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CONSTRUCTION DETAIL GUIDE 2

Roof & Eaves

Metal Roofing, Sarking, Soffit, Gutter & Eave Details for WUI Construction

Adapted from AS 3959:2018, California Building Code Ch. 7A, NRC Guide, FireSmart Canada, and IBHS standards.

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1. Why Roof & Eaves Are Critical

The roof is the single largest surface exposed to ember attack during a wildfire. Wildfire researchers consistently identify the roof as the most vulnerable component of a building in a WUI fire event. During the 2018 Camp Fire in Paradise, California, post-fire surveys found that homes with Class A fire-rated roofs were more than three times more likely to survive than those with combustible roof coverings. In the 2003 Okanagan Mountain Park Fire in Kelowna, BC, structures with untreated cedar shake roofs were among the first to ignite.

Roof ignition during a WUI fire occurs through three mechanisms, often working in combination:

Ember accumulation on the roof surface

Wind-driven embers land on the roof, accumulate in valleys, ridges, and at roof-to-wall intersections, and ignite any debris or combustible material present. IBHS research at their South Carolina test facility has demonstrated that even Class A fire-rated roof coverings can be compromised when embers ignite debris that has accumulated on the roof surface. The roof covering resists direct ignition — but the debris on top of it does not.

Ember entry through gaps in the roof assembly

Gaps under corrugated or profiled roof coverings at ridges, hips, and eaves allow embers to bypass the fire-rated surface and reach the combustible sheathing or framing beneath. Flat and barrel-shaped tiles, metal panels, and cement roof coverings all have profiles that create gaps between the covering and the sheathing. These gaps also attract birds and rodents, whose nesting materials are readily ignited by embers. AS 3959 addresses this directly: gaps greater than 3mm under corrugations or ribs must be sealed at the fascia or wall line and at valleys, hips, and ridges.

Gutter ignition and flame impingement at the roof edge

Gutters filled with dry leaves, pine needles, and vegetative debris are one of the most common ignition points during a WUI fire. IBHS testing found that embers readily ignite debris in gutters, and the resulting flames impinge directly on the roof edge — a potentially vulnerable area even for a Class A roof. The material of the gutter itself matters less than the debris inside it. A metal gutter stays in place while its debris burns, directing flames at the fascia and roof edge. A vinyl gutter melts, detaches, and falls to the ground with its burning contents — which then exposes the siding below. Both outcomes are damaging; neither is acceptable.

THE ROOF IS THE STARTING POINT

IBHS identifies the roof as one of three critical components in their Wildfire Prepared Home system (alongside vents and Zone 0 defensible space). “If you have a combustible wood shake roof, replacing it with a Class A roof is the most important change you can make.” Ensuring that you have a Class A rated roof is the single most important structural measure for wildfire resilience.

Eaves: the transition zone

Eaves are the transition between the roof and the wall — and they represent one of the most complex junctions in the building envelope from a fire protection perspective. Open eaves expose rafter tails and the underside of roof sheathing to direct flame contact and radiant heat from below. Enclosed (soffited) eaves are better, but gaps between the fascia and roof sheathing create pathways for ember entry into the attic. IBHS testing found that most ember entry in soffited-eave construction occurred through the gap between the fascia and roof sheathing, and that installing a metal drip edge at the roof edge significantly reduced this entry.

Eaves also concentrate risk because they are where soffit vents are typically located — and soffit vents are a primary ember entry pathway (see Module 3: Vents & Penetrations for detailed vent specifications). The eave is where the gutter meets the fascia, where the roof meets the wall, where ventilation openings are located, and where debris naturally accumulates. Getting the eave detail right is critical.

CANADIAN CONTEXT: CEDAR SHAKE ROOFS

Cedar shake and shingle roofs remain common in rural BC, particularly on homes built before 2000. An untreated wood shake roof is the single greatest structural vulnerability a home can have in a WUI fire. Unlike treated wood products, untreated cedar shakes have no fire-retardant treatment and can be readily ignited by a single ember. Multiple jurisdictions in California, Colorado, and Oregon have banned wood shake roofs entirely in WUI zones. No such ban currently exists in BC, but replacement with a Class A roof covering is the most impactful single upgrade any homeowner in a WUI area can make. If your home has a cedar shake roof, this is the first thing to address — before windows, before vents, before shutters.

2. Specifications by WER Level

The following specifications are graded by FireHard Canada Wildfire Exposure Rating (WER) level. Each level builds on the previous — WER-2 includes all WER-1 requirements plus additional measures. For a full explanation of the WER system, see the FireHard Canada WER Technical Document (free download at firehard.ca).

2.1 Roof Coverings

Component	WER-1	WER-2	WER-3	WER-4
Roof covering	Class A fire-rated (ASTM E108 / UL 790). Metal, asphalt, concrete tile, clay tile, or fibre cement.	Class A fire-rated. Non-combustible preferred: metal standing seam or concrete tile.	Non-combustible only: metal standing seam, concrete tile, or clay tile. No asphalt shingles.	Non-combustible. Metal standing seam preferred. Per AS 3959 Cl. 8.6/9.6.
Underlayment	Code-compliant underlayment per NBC.	Self-adhering modified bitumen or ASTM cap sheet. Flammability index ≤5.	Self-adhering modified bitumen. Flammability index ≤5. Full roof coverage including ridge. Per AS 3959 sarking requirements.	Fire-rated underlayment. Flammability index ≤5. Full sarking per AS 3959 Cl. 9.6.2.
Roof sheathing	Code-compliant (plywood or OSB).	Minimum 15mm (5/8″) plywood or OSB.	Minimum 15mm plywood or OSB. Consider fire-retardant treated plywood.	Fire-retardant treated plywood minimum 15mm. Or non-combustible sheathing.
Ridge and hip	Factory ridge cap per manufacturer.	Sealed to prevent ≤3mm gaps. Bird-stopping at all open profiles.	Sealed with non-combustible material or ≤2mm mesh at all gaps. Bird-stopping mandatory.	Fully sealed. Non-combustible closure strips. ≤2mm mesh at any remaining gap.
Valley	Code-compliant valley flashing.	Metal valley flashing min. 0.48mm (26 gauge) galvanised. Underlayment 900mm wide min.	Metal valley flashing min. 0.48mm. ASTM cap sheet underlayment 900mm wide full length.	Metal valley flashing. Full cap sheet underlayment. No combustible debris traps.
Roof-to-wall junction	Sealed per code. Step flashing.	Sealed to prevent >3mm gaps. Step flashing with kick-out diverter.	Fully sealed with non-combustible material. Metal angle flashing at intersection.	Fire-rated junction. Metal flashing. Intumescent seal at all gaps.

Component	WER-1	WER-2	WER-3	WER-4

CLASS A ROOF RATING

Class A is the highest fire classification for roof coverings under ASTM E108 / UL 790. It means the roof covering can withstand severe fire test exposure: burning brands (embers), intermittent flame, and a spreading flame test. Metal roofing (standing seam, corrugated), concrete and clay tiles, and most asphalt shingles labelled “Class A” meet this standard. Untreated wood shakes are unrated. Fire-retardant treated wood shakes can achieve Class B or C but not Class A. For WUI applications, Class A is the minimum standard at every WER level.

2.2 Eaves and Soffits

Component	WER-1	WER-2	WER-3	WER-4
Eave type	Enclosed (soffited) preferred. Open eaves: inspect and seal all gaps.	Enclosed (soffited) required. No open eaves.	Enclosed (soffited) required. Soffit material non-combustible or ignition-resistant.	Enclosed (soffited). Non-combustible soffit and fascia. Per AS 3959 Cl. 8.6.6/9.6.6.
Soffit material	Vinyl, fibre cement, aluminium, or plywood. Maintain in good repair.	Fibre cement, aluminium, or fire-rated plywood. No vinyl.	Non-combustible: fibre cement or aluminium only. Or 5/8″ Type X gypsum behind exterior covering.	Non-combustible only. Fibre cement or aluminium. 1-hour fire-resistive assembly at underside.
Fascia	Wood acceptable if painted and maintained.	Non-combustible fascia preferred. Wood acceptable if protected by metal drip edge.	Non-combustible: fibre cement, aluminium-wrapped, or metal. Metal drip edge mandatory.	Non-combustible metal or fibre cement. Metal drip edge. Per AS 3959.
Fascia-to-sheathing gap	Seal any gaps >3mm.	Seal all gaps. Install metal drip edge to cover fascia-to-sheathing gap.	Metal drip edge mandatory. No gaps >3mm. Per AS 3959 Cl. 3.6.	Fully sealed. Metal drip edge. Intumescent backing seal.
Soffit vents	See Module 3. Screen with ≤3mm mesh minimum.	See Module 3. ASTM E2886-listed ember-resistant vents.	See Module 3. ASTM E2886-listed. Continuous soffit strip preferred over individual vents.	See Module 3. ASTM E2886-listed. All vent openings fire-rated.
Overhang depth	No specific requirement. Keep debris-free.	No specific requirement. Non-combustible soffit mitigates overhang risk.	Consider reducing overhang depth on fire-approach side if >600mm.	Minimise overhang on fire-approach side. Non-combustible construction throughout.

Component	WER-1	WER-2	WER-3	WER-4

OPEN vs. ENCLOSED EAVES

Open eaves (exposed rafter tails) are common in older BC homes and in some architectural styles. From a wildfire perspective, open eaves are significantly more vulnerable because they expose the underside of roof sheathing and framing directly to radiant heat and flames from below. IBHS testing showed that ember entry into the attic is substantially higher with open-eave construction. Enclosing eaves with non-combustible soffit material is one of the most effective retrofit measures. For new construction at WER-2 and above, enclosed eaves are required.

2.3 Gutters

Component	WER-1	WER-2	WER-3	WER-4
Gutter material	Metal preferred. Vinyl acceptable if maintained.	Metal only (aluminium or steel). No vinyl.	Metal only. Aluminium or steel.	Metal only. Steel preferred.
Gutter guards	Recommended. Keep gutters debris-free.	Non-combustible gutter guards required (metal mesh or micro-mesh).	Non-combustible metal gutter guards required. Ember-resistant design.	Non-combustible metal gutter guards. Ember-resistant certified.
Debris maintenance	Clean gutters minimum twice annually (spring and fall).	Clean gutters minimum twice annually. Inspect monthly during fire season.	Clean gutters minimum twice annually. Inspect monthly. Consider gutter removal on fire-approach side if not needed for drainage.	Clean gutters quarterly minimum. Monthly inspection. Consider elimination on fire-approach side.
Downspouts	Code-compliant.	Metal. Discharge away from foundation.	Metal. Discharge away from foundation. No combustible splash blocks.	Metal. Non-combustible discharge path.

GUTTERS: THE OVERLOOKED IGNITION POINT

IBHS research found that debris in gutters is one of the most common ignition points during WUI fires. Embers ignite accumulated leaves and pine needles, and the resulting flames impinge directly on the roof edge. Even homes with Class A roofs can be compromised this way because the fire attacks the edge of the roof assembly, not the fire-rated surface. The simplest and cheapest wildfire measure any homeowner can take is cleaning their gutters. For homes in high-exposure areas, consider whether gutters on the fire-approach side are structurally necessary — if your roof has adequate overhang and the grade slopes away from the foundation, removing gutters on that side eliminates the ignition point entirely.

2.4 Roof Penetrations

Component	WER-1	WER-2	WER-3	WER-4
Plumbing vents	Seal gap between pipe and roof to ≤3mm.	Seal to ≤3mm. Non-combustible flashing boot.	Seal to ≤3mm. Non-combustible flashing. Metal pipe collar.	Fully sealed. Non-combustible. Metal pipe collar. Intumescent seal.
Skylights	See Module 1 (Openings).	See Module 1. Dual-pane tempered. Non-combustible frame.	See Module 1. Dual-pane tempered min. 5mm. Fixed (non-operable) preferred.	See Module 1. Fire-rated assembly. Fixed only.
Chimneys	Spark arrestor screen: 10mm (3/8″) to 13mm (1/2″) mesh.	Spark arrestor screen. Seal chimney-to-roof gap to ≤3mm. Non-combustible flashing.	Spark arrestor screen. Cricket/saddle flashing. Non-combustible material within 600mm.	Spark arrestor. Cricket flashing. 1.5m non-combustible zone on roof around chimney.
Solar panels	Maintain clearance per manufacturer. Keep debris from accumulating beneath.	Non-combustible mounting hardware. Screen gaps between panels and roof with ≤3mm mesh.	Non-combustible mounting. Screen all gaps. ≤2mm mesh or solid non-combustible closure at edges.	Non-combustible mounting. Fully enclosed underside or ≤2mm mesh. Fire-rated conduit.
Evaporative coolers / HVAC	Seal roof penetration to ≤3mm.	Seal to ≤3mm. Non-combustible flashing and curb.	Non-combustible curb and flashing. Screen any openings with ≤2mm mesh.	Non-combustible. Screened. Fire-rated conduit at penetration. Per AS 3959.

SOLAR PANELS AND WILDFIRE

Solar panels create a protected space between the panel and the roof surface where debris can accumulate and embers can lodge. This space is difficult to inspect and clean. For WUI homes, specify non-combustible mounting hardware (not plastic clips) and screen the gap between panels and roof at all edges. Some jurisdictions now require animal guards / critter guards around solar arrays — these serve double duty as ember screens if made from non-combustible metal mesh.

3.5 Exterior Sprinkler and Wetting Systems

Homeowners researching wildfire protection will encounter exterior sprinkler systems — roof-mounted or eave-mounted spray heads designed to wet the building envelope and surrounding area during a fire event. These systems have real history, real advocates, and real limitations. This section provides an honest assessment of where they fit (and where they don't) in a comprehensive hardening strategy.

How exterior sprinklers work

Exterior sprinkler systems create a wet microclimate around the home by spraying water onto the roof, walls, eaves, and surrounding vegetation. The water hydrates combustible surfaces (making them harder to ignite from embers), increases local humidity, and cools the air around the structure. Systems are typically mounted along the roof ridge, at eave edges, or on poles surrounding the property. They can be activated manually, by heat sensors, or remotely via phone or SMS. The water source may be municipal supply, a well, a dedicated tank, or a natural water body (lake or river) with a pump.

The evidence: what works

Ham Lake Fire, Minnesota (2007): The strongest evidence for exterior sprinklers comes from the 2007 Ham Lake Fire on the Gunflint Trail in northern Minnesota. Of 188 properties equipped with lake-fed sprinkler systems (installed starting in 2001 with FEMA grant funding), all survived. More than 100 neighbouring properties without sprinklers were destroyed. This was a high-intensity, wind-driven fire with 120-foot flames. The sprinkler systems were fed by pumps drawing directly from lakes — an effectively unlimited water supply.

Australian practice: Australia has a dedicated standard for bushfire water spray systems (AS 5414:2012). CSIRO acknowledges that sprinkler systems "can aid in the survival of buildings during a bushfire." In Australian practice, sprinklers are considered a supplementary active system used alongside passive building construction measures, not as an alternative to them.

FEMA guidance: FEMA recommends exterior sprinkler systems as part of home hardening, specifically advising homeowners to "purchase and install external sprinkler systems with dedicated power sources or a water tank." The key qualifier is "dedicated power sources" — FEMA recognises that mains power cannot be relied upon during a wildfire.

The problems: what can go wrong

CRITICAL DEPENDENCIES

Exterior sprinkler systems are active systems. Unlike passive hardening (NC cladding (or equivalent), tempered glass, mineral wool), which works automatically and permanently, sprinklers require: (1) a reliable water supply with adequate volume and pressure, (2) a power source for the pump that works when mains power fails, (3) correct activation timing — too early wastes water, too late is useless, (4) ongoing maintenance of pumps, heads, and pipes, and (5) someone to make the decision to activate — or an automated system that makes the decision correctly. If any one of these fails, the system provides zero protection.

Water supply: A wildfire sprinkler system with just three heads can use over 45,000 gallons (170,000 litres) per day. Five heads can use 72,000 gallons (270,000 litres) per day. Municipal water supplies are generally inadequate in both volume and pressure, and cannot be relied upon during emergencies when multiple homes are drawing water simultaneously. Municipal pressure drops when many homes turn on garden sprinklers, which reduces effectiveness for everyone. Effective systems typically require a direct connection to a lake or river, or a very large dedicated storage tank. Most suburban and semi-rural WUI properties do not have access to these water sources.

Power failure: Mains electricity commonly fails during wildfires — from downed power lines, utility shutoffs, or fire damage to the grid. A pump that runs on mains power will stop when you need it most. Effective systems require a dedicated generator or battery backup, adding cost and another potential point of failure. The generator itself needs fuel and maintenance.

Wind: The most dangerous wildfires are wind-driven events. Wind disperses water spray away from the target surfaces, reducing or eliminating coverage. Systems are designed with overlapping coverage to compensate, but wind is unpredictable in direction and intensity. The same wind conditions that make wildfires most dangerous also make sprinklers least effective.

Activation timing: Sprinklers must be activated before the fire arrives but not so early that the water supply is exhausted. Embers can arrive over an hour before the fire front, so the system may need to run for extended periods. If the system requires manual on-site activation, this creates a dangerous conflict with evacuation timing — staying to activate the system delays your departure. Fire Safe Marin explicitly states: “We do not recommend any exterior sprinkler system which must be manually triggered on-site. You must evacuate early.”

Maintenance: Pumps, heads, pipes, and connections all require regular testing and maintenance. Freezing is a serious concern in Canadian winters — water in exposed pipes will freeze and rupture the system. Dry-pipe systems or seasonal draining are required, adding complexity. A system that has not been tested and maintained may fail when activated.

False confidence: The most dangerous risk of sprinkler systems may be psychological. A homeowner who has installed an expensive sprinkler system may believe their home is protected and delay evacuation, reduce investment in passive hardening, or make decisions based on a false sense of security. IBHS has noted that “limited methodical research exists on their real-world effectiveness” and that many unknowns remain. Fire Safe Marin warns: “Beware of snake oil. Be alert for manufacturers overselling their product’s capabilities.”

Active vs passive protection: the fundamental question

	Exterior Sprinklers (Active)	Passive Hardening (WER)
Works when	Activated, water flowing, power on, wind cooperates	Always. NC materials do not burn regardless of conditions
Depends on	Water supply, power, activation, maintenance, weather	Nothing. Materials are inherently non-combustible
Fails when	Power out, water exhausted, pump fails, wind too high, freeze damage, not activated	Assembly failure under extreme conditions (but degrades gradually, not catastrophically)
Maintenance	Annual pump testing, head inspection, freeze protection, fuel for generator	Standard building maintenance. Visual inspection
Canadian winter	Must be drained or dry-piped. Seasonal startup required. Freeze damage risk	No seasonal concerns. Works year-round
Cost	$5,000–$15,000+ installed. Plus annual maintenance, fuel, pump replacement	Varies by WER level. One-time cost integrated into building envelope
Insurance	Not recognised by California Ch. 7A or	NC cladding (or equivalent), vents,

	Exterior Sprinklers (Active)	Passive Hardening (WER)
	Safer from Wildfires. Not a qualifying measure	glazing, shutters all qualify for CA insurance discounts
Best use	Supplementary layer on lakefront properties with reliable water. Not a primary defence	Primary wildfire hardening strategy for all property types and WER levels

Where exterior sprinklers fit in the WER system

The WER system is built on passive protection because passive systems work regardless of power, water, activation, wind, or human decision-making. However, we acknowledge that exterior sprinklers can provide a supplementary layer of protection in specific circumstances:

Lakefront or riverfront properties: If you have direct access to a large natural water body and can install a pump with independent power (generator or solar/battery), a sprinkler system is a reasonable supplementary measure. The Gunflint Trail success story is compelling precisely because those properties had unlimited lake water. This describes many recreational and rural properties in BC and northern Alberta.

Properties with existing combustible cladding during retrofit: If your home has wood cladding that you cannot immediately replace with NC materials, a sprinkler system can provide interim protection while you plan and execute the full retrofit. It is a bridge measure, not a permanent solution.

High-value properties at WER-3 or WER-4: For properties at the highest risk levels, after completing all passive hardening measures, an exterior sprinkler system adds a redundant layer. This is a “belt and suspenders” approach that makes sense when the consequences of failure are severe and the water supply is reliable.

FIREHARD CANADA POSITION ON EXTERIOR SPRINKLERS

Exterior sprinkler systems are not a substitute for passive building hardening. They are a supplementary active system that may add value in specific circumstances, particularly for lakefront properties with reliable water supply and independent power. They should never be the primary or sole wildfire protection measure. The WER system’s specifications do not include exterior sprinklers because we will not specify a system whose effectiveness depends on conditions we cannot control. Complete your passive hardening first. If you still want additional protection and have the water supply to support it, a well-designed exterior sprinkler system is a reasonable addition — not a replacement.

If you choose to install an exterior sprinkler system

Water source: Direct pump from lake or river is ideal. Dedicated tank minimum 10,000 litres (2,600 gallons) for short-duration protection; 40,000+ litres for extended operation. Do not rely on municipal water supply.

Power: Dedicated generator (gasoline or propane) with automatic transfer switch, or solar/battery system. Test monthly. Keep fuel fresh and topped up during fire season.

Activation: Remote activation (phone, SMS, or automated heat/smoke sensor) so you do not need to be on-site. Activate before evacuation, not instead of evacuation.

Piping: All metal piping and fittings. Plastic pipes and hoses will melt under radiant heat. Drain or dry-pipe for Canadian winter.

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Coverage: Roof ridge, eave edges, and ground-level perimeter for maximum coverage. Design for 100%+ overlap to account for wind displacement.

Standard: Consult AS 5414:2012 (Australian bushfire water spray systems) for design guidance. No equivalent Canadian standard currently exists.

Maintenance: Test full system monthly during fire season (May–October). Annual professional inspection of pump, heads, and connections. Drain before first freeze.

3. AS 3959 to Canadian Adaptation: Roof & Eaves

The FireHard Canada WER roof specifications draw on AS 3959:2018 Sections 5.6 through 9.6, which provide element-by-element roofing requirements across five Bushfire Attack Levels (BAL-12.5 through BAL-FZ). The following summarises the key AS 3959 requirements and how they translate to Canadian residential construction.

Roof coverings

AS 3959 requires non-combustible roof coverings at all BAL levels. This aligns with the Class A requirement in the WER system. Canadian homes with asphalt shingles labelled Class A meet this requirement at WER-1 and WER-2. At WER-3 and above, the radiant heat fluxes involved favour metal or concrete/clay tile — asphalt shingles can deform and create gaps under prolonged radiant heat exposure even though they pass the ASTM E108 fire test.

Sarking (underlayment)

AS 3959 requires full sarking (underlayment) on tiled roofs at all BAL levels and on sheet roofs at BAL-19 and above. The sarking must have a flammability index no greater than 5 (tested to AS 1530.2) and must cover the entire roof area including the ridge, with no gaps where it meets fascias, gutters, and valleys. For Canadian applications, self-adhering modified bitumen underlayment (commonly available as ice and water shield) meets the flammability and continuity requirements and also provides the moisture protection critical in Canadian climates.

Sheet roof gap sealing

AS 3959 requires that gaps greater than 3mm under corrugations or ribs of sheet roofing be sealed at the fascia or wall line and at valleys, hips, and ridges using mesh (≤2mm aperture), mineral wool, or other non-combustible material. This is directly applicable to Canadian metal roofing installations. Standard foam closure strips used in Canadian metal roofing are combustible — at WER-2 and above, specify non-combustible closure strips (mineral wool or metal) or install mesh behind conventional closures.

Eaves standardisation

AS 3959 Amendment 2 (2020) standardised eaves requirements across all BAL levels to reference Clause 3.6 directly: all eaves ventilation openings must be fitted with ember guards of corrosion-resistant steel, bronze, or aluminium with a maximum 2mm mesh aperture. Eaves penetrations are protected to the same standard as roof penetrations. Joints in eaves linings, fascias, and gables may be sealed with plastic joining strips or timber storm moulds. FireHard Canada adopts this standardised approach — eave ventilation protection at all WER levels references Module 3 (Vents & Penetrations) which specifies ASTM E2886-listed products for Canadian availability.

Roof ventilation

AS 3959 requires roof ventilation openings (gable vents, roof vents, ridge vents) to be fitted with ember guards of non-combustible material or mesh with a maximum 2mm aperture. This requirement is unchanged across all BAL levels. In Canadian practice, ridge and gable vents are typically screened with standard 6mm (1/4″) or 3mm (1/8″) mesh, which allows embers to pass through. At WER-1, 3mm mesh is the minimum; at WER-2 and above, ASTM E2886-listed vents are required. See Module 3 for complete vent specifications.

4. Construction Sequences

4.1 New Construction: Roof Assembly for WER-2+

The following sequence describes best practice for new residential roof construction in WUI areas targeting WER-2 or higher. Steps are listed in construction order.

Step 1: Roof framing and sheathing

Install roof framing per structural engineering requirements. Sheath with minimum 15mm (5/8″) plywood or OSB. For WER-3+, consider fire-retardant treated plywood. Ensure sheathing is continuous to the eave edge — do not leave gaps between the last sheet and the fascia line.

Step 2: Eave enclosure

Frame soffits at eave line. Install blocking between rafters at the wall line to create a continuous barrier between the attic space and the soffit cavity. The blocking must be tight-fitting with no gaps greater than 3mm. This is the single most critical detail in the roof-to-wall transition — gaps here provide a direct pathway for embers from the soffit cavity into the attic.

Step 3: Underlayment

Install self-adhering modified bitumen underlayment (ice and water shield) over the entire roof surface. Overlap all joints minimum 150mm. Extend underlayment over the ridge. Seal all edges to the sheathing surface with no gaps or fish-mouths. At WER-3+, the underlayment must have a flammability index no greater than 5 (per AS 3959 sarking requirements). Standard ice and water shield products typically meet this requirement — verify with the manufacturer.

Step 4: Valley and hip flashing

Install metal valley flashing minimum 0.48mm (26 gauge) galvanised steel, minimum 900mm wide, over a layer of ASTM cap sheet or self-adhering underlayment extending the full length of the valley. Seal all edges. Install hip flashing or hip cap per roof covering manufacturer's instructions using non-combustible materials.

Step 5: Drip edge and fascia

Install metal drip edge at eave and rake edges. The drip edge must cover the gap between the roof sheathing and the fascia board — this is the gap through which IBHS testing found most ember entry occurs in soffited-eave construction. Fascia should be non-combustible (fibre cement or aluminium-wrapped) at WER-2+ or protected by the metal drip edge at WER-2 minimum.

Step 6: Roof covering installation

Install Class A fire-rated roof covering per manufacturer instructions. At ridges, hips, and eaves, install non-combustible closure strips or bird-stopping to seal all gaps greater than 3mm between the roof covering and the sheathing. Standard foam closure strips are combustible — at WER-2+, specify mineral wool or metal closure strips. For metal roofing, ensure all fastener penetrations are sealed.

Step 7: Soffit and vent installation

Install non-combustible soffit material (fibre cement or aluminium). Install ASTM E2886-listed soffit vents at required intervals for attic ventilation (see Module 3). Seal all joints in the soffit to

≤3mm gaps. Where soffit meets wall, ensure a continuous seal — this junction is where wall-to-roof fire spread often occurs.

Step 8: Gutter installation

Install metal gutters (aluminium or steel) with non-combustible gutter guards. Ensure gutters do not create additional gaps at the fascia-to-sheathing junction. Downspouts should discharge away from the building foundation onto non-combustible surfaces.

Step 9: Roof penetration sealing

Seal all roof penetrations (plumbing vents, HVAC, solar panel mounts, electrical masts) to ≤3mm gaps using non-combustible flashing and sealant rated for high temperature (≥260°C). Install spark arrestor screens on chimneys (10–13mm mesh). Screen any roof-level ventilation openings with ≤2mm non-combustible mesh.

4.2 Retrofit Upgrade Sequence (Prioritised by Cost-Effectiveness)

For existing homes, the following upgrades are listed in priority order from most cost-effective to most expensive. Each step provides meaningful protection on its own.

Step 1: Clean and maintain (<$100/year)

Remove all debris from roof, gutters, and valleys. Clear debris from eave areas. Trim overhanging branches to minimum 3m from roof. Remove moss and organic growth. Clean gutters minimum twice annually and monthly during fire season. This single step eliminates the fuel that embers need to ignite and costs almost nothing.

Step 2: Seal gaps ($200–$500)

Inspect and seal all gaps greater than 3mm at: roof-to-wall junctions, fascia-to-sheathing gaps, ridge and hip closures, eave blocking, and around all roof penetrations. Use high-temperature silicone sealant (≥260°C) or non-combustible caulk. Install metal drip edge if not present. This is the single highest-value retrofit for the cost.

Step 3: Install gutter guards ($300–$800)

Install non-combustible metal gutter guards (aluminium or steel micro-mesh). Available from major home improvement retailers. Professional installation typically $15–$25 per linear metre. Eliminates the gutter-as-ignition-point vulnerability. If gutters are vinyl, replace with aluminium at the same time.

Step 4: Enclose open eaves ($1,500–$5,000)

If your home has open eaves (exposed rafter tails), enclosing them with non-combustible soffit material is one of the most impactful retrofit upgrades. Install fibre cement or aluminium soffit panels, blocking between rafters at the wall line, and a non-combustible fascia. This upgrade also improves energy efficiency and reduces pest entry. Cost varies significantly based on home size and eave depth.

Step 5: Upgrade vent screens ($500–$2,000)

Replace standard vent screens with ASTM E2886-listed ember-resistant vents. Priority: soffit vents, gable vents, ridge vents. See Module 3 for specifications and product recommendations. Typical cost: $50–$150 per vent for product, plus installation.

Step 6: Replace roof covering ($10,000–$30,000+)

If your roof has untreated cedar shakes, this is the most important upgrade regardless of cost. Replace with Class A fire-rated metal, asphalt, or concrete tile. If your roof is already Class A asphalt shingles in good condition, this step can be deferred to normal re-roofing schedule — but plan to upgrade to metal or concrete tile at that time for WER-2+ performance. Typical cost for a BC home: $10,000–$30,000 depending on roof area and material selection.

COST-EFFECTIVENESS HIERARCHY

Steps 1–3 can protect most homes for under $1,500 total. They address the most common ignition mechanisms (debris accumulation, ember entry through gaps, gutter ignition) at minimal cost. A homeowner who completes Steps 1–3 has addressed the majority of their roof-related wildfire risk. Steps 4–6 provide additional protection and should be prioritised based on the specific home's vulnerabilities and WER level.

5. Product Research & Recommendations

The following product categories and manufacturers are referenced for informational purposes. FireHard Canada does not receive compensation from any manufacturer listed. Inclusion does not constitute endorsement; omission does not imply unsuitability.

5.1 Roof Coverings

Metal roofing (preferred for WER-2+)

Metal standing seam roofing is the preferred option for WUI applications: non-combustible, Class A rated, no profile gaps when properly installed with sealed seams. Available in steel (galvanised, Galvalume, or painted) and aluminium. Canadian manufacturers: Ideal Roofing (Ottawa, ON); Vicwest (national); Westform Metals (BC); Metalline Products (national). Typical installed cost: $15–$30/sq ft depending on profile and gauge.

Asphalt shingles (acceptable WER-1 and WER-2)

Most laminated/architectural asphalt shingles carry a Class A fire rating (ASTM E108). They are the most common roof covering in Canada and are acceptable at WER-1 and WER-2. However, asphalt shingles can deform under sustained radiant heat, potentially creating gaps. For WER-3+, metal or concrete tile is preferred. Canadian manufacturers: IKO (national); BP (national); CertainTeed (national); GAF (widely available).

Concrete and clay tile

Non-combustible, extremely durable, and available in profiles that can be sealed against ember entry. Heavier than metal or asphalt, requiring structural verification. Less common in BC but increasingly specified for WUI applications. Bird-stopping (closure strips at eaves and ridges) is critical — the gaps under tile profiles are large enough for ember entry. Suppliers: Boral Roofing; Eagle Roofing Products; MonierLifetile.

5.2 Underlayment

Self-adhering modified bitumen (ice and water shield): Grace Ice & Water Shield; Blueskin by Henry; Resisto SA; CGC Shingle-Mate. These products are widely available through Canadian building supply distributors and meet the flammability index ≤5 requirement when verified with the manufacturer. For WER-3+, specify full-roof application, not just eave/valley strips.

5.3 Closure Strips and Sealing

Standard foam closure strips are combustible and should be supplemented or replaced at WER-2+. Non-combustible alternatives: mineral wool closure strips (Roxul/Rockwool); metal profile closure strips (available from most metal roofing manufacturers); stainless steel mesh behind foam closures (provides ember barrier even if foam melts).

5.4 Gutter Guards

Non-combustible metal gutter guards suitable for WUI applications: LeafFilter (stainless steel micro-mesh on aluminium frame); Gutter Helmet (aluminium); Valor Gutter Guards (stainless steel); MasterShield (stainless steel micro-mesh); A-M Aluminium Gutter Guard (Canadian, aluminium). For maximum ember protection, specify a micro-mesh design that prevents debris accumulation on top of the guard as well as inside the gutter.

5.5 Soffit and Fascia

Non-combustible soffit materials suitable for WUI applications: fibre cement soffit panels (James Hardie HardieSoffit; Allura; Nichiha); aluminium soffit (Gentek; Kaycan; Royal Building Products — specify aluminium, not vinyl); pre-finished steel soffit. For fascia, aluminium coil stock (brake-formed to profile) or fibre cement fascia board. Vinyl soffit is not acceptable at WER-2+: PVC melts at approximately 80–100°C and burns readily, providing a direct pathway for fire to reach the roof framing.

5.6 Drip Edge

Metal drip edge is a standard roofing product available from all major roofing distributors. For WUI applications, the drip edge serves dual purpose: weather protection and ember barrier at the fascia-to-sheathing gap. Specify minimum 0.48mm (26 gauge) galvanised steel or aluminium. Ensure the drip edge extends over the fascia and under the first course of roof covering with no gaps greater than 3mm.

6. Maintenance Protocol

Roof and eave maintenance is arguably the most important ongoing wildfire protection activity. The best-constructed roof assembly will fail if covered in combustible debris.

6.1 Annual Inspection Checklist

1. Inspect roof surface for debris accumulation. Clear all leaves, needles, moss, and organic material from roof surface, valleys, ridges, and roof-to-wall intersections.

2. Clean gutters and downspouts. Remove all debris. Verify gutter guards are intact and functioning. Check for sagging or detachment.

3. Inspect ridge, hip, and eave closures. Verify bird-stopping and closure strips are intact with no gaps >3mm. Replace any damaged or missing closures.

4. Inspect fascia and drip edge. Check for rot, damage, or gaps between fascia and roof sheathing. Verify metal drip edge is intact.

5. Inspect soffit. Check for damage, holes, gaps, or pest entry. Verify all soffit vent screens are intact and not blocked by debris or paint.

6. Inspect roof-to-wall junctions. Check step flashing and kick-out diverters. Verify sealant is intact and gaps remain ≤3mm.

7. Inspect roof penetrations. Check flashing boots around plumbing vents, electrical masts, HVAC, and solar mounts. Seal any gaps >3mm.

8. Inspect chimney. Verify spark arrestor screen is intact (10–13mm mesh, no holes or corrosion). Clean chimney flashing. Remove any debris accumulation around chimney base on roof.

9. Check overhanging vegetation. Trim all branches to minimum 3m horizontal clearance from roof. Remove dead branches overhanging the roof from any distance.

10. Inspect eave blocking. From inside the attic (if accessible), verify blocking between rafters at the wall line is intact with no gaps. Check for daylight penetration — any visible daylight indicates a potential ember entry pathway.

6.2 Pre-Season Preparation

Before fire season (typically May–June in BC interior):

Clean roof and gutters thoroughly, even if cleaned in fall. Spring pollen, seed pods, and winter debris accumulate quickly.

Verify all closures and seals are intact after winter freeze-thaw cycling. Canadian winters are particularly hard on sealants and closure strips — inspect annually at minimum.

Move combustible items away from eave areas. Do not store firewood, lumber, cardboard, or other combustibles under eaves or against the wall below the eave line.

Test attic ventilation. Verify soffit and ridge vents are not blocked by insulation, debris, or ice dam damage from winter.

8. Referenced Standards

Standard	Title	Roof & Eave Relevance
AS 3959:2018	Construction of Buildings in Bushfire-Prone Areas	Sections 5.6–9.6: roof coverings, sarking, eaves, roof ventilation, penetrations by BAL level
ASTM E108 / UL 790	Standard Test Methods for Fire Tests of Roof Coverings	Class A/B/C fire rating for roof coverings. Burning brand, intermittent flame, spreading flame tests.
ASTM E2886	Evaluation of Vents to Resist Ember and Flame Entry	Test standard for ember-resistant vents (soffit, gable, ridge). Referenced in Module 3.
CBC Chapter 7A	Materials and Construction for Exterior Wildfire Exposure	Section 705A (roofing), 706A (attic ventilation), 707A (eaves and soffits)
NRC WUI Guide (2021)	National Guide for Wildland-Urban Interface Fires	Construction Class recommendations for roofs by exposure level
NFPA 1144	Reducing Structure Ignition Hazards from Wildland Fire	Roof covering, gutter, eave, and vent recommendations
IBHS Wildfire Prepared Home	Wildfire Prepared Home Standard (2025)	Roof as critical system. Class A required. Gutter maintenance. Vent ember resistance.
ASTM D2898	Weathering Protocol for Roof Coverings	Accelerated weathering to ensure fire-rated performance over time
AS 1530.2	Fire Tests on Building Materials — Flammability Index	Test standard for sarking/underlayment flammability (≤5 required by AS 3959)
SFM 12-7A-3	Eave Testing Standard	California performance test for eave assemblies under wildfire exposure

9. Neighbouring Structure Exposure: Roof & Eaves

During a wildland-urban interface fire, your roof and eaves face a specific threat from neighbouring structures that differs from vegetation fire exposure. A burning neighbouring building produces heat and embers that rise vertically and attack your eaves, soffits, and roof edge from below and at close range for 30–90 minutes. For full details on building-to-building fire spread, see Module 6.

Soffits under sustained radiant heat

When a neighbouring structure burns at close range (3–6 metres), convective heat and flames rise and attack the underside of your eaves directly. Unenclosed soffits with exposed rafter tails allow this heat and ember exposure to reach the roof cavity within minutes. Even enclosed vinyl soffits can melt and fail under the sustained upward heat from a burning neighbour. This is why non-combustible soffit material (fibre cement or aluminium) is specified on faces adjacent to close neighbours, regardless of the vegetation-based WER level.

Gutter ignition from neighbour embers

A burning structure generates embers continuously for 30–60 minutes. Embers from a close neighbour land in your gutters from a consistent direction and accumulate rapidly. Metal gutters with non-combustible guards are essential on faces adjacent to close neighbours. Vinyl gutters should be replaced — they melt under moderate radiant heat and fail before the ember storm subsides.

Roof edge as the transition zone

The roof edge — where the gutter, fascia, soffit, and roof covering meet — is the most vulnerable zone during a neighbouring structure fire. Heat rises from the burning neighbour and concentrates at your eave line. Metal drip edge, non-combustible fascia, enclosed non-combustible soffits, and metal gutters with guards form a continuous non-combustible barrier at this transition zone. See Module 6 Section 6 (CNEL system) for the complete wall-to-roof junction specification.

10. References

Standards and Codes

AS 3959:2018 + Amd 2:2020. *Construction of Buildings in Bushfire-Prone Areas.* Standards Australia. Sections 5.6–9.6 (roofing), 3.6 (ember guards), 3.10 (sarking).

AS 1530.2. *Methods for Fire Tests on Building Materials — Flammability Index.* Standards Australia.

ASTM E108 / UL 790. *Standard Test Methods for Fire Tests of Roof Coverings.* ASTM International / Underwriters Laboratories. Class A/B/C fire rating.

ASTM E2886/E2886M. *Evaluating the Ability of Exterior Vents to Resist Ember and Flame Entry.* ASTM International.

ASTM D2898. *Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing.* ASTM International.

California Building Code, Chapter 7A [SFM]. *Materials and Construction Methods for Exterior Wildfire Exposure.* 2022 Edition. Sections 705A (roofing), 706A (vents), 707A (eaves/soffits).

SFM Standard 12-7A-3. *Eave Testing Standard.* California Office of the State Fire Marshal.

NFPA 1144. *Standard for Reducing Structure Ignition Hazards from Wildland Fire.* National Fire Protection Association.

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Research Papers and Reports

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Quarles, S.L., Valachovic, Y., Nakamura, G.M., Nader, G.A., and De Lasaux, M.J. (2010). *Home Survival in Wildfire-Prone Areas: Building Materials and Design Considerations.* UC ANR Publication 8393.

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Fire Safe Marin (2025). “Fire-Resistant Roofs.” firesafemarin.org. Gutter debris ignition, roof edge vulnerability, Class A performance.

UC ANR Fire Network (2025). “Eaves.” ucanr.edu/program/uc-anr-fire-network/eaves. Open vs. enclosed eave construction, Chapter 7A verification pathways.

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

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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.

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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.

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