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# Development in Australian bushfire prone areas

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Cover image. Bushfire rebuild after the 2013 loss of the original pole-frame timber house, Blue Mountains, NSW, by ECOdesign Architects (Image: Nigel Bell)

## Abstract

Bushfire has long been a part of Australian landscape ecology and mythology, but climate change is now driving an increase in fire emergencies and a greater regulatory response. There are new levels of bushfire frequency, severity and unpredictability across much of Australia – and indeed globally. The previous bushfire season pattern is no more, with record heat and drying creating extreme fire weather patterns. The risk is spreading from the rural and urban-bushland interface, across more of the landscape and into towns and cities. Increasingly, an expansion of development types in bushfire prone areas — not just dwellings — will need to address bushfire risk from a mandated bushfire assessment upfront through to a regulated planning and construction response. The National Construction Code with state/territory variations now calls up the bushfire Australian Standards and the NASH Standard (steel) as Deemed-to-Satisfy alternatives.

This Note outlines the impact of climate change on bushfire conditions in Australia and the ensuing regulatory imperatives for planning and construction within bushfire prone areas. It provides an overview of bushfire attack, the Fire Danger Index, the regulatory framework plus development issues and concerns currently applicable to states and territories. Planning and design considerations, including siting and landscaping concerns, are not covered by this note and will be the subject of a separate note.

# Introduction

From indigenous 'fire-stick farming' (*mlakidang*, 2014) to proactive prescribed burning and emergency back-burning, fire has had many uses in the Australian context. But the balance between bushfire prevention and suppression is changing, along with the likely consequences of extreme bushfires (Sharples et al, 2016). Bushfire frequency and severity have increased markedly in recent decades, burning places and regions previously thought immune ie Wet Tropics Queensland and the Tasmanian Wilderness World Heritage area (Earl et al, 2019).

Australia leads the world in fatalities from bushfires (Blanchi et al, 2013), yet the massive scale of building loss in California in late 2018 dwarfs all previous fires (Bowman et al, 2018). Climate change predictions indicate that mega-bushfires may become the new norm in many areas, overwhelming many communities' and agencies' ability to mitigate, evacuate or respond effectively. Enhanced bushfire risk is but one human, environmental and financial consequence of climate change.

The devastating Victorian 2009 Black Saturday bushfires and subsequent Royal Commission marked the change in regulatory response across Australia (2009 Victorian Bushfires Royal Commission, 2010a and 2010b). New Australian Standards were developed (see text box below), and the existing main standard AS 3959-2009 was upgraded and further revised in 2018. The National Construction Code (NCC) has mandated application of these standards across Australia, with most states and territories introducing localised changes to their planning regimes for greater bushfire protection. While NSW has empowered the Rural Fire Service to become the de facto consent authority in bushfire-prone areas, other states have implemented bushfire overlays for everyday planning practices or have left the matter within building control, as outlined later. However, every new bushfire with significant loss of life and/or property leads to moves for further development restrictions with consequent cost and approval difficulties placed directly on the applicant or developer — without a considered holistic approach.

**Standards related to bushfire issues:**

AS 3959:2018 *Construction of buildings in bushfire-prone areas*

AS 5414—2012 *Bushfire water spray systems*

ABCB, *Private Bushfire Shelters Performance Standard 2014*

NASH Standard *Steel Framed Construction in Bushfire Areas 2014*

# Bushfire danger and climate change

Australian vegetation has grown and adapted to bushfires for tens of thousands of years, to become the most flammable landscape on Earth (ATSE, 1999). The extent, frequency and intensity of future bushfire events is on the rise. Research has shown that climate change is bringing on extreme weather events with lengthened fire seasons since around 1970 (Clarke et al, 2012; Climate Institute, 2016; Climate Council, 2018).

**The extent, frequency and intensity of future bushfire events is on the rise.**

The average temperature has risen across the continent by almost 1$^0$C since Federation (Figure 1), while rainfall in many areas has dramatically fallen from long-term averages. All but one of the ten hottest years on record have occurred since 2005 (Bureau of Meteorology, 2019) (Figure 2). Widespread warmer and drier weather has moved from severe through to catastrophic weather conditions, including that which promotes bushfires. In summary, the areas affected by bushfire have broadened, the fire season has extended and the opportunity for hazard reduction between fire seasons is much reduced (Climate Council, 2018; Hamilton, 2019).

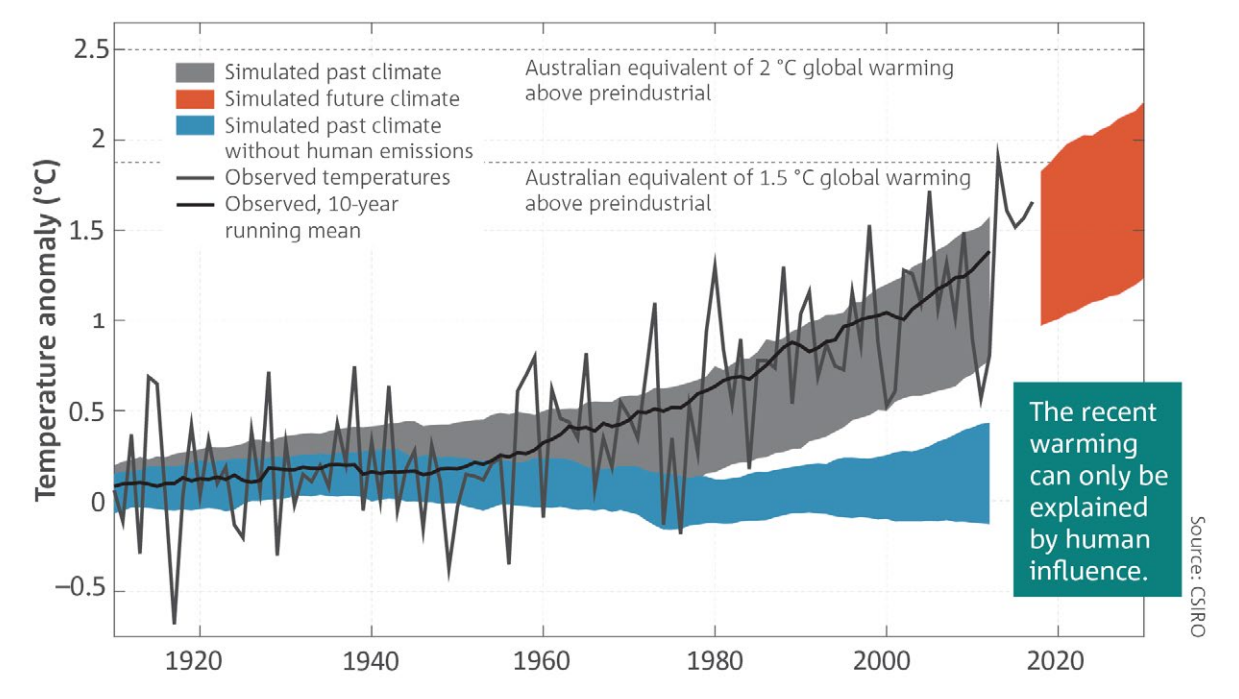


Figure 1. Future climate: Australia's average temperature relative to 1861–1900 (Image: Commonwealth of Australia, 2018). Reproduced by permission of Bureau of Meteorology, © 2018 Commonwealth of Australia.

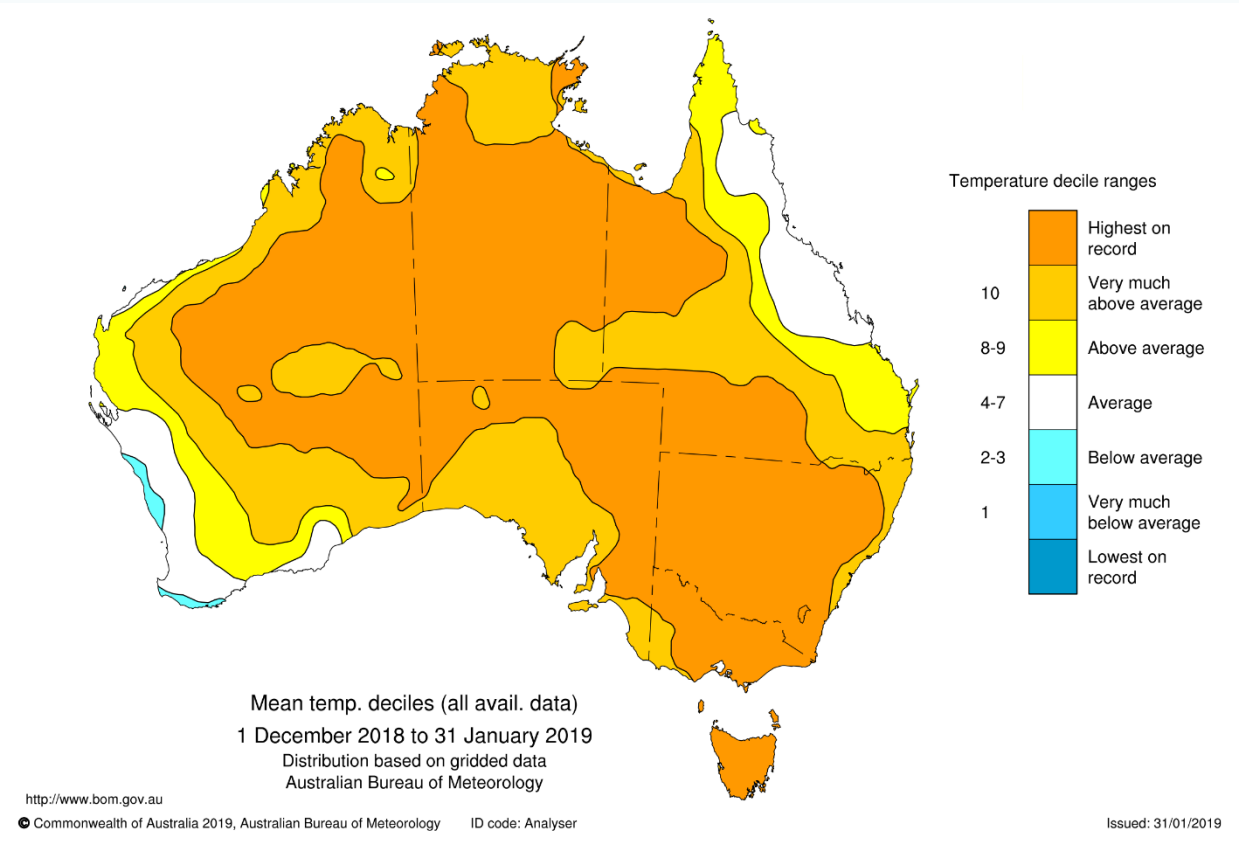


Figure 2. The mean temperature in December 2018 to January 2019 showing most of Australia was the hottest on record. (Image: Bureau of Meteorology, 2019). Reproduced by permission of Bureau of Meteorology, © 2018 Commonwealth of Australia.

# Forest Fire Danger Index (FDI)

The *Forest Fire Danger Index* (FFDI – often shortened to FDI for simplicity) is the regulatory starting point in assessing bushfire risk. This index estimates the fire danger on a given day based on records of dryness (taking into account rainfall and evaporation) plus observations of temperature, humidity and wind speed.

The consequence of changing weather patterns from climate change on bushfires is seen in studies showing a rapid increase in the FDI from 1973 across Australia, accelerating since the late 1990s (The Climate Institute, 2016). By 2050, compared to the weather from 1980-1999, extreme fire weather days are projected to grow by 10 per cent to 50 per cent (with low growth in greenhouse gas emissions) and by 100 per cent to 300 per cent if a higher greenhouse gas emission scenario prevails (The Climate Institute, 2016).

While an increase in the FDI in recent decades (Figure 3) has also seen an increase in the length of the fire-weather season, there is also much year to year variability, brought on by another climate change factor: the *El Niño* southern oscillation (warming) and *La Niña* (cooling) years, shifting global weather patterns of extreme rainfall and cyclones in one area, and extreme drought in another across the continents.

Nevertheless, heightened heat, lower humidity and drought with stronger wind patterns contribute to high/higher FDI values with consequences for the number and intensity of bushfire days. This is the primary starting point for assessment of bushfire hazard and risk in Australia. New and higher FDIs are likely to eventuate across all jurisdictions (even where resisted), which in turn will lift the required bushfire development response.

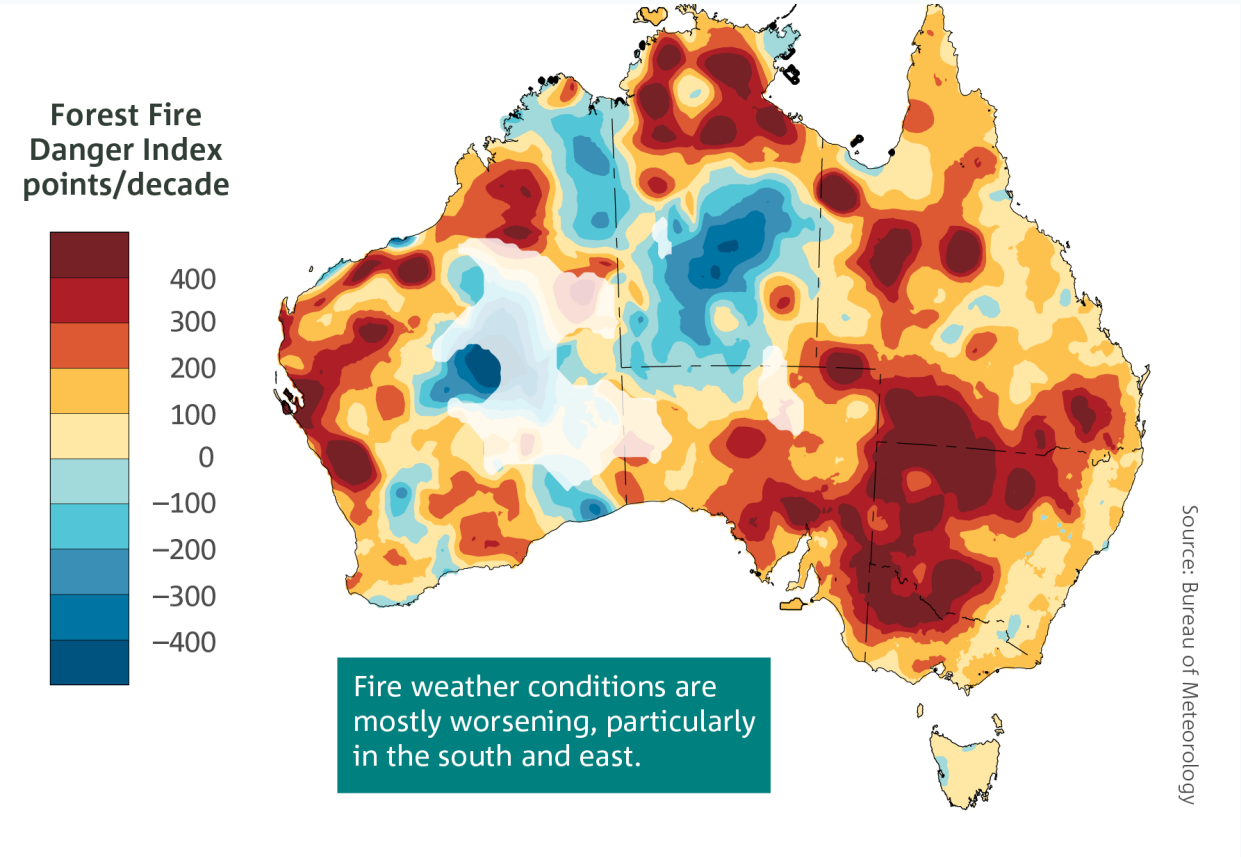


Figure 3. Trend in the annual sum of Forest Fire Danger Index, 1978–2017 showing (yellow to red) the increase in fire weather season (Image: Commonwealth of Australia, 2018). Reproduced by permission of Bureau of Meteorology, © 2018 Commonwealth of Australia.

## Some costs of bushfires

While Aboriginal peoples lived with bushfires and used controlled burns to their hunting advantage, the early white settlers learned to fear them (Gammage, 2011). This fear remains a primary emotion for many today, although too few perceive that they are at risk from bushfires despite objective evidence (Brown, 2013). Social research has shown that long-term emotional damage for those who lived through severe fire events may outlast the physical damage and loss (Every, 2016; University of Melbourne, 2016). Towns may be slowly rebuilt, but emotionally secure lives and communities, not as readily.

Since Australian records commenced in 1851, bushfires have accounted for more than 800 deaths, with total accumulated cost estimated at $1.6 billion (Blanchi et al, 2013). Historically, Victoria has suffered the worst bushfire events (loss of life and property), while Queensland has recently experienced major rainforest fires (Cox, 2018) and Tasmanian World Heritage regions burned for the first time in 1000 years in late 2018 and early 2019 (Earl et al, 2019). Studies have shown that Victoria has suffered the worst from civilian fatalities (65 per cent) and house losses (57 per cent), followed by NSW (14 per cent and 19 per cent respectively) and Tasmania (9 per cent of fatalities) (ABCB, 2019).

Drought, hail, severe storms, flooding and cyclones have cost more than bushfires for insurance companies, yet of these natural disasters bushfires have led to the greatest loss of life. Consequently, insurance premiums in bushfire-prone areas have not yet reflected the individual bushfire hazard and risk. Nevertheless, those seeking to build within bushfire-prone areas become acutely aware of the financial impacts of bushfire building regulations which can easily add $100,000 or more in construction costs in higher risk level areas (AAMI, 2016). Increasingly, only products and assemblies fully tested to the bushfire standard are accepted by regulators, and these offer limited choice.

## Bushfire attack

The Black Saturday bushfires eliminated the previous mantra that 'buildings save people and people save buildings', due to what was then an unprecedented fire. Fire authorities are now promoting every household to have an individual written Bushfire Plan, with advice to leave early under the threat of a bushfire. Some jurisdictions are now seeking to evacuate people (and pets) from critical areas in advance of the fire front (when the FDI is > 50), plus containment of the fire from the air (at great expense but better human safety). Human safety concern has come to dominate policy and planning in the last decade, with acceptance that this means a greater loss of buildings, livestock, native flora and fauna.

With evacuations in advance of the fire front, an increased 'house to house' fire loss such as in Canberra 2003 is to be expected (Blanchi & Leonard, 2005). With fewer people to extinguish building ignition points, burning embers on combustible decks, sills and doormats can fester to quickly become unstoppable house fires. The influence of fences and garden vegetation to minimise or exacerbate fire attack and spread has come under greater scrutiny recently, but to date has escaped regulation due to the vast extent of variables.

### Mechanisms of bushfire attack

Buildings are damaged and destroyed through five mechanisms of bushfire attack, most often through combinations that cause ignition and burning. Once ignited, there is every likelihood of building loss unless there is human intervention at the critical time.

**Ember attack:** Burning ember attack can occur before, during and after the main fire front has passed through (and sometimes from kilometres away). Embers can ignite a building through direct contact with combustible material; enter through small gaps in the building structure (ie under roof cladding/sheeting); through broken glass (thereby igniting the building from the inside) or from the ignition of materials nearby (ie combustible deck, garden wood mulch, timber fence). Ember attack is the primary cause of house loss (around 80 per cent), with the weakest link often being timber decks and/or verandas, followed by sparks entering into roof cavities, most typically from gutters and at the eaves.

**Radiant heat:** This may arise directly from the fire front or combustion nearby (ie a garage/carport or adjacent house). It may super-heat building components (inside or outside) so they ignite from flammable gases, or from drying the building materials so they become more readily flammable. The greatest bushfire risk to human life and wellbeing is exposure to radiant heat in the open, followed by exposure to radiant heat when trapped within burning buildings.

**Flame contact:** This risk is influenced by the nearby fuel load, slope and fire intensity; hence siting of buildings and combustibility of building materials is crucial, as is avoiding fine fuels (ie garden, mulch) and nearby items (ie decks, fences and buildings) close to the building. Approximately 85 per cent of house losses occur within 100 metres of bushland (Leonard, cited within Victorian Bushfires Royal Commission, 2010b).

**Convective heat:** Hot air from an approaching bushfire pre-heats and dries out both vegetation and buildings, creating hot gases that increase the likelihood of ignition.

**Strong winds:** Bushfire weather is associated with strong/extreme winds. Aside from winds driving ember attack and spotting, the internal/external pressure difference also creates conditions for building failure (ie falling branches, glazing failure, roof dislodgement). And bushfires create their own extreme weather (Victorian Bushfires Royal Commission, 2010a and 2010b).

## Assessing the level of bushfire attack – FDI

As discussed, the FDI is an overall index that approximates the potential fire danger – and it's increasing. The current bushfire regulations (AS 3959:2018) are conservatively based on 2009 FDIs, rather than responding to the higher risk scenario already established (Figure 5). In NSW, the Rural Fire Service (RFS) has sought to raise the FDIs to 100 across the state (except alpine regions).

## Measuring risk – Bushfire Attack Levels (BALs) ratings

From 2009, the Australian Standard AS 3959 *Construction of Buildings in Bushfire-Prone Areas* has adopted six BAL ratings as a means of assessing a building's potential exposure to bushfire attack (Figure 6). The BAL is largely based upon radiant heat flux expressed in kW/m$^2$, with each step representing a higher risk, from 12.5kW/m$^2$ (BAL—12.5) through to 40 kW/m$^2$ (BAL—40).

Up to BAL—29, most common building materials and construction is likely to be acceptable. At BAL—40 the range of acceptable materials and components gets more restrictive and expensive (tested to AS 1530.8.1, although the generic roofing solutions within the AS 3959 Appendices have not been tested but are still accepted).

For development in BAL—FZ (Flame Zone), subject to intense embers, heat, flame and more, all materials and components must be fully fire-tested to AS 1530.8.2 if the building is sited less than ten metres from the edge of classified vegetation. At the time of writing this was an issue, as some jurisdiction's product testing to AS 1530.4 with acceptable FRLs (Fire Resistance Levels) were not deemed comparable or acceptable without submission of an NCC Alternative Solution expert report. The development consequence is restricted choices, significantly higher building costs (especially glazed components), approval delay and considerable uncertainty. This is a serious problem for industry, as regulators minimise their liability.

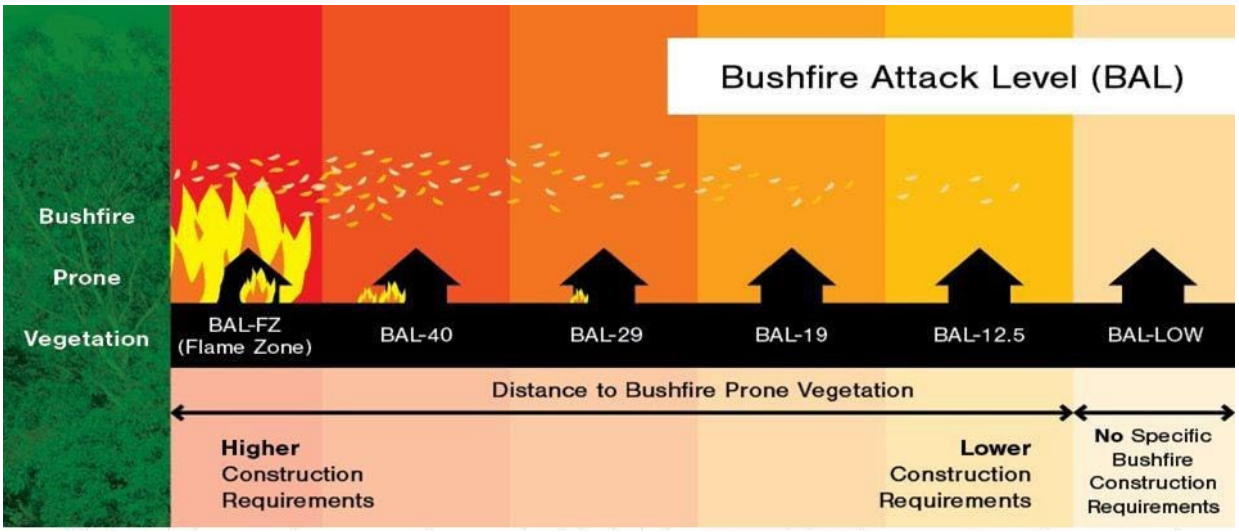


Figure 4. Bushfire Attack Level (BAL) rating (Image courtesy of Skydome Hunter Coast, 2019)

| State / region | FDI |
|---|---|
| **Australian Capital Territory** | 100 |
| **New South Wales** | |
| (a) Greater Hunter, Greater Sydney, Illawarra/Shoalhaven, Far South Coast and Southern Ranges fire weather districts | 100 |
| (b) NSW alpine areas | 50 |
| (c) NSW general (excluding areas named above) | 80 |
| **Northern Territory** | 40 |
| **Queensland** | 40 |
| **South Australia** | 80 |
| **Tasmania** | 50 |
| **Victoria** | |
| (a) Victoria alpine areas | 50 |
| (b) Victoria general (excluding alpine areas) | 100 |
| **Western Australia** | 80 |

Figure 5. Current values for FDI (Source: AS/NZS AS 3959-2018 Table 2.1; © Standards Australia Limited. Copied by Australian Institute of Architects with the permission of Standards Australia and Standards New Zealand under Licence 1910-c014)

| BAL | Description |
|---|---|
| **BAL—LOW** | There is insufficient risk to warrant any specific construction requirements. |
| **BAL—12.5** | There is a risk of ember attack. |
| **BAL—19** | Ember attack plus burning debris ignited by windborne embers, plus radiant heat. |
| **BAL—29** | Increasing levels of ember attack and burning debris ignited by windborne embers, plus increased radiant heat (19 – 29 kW/m$^2$). |
| **BAL—40** | Much increased risk from ember attack and burning debris ignited by windborne embers, plus higher level of radiant heat and some likelihood of direct exposure to flames (29 - 40 kW/m$^2$). |
| **BAL—FZ** (Flame Zone) | Highest risk of ember attack plus direct exposure to heat (> 40 kW/m$^2$) plus flames from the fire front. The standard notes that Authorities may require additional measures, other than construction requirements. |

Figure 6. BAL ratings (Source: AS/NZS AS 3959-2018 Appendix G3 [paraphrased]. © Standards Australia Limited. Copied by Australian Institute of Architects with the permission of Standards Australia and Standards New Zealand under Licence 1910-c014)

### Procedure for making a bushfire attack assessment

There are five steps in making a Method 1 (everyday) assessment within AS 3959:2018. Increasingly, this should be made by trained and accredited bushfire assessors only (Refer Acumen note: Projects in bushfire-prone areas).

1 Determine the Fire Danger Index (FDI)

2 Determine the vegetation classification(s)

3 Determine the distance of the building from classified vegetation

4 Determine the effective slope (which holds the classified vegetation)

5 Determine the BAL rating from AS 3959 charts.

Construction requirements from AS 3959:2018 (plus state variations where relevant) are then applied to the project. All these steps require some specialist knowledge.

Method 2 within AS 3959 uses highly complex formulae and should only be used by appropriately accredited assessors (see note on assessors below). It includes wind speed, more detailed vegetation and fuel load, flame length, flame width, the elevation of the receiver, radiant heat flux, view factor, and atmospheric transmissivity.

### Note on assessors and providing advice

The Australian Institute of Architects strongly recommends that an accredited bushfire-hazard assessor should be engaged, rather than architects providing advice outside their area of expertise and insurance cover (Refer Acumen Practice Note: Projects in bushfire-prone areas, Australian Institute of Architects, 2018). The Fire Protection Association of Australia (FPAA) lists practitioners who have qualified through graduate studies in Bushfire Planning and Design (BPAD) to become accredited bushfire practitioners (note, at different levels of expertise). Practitioners need to be wary of using absolute terms implying bushfire safety, rather than cautioning that a project designed and built to the applicable BAL rating has fire defences built-in to that level. Words like 'fire resistant' are more appropriate than terms such as 'fire-safe', 'fire bunker', 'fire refuge' and the like.

## Regulatory controls

Every state and territory addresses bushfire management somewhat differently – although there is one national Australian Standard AS 3959:2018, which is universally called up within the NCC. The NCC also accepts that the steel-framed NASH *Standard for Steel Framed Construction in Bushfire Areas* meets the Deemed-to-Satisfy requirements.

### AS 3959:2018 *Construction of buildings in bushfire-prone areas*

This revised and updated standard (from 2009) is applicable for all bushfire-affected construction from 1st May 2019, but with some state variations as outlined below.

While the scope of the standard has remained constant over the years, many elements have grown in regulatory complexity including the method of site assessment requirements, vegetation classification, shielding, enhanced requirements for fire testing (to AS 1530 as outlined below), enhanced glazed components, what constitutes approved /excluded materials, and the requirements for fire testing.

### AS 5414—2012 *Bushfire water spray systems*

Commercial and industrial buildings have utilised sprinkler systems (including externally over windows and openings) to AS 2118.4, but systems designed against bushfire attack raise other issues. These include the system design (the technical capability and/or accreditation), operation (manual/automatic), duration, extent/limits of water supply (when reticulated mains have failed), nozzle type location and spacing (with diverging views on this), type of pump (ie petrol, diesel), spray type and location to provide some protection against ember attack plus limited radiant heat flux.

It is significant that there is no regulatory assistance or concession for installing a complying system (ie dropping one BAL level as for shielding within AS 3959). The scope of the standard also specifically states that it's applicable only up to BAL—19 (< 19 kW/m$^2$). Consequently, this standard is of reduced utility. Nevertheless, installation of a suitable water spray system remains a practical retrofit solution to enhance bushfire safety.

## *Performance Standard for Private Bushfire Shelters 2014*

The Australian Building Codes Board determined that this would become an advisory document, rather than a mandated standard. While the risk mitigation of a properly designed and built shelter was recognised, the fire variables were deemed too great to provide more than advice. It requires that a fire engineer certify such structures as an Alternative Solution under the NCC to address the following summarised criteria (Figure 7).

At the time of writing, there were very few ready-made or prefabricated private bush fire shelter options on the market due to cost, difficulties of construction and approval, plus questions of ongoing liabilities. However, Victoria has accepted conforming shelters if written into ongoing property and maintenance agreements, giving a one-step reduction in the BAL rating requirements for the dwelling.

## NASH Standard *Steel Framed Construction in Bushfire Areas 2014*

The National Association of Steel-Framed Housing (NASH) provided research evidence and fire engineering principles to justify NCC/BCA acceptance as an equal solution to that of AS 3959. This standard can be used for all BAL levels up to BAL—FZ.

The key difference to all other approaches is that it requires fully non-combustible construction with all steel framing (underfloor, floor, walls and roof) that conforms to *NASH Standard for Residential and Low-Rise Steel Framing, Part 1: Design Criteria,* or *Part 2: Design Solutions*. It, therefore, permits any non-combustible claddings and linings on the basis that any fire embers will not cause ignitions due to the steel framing.

| Design component | Acceptance criteria |
|---|---|
| **Location** | Distance to the dwelling, boundaries, adjacent structures and other fuel sources. |
| **Access from the dwelling to the shelter** | Travel distance, maximum 20 metres. |
| **Access pathway between the dwelling and the shelter** | Pathway to be unobstructed, non-combustible, one-metre wide and not a hazard to travel. |
| **Provision of tenable conditions within a shelter** | A minimum 60 minutes occupation, with minimum heights and volume per person, a tenable interior environment (temperature, plus interior surface temperature), minimum air toxicity (off-gassing), smoke sealing and ventilation. |
| **External envelope** | Construction materials, structural design, size of openings, acceptable bushfire test regimes. |
| **Access doors or hatches** | Size, width and test regimes for access doors or ladders, plus maintenance of access/egress after a fire. |
| **Signage** | Specified size and wording of signage outside and in. |
| **Capacity to assess external conditions** | Specified maximum and minimum size of viewing window. |
| **Maintenance** | A maintenance manual is mandated. |

Figure 7. Acceptance Criteria summary (in part) from Table 2.4 of the *Performance Standard for Private Bushfire Shelters* (ABCB, 2012)

# State and territory bushfire requirements

Under Australia's emergency management arrangements, state and territory organisations are the primary agencies responsible for bushfire safety. The degree of development integration (or otherwise) varies enormously. The information below gives a brief overview of the varying approaches between states and territories at the time of writing.

## Australian Capital Territory (ACT)

Being 'the bush capital of Australia', nearly a quarter of all Canberra's housing is within a defined Bushfire Prone Area (BPA), along with all rural ACT. At the time of writing, the ACT Emergency Services Agency stated that government was considering mandating that all buildings within a BPA must conform to AS 3959 requirements, rather than just the rural housing standard.

Usefully, the ACT Government (Advisory Note 1601) has mapped all bushfire-affected suburbs and provided every property with a BAL rating upfront. The Territory Code contains this information within the Single Dwelling Housing Development Code and Precinct Maps and Codes. Following that, the application of construction requirements from AS 3959:2018 applies. Since the lessons from the many 'house-to-house' fires in the 2003 Canberra bushfires, there are now specific warnings about facing gas bottle pressure-relief valves and meters away from combustibles, plus vegetation clearance requirements.

## New South Wales (NSW)

Development within NSW has been primarily controlled by the NSW Rural Fire Service whose regulatory requirements are more onerous and comprehensive than those of AS 3959:2018. The draft 2019 *Planning for Bush Fire Protection* has widened its remit to bushfire planning controls over Special Fire Protection Purpose development (being schools, hospitals, aged care and tourist accommodation etc), plus bushfire-planning controls on commercial, industrial, tertiary institutions (Class 5 to 8) and assembly buildings (Class 9). Multistorey buildings, strategic planning and master-planning are captured within the broad remit on a case-by-case basis plan.

Intensification of residential use is not accepted for properties past BAL—29, precluding many property options and severely limiting many proposed developments in bushfire-prone areas. Garages and carports within six metres of a dwelling must be constructed in accordance with the NCC and AS 3959.

While private bushfire shelters may be accepted if certified by 'an appropriately qualified practitioner' (such as a fire engineer), they are not accepted as an alternative to full building compliance with AS 3959.

Accredited bushfire practitioners (and their clients) complain about the lack of certainty regarding the RFS overview, in that many consultants' bushfire-attack assessments are overruled. While local government is obliged to forward all development applications past BAL—29 to the RFS for comment (with no timetable), councils deal with compliance. As a result, in higher BAL situations, many applications are caught between jurisdictions, experts, interpretations and construction matters – all with significant costs.

## Northern Territory (NT)

Bushfires and grassfires are common across the NT, but typically in sparsely settled areas with limited water supplies. Hence, bushfire-management responsibilities are split between the property owners and the NT Fire and Rescue Service. From November 2016 the *Bushfires Management Act* provides a response to mitigation management and suppression of bushfires outside of the Emergency Response Area of cities and towns. Total fire bans exist all year round for Darwin and nearby, plus within a 50km radius of Tenant Creek, Katherine and Alice Springs. The relevant jurisdiction assesses the risk of bushfires across large swathes of grassland and savannah, but this does not extend to specific planning and construction controls for housing (or other building typologies).

## Queensland

New controls were introduced following the 2018 State Planning Authority's Natural Hazards, Risk and Resilience – Bushfire State Interest guidance material and the QFES draft Planning for Bushfire Resilient Communities technical document. The newly developed state methodology (Leonard et al, 2014) arises from highly detailed vegetation mapping, plus a methodology that informs bushfire mitigation and preparation actions across the state.

Brisbane City Council has retained the previous system where designated bushfire-prone areas require a Bushfire Management Plan and a site-specific Bushfire Hazard Assessment. The Hazard Assessment uses a weighting scorecard around vegetation type/proximity, slope and aspect, to determine whether the risk is high, medium or less – plus a required separation distance of 100 metres from the edge of the asset to the vegetation hazard.

## South Australia (SA)

Current SA bushfire mapping has three grades: high, medium and low. Proposals to develop property within high-bushfire-risk areas are assessed against the bushfire-protection planning provisions of the relevant local area development plan, including a referral to the Country Fire Service. All new dwellings or tourist accommodation are assessed for compliance with having a dedicated water supply (22,000L), enclosure between ground and floor, be setback 20 metres from combustible vegetation, be located to minimise risk, and have acceptable roads and tracks for fire fighting vehicles. The SA Country Fire Service Development Assessment team has two sections: Residential and Commercial (for development > 500m$^2$).

In addition, new buildings are assessed against the provisions of the building regulations including the Ministers Specification to ensure they are designed and constructed to provide protection ranging from sparks and embers up to direct flame contact. This requires a site assessment in accordance with AS 3959.

## Tasmania

The Tasmanian Planning Scheme Local Provision Schedules includes bushfire mapping. The Tasmanian Fire Service (TFS) enacts Part 5 of the Building Regulations 2016. This calls up Director's Determination – Requirements for Building in Bushfire-Prone Areas, which then references AS 3959. A Bushfire Hazard Management Plan approval is required for all affected property developments, prior to building approval. Mapping updates were completed in 2018, with the TFS seeking greater separation from the bushfire hazard than previously.

Of particular note is the advice that the risk of failure with BAL—40 or BAL—FZ construction is regarded as so high that the TFS will not generally support approval without a thorough risk analysis provided and accepted. This is at variance with the NCC which deems that compliance with AS 3959 is satisfactory in mitigating bushfire risk for construction.

## Victoria

The Victorian Bushfire Royal Commission (2009 - 2010) recommendations led to the Integrated Planning and Building Framework for Bushfire in Victoria. This prioritises human life over other policy provisions through Planning Scheme Amendments VC83. Bushfire information is available through mapping and area reports regarding the hazard, plus Advisory Notes, a Bushfire Information Hotline and guidelines from the Victorian Country Fire Authority (CFA).

Where applicable, the Bushfire Management Overlay (BMO) to a Planning Scheme requires a statement of bushfire management objectives plus details when the requirements apply. BMO permits are required to subdivide land, dwellings and higher-risk development types. Building permits must include compliance with all bushfire-protection measures. Victoria has produced the only comprehensive guide to landscaping in bushfire-prone areas, the CFA's Planning for Bushfire Victoria: guidelines for meeting Victoria's bushfire planning requirements, 2012.

Planning and building requirements include bushfire-hazard assessments in accordance with AS 3959, to broaden landscape assessments of the locality to more than 150 metres from the site. A bushfire-management statement is required to explain how the development meets the planning requirements. Vegetation management must now conform to the 10/30 rule for dwellings built before September 2009, and 10/50 rule since (the ability to remove/destroy/lop trees within 10 metres and fuel reduce native vegetation the further distance 'as of right' within the property).

## Western Australia (WA)

From late 2016, State Planning Policy 3.7 Planning in Bushfire Prone Areas (SPP 3.7) directs how land use should address bushfire risk management in WA. It applies to all land that has been designated as bushfire prone by the Fire and Emergency Services Commissioner as highlighted on the Map of Bush Fire Prone Areas. Updated building regulations followed the planning.

Generally, if the land area is less than 1,100 m$^2$ and/or less than BAL—40, then Development Approval (DA) is not required in many areas. Where a DA is required and is within a bushfire-mapped area, it will need to address the bushfire-protection criteria in the Guidelines for Planning in Bushfire Prone Areas (which aims to reduce the risk to BAL—29 or less). The BAL rating construction standards as set out in AS 3959 then applies.

BAL assessments are required for mixed-use commercial, industrial and public buildings (Class 4 to 9) in mapped bushfire-prone areas, to include a Bushfire Management Plan. WA Planning Commission Fact Sheets (January 2016) suggest that DAs in areas of BAL—40 or BAL—FZ will not be supported in most instances. Irrespective, high-risk land uses have additional requirements such as emergency management and evacuation procedures.

# Conclusion

There is no doubt that planning for bushfire-prone development is firmly on the national agenda. With climate change impacts leading to enhanced bushfire weather, a broader range of planning and building types (ie. Class 1 to 9) are being regulated for bushfire risk across a number of jurisdictions. Individual property owners face the increased construction cost and regulatory burden – including enhanced controls.

Bushfire assessment is required at the earliest stages of feasibility, planning and design by trained assessors. BAL—Flame Zone development is especially difficult, expensive and contentious, with some moves to effectively sterilise that land without compensation. Hence proximity to unmanaged native vegetation on slopes will dominate development opportunities. Development considerations present only one aspect of mitigation required to be addressed for construction in bushfire-prone areas. Designing and planning on bushfire-prone land is becoming increasingly challenging, testing our professional, financial, emotional and cultural connections to this land.

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# About the Author

## Nigel Bell

Nigel Bell is principal of *ECOdesign Architects + Consultants* based in Katoomba, NSW. Living and working in the Blue Mountains World Heritage (bushland) area has honed his awareness, knowledge and design practice around sustainability and bushfire over decades. He's taught at universities, TAFE and community level, and is active in many bushfire-related matters.

Following the 2009 Black Saturday bushfires, Nigel facilitated the community recovery in Marysville and district (visioning, design charrette) and assisted bushfire recovery following the Springwood / Winmalee bushfires in 2013.

Nigel has served as a NSW Chapter Councillor, on the NSW Architects Registration Board, is an Al Gore trained 'Climate Reality Leader', has lead bushfire recovery tours, and represented the Australian Institute of Architects on all three bushfire Australian Standards. He is co-author of a forthcoming book on bushfire design.





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