have fire brands/embers igniting spot fires as much as one-half mile or more ahead of the fire front. Some studies have reported spotting fire as much as ten miles ahead of the fire front. The brands/embers can carry enough heat energy to ignite combustible structures as they blow against or land on the combustible surfaces of a home. The findings support and stress the importance of ignition resistant construction. Specifically, features such as screened attic vents, composite decking and Class A roofing provide significant defense against brand/ember initiated ignition of homes.

Figure 1
Vegetation Exposure
The next highest source of ignition to homes was burning vegetation in close proximity to structures as represented in Figure 2. Trees such as dense conifers and similar vegetation tend to catch firebrands/embers and when located adjacent to, or in close proximity of the homes, can be a significant fire exposure to the structure.

Figure 2
Structural Exposure
Similar to vegetation exposure, homes to home ignition is a common event in wildland/urban interface fires. During the Waldo Canyon Fire, the two neighborhoods that experienced the most losses were a result of home to home ignition. Another part of structural exposure is that of a structural fire spreading to surrounding vegetation, which can spread to surrounding homes. Figure 3 shows the density of a neighborhood within a forested area.

Fire Front/ Direct Flame Contact
The smallest percentages of home ignitions occur due to direct flame contact or impact from the wildland fire front. Typically, in these cases, the fire front approaches from open space or forest land. A fast moving crown fire through a forested area burns with intense radiant heat that pre-heats everything within its path. As the fire front approaches the houses on the perimeter of the neighborhood, they can be very vulnerable to easy ignition (Figure 4). Good forest health goes a long way in keeping wildland fires small and preventing crown fires. Unfortunately, this type of fire is the hardest to mitigate, and in must urban environments is beyond the capability of a homeowner to mitigate.
During the fire, and in the days following, there were many examples of successful wildfire mitigation work. Fire crews were able to defend structures because homeowners had taken the time to create a defensible space around their home. Some neighborhoods or portions thereof, sustained little to no fire damage because of mitigation work prior to the fire in the open spaces throughout the neighborhoods.

History has shown again and again that the loss of structures during a wild fire event can be prevented if steps are taken prior to the fire to protect your home and property.
Ignition Resistant Construction Features

This section of the design manual specifically addresses the construction materials and finishes used to reduce the likelihood of ignition of a home during a wild fire.

Class A Roofing

A class A roof is not just the roof covering itself, but is an overall assembly required to achieve a Class A rating. Roofing products are tested by submitting a roofing mock up to a testing lab, where they subject the roofing assembly to a fire brand test. This test involves placing a burning fire brand upon the roof. Figure 5 shows the three sizes of fire test brands – the largest is Class A (12”x12”), Class B (6”x6”), Class C (1”x1”). During the test, the fire cannot penetrate the roof or cause the roof structure/underlayment to ignite before the brand is consumed and burns out.

![Figure 5](image)

Combustible roofing materials, to include wood, fiberglass, etc. are subject to ignition from fire embers and brands. Many homes that ignite in wildland urban interface fires burn from the top down, this is a result of ignition of the roofing materials of the combustible roofing decking.

There are many types and architectural styles of Class A roofing materials available on the market today. The variety of styles allow for flexibility in achieving the desired look of the home and complying with homeowner associations’ architectural design standards while providing for fire resistive properties that are so important in the wildland urban interface.

Typical Class A roofing products include, but are not limited to the following types:

- Asphalt shingles
- Metal/Stone-coated metal
- Concrete (standard weight and lightweight)
- Clay tile
- Synthetic
- Slate
- Hybrid composite
**Exterior Cladding & Siding, Eaves and soffits**

The home’s siding is the largest overall surface of the home. The materials, in which the exterior of the home are wrapped, play a significant role of preventing vegetation to home, home to vegetation, or home to home ignition. In exposure fires, the siding of a home is subject to extremely high radiant heat, which can ultimately ignite the home. This is the same problem experienced throughout history in terms of conflagrations such as the Great London Fire and Great Chicago Fire that consumed entire cities.

Ignition resistant siding helps prevent home ignition thereby slowing the fire’s progress through a neighborhood and giving the fire department an opportunity to contain and control the fire.

There are many different exterior cladding and siding products available to satisfy a variety of architectural styles. The most common as shown in Figure 6 below, are natural or fabricated stone/rock, stucco, and cement board.
Exterior Cladding & Siding, Eaves and soffits
Projection of homes is areas that are vulnerable to heat and embers collection. While not common in this area, the undersides of some building projections are left open to expose the structural members. The exposed structural members are generally combustible and can act as a heat collection and ignition point on the home.

Enclosing the underside of projections with ignition resistant products will help to reduce the likelihood of fire starting in these areas. See figure 8 below for examples on how to properly protect the underside of the projections. In the example photos, the horizontal surface is constructed with cement board as would commonly be used for soffit and fascia materials.

Exterior Doors
As with any entry point into a home, exterior doors can leave the house vulnerable to fire intrusion. The International Residential Code requires that exterior doors meet or exceed specific industry testing standards in terms of deflection caused by wind. A solid core door not only provides the best protection against deflection by wind, but it also provides protection against radiant heat as compared to a lighter weight hollow core door. Doors should be constructed of non-combustible products such as metal or composites. Wooden doors are acceptable when they are solid core construction.

Sliding glass doors or decorative front doors with glass panels shall have tempered glass that are designed to withstand impact and meet the design standards required by building codes (Figure 9). In an effort not to restrict architectural design and curb appeal, the exception to this section allows for entry doors with decorative glass, which may or may not be tempered.
**Windows**

There are two main components of windows that are vulnerable to fire: the first is the frame construction, and the second is the glazing (or glass surface). While not specifically addressed by the Ignition Resistant Construction Ordinance, if vinyl windows are used, they should contain an aluminum sub-frame to help the window frame retain its shape when exposed to increased heat. Melting or distortion of the frame can cause the glass panes to shift or fall out.

Today’s windows are constructed to be very energy efficient in terms of insulation properties and UV reflection. As such, most windows perform extremely well during a wildfire. Dual pane windows can successfully withstand a flame front as it moves quickly into or through a community by reflecting the radiant heat energy.

Just like placing a hot glass in cold water, the extreme temperature fluctuation in a wildfire will cause the glazing in a window to crack. The insulating factor of a dual pane window will help protect against the temperature differences. Single pane windows do not perform as well and are vulnerable to cracking and breaking due to the intense heat of a wildfire.

Most homes built today already include dual pane windows as an energy conservation and efficiency feature. Similar to the section on doors, above, windows must meet or exceed rigorous testing to national standards to be approved for use in a home.

**Attic Vents**

Ember intrusion is a very significant factor in determine whether or not a home will survive a wildfire event. Attic venting is critical in preventing excessive temperatures and moisture in attics; however, the venting also leaves homes very vulnerable to ember intrusion. Using vents 1/8” screening is important in restricting the size and overall number of embers able to enter the attic (Figure 10). This screening will not stop all embers, but generally speaking, embers less than 1/8” do not have the heat energy needed to ignite combustible framing or insulation within the attic space.
Consider a camp fire; as the fire pops and cracks, small embers fly out of the fire. The small embers will generally burn out before falling to the ground. The small embers do not have enough heat energy to continue to burn. Now, think of the larger embers or brands that pop from a campfire and land on the ground. Many of the larger embers will still be glowing, if not flaming, when they land. These larger embers or brands are the ones that need to be kept out of attic spaces as they have enough heat energy to ignite combustible structural members. Even with the smaller vent screens, potentially hundreds of smaller embers will enter the attic. The primary goal is to prevent thousands of larger/hotter embers and brands from entering the home, as there will be a much higher risk of ignition.

As an added safety measure, homeowners should not use attics for the storage of combustible materials as they may ignite from embers as well.

There are several different types of vents commonly used for attics, which include soffit (Figure 11), roof (Figure 12), ridge (Figure 13), and gable (Figure 14) vents. Each of these vents types are required to include 1/8”screening.
Gable vents (Figure 14) are highly discourages as they are more susceptible to ember intrusion and should only be considered on sides of homes that do not face steep slopes or typical prevailing winds. Figure 15 is example of a faux gable vent and is for decorative purposes only. The decorative vent does not penetrate the attic and therefore does not require screening.
Other types of vents, such as those for crawlspace are also vulnerable to ember intrusion. The same screening practices for these are recommended.

**Gutters**

Studies have been conducted to evaluate the performance of both metal and vinyl gutters during wildfires. While the gutter material certainly has an impact or greater concerns is the combustible debris (leaves, pine needles etc.) that can accumulate in gutters and ignite the debris during a fire.

Metal gutters will not burn, and they tend to stay in place during a fire. Any debris within the gutter that ignites will burn and expose the roof decking and fascia to heat and direct flame contact. Vinyl gutters tend to ignite when exposed to significant heat or fire, but they will melt away from the structure, thus limiting the amount of heat or flame exposure to the roof decking or fascia. From a fire safety standpoint, it is important to prevent the accumulation of combustible debris in the gutter than be concerned with the actual material of the gutter itself. If gutter caps are not used to prevent accumulation of foreign combustible debris (Figure 16), the homeowner must be vigilant to ensure the gutters are cleaned out on a regular basis.

![Figure 16](image)

Standard practice is to install a piece of metal flashing, otherwise known as a drip edge along the exposed face of the roof decking. This design is common from the moisture prevention aspect, but it is also found to be very effective in preventing flame exposure or ember intrusion along the exposed edge of the roof decking under the shingles or roofing material. This drip edge shall cover the edge of the roof deck, extend into the gutter and shall be installed tightly against the gutter material (Figure 17). In most cases a very long roof line, additional flashing may be needed to be installed behind the gutter and drip edge to prevent exposure to the fascia.
D-2 Eave with Gutter Detail

Figure 17
Decks
Decks and outdoor living spaces are an important aspect of East Mountain living. Many homes throughout this community utilize decks and other outdoor living spaces to take full advantage of the beautiful views and climate the East Mountains has to offer. As such, residents desire to retain decks as an important aspect of their homes. When choosing decking material it is important to understand that deck safety is not just about the decking material, but as a package design to include smart storage and landscaping practices. Decks are most vulnerable to ignition from direct flame impingement from adjacent combustible material such as firewood, bushes, trees, etc., and from fire brands or embers landing on the horizontal surfaces of the deck. The point at which the deck connects to the home should have adequate metal flashing to provide additional protection against ignition where there is potential for an increased accumulation of embers and brands.

When choosing decking surfaces there are two primary material types on the market; wood and composite or PVC. Wood is the most common product found in the construction of decks. Wood is generally fairly easy to work with; however, it does require significant maintenance to keep it from drying out and splitting. The dry and split wood is very susceptible to capturing embers and igniting. Composite decking on the other hand is relatively maintenance free and does not rot or split, making it a much better product in terms of fire safety.

Like roofing materials, building products are tested for the surface burning characteristics and given a rating classification depending upon how well they resist ignition and spread of flame across the surface. The classification has three levels; Class A, Class, B, and Class C, with Class A having the best performance at resisting flame spread. Many natural wood products inherently have a Class C rating, with the exception of some exotic hardwoods or other products not typically selected for decking materials. Many of the composite or PVC decking materials are available with a Class B rating, some even have a Class A rating (Figure 18)

![Figure 18](image)

Figure 18
During the wildfires mentioned earlier, many of the decks that ignited or burned were due to direct flame contact from ignition of combustible storage under the deck or adjacent trees and bushes. In these cases, both wood and composite decks burned. Where decks were subject to embers and fire brands, wooden deck surfaces were more easily ignited than the composite decks, which tended to melt but not ignite. Figure 19 shows a composite deck that was attached to a home completely destroyed by fire. The deck did receive damage, but for the most part was intact as the composite deck itself did not burn. In contrast, Figure 20 shows a combustible deck that was ignited due to embers/brands. Fire fighter intervention prevented further damage to the deck and the home.

Examples of composite or ignition resistant decking products may be found in Annex A in the back of this document.

While standard lumber is common, many builders and home owners are utilizing alternative materials for the construction of their decks. Figure 21 show a deck built with metal framing member in lieu of wood. Although not shown in the photo, this deck also has a concrete decking surface. In addition, they chose to wrap the support columns in stucco rather than leaving them exposed. Like the base of walls, it is also important to enclose the base of any exterior columns as discussed in the next section. These areas are vulnerable to debris and ember collection inside the base of the column.
**Base of Walls**

Traditional building construction methods have the tendency to leave gaps under the lower edge of siding at the base of walls, posts, columns, etc. Figure 22 shows a close up view, looking from the bottom of the wall, which reveals vulnerable gaps at the base of walls. In the picture on the left you can see the exposed combustible sheathing (green) and foam board insulation (blue). In the picture on the right you can see the combustible wood sheathing (brown). This gap, while typically not noticeable, provides an entry point for embers and flames to enter the exterior walls of the home. As wind and embers blow up against the foundation of the home, the gap left between the siding and foundation can leave the stud wall cavity exposed. The gap provides for a point of ember intrusion into the combustible wall cavities and concealed spaces of the home. Fire can burn undetected and unimpeded in the concealed spaces for long periods of time before venting to the exterior where it is discovered. This gap needs to be protected with screening or sealed off with caulking, fire resistive foam, mortar, or similar product.
In Figure 23, the builder utilized metal flashing and stucco to seal the exposure where the wall connects to the foundation. Be advised that there may be need or desire to provide provisions for a weep or drainage to prevent moisture and condensation collection within the wall. Make sure these drains or weeps are not closed off when sealing the bottom side of the walls if moisture control is needed.

![Figure 23](image)

**Chimneys**
Spark arresters are required to be installed in accordance with the mechanical and building codes for all new installations of solid fuel and wood burning appliances. We highly recommend them to be installed on existing chimneys as well. While spark arresters are important from wildfire prevention standpoint, they are different from the other provisions in this manual. These are not for protecting your home from wildfires, but for preventing a wildfire from starting due to embers from your wood burning appliances.

Spark arresters are designed to catch embers and brands that are produced during normal operation of a fireplace or wood burning appliance. Prevention of embers and brands from exiting a chimney reduces the risks of ignition outside the home and potentially causing a wildfire event. Code compliant spark arresters shall be constructed of woven or welded screenings of 12 USA standard wire gauge having openings not exceeding ½ inch (figure 24).
Alternative Methods and Materials

The Bernalillo County Fire Department recognizes that there are many different construction methods and materials available in the construction of a home. As with everything else, technology continues to improve and new products and construction methods are frequently introduced into the home building markets. As such, we are open to discussion and evaluation of methods or materials not specifically addressed within this document. Our goal is smart construction with ignition-resistant design that will increase a home’s ability to stand alone with limited or no fire fighter intervention during a wildfire event. Nothing in this design manual is intended to prevent the use of products that have been tested and proven to provide equivalent or greater levels of protection and design than what have been called out in this manual. Consideration of alternative building products will generally require manufacturer’s literature and independent product testing reports describing the flame spread characteristics of the proposed materials.

For additional information and updated lists of potentially acceptable construction materials, please visit the California Office of the State Fire Marshal, California Department of Forestry and Fire Protection web site at http://osfm.fire.ca.gov/licensinglistings/ licenselisting_bml_searchcotent.php. This site will include many of the product suggestions listed in this document, as well as any additional products that may have been added since the publication of this document. The City of Colorado Springs does not endorse any specific product or material, but rather looks subjectively at each product for compliance with code and documented testing performance when considering its use in a local application.
**Fuels Management**

This section of the design manual specifically addresses landscaping and natural vegetation surrounding homes, and how to apply Firewise landscaping design to reduce the likelihood of ignition of a home from a wildfire. Fuels management includes selecting plant materials that have a greater resistance to wildfire in terms of susceptibility to ignition and providing adequate clearance to homes.

**Plant Selection**

Proper selection of plants and trees is critical when creating a defensible space around your home. However, it’s not just how you landscape, but the selection of plants and materials is of equal importance. Colorado Springs is a semi-arid climate and prone to drought conditions. Selection of plants that are drought resistant and tend to maintain greater fuel moisture is a good start. Deciduous plants are a great choice because they generally have higher moisture content, and can shed their leaves when they go dormant due to drought or during the winter months. The shedding of leaves allows the structure of the plant or tree to retain higher moisture content.

Other attributes and considerations for fire resistant landscaping include:

- Avoid plants with volatile oils and resins like pine and juniper
- Choose plants that are native to the area and are drought tolerant for our climate
- Choose plants with naturally higher moisture content
- Consider mature size and spacing
- Select a diversity of species (as different plants are more susceptible to burning at various times of the year)

For additional information on Fire Wise Plant Materials, refer to Annex B in the back of this manual.
**Home Ignition Zone**

**BCFD WUI Code Section M503.2**

Trees are allowed within the defensible space, provided the horizontal distance between crowns of adjacent trees and crowns of trees of structures, overhead electrical facilities or unmodified fuel is not less than 10 feet. Deadwood and litter shall be regularly removed from trees.

The home ignition zone is defined as the first thirty feet (30’) immediately surrounding a structure including the roofline and decks. Contrary to false impression, this area does not have to be clear cut. Fuels management is about making smart choices in selecting the plants within the home ignition zone and maintaining the existing healthy vegetation using the techniques covered in this section. There are three primary fuel layers of vegetation to be considered when evaluating the home ignition zone. These layers include:

- Surface fuels
- Ladder fuels
- Aerial Fuels

Figure 25 illustrates an overgrown lot; this image is typical of an unmitigated property. Figure 26 provides and an example of a well-developed defensible space with plenty of clearance within the home ignition zone.
Figure 27 is an example of the various layers of vegetation within the home ignition zone. Note the separation of fuels and the use of features such as rock walls and planting beds to create defined fuel breaks.

![Figure 27](image)

**Surface Fuels**

Surface fuels include any material or surfaces at grade. Native or planted grasses, fallen pine needles, leaves, small twigs, and other low growing vegetation are the most common type surface fuels. Typically a wildfire starts in the surface fuels and spreads to the ladder fuels. Surface fuels are predominantly considered to be light, flashy fuels. These fuels generally don’t have very high heat energy, but they do provide for very rapid fire spread when the fuel moisture is low. Keeping grasses mowed to a height of less than four inches (4”) and well irrigated, along with removing the fallen pine needles, leaves, and small twigs, within close proximity to the home will reduce the rate of spread as well as the intensity. Considerations regrading surface fuels are the height of materials, clearance to structures, and fuel moisture.
Also, of significant consideration in terms of the safety zone is mulch. While mulch might not seem like a big deal, combustible mulch near homes can be a catch basin for embers and brands. Avoid mulches that tend to be light weight. Denser bark or even rock and stone are a much better choice for mulch around the perimeter of the home. Rock or stone mulch should always be used when vinyl gutters are present on the home as discussed in the gutters section on page 16.

**Ladder Fuels**
Ladder fuels are brushes and other low level vegetation and are intermediate level plants that generally grow in the two to six foot high range. The ladder fuels become a conduit for flame transfer from surface fuels to larger plants and trees. Ladder fuels are an important consideration when evaluating the overall safety zone of the home. Care should be taken to select plants from the Fire Wise Plant Materials list from Annex B of this document.

Maintenance of ladder fuels includes removing debris and dead branches from the base (understory) of the plant and limiting the size of clusters of multiple plants to no more than one hundred (100) square feet. Gamble oak, or scrub oak, grows in clumps and share root systems. Limiting the size of and separating the clumps from other vegetation is intended to break up the continuity of ladder fuels leading up to structures. By removing the debris and dead branches from the ladder fuels, the likelihood of ignition from a surface fuel fire is reduced.

**Aerial Fuels**
Trees are obviously the largest and often times most sought after vegetation within the home ignition zone. Strong, healthy trees provide many benefits to homeowners, including curb appeal, shade, wild life habitat, and soil stabilization.

There are several factors to consider when selecting trees to plant or maintain around a home. First and foremost, select types and species of trees that are found on the FireWise Plant Materials list in Annex B of this document. Care should be taken to avoid trees such as conifers or evergreens, including pines, firs, spruces and junipers in the safety zone. These trees have characteristics that make them prone to fire including resin and oil content, low hanging limbs, needles, thin bark, and low fuel moisture. Some pines, like Ponderosas, have thicker bark and higher limbs that make it the better choice for selecting an evergreen. Deciduous trees are always a much better choice in the safety zone.

The next thing to consider is the maturity and health of existing trees. A certified arborist can be a great resource in determining the overall health of trees around a home. However, some indicators of stressed or unhealthy trees include obvious sign of disease such as mistletoe as shown in Figure 28, or pest infestation such as pine beetle as indicated by the sap in Figure 29.
The biggest consideration in terms of trees within the home ignition zone is to provide plenty of clearance between trees, other vegetation, and structures. In the previous section, intermediate fuels are described as ladder fuels because they can be a conduit for flame transfer from surface fuels to larger plants and trees. The most dangerous and rapid fire spread during a wildfire is known as a crown fire, which allows fire to jump from bush to bush or tree top to tree top, covering large areas of land in very short timeframes. Trees can also be a method of fire spread to structures and homes when adequate clearance is not provided as described in the following sections.
BCFD WUI Code Section M504.4

Tree crowns extending to within 10 feet of any structure shall be pruned to maintain a minimum horizontal clearance of 10 feet. Tree crowns within the defensible space shall be pruned to remove limbs located less than 6 feet above the ground surface adjacent to the trees.

Portions of tree crowns that extend within 10 feet of the outlet of a chimney shall be pruned to maintain a minimum horizontal clearance of 10 feet.

The intent of the ten feet (10’) clearance of trees and intermediate fuels is to provide spacing between the tree limbs, eaves, roofline, or deck. Figure 30 is an illustration that compares and contrasts adequate clearance to the home. The ten feet (10’) clearance also accounts for several tree characteristics including mature height, shape, leaf type, moisture content, resins, and additional plant characteristics that make trees less ignition resistant. In some instances based on property lines, it may not be possible to maintain the ten feet (10’) clearance. In certain circumstances, trees, shrubs, and other plants identified as FireWise plants are allowed within the ten feet (10’). See Annex B in the back of this manual or visit the following website for more information on FireWise Plant materials.

http://aces.nmsu.edu/defensible_zone/protect/docs_pdf/fire_wise.pdf

Figure 30
Figure 31 shows two examples where the 15’ clearance to the main structure is not provided. In both of the examples provided, the homes are at significant risk of vegetation to structure ignition in the event of a wildfire.

![Figure 31](image)

**Figure 31**

**Pruning of limbs**

Pruning up to six feet (6’) in height is intended to remove ladder fuels and prevent fire spread from the surface into the crowns of the trees and brush. Both live and dead limbs can act as ladder fuels. The six feet (6’) limit for pruning is intended to leave enough foliage on the tree to make enough food so the tree will survive. It is also intended to provide a limit that residents can safely prune up to without climbing the tree or cutting overhead. While pruning is limited to six feet (6’) the recommendations is always to maintain at least 70% of the crown to ensure good health of the tree.

Figure 32 shows an example of a home site before creating a defensible space, the lot is overgrown and creates a significant fire risk. Figure 33 is the same lot after the defensible space has been created. The lot is now safer for the property owner and is esthetically pleasing and no longer overgrown.

![Figure 32](image)  ![Figure 33](image)
Figure 34 provides a great example of how good clearance to the structure and pruning of limbs successfully protected a home from ignition. The arrow in the photo identifies where the fire burned along the ground but stopped short of the home. The scrub oak was properly pruned and limbed up to prevent the ground cover from extending into the taller plants.

Figure 34

**Clearance of Tree Branches to Structures and Appurtenances**

**BCFD WUI Code Section M504.4**

*Tree crowns extending to within 10 feet of any structure shall be pruned to maintain a minimum horizontal clearance of 10 feet.*

While house plants and landscape plans note the relation of vegetation to the structure, it again does not address the size, shape, or future growth of the tree. Figure 35 shows how dense vegetation and landscaping creates a means for continuity for a surface fire to spread to the ladder fuels and into the trees. In contrast, Figure 36 shows how a good defensible space is designed to limit the spread of fires, thus keeping the fire small and manageable. Regardless of the planting location, no limbs should reach on, over, or under rooflines, decks, eaves, or chimneys (figure 37).
Like building construction, good fuels management practices include a systems approach within the home ignition zone. Overall clearance to the main structure is essential in providing a buffer or fire break between combustible vegetation and the home. Pruning of limbs helps to reduce the ladder fuels, which prevents ground cover fires from moving to the crowns of trees where the fire can spread much more freely. Keeping tree branches from touching or being in close proximity to a home will provide protection from a crown fire and reduce the likely ignition of the home. Overlooking just one piece of the fuels management model will reduce the overall protection of the home.
Additional Tips to Reduce Your Wildfire Risk

1. Create defensible space around your home. Bernalillo County Fire Department recommends thinning out 30 feet or to your property line, whichever comes first.
2. Keep rain gutters clear of leaves and pine needles.
3. Do not store combustibles on or under decks, including fire wood.
4. Rake up pine needles and leaves within 30 feet of any structure.
5. Select plant species with fire resistant characteristics.
6. Keep grasses mowed to a maximum height of 4 inches
7. Incorporate landscaping designs to break up fuel continuity (i.e. paths, rock walls, gravel mulch.
8. Keep addresses clearly marked and visible from both directions of traffic. (Fire fighter can’t help you if they can’t find you.)
9. Prune lower branches. Removing ladder fuels will help keep the fire from getting into the crowns of the trees. Remove dead or diseased trees and brush.
10. When making home improvements or repairs, consider wildfire safety. Refer to this manual and incorporate ignition resistant design whenever possible.
11. Maintenance! You have worked hard to protect your investment, make sure you continue those efforts through regular maintenance.
12. Get involved with your HOA and participate in neighborhood chipping programs.
13. Work with your neighbors and encourage them to participate in wildfire mitigation efforts as well.
14. Contact the BCFD Fire Marshal’s Office at 468-1340 to request a free on-site consultation regarding specific wildfire threats on your property
Creating Defensible space around your home can be done by following these 8 easy tips!

◊ Remove brush, weeds, dry grasses, needles, leaves and any other flammable vegetation within 30 feet of any structure (or to property line).

◊ Additional clearance up to 100 feet (or to property line) may be needed to protect homes near brush fields and/or wooded areas.

◊ Maintain trees, shrubs, or bushes adjacent to or overhanging any structure clear of dead limbs.

◊ Prune trees so that no limb is within 10 feet of any chimney opening. 1/2 inch maximum

◊ Maintain roof gutters, and deck surfaces free of leaves, needles, twigs and any combustible material.

◊ Clear all brush, weeds, grass and hazardous vegetation within 10 feet of any road.

◊ Clear all vegetation, trash, or other combustible material a minimum of 10 feet from propane tanks and containers.

◊ Remove all cut vegetation, combustible debris and dispose of it in a legal and safe manner.

Brush Clearance and Maintenance is a Year Round Responsibility

REMOVE
Limbs within 10 feet of chimney
Dead limbs overhanging buildings

CLEAN
All needles and leaves off roof.....

Clear
All flammable vegetation within 30 feet of buildings
**Summary**

The Bernalillo County Fire Department is here to support and encourage the citizens of our county to do their part in keeping our community safe against the ever present threat of wildfire. Wildfire safety and prevention is *EVERYONE’S* responsibility and it is up to each and every homeowner to take the necessary steps to prepare their home against wildfire.

The information provided within this design manual is an overview, and by no means all-encompassing in terms of the methods and materials available for ignition resistant construction and smart landscaping practices. We encourage you to contact the Bernalillo County Fire Marshal’s Office if you have any questions or would like us to visit with you regarding your wildfire risk.