

**FIREHARD.CA**

**TECHNICAL BULLETIN TB-04**

# Wildfire-Resilient Subdivision Design

Guidance for Planners, Zoning Officials, and Developers

How better subdivision design reduces wildfire risk and shifts costs from homeowners to where they belong

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## **DISCLAIMER**

This guide is published by FireHard Canada for general educational and informational purposes. It provides technical guidance on wildfire-resilient subdivision design based on current Canadian building science, the NRC National Guide for WUI Fires, and international best practice.

Not professional advice: This guide does not constitute professional engineering, planning, legal, or construction advice. Municipalities should obtain legal review before adopting any DPA language.

No guarantee of wildfire survival: Compliance with these recommendations does not guarantee that a property or subdivision will survive a wildfire event.

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# Contents

## 1. Why This Matters: The Developer's Role in Wildfire Risk

## 2. Radiant Heat: NBC vs. Wildfire Reality

- 2.1 How the NBC Calculates Spatial Separation
- 2.2 Why This Doesn't Work for Wildfire
- 2.3 Radiant Heat Flux and Distance

## 3. The Economics: Separation vs. Hardening

- 3.1 Per-Home CNEL Hardening Costs
- 3.2 Per-Lot Development Cost of Wider Setbacks

## 4. CNEL and Building Separation: A Cost Comparison

## 5. Accessory Building Setbacks

- 5.1 Recommended Setbacks for WUI

## 6. Subdivision Layout for Wildfire Resilience

- 6.1 Road Width and Access
- 6.2 Lot Orientation
- 6.3 Perimeter Design
- 6.4 Water Supply

## 7. Development Permit Area (DPA) Template Language

- 7.1 Designation and Justification
- 7.2 Key Development Permit Conditions

## 8. Vegetation Management at the Subdivision Scale

- 8.1 Recommended Subdivision-Scale Treatments

## 9. Recommendations for Planners

- 9.1 Immediate (No Bylaw Change Required)
- 9.2 Near-Term (Bylaw Amendment)
- 9.3 Long-Term (Policy and Culture Change)

## 10. References

## About FireHard Canada

# 1. Why This Matters: The Developer's Role in Wildfire Risk

When a subdivision is built in or near the wildland-urban interface (WUI), a series of design decisions are made at the planning stage that permanently define the wildfire risk profile of every home in that development. Lot width, building setbacks, road layout, and the interface with adjacent wildland—these decisions are made by the developer, approved by the municipality, and then lived with by homeowners for decades.

Once lots are sold and homes are built, the options for reducing structure-to-structure fire risk become dramatically more expensive. A homeowner whose house is 2.4 metres from their neighbour's may face \$25,000–40,000 in CNEL-3 hardening to achieve basic wildfire resilience. That same level of protection could have been achieved for a fraction of the cost if the subdivision had been designed with 6-metre building separations instead of the minimum 1.2 metres allowed under NBC spatial separation rules.

## THE CORE PROBLEM

Canada's National Building Code (NBC) spatial separation rules (Section 9.10.15) were designed for urban fire spread between burning interiors—not for wildfire. The NBC allows houses as close as 1.2 metres apart. In a wildfire, that proximity creates conditions where the failure of one home virtually guarantees the ignition of its neighbour, regardless of construction quality. Current zoning and building codes allow developers to create subdivisions with extreme wildfire risk, leaving homeowners to bear the cost of mitigation.

This technical bulletin provides planners and zoning officials with the evidence and tools to require better subdivision design in WUI areas—shifting wildfire resilience from an expensive retrofit problem to an affordable design decision.

## 2. Radiant Heat: NBC vs. Wildfire Reality

### 2.1 How the NBC Calculates Spatial Separation

The NBC’s spatial separation requirements (9.10.15.1 through 9.10.15.4) are based on the 1958 St. Lawrence Burn Tests conducted by NRC. These tests measured radiant heat flux from post-flashover interior compartment fires radiating through windows and openings. The key assumption: fire radiates outward from openings in the burning building’s facade, and the receiving building must be far enough away that the incident radiant heat does not ignite its exterior.

The limiting distance—the distance from the building face to the relevant property line—is calculated based on the percentage of unprotected openings in the exposing wall. For Part 9 residential buildings, this typically allows construction within 0.6 metres of the property line, resulting in building-to-building separations as low as 1.2 metres where two properties share a common lot line.

### 2.2 Why This Doesn’t Work for Wildfire

In a wildfire scenario, the exposure conditions differ fundamentally from an interior compartment fire:

- Ember attack precedes radiant heat. Embers can travel kilometres ahead of the fire front and ignite multiple structures simultaneously. The NBC model assumes sequential fire spread from one building to the next; wildfire attacks an entire neighbourhood at once.
- Exterior surfaces are the primary fuel. In wildfire, the exterior cladding, trim, soffits, decks, fences, and vegetation ignite first. The NBC model assumes fire radiates from interior openings. In wildfire, the entire wall face and roof can become a radiant heat source.
- Wind and convection amplify heat transfer. Wildfire events are driven by wind. Convective heat transfer from flames and hot gases significantly increases the total heat flux beyond what radiant-only models predict. Research shows convection can double effective heat transfer at close range.
- Multiple simultaneous exposures. In dense subdivisions, a home may be exposed to radiant heat from two or more burning neighbours simultaneously—something the NBC’s single-source model does not address.

### 2.3 Radiant Heat Flux and Distance

The relationship between radiant heat flux and distance follows an inverse-square decay. Research consistently identifies 12.5 kW/m<sup>2</sup> as the critical threshold for piloted ignition of wood and common building materials under sustained exposure.

Separation	Approx. Radiant Heat (kW/m <sup>2</sup> )	CNEL Level	Ignition Risk	NBC Status
1.2 m	80–150+	Beyond scope	Certain ignition. Flame impingement likely.	Allowed
2.4 m	40–80	CNEL-3	Rapid ignition of combustible surfaces. Glass failure.	Allowed
4 m	20–40	CNEL-2	Sustained ignition of unprotected wood. Glass cracking.	Allowed
6 m	10–20	CNEL-1	Possible ignition of vulnerable materials. Embers remain primary risk.	Allowed

10 m	4–8	WER only	Below wood ignition threshold. Ember attack remains.	Allowed
15 m+	<4	WER only	Radiant heat is not a significant factor. Ember defence only.	Allowed

*Heat flux values are approximate and vary with fire intensity, wall composition, wind, and geometry. Based on view factor calculations for a 2.4m high × 8m wide fully involved residential wall face.*

**KEY INSIGHT**

The NBC allows building separations of 1.2 m, which produce radiant heat fluxes of 80–150+ kW/m<sup>2</sup>—six to twelve times the ignition threshold for wood. At 6 m separation, the flux drops to 10–20 kW/m<sup>2</sup>, near or below the critical threshold. The difference between catastrophic structure-to-structure fire spread and manageable risk is a design decision made at the subdivision stage.

### 3. The Economics: Separation vs. Hardening

The fundamental economic question is: who pays for wildfire resilience? Under current practice, the developer builds to minimum NBC setbacks, sells the lots, and walks away. The homeowner inherits the close-neighbour exposure and must either accept the risk or pay for expensive envelope hardening.

There is an alternative. If the subdivision is designed with wider building separations, the per-home hardening cost drops dramatically—often by more than the per-lot development cost increase. The total cost of wildfire resilience (development + construction) is lower, and the cost is shared between the developer and the homeowner rather than borne entirely by the homeowner.

#### 3.1 Per-Home CNEL Hardening Costs

The following are order-of-magnitude estimates for a typical 1,500 sq ft single-storey home, based on the FireHard CNEL specification system:

CNEL Level	Separation	Key Requirements	Est. Cost/Home	Primary Cost Drivers
No CNEL	10 m+	Standard WER only. No close-neighbour upgrades.	\$0–\$2,000	Basic maintenance and ember defence only
CNEL-1	6–10 m	NC cladding recommended. Tempered glazing. Ember-resistant vents.	\$3,000–\$8,000	Glazing upgrades, vent screening, cladding
CNEL-2	4–6 m	NC cladding required. Tempered glazing. Type X sheathing. Shutters recommended.	\$12,000–\$25,000	Full wall assembly upgrade, sheathing, shutters
CNEL-3	2.4–4 m	NC everything. Type X gypsum. Mineral wool. Shutters required. Sealed NC soffit.	\$25,000–\$40,000	Complete envelope rebuild on exposed face

*Costs are order-of-magnitude estimates. Based on 2026 BC pricing.*

#### 3.2 Per-Lot Development Cost of Wider Setbacks

Increasing building separation from 1.2 m to 6 m requires wider lots or different lot configurations:

Design Change	Lot Width Impact	Density Impact	Est. Per-Lot Cost Increase	Notes
1.2 m → 3 m setback (6 m separation)	+1.8 m per lot	~5–8% fewer lots	\$2,000–\$6,000	Less impact in rural WUI where lots are already wider.
1.2 m → 4 m setback (8 m separation)	+2.8 m per lot	~8–12% fewer lots	\$4,000–\$10,000	Eliminates CNEL-1 for most homes.
1.2 m → 5 m setback (10 m separation)	+3.8 m per lot	~12–18% fewer lots	\$6,000–\$15,000	Eliminates all CNEL requirements.

*Development cost estimates based on typical BC WUI community land values (\$50–\$150/m<sup>2</sup>) and infrastructure costs (\$180–\$335/linear foot of road).*

## 4. CNEL and Building Separation: A Cost Comparison

The following table compares the total cost of wildfire resilience (development + construction) under two approaches: (A) minimum NBC setbacks with CNEL hardening paid by the homeowner, and (B) wider setbacks with reduced or eliminated CNEL requirements. Costs are per home.

Scenario	Separation	CNEL Level	Hardening Cost	Added Lot Cost	Total Cost	Who Pays
A1: Status quo	1.2–2.4 m	CNEL-3	\$25,000–\$40,000	\$0	\$25,000–\$40,000	Homeowner 100%
A2: Typical suburban	2.4–4 m	CNEL-2	\$12,000–\$25,000	\$0	\$12,000–\$25,000	Homeowner 100%
B1: 3 m setback	6 m	CNEL-1	\$3,000–\$8,000	\$2,000–\$6,000	\$5,000–\$14,000	Shared ~50/50
B2: 4 m setback	8 m	None	\$0–\$2,000	\$4,000–\$10,000	\$4,000–\$12,000	Developer ~80%
B3: 5 m setback	10 m	None	\$0	\$6,000–\$15,000	\$6,000–\$15,000	Developer 100%

### THE CASE FOR BALANCE

Scenario B1 (6 m separation) achieves comparable or better total resilience at roughly one-third the cost of A1 (minimum NBC), and the cost is shared between developer and homeowner. Scenario B2 (8 m separation) eliminates CNEL requirements entirely at a total cost of \$4,000–\$12,000 per home—less than a third of the current status quo—with the developer bearing most of the cost as a design decision, not the homeowner as a retrofit.

The economic argument is clear: for WUI subdivisions, wider building separations are the most cost-effective wildfire resilience measure available. Every dollar spent on lot width saves multiple dollars in envelope hardening. And the cost falls on the party best positioned to absorb it—the developer, who can distribute it across lot prices—rather than the homeowner, who faces it as a single unexpected expense years after purchase.

## 5. Accessory Building Setbacks

Accessory buildings—sheds, detached garages, carports, workshops—are among the most dangerous structures in a WUI fire. They are typically combustible (wood frame, vinyl siding), contain ignitable contents (fuel, paint, lumber, vehicles), and are exempt from or subject to minimal building code requirements. Under NBC Section 9.10.15.5(4), accessory buildings on the same property are exempt from spatial separation requirements to the principal building.

### THE GAP

A combustible shed can be built within 1 metre of a house with no fire separation requirements. In a wildfire, that shed becomes a 30-minute fuel source radiating heat directly onto the house’s wall. The NBC exemption makes sense for urban interior fires (the shed is on the same property, so fire department response treats it as one incident) but is dangerous for wildfire, where the shed may ignite from embers independently of the house.

### 5.1 Recommended Setbacks for WUI

Accessory Building Type	Current NBC Requirement	Recommended WUI Minimum	Rationale
Combustible shed, workshop, carport (<10 m <sup>2</sup> )	No minimum from principal building	3 m from any building	Prevents direct flame impingement. Reduces radiant heat to manageable level.
Combustible garage, workshop (10–55 m <sup>2</sup> )	No minimum from principal building	5 m from any building	Garages contain vehicles, fuel, chemicals. Higher fire load requires greater separation.
Any accessory building with fuel or chemical storage	No minimum from principal building	6 m from any building	Contents can produce sustained high-intensity fire. Treat as high-hazard exposure.
NC accessory building (concrete block, metal)	No minimum from principal building	1.5 m from principal building	NC construction reduces radiant heat source. Setback for access and ember clearance.

**Accessory buildings on adjacent properties:** Combustible accessory buildings near a shared property line should be assessed for CNEL exposure to the neighbouring principal building, just as the principal building itself would be. A shed at 2 m from the property line, 1 m from the neighbour’s house, creates a CNEL-3 exposure that the neighbour cannot control.

## 6. Subdivision Layout for Wildfire Resilience

Beyond building separation, subdivision layout decisions have significant impact on wildfire outcomes. The following elements should be considered at the planning stage:

### 6.1 Road Width and Access

- Minimum two access/egress routes for any subdivision with more than 30 dwellings. Cul-de-sacs create evacuation bottlenecks and trap fire apparatus.
- Road width minimum 7 m (travelled surface) to allow two-way traffic including fire apparatus during evacuation. Parking should not reduce effective width below 6 m.
- Road surface: Paved or hard-surfaced. Gravel roads produce dust that reduces visibility during evacuation and fire response.
- Turn-arounds: Every cul-de-sac and dead-end must accommodate a fire apparatus turning radius (minimum 12 m inside radius). T-heads or hammerheads are acceptable; three-point turns are not.
- Road gradient: Maximum 12% for roads intended as evacuation routes. Steeper grades impede fire apparatus and create upslope fire acceleration channels.

### 6.2 Lot Orientation

- Minimize lots facing upslope wildland. Fire accelerates upslope. Lots at the top of a slope facing downhill toward wildland receive less radiant heat than lots at the base facing uphill.
- Orient long axis of lots perpendicular to likely fire approach where possible, minimizing the exposed wall area facing the fire.
- Corner lots at the wildland interface have two exposed faces and should be flagged for higher WER treatment or reserved for non-combustible construction.

### 6.3 Perimeter Design

- Perimeter road or firebreak: A road or maintained firebreak between the outermost lots and the wildland interface provides a fuel break, an access route for fire apparatus, and a defensible space buffer. Minimum 10 m width recommended.
- No lots backing directly onto wildland without a minimum 10 m managed buffer. Properties that back directly onto forest with no fuel break are the highest-risk properties in any subdivision.
- Linear parks and utility corridors can serve as firebreaks if maintained with low-fuel landscaping. These should be designed as part of the wildfire mitigation plan, not just amenity features.

### 6.4 Water Supply

- Hydrant spacing: Maximum 150 m between hydrants in WUI subdivisions.
- Minimum flow: 150 L/min at 140 kPa (20 psi) for residential sprinkler supply; consult AHJ for fire flow requirements.
- Dry hydrants or cisterns where municipal water is not available. Minimum 45,000 L per 10 dwellings.

## 7. Development Permit Area (DPA) Template Language

The following language is provided as a starting point for municipalities establishing Wildfire Hazard Development Permit Areas. This text is not legal advice and should be reviewed by municipal legal counsel before adoption. Municipalities in BC may establish DPAs under Section 488(1)(b) of the Local Government Act for protection from hazardous conditions.

### 7.1 Designation and Justification

#### SAMPLE DPA LANGUAGE

The [Municipality Name] designates the areas shown on Schedule [X] as Development Permit Area [Number]—Wildfire Hazard, pursuant to Section 488(1)(b) of the Local Government Act. Justification: The designated area includes lands identified as being within or adjacent to the wildland-urban interface where wildfire hazard poses a risk to life and property. The purpose of this DPA is to establish conditions for the subdivision and development of land to minimize wildfire risk through building separation, construction standards, vegetation management, and site design.

### 7.2 Key Development Permit Conditions

The following conditions are recommended for inclusion in a WUI DPA:

#### Building separation

- Minimum building separation of 6 m between principal buildings on adjacent lots.
- Minimum 3 m setback for combustible accessory buildings from any principal building on the same or adjacent property. NC accessory buildings: 1.5 m minimum.
- Where 6 m separation cannot be achieved, the exposed face(s) of both buildings must comply with CNEL hardening specifications equivalent to the separation distance achieved.

#### Construction standards

- All new construction must meet a minimum WER-1 standard as defined by the FireHard Wildfire Exposure Rating system or equivalent.
- Buildings within 10 m of the wildland interface must meet WER-2 or higher.
- All roofing must be Class A rated per CAN/ULC-S107.
- Non-combustible cladding is required on any wall face within 6 m of an adjacent building.

#### Subdivision design

- Two independent access/egress routes for subdivisions with more than 30 dwellings.
- Minimum 10 m maintained fuel break between outermost lots and wildland interface.
- Road minimum 7 m travelled width; cul-de-sacs with minimum 12 m turning radius.

#### Vegetation management

- Developer must establish FireSmart Priority Zones 1 and 2 (0–30 m from structures) on all lots prior to sale.
- Subdivision-scale fuel management plan required for lands between the development boundary and the wildland interface.
- Registered covenant on title requiring ongoing maintenance of Priority Zone 1.

## 8. Vegetation Management at the Subdivision Scale

FireSmart Canada addresses vegetation management at the property level through Priority Zones 1 (0–10 m), 2 (10–30 m), and 3 (30–100 m) around individual structures. This is essential work, and FireHard fully supports the FireSmart vegetation management framework for homeowners.

What FireSmart does not address—because it is not within its scope—is the subdivision-scale vegetation management responsibility that belongs to the developer and the municipality:

- Fuel breaks between the development and the wildland. Who is responsible for the vegetation between the last lot’s fence and the forest? In most subdivisions, nobody. This is the developer’s responsibility at the planning stage.
- Common-area fuel management. Parks, stormwater corridors, utility easements, and undeveloped lots within the subdivision can carry fire through the development. These require fuel management plans as a condition of development approval.
- Interface treatment before lot sale. The developer should be required to establish FireSmart Priority Zones 1 and 2 on all perimeter lots before the first lot is sold, not leave it to individual homeowners who may never do it.

### 8.1 Recommended Subdivision-Scale Treatments

Zone	Width	Treatment	Responsibility
Development buffer	10–30 m from subdivision boundary	Fuel-reduced zone between last lot and wildland. Canopy thinning, understory removal, no continuous fuel ladder.	Developer at time of subdivision. Municipality maintains.
Perimeter lots Priority Zone 1	0–10 m from building	Per FireSmart: NC ground cover, no combustible vegetation, 1.5 m NC zone around structure.	Developer establishes before lot sale. Homeowner maintains.
Perimeter lots Priority Zone 2	10–30 m from building	Per FireSmart: spaced trees, no continuous understory, fire-resistant plantings.	Developer establishes. Homeowner maintains. Covenant on title.
Common areas	As applicable	Low-fuel landscaping. No coniferous hedging near structures. Maintained irrigated landscaping or NC ground cover.	Strata/HOA or municipality. Defined at subdivision.

#### COMPLEMENTARY TO FIRESMART

This section does not replace FireSmart vegetation management guidance for individual homeowners. It addresses the gap between FireSmart’s property-level scope and the subdivision-scale decisions that must be made before individual properties exist. FireSmart provides the ‘what.’ This bulletin asks ‘who does it and when?’

## 9. Recommendations for Planners

The following actions are recommended for municipalities with WUI development:

### 9.1 Immediate (No Bylaw Change Required)

- Request wildfire risk assessments for all new subdivision applications in or adjacent to WUI areas.
- Flag applications where building separations will be less than 6 m and request the developer to demonstrate how CNEL exposure will be mitigated.
- Include wildfire considerations in pre-application discussions with developers.
- Reference FireHard's WER and CNEL specifications in development permit conditions.

### 9.2 Near-Term (Bylaw Amendment)

- Establish a Wildfire Hazard DPA for all lands within or adjacent to the WUI, using Section 7 of this bulletin as a starting point.
- Amend zoning bylaws to require minimum 6 m building separation (3 m side setback) in WUI zones, exceeding the NBC minimum.
- Require accessory building setbacks in WUI zones: 3 m for combustible, 1.5 m for NC.
- Require developers to submit a subdivision fire resilience plan including building separation analysis, access/egress, and fuel management.

### 9.3 Long-Term (Policy and Culture Change)

- Work with provincial government to include wildfire as a hazard in official community plans.
- Advocate for NBC amendments recognizing wildfire exposure in spatial separation rules.
- Develop municipal capacity for WUI assessment: train planning staff, engage fire services in development review, and establish relationships with building science professionals.
- Consider requiring WER assessments for all new construction in WUI zones, analogous to geotechnical assessments in landslide-prone areas.

#### THE DEVELOPER'S RESPONSIBILITY

Developers who build in the WUI are creating long-term wildfire risk. The subdivision design decisions they make today will determine the fire outcomes for that community for the next 50–100 years. Requiring wider setbacks, fire-resilient design, and vegetation management at the subdivision stage is not an unreasonable burden—it is the same principle that requires geotechnical assessments on unstable slopes, floodplain setbacks near rivers, and seismic design in earthquake zones. Wildfire should be treated with equal seriousness.

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## About FireHard Canada

FireHard Canada is a free, open wildfire construction guidance framework developed by building science professionals in Smithers, British Columbia. We live and work in wildfire country.

The FireHard system provides comprehensive construction design guidance that complements existing programs. The NRC provides the science. FireSmart Canada provides vegetation management and community preparedness guidance. FireHard provides building construction design guidance. These are independent programs addressing different aspects of wildfire resilience.

Our framework includes the Wildfire Exposure Rating (WER) system for overall building assessment, the Close Neighbour Exposure Level (CNEL) system for structure-to-structure exposure, six technical construction guides, design guides for each WER level, and technical bulletins on specific topics.

All FireHard publications are free and available at [firehard.ca](https://firehard.ca).

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