

Solutions and Mitigation



CHAPTER THREE *provides users with solutions or mitigative approaches to reduce the hazard posed by interface fire to communities or homes. The principal aspects and recommended guidelines for interface fire hazard mitigation are discussed in three sections: vegetation management, structural options, and infrastructure. A FireSmart community meets or exceeds these guidelines. Having your community working toward these guidelines is a worthwhile goal.*

INTRODUCTION

During a major interface fire with a number of buildings at risk, firefighters may have to decide which buildings they should try to save. It is futile to try to protect buildings or homes shrouded in dense forest fuels. Some firefighters have paid for such efforts with their lives.

Unprotected buildings, whose owners have not applied FireSmart principles and standards, may not receive priority action from firefighters. In the interface, FireSmart buildings are the result of owners' efforts. This chapter provides concerned homeowners, community groups, and officials with detailed information on the best options for fire protection in the wildland/urban interface. Mitigation of fire in

the wildland/urban interface is discussed in three sections: vegetation management, structural options, and infrastructure.

These guidelines are based primarily on National Fire Protection Association (NFPA) standards that are published as a code: NFPA 1144 — Standard for Protection of Life and Property from Wildfire. We also include the recommended guidelines of a variety of fire protection agencies.

NFPA 1144 standards are untested in northern (boreal forest) conditions. Fire protection officials feel that the NFPA 1144 standards should be viewed as minimum guidelines in the north.



PHOTO: NFPA

VEGETATION MANAGEMENT

Reduction of fire danger in fuels capable of supporting fast-spreading, high-intensity fires often requires significant intervention—removal, reduction, or conversion of on-site fuels.

Apply these fuel-management recommended guidelines with discretion. Each interface community must decide what level of treatment is permissible or desirable before the aesthetic and wilderness virtues of the community are threatened.

Interface residents should meet to decide on acceptable levels of fire hazard reduction and then determine how to accomplish the hazard reduction. Fire officials can support this dialogue by organizing meetings and providing unbiased information on the pros and cons of various strategies.

Note: Within this section, the words “vegetation” and “fuel” are used synonymously.

VEGETATION MANAGEMENT STRATEGIES

Other factors that figure prominently in a community’s choice of vegetation management strategy are maintenance, water requirements, homeowner capabilities, erosion control, and historical weather and fire behavior patterns.

Vegetation management strategies break down into three approaches. These are:

- Fuel removal
- Fuel reduction
- Fuel conversion

Recommended guidelines are provided for each vegetation management strategy. For communities or individuals seeking a higher degree of protection, vegetation management standards providing a higher level of protection are outlined in Appendix 2: Fuel Reduction Standards for Crown Fire Hazard.



Before



After

ESTABLISHING PRIORITY ZONES

Before planning or initiating fuel management activities around buildings or facilities in the interface, we suggest that three concentric Priority Zones be established around each building. There are unique vegetation management activities recommended for each priority zone.

Priority Zone 1: This area is immediately adjacent to a given building and extends outward in all directions for a recommended minimum of 10 metres in flat terrain. The main objective of vegetation management in this zone is to create an environment that will not support fire of any kind. In some situations, this may be the only zone or area that homeowners need to manage.

Priority Zone 2: This area begins 10 metres from the building and extends to 30 metres from the building. The main objective of fuel management within this zone is to create an environment that will only support fires of lower intensity and rate of spread.

Priority Zone 3: This area begins 30 metres from the building and extends to 100 metres or farther from the building. Fuel management in this area may only be needed in specific cases, when high hazard levels resulting from heavy continuous forest vegetation and steep topography are not reduced enough by fuel management in Priority Zone 2.

Specific vegetation management strategies such as fuel removal, conversion, and reduction are outlined in more detail later in this section.

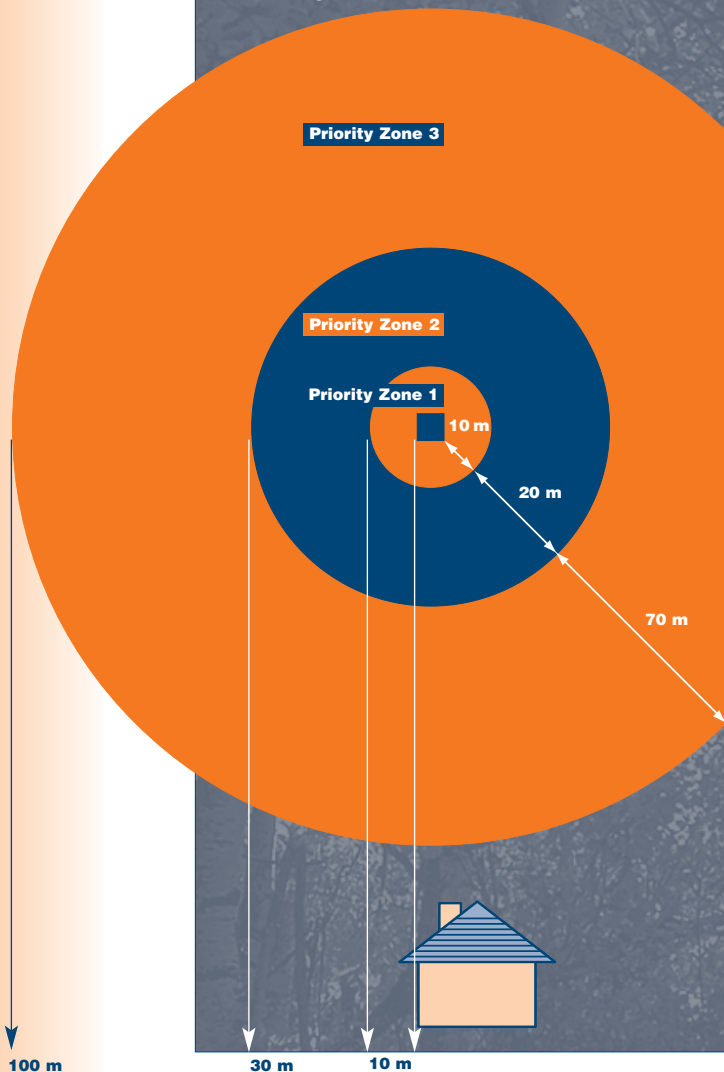
Fuel Modifications and Priority Zones:

While some homes or facilities will be able to meet their fuel modification requirements by treating fuels in Priority Zone 1 only, other homes and facilities will require treatment of fuels within Priority Zones 1, 2, and 3.

Establishing Priority Zones

Fuel Modified Areas and Firefighter Safety:

Current research indicates that firefighters are more vulnerable to the radiant heat generated by large wildland fires advancing on an interface property than are the structures themselves. While creation of adequate fuel modified areas between the structure and vegetation will significantly reduce the chance of building ignitions, it cannot provide a safe environment for firefighters. Firefighters recognize the advantage that fuel modified areas provide in establishing effective fire suppression actions but follow designated safe work procedures that require them to retreat to designated safety zones during high levels of fire behavior as the fire passes through an interface area.



Priority Zone 1: Area Within 10 Metres of a Building

The goal of vegetation management in Priority Zone 1 is to create a fuel modified area in which flammable vegetation surrounding buildings is eliminated or converted to less flammable species. This fuel-free zone is immediately adjacent to a given building and extends outward in all directions for a recommended minimum of 10 metres in flat terrain.

Recommended guidelines for Priority Zone 1

Fuel removal and conversion are the principal vegetation management strategies in Priority Zone 1.

- This area must reduce the risk to buildings from approaching wildfire and reduce the

potential for a building fire spreading to the wildland. The minimum distance between a building and untreated fuels should be 10 metres.

- Annual grasses within 10 metres of buildings should be mowed to 10 centimetres or less.
- Ground litter and downed trees should be removed annually.
- Overmature, dead, and dying trees with potential to ignite and carry fire should be removed.
- Owners are encouraged to convert remaining vegetation to less fire-prone species if consistent with ecological factors.
- Vegetation existing away from the immediate area of the building should be thinned and pruned to prevent a fire from being carried toward or away from the building.
- Where slope and aspect increase the hazard to

WHAT IS A FUEL MODIFIED AREA ?

Fuel modified areas between a building and a potential wildland fire have combustible materials and vegetation removed, reduced or converted to reduce the potential for an advancing wildland fire to spread to the building or, conversely, for a building fire to spread to the adjacent wildland. Without fuel modified areas, fire intensity and rate of spread can make firefighting difficult or impossible.



Fire in the interface without fuel modification.



Fire in the interface with fuel modification.

► *Hazardous accumulation of ground-level fuels and debris.*

buildings and greenbelts, fuelbreaks should be provided.

- Structures adjacent to slopes without adequate setback will require increased fuel treatment distances. Where slope and aspect increase the hazard to buildings and greenbelts, fuelbreaks should be provided.

Fuel removal in Zone 1

Removing flammable vegetation from around a building will reduce the fire danger. Fuel removal involves removal of ground-level fuels, piled debris, and other combustibles.

Removal of ground-level fuels

Surface fuels range from downed tree trunks to needles and other forest litter. This accumulation of dead organic material and other vegetation is responsible for carrying a fire along the forest floor. This forest litter must be removed if the fire danger is to be reduced significantly.

Surface vegetation is considered *scattered* if groups of logs, branches, and twigs are widely spaced (e.g., separated by 3 - 5 metres or more). Surface vegetation is *abundant* if groups of logs, branches, and twigs are continuous or nearly continuous across the forest floor.

Removing surface fuels also reduces the probability that a surface fire will gain enough intensity to develop into a crown fire.

▼ *A well-maintained lawn provides protection within Zone 1.*



PHOTO: BRIAN MOTTUS



PHOTO: DON MORTIMER

Recommended guidelines for removal of ground-level fuels

Remove downed tree trunks along with smaller branch materials. Reduce finer twigs, needles, and litter by raking into piles and burning or hauling away.

If it is feasible, prescribed burning of scattered fuels by fire specialists under controlled conditions can also accomplish adequate fuel removal. Check with local authorities for approval and a burning permit.

Remove small trees and shrubs. Flammable species such as juniper and pine trees or cured grasses are particularly hazardous. Keep grasses within 10 metres of the building watered and trimmed to less than 10 centimetres or replaced with non-flammable walkways, patios, or other landscaping materials.

Note: Fuel modification will result in increased

surface vegetation (grass and shrubs). These fuels will be more flammable but will burn with reduced intensity. Ongoing maintenance actions will be needed periodically to reduce surface fuel accumulations.

Removal of piled debris and other combustibles

Firewood, building material or other combustible debris piles and wooden storage sheds or fences are all serious fire dangers. In case of wildfire these items will ignite and burn intensely. They are usually located near the principal building and are often responsible for igniting interface buildings during fire events.

Research indicates that neighboring structures are a significant potential ignition source due to radiant heat exposure, longer burning times, and the additional effect of firebrand production from burning structures.

Recommended guidelines for removal of piled debris and other combustibles

Keep firewood, combustible debris, outbuildings and other structures at least 10 metres from the building.

We recommend that neighboring structures



PHOTO: STEW WALKINSHAW

be located at least 10 metres from the building.

Avoid locating combustible material downslope from the building. If this is not possible, increase the distance specified above.

▲ *Improper firewood storage.*

Fuel conversion — alternative vegetation

Fuel conversion is the removal of flammable species and the replacement of them with less flammable ones.

◀ *Firewood stored away from building and decks.*



PHOTO: BRIAN MOTTUS

Recommended guidelines for fuel conversion

Plants that are low growing and woody or deciduous are referred to as low-fuel-volume plants. These plants are ideal replacements for more highly flammable species growing close to interface buildings, or in areas where a firebreak is planned.

The type of vegetation and topography in an area will determine the degree of management needed. Replace highly flammable species such as juniper or cedar adjacent to buildings with watered lawns and low-fuel-volume plants. Individual trees and shrubs may be kept, if this vegetation would not readily transmit fire to the building. Where slopes are involved, consider the stability of those slopes in any sort of vegetation management plan.

Different regions within Canada have different climates and soils that determine various vegetation management strategies. Nursery and landscape professionals often have recommended plant lists for specific regions of the country. Cross-referencing of these lists with the recommended guidelines of fire officials will enable homeowners to make a suitable conversion to fire-resistant plants.

In some locations, you may want to replace coniferous trees with deciduous trees.

How to choose FireSmart vegetation

In deciding which vegetation to remove, reduce, or replace in a program of fuel management, it is important to know the characteristics that make one species of vegetation more flammable than another.

The most flammable plants include those that rapidly accumulate quantities of dead foliage and branches, dead and diseased trees, vegetation with high oil or resin content, and plants that dry quickly in arid weather. When planting a new landscape, avoid choosing a species with these characteristics.

Most plants will burn under extreme fire weather conditions such as drought aggravated by high winds, but they will burn at different intensities and rates of spread. *Fire-resistant* plants burn at a relatively low intensity, with a low rate of spread.

Interface residents should attempt to use fire-resistant vegetation when planting new landscapes.

Important note: Abnormal weather patterns can create problems with severe fire behavior occurring in normally fire-resistant vegetation. FireSmart recommended guidelines on fuel conversion and fire resistant vegetation are based on general principles and typical weather patterns.

FIRE-RESISTIVE VEGETATION

Fire-resistant vegetation has these characteristics:

CHARACTERISTICS	EXAMPLE
Accumulates minimal dead vegetation	Sparsely branched trees and shrubs
Non-resinous plants	Deciduous trees and shrubs
Plants with low volumes of vegetation	Younger, sparse growing trees and shrubs
Plants with high live fuel moisture	Succulent plants that retain a large amount of water
Drought-tolerant plants	Deeply rooted plants with thick, heavy leaves
Trees without ladder fuels	Deciduous trees or conifers pruned to two metres
Low maintenance vegetation	Slow-growing plants requiring little care
Plants with thick woody stems	Require prolonged heating to ignite

FIRESMART TREES

Use the table below to help you make choices during forest thinning, reduction and conversion operations.

Tree species	Flammability
Aspen	Very Low
Birch	Low
Maple	Very Low
Poplar	Very Low
Black spruce	Very High
White spruce	High
Engelmann spruce	High
Jack pine	High
Lodgepole pine	High
White pine	Medium
Ponderosa pine	Medium
Western red cedar	High
Mountain hemlock	High
Western hemlock	High
Douglas-fir	High
Grand fir	High
Sub-alpine fir	High
Western larch	Low

Priority Zone 2: Area 10-30 Metres from a Building

The goal of vegetation management in Priority Zone 2 is to further extend the fuel modified area by reducing flammable vegetation with a variety of thinning and pruning actions.

Recommended guidelines for Priority Zone 2

Priority Zone 2 should be an environment that will not support high-intensity crown fires.

Surface fire may spread across this zone but it will be of low intensity and readily extinguished.

- Fuel reduction (rather than removal) is the main strategy for vegetation management in Priority Zone 2. Actions listed refer largely to coniferous (evergreen) forests or evergreens in mixed wood.
- Thinning of deciduous (e.g., aspen) forests or removal of deciduous trees within mixed-wood forests is discouraged. These forest types hinder fire spread during most times of the year.
- On flat terrain, Priority Zone 2 is concentric and 20 metres wide. It extends outward from 10 metres from the building walls to 30 metres from the facility.
- On sloped terrain, the width of Priority Zone 2 must be extended.
- Effective fuel management in Priority Zone 2 requires an extensive initial effort followed by an ongoing maintenance program.



PHOTO: JOHN LUCKHURST

Fuel reduction in Zone 2

Reduction of flammable vegetation in Priority Zone 2 will further reduce the fire danger. Fuel reduction involves thinning the forest canopy, thinning under-story, and pruning lower branches.

Thinning the forest canopy in Zone 2

Thinning involves removing selected whole trees, especially highly flammable species and individuals. The goal of the thinning process is to leave a forest of more fire-resistant or separated trees. Separated trees are widely spaced and crowns do not touch or overlap. Separation of tree crowns reduces the probability of fire spreading laterally from one crown to another. Continuous trees are tightly spaced and crowns frequently touch or overlap.

Recommended guidelines for thinning the forest canopy

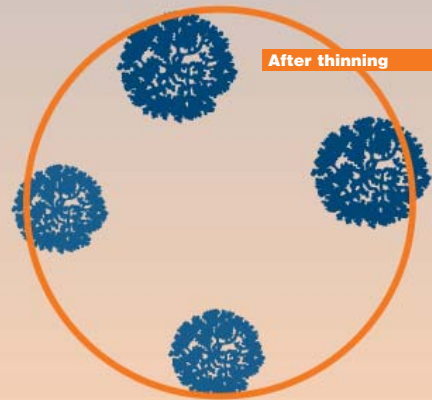
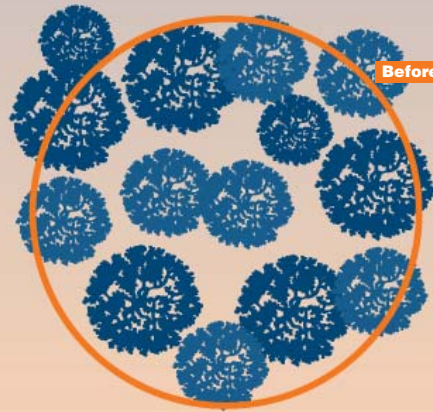
- Thin stands of trees for a distance of two tree heights—at least 30 metres in each direction from the building if on level terrain.
- Remove concentrations of overmature, dead and dying trees, that have high potential to ignite and carry fire to the building.

Thinning requirements and slopes

- Increasing slopes require increased treatment distances to be effective.
- Multiply recommended distances for level terrain by the factor shown in the following examples.

THINNING REQUIREMENTS

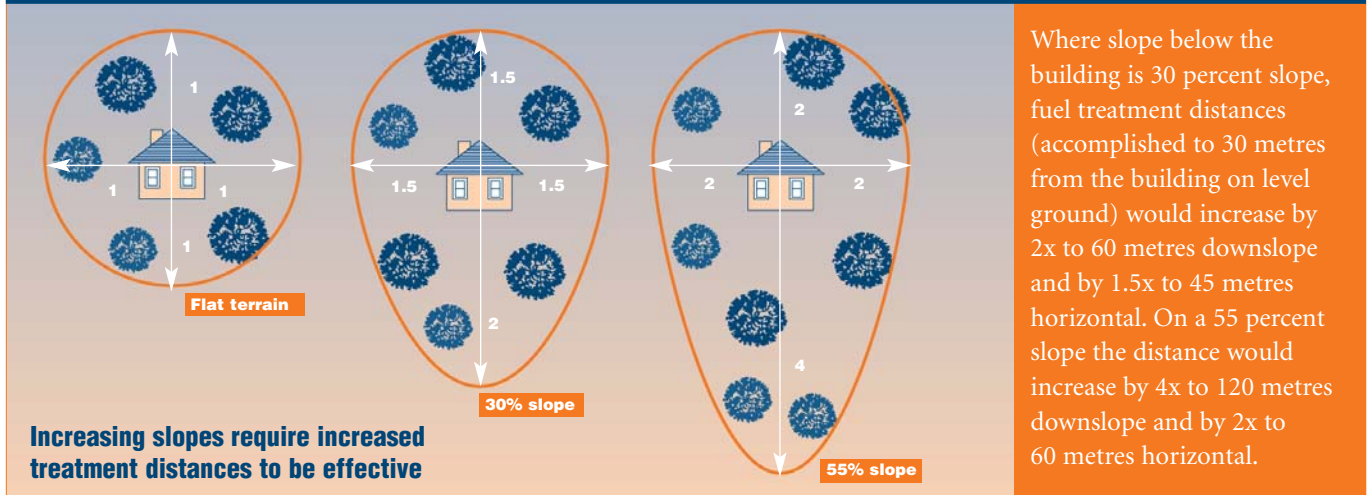
Thin forest stands to reduce crown cover to less than 40 percent with at least 3 metres between crowns (up to 6 metres between crowns may be required in some situations). Crown cover is the percentage of ground area covered by tree crowns if viewed from above.



Thinning reduces the crown cover of the forest



SLOPES



Note: Thinning can result in additional tree losses because of wind damage if the original stand is very dense and the initial thinning process opens it too wide. To reduce this problem, we recommend a two-stage thinning. The initial thinning should remove one-half to two-thirds of the desired amount, followed by another removal five to 10 years later if needed. Generally, the largest trees will be the most windfirm and healthy, and should be kept.

Understory thinning

Understory thinning involves removing all or most understory trees. An understory tree is an immature tree growing under the canopy of taller trees. The

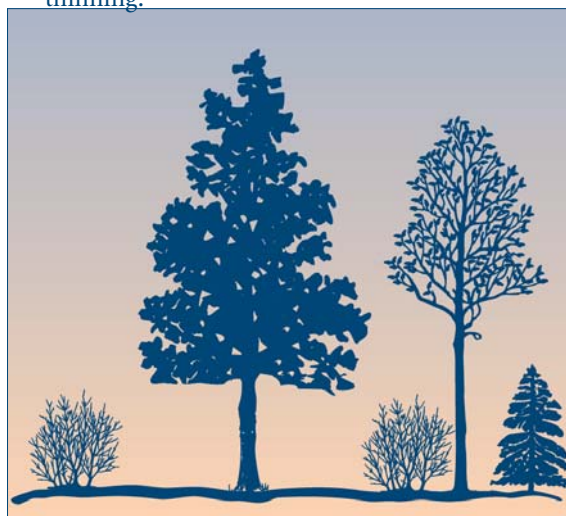
goal of the understory thinning process is to reduce the probability of surface fires climbing into the forest canopy.

Recommended guidelines for understory thinning

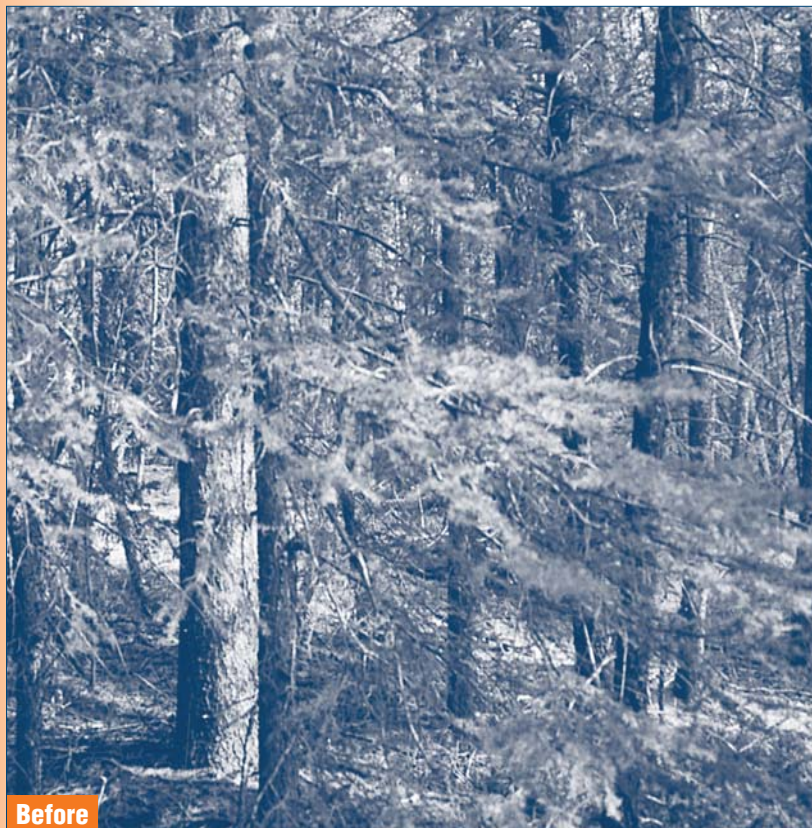
- Remove all trees growing under the canopy of a taller tree (understory trees), although you may decide instead to remove the taller tree, depending on its health, shading, etc. If some of these understory trees are retained, they should not be left in clumps and should be at least 4 metres apart.
- Treatment distances from the building should be the same as those specified for overstory thinning.



Before understory thinning

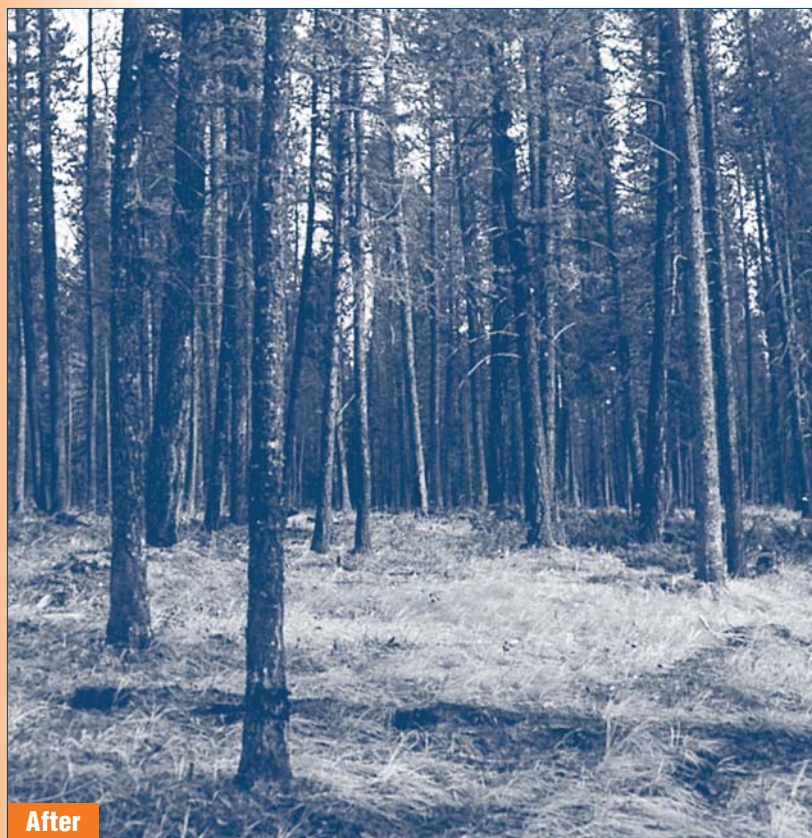


After understory thinning



Before

PHOTO: RICK ARTHUR

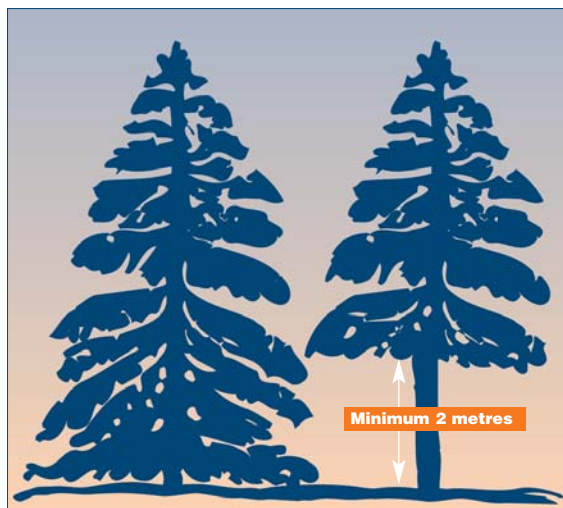


After

PHOTO: RICK ARTHUR



Ladder fuels carry flames from surface fuels into the forest canopy.



Recommended pruning

Pruning lower branches

Pruning involves removal of lower branches of large trees and the litter that accumulates on them. This prevents flames from climbing, as if on a ladder, from the ground into the canopy above, which greatly increases the intensity of the fire. Pruning is especially important on conifers.

Recommended guidelines for pruning lower branches

- Prune all conifers. Remove the live and dead branches at least 2 metres from the ground. This reduces the probability of surface fires spreading into the crown.

- Dispose of slash created by the thinning and pruning procedures promptly to avoid buildup of fire hazard and destructive insect activity such as bark beetles.
- There are some exceptions. Pruning in pine stands with a low percentage of spruce and fir trees may be limited to the pine trees. In these situations, pruning of spruce, fir or isolated trees may not be recommended for aesthetic reasons. The unpruned trees will be more likely to candle, so it is important to remove adjacent trees to avoid crown fire.
- Lower branches of spruce and fir may need pruning in some areas. Young trees less than 8 metres high could be left unpruned but additional space should be provided around them. This ensures sustainable forest cover as young trees gradually replace the older ones.

FireSmart techniques for fuel removal and fuel reduction

There are several ways of reducing the hazards presented by excess fuels.

- **Hand clearing** is the most common method. Tools include rakes, axes, shovels, and pruning saws.
- **Mechanical** methods quickly reduce or remove large amounts of flammable vegetation. Tools and machinery include tractor and disk, lawn mower, chipper, and the power string trimmer.
- **Prescribed burning** is the application of fire to natural or managed vegetation under controlled conditions in order to burn flammable vegetation. Prescribed burning should only be done by fire protection professionals in compliance with local policies and regulations.
- **Watering** landscapes and vegetation close to interface buildings is recommended during prolonged drought.
- **Grazing** by domestic animals is a simple and often overlooked method for reducing grasses, shrubs, and other low-growing vegetation.

Priority Zone 3: Area 30 – 100 Metres from a Building

This area begins 30 metres from the building and extends to 100 metres or farther from the building. The strategies and standards for vegetation management in Priority Zone 3 are similar to those applied in Priority Zone 2. For information on these, see Priority Zone 2 (Page 3-9).

Recommended guidelines for Priority Zone 3

- Fuel management measures in Zone 3 should create an environment that will not support high-intensity crown fires. Fire may spread across this zone but it should be of low intensity and more readily extinguished.
- Fuel management in this area is required where there are high hazard levels resulting from heavy continuous forest vegetation and steep topography, and the hazard is not reduced to desired levels by fuel management in Priority Zone 2.
- Fuel reduction and conversion (rather than removal) are the principal vegetation management strategies in Priority Zone 3.
- Keeping deciduous (e.g., aspen) forests and deciduous trees within mixed-wood forests is encouraged as these forest types hinder fire spread during most times of the year.
- On flat terrain, Priority Zone 3 is concentric and extends outwards beginning 30 metres from the facility walls and ends 100 metres from the facility.
- On sloped terrain, the width of Priority Zone 3 must be extended further downslope.
- Effective fuel management in Priority Zone 3 requires an extensive initial effort followed by an ongoing maintenance program.

Fuel Modification for Communities: Community Fireguards

Fuel modification concepts can also be applied to towns, villages, large facilities, or groups of buildings that interface with continuous forest fuels. In this situation, a community fireguard should be installed. A community fireguard is a wide area in which a combination of fuel management strategies and the standards described for Priority zones 1, 2

WHAT ABOUT WILDLIFE?

Many of the vegetation management actions taken to reduce the risk of wildfire losses also make changes to the character of wildlife habitat surrounding homes or communities.

How does fuel reduction affect wildlife and what can you do to avoid unnecessary impacts or even improve opportunities for wildlife in your neighborhood?

Here are some important considerations and useful tips:

- In some locations, forest openings and areas of less dense forest canopy were more common in the past. Reducing the forest density may actually help restore habitat qualities that are now in short supply and critical to some species.
- Thinning the forest canopy allows more sunlight to reach the ground and may result in additional plant growth (e.g., grasses fed on by deer, flowering plants for insects).
- Leaving some decaying logs and litter on the forest floor provides habitat for small mammals and insects that are fed upon by birds and other wildlife.
- Large-diameter snags (standing dead trees) are potential wildlife trees. Leaving occasional snags provides nesting sites and perches for a wide array of resident and migratory birds — as well as squirrels and bats.
- Preserving deciduous shrubs and a scattering of younger trees provides greater diversity in the forest layers, providing hiding cover for wary wildlife and feeding opportunities for others.

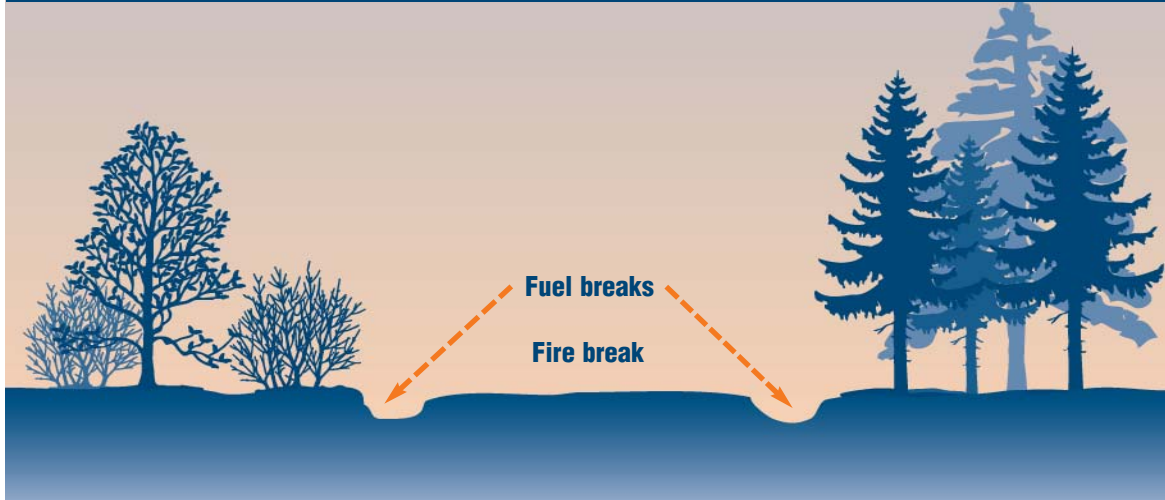
Currently, research is underway to identify innovative, ecologically based methods for managing forest fuels in ways that reduce wildfire risk but also optimize or improve ecological conditions, wildlife habitat, and aesthetic qualities in the interface. Homeowners can be both FireSmart and ForestWise.



PHOTO: JOHN LUCKHURST

PHOTO: PARKS CANADA

WHAT IS A COMMUNITY FIREGUARD?



The community fireguard incorporates both **fire breaks** and **fuel breaks**. Fire breaks are barriers to fire spread built by clearing or significantly

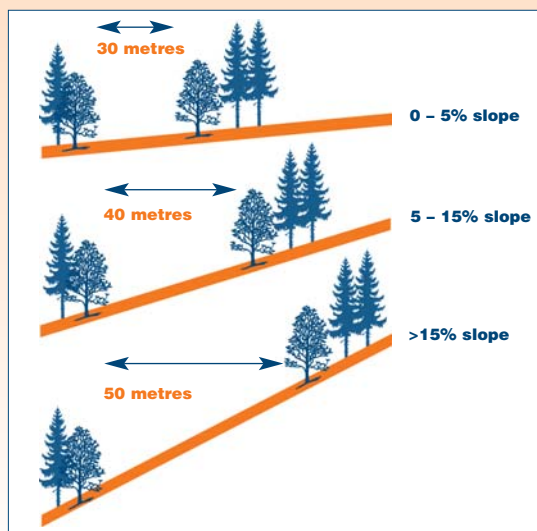
thinning fuels on a strip of strategically located land. Fuel breaks are trenches dug down to mineral soil that stop surface fire spread.

FIRE BREAK GUIDELINES

1. The width of the fire break will vary with the slope.

Slope/Width of Fire break

0 - 5 %	30 m
5 - 15 %	40 m
> 15 %	50 m



2. Widen the fire break where gullies and terrain variations increase the slope.
3. Remove, reduce, or convert vegetation within the entire width of the fire break to a less aggressive standard for at least 5 metres on both sides of the fire break. Increase this 5-metre zone to 10 metres or beyond where high fire behavior levels are anticipated. Vegetation management should meet the same minimum standards as are used for the Priority zones 1 and 2.
4. Build a fuel break on both sides of the firebreak. The fuel break should be one metre wide, dug down to mineral soil and water-barred where needed. (Water bars are channels built across the exposed soil of the fuelbreak perpendicular to the slope—channelling runoff water before it can rush down the hill causing excessive erosion or gullyng.)



PHOTO: NPPA

▲ *Community fireguard integrated with public green space and trails.*

and 3 have been applied.

To appreciate the importance of community fireguards, recall that large wildfires are often spread by embers lofted up to one kilometre in advance of the main fire front. Although the fireguard forms one line of defence, it is by no means a fail-safe blockade to wildfire. A fireguard also provides firefighters a place to stage more aggressive fire control tactics.

Even with a community fireguard, buildings within the community will still need to maintain fuel modified areas.

A trail bed for hiking or horse use will also act

as a fuelbreak and will increase firebreak effectiveness, if it is necessary to keep ground cover intact for aesthetic or other reasons. If fuelbreak construction is not feasible during initial establishment of a firebreak, remove surface fuel to a more aggressive standard.

To build a community firebreak, outline the proposed area on a map. Everyone within the community who will be affected should meet to decide where and how much fuel modification is needed. Then the boundaries can be marked with flags in preparation for the physical work of constructing the firebreak. The community side of the firebreak should follow the lot boundaries and be as straight as possible. The boundary on the forest side of the firebreak will vary with the slope and any other special concerns. If the firebreak is to be built on an individual lot, the boundaries of the firebreak should follow the property stakes.

Ideally, all properties adjacent to continuous forest fuels will have a firebreak. Firebreaks should be built to the following standards:

Disposal of Forest Debris

Vegetation management can produce a tremendous amount of material requiring disposal. If this combustible material is left on site, it will create additional fire danger. Use one or more of these methods to dispose of combustible debris:

Landfill disposal

Taking the debris to an authorized landfill site has the advantage of removing the material from the site completely. On the downside, the cost of hauling to a landfill site is high and the large volumes of forest vegetation will quickly fill landfill sites.

Composting

This is a good choice to reduce costs by minimizing hauling and landfill use. It also eliminates the smoke emissions and environmental damage of burning and allows the nutrients in the material to be recycled. On the downside, the composting material remains on site. Another disadvantage is that coniferous forest litter takes many years to decompose. Deciduous litter and grass clippings decompose quickly and are the best materials for composting.

An alternative to on-site composting of forest litter is a community composting program. A cen-

tralized composting area is built within an interface neighborhood and run by volunteers or a community organization. Program operating expenses can be defrayed by the sale of high-quality, composted soils to the community.

Chip and spread

A mechanical chipper can process slash into chips that are then spread over the ground. Chipped slash decomposes more rapidly and will present little fire danger (as long as chips are not spread too thickly). Chips act as mulch to hold soil moisture, stimulate plant growth and prevent erosion on slopes. The disadvantages to this system of slash disposal are the very high costs. If the chips are spread too thickly, the fire danger remains high and plant growth is slowed.

Salvage

Timber or firewood-sized material can be separated and used by residents. The remaining material should be disposed of safely. Firewood piles are

easily ignited during interface fire events. Locate them at least 10 metres from buildings and never downslope.

Pile and burn

Under the right fuel moisture and weather conditions, piling and burning debris can provide a very effective reduction to the on-site fire danger. To reduce smoke production, the material to be burned must be as dry as possible. To dry the fuels, rake or throw them into burnable-sized piles away from standing trees and leave them to air dry. Never burn green or freshly cut fuels because of their high moisture content.

Ideally, burn piles only after materials have dried for at least one season and after a period of dry weather. The best burning conditions usually occur between noon and four o'clock in the afternoon, under light to moderate wind conditions. As air movement is needed to disperse the smoke emissions, avoid burning in the mornings or evenings, during temperature inversions, or on very calm



◀ *Thinning pine stand with pile and burn technique.*

PHOTO: PARKS CANADA

days. Stable air does not allow effective smoke dispersion so that the burning affects local air quality.

For the best burning results, with minimal smoke production, start a small, hot-burning fire and then build on to it, maintaining the fire intensity. Residents with smaller quantities of debris to dispose of may choose to use burning barrels, which reduce the chance of fire spreading into adjacent fuels.

Extinguish all burning material once the fire is down to a smoldering state. Smoldering fires produce the most smoke and should be avoided. Monitor fires closely at all times—unattended fires pose a hazard to nearby houses and forests.

Before igniting a fire within municipal limits, contact your fire department to ensure that you comply with all local by-law requirements. Rural home-owners usually require burning permits from local authorities.

Maintaining thinned forests

Firebreak effectiveness tends to decrease over time. After the initial vegetation management, trees will continue to grow, usually at a faster rate. The increased light on the forest floor encourages heavy grass and brush

growth where, in many cases, nothing grew before. Site disturbance exposes mineral soil, which creates a seed bed for new trees. This in turn leads to new opportunities for fire.

Some species of trees are easily felled by winds that penetrate the forest cover more easily after the original clearing and thinning has been done.

An interface building or community will not continue to be FireSmart without occasional maintenance of previously treated areas. Fuelbreak maintenance problems are most often the result of neglect. During years of low fire incidence, residents may become complacent about vegetation management.

Fire officials and fire prevention specialists trained in interface fire hazard assessment and mitigation should periodically inspect interface buildings to ensure fuel modified areas still meet FireSmart recommended guidelines.

► *Periodic maintenance of community fire guards is essential.*

▼ *A fuel modification project in Banff.*

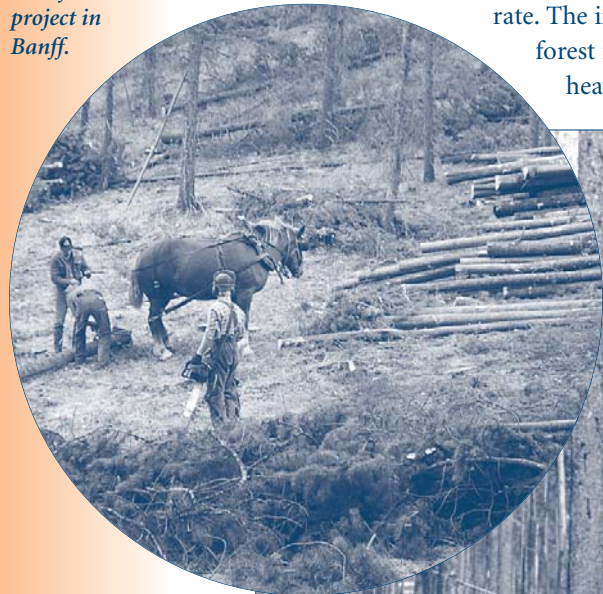


PHOTO: PARKS CANADA

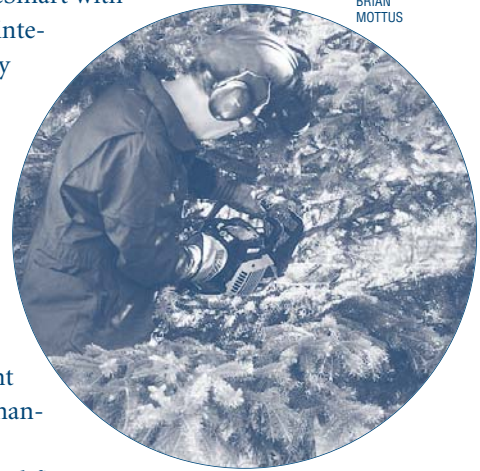


PHOTO: BRIAN MOTTUS



PHOTO: KELVIN HIRSCH

► *Fuel reduction completed.*

STRUCTURAL OPTIONS

This section outlines FireSmart design standards recommended for the construction or retrofit of interface buildings. As the hazard of wildfire destruction in the interface is more widely recognized, the safety of buildings will become a higher priority than before.

There will be a legislated, or market-driven, demand for FireSmart principles to be reflected in the design, construction, and maintenance of an interface residence or community. Fire officials, interface architects, contractors, developers and owners can use the options and recommended guidelines provided here to build FireSmart buildings and communities. Where local building codes, development bylaws, or covenants exceed the standards recommended in this manual, follow local codes and bylaws.

Others involved with the construction industry, including manufacturers, real estate professionals, inspectors, building material suppliers, insurers and mortgage lenders, should be informed about what can be done to reduce the vulnerability of buildings to wildfire. Fire officials and municipal planners will increasingly be called on to provide informed and unbiased advice to these individuals and organizations.

Roofing

Although many factors contribute to the ability of a building to withstand an interface fire event, roofs that catch fire are the main cause of building losses in wildland/urban interface areas. The roof is the



PHOTO: BRIAN MOTTUS



PHOTO: DAVE BROWN

most vulnerable component of the building. Its more-or-less horizontal surface catches and holds much of what falls on it. Firebrands and flaming debris generated by large fires can travel great distances. Once airborne, these brands are pushed by prevailing winds or driven aloft great distances by the fire's convection column. The firebrands respect no boundaries and jump over built and natural fuel-breaks to ignite spot fires.

Firebrands landing on a combustible roof surface will often start a new fire. This new fire, in turn, may produce more airborne firebrands (particularly if the roof is built of untreated wooden shakes).

Roofing classifications for combustibility

Building codes have long recognized the role of roofing in the spread of fires. Building codes apply the roofing classifications A, B and C, based on the combustibility of the exterior roofing surface.

Wooden shakes can only provide an A-, B-, or C-rated roof level of fire protection if they are pressure treated in the factory with a fire-retardant chemical. The treated shakes receive a B or C rating and can then be incorporated into a Class A-, B-, or C-rated roof structure. Some manufacturers offer lifetime warranties on the fire-retardant qualities of their product.

◀ *Wooden shakes can only provide an A-, B-, or C-rated roof level of fire protection if they are pressure treated in the factory with a fire-retardant chemical.*

► Roofs that catch fire are the main cause of building losses in wildland / urban interface areas.

PHOTO: PARKS CANADA



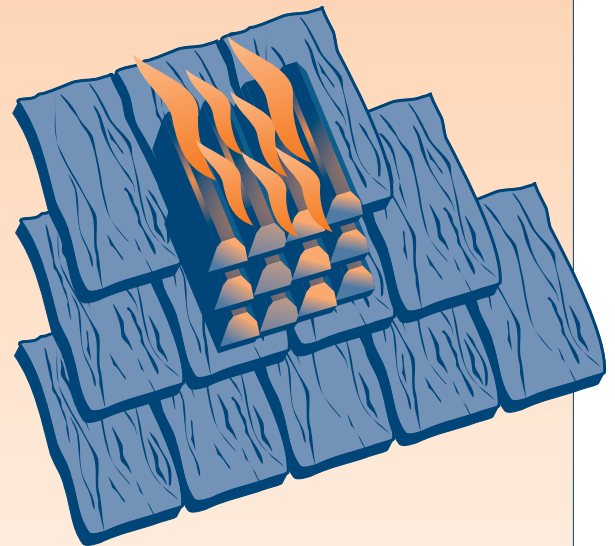
TESTING FOR COMBUSTIBILITY

Testing involves burning wood cribs or brands of varied sizes placed on the roof surface to test the combustibility of roofing materials. This simulates the spotting of firebrands and flaming debris so typical of wildland fires.

To attain a Class A rating, a test roof must remain unburned after the largest brand is placed on the roof and allowed to burn itself out.

Smaller brands are used to help determine B and C ratings.

Underwriters' Laboratories of Canada (ULC) rated Class A roofing material test is wood cribbing material of kiln-dried, knot-free Douglas-fir. Wood crib dimensions are 305mm square and about 57mm high. Wood crib is three layers of 12, 19mm by 19mm by 305mm strips, arranged 12mm apart, nailed at each end. Each layer is stacked 90 degrees to adjacent layer.



Rating	Class A	Class B	Class C
Fire Resistance	High	Moderate	Low

PHOTO: DAVE BROWN

COMMON ROOF TYPES AND FIRE RATINGS

Type	Fire Rating	Advantages and Disadvantages
Clay Tile	Class A	Durable but fragile. Heavy tiles need strong framing. (Can re-roof on standard framing with bracing).
Concrete Tile	Class A	Weight/breakage challenge as with clay tile. (lightweight concrete tile available)
Fibreglass / Asphalt Composition Shingles	Class A	Easy to apply, most common and economical of A-rated roofs. Some homeowners associations have covenants forbidding use.
Metal Roofing	Rating requirements vary: Class A – if old roof removed. Class B – installed with heavy roofing paper over old roof. Class C – if applied directly over old roof.	Lightweight and durable, wide color range. Some designed to simulate shake roof appearance.
Fibrous Cement Shake	Rating requirements vary: Class A – if installed over plywood. Class B – if not installed over plywood.	Lightweight and durable. Best simulation of shake and slate appearance. No roof reinforcement needed.
Built-up Roof	Rating requirements vary: Class A – 9 layers of roofing felt. Class B – 7 layers of roofing felt. Class C – 3 layers of roofing felt.	Standard tar and gravel flat roof, inexpensive. Unless done properly, no rating secured at all. (Asphalt or paper felt placed over wood with insufficient top coating is very flammable).
ULC Rated Shakes	Rating requirements vary: Class A – 'B'-rated shakes over roof deck Class B – 'B'-rated shakes over sheathing. Class C – 'C'-rated shakes over lathing. No other shakes meet fire ratings.	Must be kept clean. Moss, needles and other debris increase fire danger.
Unrated Shakes	None	Untreated shakes (or those with spray-on fire-retardant treatments) are highly combustible.

► *Metal roofing, slate, tile (clay or concrete), composition (asphalt and fiberglass shingle) and treated wooden shakes all provide increased fire resistance.*



PHOTO: KELVIN HIRSCH

There are other FireSmart roofing options. Metal roofing, slate, tile (clay or concrete), composition (asphalt and fiberglass shingle) and treated wooden shakes all provide increased fire resistance. Whatever material you choose, it must be installed in compliance with local building codes to achieve the fire resistance of an A-, B-, or C-rated roof.

Wooden shakes remain extremely popular with interface homeowners and designers. Some agencies and interface developments have imposed restrictive covenants or ordinances that require buildings to be roofed with wooden shakes without imposing a recommended minimum rated roof standard. The result of this type of covenant is that some buildings may have rated roofs while others will only have untreated wooden shake roofs.

Fire officials should work with local governing

bodies to implement policy changes so that building material requirements in interface areas are based on fire hazard rating, not aesthetics. Municipalities should consider modifying policies to require at least a Class C level of protection for roofing materials used in new construction in interface areas.

Recommended guidelines for roofing

- Use only fire-retardant roofing rated Class A, B, or C. Use fire hazard severity classifications as determined by fire officials to determine specific rating requirements.
- Clear roofs of all overhanging branches or needles and combustible debris buildup on roof surfaces or in gutters. When needles and debris begin burning on the roof surface even fire-resistant materials will ignite.

Chimneys or Stovepipes

Many interface buildings feature wood stoves or fireplaces as principal or auxiliary heating systems. Chimneys present a serious hazard in interface areas if they are not equipped to prevent firebrands or embers from escaping.

Recommended guidelines for chimneys or stovepipes

All chimneys used with solid or liquid fuel-burning devices should have approved spark arrestors. Arrestors must be securely attached and made of 12-gauge welded or woven wire mesh screen with mesh openings of less than 12 millimetres. Chimney outlets should have at least 3 metres' clearance from all vegetation and obstructions. Chimney outlets must be .6m higher than any part of the roof that is within 3m.

Exterior Siding

After the roof, siding material is the structural component most vulnerable to fire. An interface fire burning the forest and vegetation surrounding a building will produce intense heat that can result in exterior ignitions. Airborne firebrands and embers will travel on the high winds that often accompany wildfires. Lodging in and against the

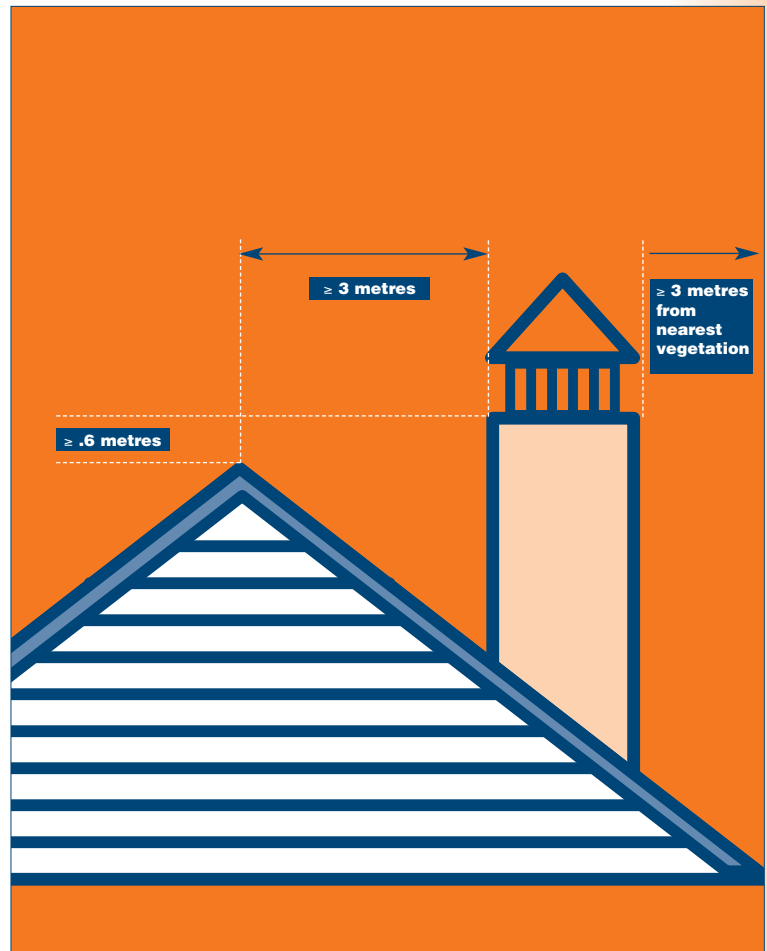


PHOTO: KELVIN HIRSCH

structural exterior, these firebrands are a major source of building ignitions.

When siding material is combustible, whether the building survives will depend on how easily the building exterior can be ignited. Vegetation or combustibles close to the building exterior or exterior wall features that can trap accumulations of embers will increase the ignition hazard to structures during a fire passage.

Materials such as stucco, metal siding, brick, cement shingles, concrete block, poured concrete and rock offer superior fire resistance. Logs or heavy timbers provide a more fire-resistant building exterior than board siding. Vinyl siding may melt, exposing flammable sheathing.

Wooden siding offers very little fire resistance yet is commonly used in interface areas. Untreated wooden shakes or tarpaper used as siding material provide no fire protection and actually increase the hazard. Residents can increase the fire resistance of a wood-sided building by eliminating areas on the siding surface where sparks and embers will lodge. Exterior vertical walls should be sheathed from ground level to roof line with material that is at least 12 millimetres thick.

Recommended guidelines for exterior siding

Any material used for siding purposes should be fire resistant, such as stucco, metal siding, brick, cement shingles, concrete block, poured concrete and rock. Siding material should be at least 12 millimetres thick and extend from ground level to the roofline.

Window and Door Glazing

Glass shattered by fire creates an opening in a building exterior that allows firebrands to enter the building so that it burns from the inside. Clear concentrations of fuels within 10 metres of windows and glass doors.

Small or multiple-pane windows are less vulnerable to breakage than large panes. Single-pane windows fracture and collapse more easily than double- or triple-pane windows. Tempered glass provides more safety than plate glass does. It is highly unlikely that an interior will ignite from thermal radiation through intact plate glass.

For more effective fire protection, windows and other openings should have solid shutters. Ideally, these will be made of non-flammable material, although 12-millimetre **exterior-grade** plywood can be used. An alternative protective measure is to screen all glazed openings with corrosion-resistant, 3-millimetre wire mesh.

During fire season, store screens and shutters where they are easily reached for installation before fire approaches the building.



PHOTO: PELLA WINDOWS

Recommended guidelines for windows and door glazing

- Clear concentrations of vegetative fuels that are within 10 metres of glazed openings unless there are solid shutters to cover the glazing.
- Greater protection is provided by smaller (less than 1 metre by 1 metre) thermal pane, tempered glass windows. Larger windows provide less protection. Single-pane glass provides virtually no fire protection.
- Solid shutters will provide increased fire protection. They should be made of non-flammable material, although 12-millimetre exterior-grade plywood can be used.
- In the absence of shutters, exterior metal fire-screens with corrosion-resistant mesh no coarser than 3 millimetres will prevent fire-brands from accumulating on windowsills and then igniting walls.
- Store screens and shutters where they can be installed quickly, before fire approaches the building.



PHOTO: JOHN LUCKHURST

Eaves, Vents, and Openings

While vents perform the important function of allowing trapped moisture to escape from attics, soffits and crawlspaces, they are ready-made openings that can allow heat and embers to enter a building and ignite it.

Recommended guidelines for eaves, vents, and openings

To prevent entry of windblown embers, all eaves, attic and underfloor openings need solid, non-flammable, exterior protective shutters. Fire shutters can be made of 12-millimetre exterior-grade plywood. Store screens and shutters where you can reach them easily for quick installation in case of fire. As a minimum protective measure, all openings should be screened with corrosion-resistant, 3-millimetre non-combustible wire mesh.

Provide interior access to attics and crawlspaces so homeowners can find and extinguish spot fires following the passage of the fire.

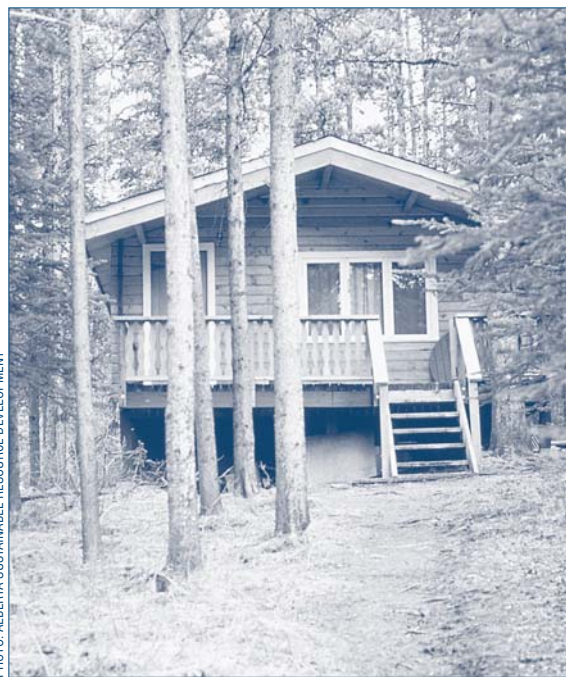


PHOTO: ALBERTA SUSTAINABLE RESOURCE DEVELOPMENT

Balconies, Decks, and Porches

Outdoor living areas are important to the interface lifestyle. It is unlikely that homeowners will be willing to eliminate stilt construction and overhangs used in the assembly of decks and balconies, despite the fire danger they create by trapping heat rising along exterior siding.

Stilt construction allows fire to get under overhangs and ignite the building. If vegetation, debris, or stored combustibles are allowed to accumulate under the overhang, the fire danger is further increased. Fortunately, there are ways to reduce the fire danger of these building features.

Recommended guidelines for balconies, decks, and porches

Build balcony and deck surfaces of non-combustible or fire-resistant materials. Enclose eaves, cantilevers, balconies, and undersides of overhangs that are built of combustible material with 12-millimetre sheathing. Ideally, sheathing material should be non-flammable.

Stilts can be built from or encased in non-combustible materials. Use of heavy timbers instead of 2x4s will increase the fire resistance of the building.

Slotted deck surfaces allow needle litter to accumulate below the deck. Provide access to these spaces so that debris may be removed on a regular basis.

► *Areas under a trailer or manufactured home should be sheathed with non-combustible materials.*

Trailers and Manufactured Homes

Manufactured homes have many of the fire dangers outlined for other buildings. Although roofs and siding are usually metal and non-combustible, storage sheds or porches made of wood and plastic are common, and increase the fire danger.

Recommended guidelines for trailers and manufactured homes

All the specific vegetation management and structural option recommended guidelines that apply to conventional homes in the interface also apply to making trailer and manufactured homes FireSmart. Areas under a trailer or manufactured home should be sheathed with non-combustible materials. This will prevent buildup of flammable material and prevent firebrands from blowing in under the unit.

If the installation is to be mobile or semi-permanent, provide adequate tie-downs. Many mobile-home fires are caused by movement of the home, which can damage electrical and gas service connections and cause fires.



PHOTO: DON MORTIMER

On-site Firefighting Equipment

Interface fires often start as small accidental ignitions, and timely action by properly equipped residents can make the difference between a fire that escapes and a fire that is quickly controlled. Homeowners are not encouraged to attack large or fast-moving wildfires.

Homeowners should have a round-point shovel and a grubbing tool readily available from the outside of the home. A lack of available tools greatly reduce the chance of interface residents successfully suppressing small fires in time. A small amount of water can cool or extinguish small fires close to buildings. Water should always be readily available during any backyard burning, in any weather.

Exterior faucets and garden hoses long enough to reach around all buildings and onto the roof will help the homeowner protect the house. Houses without pressurized water systems should have a minimum 205-litre (45-gallon) fire safety water barrel close to the building, with a 10-litre (two-gallon) pail attached. Reserve this water for fire protection.

A rooftop access ladder and rooftop sprinkler are useful for fighting rooftop fires or wetting down the roof if a forest fire is advancing on the house, although high winds may blow the water away before it contacts the roof. The sprinkler can be left running on the roof if residents have to evacuate, but use caution; getting to rooftops in windy, smoky conditions can be hazardous.

Household water supplied by electric pump is unreliable; power outage often accompanies forest fire incidents. Household water obtained from a community water main is also unreliable as demand often exceeds supply during a fire. More information on firefighting water supply considerations is provided in the next section.

Recommended guidelines for on-site firefighting equipment

Keep a shovel and a grubbing tool readily available from the exterior of the building during fire season.

Maintain a water supply at exterior faucets with adequate hose length to reach around the building and onto the roof during fire season.

If your house does not have a pressurized water system, keep a water-filled 205-litre fire safety water

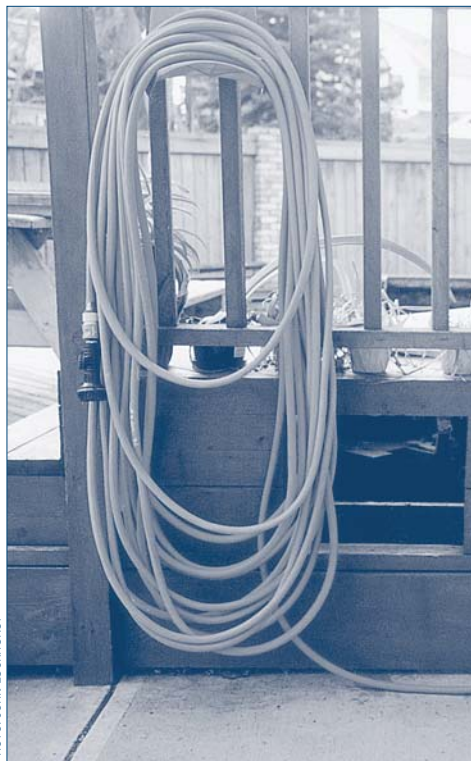


PHOTO: JOHN LUCKHURST

barrel close to the building, with a 10-litre pail attached.

Keep a rooftop access ladder and rooftop sprinkler system available during the fire season.

SPRINKLER SYSTEMS

Sprinkler systems are a simple, effective, and safe tool to use in protecting structures in the interface from wildfire. They wet down the structures, which reduces the threat of ignition from firebrands. Sprinkler systems also help cool the buildings during exposure to radiant heat from wildfire. Wetting down the areas surrounding the structures increases relative humidity in immediately adjacent areas and reduces the fuel available for ignition around the structure.

▲ Adequate hose and rooftop sprinklers are essential. ▼



PHOTO: RAPID FIRE AND RESCUE SERVICES

INFRASTRUCTURE

This section looks at the network of roadways, open spaces, water supply, and utilities that make up the infrastructure of an interface community.

FireSmart infrastructure cannot increase the probability of structural survival (this is determined by vegetation management and the use of FireSmart structural options). FireSmart infrastructure will, however, increase resident and firefighter safety and facilitate quick response by firefighters.

Firefighters in the wildland/urban interface are already working at a disadvantage, without an inadequate water system or narrow roads, steep grades, and underbuilt bridges.

Infrastructure problems within the interface community are potentially hazardous for both residents and firefighters. Many incidents resulting in tragic and costly losses can be blamed on substandard water supply, or inadequate access and evacuation routes.

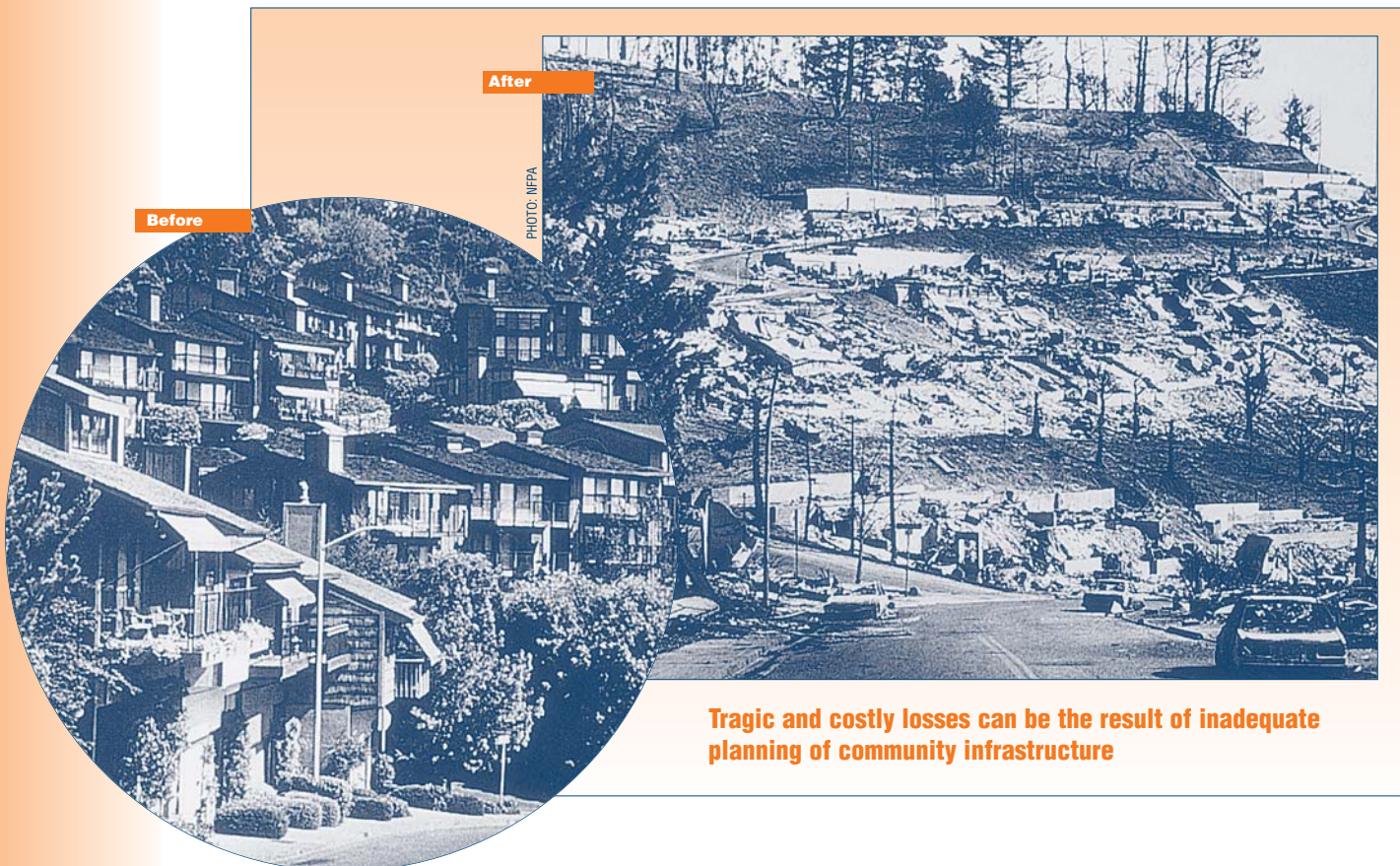
Access Routes

Roads serve several purposes during an interface fire. Roads are access routes for emergency vehicles, many of which are heavy and large. A fully loaded fire truck can weigh up to 20 tonnes.

Roads are also escape routes for residents during a fire, and need to provide safe simultaneous access for emergency vehicles and public evacuation. Roads may serve as firebreaks to provide fire protection and assist firefighting efforts in the interface.

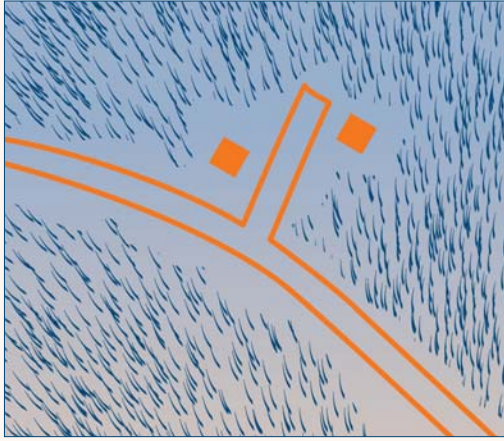
Narrow driveways or dead-end roads without cul-de-sac turnarounds are a particular problem for fire trucks that may be unable to turn around when needed. This means the fire truck must make a backing exit that is slower and dangerous. Wherever possible, buildings should have alternate access routes provided to facilitate emergency evacuation if approaching fire blocks principal access routes.

Street signs and house numbers that are hard to see in dark or smoky conditions can result in access delays for firefighters. Combustible signs are not reliable as they may not survive even low-intensity ground fire.

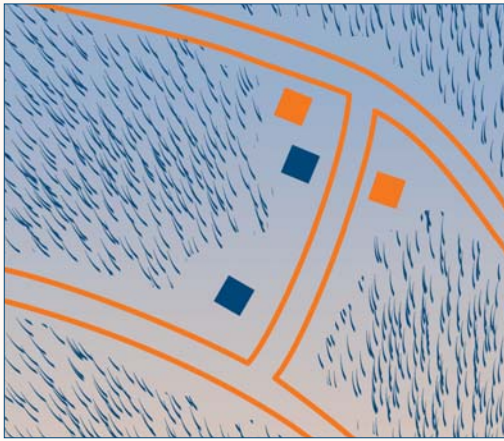


Tragic and costly losses can be the result of inadequate planning of community infrastructure

ACCESS ROUTES



Inappropriate dead-end access



Two-way access

Access routes should be designed using looped networks capable of accommodating two-way traffic. All developments should have at least two access routes.

For interface fire protection purposes, access route standards are divided into two categories: road standard, for an access route that serves more than one parcel; and driveway standard, for the route to a building that is located more than 45 metres off a road. Wherever possible, road access routes should also work as perimeter firebreaks to provide fire protection and assist fire suppression efforts in the interface.

Recommended guidelines for roads

The following recommended guidelines are for use in the layout, design, construction, and maintenance of both roadways and fire service access routes. Access routes built and serviced to these standards will facilitate safe and efficient access for both residents and firefighters.



PHOTO: JOHN LUCKHURST



- Roads should provide safe simultaneous access for emergency vehicles and public evacuation with a traveled way of not less than 6.1 metres horizontally and 4.1 metres vertically. Where parking is permitted, an additional 2.7 metres of improved road width should be provided.
- Road curvature radius should be at least 30 metres, measured from the centre line.
- Road gradient should not exceed 10 percent. Exceptions to this may be negotiated with fire officials.
- Dead-end roads more than 90 metres in length should be provided with a turnaround at the terminus having no less than 36 metres outside diameter of traveled way. Fire officials may authorize a “hammerhead T” turnaround to provide three point turnaround ability. Dead-end roads should have their non-through traffic status posted.
- All gates should be located at least 9 metres from the public right of way and should not open outward. Gate openings should provide a clear opening of not less than .6 metres wider than the travelled way.
- Fire service personnel shall be provided with ready access to any locking mechanism on any gate restricting access to any road.
- Roads should have a hard all-weather surface capable of supporting any fire apparatus likely to be operated on the road.
- Bridges should be designed and built with a hard all-weather surface capable of supporting the heaviest piece of fire apparatus likely

to be operated on the bridge. Load limits should be clearly posted at the approaches to each bridge.

Recommended guidelines for fire service access driveways

- Driveways more than 45 metres in length should be a minimum of 3.7 metres in width and provide 4.1 metres vertical clearance over the full width. Fire officials may specify additional width and clearance.
- Turnouts shall be spaced so that drivers can see from one turnout to the next. Turnout requirement is waived where the fire service access width is 6.1 metres or more. Driveways more than 90 metres in length should be

► *Dead-end roads should be posted as no-through roads.*

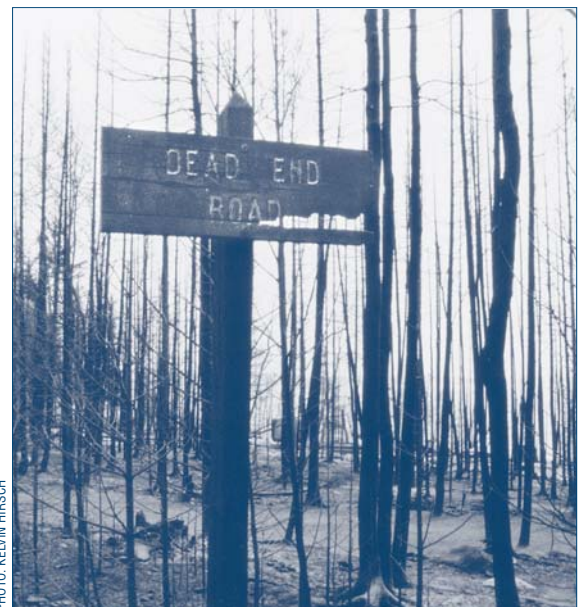
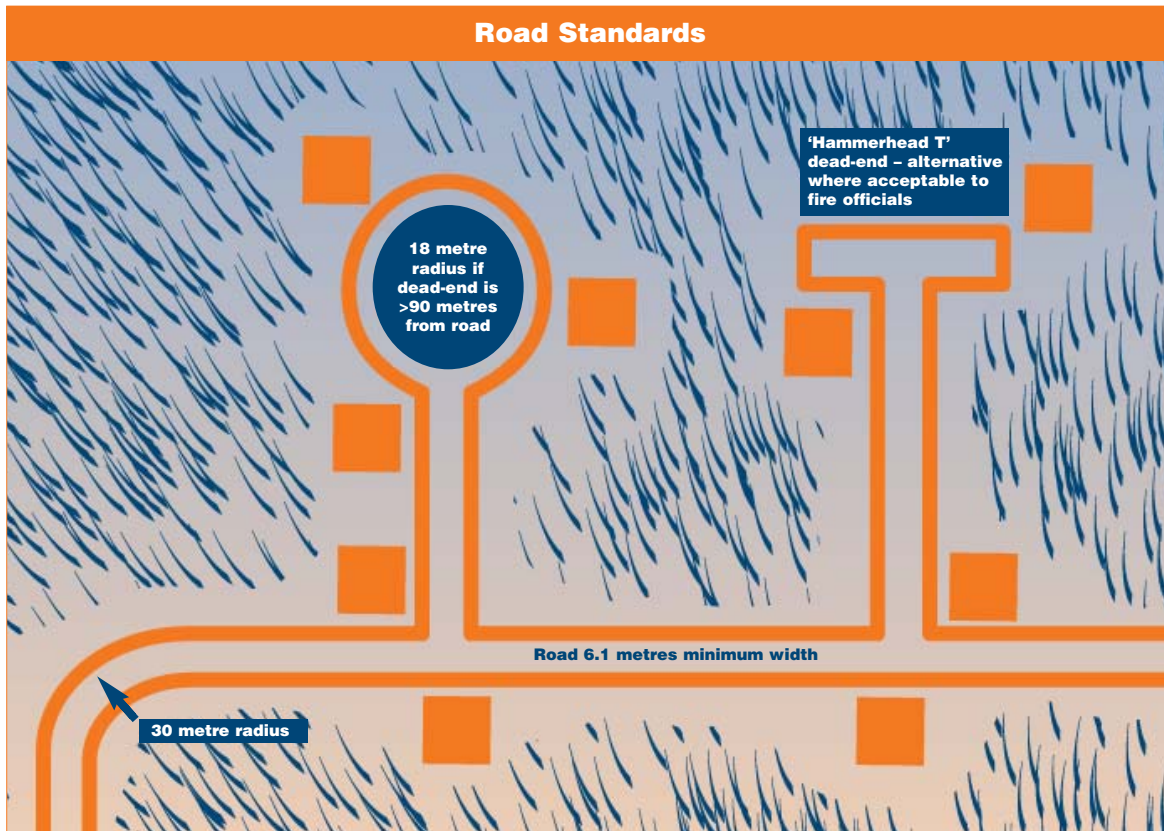


PHOTO: KELVIN HIRSCH



provided with turnouts at locations approved by fire officials.

- Driveway gradients should not exceed 10%. Exceptions to this may be negotiated with fire officials.
- Driveway turns should not restrict the access of the largest emergency vehicle likely to be operated on the driveway. Fire officials will specify local emergency response agency requirements.
- All gates should be at least 9 metres from the public right-of-way and should not open outward. Gate openings should provide a clear opening at least .6 metres wider than the travelled way.
- Fire service personnel should be able to unlock any gate restricting fire service access.
- Driveways should have an all-weather surface capable of supporting any fire apparatus likely to be operated on the fire service access.
- Dead-end driveways more than 91 metres in length shall be provided with a turnaround at the terminus having no less than 15 metres outside diameter of travelled way. Fire officials



PHOTO: ALBERTA SUSTAINABLE RESOURCE DEVELOPMENT

► *Visible signing is important.*

may authorize a “hammerhead T” turn-around to provide three point turnaround ability. Dead-end roads should have signs warning of their no-through-traffic status.

Recommended guidelines for signs for road, driveways, and buildings

- Signs should be clearly visible and legible from the road and use a consistent system that provides for sequenced or patterned numbering and non-duplicated naming.
- Signs should be built of non-combustible materials and mounted 2 metres above the surface of the road.
- Signs with information such as “dead-end” or “bridge out” will be placed by designated by fire officials. Signs will be placed identifying firefighting water source and type of location.
- Letters, numbers, and symbols used on all signs should be at least 10 centimetres high with a 12-millimetre stroke, contrast with the background color of the sign, and be reflective.

Open Spaces — Greenbelt Areas

Open space can be incorporated into interface areas whenever planning officials have an opportunity to dedicate tracts of land to non-residential purposes. The goal of providing or leaving natural open areas undeveloped is to incorporate the fuel modified area concept into the community layout.

Open-space or greenbelt areas are effective in moving the edge of the interface away from buildings, and in reducing the danger of wildfire spreading to buildings. Consider the topography and prevailing winds when planning the location of open spaces—place open spaces downslope or upwind of the community or facility. Open-space areas lose their effectiveness unless they are regularly maintained.

Some examples of open areas are parking lots, cultivated fields, orchards, golf courses, parks and playgrounds, or any area of sparsely forested land that has had surface and above-ground fuels removed.

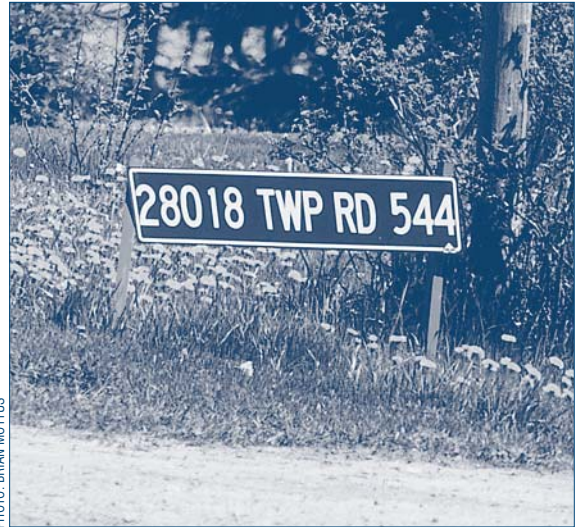


PHOTO: BRIAN MOTTUS

Recommended guidelines for open spaces — greenbelt areas

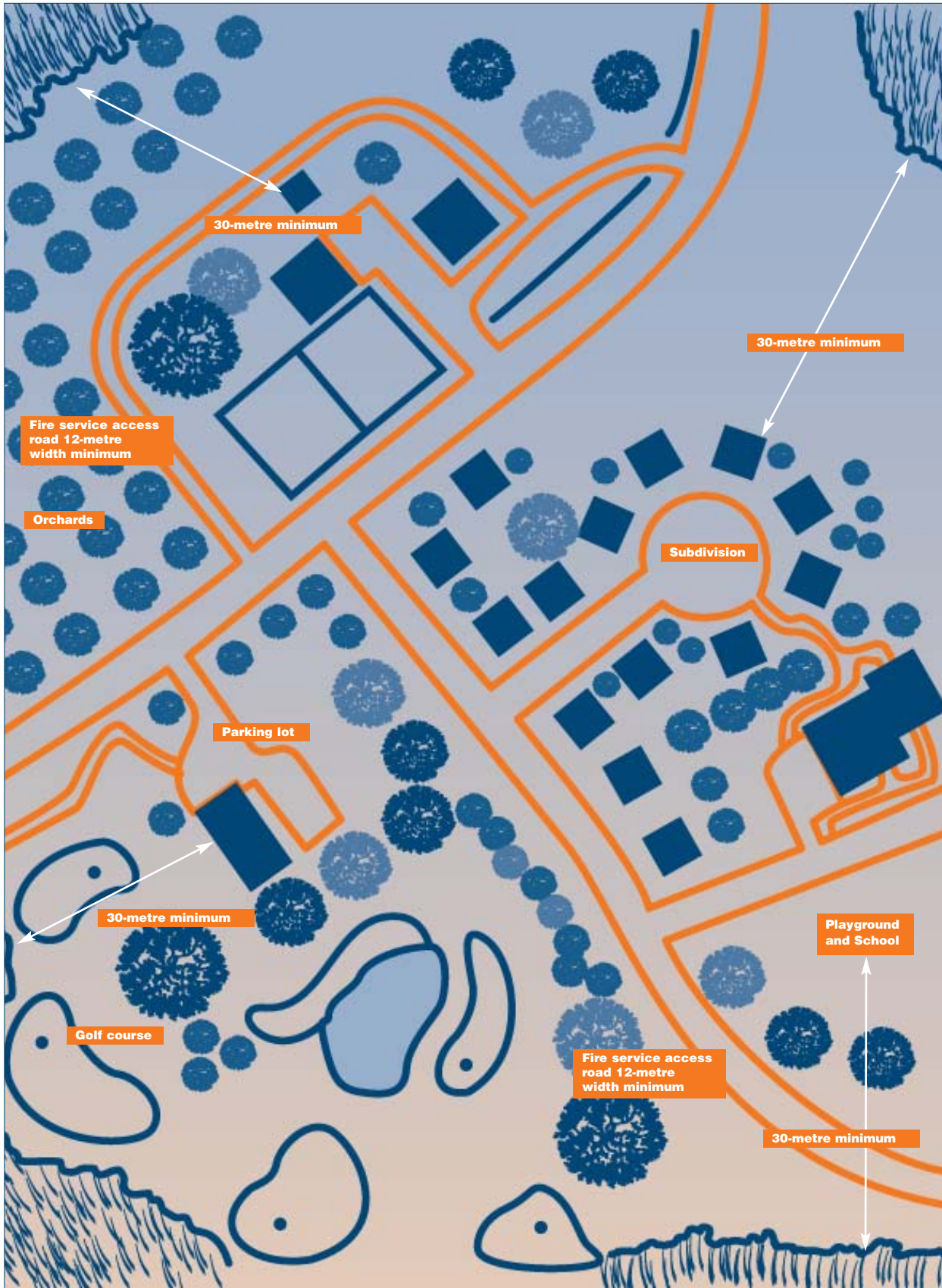
- Open spaces provide perimeter protection by moving the interface back from buildings and should be incorporated into interface developments and communities wherever possible.
- Where open spaces are used as firebreaks, they should be at least 30 metres wide on level ground and up to 50 metres wide when located on or near slopes. Fire officials may specify greater widths when higher hazard levels exist.
- Open spaces should have short grass or other closely trimmed vegetation. Remove surface and ladder fuels.
- Open-space perimeters should have fire service access routes that connect to principal roadways.

Water Supply

Wildfire suppression needs substantial volumes of water from a dependable source. The capability of interface fire departments is limited by the adequacy of the water supply.

Some interface communities have a fire department and have a public water system with fire hydrants. Water main size, fire hydrant spacing and capabilities must comply with Fire Underwriters Survey or National Fire Protection Association standards. A public water system with fire hydrants or standpipes is a viable option where building density and community size allows for the added expense of establishing such a system.

◀ An example of how open spaces can be incorporated into interface areas.



Some interface communities are served by a fire department but have no public water system. These communities begin with several residents sharing a single water source. Subsequent development increases structural density and property values, but water supplies do not expand along with the community.

Water supply for fire suppression in these communities is limited to the amount carried on fire trucks or developed on-site by the residents of the community. Community values and acceptance of risk should be considered, but fire officials should

advise planners, developers or property owners that, without adequate water, fire protection capabilities will be limited.

Residents of communities without a fire department depend entirely on water sources they have developed to supply firefighting water delivery systems they have bought or built themselves.

The initial cost of an adequate public or private water system is high but will certainly be viewed as cost effective if there is ever an interface fire.

Recommended guidelines for water supply

All buildings proposed and existing within interface areas should have a water supply for the purpose of firefighting, that meets the requirements of either the Fire Underwriters Survey Guide—Water Supply for Public Fire Protection, or the National Fire Protection Association (NFPA) 1231—Standard on Water Supplies for Suburban and Rural Fire Fighting.

Fire protection water supply provided by homeowners

Interface homeowners with fire department protection and fire hydrants or standpipes already have a relatively high level of fire preparedness and may choose to implement only some of the measures. Interface homeowners with no fire department protection have a much lower level of fire preparedness and may choose to implement all of these measures.

Providing a firefighting pump and water delivery system that will meet the requirements of your property requires some planning. Fire officials and fire equipment retailers can advise interface homeowners or community groups on the most cost-effective methods of providing adequate water for fire protection. Be prepared to tell them:

1. the size of your buildings and their layout on the property;
2. the distance from the water source to buildings and other areas on your property requiring fire protection;
3. the vertical distance from the water source to the top of your building(s);
4. the approximate volume or flow rate of your water source.

► Portable water reservoirs can supplement public supplies.



PHOTO: NFPA

▼ Portable floating pumps are effective on small water sources.



PHOTO: INITIAL ATTACK

Domestic water supply

Structures in interface areas should use larger-diameter supply mains. This will provide higher volumes and pressures if household water supply has to be used for fire suppression.

There should be at least a 25-millimetre line between the community water main and any water outlet that might be used for firefighting. These outlets should have an operating pressure of at least 345 kPa (50 psi).

Hose connections should be plumbed on both the exterior of the building and on standpipes located 15 metres from the building. A 37-millimetre line equipped with forestry quick-couple connections provides a more effective supply. Garden hose outlets and connections are acceptable as a minimum.

Hose

Keep enough garden hose at each interface building to allow a water stream to be directed on all exterior surfaces of the building, including the roof. Equip each hose with a nozzle and keep it connected during the fire season.

Rooftop access ladder and sprinkler

Provide access to the roof in order to wet it down or suppress spot fires that may ignite on the roof. Connect the sprinkler to the hose and nail it to the roof, but turn it on only if fire is an immediate risk. Unnecessary use of water during interface fire incidents will reduce the firefighting water supply where it is needed most.

Emergency water supply

Homeowners should consider a number of alternatives in installing water sources for fire suppression purposes.

Independent water systems

Consider developing water supply systems that are not dependent on community water pressure or electric well pump (both of which are often unserviceable during interface fires). Reservoirs that gravity feed to a standpipe near the building with pressures between 345 and 690 kPa (50 and 100 psi) are excellent. Providing a 37-millimetre line equipped with forestry quick-couple hose connections will also greatly assist firefighters.



PHOTO: JOHN LUCKHURST

Electrically operated pumps

Most well water is supplied by electrical pumps. Consider having an auxiliary gasoline-powered generator that you can wire directly to your electrical pump. The alternative power source will ensure water supply if fire threatens your building or property. Residents with electrically supplied water pressure may wish to consider auxiliary gasoline-powered pumps for use during firefighting emergencies.

▲ Ponds or dugouts can be a valuable source of water during interface suppression situations.



PHOTO: CDF

Water storage capability

Tanks, ponds, pools, or underground cisterns can store water for emergency use. Storage vessels should have 37-millimetre hose connections and be located within 15 metres of the building. Make water available from private swimming pools and hot tubs accessible within 5 metres by fire department engines.

Interface buildings without a pressurized water system should have at least one large water barrel and a 10-litre fire pail.



PHOTO: CDF

Gasoline-powered pumps

Consider a gasoline-powered pump if you are near a water source. You will need a gas-engine fire pump sufficient to supply your firefighting needs, and enough fire hose of adequate diameter (19mm, 25mm or 37mm) to reach all areas on your property that may require firefighting water.

Sprinklers and Roof Watering Systems

Property owners with gasoline-powered pumps and independent water sources may wish to pre-configure a system of sprinklers or soaker hoses to further protect their properties. Sprinklers deliver a relatively low volume of water to a structure and surround-

ing vegetation over a period of time. In a matter of hours, structures and vegetation can be thoroughly soaked, increasing fire resistance significantly. A further advantage of sprinkler systems is that they can be configured to operate remotely, freeing firefighters and property owners to accomplish other tasks.

Sprinklers and roof watering systems should not be considered an alternative to the use of FireSmart construction materials and design standards or application of FireSmart vegetation management guidelines. Sprinkler systems do not provide reliable structure protection and can become unserviceable for a number of reasons. The soaking effect of sprinklers is quickly lost in high fire danger weather conditions or when equipment failures occur.

Research is currently underway to determine the most effective sprinkler head configurations and water flow rates for structure and property protection. Check for the latest results on the Partners in Protection website and consult your local fire officials for advice on sprinklers and roof watering system options.

Firefighting Foams and Gels

Property owners with gasoline-powered pumps and independent water sources may wish to increase the effectiveness of their firefighting water supplies by considering the addition of approved firefighting foam concentrates, gels and wetting agents to the firefighting water supply.

Firefighting foam is a concentrated soap with a foaming additive that allows the water it is mixed with to expand, penetrate and extinguish fire more effectively than water alone. Firefighting foam concentrate is added to the firefighting water supply either at the pipe or at the specially designed foam nozzle.

Firefighting foams are relatively short-lived, especially under typical high-fire-danger weather conditions. Application of foam to structures and vegetation requiring protection from fire must occur almost immediately before the fire reaches the site.

Fire gels are a relatively new fire protection technology. **Not all gels are CSA approved - check before purchasing.** Fire gel concentrate is mixed with water, forming a tacky solution that is applied to any combustible structure or vegetation. The gel

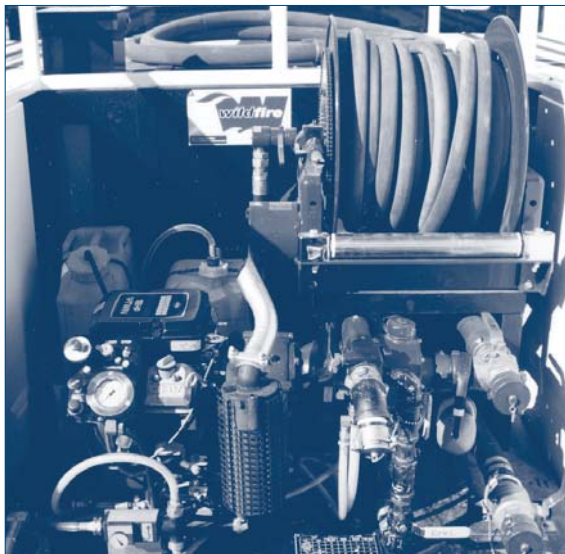


PHOTO: ALBERTA SUSTAINABLE RESOURCE DEVELOPMENT

Utilities — Electric and Gas

Electric utilities

Overhead power lines have the potential to be a major source of ignition for interface fires. Primary distribution lines, normally below 25,000 volts, are a particular problem. They often run cross-country, making inspection and maintenance difficult. Downed conductors may remain energized. System circuit breakers may be re-energized several times, subsequent to an outage, before finally remaining open. Re-energizing of a conductor may cause arcing, which may in turn ignite combustible materials in the vicinity. Secondary services (lower voltage lines from the user's customer transformer to the premises) are lower in voltage. Although not as high a risk with respect to arcing, these lines are more susceptible to being overgrown with vegetation, causing short circuits, and possibly fires.

◀ Adequate clearance is needed so that overhead power lines are not struck by falling trees.

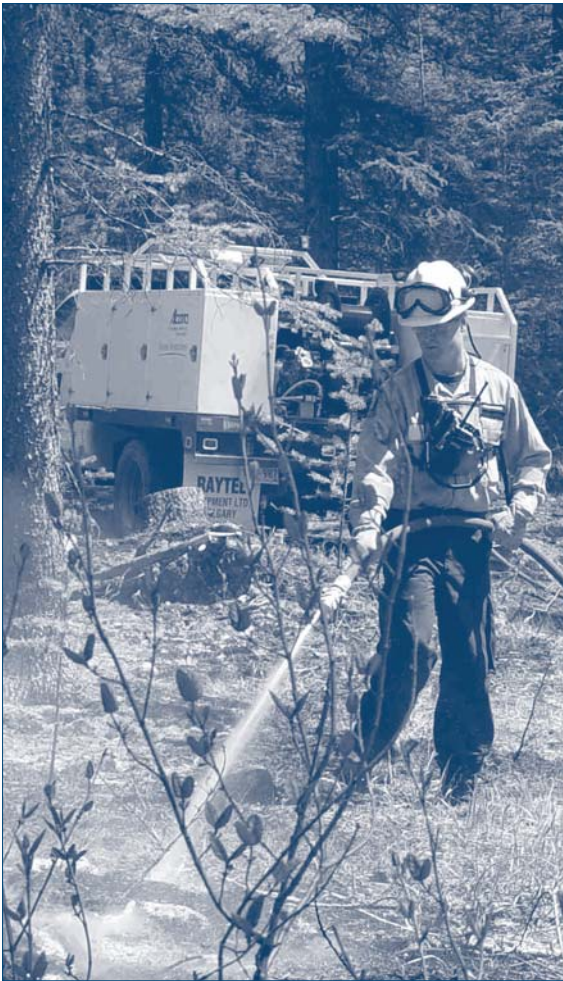


PHOTO: RICK ARTHUR

adheres well, even to vertical surfaces, and provides an insulating zone between the heat of the fire and the protected surface. Fire gels are mixed and applied in the same manner as firefighting foams using standard foam nozzles. Fire gel can also be applied using standard hoses and nozzles.

Fire gels are highly effective, providing a longer lasting fire retardant effect than firefighting foam. Gels can be rehydrated with more water if they dry out after application to protected surfaces. Fire gels can be difficult to clean off (pressure washing is required). Follow maintenance procedures to prevent the equipment becoming clogged.

Research on both foams and gels is ongoing. Check for the latest information on the Partners in Protection website. Consult local fire officials for further advice on the selection and use of firefighting foams and gels.



PHOTO: ATCO ELECTRIC

► Secondary services are more susceptible to being overgrown with vegetation.

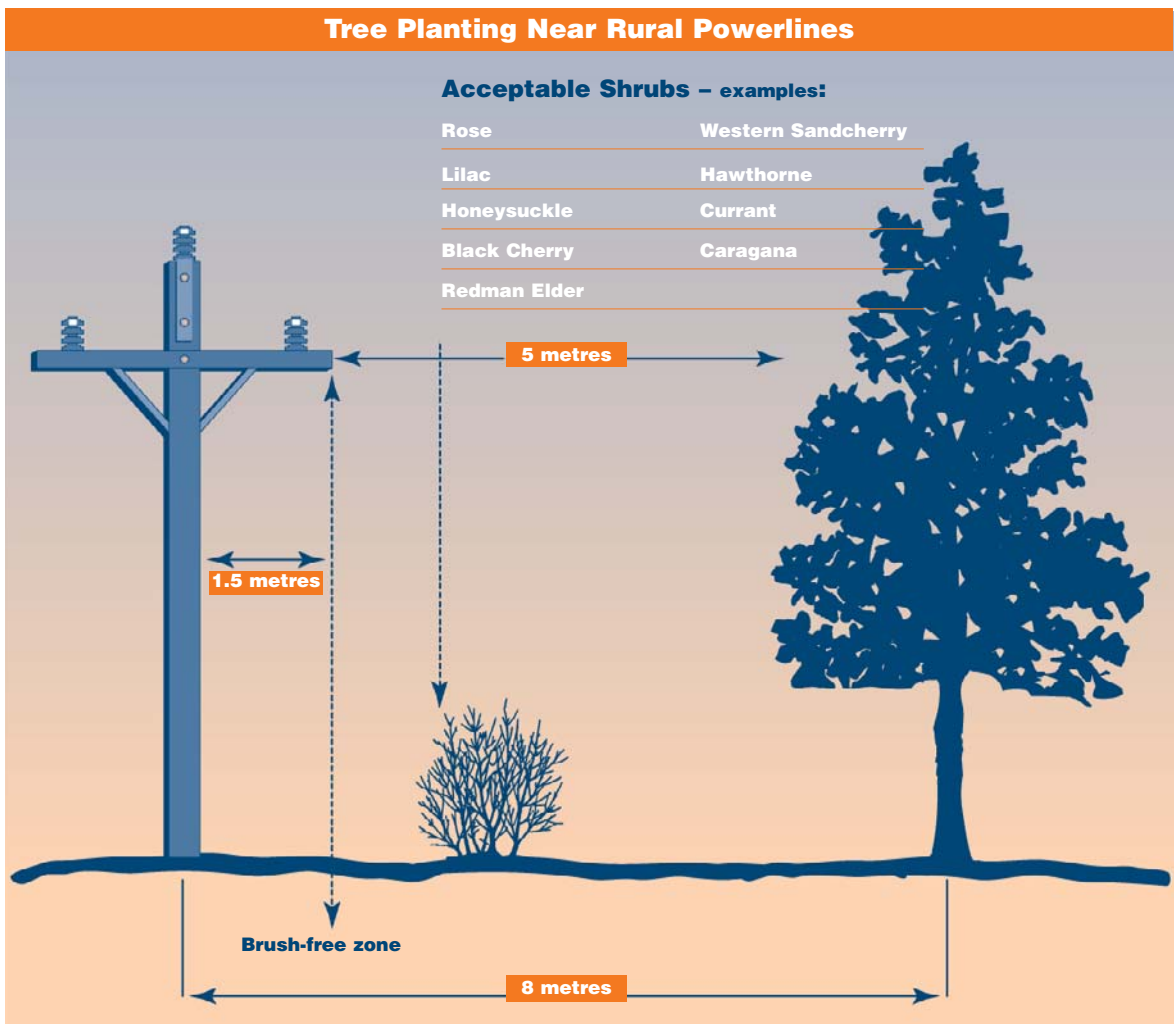


PHOTO: ATCO ELECTRIC

Recommended guidelines for electrical utilities. Underground power distribution offers the greatest fire safety. These installations are not vulnerable to falling vegetation or traffic damage. Utilities, wire owners, or wire service providers should keep vegetation cleared to appropriate distances from the powerline to prevent vegetation from making contact. “Hazard trees”—trees likely to contact the powerline—should be removed. Vegetation under the powerlines may also contribute to ignitions. Contact your electrical utility company if this maintenance is necessary. They will gladly assist in carrying out the needed maintenance, or advise the property owner of what to do.

Propane

Propane tanks surrounded by dense concentrations of vegetation are potential bombs. When the wildland fuels near the tanks burn during an interface fire, the internal pressure of the tank can cause the



◀ Properly located and maintained propane tanks.



PHOTO: BRIAN MOTTUS

tank to vent through a relief valve. This will create an intense fire that could ignite nearby combustibles. If the venting tank is located immediately next to a building, loss of the building is almost guaranteed. For this reason, propane tank valves should point away from any building.

If the relief valve on the tank fails to function, a boiling liquid vapor explosion can result. These events are best described as catastrophic — a 2,300 litre (500 gallon) propane tank that explodes in this manner creates a shock wave that is capable of killing anyone within 300 metres. Propane tanks with untreated fuels next to them are a serious hazard to firefighters. Fire officials should note the locations of all tanks within interface areas and work with homeowners to ensure that propane tanks are safely maintained.

Recommended guidelines for propane

Propane tanks should have all vegetation within 3 metres cleared away. Locate tanks at least 10 metres from the building.

Summary

Chapter 3 provides manual users with a number of recommended guidelines for the design, layout, construction, and maintenance of interface buildings and communities. These guidelines are based primarily on National Fire Protection Association (NFPA) standards that are published as a code NFPA 1144 – Standard for Protection of Life and Property from Wildfire.

A variety of other codes and standards are cited with pertinent and applicable items included in Chapter 3 as components of the recommended guidelines or general discussion.

An important adjunct to Chapter 3 is provided in Appendix 2. These recommended guidelines are based on standards developed by Arbor (1991). All fuel management activities that could be prescribed for interface fire danger mitigation are covered in detail within these recommended guidelines.

