T E C H N I C A L D O C U M E N T

Wildfire Exposure Rating

A Canadian Framework for Residential Wildfire Hardening

WER Methodology | Version 1.0 | February 2026

Prepared by FireHard | firehard.ca | A Wildernest Systems Inc. project

This document describes the FireHard Wildfire Exposure Rating (WER) methodology for assessing residential wildfire vulnerability and specifying construction measures for Canadian WUI conditions. The WER system synthesizes the National Research Council of Canada WUI Guide (2021), Australian Standard AS 3959:2018, California Building Code Chapter 7A, IBHS Wildfire Prepared Home program, and FireSmart Canada guidance into a simplified, action-oriented framework for homeowners, contractors, insurers, and authorities having jurisdiction.

DISCLAIMER: The FireHard system — including the WER rating, technical documents, and design guides — is a voluntary framework based on current best practices from wildfire research in Canada, the United States, and Australia. It is not a building code, regulation, or mandatory standard. It does not replace professional engineering, architectural, construction, insurance, or legal advice. No building is fireproof. Compliance with FireHard specifications does not guarantee survival during a wildfire event.

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1. Purpose and Scope

Canada has no mandatory wildfire construction standard. The National Building Code of Canada does not address wildfire exposure. The British Columbia Building Code (BCBC 2018) does not reference wildfire. FireSmart Canada provides awareness-level guidance but does not specify construction details. The National Research Council (NRC) published a voluntary National Guide for Wildland-Urban Interface Fires in 2021, which defines exposure levels and construction classes, but it has not been adopted into any provincial building code and its recommendations reference test standards rather than prescribing practical construction measures.

The result is a gap between awareness and action. Homeowners in British Columbia's wildfire-prone communities are told their homes are at risk but are not told, with specificity, what to do about it. Contractors lack construction details. Insurers lack a framework for evaluating hardening measures. Authorities having jurisdiction lack a basis for requiring construction upgrades.

The FireHard Wildfire Exposure Rating (WER) system addresses this gap by:

1. Defining four wildfire exposure levels based on the dominant threat mechanism (embers, radiant heat, direct flame, flame zone), using Canadian fuel types, terrain, and climate conditions.

2. Specifying construction measures for each WER level across all building envelope components, with materials, dimensions, and product references.

WER levels are cumulative. Each level includes all measures from the levels below it. WER-2 requires all WER-1 measures plus WER-2 additions. WER-3 requires all WER-1, WER-2, and WER-3 measures. A building rated WER-3 must meet every specification from WER-1, WER-2, and WER-3.

3. Aligning with the NRC Guide's Construction Classes so that when the Guide is eventually adopted into code, WER-rated buildings will meet or exceed requirements.

4. Providing a professional assessment methodology that a P.Eng. can apply to produce site-specific WER ratings with defensible engineering basis.

SCOPE

This methodology applies to residential buildings (Part 9 of NBC) in British Columbia's wildland-urban interface. It may be adapted for other Canadian provinces. It does not address commercial, industrial, or multi-storey (Part 3) buildings, though many principles are transferable.

1.1 Referenced Standards and Sources

The WER methodology draws on the following standards, codes, and research. Where specifications conflict, the more conservative (protective) value is adopted.

Source	Description and Relevance
NRC Guide (2021)	National Guide for Wildland-Urban Interface Fires. National Research Council Canada, 192 pp. Defines hazard levels, exposure levels, construction classes CC1(FR) through CC3, and construction measures.

Source	Description and Relevance
AS 3959:2018 Amd 2	Construction of Buildings in Bushfire-Prone Areas. Standards Australia. Defines BAL levels, 2 mm mesh aperture, bushfire shutter specifications, material requirements by exposure level.
California Ch. 7A	California Building Code Chapter 7A: Materials and Construction Methods for Exterior Wildfire Exposure. Defines WUI construction requirements, ASTM E2886 vent testing, prescriptive material standards.
IBHS (2025)	Insurance Institute for Business & Home Safety. Wildfire Prepared Home program. Base and Plus designations with specific component requirements.
FireSmart Canada	FireSmart Wildfire Resilience Best-Practice Checklist. 3 mm non-combustible metal screening. Priority zone vegetation management framework.
ASTM E2886	Standard Test Method for Evaluating the Ability of Exterior Vents to Resist the Entry of Embers and Direct Flame Impingement.
ASTM E2707	Standard Test Method for Determining Fire Penetration of Exterior Wall Assemblies Using a Direct Flame Impingement Exposure.
NBC / BCBC	National Building Code of Canada 2020 / BC Building Code 2018. Part 9 residential construction. Section 9.19 Roof Spaces (ventilation ratios).
CFFDRS / FBP	Canadian Forest Fire Danger Rating System / Fire Behaviour Prediction System. 16 fuel types used for exposure assessment inputs.

2. Wildfire Exposure Rating (WER) Levels

The WER system defines four levels of wildfire exposure. Each level is named by the dominant threat mechanism that a building at that exposure would face during a wildfire event. Higher numbers indicate higher exposure and require more stringent construction measures.

The key principle: every WER level includes all threats from the levels below it. A WER-3 building faces embers, radiant heat, AND direct flame. The level name reflects the highest-intensity threat the building must resist.

2.1 WER-1: Ember Exposure

Threat: Windborne burning embers (firebrands) capable of travelling kilometres ahead of a fire front. Embers can lodge in vents, gutters, gaps, and combustible materials around the building, causing ignition.

Typical conditions: Building is within a region of moderate to high wildfire hazard (NRC Hazard Level 2–4) but has significant separation from wildland fuels, OR effective vegetation management has been applied within 100 m. The dominant exposure is ember transport, not radiant heat or flame.

NRC Guide equivalent: Construction Class CC3. Exposure Level: Ember-Only or Low.

AS 3959 equivalent: Approximately BAL-12.5 (radiant heat flux up to 12.5 kW/m²).

2.2 WER-2: Radiant Heat Exposure

Threat: Embers PLUS radiant heat from burning vegetation or structures close enough to degrade, ignite, or shatter building components (glazing, cladding, vinyl products) without direct flame contact.

Typical conditions: Building is within 100 m of continuous forest or dense wildland fuels with limited vegetation management. Partial vegetation management (Priority Zones 1A and 1) has been applied but fuels remain in outer zones. Moderate slopes may amplify radiant heat exposure.

NRC Guide equivalent: Construction Class CC2. Exposure Level: Moderate.

AS 3959 equivalent: Approximately BAL-19 to BAL-29 (radiant heat flux 19–29 kW/m²).

2.3 WER-3: Direct Flame Exposure

Threat: Embers PLUS radiant heat PLUS direct flame contact from burning vegetation, adjacent structures, or accumulated fuels. Flame contact can occur from surface fire, crown fire dropping to ground level, or burning structures/fences/decks attached to the building.

Typical conditions: Building is within 30 m of continuous forest or dense fuel with limited vegetation management. Steep uphill slope from fuels toward building (fire travels faster

upslope). Adjacent combustible structures within 10 m. Vegetation management limited to Priority Zone 1A only, or not applied.

NRC Guide equivalent: Construction Class CC1. Exposure Level: High with partial vegetation management.

AS 3959 equivalent: Approximately BAL-29 to BAL-40 (radiant heat flux 29–40 kW/m² plus flame contact potential).

2.4 WER-4: Flame Zone

Threat: Complete flame engulfment. The building is within the expected flame length of surrounding fuels and could be directly engulfed by fire. Extreme radiant heat (>40 kW/m²), sustained flame contact, and massive ember bombardment.

Typical conditions: Building is immediately adjacent to dense wildland fuels with no effective vegetation management. Located on a steep slope with continuous fuel below. No separation from forest canopy. Structure is within the modelled flame length of the design fire for the surrounding fuel type.

NRC Guide equivalent: Construction Class CC1(FR). Exposure Level: High or Moderate with no vegetation management.

AS 3959 equivalent: BAL-FZ (Flame Zone). Radiant heat flux >40 kW/m² with direct flame engulfment.

WER-4: PROFESSIONAL ASSESSMENT REQUIRED

FireHard strongly recommends against residential construction in WER-4 exposure without professional engineering assessment. Where construction proceeds, fire-resistance-rated exterior walls, steel or bronze mesh only (no aluminium), complete non-combustible exterior, and wildfire shutters on all openings are minimum requirements. Vegetation management is critical and may be the most cost-effective intervention.

2.5 Cross-Reference to International Standards

The following table shows how WER levels map to existing international frameworks. These are approximate equivalencies; site-specific conditions may shift a property between adjacent levels.

WER	Primary Threat	NRC Guide CC	AS 3959 BAL	CA Ch. 7A / IWUIC
WER-1	Embers	CC3	BAL-12.5	IWUIC Zone C
WER-2	Embers + Radiant heat	CC2	BAL-19 to BAL-29	IWUIC Zone B
WER-3	Embers + Radiant heat + Flame	CC1	BAL-29 to BAL-40	IWUIC Zone A
WER-4	Flame engulfment	CC1(FR)	BAL-FZ	Not separately classified

3. Assessment Methodology

A WER rating can be determined through two pathways: a simplified self-assessment (for homeowner awareness and prioritization) and a professional assessment (for engineering reports, insurance documentation, and construction specifications).

3.1 Simplified Self-Assessment

The simplified method allows a homeowner or contractor to estimate the WER level based on observable site conditions. It is intentionally conservative—where conditions are ambiguous, the higher WER level should be assumed.

Step 1: Confirm Wildfire Hazard

Determine whether the property is within a wildfire hazard area. In British Columbia, use the BC Wildfire Service interactive map (gov.bc.ca) or local Community Wildfire Protection Plans (CWPPs). If the property is within or adjacent to a community identified as having wildfire risk, proceed to Step 2. If the property is in an urban area with no wildland fuels within 2 km, WER assessment is generally not required.

Step 2: Identify Dominant Fuel Type

Observe the dominant vegetation within 100 m of the building. Canadian Fire Behaviour Prediction (FBP) fuel types can be simplified into four broad categories for self-assessment:

Category	Description	Example FBP Types
Coniferous Forest	Spruce, pine, fir, cedar. Dense canopy. High fire intensity. Significant ember production.	C-1 to C-7 (Spruce, Pine, Douglas Fir, Ponderosa Pine)
Deciduous / Mixed	Deciduous or mixed forests. Aspen, birch, poplar with some conifers. Lower fire intensity than pure coniferous. Moderate ember production.	D-1 (Leafless Aspen), M-1 to M-4 (Mixedwood)
Grass / Shrub	Open grassland, rangeland, low shrub. Fast-moving fire with shorter flame lengths. Lower ember production but rapid spread.	O-1a/b (Grass), S-1 to S-3 (Slash)
Managed / Low Fuel	Irrigated lawns, agricultural fields, managed landscapes with minimal combustible vegetation.	Non-fuel or managed

Step 3: Assess Separation and Slope

Measure or estimate the distance from the building to the nearest edge of continuous wildland fuel (the vegetation categories above). Assess the slope between the fuel and the building. Uphill slopes amplify fire behaviour—fire travels faster upslope and generates more radiant heat.

Step 4: Determine WER Level

Use the following decision matrix. Find the row matching your dominant fuel type and separation distance, then apply the slope modifier.

Fuel Type	>100 m	30–100 m	10–30 m	<10 m
Coniferous Forest	WER-1	WER-2	WER-3	WER-4
Deciduous / Mixed	WER-1	WER-1	WER-2	WER-3
Grass / Shrub	WER-1	WER-1	WER-2	WER-3
Managed / Low Fuel	—	WER-1	WER-1	WER-2

SLOPE CORRECTION TABLE

Slope significantly affects wildfire behaviour. Fire travels faster uphill, flame lengths increase, and the effective vegetation-to-building distance decreases. The slope correction is applied per-face based on the uphill gradient from the dominant fuel source to the building face.

Slope correction (applied to the base WER level for each exposed face):
0-5 degrees (0-9% grade, flat to gentle): No adjustment.
5-10 degrees (9-18% grade, moderate slope): Increase WER by one level.
10-15 degrees (18-27% grade, steep slope): Increase WER by one level; if dense coniferous fuel within 30 metres, increase by two levels.
15-20 degrees (27-36% grade, very steep): Increase WER by two levels.
Greater than 20 degrees (>36% grade): Default to WER-4 and seek professional assessment.

The slope correction cannot reduce a WER level, only increase it. WER-4 is the maximum. A building on a ridge or slope may have different effective WER levels on its uphill and downhill faces. Assess each face independently.

Estimated radiant heat flux by WER level (aligned with AS 3959 BAL methodology):
WER-1: Less than 10 kW/m² (primarily ember attack, limited radiant heat)
WER-2: 10-19 kW/m² (significant ember attack plus moderate radiant heat)
WER-3: 19-40 kW/m² (severe radiant heat, potential flame contact at close range)
WER-4: Greater than 40 kW/m² (extreme radiant heat, direct flame engulfment)

Example: Coniferous forest at 50 metres on flat ground is WER-2. On a 12-degree upslope, the increased flame length and reduced effective separation increase the exposure to WER-3. The same forest at 25 metres on a 15-degree slope defaults to WER-4.

VEGETATION MANAGEMENT CREDIT

Effective vegetation management per FireSmart Priority Zones can reduce the effective WER level. If Priority Zones 1A through 2 (0–30 m) have been treated according to FireSmart or NRC Guide recommendations AND are maintained annually, the WER level may be reduced by one step. This credit cannot reduce below WER-1 and should be confirmed by professional assessment for insurance or regulatory purposes.

3.2 Professional Assessment

A professional WER assessment is a site-specific evaluation conducted by a qualified professional (P.Eng.) producing a stamped report. Where projects require site-specific landscape design beyond FireSmart's general vegetation management guidance, landscape

architecture services are available through FireHard's partnership with Lazzarin Svisdahl Landscape Architects. **This is the deliverable for FireHard's paid assessment service, provided through Bulkley Valley Engineering Services Ltd.**

The professional assessment expands the simplified method by incorporating:

1. Detailed vegetation survey using CFFDRS FBP fuel type classification within 100 m (Priority Zones 1A through 3) and up to 2,000 m (Exposure Zones 4 and 5).

2. Slope measurement (clinometer or survey data) for all fuel-bearing aspects relative to the building.

3. NRC Guide Detailed Method for exposure level determination, incorporating hazard level from Canadian Forest Service wildfire hazard mapping, fuel percent cover, and topographic adjustment factors.

4. Building envelope inspection: roof type and condition, wall cladding material and condition, vent types and mesh apertures (measured with circular probe per AS 3959 Clause 3.6), glazing type, door construction, subfloor condition, deck attachment details, eave construction.

5. Gap and penetration survey: all openings >3 mm in the building envelope identified and catalogued.

6. Adjacent structure assessment: combustible structures, fences, decks, or stored materials within 10 m of the building that could act as fire bridges.

7. Photographic documentation of all assessed elements.

8. Assignment of WER level with written rationale referencing specific site conditions and NRC Guide methodology.

9. Prioritized remediation plan: construction measures ranked by impact, estimated cost, and recommended sequence of implementation.

Assessment Report Deliverables

A professional WER assessment report includes: (a) site plan showing building footprint, vegetation, slopes, and priority zones; (b) WER level assignment with basis; (c) building envelope deficiency table with photo reference; (d) prioritized remediation plan with specifications referencing FireHard construction detail guides; (e) estimated cost ranges for remediation measures; (f) P.Eng. seal and signature (Bulkley Valley Engineering Services Ltd., EGBC Permit No. 1001683). Optional add-on: site-specific defensible-space landscape design, fire-resistant planting plan, and hardscape recommendations (Lazzarin Svisdahl Landscape Architects).

4. Construction Measures by WER Level

This section specifies recommended construction measures for each WER level, organized by building component. These specifications draw on the most protective requirements from the referenced standards. All measures are cumulative—WER-2 includes all WER-1 measures plus additional requirements.

Component	WER-1 (Ember)	WER-2 (Radiant)	WER-3 (Flame)	WER-4 (Flame Zone)
Roof Covering	Class A fire-rated (metal, concrete tile, clay tile, asphalt with Class A rating). No combustible roof coverings.	As WER-1. Full sarking (non-combustible membrane) under tile roofs.	As WER-2. Non-combustible covering only (metal or concrete tile). No asphalt shingles.	As WER-3. Non-combustible roof covering tested to AS 1530.8.1 or equivalent.
Roof Gaps & Penetrations	All gaps >3 mm sealed with non-combustible material. Vent pipes, solar mounts, aerials sealed at roof line.	As WER-1. Sheet roof corrugation gaps sealed with 2 mm mesh or mineral wool at fascia/wall line.	As WER-2. All roof penetration frames non-combustible. PVC vent pipes replaced with metal.	As WER-3. Roof penetration frames of corrosion-resistant steel or bronze only.
Gutters	Non-combustible gutters (metal). Gutter guards or regular debris removal program.	As WER-1. Enclosed gutter guards (non-combustible mesh, ≤2 mm aperture).	As WER-2.	As WER-3. Non-combustible gutter guards mandatory.
Eaves & Soffits	Enclosed soffits (no open eaves). Soffit material non-combustible or fibre cement ≥6 mm. Ventilation openings screened with 2 mm corrosion-resistant mesh.	As WER-1. Soffit vents fitted with ember guards per AS 3959 Clause 3.6.	As WER-2. Soffit material non-combustible only (no fibre cement). Consider unvented attic assembly.	Non-combustible soffits. Unvented attic preferred. If vented, ASTM E2886-listed soffit vents only.
Gable & Roof Vents	All gable/roof vents screened with 2 mm corrosion-resistant mesh (stainless steel, bronze, aluminium).	As WER-1. Replace existing vents with ember-resistant products (baffled or intumescent). ASTM E2886-listed vents recommended.	ASTM E2886-listed vents required. Non-combustible frames. Consider eliminating gable vents (relocate to ridge).	ASTM E2886-listed vents required. Steel or bronze mesh only (no aluminium). Strongly consider unvented attic assembly.
Foundation / Crawlspace Vents	All foundation vents screened with 2 mm corrosion-resistant mesh. Clear combustible	As WER-1.	As WER-1. Enclose subfloor with non-combustible material, 2 mm mesh, or combination per AS	Subfloor fully enclosed with wall meeting WER-4 wall requirements. Non-combustible supports.

Component	WER-1 (Ember)	WER-2 (Radiant)	WER-3 (Flame)	WER-4 (Flame Zone)
	storage from subfloor.		3959 Clause 7.2.	
External Walls (<400 mm from ground)	Non-combustible or fibre cement ≥6 mm, or bushfire-resisting timber.	Non-combustible or fibre cement ≥6 mm. No vinyl, no untreated timber.	Non-combustible cladding. Tested per ASTM E2707 recommended. Steel sheeting acceptable.	Fire-resistance rated wall assembly (≥45 min with vegetation management in Zone 1A; ≥1 hr without). Non-combustible cladding.
External Walls (above 400 mm)	Ignition-resistant cladding recommended (fibre cement, stucco, brick, stone, metal).	Ignition-resistant cladding required. No vinyl siding on exposed elevations.	Non-combustible or ignition-resistant cladding tested per ASTM E2707.	Fire-resistance-rated wall assembly as above. Non-combustible cladding throughout.
Windows	Tempered glass or insulated glazing units (IGUs) recommended. Screen openable portions with 2 mm mesh.	Tempered or laminated safety glass on exposed elevations. Screen openable portions with 2 mm corrosion-resistant mesh.	Tempered or laminated safety glass all elevations. Wildfire shutters on exposed elevations. 2 mm mesh on all openable portions.	All windows protected by wildfire shutters per AS 3959 Clause 3.7 OR screened externally with 2 mm steel/bronze mesh. Non-combustible frames.
Doors	Solid core exterior doors. Weatherstripping and draught excluders. Gaps ≤3 mm at jambs, head, sill.	As WER-1. Glazed portions tempered or laminated. Screen glazed door panels with 2 mm mesh.	Non-combustible or fire-rated door assemblies on exposed elevations. Wildfire shutters recommended. Gaps ≤3 mm.	Fire-rated door assemblies all elevations. Wildfire shutters or external 2 mm steel/bronze screens. Vehicle access doors: no ventilation slots.
Garage Doors	Weatherstripping at all edges. Gaps ≤3 mm. Non-combustible or solid core.	As WER-1. Draught seals and weatherstripping. Screen any ventilation openings with 2 mm mesh.	Non-combustible garage door. Weatherstrips, draught excluders or brushes per AS 3959 Amd 2 Clause 7.5.6. Ventilation slots screened per Clause 3.6.	Non-combustible garage door. No ventilation slots. Weatherstripping with flammability index ≤5.
Decks & Attachments	Non-combustible or ignition-resistant decking within 1.5 m of building. Clear combustible storage below deck.	Non-combustible or ignition-resistant decking. Underside enclosed or screened with 2 mm mesh within 10 m of building.	Non-combustible decking and framing within 3 m of building. Enclose underside. Non-combustible supports.	Non-combustible throughout. Deck enclosed with non-combustible wall or 2 mm steel/bronze mesh.
Fencing within 1.5	Non-combustible	Non-combustible	Non-combustible	Non-combustible

Component	WER-1 (Ember)	WER-2 (Radiant)	WER-3 (Flame)	WER-4 (Flame Zone)
m	fence or non-combustible connection between fence and building.	fence within 1.5 m of building. Combustible fencing detached from building with non-combustible break.	fencing within 6 m of building.	fencing within 10 m of building.
Service Penetrations	All gaps around pipes, conduits, cables, and services sealed to ≤2 mm with non-combustible sealant (intumescent fire caulk recommended).	As WER-1.	As WER-1. Non-combustible pipe materials within wall cavity (no PVC within 400 mm of exterior face).	As WER-3.
Wildfire Shutters	Optional. Recommended for high-value glazing on exposed elevations.	Recommended on exposed elevations (those facing wildland fuels within 100 m).	Required on all exposed elevations. Per AS 3959 Clause 3.7: fixed, non-removable, ≤3 mm gap, manually operable, 2 mm perforations max, ≤20% perforated area.	Required on all elevations. Steel or bronze construction. Per AS 3959 Clause 3.7. At least one operable from inside for egress.

USING THIS TABLE

For retrofit projects, begin with the highest-impact items for your WER level: vents, roof gaps, and eaves are typically the highest priority because ember entry through these pathways causes the majority of structure losses. For new construction, all measures for the applicable WER level should be specified from the outset. FireHard's free construction detail guides provide step-by-step installation guidance, product references, and CAD-ready details for each component.

5. British Columbia Considerations

5.1 Regulatory Landscape

As of February 2026, no BC regulation requires wildfire-resistant construction for residential buildings. The BCBC 2018 (based on NBC 2015 with BC amendments) does not address wildfire exposure. The BC Wildfire Act addresses land management and fire suppression but not building construction. Individual local governments may adopt wildfire-related development permit area (DPA) guidelines under the Local Government Act, but these vary widely and typically address vegetation management rather than construction specifications.

The NRC Guide (2021) is the most comprehensive Canadian reference and is expected to form the basis of a future national WUI code. The NRC is actively developing location-specific wildfire exposure data for NBC reference locations, funded by Infrastructure Canada's Climate Resilient Built Environment initiative. When this code is published, WER-rated buildings built to this methodology will meet or exceed its requirements.

5.2 Climate and Fuel Considerations

British Columbia's interior presents wildfire conditions comparable to the most fire-prone areas globally. Key factors for WER assessment in BC:

Coniferous dominance: BC's interior forests are predominantly spruce, pine, and Douglas fir (FBP fuel types C-2, C-3, C-4, C-7). These produce extreme fire behaviour with high crown fire potential, long flame lengths, and massive ember production. The Mountain Pine Beetle epidemic (2000s) created vast stands of dead timber that remain as elevated fuel loads.

Terrain: BC's mountainous terrain amplifies fire behaviour through slope effects. Homes built on hillsides above fuel-bearing valleys are particularly exposed. The slope modifier in the WER simplified assessment (Section 3.1, Step 4) is critical in BC.

Moisture and snow: BC's climate produces high moisture loads and significant snow accumulation. Unvented attic assemblies (recommended at WER-3 and WER-4) must be carefully designed to manage moisture. Consult Building Science Corporation BSI-129 for guidance on unvented roof assemblies in cold climates.

Coniferous debris: Pine and spruce needles accumulate rapidly on roofs, in gutters, and around foundations. Maintenance frequency is higher in BC than in deciduous-dominant regions. The WER maintenance protocol (Section 6) accounts for this.

5.3 Insurance Implications

Canadian insurers are increasingly considering wildfire exposure in residential underwriting. A professional WER assessment report provides documentation that insurers can use to evaluate risk reduction. Key recommendations: (a) document all hardening measures with dated photographs; (b) retain receipts for wildfire-resistant materials and products; (c) request that your insurer acknowledge wildfire hardening measures in your policy file; (d) a P.Eng.-stamped WER assessment and post-remediation review letter provide the highest level of documentation.

5.4 BCBC 2018 Ventilation Requirements

WER measures must not compromise code-required attic ventilation. BCBC 2018 Section 9.19 requires: unobstructed vent area of 1/300 of insulated ceiling area (1/150 for roof slopes less than 1 in 6); minimum 63 mm airspace between insulation top and roof sheathing underside; baffles at eave edge extending at least 50 mm above insulation. Ember-resistant vent products must provide adequate net free vent area (NFVA) to meet these ratios. Verify NFVA ratings when specifying ember-resistant vents, as baffled and intumescent designs may have reduced NFVA compared to conventional vents.

6. Maintenance Protocol

Wildfire hardening is not a one-time project. The building envelope degrades, vegetation regrows, and debris accumulates. A building that meets WER-2 specifications at construction can effectively become WER-1 or worse without maintenance. The following seasonal inspection protocol applies to all WER levels.

6.1 Annual Inspection (Spring, Before Fire Season)

Vents and mesh: Inspect all vent screens for damage, corrosion, or clogging. Clean debris from mesh surfaces. Replace any mesh with apertures exceeding 2 mm or showing corrosion damage. Verify intumescent coatings (Vulcan Vents, BrandGuard) are intact and not prematurely activated.

Roof and gutters: Clear all accumulated needles, leaves, and debris from roof surfaces, valleys, gutters, and downspouts. Inspect gutter guards for damage. Verify roof penetration seals are intact.

Gaps and seals: Inspect all caulking and sealant around service penetrations, at roof/wall junctions, and at eave lines. Re-seal any gaps exceeding 3 mm. Use intumescent fire caulk (EverKem 814+ or equivalent) for all wildfire-exposed seals.

Shutters: Operate all wildfire shutters through a full open/close cycle. Verify manual crank mechanism is functional. Check for gaps >3 mm between shutter and wall/sill/head when closed. Lubricate guide tracks.

Vegetation: Verify defensible space per FireSmart Priority Zones. Remove new growth within 1.5 m of building. Prune branches overhanging roof. Clear accumulated fuel (firewood, lumber, stored combustibles) from within 10 m of building.

6.2 Post-Event Inspection

After any wildfire event within 30 km of the property (even if the building was not directly threatened), inspect all ember-resistant components for heat damage, activated intumescent coatings, or ember accumulation in protected areas. Document any damage with photographs for insurance records.

7. Neighbouring Structure Exposure

7.1 The Problem

Most Canadian subdivision homes are built 1.5 to 6 metres apart. At these distances, a fully involved neighbouring structure produces radiant heat fluxes of 20 to 80 kW/m² on the exposed face of adjacent buildings. This exceeds the piloted ignition threshold for most combustible cladding materials (approximately 12.5 kW/m² for wood products). The duration of exposure from a structural fire (30 to 90 minutes) far exceeds the brief pulse of a passing wildland fire front (typically 5 to 15 minutes).

Structure-to-structure fire spread is a leading cause of loss in wildland-urban interface events. NIST investigations of the 2018 Camp Fire, 2020 Marshall Fire, and 2021 Lytton fire all document cases where structure-to-structure ignition was the primary loss mechanism in dense neighbourhoods. In Lytton, the majority of structures were lost to fire spread between buildings, not direct wildland fire contact.

The WUI fire problem is fundamentally a community problem. A home's wildfire survival depends as much on its neighbours' condition as on its own construction. This reality requires a framework that addresses the close neighbour exposure as a distinct hazard, separate from but related to wildland fire exposure.

7.2 Research Basis

The Close Neighbour Exposure Level (CNEL) system is based on the following research:

NIST Technical Note 1600 (Maranghides & Mell, 2009): Investigation of the 2007 Witch/Guejito fires in San Diego County. Documented structure-to-structure ignition as a primary spread mechanism in WUI communities. Found that homes ignited neighbouring homes through radiant heat at separations under 6 metres and through brand transport (burning debris carried by wind and convection) at greater distances.

NIST Technical Note 1796 (Maranghides et al., 2013): Investigation of the 2011 Amarillo, Texas fires. Documented structure-to-structure ignition at separations as small as 1.5 metres, with radiant heat flux exceeding 40 kW/m² at the receiving wall surface when a neighbouring structure was fully involved. Identified that brand transport from burning structures was responsible for ignitions at distances exceeding 30 metres.

NIST Technical Note 2205 (Maranghides et al., 2021): Post-fire investigation of the 2018 Camp Fire in Paradise, California. The deadliest and most destructive WUI fire in California history (85 fatalities, 18,804 structures). Found that structure-to-structure fire spread was the dominant loss mechanism in the town. Defensive actions by fire services were overwhelmed by the sheer number of simultaneous structure fires. The rate of structure-to-structure spread exceeded suppression capacity within minutes.

IBHS Research on Community-Scale Fire Spread (2019–2024): Institute for Business and Home Safety research consistently shows that in WUI fires, most homes that burn are ignited by other structures or by embers, not by direct flame contact from wildland fuel. IBHS coined the term "the neighbourhood effect" to describe how the condition of surrounding structures is the dominant factor in individual building survival. A hardened home in an unhardened neighbourhood has significantly lower survival probability than the same home in a hardened neighbourhood.

Australian Standard AS 3959 Clause 3.5: The Australian standard explicitly addresses radiant heat from neighbouring structures. At 3 metres separation from a fully involved structure, incident radiant heat flux can reach 40–80 kW/m² depending on the fire size and receiving wall angle. This maps to BAL-40 or BAL-FZ in AS 3959 terms. The standard requires that where a neighbouring structure is

within the assessment distance, its potential contribution to radiant heat exposure must be included in the BAL calculation.

NRC National Guide for Wildland-Urban Interface Fires (2021): Recognises that structure-to-structure fire spread is a significant component of WUI fire loss in Canada. Construction Class CC-1 (highest) includes requirements for fire-rated wall assemblies on exposing faces, consistent with the CNEL-3 approach described below.

Lytton, BC Post-Fire Analysis (2021): The Village of Lytton was destroyed by wildfire on June 30, 2021. Post-fire analysis by the BC Wildfire Service and NRC confirmed that the majority of structure losses in the village core were caused by structure-to-structure fire spread rather than direct wildland fire contact. Building separation distances in the village were typically 3–6 metres. The fire entered the community edge and then propagated through the built environment via a cascade of structure ignitions.

7.3 Why a Separate Framework Is Needed

The original FireHard approach tied the CNEL system to the property's wildland WER level. This created a practical problem: a home in a dense subdivision with no significant wildland exposure receives a low wildland WER rating (WER-1 or none) but may face substantial close neighbour risk. Conversely, applying full WER-4 specifications to close neighbour faces over-builds on some elements (such as ember screening on non-facing sides) while potentially under-addressing others (such as the specific radiant heat flux from a burning structure at known separation distances).

The exposure profile from a neighbouring structure is fundamentally different from wildland fire exposure. It is directional (concentrated on the facing elevation), predictable in intensity (based on separation distance and fuel load), longer in duration than a wildland fire front (30–90 minutes versus 5–15 minutes), and produces burning brands (larger debris) rather than the fine ember shower of a wildland fire. These differences justify a separate assessment framework that addresses the specific hazard with proportional measures.

The National Building Code of Canada addresses fire spread between buildings through limiting distance and fire-resistance rating requirements based on the percentage of unprotected openings in an exposing building face. However, these provisions assume the exposing building is intact, the fire is contained by a rated assembly, and fire services will respond. In a WUI event, the exposing building may be fully involved with no suppression available, producing sustained radiant heat fluxes that far exceed the design basis of the spatial separation tables. Building code spatial separation requirements also apply only at the time of building permit and do not account for combustible fences, decks, stored materials, or vegetation that accumulate between buildings over time.

7.4 Close Neighbour Exposure Level (CNEL) System

The CNEL system provides a separation-distance-based framework for hardening building faces exposed to neighbouring structures. CNEL is determined by two factors: the separation distance between the subject building face and the neighbouring structure, and the condition (WER level) of the neighbouring structure. A neighbour that is itself hardened presents a lower risk because it is less likely to become fully involved.

7.4.1 CNEL-1: Moderate Exposure

Applies when: separation distance is 6–10 metres, OR separation distance is 3–10 metres and the neighbouring structure is rated WER-2 or higher.

Radiant heat basis: At 6–10 metres from a fully involved single-storey wood-frame structure, incident radiant heat flux is approximately 8–15 kW/m² (at or below the piloted ignition threshold for most

combustible cladding). The primary risk at this distance is brand transport and ember exposure from the burning structure, not sustained radiant heat ignition.

Specifications: Class A roof covering. Non-combustible cladding on the facing wall to 400mm minimum above grade. Tempered glazing on facing windows. Enclosed non-combustible soffits on the facing eave. Non-combustible or fire-rated fencing between structures. Combustible materials cleared from the separation zone. Non-combustible ground cover in the separation zone within 1.5 metres of either structure. Non-facing sides remain at the property's wildland WER level.

7.4.2 CNEL-2: High Exposure

Applies when: separation distance is 3–6 metres AND the neighbouring structure is rated WER-1 or unrated.

Radiant heat basis: At 3–6 metres from a fully involved structure, incident radiant heat flux is approximately 15–40 kW/m² (NIST TN 1796, AS 3959 Clause 3.5). This exceeds the piloted ignition threshold and approaches the spontaneous ignition threshold for wood products (~25 kW/m²). At these distances, the facing wall must resist sustained radiant heat exposure for 30–60 minutes without igniting or losing structural integrity.

Specifications: All CNEL-1 measures, plus: full non-combustible cladding on the facing elevation (fibre cement, metal panel, stucco, or masonry). Type X glass-mat faced gypsum sheathing (15.9mm) behind cladding on the facing wall. Tempered or fire-rated glazing on all facing windows. Enclosed non-combustible soffits with ASTM E2886 ember-resistant vents on the facing side. Non-combustible fencing or barrier between properties. Non-combustible ground cover in the full separation zone. Non-combustible attachments (decks, pergolas) on the facing elevation.

This is the workhorse level of the CNEL system. It addresses the most common Canadian suburban condition: homes on standard residential lots with 3–5 metre side-yard setbacks, where the neighbouring home's condition is unknown or unhardened. The cost of CNEL-2 measures on a single elevation is typically $5,000–15,000 for retrofit and $2,000–8,000 incremental in new construction.

7.4.3 CNEL-3: Severe Exposure

Applies when: separation distance is less than 3 metres, OR the neighbouring structure is a known high-risk condition (derelict, combustible storage, combustible accessory structure within 1.5 metres of the subject building).

Radiant heat basis: At less than 3 metres from a fully involved structure, incident radiant heat flux exceeds 40 kW/m² and can reach 80 kW/m² or more (NIST TN 1796, AS 3959). This exceeds the spontaneous ignition threshold for all combustible materials. The facing wall must function as a fire-rated assembly capable of resisting sustained high-intensity exposure for up to 90 minutes.

Specifications: All CNEL-2 measures, plus: fire-rated wall assembly on the facing elevation (non-combustible cladding + Type X gypsum sheathing + mineral wool cavity insulation). Fire-rated or no glazing on the facing wall (minimise window area on the exposed face; where windows are required, specify fire-rated assemblies). Wildfire shutters on all facing windows. Non-combustible soffit with no vents on the facing eave (sealed; compensating ventilation provided on non-facing sides or by unvented roof assembly). Radiant heat barrier between properties (masonry wall, concrete block fence, or non-combustible panel fence with fire-rated core).

CNEL-3 is a significant intervention but is still less than full WER-4 specification because it is single-elevation focused. Non-facing elevations remain at the property's wildland WER level. The cost of CNEL-3 measures on a single elevation is typically $15,000–35,000 for retrofit and $5,000–15,000 incremental in new construction.

7.5 CNEL Decision Tree

The following decision process determines the CNEL level for each building face:

Step 1: Measure the separation distance from each building face to the nearest neighbouring structure or property line (for new construction, assume worst-case: a fully involved wood-frame structure at the minimum setback permitted by zoning).

Step 2: For each face within 10 metres of a neighbouring structure, determine the neighbour's WER condition. If unknown, assume unrated (worst case).

Step 3: Apply CNEL levels: separation greater than 10 metres: no CNEL measures required (wildland WER level governs). Separation 6–10 metres, OR 3–10 metres with neighbour WER-2+: CNEL-1. Separation 3–6 metres with neighbour WER-1 or unrated: CNEL-2. Separation less than 3 metres, OR neighbour is known high-risk: CNEL-3.

Step 4: Compare the CNEL specification with the property's wildland WER level for that face. Apply whichever is more stringent on each element.

Step 5: For properties with multiple close neighbours (e.g., both side yards), assess each face independently. A property may have different CNEL levels on different faces.

7.6 Relationship Between CNEL and WER

CNEL and WER are complementary systems. A property in a WUI area may have both a wildland WER level (based on vegetation exposure, slope, and separation from wildland fuels) and one or more CNEL levels (based on proximity to neighbouring structures). The two systems are applied independently, and the more stringent specification governs for each building element on each face.

Example: A home rated WER-2 for wildland exposure with a 4-metre separation to an unrated neighbour on the east side. The east face requires CNEL-2 measures (which are more stringent than WER-2 on cladding and sheathing). The north, south, and west faces require WER-2 measures only (no close neighbour exposure). The roof requires the higher of WER-2 or CNEL-2 specifications (in this case, equivalent: Class A roof, ASTM E2886 vents).

For properties with no wildland exposure but close neighbour risk (e.g., a dense urban infill lot), the CNEL system provides standalone guidance. No wildland WER assessment is required; the CNEL level alone governs the specifications for the affected faces.

7.7 New Construction: Property-Line Assessment

For new construction, the CNEL assessment is based on the property line rather than an existing neighbouring building. The neighbouring lot may be undeveloped at the time of construction but could be developed at any time during the 50-year design life of the building. The assessment assumes worst-case: a fully involved wood-frame residential structure at the minimum setback permitted by the applicable zoning bylaw. If the resulting separation distance triggers CNEL-1, CNEL-2, or CNEL-3, the new building is designed accordingly.

This approach ensures the building is hardened for the realistic exposure it will face over its design life, not just the conditions at the time of construction. It is consistent with the building code's approach to limiting distance, which similarly assumes a worst-case fire in the exposing building regardless of whether that building currently exists.

7.8 Community-Level Effectiveness

The CNEL system operates on the principle that every home that hardens makes every neighbouring home safer. In a subdivision where all homes are hardened to CNEL-2 or above on their close-neighbour faces, the probability of structure-to-structure fire spread drops dramatically

because there is no fully involved neighbouring structure to generate the sustained radiant heat that drives the ignition cascade.

This creates a positive feedback loop. As more homes in a neighbourhood are hardened, the CNEL levels for remaining unhardened homes effectively decrease (because their neighbours are now WER-2+, which shifts CNEL-2 to CNEL-1 for the same separation distance). Community-level adoption produces multiplicative rather than additive risk reduction.

This is why FireHard Canada publishes all resources free. The goal is community-level adoption. A single hardened home in a row of unhardened homes gains limited benefit. A row of hardened homes creates a firebreak.

Verification Pathways

The WER system recognizes three pathways to meet each specification. This mirrors how building codes work — a prescriptive path for straightforward compliance, and alternative solution paths for flexibility.

Deemed-to-Satisfy

Materials and assemblies explicitly named in the FireHard specification. If the design guide lists it, it meets the standard. Example: fibre cement panel, metal cladding, stucco, or masonry all satisfy “noncombustible cladding (or engineered equivalent)” without further testing.

Tested Equivalent

Products tested to the referenced standard by a recognized testing laboratory. The manufacturer’s test report is the evidence of compliance. Example: an ember-resistant vent not listed in this guide but tested to ASTM E2886 by an accredited lab meets the WER-2 vent specification.

Engineered Alternative

A P.Eng. assessment demonstrating equivalent performance through analysis. The engineer’s sealed report is the evidence. Example: a heavy-timber fence post (140×140mm minimum) may satisfy the WER-2 fencing specification through charring rate analysis, even though it is not noncombustible.

Fire-Rated Timber

Where a specification says “NC or fire-rated,” fire-rated timber is an acceptable alternative when it meets minimum section dimensions. Large-section timber chars at a predictable rate (approximately 0.65mm/min for softwood per Eurocode 5) and can maintain structural integrity for defined periods. For fencing, outbuilding framing, and deck substructure, timber sized to resist ignition for the design fire exposure period is acceptable at WER-1 through WER-3. Minimum section dimensions are specified in the relevant design guides. At WER-4, all exterior materials must be noncombustible — no timber alternatives.

Close Neighbour Exposure Level (CNEL)

Most Canadian subdivision homes are built 1.5–6 metres apart. If any face of your home is within 10 metres of a neighbouring structure, the CNEL system applies to that face. Measures scale with WER level. See the CNEL section in each FireHard design guide and Construction Detail Guide 6 for full technical details.

Disclaimer

This document is published by FireHard Canada for general educational and informational purposes. It provides technical guidance on wildfire-resistant construction practices based on current Canadian building science, standards, and research.

Not professional advice: This document does not constitute professional engineering, architectural, or construction advice. It is not a substitute for the services of a licensed engineer, architect, or other qualified professional.

No building is fireproof: Compliance with the recommendations in this document does not guarantee that a property will survive a wildfire event. Wildfire outcomes depend on fire intensity, duration, wind conditions, ember density, suppression response, terrain, vegetation, neighbouring property conditions, and other factors beyond building construction.

Building code responsibility: Building codes vary by province, territory, and municipality. This document does not warrant that any specification satisfies the requirements of any specific jurisdiction.

Site-specific conditions: The specifications in this document are general in nature. A qualified professional familiar with local conditions should assess applicability to a specific property.

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About FireHard Canada

FireHard Canada (firehard.ca) is a trade name of Wildernest Systems Inc. The Wildfire Exposure Rating (WER) system was developed by engineers at Wildernest Systems Inc. and Bulkley Valley Engineering Services Ltd., with landscape architecture expertise from Lazzarin Svisdahl Landscape Architects.

FireHard Canada publishes free wildfire hardening resources for Canadian homes. Six Construction Detail Guides, FireHard Self-Assessment Guides, four FireHard Design Guides, a New Construction Design Guide, and the FireHard Technical Reference are all available free at firehard.ca.

We are building FireHard Canada non-profit organization for stakeholder engagement, peer review, and ongoing refinement of the WER system. We are actively seeking engineers, architects, building scientists, insurers, building officials, researchers, and community advocates to participate.

Get involved: firehard.ca/partners

Contact: info@firehard.ca | Web: firehard.ca