BUSHFIRE PROTECTION ASSESSMENT

Proposed Comprehensive Cancer Care Centre

Shoalhaven District Memorial Hospital, Scenic Drive, Nowra

Prepared for
Health Infrastructure – Shoalhaven Comprehensive Cancer Centre

7 June 2011

Bushfire Protection Assessment

Proposed Comprehensive Cancer Care Centre:

Shoalhaven District Memorial Hospital, Scenic Drive, Nowra

PREPARED FOR	**Health Infrastructure - Shoalhaven Comprehensive Cancer Centre**
PROJECT NO	**10SGBBUS-0129**
DATE	**June 2011**

DOCUMENT TRACKING

ITEM	DETAIL
Project Name	Bushfire Protection Assessment, Proposed Comprehensive Cancer Care Centre, Shoalhaven District Memorial Hospital, Scenic Drive, Nowra
Project Number	10SGBBUS-0129
File location	\\ecosgb01\synergy\Projects\10SGBBUS\10SGBBUS-0129 Shoalhaven Comprehensive Cancer Centre\Report\Final Reports\10SGBBUS-0129 FINAL BPA Shoalhaven Comprehensive Cancer Care Centre, Nowra v2 110607.doc
Prepared by	Susan Courtney
Reviewed by	Rod Rose
Approved by	 Rod Rose
Status	FINAL
Version Number	2
Last saved on	7 June 2011

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Johnstaff Projects Pty Ltd.

Contents

List of Figures

List of Tables

1 Property and proposal

1.1 BACKGROUND

The Shoalhaven Comprehensive Cancer Care Centre (SCCC) is being developed under Part 3A of the *Environmental Planning and Assessment Act 1979* and will require approval from the Director-General of the NSW Department of Planning (DoP).

NSW Health has identified the South Coast as geographic area of high priority for expansion of radiotherapy services. In recognition of this identified need, NSW Health completed an application in November 2009 and was successful in achieving capital funding under the Commonwealth Health and Hospital Fund – Regional Cancer Centres Initiative.

The population catchment for SCCC includes Nowra and the Shoalhaven region, Wollongong, Shellharbour, Kiama and the Eurobodalla Shire.

The new Regional Cancer Centre at Shoalhaven broadly comprises the following:

- integrated multidisciplinary cancer care with bunkers, linear accelerators and associated equipment to deliver radiotherapy;
- co-located ambulatory services providing multidisciplinary clinics, allowing patients to have their treatment program planned in one visit with increased access to medical oncology; radiation therapy (for both treatment and palliation); allied health; and support services;
- 8 additional chemotherapy treatment spaces (an increase from 6 to 14 treatment spaces);
- clinical trial facilities;
- cancer patient information and support services;
- a service delivery hub for locally delivered and rural outreach cancer control and support services;
- referral networks and support throughout SESIAHS and Greater Southern Area Health Service and General Practice to deliver safe and appropriate care that is patient centred in its principles;
- teaching and research facilities;
- clinical offices;
- scope for further service expansion as population demand requires (2nd linear accelerator and additional chemotherapy chairs); and
- car parking and accommodation.

1.2 LOCATION AND DESCRIPTION OF SUBJECT LAND

The preferred site that has been selected for the proposed SCCC is Lot 7300 DP 1132679 Scenic Drive, Nowra, and is Crown Land under the care and control of Shoalhaven City Council (see Figure 1). The SCCC site is proposed to be located in the south-western portion of the site which is currently known as Nowra Park (see Figure 2).

The SCCC will become part of the Shoalhaven District Memorial Hospital to the north and will be linked via a walkway on the eastern side of the facility adjoining Nowra Park (see Figure 3).

The site was selected primarily based because of the following advantages:

- it adjoins Shoalhaven District Memorial Hospital (SDMH) to the north;
- it's a 'greenfield' site;
- there are extensive water/bushland views to the west and parkland views to the east of the site;
- it allows for a stand-alone facility requiring minimal alterations to the existing SDMH; and
- the site provides simple staging/growth possibilities.

The only bush fire prone vegetation within 140 m of the proposed SCCC is a narrow band of disjointed dry sclerophyll forest/eastern riverine forest between Scenic Drive and the Shoalhaven River to the east. This vegetation is sparse and is scattered along the base and the top of a large sandstone cliff.

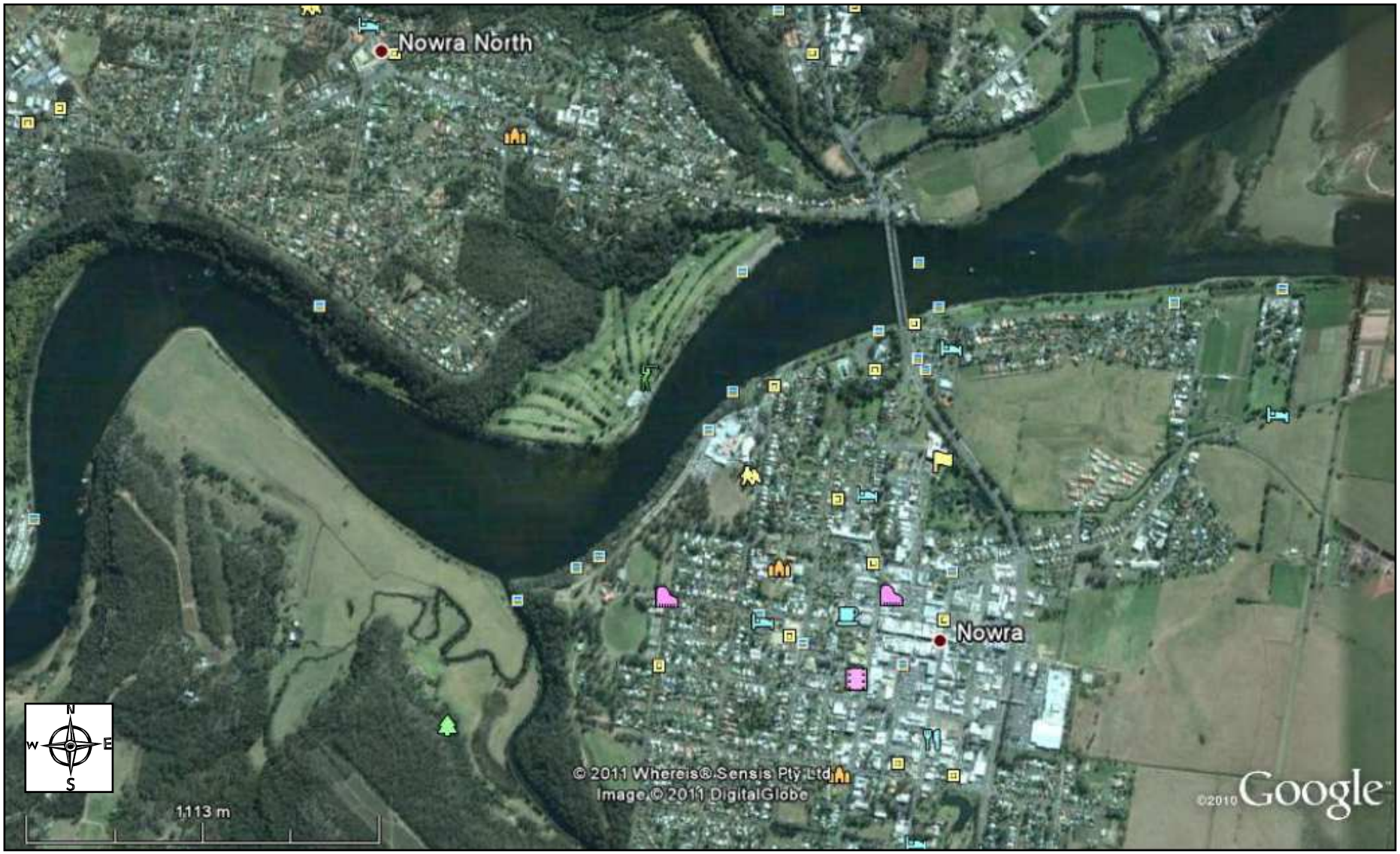


Figure 1: Aerial photograph showing location of subject land in Nowra

Figure 2: Aerial photograph showing SDMH and SCCC site in more detail

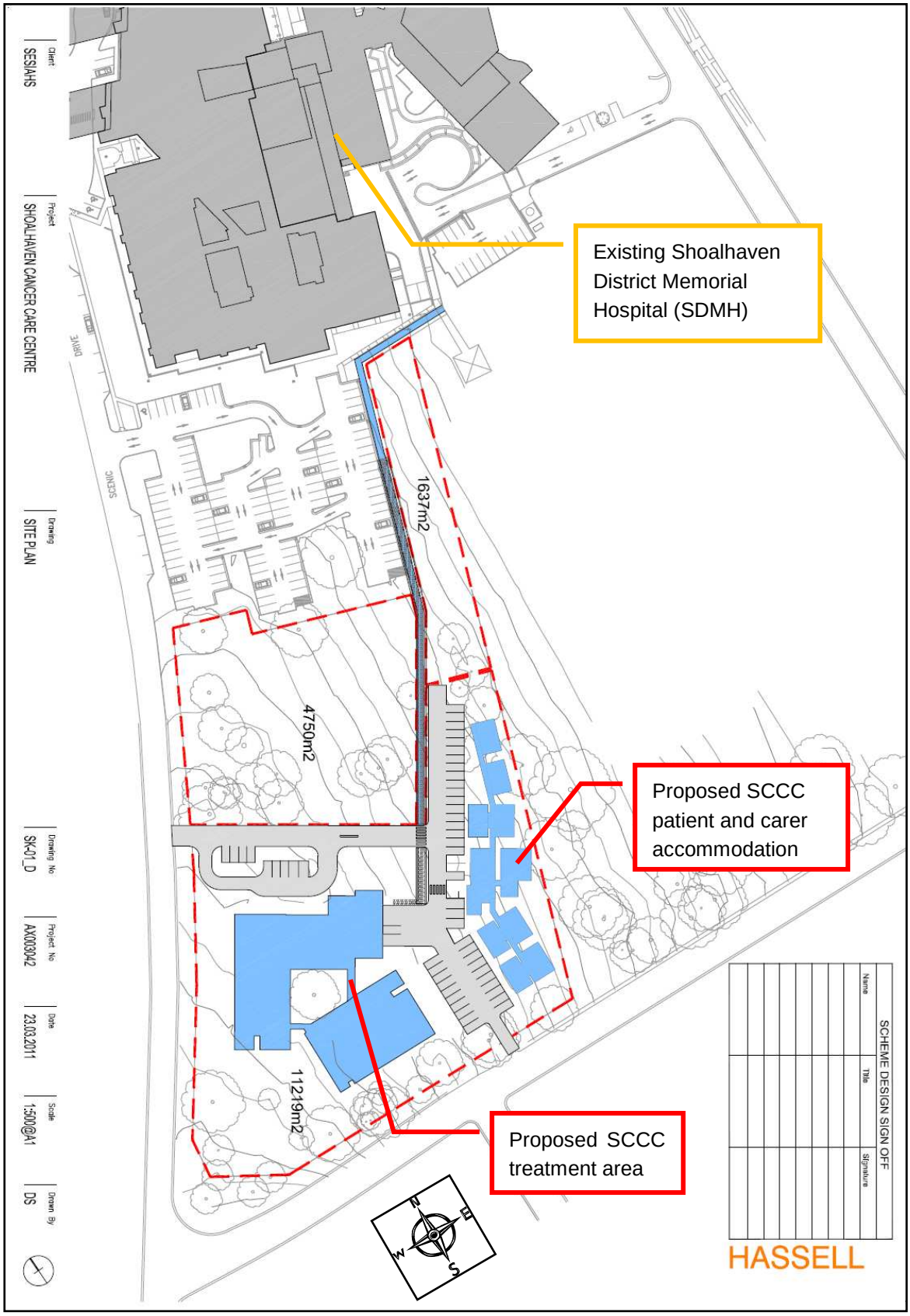


Figure 3: Proposed SCCC layout

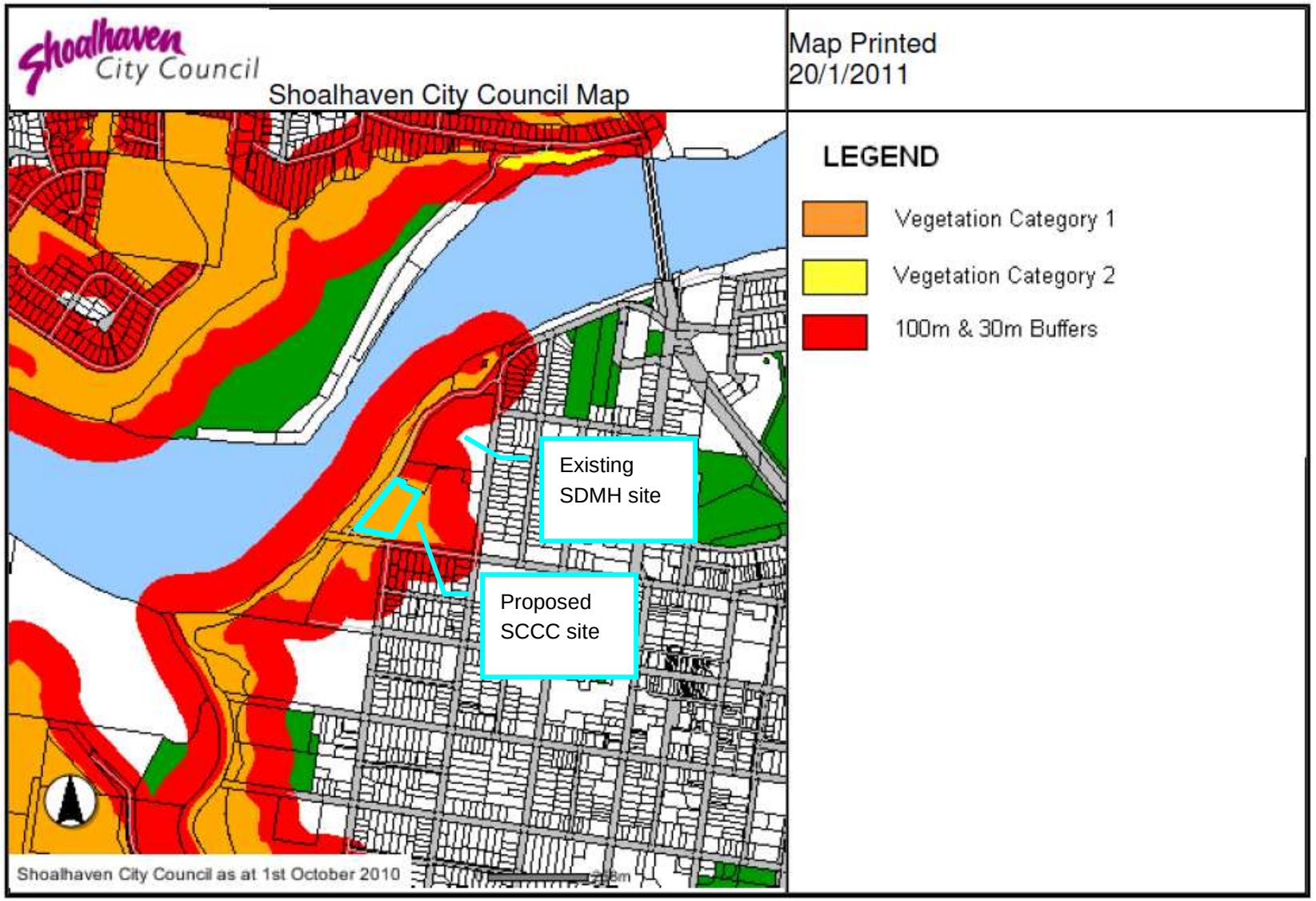


Figure 4: Excerpt of Shoalhaven Bush Fire Prone Land Map

2 Planning framework

2.1 LEGISLATION

2.1.1 *Environmental Planning and Assessment Act 1979* (EPA Act)

The concept plan for the SDBP development has received initial approval from the Minister for Planning under Part 3A of the EP&A Act. However, the Minister for Planning has requested further information in relation to the proposed development including information on any bushfire implications.

2.1.2 Rural Fires Act 2007 (RF Act) and *Rural Fires Regulation 2008* (RF Regulation)

The RF Act and its associated RF Regulation provide the legislative framework for bushfire planning, mitigation and suppression in NSW. The RF Act defines Bush Fire Prone Land and outlines the requirements for a Bush Fire Safety Authority for integrated development. The RF Act also defines 'Special Fire Protection Purpose' (SFPP) development (discussed in more detail in the ensuing section) and the RF Regulation prescribes those types of development that are classified as SFPP development.

2.1.3 'Planning for Bush Fire Protection' 2006

The document 'Planning for Bush Fire Protection 2006' (PBP) clarifies the role and responsibilities of councils, developers and land owners. PBP (and various RFS published Fast Facts) outline the most current standards for bushfire protection for built assets applicable in NSW and provides standards that will guide the proposed development in relation to:

- access to and from the property for evacuation and fire fighting;
- the provision of an adequate water supply for fire fighting;
- building setbacks, including the provision of 'Asset Protection Zones';
- design, staging and siting of the development; and
- building construction standards.

Under PBP, the proposed SCCC development is classified in two ways:

(i) Special Fire Protection Purpose Development; and

(ii) Infill Development.

2.1.3.1 General comment on SFPP development

PBP outlines the specific objectives that must be achieved for both residential development and Special Fire Protection Purpose (SFPP) development. Development is considered SFPP where the development includes one of the following:

- *a school;*

- *a child care centre;*
- *a hospital (including a hospital for the mentally ill or mentally disordered);*
- *a hotel, motel or other tourist accommodation;*
- *a building wholly or principally used as a home or other establishment for mentally incapacitated persons;*
- *housing for older people or people with disabilities within the meaning of State Environmental Planning Policy No 5— housing for Older People or People with a Disability (now SEPP (Seniors Living));*
- *a group home within the meaning of State Environmental Planning Policy No 9— Group Homes;*
- *a retirement village; or*
- *any other purpose prescribed by the regulations.*

The nature of SFPPs is such that the occupants may be more vulnerable to bushfire attack for a variety of reasons including a reduced capacity to evaluate risk and to respond to the bush fire threat, and the fact that the logistical arrangements for the numbers of occupants may be complicated. In particular, the SCCC may accommodate a number of patients/carers who are not familiar with the local area and who do not have a good understanding of bushfire behaviour and some of the patients may be frail. Consequently, SFPPs need to meet a more stringent set of bushfire protection requirements than residential development.

2.1.3.2 General comment on Infill development

PBP defines infill development as

> *the development of land by the erection of or addition to a residential building (or buildings) which does not require the spatial extension of services including public roads, electricity, water or sewerage and is within an existing allotment* (RFS 2006, p. 42).

While the SDMH and SCCC are not residential developments, the RFS accept SFPP development as infill where the above applies (RFS 2006, Section 4.2.5. p. 30).

In the case of the proposed SCCC, it is an addition to the existing SDMH that will be linked via a walkway on the eastern side of the site and does not require the spatial extension of public roads, electricity, water or sewerage as these are already provided to the proposed site.

2.2 RELEVANT ENVIRONMENTAL PLANNING INSTRUMENTS

2.2.1 State Environmental Planning Policy (Major Projects) 2005

State Environmental Planning Policy (Major Projects) 2005 outlines the types of development declared to be a Major Project for the purposes of Part 3A of the EP&A Act. Part 3A provides for an integrated assessment of major development including the consideration of bush fire risk.

PBP should be consulted when selecting sites for development and during environmental assessments of proposed development (RFS 2006).

2.2.2 Shoalhaven Local Environmental Plan 1995 (MLEP)

The study area falls within the Shoalhaven Local Environmental Plan 1995 (Shoalhaven LEP) on land zoned 6 (a) (Open Space Recreation "A" (Existing) Zone). The primary objectives of this zone are to identify land where existing recreation facilities for the general use of the community are provided.

2.3 OTHER PLANNING CONSIDERATIONS

2.3.1 Australian Standard 3959-2009 'Construction of buildings in bushfire-prone areas' (AS 3959-2009)

In conjunction with PBP, AS 3959-2009 provides the basis for site specific bushfire attack assessment in NSW (Standards Australia, 2009). AS 3959-2009 also specifies the requirements for building construction in bush fire prone areas to improve building resistance to bushfire attack from burning embers, radiant heat and flame contact.

2.3.2 Shoalhaven Bushfire Risk Management Plan 2010 (BFRMP)

The Shoalhaven BFRMP forms the basis for bushfire risk management in Nowra region where the proposed SCCC site is located (Shoalhaven City Council 2010). The BFRMP has no specific requirements for the study area and it has no requirements to be specifically considered in a development application.

2.3.3 NSW Rural Fire Service policy documents

The NSW RFS prepare various policy documents to clarify and add to that required by PBP including Development Control Practices Notes, Development Control Notes and Fast Facts. Each of the policies may have some relevance to the specific approach taken for the development and as such have been considered in the preparation of this assessment.

2.3.4 Endangered Species, Populations and Ecological Communities

A Flora and Fauna Assessment (FFA) of the proposed SCCC development was prepared by LesryK Environmental Consultants in August 2010 (LesryK 2010). The FFA determined that the proposed development would not have a significant impact on any endangered species, populations or ecological communities.

The vegetation removal required to accommodate the footprint of the SCCC development will also create the required APZ for the proposed development and no additional vegetation removal will be required to establish APZs for the proposed SCCC.

The FFA determined that there were no known significant environmental features, threatened species or Aboriginal relics identified under the *Threatened Species Conservation Act 1995* or the *National Parks Act 1974* that will affect or be affected by the bushfire protection proposals in this report.

2.4 SUMMARY

The final approval of the proposed SCCC by the NSW Minster for Planning requires further information on the potential bushfire threat and relevant bushfire protection measures. Consequently, the infill SFPP development proposed within the subject site has been assessed using the requirements of 'Planning for Bush Fire Protection 2006' and AS 3959-2009 'Construction of buildings in bushfire-prone areas'.

The subject land is identified as Bush Fire Prone Land by Shoalhaven City Council as shown in Figure 4. The following assessment is prepared in accordance with Section 100B of the *Rural Fires Act 1997*, Clause 44 of the *Rural Fires Regulation 2008*, and 'Planning for Bushfire Protection 2006' (RFS 2006) herein referred to as PBP.

3 Bushfire risk and threat assessment

Figure 4 shows that the entire proposed SCCC site is mapped as Bush Fire Prone Land. However, there are some inaccuracies in this BFPL Map that have apparently resulted from a lack of ground truthing and a city-wide over approach. These inaccuracies will be discussed in more detail in subsequent sections of this report.

3.1 VEGETATION

PBP requires the 'predominant vegetation' occurring up to 140 m from a proposed development to be determined in all directions.

It also states that 'where a mix of vegetation types exist the type providing the greater hazard is said to predominate' *i.e.* to be used in determining the bushfire protection measures required.

As shown in Figure 4, there are two areas of vegetation mapped as bush fire prone vegetation within 140 m of the proposed SCCC.

Within and immediately adjacent the proposed SCCC site, there are small remnants of dry sclerophyll forest within Nowra Park. These remnants are small and discontinuous with significant areas of grassland between them that are regularly slashed as part of the maintenance of Nowra Park.

The construction of the SCCC site will remove all areas of unmanaged vegetation from this area with the remaining Park to be regularly maintained. Consequently, no bush fire prone vegetation will remain to the east of Scenic Drive and this vegetation has been discounted for the purpose of this assessment.

The only remaining bush fire prone vegetation within 140 m of the proposed SCCC is a narrow band of dry sclerophyll forest and Eastern Riverine Forest along the cliff line to the north-west on the opposite side of Scenic Drive on the bank of the Shoalhaven River (see Photograph 1 overleaf and Photographs 2-9 on pages 25-26).

Photo 1: View of low hazard vegetation along cliff line to the north-west of the proposed SCCC from the Shoalhaven River showing large boulders and sheer cliff faces – orange arrow shows approximate location of existing Shoalhaven Hospital and red arrow shows approximate location of proposed SCCC.

The vegetation is classified as 'low hazard' vegetation using the provision on page 52 of PBP (RFS 2006). Low hazard vegetation uses rainforest setbacks and construction standards as a surrogate for the reduced fire behaviour expected from small and/or narrow areas of vegetation. The 'low hazard' rating is justified by the following:

1. The narrow width of the vegetated corridor (≤ 40 m);
2. Fuel loads are reduced by approximately 70% due to large rock boulders and bare rock cliff faces occupy approximately 70% of the ground cover below the subject land (see Photographs 1-9);
3. A crown fire is not able to develop on the site due to the sheer vertical cliff face, high percentage of rock cover, minimal ground and shrub cover and narrow width of this riparian vegetation (see Photographs 1-9);
4. Widespread higher intensity bushfire will not occur in the locality due to the narrow width of vegetation, extensive areas of rock and bare ground within that vegetation and the fact that it is surrounded by the Shoalhaven River to the north-west and existing residential development in all other directions;

The only area of any continuity of vegetation near the proposed SCCC development is between the top of the cliff line above the river and Scenic Drive; this vegetation is no more than 15 m wide and it also has a high percentage of rock cover..

In all other directions from the proposed SCCC development, there are managed lands in the form of the existing SDMH to the north, Nowra Park to the east and Nowra Showground to the south.

3.2 SLOPE

PBP (p. 50) defines the 'effective slope' as 'that slope within the hazard which most significantly affects fire behaviour of the site having regard to the vegetation class found'. The effective slopes are classified within five slope classes, one being flat/upslope and four being down.

The large, sheer cliff line and associated boulders within the narrow band of vegetation to the north-west of the proposed SCCC has a significant effect on the 'effective slope' that influences fire behaviour within this vegetation.

There are downslopes of <5 degrees at both the base of the cliff into the Shoalhaven River (with only a few metres of vegetation cover); and at the top of the cliff line adjacent Scenic Drive (with vegetation up to 15 m wide). Between these two vegetated slopes is a sheer, vertical (and in many areas overhanging), bare rock cliff face (see Photographs 1-9).

Therefore this assessment concludes that the slope most affecting fire behaviour in the low hazard vegetation to the north-west of the proposed SCCC are 'downslope >0-5 degrees'. The predominant vegetation is located at the top of the cliff on 3^{o} downslopes.

3.3 BUSHFIRE DAMAGE POTENTIAL

Life may be threatened directly by bushfire through flame contact, radiant heat and smoke, and indirectly through inappropriate evacuation procedures, the effects of wind, increased stress and dehydration *etc*. With regard to built assets the most obvious threat is the impact from flame contact, wind, radiant heat, smoke and burning debris and this may affect buildings and infrastructure.

Research has shown that ember attack is responsible for most bushfire related house fires (Barrow, 1945 and Ramsay et al, 1996). However strong winds generated by severe bushfires may drive embers into vulnerable areas of a building, preheat and dry fuels ahead of a fire, lift roofing, damage windows, and extend flames along a more horizontal plane closer to building elements. Embers can cause spotting well in advance of a bushfire and provide piloted ignition to building elements. Radiant heat can impair fire fighting operations, the health of building occupants, and the integrity of building elements. Flames potentially restrict fire fighting operations, provide piloted ignition to building elements and threaten the health of residents and their capacity to evacuate the area (RFS 2006).

The low hazard vegetation to the north-west of the proposed SCCC has some potential to adversely impact life and property within the proposed development. Therefore, bushfire protection measures should be implemented to prevent flame contact, reduce radiant heat to below ignition thresholds for various elements of a building, to minimise the potential for embers to cause ignition, and to facilitate fire suppression and evacuation operations in the event of a bushfire. Section 5 of this report provides bushfire protection measures which achieve a reduction of the bushfire risk to a level consistent with PBP (and therefore accepted best practice in NSW).

3.4 RESIDUAL RISK

For the study area, residual risk is defined as the bushfire risk that remains after the development has been constructed and the implementation of its bushfire protection measures (Section 5) such as asset protection zones and appropriate building construction standards.

Although residual risk can be further reduced through provision of effective fire response, provision of water supplies, and access for fire fighting purposes, some bushfire risk to life and property will remain and despite the provision of best practice risk reduction measures, bushfires will continue to threaten life and property to some extent. It is not possible to totally eliminate the bushfire risk that exists on bushfire prone land, unless extensive areas are totally cleared/developed to the detriment of the

surrounding environment. However, it is envisaged that the bushfire protection measures proposed in Section 5 will reduce the residual risk to a low and acceptable level for the proposed development.

4 Bushfire Protection Measures

4.1 ASSET PROTECTION ZONES (APZ)

4.1.1 APZ dimensions

The 'NBC Bushfire Attack Assessor V2.0' (BFAA) has been used to determine the width of Asset Protection Zones (APZ) for the proposed SCCC. The BFAA has been utilised instead of PBP as it allows a more detailed analysis based on actual slope in degrees rather than slope categories and it also allows the manipulation of other parameters such as fuel loads to allow a more accurate determination of APZ for this unique site.

The following measurements were utilised in the BFAA APZ calculation:

1. Fire Danger Index – 100 for Illawarra/Shoalhaven Fire Weather Area;
2. Vegetation type – rainforest (as a surrogate for the low hazard vegetation);
3. Vegetation slope – downslope 3 degrees;
4. Site slope – 0 degrees (the site is actually slightly downslope in the opposite direction to the vegetation below the crest of the hill, but 0 has been used for a conservative approach);
5. Fuel loads – have been conservatively left unchanged when in reality, the high percentage of rock cover (70%) is likely to result in lower than expected available fuel loads in the narrow band of vegetation to the north-west of the proposed SCCC;
6. Flame width – 25 m has been used instead of 100 m; modelling has shown that the width of a fire approaching the proposed SCCC along the low hazard vegetation is likely to be in the vicinity of 15 m wide which reflects the maximum width of the band of vegetation at the top of the cliff face, but 25 m has been used as a conservative value.

The maximum radiant heat level permitted for SFPP development is 10 kW/m^2 which is an intensity at which people can safely move around outdoors. This allows for the safe assisted evacuation of the occupants of the SFPP development.

Consequently, the minimum APZ required for the proposed SCCC development is 25 m as outlined in the SFPP APZ report in Appendix1. The proposed SCCC is to have a minimum APZ of 27 m – the first 15 m will be within the setback from Scenic Drive within the subject land and the remaining 12 m will be located within the tarred road surface and adjoining concrete footpaths within the Scenic Drive road reserve. This exceeds the minimum APZ of 25 m as calculated by the BFAA and complies with the requirements of PBP.

Table 1: Threat assessment, APZ and category of bushfire attack

Direction from envelope	Slope[1]	Vegetation[2]	BFAA required APZ[3]	Proposed APZ	AS3959 Construction Standard[4]	Comment
North-west	>0-5° downslope (4°)	Low hazard vegetation (rainforest)	25 m	27 m	BAL-12.5	15 m of APZ to be created within SCCC site; remainder is in place within Scenic Drive road reserve
All other directions	Managed lands					

[1] Slope most significantly influencing the fire behaviour of the site having regard to vegetation found. Slope classes are according to PBP.

[2] Predominant vegetation is identified, according to PBP and *"Where a mix of vegetation types exist the type providing the greater hazard is said to be predominate".*

[3] Assessment according to the Bush Fire Attack Assessor (v1.4.2), see Appendix 1 for reports.

[4] Assessment according to the Bush Fire Attack Assessor (v1.4.2), see Appendix 1 for reports.

4.1.2 APZ Maintenance Requirements

4.1.2.1 APZ maintenance requirements and principles applying to all portions of the APZ

The portion of the APZ within Scenic Drive is already in place in the form of the tarred road surface and the concrete footpaths either side. The portion of the proposed APZ within the SCCC site will be created by the vegetation clearance required to construct the proposed facility and no further vegetation clearance or tree removal is required to support the proposed development.

The following requirements apply to all portions of the proposed APZ and will help guide landscaping design and management:

- Annual audit by a BPAD certified bushfire consultant is required to verify the buildings and APZ are complaint, prior to August each year;
- Measures to be put in place to ensure ongoing (at least annual) maintenance is carried out prior to August each year;
- Develop appropriate treatments in proximity to critical (susceptible) building elements e.g. windows;
- Utilise clumps rather than rows, unless the rows run parallel to the building line;
- Restrict ground fine fuel loads to <4 tonnes/ha. Trees are excluded from this, as are tall shrubs. Branches can be pruned up to 2 m above ground level;
- Adequate spacing should be provided to critical building elements (windows, doors etc). Where in proximity to critical building elements the design should utilise lower density plantings, lower heights and non-combustible mulches;

- Careful species selection such as native species, avoidance of rough barked species and avoidance of shrub (or other) species with high levels of fine fuel. Species selection should also consider the following vegetation attributes:
    - Moisture content of leaves;
    - Volatile oil content of leaves;
    - Mineral content of leaves;
    - Leaf fineness;
    - Density of foliage;
    - Continuity of plant form;
    - Height of lowest foliage above ground;
    - Size of plant;
    - Dead foliage on the plant.

4.1.2.2 Inner Protection Area between the SCCC outer building line and Scenic Drive

Fuel management within this IPA is to be as follows:

- No tree or tree canopy is to occur within 2 m of any building roofline
- The presence of a few shrubs or trees in the APZ is acceptable provided that they:
    - are well spread out and do not form a continuous canopy;
    - are not species that retain dead material or deposit excessive quantities of ground fuel in a short period or in a danger period; and
    - are located far enough away from the building so that they will not ignite the building by direct flame contact or radiant heat emission.
- Utilise non-combustible surfaces (pathways and the like) around buildings where possible; and
- A minimal ground fuel is to be maintained to include less than 4 tonnes per hectare of fine fuel (fine fuel means ANY dead or living vegetation of <6 mm in diameter e.g. twigs less than a pencil in thickness. 4 t/ha is equivalent to a 1 cm thick layer of leaf litter).

4.1.2.3 Inner Protection Area within the outer building line of the SCCC

Fuel management within this IPA is different (less intense) because it DOES NOT provide a direct link between the hazard and buildings. It is an internal IPA where the primary bushfire attack is burning debris and is not required to mitigate direct flame spread to buildings from the hazard.

Fuel management within this area is to be as for the IPA outlined at 4.1.2 except that no tree or tree canopy is to overhang any building roofline (as opposed to within 2 m).

- The presence of a few shrubs or trees in the IPA is acceptable provided that they:
    - are well spread out and do not form a continuous canopy;
    - are not species that retain dead material or deposit excessive quantities of ground fuel in a short period or in a danger period; and
    - are located far enough away from vulnerable parts of buildings *e.g.* windows, so that they will not ignite the building by direct flame contact or radiant heat emission.
- A minimal ground fuel is to be maintained to include less than 4 tonnes per hectare of fine fuel (fine fuel means ANY dead or living vegetation of <6 mm in diameter e.g. twigs less than a pencil in thickness. 4 t/ha is equivalent to a 1 cm thick layer of leaf litter); and

4.2 CONSTRUCTION STANDARD

As shown in Table 1 (p. 16), the level of bushfire attack and required building construction standard as per Australian Standard AS 3959-2009 'Construction of buildings in bushfire-prone areas' for the proposed SCCC is BAL-12.5 (Standards Australia 2009).

Furthermore, the provisions of Section 3 'Construction General' of AS3959-2009 and the ember protection provisions outlined on Page 10 of the 2010 Appendix 3 Addendum to PBP are also required for the proposed buildings where applicable.

The carer accommodation is located greater than 100 m away from the low hazard vegetation across Scenic Drive along the bank of the Shoalhaven River and consequently is classified as BAL-LOW which has no specific bushfire construction requirements.

4.3 WATER SUPPLY

The subject land will be serviced by reticulated water. The furthest point from any future buildings to a hydrant will be less than 70 m. The reticulated water supply will comply with the following acceptable solutions within Section 4.1.3 of PBP:

- Fire hydrant spacing, sizing and pressures comply with AS 2419.1 – 2005 'Fire hydrant installations – System design, installation and commissioning' (Standards Australia 2005). Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles;
- Hydrants are not located within any road carriageway;
- All above ground water and gas service pipes external to the buildings are metal, including and up to any taps; and
- The [PBP] provisions of parking on public roads are met.

4.4 GAS AND ELECTRICAL SUPPLIES

In accordance with PBP, electricity supply to the proposed SCCC should be underground.

Any gas services are to be installed and maintained in accordance with AS/NZS 1596:2008 (Standards Australia 2008).

4.5 ACCESS

4.5.1.1 Public roads

The proposed SCCC will be accessed from both Scenic Drive to the west and from North Street to the south. Both of these roads are fully formed two-way public roads maintained by Shoalhaven City Council and comply with the public road design requirements specified within Section 4.1.3 of PBP.

4.5.1.2 Internal access roads

The proposed internal access system within the SCCC development is shown in grey in Figure 3. The internal access system consists of a through road that will permit access and egress to the SCCC and its associated carer accommodation from both Scenic Drive to the west and North Street to the south.

The link to North Street to the south of the proposed SCCC facility means that occupants may be evacuated away from the bush fire hazard in Scenic Drive to the west.

As outlined in Table 2 overleaf, the proposed internal access system either complies or has the ability to comply with all of the PBP design requirements for property access roads. The internal access system provides two-way access throughout the facility for fire tankers and also provides a turn-around area in front of the main building. There are additional three point turning areas within the car parks in front of the carer accommodation and on the eastern side of the main SCCC building in the ambulance entry area.

The internal road system within the proposed SCCC facility provides safe access and egress for both occupants and firefighters.

Table 2: Performance criteria for proposed property access roads*[1]

Performance Criteria	Acceptable Solutions	Complies
The intent may be achieved where:		
▪ access to properties is provided in recognition of the risk to fire fighters and/or evacuating occupants	▪ at least one alternative property access road is provided for individual dwelling (or groups of dwellings) that are located more than 200 metres from a public through road	Not applicable
▪ the capacity of road surfaces and bridges is sufficient to carry fully loaded firefighting vehicles ▪ all weather access is provided	▪ bridges clearly indicate load rating and pavements and bridges are capable of carrying a load of 15 tonnes ▪ roads do not traverse a wetland or other land potentially subject to periodic inundation (other than a flood or storm surge)	Not applicable Complies
▪ road widths and design enable safe access for vehicles	▪ a minimum carriageway width of four metres for rural-residential areas, rural landholdings or urban areas with a distance of greater than 70 metres from the nearest hydrant point to the most external part of a proposed building (or footprint) *Note: No specific access requirements apply in a urban area where a 70 metres unobstructed path can be demonstrated between the most distant external part of the proposed dwelling and the nearest part of the public access road (where the road speed limit is not greater than 70kph) that supports the operational use of emergency firefighting vehicles (i.e. a hydrant or water supply.* ▪ in forest, woodland and heath situations, rural property access roads have passing bays every 200 metres that are 20 metres long by two metres wide, making a minimum trafficable width of six metres at the passing bay ▪ a minimum vertical clearance of four metres to any overhanging obstructions, including tree branches ▪ internal roads for rural properties provide a loop road around any dwelling or incorporate a turning circle with a minimum 12 metre outer radius ▪ curves have a minimum inner radius of six metres and are minimal in number to allow for rapid access and egress ▪ the minimum distance between inner and outer curves is six metres ▪ the crossfall is not more than 10 degrees ▪ maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads *Note: Some short constrictions in the access may be accepted where they are not less than the minimum (3.5m), extend for no more than 30m and where the obstruction cannot be reasonably avoided or removed. The gradients applicable to public roads also apply to community style development property access roads in addition to the above* ▪ access to a development comprising more than three dwellings have formalised access by dedication of a road and not by right of way	Complies Complies – two way roads Can comply Complies Complies Complies Complies Complies Not applicable

*[1] PBP page 23

4.6 EVACUATION AND EMERGENCY PROCEDURES

The nature of SFPP development means that occupants may be potentially more vulnerable to bushfire attack. In the case of the proposed SCCC, patients and carers who visit and/or stay at the facility will potentially have a poor understanding of bushfire and not be familiar with the local area.

Therefore, SFPP development requires an evacuation/emergency plan to be prepared consistent with the RFS Guidelines for the 'A Guide to Develop a Bushfire Evacuation Plan' (RFS, 2004). The plan should be prepared to as soon as practicable and updated with specific management details prior to occupation of the SCCC. The evacuation/emergency plan should include the following:

- An evacuation plan;
- A bushfire response plan; and
- Annual audit procedures.

4.7 ANNUAL AUDIT PROCEDURES

The bushfire protection measures recommended by this report achieve the protection levels required by PBP 2006 and AS3959 – 2009. Maintenance of these protection measures is critical to their longer term effectiveness.

Heavily weathered or damaged building materials may increase a building's vulnerability to bushfire attack to an extent where it no longer complies with the original BAL construction standard. The gutters and other areas of leaf litter and other debris accumulation on and against buildings also require regular cleaning.

Similarly, APZ must be maintained to ensure the fuel loads, vegetation structure, along with the size and juxtaposition of the APZ, is compliant with that approved at the time of construction. As vegetation grows back after initial removal, and leaf litter and other debris is continuously accumulating, the APZ must be regularly maintained.

The frequency of maintenance is dependent upon the fuel type and the seasonal growing conditions. Moister warmer years and seasons result in faster accumulation of finer fuels and very hot, windy or drought periods, result in heavier litter fall.

Annual auditing of the APZ, building maintenance and firefighting equipment is therefore required. This should be undertaken by a BPAD qualified bushfire consultant prior to August each year. Any work required by the audit should be completed prior to September each year.

4.8 SUMMARY OF PROTECTION MEASURES AND CONFORMITY WITH PBP 2006

The suite of bushfire protection measures outlined in this section of the report provides an acceptable level of bushfire protection for a Special Fire Protection Purpose (SFPP) development on a relatively low risk site.

The proposed development has the capacity to comply with all of the acceptable solutions in PBP for bushfire protection measures for SFPP development provided that the following measures are implemented:

(i) A minimum 29 m APZ must be established between the SCCC and the nearest bush fire prone vegetation (12 m of which is already in place within Scenic Drive);

(ii) The SCCC must be constructed to BAL-12.5 as per AS 3959-2009 including Section 3 – Construction General and the ember protection measures outlined in the 2010 Appendix 3 Addendum to PBP where applicable;

(iii) Landscaping within the SCCC facility is to be designed and maintained in accord with the requirements outlined in 4.1.2.2 of this report;

(iv) All access within the proposed SCCC is to comply with PBP as outlined in Table 2;

(v) Utilities for the proposed SCCC development are to comply with the requirements of PBP as outlined in Sections 4.3 and 4.4 of this report;

(vi) A bushfire evacuation/emergency plan is to be prepared for the proposed SCCC facility and reviewed prior to occupation of the development;

(vii) An annual audit of APZ, building maintenance and firefighting equipment is to be carried out by a BPAD qualified practitioner.

5 Conclusion

The proposed development of the Shoalhaven Comprehensive Cancer Care Centre (SCCC) is on Bush Fire Prone Land as mapped by Shoalhaven City Council and consequently, this development must comply with the requirements of 'Planning for Bushfire Protection 2006' for Special Fire Protection Purpose development. The SCCC development has been classified as a Part 3A – Major Project under the NSW Environmental Planning and Assessment Act 1979 and will consequently be assessed by the NSW Department of Planning.

The proposed SCCC development is proposed to be located on a low bushfire risk site near the existing Shoalhaven District Memorial Hospital in Scenic Drive, Nowra. While the forest/forested wetland vegetation to the north-west of the site along the banks of the Shoalhaven River is on very steep slopes, the narrow width of this vegetation, high percentage of rock cover and subsequent reduction in fuel loads and the sheer cliff face considerable mitigate the risk posed by this vegetation. There is little scope for fire spread from the base of the slope towards the proposed SCCC as it is largely prevented by the cliffs and boulders; and the depth of fire run across the top of the cliff is narrow (≤ 15 m).

Consequently, and as demonstrated within this report, the proposed SCCC exceeds the minimum SFPP APZ, and can comply with PBP requirements for Bushfire Attack Levels, access, and utilities. Furthermore, a Bushfire Emergency and Evacuation Plan will be required prior to occupation of the SCCC. These measures will provide a level of bushfire protection for the proposed SCCC commensurate with bushfire risk.

Susan Courtney

Senior Bushfire Planner

6 References

Australian Building Codes Board**.** 2010. *Building Code of Australia*. Commonwealth of Australia.

Barrow, G.J. (1945). A survey of houses affected in the Beaumaris fire, January 14, 1944. *Journal of the Council for Scientific and Industrial Research* [now CSIRO] 18, 27-37.

Energy Australia. 2002. *Network Standard NS 179 (Vegetation Safety Clearances),* Sydney.

LesryK Environmental Consultants, 2010. *Flora and fauna assessment, proposed rezoning. Nowra Park, Corner of Scenic Drive and North Street, Nowra, New South Wales*. LesryK, Bundeena.

NSW Rural Fire Service (NSWRFS). 2006. *Planning for Bushfire Protection: A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners.* Australian Government Publishing Service, Canberra.

NSW Rural Fire Service (NSWRFS). 2004. *Building in Bush Fire Prone Areas: Guidelines for Subdivision Applications.* Australian Government Publishing Service, Canberra.

Ramsay, G.C., McArthur, N.A. and Dowling, V.P. (1996). Building in a fire-prone environment: research on building survival in two major bushfires. *Proc. Linn. Soc*. *116*, 133-140.

Shoalhaven Bush Fire Management Committee (BFMC). *Shoalhaven Bush Fire Risk Management Plan 2010*, Shoalhaven BFMC.

Shoalhaven City Council. 1985. *Local Environment Plan*, Shoalhaven City Council.

Standards Australia. 2000. *Construction of buildings in bushfire-prone areas, AS 3959,* Second edition 1999 and Amendment 1, 2000, Standards Australia International Ltd, Sydney

Standards Australia. 2005. *Fire hydrant installations - System design, installation and commissioning*, AS2419.1, Fourth edition 2005, Standards Australia International Ltd, Sydney.

Standards Australia. 2005. *The storage and handling of LP Gas*, AS/NZS 1596:2008, Fourth edition 2005, Standards Australia International Ltd, Sydney.

7 Photographs

Photo 2: Sample of cliff overhangs below proposed SCCC site

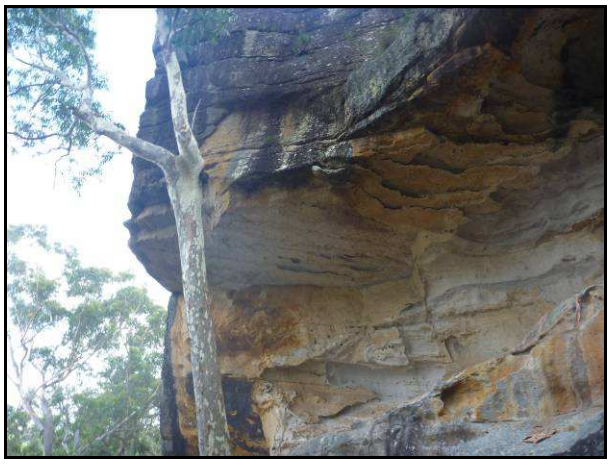


Photo 3: Sheer cliff face below proposed SCCC site

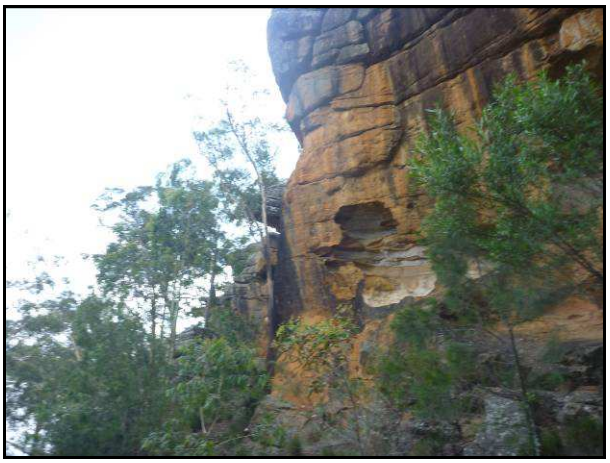


Photo 4: Boulders within scant vegetation along Shoalhaven River north-west of proposed SCCC site

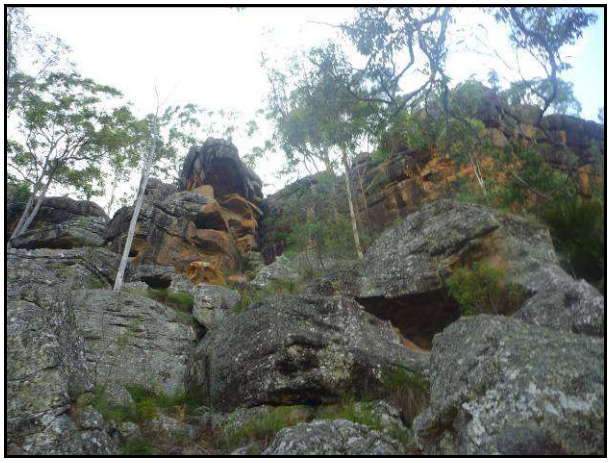


Photo 5: Small amount of forested wetland at base of cliff to north-west of proposed SCC site

Photo 6: Cliffs below Shoalhaven Hospital from Scenic Drive

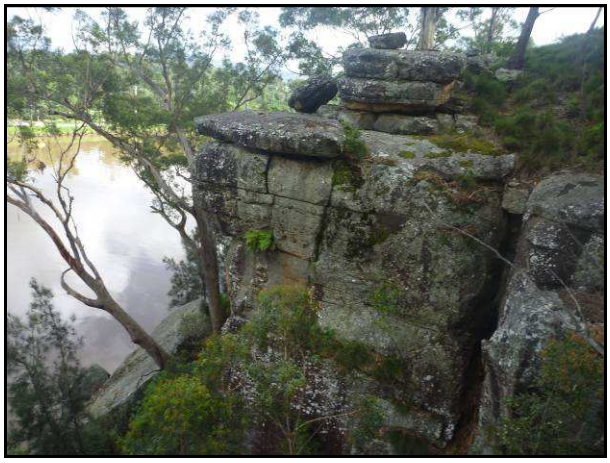


Photo 7: Narrow band of forest along the top of the cliff near the Shoalhaven Hospital

Photo 8: Narrow band of forest along the top of the cliff near the proposed SCCC site

Photo 9: Top of sheer cliff face below proposed SCCC site

Photo 10: Existing bush fire prone vegetation within the proposed SCCC site to be removed

Photo 11: Vegetation within Nowra Showground to the south of the proposed SCCC site which has been mapped as bush fire prone, but is not

Appendix 1 – Bush Fire Attack Assessor Reports

Minimum SFPP APZ required

NBC Bushfire Attack Assessment Report V2.0

AS3959 (2009) Appendix B - Detaied Method 2

Print Date: 7/06/2011 **Assessment Date:** 13/05/2011

Site Street Address: SCCC, Nowra

Assessor: David Peterson, Eco Logical Australia

Local Government Area: Shoalhaven **Alpine Area:** No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: North-west APZ

Vegetation Information

Vegetation Type: Rainforest **Vegetation Group:** Forest and Woodland

Vegetation Slope: 3 Degrees **Vegetation Slope Type:** Downslope

Surface Fuel Load(t/ha): 8 **Overall Fuel Load(t/ha):** 10

Site Information

Site Slope: 0 Degrees **Site Slope Type:** Level

Elevation of Receiver(m): Default **APZ/Separation(m):** 25

Fire Inputs

Veg./Flame Width(m): 25 **Flame Temp(K)** 1200

Calculation Parameters

Flame Emissivity: 95 **Relative Humidity(%):** 25

Heat of 18600 **Ambient Temp(K):** 308

Moisture Factor: 5 **FDI:** 100

Program Outputs

Category of Attack: LOW **Peak Elevation of Receiver(m):** 4.24

Level of Construction: BAL 12.5 **Fire Intensity(kW/m):** 6101

Radiant Heat(kW/m2): 9.29 **Flame Angle (degrees):** 73

Flame Length(m): 8.88 **Maximum View Factor:** 0.1

Rate Of Spread (km/h): 1.18 **Inner Protection Area(m):** 25

Transmissivity: 0.829 **Outer Protection Area(m):** 0

Radiant heat flux modelling based on SCCC APZ

NBC Bushfire Attack Assessment Report V2.0

AS3959 (2009) Appendix B - Detaied Method 2

Print Date: 7/06/2011 **Assessment Date:** 13/05/2011

Site Street Address: SCCC, Nowra

Assessor: David Peterson, Eco Logical Australia

Local Government Area: Shoalhaven **Alpine Area:** No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: North-west BAL

Vegetation Information

Vegetation Type: Rainforest **Vegetation Group:** Forest and Woodland

Vegetation Slope: 3 Degrees **Vegetation Slope Type:** Downslope

Surface Fuel Load(t/ha): 10 **Overall Fuel Load(t/ha):** 12

Site Information

Site Slope: 0 Degrees **Site Slope Type:** Level

Elevation of Receiver(m): Default **APZ/Separation(m):** 25

Fire Inputs

Veg./Flame Width(m): 25 **Flame Temp(K)** 1090

Calculation Parameters

Flame Emissivity: 95 **Relative Humidity(%):** 25

Heat of 18600 **Ambient Temp(K):** 308

Moisture Factor: 5 **FDI:** 100

Program Outputs

Category of Attack: LOW **Peak Elevation of Receiver(m):** 5.15

Level of Construction: BAL 12.5 **Fire Intensity(kW/m):** 9151

Radiant Heat(kW/m2): 7.92 **Flame Angle (degrees):** 69

Flame Length(m): 11.03 **Maximum View Factor:** 0.127

Rate Of Spread (km/h): 1.48 **Inner Protection Area(m):** 25

Transmissivity: 0.822 **Outer Protection Area(m):** 0

Appendix 2 – Bush Fire Construction Requirements for the SCCC Treatment Facility

SECTION 3 CONSTRUCTION GENERAL

3.1 GENERAL

This Section specifies general requirements for the construction of buildings for all Bushfire Attack Levels (BALs).

NOTE: There are a number of Standards that specify requirements for construction; however, where this Standard does not provide construction requirements for a particular element, the other Standards apply.

The BALs and the corresponding Sections for specific construction requirements are listed in Table 3.1.

TABLE 3.1

BUSHFIRE ATTACK LEVELS AND CORRESPONDING SECTIONS FOR SPECIFIC CONSTRUCTION REQUIREMENTS

Bushfire Attack Level (BAL)	Classified vegetation within 100 m of the site and heat flux exposure thresholds	Description of predicted bushfire attack and levels of exposure	Construction Section
BAL—LOW	See Clause 2.2.3.2	There is insufficient risk to warrant specific construction requirements	4
BAL—12.5	≤12.5 kW/m^2	Ember attack	3 and 5
BAL—19	>12.5 kW/m^2 ≤19 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux	3 and 6
BAL—29	>19 kW/m^2 ≤29 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux	3 and 7
BAL—40	>29 kW/m^2 ≤40 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers together with increasing heat flux with the increased likelihood of exposure to flames	3 and 8
BAL—FZ	>40 kW/m^2	Direct exposure to flames from fire front in addition to heat flux and ember attack	3 and 9

3.2 CONSTRUCTION REQUIREMENTS FOR SPECIFIC STRUCTURES

3.2.1 Attached structures

Where any part of a garage, carport, veranda or similar roofed structure is attached to, or shares a common roof space with, a building required to comply with this Standard, the entire garage, carport, veranda or similar roofed structure shall comply with the construction requirements of this Standard, as applicable to the subject building.

Alternatively, the structure shall be separated from the subject building by a wall that extends to the underside of a non-combustible roof covering, and that complies with one of the following:

(a) The wall shall have an FRL of not less than 60/60/60 for loadbearing walls and –/60/60 for non-loadbearing walls when tested from the attached structure side and shall have openings protected as follows:

(i) Doorways—by FRL –/60/30 self-closing fire doors.

(ii) Windows—by FRL –/60/– fire windows permanently fixed in the closed position.

(iii) Other openings—by construction with an FRL not less than –/60/–.

NOTE: Control and construction joints, subfloor vents, weepholes and penetrations for pipes and conduits need not comply with the above [Item (iii)].

or

(b) The wall shall be of masonry, earth wall or masonry-veneer construction with the masonry leaf of not less than 90 mm in thickness and shall have openings protected as follows:

(i) Doorways—by FRL –/60/30 self-closing fire doors.

(ii) Windows—by FRL –/60/– fire windows permanently fixed in the closed position.

(iii) Other openings—by construction with an FRL not less than –/60/–.

NOTE: Control and construction joints, subfloor vents, weepholes and penetrations for pipes and conduits need not comply with the above [Item (iii)].

3.2.2 Garages and carports below the subject building

Where a garage or carport is below a building required to comply with this Standard, it shall comply with the construction requirements of this Standard, as applicable to the subject building.

Alternatively, any construction separating the garage or carport (including walls and flooring systems) from the remainder of the building shall comply with one of the following:

(a) The separating construction shall have an FRL of not less than 60/60/60 for loadbearing construction and –/60/60 for non-loadbearing construction when tested from the garage or carport side and shall have openings protected in accordance with the following:

(i) Doorways—by –/60/30 self-closing fire doors.

(ii) Windows—by –/60/– fire windows permanently fixed in the closed position.

(iii) Other openings—by construction with an FRL not less than –/60/–.

NOTE: Control and construction joints, subfloor vents, weepholes and penetrations for pipes and conduits need not comply with the above [Item (iii)].

or

(b) Where part or all of the separating construction is a wall, the wall need not comply with Item (a) above, provided the wall is of masonry, earth wall or masonry-veneer construction with the masonry leaf of not less than 90 mm in thickness and the wall has openings protected in accordance with the following:

(i) Doorways—by –/60/30 self-closing fire doors.

(ii) Windows—by –/60/– fire windows permanently fixed in the closed position.

(iii) Other openings—by construction with an FRL not less than –/60/–.

NOTE: Control and construction joints, subfloor vents, weepholes and penetrations for pipes and conduits need not comply with the above [Item (iii)].

3.2.3 Adjacent structures

Where any garage, carport, or similar roofed structure is not attached to a building required to comply with this Standard, the entire garage, carport, or similar roofed structure on the subject allotment shall comply with the construction requirements of this Standard.

Alternatively, the adjacent structure shall be separated from the subject building by one of the following:

(a) A distance of not less than 6 m from the building required to comply with this Standard.

or

(b) A wall that extends to the underside of a non-combustible roof covering and has an FRL of not less than 60/60/60 for loadbearing walls and –/60/60 for non-loadbearing walls when tested from the attached structure side. Any openings in the wall shall be protected in accordance with the following:

(i) Doorways—by FRL –/60/30 self-closing fire doors.

(ii) Windows—by FRL –/60/– fire windows permanently fixed in the closed position.

(iii) Other openings—by construction with an FRL not less than –/60/–.

NOTE: Control and construction joints, subfloor vents, weepholes and penetrations for pipes and conduits need not comply with the above [Item (iii)].

or

(c) A wall that extends to the underside of a non-combustible roof covering and is of masonry, earth wall or masonry-veneer construction with the masonry leaf of not less than 90 mm in thickness. Any openings in the wall shall be protected in accordance with the following:

(i) Doorways—by FRL –/60/30 self-closing fire doors.

(ii) Windows—by FRL –/60/– fire windows permanently fixed in the closed position.

(iii) Other openings—by construction with an FRL not less than –/60/–.

NOTE: Control and construction joints, subfloor vents, weepholes and penetrations for pipes and conduits need not comply with the above [Item (iii)].

3.3 EXTERNAL MOULDINGS

Unless otherwise required in Sections 4 to 9, combustible external mouldings, jointing strips, trims and sealants may be used for decorative purposes or to cover joints between sheeting material.

3.4 HIGHER LEVELS OF CONSTRUCTION

Construction requirements specified for a particular Bushfire Attack Level (BAL) shall be acceptable for a lower level. For example, if the site has been assessed at BAL—12.5, BAL—12.5 construction is required; however any element or combination of elements contained BAL—19, BAL—29, BAL—40 and BAL—FZ levels of construction may be used to satisfy this Standard.

3.5 REDUCTION IN CONSTRUCTION REQUIREMENTS DUE TO SHIELDING

The construction requirements for the next lower BAL than that determined for the site may be applied to an elevation of the building where the elevation is not exposed to the source of bushfire attack. An elevation is deemed to be not exposed to the source of bushfire attack if all of the straight lines between that elevation and the source of bushfire attack are obstructed by another part of the building (see Figure 3.1).

The construction requirements for a shielded elevation shall be not less than that required for BAL—12.5, except where the exposed elevations have been determined as BAL—LOW.

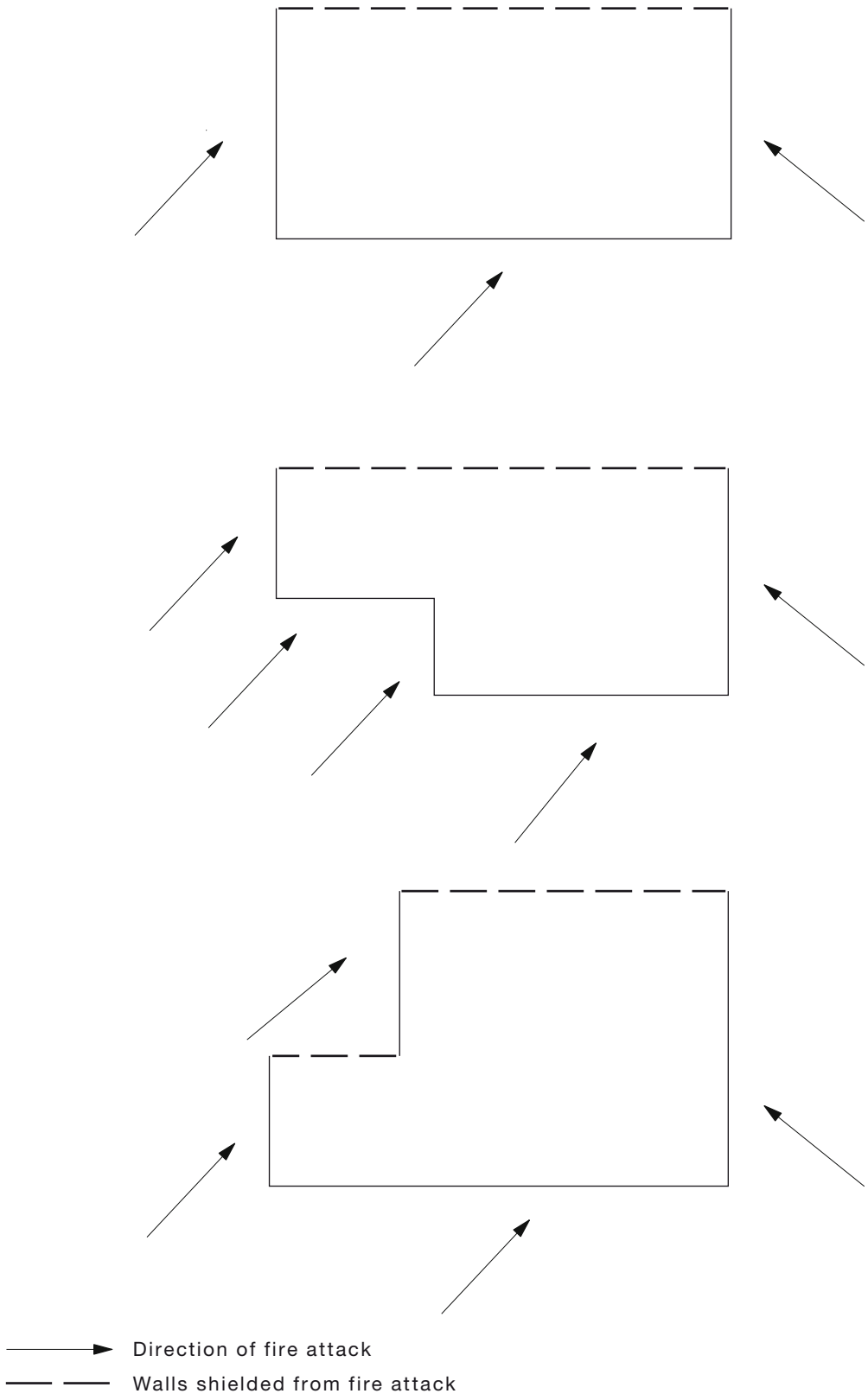


FIGURE 3.1 EXAMPLES OF WALLS SUBJECT TO SHIELDING

3.6 VENTS, WEEPHOLES AND GAPS

Where a circular probe of 3 mm diameter is capable of being passed through external vents, weepholes or gaps, the vents, weepholes and gaps shall be screened as specified in Sections 3, 5, 6, 7, 8 and 9, except for weepholes from the frames of windows and glazed doors.

To determine the maximum aperture size of screening material, it shall not be possible to pass a circular probe of 2 mm diameter through the aperture.

Gaps between doors and the door jambs, heads or sills (thresholds) shall be as shown in Figure 3.2. Alternatively, gaps shall be protected by draught excluders.

C3.6 *Weepholes from the frames of windows and glazed doors and those gaps between doors and door jambs, heads or sills (thresholds) that may exceed 3 mm (see Figure 3.2) are exempt from screening because they do not provide a direct passage for embers to the interior of the building or building cavity.*

A1

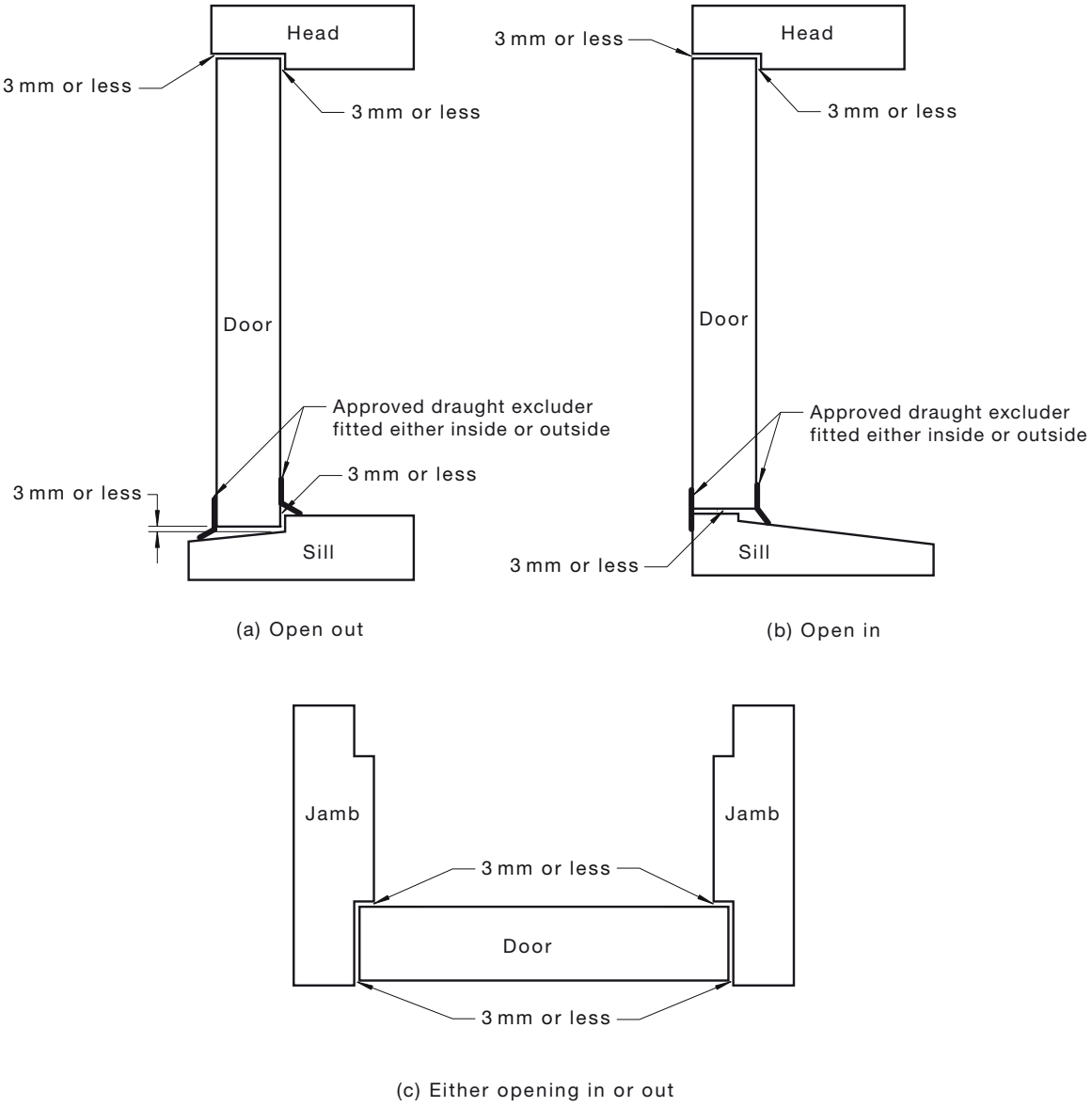


FIGURE 3.2 GAPS BETWEEN DOORS AND THE DOOR JAMBS, HEADS OR SILLS (THRESHOLDS)

3.7 BUSHFIRE SHUTTERS

Bushfire shutters shall—

(a) be fixed to the building and be non-removable;

(b) when in the closed position, have no gap greater than 3 mm between the shutter and the wall, the sill or the head;

(c) be readily manually operable from either inside or outside;

(d) protect the entire window assembly or door assembly;

(e) consist of materials specified in Clauses 5.5.1, 6.5.1, 7.5.1, 8.5.1 and 9.5.1 for the relevant BAL; and

(f) where perforated, have—

(i) uniformly distributed perforations with a maximum aperture of 3 mm when the shutter is providing radiant heat protection or 2 mm when the shutter is also providing ember protection (such as where the openable portion of the window is not screened in accordance with the requirements of the respective BAL); and

(ii) a perforated area no greater than 20% of the shutter.

If bushfire shutters are fitted to all external doors then at least one of those shutters shall be operable from the inside to facilitate safe egress from the building.

3.8 TESTING TO AS 1530.8

A1

Where any material, element of construction or system satisfies the test criteria of either AS 1530.8.1, for BAL—12.5, BAL—19, BAL—29 and BAL—40 or AS 1530.8.2 for BAL—FZ, it satisfies the requirements of that BAL.

If any material, element of construction or system satisfies the test criteria without screening for ember protection, the requirements of this Standard for screening of openable parts of windows or doors shall still apply.

3.9 GLAZING

Glazing requirements shall be in accordance with Sections 5 to 9 of this Standard.

See AS 1288 for an explanation of the terminologies used to describe various types of glass in this Standard.

A2

3.10 SARKING

Where sarking is required in Sections 5 to 9, it shall have a flammability index of not more than 5 when tested to AS 1530.2.

A2

3.11 TIMBER LOG WALLS

Where the thickness of a timber log wall is specified in Sections 5, 6 and 7, two criteria are nominated, as follows:

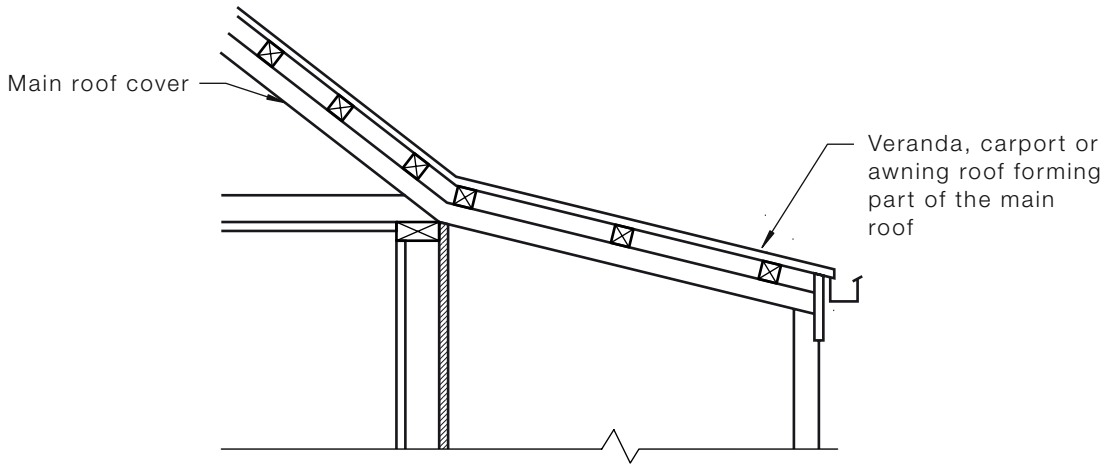
(a) The nominal overall thickness is the overall thickness of the wall.

(b) The minimum thickness is the thickness of the wall at the interface of two logs in the wall.

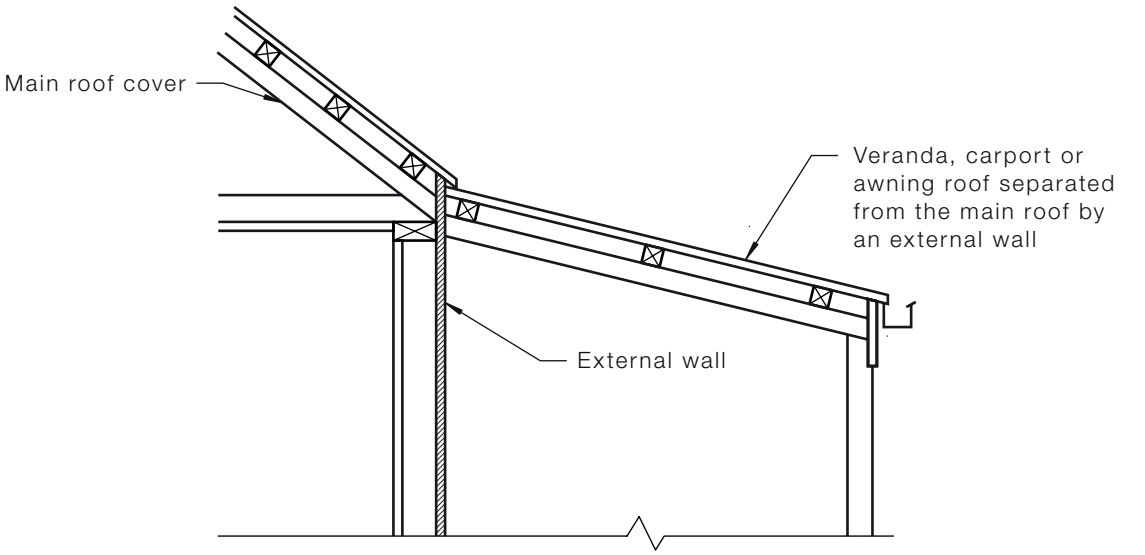
For most log profiles, the thickness of the log at the interface with an adjacent log is less than the overall thickness of the wall.

APPENDIX D
ILLUSTRATIONS
(Normative)

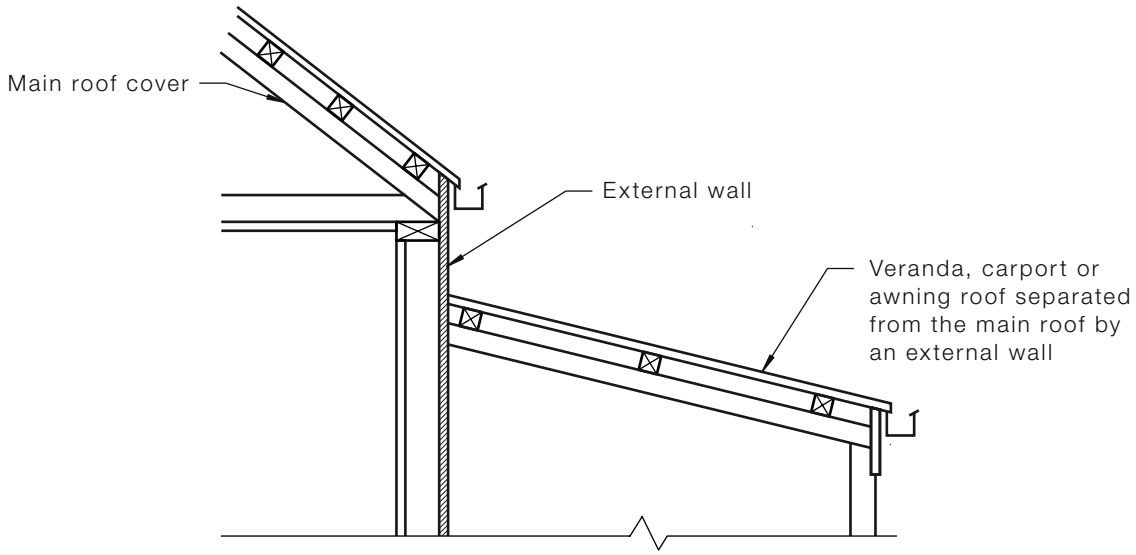
The following illustrations (Figures D1 to D4) support requirements of this Standard:



(a) Continuous roof

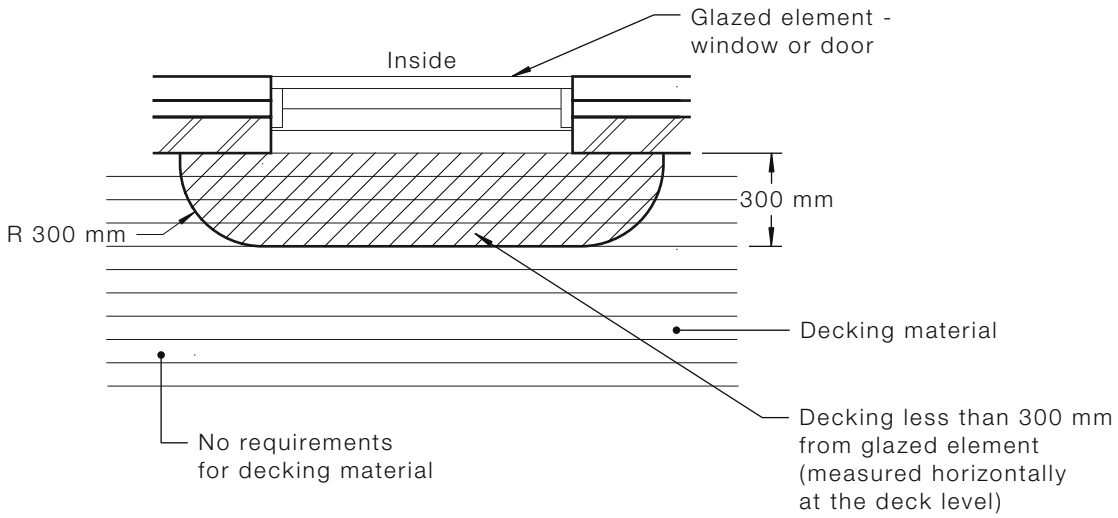


(b) Continuous roof with veranda, carport or awning roof separated from main roof

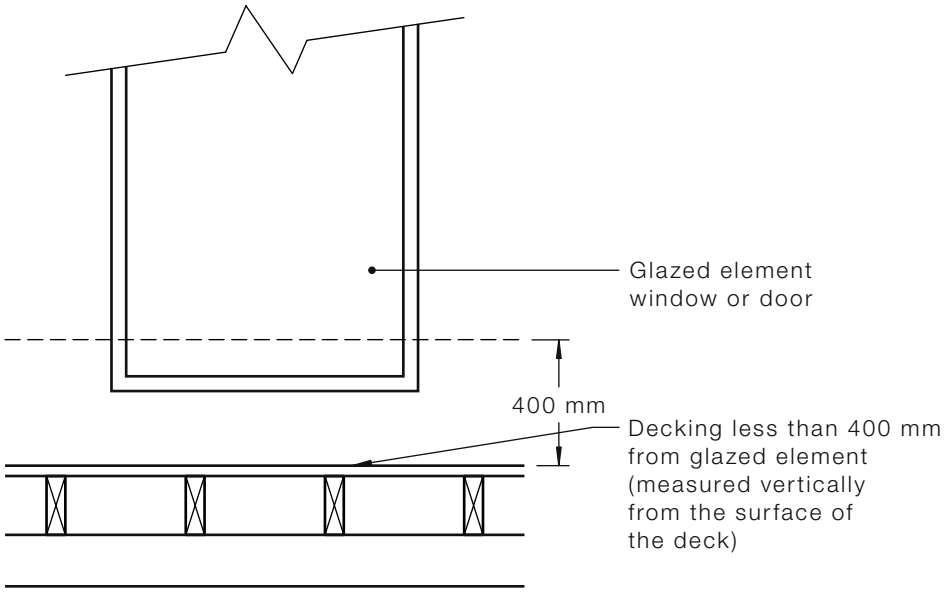


(c) Discontinuous roof

FIGURE D1 VERANDA, CARPORT OR AWNING ROOFS SHOWING CONTINUOUS AND DISCONTINUOUS ROOF TYPES



(a) Plan view

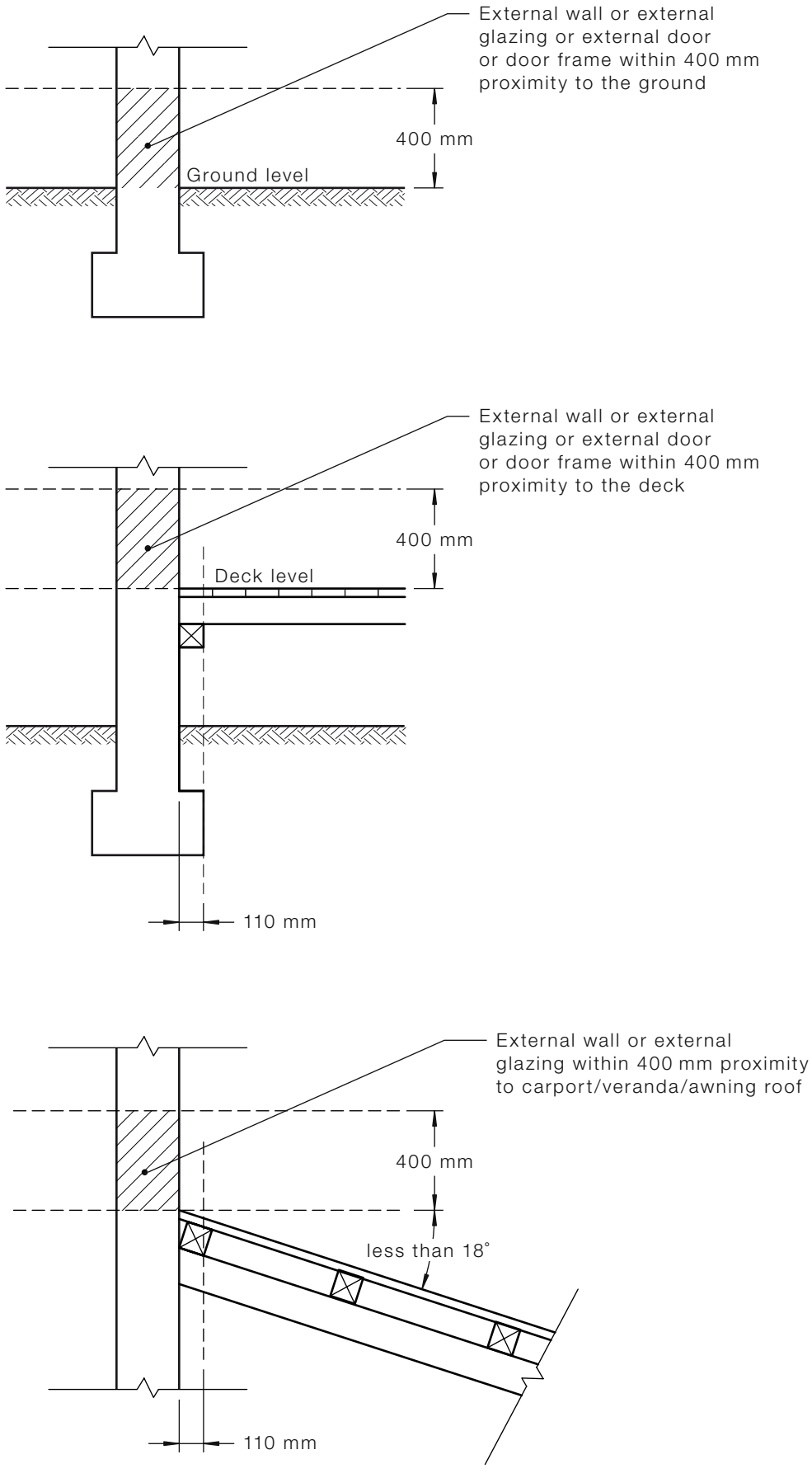


(b) Elevation view

A1

FIGURE D2 DECKING WITHIN HORIZONTAL AND VERTICAL LIMITS OF GLAZED ELEMENTS

A1



DIMENSIONS IN MILLIMETRES

FIGURE D3 EXTERNAL WALLS OR EXTERNAL GLAZING, OR EXTERNAL DOORFRAMES WITHIN LIMITS ABOVE GROUND, DECKS, CARPORT ROOFS

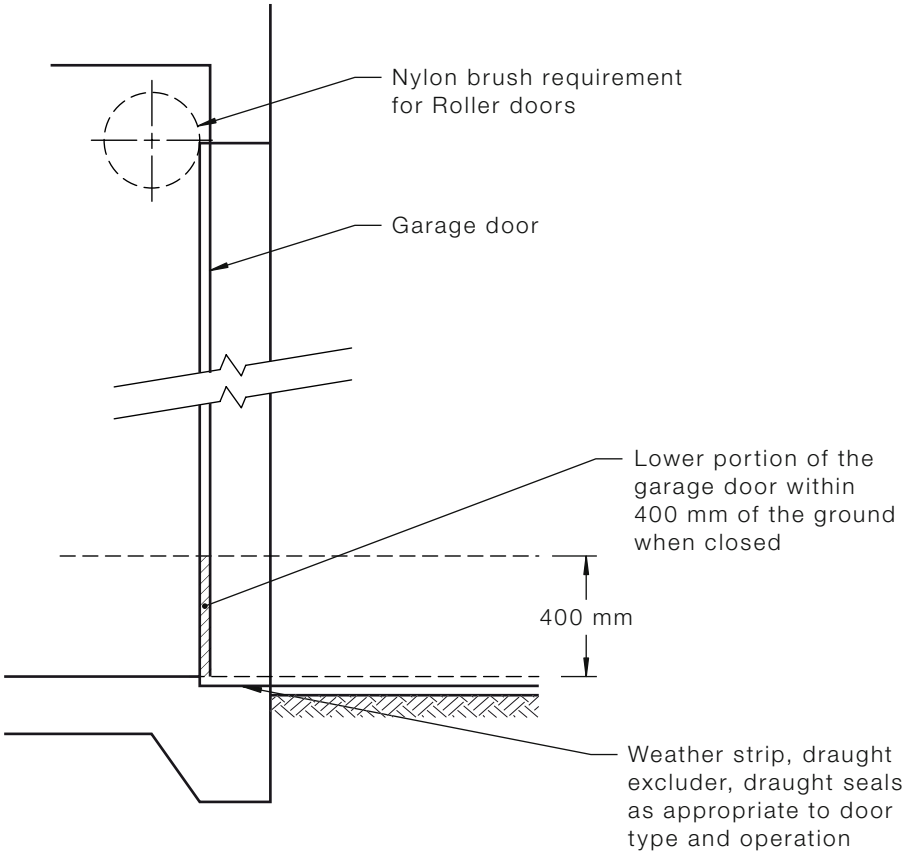


FIGURE D4 VEHICLE ACCESS DOORS (GARAGE DOORS)

APPENDIX E

TIMBER SPECIES AND DENSITIES

(Normative)

E1 GENERAL CONSTRUCTION

A1 Timber with a density of 750 kg/m^3 or greater at a 12 percent moisture content is suitable for construction where specified in Sections 5 and 6. Examples of suitable timber species are listed in Table E1.

Densities of timber species not listed in Table E1 may be found in AS 1720.2.

Many of the timber species listed in Table E1 from various regions of Australia may not be available in all areas.

TABLE E1

A2 ### TIMBER SPECIES WITH A DENSITY OF 750 kg/m^3 OR GREATER

Standard trade name	Botanical name
Ash, Crow's	Flindersia australis
Ash, silvertop	Eucalyptus sieberi
Balau (selangan batu)	Shorea spp.
Bangkirai	Shorea laevifolia
Belian	Eusideroxylon zwageri
Blackbutt	Eucalyptus pilularis
A1 Blackbutt, New England	Eucalyptus andrewsii
	Eucalyptus campanulata
Box, brush	Lophostemon confertus
Box, grey	Eucalyptus microcarpa
Box, grey, coast	Eucalyptus bosistoana
Box, white-topped	Eucalyptus quadrangulata
Box, yellow	Eucalyptus melliodora
Brownbarrel	Eucalyptus fastigata
Candlebark	Eucalyptus rubida
Gum, blue, southern	Eucalyptus globulus
Gum, blue, Sydney	Eucalyptus saligna
Gum, grey	Eucalyptus propinqua
Gum, grey, mountain	Eucalyptus cypellocarpa
A1 Gum, Maiden's	Eucalyptus maidenii
Gum, manna	Eucalyptus viminalis
A1 Gum, red, forest	Eucalyptus tereticornis
Gum, red, river	Eucalyptus camaldulensis
Gum, rose	Eucalyptus grandis

(*continued*)

TABLE E1 (*continued*)

Standard trade name	Botanical name
Gum, spotted	Corymbia maculata
	Corymbia henryi
	Corymbia citriodora
Gum, sugar	Eucalyptus cladocalyx
Hardwood, Johnstone River	Backhousia bancroftii
Ironbark, grey	Eucalyptus paniculata
Ironbark, red	Eucalyptus sideroxylon
Jarrah	Eucalyptus marginata
Kapur	Dryobalanops spp.
Karri	Eucalyptus diversicolor
Kempas	Koompassia malaccensis
Keruing	Dipterocarpus spp.
Kwila (Merbau)	Intsia bijuga
Mahogany red	Eucalyptus resinifera
Mahogany, southern	Eucalyptus botryoides
Mahogany, white	Eucalyptus acmenoides
Messmate	Eucalyptus obliqua
Messmate, Gympie	Eucalyptus cloeziana
Northern Box (Pelawan)	Tristaniopsis spp.
Oak, American	Quercus spp.
Peppermint, narrow-leaved	Eucalyptus australiana
Satinay	Syncarpia hillii
Stringybark, Blackdown	Eucalyptus sphaerocarpa
Stringybark, blue-leaved	Eucalyptus agglomerata
Stringybark, brown	Eucalyptus baxteri
Stringybark, silvertop	Eucalyptus laevopinea
Stringybark, white	Eucalyptus eugenioides
A1 Stringybark, yellow	Eucalyptus muelleriana
Tallowwood	Eucalyptus microcorys
Turpentine	Syncarpia glomulifera
A1 Woollybutt	Eucalyptus longifolia

E2 WINDOWS AND DOORS

A1 Timber species with a density of 650 kg/m^3 or greater at a 12 percent moisture content is suitable for window joinery, door frames and the framing surrounding any glazing where specified in Sections 5 and 6. Examples of suitable timber species are listed in Table E2.

Densities of timber species not listed in Table E2 may be found in AS 1720.2.

Many of the timber species listed in Table E2 from various regions of Australia may not be available in all areas.

TABLE E2

SOME TIMBER SPECIES WITH A DENSITY OF 650 kg/m^3 OR GREATER

Standard trade name	Botanical name
Ash, alpine	Eucalyptus delegatensis
Ash, Crow's	Flindersia australis
Ash, mountain	Eucalyptus regnans
Ash, silvertop	Eucalyptus sieberi
Balau (selangan batu)	Shorea spp.
Bangkirai	Shorea laevifolia
Beech, myrtle	Nothofagus cunninghamii
Belian	Eusideroxylon zwageri
Blackbutt	Eucalyptus pilularis
A1 Blackbutt, New England	Eucalyptus andrewsii
	Eucalyptus campanulata
Blackwood	Acacia melanoxylon
A1 Box, brush	Lophostemon confertus
Box, grey	Eucalyptus microcarpa
Box, grey, coast	Eucalyptus bosistoana
Box, white-topped	Eucalyptus quadrangulata
Box, yellow	Eucalyptus melliodora
Brownbarrel	Eucalyptus fastigata
Candlebark	Eucalyptus rubida
A1 Cypress	Callitris glaucophylla
Gum, blue, southern	Eucalyptus globulus
Gum, blue, Sydney	Eucalyptus saligna
Gum, grey	Eucalyptus propinqua
Gum, grey, mountain	Eucalyptus cypellocarpa
A1 Gum, Maiden's	Eucalyptus maidenii
Gum, manna	Eucalyptus viminalis
Gum, mountain	Eucalyptus dalrympleana
A1 Gum, red, forest	Eucalyptus tereticornis
Gum, red, river	Eucalyptus camaldulensis
Gum, rose	Eucalyptus grandis
Gum, shinning	Eucalyptus nitens
Gum, spotted	Corymbia maculata
	Corymbia henryi
	Corymbia citriodora
Gum, sugar	Eucalyptus cladocalyx
Hardwood, Johnstone River	Backhousia bancroftii
Ironbark, grey	Eucalyptus paniculata

(*continued*)

TABLE E2 (*continued*)

Standard trade name	Botanical name
Ironbark, red	Eucalyptus sideroxylon
Jarrah	Eucalyptus marginata
Kapur	Dryobalanops spp.
Karri	Eucalyptus diversicolor
Kempas	Koompassia malaccensis
Keruing	Dipterocarpus spp.
Kwila (Merbau)	Intsia bijuga
Mahogany, Philippine red, dark	Shorea spp.
Mahogany red	Eucalyptus resinifera
Mahogany, southern	Eucalyptus botryoides
Mahogany, white	Eucalyptus acmenoides
Messmate	Eucalyptus obliqua
Messmate, Gympie	Eucalyptus cloeziana
Northern Box (Pelawan)	Tristaniopsis spp.
Oak , American	Quercus spp.
Peppermint, narrow-leaved	Eucalyptus australiana
Pine, celery-top	Phyllocladus asplenifolius
Pine, slash	Pinus elliottii
Ramin	Gonystylus spp.
Rosewood, New Guinea	Pterocarpus indicus
Satinay	Syncarpia hillii
Stringybark, Blackdown	Eucalyptus sphaerocarpa
Stringybark, blue-leaved	Eucalyptus agglomerata
Stringybark, brown	Eucalyptus baxteri
Stringybark, silvertop	Eucalyptus laevopinea
Stringybark, white	Eucalyptus eugenioides
A1 Stringybark, yellow	Eucalyptus muelleriana
Tallowwood	Eucalyptus microcorys
Taun	Pometia pinnata
Turpentine	Syncarpia glomulifera
Vitex, New Guinea	Vitex cofassus
A1 Woollybutt	Eucalyptus longifolia

APPENDIX F

BUSHFIRE-RESISTING TIMBER

(Normative)

F1 GENERAL

Bushfire-resisting timber is timber that is deemed to be acceptable to withstand exposure up to a BAL—29 condition.

Timber may be 'bushfire-resisting' by means of one or more of—

(a) the inherent properties of the material itself;

(b) being impregnated with fire-retardant chemicals; *or*

(c) the application of fire-retardant coatings or substrates.

F2 TESTING

The following apply:

(a) To satisfy the requirements for bushfire-resisting timber, timber shall be tested in accordance with AS/NZS 3837 and shall meet the following criteria:

(i) The maximum heat release rate shall be not greater than 100 kW/m^2.

(ii) The average heat release rate for 10 min following ignition shall be not greater than 60 kW/m^2 when the material is exposed to an irradiance level of 25 kW/m^2.

(b) Where the timber has been altered by chemicals, the test samples shall be subjected to the regime of accelerated weathering described in Paragraph F3 except that where the timber is protected from the weather, as described in AS 1684.2 and AS 1684.3 (for example, cladding protected by a veranda), accelerated weathering of the test samples is not required before being tested to AS/NZS 3837.

External timbers are deemed to be protected if they are covered by a roof projection (or similar) at 30 degrees or greater to the vertical and they are well detailed and maintained (painted or stained and kept well ventilated).

A2 NOTE: The purpose of testing is to assess timber performance rather than to simulate a bushfire. The irradiance set for the test is not to be considered to be correlated to the BAL.

F3 ACCELERATED WEATHERING

Where accelerated weathering is required before testing to AS/NZS 3837, external fire-retardant-coated substrates shall be subjected to the ASTM D2898 Method B weathering regime, with the water flow rate modified to be the same as that within ASTM D2898 Method A.

A2

F4 BUSHFIRE-RESISTING SPECIES

Some species have been tested and have met the requirements of Paragraph F2 above.

NOTE: For bushfire-resisting species, see Appendix H.

APPENDIX G

EXPLANATION OF BUSHFIRE ATTACK LEVELS (BALs)

(Informative)

G1 GENERAL

A1 To determine the construction requirements for a building site, the threat or risk of bushfire attack needs to be assessed.

G2 1999 and 2009 EDITIONS OF AS 3959

The 1999 edition of AS 3959 provided four levels of risk: Low, Medium, High, Extreme.

This Standard provides six levels of risk: BAL—LOW, BAL—12.5, BAL—19, BAL—29, BAL—40, BAL—FZ.

The BAL system of levels (see Paragraph G4) is based on the potential exposure of the site to heat flux exposure thresholds, expressed as kW/m^2 (see Table G1). Because the site assessment methodology has changed, it is NOT appropriate to compare the construction requirements from a level in the 1999 edition with those of a level in this Edition.

G3 RADIANT HEAT THRESHOLDS OF PAIN AND IGNITION

In a bushfire, radiant heat levels may be unsafe for humans and could also ignite combustible materials in the vicinity. Table G1 provides an indication of the potential effects of radiant heat levels on both humans and selected materials to assist the reader in understanding the implications of the different BALs.

TABLE G1

TYPICAL RADIANT HEAT INTENSITIES FOR VARIOUS PHENOMENA

Phenomena	kW/m^2
Pain to humans after 10 s to 20 s	4
Pain to humans after 3 s	10
Ignition of cotton fabric after a long time (piloted) (see Note 2)	13
Ignition of timber after a long time 13 (piloted) (see Note 2)	13
Ignition of cotton fabric after a long time (non-piloted) (see Note 3)	25
Ignition of timber after a long time (non-piloted) (see Note 3)	25
Ignition of gaberdine fabric after a long time (non-piloted) (see Note 3)	27
Ignition of black drill fabric after a long time (non-piloted) (see Note 3)	38
Ignition of cotton fabric after 5 s (non-piloted) (see Note 3)	42
Ignition of timber in 20 s (non-piloted) (see Note 3)	45
Ignition of timber in 10 s (non-piloted) (see Note 3)	55

NOTES:

1 Source AS 1530.4—2005.

2 Introduction of a small flame to initiate ignition.

3 Flame not introduced to initiate ignition.

G4 BUSHFIRE ATTACK LEVELS (BALs) EXPLAINED

A1 The 2009 edition of AS 3959 (this Standard) explains Bushfire Attack Levels (BALs) as follows:

(a) **BAL—LOW** The risk is considered to be **VERY LOW**.

There is insufficient risk to warrant any specific construction requirements but there is still some risk.

(b) **BAL—12.5** The risk is considered to be **LOW**.

There is a risk of ember attack.

The construction elements are expected to be exposed to a heat flux not greater than 12.5 kW/m^2.

(c) **BAL—19** The risk is considered to be **MODERATE.**

There is a risk of ember attack and burning debris ignited by wind borne embers and a likelihood of exposure to radiant heat.

The construction elements are expected to be exposed to a heat flux not greater than 19 kW/m^2.

(d) **BAL—29** The risk is considered to be **HIGH.**

There is an increased risk of ember attack and burning debris ignited by windborne embers and a likelihood of exposure to an increased level of radiant heat.

The construction elements are expected to be exposed to a heat flux not greater than 29 kW/m^2.

(e) **BAL—40** The risk is considered to be **VERY HIGH.**

There is a much increased risk of ember attack and burning debris ignited by windborne embers, a likelihood of exposure to a high level of radiant heat and some likelihood of direct exposure to flames from the fire front.

The construction elements are expected to be exposed to a heat flux not greater than 40 kW/m^2.

(f) **BAL—FZ** The risk is considered to be **EXTREME.**

There is an extremely high risk of ember attack and burning debris ignited by windborne embers, and a likelihood of exposure to an extreme level of radiant heat and direct exposure to flames from the fire front.

The construction elements are expected to be exposed to a heat flux greater than 40 kW/m^2.

APPENDIX H

BUSHFIRE-RESISTING SPECIES

(Informative)

A2 The following species have been tested and have met the requirements of Paragraph F2, Appendix F:

Standard trade name	Botanical name
Ash, silvertop	Eucalyptus sieberi
Blackbutt	Eucalyptus pilularis
Gum, red, river	Eucalyptus camaldulensis
Gum, spotted	Corymbia maculata
	Corymbia henryi
	Corymbia citriodora
Ironbark, red	Eucalyptus sideroxylon
Kwila (Merbau)	Intsia bijuga
Turpentine	Syncarpia glomulifera

SECTION 5 CONSTRUCTION FOR BUSHFIRE ATTACK LEVEL 12.5 (BAL—12.5)

5.1 GENERAL

A building assessed in Section 2 as being BAL—12.5 shall comply with Section 3 and Clauses 5.2 to 5.8.

NOTE: There are a number of Standards that specify requirements for construction; however, where this Standard does not provide construction requirements for a particular element, the other Standards apply.

Any element of construction or system that satisfies the test criteria of AS 1530.8.1 may be used in lieu of the applicable requirements contained in Clauses 5.2 to 5.8 (see Clause 3.8).

NOTE: BAL—12.5 is primarily concerned with protection from ember attack and radiant heat up to and including 12.5 kW/m^2 where the site is less than 100 m from the source of bushfire attack.

5.2 SUBFLOOR SUPPORTS

This Standard does not provide construction requirements for subfloor support posts, columns, stumps, piers and poles.

NOTE: The exclusion of requirements for subfloor supports applies to the principal building only and not to verandas, decks, steps, ramps and landings (see Clause 5.7).

A1

C5.2 *Ideally, storage of combustible materials beneath a floor at this BAL would not occur and, on this assumption, there is no requirement to enclose the subfloor space or to protect the subfloor supports, or the bearers, joists and flooring from bushfire attack; however, should combustible materials be stored, it is recommended the area be protected as materials stored in the subfloor space may be ignited by embers and cause an impact to the building.*

5.3 FLOORS

5.3.1 Concrete slabs on ground

This Standard does not provide construction requirements for concrete slabs on the ground.

5.3.2 Elevated floors

This Standard does not provide construction requirements for elevated floors, including bearers, joists and flooring.

5.4 EXTERNAL WALLS

A2

5.4.1 Walls

The exposed components of an external wall that are less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the wall (see Figure D3, Appendix D) shall be:

(a) Non-combustible material.

NOTE: Examples include, but are not limited to, full masonry or masonry veneer, with the masonry being clay, calcium silicate, concrete, natural stone, aerated concrete, mud brick; or in situ, or panel walls of concrete, aerated concrete or rammed earth.

or

A2 (b) Timber logs of a species with a density of 680 kg/m^3 or greater at a 12 percent moisture content; of a minimum nominal overall thickness of 90 mm and a minimum thickness of 70 mm (see Clause 3.11); and gauge planed.

or

(c) Cladding that is fixed externally to a timber-framed or a steel-framed wall and is—

(i) non-combustible material; *or*

(ii) fibre-cement external cladding, a minimum of 6 mm in thickness; *or*

(iii) bushfire-resisting timber (see Appendix F); *or*

(iv) a timber species as specified in Paragraph E1, Appendix E; *or*

(v) a combination of any of Items (i), (ii), (iii) or (iv) above.

or

(d) A combination of any of Items (a), (b) or (c) above.

This Standard does not provide construction requirements for the exposed components of an external wall that are 400 mm or more from the ground or 400 mm or more above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the wall (see Figure D3, Appendix D).

5.4.2 Joints

All joints in the external surface material of walls shall be covered, sealed, overlapped, backed or butt-jointed to prevent gaps greater than 3 mm.

A2

5.4.3 Vents and weepholes

Vents and weepholes in external walls shall be screened with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium, except where the vents and weepholes are less than 3 mm (see Clause 3.6), or are located in an external wall of a subfloor space.

5.5 EXTERNAL GLAZED ELEMENTS AND ASSEMBLIES AND EXTERNAL DOORS

5.5.1 Bushfire shutters

Where fitted, bushfire shutters shall comply with Clause 3.7 and be made from—

A2 (a) non-combustible material; *or*

A1 (b) a timber species as specified in Paragraph E1, Appendix E; *or*

(c) bushfire-resisting timber (see Appendix F); *or*

(d) a combination of any of Items (a), (b) or (c) above.

A1 ### 5.5.1A Screens for windows and doors

Where fitted, screens for windows and doors shall have a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium. Gaps between the perimeter of the screen assembly and the building element to which it is fitted shall not exceed 3 mm.

A1 A2 The frame supporting the mesh or perforated sheet shall be made from—

(a) metal; *or*

(b) bushfire-resisting timber (see Appendix F); *or*

A1 A2 (c) a timber species as specified in Paragraph E2, Appendix E.

5.5.2 Windows

Window assemblies shall comply with one of the following:

(a) They shall be completely protected by a bushfire shutter that complies with Clause 5.5.1.

or

A1 (b) They shall be completely protected externally by screens that comply with Clause 5.5.1A.

or

(c) They shall comply with the following:

(i) For window assemblies less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the window frame (see Figure D3, Appendix D), window frames and window joinery shall be made from:

A2

(A) Bushfire-resisting timber (see Appendix F).

or

A1 (B) A timber species as specified in Paragraph E2, Appendix E.

or

(C) Metal.

or

(D) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the frame and sash shall satisfy the design load, performance and structural strength of the member.

(ii) Externally fitted hardware that supports the sash in its functions of opening and closing shall be metal.

(iii) Where glazing is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the window frame (see Figure D3, Appendix D), the glazing shall be Grade A safety glass minimum 4 mm, or glass blocks with no restriction on glazing methods.

NOTE: Where double glazed units are used the above requirements apply to the external face of the window assembly only.

(iv) Where glazing is other than that specified in Item (iii) above, annealed glass may be used.

A1 (v) The openable portions of windows shall be screened internally or externally with screens that comply with Clause 5.5.1A.

A2

C5.5.2 *Screening of the openable portions of all windows is required in all BALs to prevent the entry of embers to the building when the window is open. Screening of the openable and fixed portions of some windows is required in some BALs to reduce the effects of radiant heat on some types of glass.*

If the screening is required to reduce the effects of radiant heat on the glass, the screening has to be external so that the glass in the openable portion of the window will be 'protected' when it is shut.

If the screening is required ***only*** *to prevent the entry of embers, the screening may be fitted externally or internally.*

5.5.3 Doors—Side-hung external doors (including French doors, panel fold and bi-fold doors)

Side-hung external doors, including French doors, panel fold and bi-fold doors, shall comply with one of the following:

A2

(a) Doors and door frames shall be protected by bushfire shutters that comply with Clause 5.5.1.

or

(b) Doors and door frames shall be protected externally by screens that comply with Clause 5.5.1A.

or

(c) Doors and door frames shall comply with the following:

(i) Doors shall be—

(A) non-combustible; *or*

(B) a solid timber door, having a minimum thickness of 35 mm for the first 400 mm above the threshold; *or*

(C) a door, including a hollow core door, with a non-combustible kickplate on the outside for the first 400 mm above the threshold; *or*

(D) a door, including a hollow core door, protected externally by a screen that complies with Clause 5.5.1A; *or*

(E) a fully framed glazed door, where the framing is made from materials specified for bushfire shutters (see Clause 5.5.1), or from a timber species as specified in Paragraph E2, Appendix E.

(ii) Where doors incorporate glazing, the glazing shall comply with the glazing requirements for windows.

A1

(iii) Doors shall be tight-fitting to the door frame and to an abutting door, if applicable.

A1

(iv) Where any part of the door frame is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the door (see Figure D3, Appendix D), that part of the door frame shall be made from:

A2

(A) Bushfire-resisting timber (see Appendix F).

or

A1

(B) A timber species as specified in Paragraph E2, Appendix E.

or

(C) Metal.

or

(D) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the door assembly shall satisfy the design load, performance and structural strength of the member.

(v) Weather strips, draught excluders or draught seals shall be installed at the base of side-hung external doors.

5.5.4 Doors—Sliding doors

Sliding doors shall comply with one of the following:

(a) They shall be protected by a bushfire shutter that complies with Clause 5.5.1.

or

A1 (b) They shall be completely protected externally by screens that comply with Clause 5.5.1A.

or

A1 (c) They shall comply with the following:

(i) Any glazing incorporated in sliding doors shall be Grade A safety glass complying with AS 1288.

(ii) Both the door frame supporting the sliding door and the framing surrounding A2 any glazing shall be made from:

(A) Bushfire-resisting timber (see Appendix F).

or

(B) A timber species as specified in Paragraph E2, Appendix E.

or

(C) Metal.

A1 *or*

(D) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the frame and the sash shall satisfy the design load, performance and structural strength of the member.

(iii) There is no requirement to screen the openable part of the sliding door. However, if screened, the screens shall comply with Clause 5.5.1A.

NOTE: The construction of manufactured sliding doors should prevent the entry of embers when the door is closed. There is no requirement to provide screens to the openable part of these doors as it is assumed that a sliding door will be closed if occupants are not present during a bushfire event. Screens of materials other than those specified may not resist ember attack.

(iv) Sliding doors shall be tight-fitting in the frames.

5.5.5 Doors—Vehicle access doors (garage doors)

The following apply to vehicle access doors:

(a) The lower portion of a vehicle access door that is within 400 mm of the ground when the door is closed (see Figure D4, Appendix D) shall be made from—

(i) non-combustible material; *or*

(ii) bushfire-resisting timber (see Appendix F); *or*

(iii) fibre-cement sheet, a minimum of 6 mm in thickness; *or*

A1 (iv) a timber species as specified in Paragraph E1, Appendix E; *or*

(v) a combination of any of Items (i), (ii), (iii) or (iv) above.

(b) Panel lift, tilt doors or side-hung doors shall be fitted with suitable weather strips, draught excluders, draught seals or guide tracks, as appropriate to the door type, with a maximum gap no greater than 3 mm.

(c) Roller doors shall have guide tracks with a maximum gap no greater than 3 mm and shall be fitted with a nylon brush that is in contact with the door (see Figure D4, Appendix D).

(d) Vehicle access doors shall not include ventilation slots.

5.6 ROOFS (INCLUDING VERANDA AND ATTACHED CARPORT ROOFS, PENETRATIONS, EAVES, FASCIAS, GABLES, GUTTERS AND DOWNPIPES)

5.6.1 General

The following apply to all types of roofs and roofing systems:

(a) Roof tiles, roof sheets and roof-covering accessories shall be non-combustible.

(b) The roof/wall junction shall be sealed, to prevent openings greater than 3 mm, either by the use of fascia and eaves linings or by sealing between the top of the wall and the underside of the roof and between the rafters at the line of the wall.

(c) Roof ventilation openings, such as gable and roof vents, shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

A2 ### 5.6.2 Tiled roofs

Tiled roofs shall be fully sarked. The sarking shall—

(a) be located on top of the roof framing, except that the roof battens may be fixed above the sarking;

(b) cover the entire roof area including ridges and hips; and

(c) extend into gutters and valleys.

A2 ### 5.6.3 Sheet roofs

Sheet roofs shall—

(a) be fully sarked in accordance with Clause 5.6.2, except that foil-backed insulation blankets may be installed over the battens; and

(b) have any gaps greater than 3 mm (such as under corrugations or ribs of sheet roofing and between roof components) sealed at the fascia or wall line and at valleys, hips and ridges by—

(i) a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium; *or*

(ii) mineral wool; *or*

(iii) other non-combustible material; *or*

(iv) a combination of any of Items (i), (ii) or (iii) above.

A2 **C5.6.3** *Sarking is used as a secondary form of ember protection for the roof space to account for minor gaps that may develop in sheet roofing.*

5.6.4 Veranda, carport and awning roofs

The following apply to veranda, carport and awning roofs:

(a) A veranda, carport or awning roof forming part of the main roof space [see Figure D1(a), Appendix D] shall meet all the requirements for the main roof, as specified in Clauses 5.6.1, 5.6.2, 5.6.3, 5.6.5 and 5.6.6.

(b) A veranda, carport or awning roof separated from the main roof space by an external wall [see Figures D1(b) and D1(c), Appendix D] complying with Clause 5.4 shall have a non-combustible roof covering.

NOTE: There is no requirement to line the underside of a veranda, carport or awning roof that is separated from the main roof space.

5.6.5 Roof penetrations

The following apply to roof penetrations:

(a) Roof penetrations, including roof lights, roof ventilators, roof-mounted evaporative cooling units, aerials, vent pipes and supports for solar collectors, shall be adequately sealed at the roof to prevent gaps greater than 3 mm. The material used to seal the penetration shall be non-combustible.

A2 (b) Openings in vented roof lights, roof ventilators or vent pipes shall be fitted with ember guards made from a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

This requirement does not apply to the exhaust flues of heating or cooking devices with closed combustion chambers.

In the case of gas appliance flues, ember guards shall not be fitted.

NOTE: Gasfitters are required to provide a metal flue pipe above the roof and terminate with a certified gas flue cowl complying with AS 4566. Advice may be obtained from State gas technical regulators.

A1 (c) All overhead glazing shall be Grade A safety glass complying with AS 1288.

(d) Glazed elements in roof lights and skylights may be of polymer provided a Grade A safety glass diffuser, complying with AS 1288, is installed under the A1 glazing. Where glazing is an insulating glazing unit (IGU), Grade A toughened safety glass minimum 4 mm, shall be used in the outer pane of the IGU.

(e) Flashing elements of tubular skylights may be of a fire-retardant material, provided the roof integrity is maintained by an under-flashing of a material having a flammability index no greater than 5.

(f) Evaporative cooling units shall be fitted with butterfly closers at or near the ceiling level or, the unit shall be fitted with non-combustible covers with a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(g) Vent pipes made from PVC are permitted.

5.6.6 Eaves linings, fascias and gables

The following apply to eaves linings, fascias and gables:

(a) Gables shall comply with Clause 5.4.

(b) Eaves penetrations shall be protected the same as for roof penetrations, as specified in Clause 5.6.5.

(c) Eaves ventilation openings greater than 3 mm shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

Joints in eaves linings, fascias and gables may be sealed with plastic joining strips or timber storm moulds.

This Standard does not provide construction requirements for fascias, bargeboards and eaves linings.

5.6.7 Gutters and downpipes

This Standard does not provide material requirements for—

(a) gutters, with the exception of box gutters; and

(b) downpipes.

If installed, gutter and valley leaf guards shall be non-combustible.

Box gutters shall be non-combustible and flashed at the junction with the roof with non-combustible material.

5.7 VERANDAS, DECKS, STEPS, RAMPS AND LANDINGS

5.7.1 General

A1 Decking may be spaced.

There is no requirement to enclose the subfloor spaces of verandas, decks, steps, ramps or landings.

C5.7.1 *Spaced decking is nominally spaced at 3 mm (in accordance with standard industry practice); however, due to the nature of timber decking with seasonal changes in moisture content, that spacing may range from 0–5 mm during service. The preferred dimension for gaps is 3 mm (which is in line with other 'permissible gaps') in other parts of this Standard. It should be noted that recent research studies have shown that gaps at 5 mm spacing afford opportunity for embers to become lodged in between timbers, which may contribute to a fire. Larger gap spacings of 10 mm may preclude this from happening but such a spacing regime may not be practical for a timber deck.*

5.7.2 Enclosed subfloor spaces of verandas, decks, steps, ramps and landings

5.7.2.1 *Materials to enclose a subfloor space*

This Standard does not provide construction requirements for the materials used to enclose a subfloor space except where those materials are less than 400 mm from the ground.

Where the materials used to enclose a subfloor space are less than 400 mm from the ground, they shall comply with Clause 5.4.

5.7.2.2 *Supports*

This Standard does not provide construction requirements for support posts, columns, stumps, stringers, piers and poles.

5.7.2.3 *Framing*

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

A1 **5.7.2.4** *Decking, stair treads and the trafficable surfaces of ramps and landings*

This Standard does not provide construction requirements for decking, stair treads and the trafficable surfaces of ramps and landings that are more than 300 mm from a glazed element.

Decking, stair treads and the trafficable surfaces of ramps and landings less than 300 mm (measured horizontally at deck level) from glazed elements that are less than 400 mm (measured vertically) from the surface of the deck (see Figure D2, Appendix D) shall be made from—

(a) non-combustible material; *or*

(b) bushfire-resisting timber (see Appendix F); *or*

A1 A2 (c) a timber species as specified in Paragraph E1, Appendix E; *or*

(d) PVC-U; *or*

(e) a combination of any of Items (a), (b), (c) or (d) above.

5.7.3 Unenclosed subfloor spaces of verandas, decks, steps, ramps and landings

5.7.3.1 *Supports*

This Standard does not provide construction requirements for support posts, columns, stumps, stringers, piers and poles.

5.7.3.2 *Framing*

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

A1 **5.7.3.3** *Decking, stair treads and the trafficable surfaces of ramps and landings*

This Standard does not provide construction requirements for decking, stair treads and the trafficable surfaces of ramps and landings that are more than 300 mm from a glazed element.

Decking, stair treads and the trafficable surfaces of ramps and landings less than 300 mm (measured horizontally at deck level) from glazed elements that are less than 400 mm (measured vertically) from the surface of the deck (see Figure D2, Appendix D) shall be made from—

(a) non-combustible material; *or*

(b) bushfire-resisting timber (see Appendix F); *or*

A1 (c) a timber species as specified in Paragraph E1, Appendix E; *or*

(d) a combination of any of Items (a), (b) or (c) above.

5.7.4 Balustrades, handrails or other barriers

This Standard does not provide construction requirements for balustrades, handrails and other barriers.

5.8 WATER AND GAS SUPPLY PIPES

Above-ground, exposed water and gas supply pipes shall be metal.

A Guide for Councils, Planners, Fire Authorities and Developers

ADDENDUM: APPENDIX 3

planning for bush fire protection

NSW RURAL FIRE SERVICE

2010

ISBN 0 9751033 2 6

Appendices

Appendix 3

Site Bush Fire Attack Assessment

A3.1 Introduction

This Appendix provides clarification on the use of AS3959-2009 as referenced in the Building Code of Australia (BCA) 2010.

Effective 1 May 2010, this document replaces Appendix 3 of *Planning for Bush Fire Protection 2006* (PBP) and is not to be used in isolation of the other components of PBP.

All development on bush fire prone land in NSW should comply with the requirements of this Appendix and other bush fire protection measures identified within PBP. Any reference in PBP to AS3959-1999 should be taken to be a reference to AS3959-2009. In addition, RFS documents that are provided as interpretations and clarification of issues related to PBP need to be considered as part of the application.

This Appendix forms an interim amendment to PBP to clarify the NSW development approval process in regards to bush fire protection and its relationship to AS3959-2009 as adopted in the BCA. A comprehensive review and revision of PBP will consider the findings of the Final Report of the 2009 Victorian Bushfires Royal Commission and any subsequent resulting changes to AS3959.

A3.2 Application

In NSW, the BCA bush fire protection provisions are applied to (via a NSW State variation to the BCA) Class 1, 2, 3 buildings, Class 4 parts of buildings, some Class 10 structures and Class 9 buildings that are Special Fire Protection Purposes (SFPPs).

The site assessment methodology covered in this Appendix applies for determining the construction requirements for buildings in a designated bush fire prone area. Appendix 2 of PBP addresses APZ requirements for subdividing land so that development flexibility is provided and future buildings can be built without theoretical exposure to potential flame contact. The APZ requirements for SFPP Developments are also covered in Appendix 2.

The methodology and criteria in this Appendix should not be applied in conjunction with the requirements found in Appendix 2 of PBP. The Asset Protection Zone (APZ) distances in Appendix 2 and the building construction requirements in this Appendix are separate processes and although complementary should be considered individually.

Generally, bush fire construction requirements do not apply under AS3959-2009 to buildings located more than 100 metres away from a bush fire hazard.

A3.3 PBP Compliance Approaches

Compliance with this Appendix is achieved on an Acceptable Solution (Deemed-to-satisfy (DTS)) or Alternative Solution basis by complying with the DTS provisions of the AS3959-2009 Tables 2.4.2, 2.4.3, and 2.4.4 or the methodology in section A3.4 as follows respectively.

In this regard any deviation from the requirements in AS3959-2009 Tables 2.4.2, 2.4.3, and 2.4.4 is considered an Alternative Solution in terms of PBP.

A3.4 Alternative Solution approach to site assessment: radiant heat flux and required separation distances

There are a number of basic concepts underpinning the requirements of PBP. Each is briefly described below:

(a) Radiant heat flux and fire intensity

Fire intensity is the rate of heat release, per unit length of the fire front, measured in kilowatts per metre (kW/m). It is a function of the heat content and weight of the fuel and the rate of spread of the fire. Radiant heat flux is a measure of heat energy impacting on a surface (kW/m^2).

(b) Fuel loads

Fuel is any organic matter available for ignition and combustible components include leaves, twigs, bark and residue (J. Gould, 2003). Fuel load is a measure (tonnes per hectare) of the accumulated vegetative matter available to a bush fire.

Fuel assessment methodology must be agreed to by the NSW Rural Fire Service (RFS). For the purposes of fuel assessment, the Natural Resources and Environment 'Overall Fuel Hazard Guide' (1999) is currently the methodology accepted by the RFS.

Determination of the protection measures required, is based on an estimation of the maximum hazard which, in turn, is based on maximum possible fuel loads likely to occur on and adjacent to the development site.

(c) Flame zone

The following definition shall supersede the definition in the dictionary section of PBP 2006 for the purposes of alternative solutions (page 73) in relation to this Appendix.

The distance from a bush fire at which it is calculated for the purposes of this document that there is significantly increased likelihood for flame contact to a building.Determined by the calculated distance at which the radiant heat received by the proposed building exceeds 40kW/m^2 or calculated by the point of potential flame contact, whichever occurs first.

Flame contact is the potential for intermittent impact of direct flame upon a surface and generally occurs at or above 29kW/m^2.

Flame length will vary (short/long) depending on vegetation type, wind and slope. Minimum defendable space and APZ requirements reflect flame length/ zone calculations.

Given the significant risk associated with developments in the flame zone and the complexity of the protection measures required, the RFS for the purposes of life safety, cannot support a 'one-size-fits-all' deemed-to-satisfy solution for buildings in the flame zone. To support this, the BCA has established a NSW variation that excludes AS3959 Section 9 Construction for Bushfire Attack Level FZ (BAL-FZ).

Class 1, 2, 3 or 4 (part) buildings not being a Special Fire Protection Purpose subject to BAL-FZ require an Alternative Solution and referral to the RFS for consideration under section 79BA of the Environmental Planning & Assessment Act 1979. Some class 10 buildings may also be referred under these provisions.

(d) Determining appropriate hazard parameters

A robust hazard assessment for habitable building development must quantify, for different vegetation types, the parameters of fire attack (embers, radiant heat, flame contact and wind) that damage or destroy buildings. This system must relate these parameters to threshold values of vulnerable components of buildings (CSIRO, 2000).

Determining appropriate hazard parameters requires measurements or models to describe:

- *components of structures, the threshold values for radiant heat flux and their duration;*
- *the flame characteristics of temperature, emissivity and hence radiant heat flux at the flame;*
- *different vegetation types, the flame height and width of flame-front and flame duration for high intensity bush fires as they reach the edge of vegetation; and*
- *the value for radiant heat flux as a function of distance from walls of flame of different dimensions. (see CSIRO, 2000)*

In 2004, the RFS developed a model which related hazard parameters to various building components. This model has been used as a basis for developing the following methodology. Table A3.4.2 of this Appendix can and should be used for determining the likely radiant heat flux on a building and hence which bushfire attack level from AS3959-2009 is appropriate in the particular circumstance.

The methodology is based on radiant heat flux derived for 12 vegetation formations (10 sub-formations), six slope classes and appropriate regional weather conditions and applied to different construction standards.

For building elements subject to radiant heat flux of greater than 29 kW/m^2, the use of exposed timber is generally not suitable without specific testing in accordance with suitable protocols.

The distances below can be considered on the basis of the various elements of a building when subject to heat, flames and ember attack. Extensive ember attack can occur beyond 100 metres ahead of a bush fire, however, distances are limited to a maximum of 100 metres for class 1, 2, 3 and Class 4 parts of buildings, some Class 10 structures and Class 9 buildings that are SFPP.

Figure A3.4.1 and Table A3.4.1 summarise the relationship between radiant heat flux and required separation (APZ) distances.

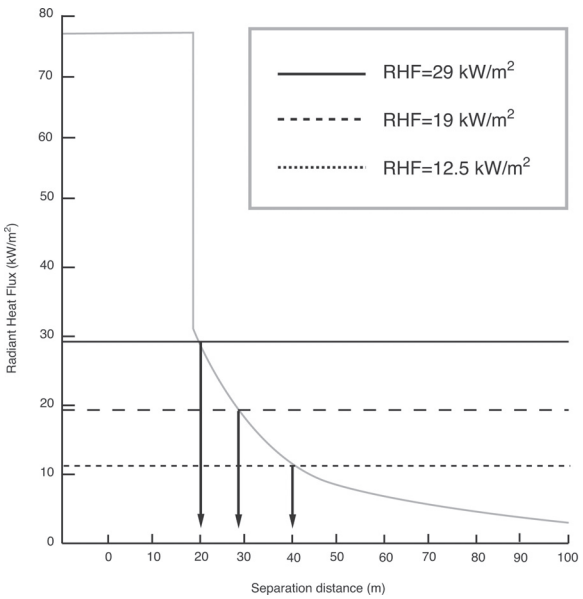


Figure A3.4.1 Sample illustration of radiant heat dynamics. Distance graph of forest for FDI = 100 (0° Slope).

Appendices

Table A3.4.1 Radiant heat flux and effects on buildings and people for a modeled forest fire (FDI 100 on flat ground)

Radiant Heat Flux	Likely Effects	Approx. Distances
2.1 kW/m^2	Unprotected person will suffer pain after 1 minute exposure – non fatal.	140 metres
3 kW/m^2	Hazardous conditions. Firefighters expected to operate for a short period (10 minutes)	100 metres
4.7 kW/m^2	Extreme conditions. Firefighter in protective clothing will feel pain. (60 seconds exposure)	70 metres
7 kW/m^2	Likely fatal to unprotected person after exposure for several minutes	55 metres
10 kW/m^2	Critical conditions. Firefighters not expected to operate in these conditions although they may be encountered. Considered to be life threatening < 1 minute in protective equipment. Fabrics inside a building could ignite spontaneously with long exposures.	45 metres
12.5 kW/m^2	Standard float glass could fail (BAL-12.5 construction) during the passage of a bush fire. Some timbers can ignite with prolonged exposure and with piloted ignition source (e.g. embers).	40 metres
19 kW/m^2	Screened float glass could fail (BAL-19 construction) during the passage of a bush fire.	27 metres
29 kW/m^2	Ignition of most timbers without piloted ignition (3 minutes exposure) (BAL-29 construction) during the passage of a bush fire. Toughened glass could fail.	20 metres
>29 – 40 kW/m^2	*Potential flame contact and increased radiant heat and ember attack.*	15 - 20 metres
>40 – 110 kW/m^2	*Significant higher likelihood of flame contact. Coupled with the radiant heat and increased ember attack is a significant risk to most structures and building materials.*	0 - 15 metres

Note: Assumes flame temperature of 1090K for all scenarios.

In general, a deemed-to-satisfy outcome can be achieved where the building is exposed to a radiant heat flux of less than or equal to 40 kW/m^2 (BAL-40). There is no deemed-to-satisfy for construction in the **Flame Zone**. Applicants need to consider the Performance Requirements of the BCA and the Specific Objectives of PBP for the type of building constructed.

Construction should not proceed where the proposed building has been identified as being at unacceptable risk because of any of the following:

- *It is located within the BAL-FZ and sufficient defendable space is not provided to protect the structure;*
- *there is no safe escape route for the building occupants and firefighters likely to be involved in protecting the building and its occupants during a bush fire.*

The level of construction cannot fall to less than BAL-12.5 construction where any part of the building is closer than 100 metres to the source of bush fire attack (unless otherwise provided for).

An elevation is exposed if there is a direct line of sight from any part of that elevation to the source of the bush fire attack (excluding fencing and other minor obstructions).

Appendices

The following table shows the bush fire attack levels under AS3959-2009.

Table A3.4.2 Radiant heat flux exposure and appropriate Bush Fire Attack Levels (BALs)

Heat Flux Exposure	Description	AS3959-2009 Construction Level
N/A	Minimal attack from radiant heat and flame due to the distance of the site from the vegetation, although some attack by burning debris is possible. There is insufficient threat to warrant specific construction requirements.	Bush Fire Attack Level – Low (BAL-LOW)
≤12.5	Attack by burning debris is significant with radiant heat (not greater than 12.5 kW/m^2). Radiant heat is unlikely to threaten building elements (eg unscreened glass). Specific construction requirements for ember protection and accumulation of debris are warranted.	Bush Fire Attack Level – 12.5 (BAL-12.5)
>12.5 ≤19	Attack by burning debris is significant with radiant heat flux (not greater than 19 kW/m^2) threatening some building elements (screened glass). Specific construction requirements for embers and radiant heat are warranted.	Bush Fire Attack Level – 19 (BAL-19)
>19 ≤29	Attack by burning debris is significant and radiant heat flux (not greater than 29 kW/m^2) threaten building integrity. Specific construction requirements for ember and higher radiant heat are warranted. Some flame contact is possible.	Bush Fire Attack Level – 29 (BAL-29)
>29 ≤40	Radiant heat flux and potential flame contact could threaten building integrity.	Bush Fire Attack Level – 40 (BAL-40)
>40	Significant radiant heat and significant higher likelihood of flame contact from the fire front will threaten building integrity and result in significant risk to residents.	Bush Fire Attack Level – Flame Zone (BAL-FZ)

Note: Attack from burning debris increases with the bush fire attack level.

An Alternative Solution will be required if the building exceeds the specification of BAL-40 of AS 3959 (ie >40 kW/m^2) in which case it is considered to be within the 'Flame Zone'. NSW has made a State based variation to the BCA. This variation excludes BAL-FZ as a deemed-to-satisfy solution.

The following subsection describes how to determine the appropriate bush fire attack level.

A3.5 Site assessment methodology for determining level of bush fire attack

This general method has been used to determine the bush fire attack level using NSW data. This provides a more refined bush fire attack site assessment.

The methodology was developed (see Douglas and Tan, 2005) from the following inputs:

- *the relevant weather scenario for the fire weather district in NSW (see inside rear cover and Table A2.3)*
- *vegetation types and the corresponding fuel types present were determined (see Table A2.1)*
- *the appropriate fuel loads for the fuel types were used for input into fire behaviour models*
- *the fire-line intensity (kW/m) for a range of slope and distance combinations was calculated*
- *the sustained flame length was calculated and a flame temperature of 1090K was applied*
- *distance classes for radiant heat flux for 12.5 kW/m^2, 19 kW/m^2, 29 kW/m^2 and 40kW/m^2 were determined using the View Factor model*
- *based on the calculated fire behaviour, the level of bush fire attack (BAL 12.5, 19, 29 and 40) corresponding to the relevant radiant heat flux on the proposed building was then determined.*

This procedure is based upon the generic method described above and uses the weather scenario of an appropriate Forest Fire Danger Index (FDI) (for forest fuels), wind speeds of 45kph and typical fuel loads for NSW vegetation experienced during a severe bush fire in NSW.

For the purposes of this Appendix, a flame temperature of 1090K has been adopted when calculating the level of bush fire attack to building elements. 1090K reflects the standard used for flame temperature for determining requirements for buildings other than for Special Fire Protection Purpose Developments.

When calculating APZ distances for Special Fire Protection Purpose Developments (Table A2.6) a 1200K flame temperature was adopted. This higher flame temperature is used for developments where occupants are considered more vulnerable to reflect a higher degree of conservatism, the key design consideration for SFPP developments.

To determine the required level of construction for a building the following steps must be followed:

Step 1: Determine vegetation formation types and sub-formations around the building (see Appendix 2), as follows:

(i) Identify all the vegetation types within 140 metres of the site using Keith (2004);
(ii) Classify the vegetation formations as set out in Table A2.1 in Appendix 2; and
(iii) Convert Keith to Specht classifications using Table A3.5.1 below.

AS3959-2009 as referenced in the BCA-2010 uses AUSLIG (1990) vegetation classifications while PBP uses Keith.

Step 2: Determine the distance between each vegetation formation identified (from the edge of the foliage cover) and the building.

Step 3: Determine the effective slope of the ground for each vegetation group (see Appendix 2) using the classes provided below.

Slopes are classified as follows:

(i) Upslopes are considered to be 0°.
(ii) Greater than 0° but not greater than 5° downslope.
(iii) Greater than 5° but not greater than 10° downslope.
(iv) Greater than 10° but not greater than 15° downslope.
(v) Greater than 15° but not greater than 20° downslope.

Step 4: Determine the relevant FDI for the council **area** in which the development is to take place from Table A2.3 in Appendix 2. For Alpine Resorts see Step 5 below.

Step 5: Match the relevant FDI, appropriate vegetation, distance and effective slope classes to determine the bush fire attack levels using the relevant tables of AS3959-2009 as indicated below:

- FDI 100 -Table 2.4.2
- FDI 80 - Table 2.4.3
- FDI 50 - Table 2.4.4

Note: A building with any facade identified as requiring a construction level must build all facades to at least BAL-12.5. Where more than one facade is exposed to a hazard, then the facade with the highest construction requirement is used to determine the appropriate level of construction. All other facades may be reduced by one level of construction unless that facade is also subject to the same bush fire attack level.

Appendices

Table A3.5.1 – Conversion of vegetation classification from David Keith's *Ocean Shores to Desert Dunes* (used in PBP) to the AUSLIG Pictorial Analysis in AS3959-2009. This conversion is based on what is considered the best representation of similar bush fire behavior potential.

David Keith's *Ocean Shores to Desert Dunes*	AUSLIG (1990) Pictorial Analysis (AS3959-2009)
Forests (Wet & Dry Sclerophyll)	*Forest*
Pine Plantations	
Forested Wetlands	
Woodlands (Grassy, Semi-Arid)	*Woodland*
Tall Heath (Scrub)	*Scrub*
Freshwater Wetlands	
Short Heath (Open Scrub)	*Shrubland*
Arid Shrubland	*Mallee/Mulga*
Alpine Complex (Sedgelands)	*Tussock Moorland*
Rainforest	*Rainforest*
Grassland	*Grassland*

For the purposes of Table A2.6 in Appendix 2, the requirements for Alpine Resorts should be developed using Table 2.4.4 of AS3959-2009. Generally, most development applications within the Alpine Resorts consist of alterations and additions to existing buildings and therefore would be treated as infill development. Developments involving new leases or new alpine resorts must contact the RFS to determine the APZ requirements.

A3.6 Construction Considerations within the Flame Zone

There is potential for flames to ignite the external facade of a building which can continue to burn after the passage of the fire front. Therefore some degree of conservatism in relation to the exposure period is appropriate.

In NSW there are no recognized deemed-to-satisfy arrangements for construction of buildings within the Flame Zone. Where sustained flame contact is likely, the radiant heat and convective heat exposures are considerable and overwhelms most materials.

While AS3959 can be used as a guide to improve building safety, this is subject to additional control measures not included in this document. The design and construction of a building is just one means of mitigating the bush fire risk and will normally require supplementation by a range of other mitigation measures to the satisfaction of the authority having jurisdiction. The extent of additional measures required will be dependent upon the bush fire hazard and its proximity to the buildings. In addition to the construction requirement of AS3959, applicants should also address the Performance Requirements of the BCA and consider the siting and the design principles in Section 4.3.5 of PBP.

Where new testing regimes are developed and deemed appropriate by the NSW Rural Fire Service, these may be incorporated as part of the process of developing alternative solutions. Alternative solutions will be considered on their merits.

A3.7 Additional Construction Requirements

Planning for Bush Fire Protection is designed to provide for improved bush fire protection outcomes through the planning system, whereas the construction requirements are established through the operation of the BCA. However, based on a review of AS3959-2009 and recent developments through the interim findings from the Victorian Royal Commission, the RFS has concerns over the levels of safety for ember protection at lower BAL levels (BALs 12.5 and 19) provided by AS3959-2009. The RFS is concerned that by adopting the new Standard there would be a reduction in safety created from that afforded by the previous NSW application of AS3959-1999 in relation to ember protection. In this regard, the RFS will aim to maintain the safety levels previously provided by AS3959-1999. In particular, the areas of concern arise from requirements for:

- Sarking
- Sub floor screening
- Floors
- Verandas, Decks, Steps, Ramps And Landings

In addition, in order to provide a suitable combination of bush fire protection measures the NSW Rural Fire Service will, as part of the planning assessment process, recommend / require additional construction requirements beyond those prescribed in AS3959-2009 as deemed appropriate.

Planning requirements for grasslands are contained within the main body of PBP.

As part of the planning requirements, the following will create part of the suite of protection

measures required to form compliance with *Planning for Bush Fire Protection*.

SARKING
Any sarking used for BAL-12.5, BAL-19, BAL-29 or BAL-40 shall be:

a. Non-combustible; or
b. Breather-type sarking complying with AS/NZS 4200.1 and with a flammability index of not more than 5 (see AS1530.2) and sarked on the outside of the frame; or
c. An insulation material conforming to the appropriate Australian Standard for that material.

SUBFLOOR SUPPORTS
For BAL-12.5 and BAL-19, Clause 5.2 and 6.2 shall be replaced by the provisions of Clause 7.2. In this regard, Clause 7.2 states:

"7.2 SUBFLOOR SUPPORTS

This Standard does not provide construction requirements for subfloor supports where the subfloor space is enclosed with—

a. *a wall that complies with .....* **(Clause 5.4 or 6.4 as appropriate)***; or*
b. *a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion resistant steel, bronze or aluminium; or*
c. *a combination of Items (a) and (b) above.*

Where the subfloor space is unenclosed, the support posts, columns, stumps, piers and poles shall be—

(i) *of non-combustible material; or*
(ii) *of bushfire-resisting timber (see Appendix F); or*
(iii) *a combination of Items (i) and (ii) above.*

NOTE: This requirement applies to the principal building only and not to verandas, decks, steps, ramps and landings (see Clause 7.7)."

ELEVATED FLOORS
For BAL-12.5 and BAL-19, Clause 5.3 and 6.3 shall be replaced by the provisions of clause 7.3. In this regard, clause 7.3.2 states:

"7.3.2 Elevated floors
7.3.2.1 Enclosed subfloor space

This Standard does not provide construction requirements for elevated floors, including bearers, joists and flooring, where the subfloor space is enclosed with—

a. *a wall that complies with .....* **(Clause 5.4 or 6.4 as appropriate)***; or*
b. *a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion resistant steel, bronze or aluminium; or*
c. *a combination of Items (a) and (b) above.*

7.3.2.2 Unenclosed subfloor space

Where the subfloor space is unenclosed, the bearers, joists and flooring, less than 400 mm above finished ground level, shall be one of the following:

a. *Materials that comply with the following:*
   (i) *Bearers and joists shall be—*
      A. non-combustible; or
      B. bushfire-resisting timber (see Appendix F); or
      C. a combination of Items (A) and (B) above.
   (ii) *Flooring shall be—*
      A. non-combustible; or
      B. bushfire-resisting timber (see Appendix F); or
      C. timber (other than bushfire-resisting timber), particleboard or plywood flooring where the underside is lined with sarking-type material or mineral wool insulation; or
      D. a combination of any of Items (A), (B) or (C) above. or
b. *A system complying with AS 1530.8.1*

This Standard does not provide construction requirements for elements of elevated floors, including bearers, joists and flooring, if the underside of the element is 400 mm or more above finished ground level."

VERANDAS, DECKS, STEPS, RAMPS AND LANDINGS
For BAL-12.5 and BAL-19, Clause 5.7 and 6.7 shall be replaced by the provisions of clause 7.7. In this regard, clause 7.7 states:

"7.7 VERANDAS, DECKS, STEPS, RAMPS AND LANDINGS
7.7.1 General

Decking may be spaced.

There is no requirement to enclose the subfloor spaces of verandas, decks, steps, ramps or landings.

7.7.2 Enclosed subfloor spaces of verandas, decks, steps, ramps and landings
7.7.2.1 Materials to enclose a subfloor space

The subfloor spaces of verandas, decks, steps, ramps and landings are considered to be 'enclosed' when —
a. *the material used to enclose the subfloor space complies with ....* **(Clause 5.4 or 6.4 as appropriate)***; and*
b. *all openings greater than 3 mm are screened with a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.*

7.7.2.2 Supports

This Standard does not provide construction requirements for support posts, columns, stumps, stringers, piers and poles.

7.7.2.3 Framing

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

7.7.2.4 Decking, stair treads and the trafficable surfaces of ramps and landings

Decking, stair treads and the trafficable surfaces of ramps and landings shall be—
a. *of non-combustible material; or*
b. *of bushfire-resisting timber (see Appendix F); or*
c. *a combination of Items (a) and (b) above.*

7.7.3 Unenclosed subfloor spaces of verandas, decks, steps, ramps and landings
7.7.3.1 Supports

Support posts, columns, stumps, stringers, piers and poles shall be—
a. *of non-combustible material; or*
b. *of bushfire-resisting timber (see Appendix F); or*
c. *a combination of Items (a) and (b) above.*

7.7.3.2 Framing

Framing of verandas, decks, ramps or landings (i.e., bearers and joists) shall be—
a. *of non-combustible material; or*
b. *of bushfire-resisting timber (see Appendix F); or*
c. *a combination of Items (a) and (b) above.*

7.7.3.3 Decking, stair treads and the trafficable surfaces of ramps and landings

Decking, stair treads and the trafficable surfaces of ramps and landings shall be—
a. *of non-combustible material; or*
b. *of bushfire-resisting timber (see Appendix F); or*
c. *a combination of Items (a) and (b) above.*

7.7.4 Balustrades, handrails or other barriers

Those parts of the handrails and balustrades less than 125 mm from any glazing or any combustible wall shall be—
a. *of non-combustible material; or*
b. *bushfire-resisting timber (see Appendix F); or*
c. *a combination of Items (i) and (ii) above.*

Those parts of the handrails and balustrades that are 125 mm or more from the building have no requirements."

HEAD OFFICE
Suite 4, Level 1
2-4 Merton Street
Sutherland NSW 2232
T 02 8536 8600
F 02 9542 5622

SYDNEY
Level 6
299 Sussex Street
Sydney NSW 2000
T 02 9993 0566
F 02 9993 0573

ST GEORGES BASIN
8/128 Island Point Road
St Georges Basin NSW 2540
T 02 4443 5555
F 02 4443 6655

CANBERRA
Level 2
11 London Circuit
Canberra ACT 2601
T 02 6103 0145
F 02 6103 0148

HUNTER
Suite 17, Level 4
19 Bolton Street
Newcastle NSW 2300
T 02 4910 0125
F 02 4910 0126

NAROOMA
5/20 Canty Street
Narooma NSW 2546
T 02 4476 1151
F 02 4476 1161

COFFS HARBOUR
35 Orlando Street
Coffs Harbour Jetty NSW 2450
T 02 6651 5484
F 02 6651 6890

ARMIDALE
92 Taylor Street
Armidale NSW 2350
T 02 8081 2681
F 02 6772 1279

BRISBANE
93 Boundary Street
West End QLD 4101
T 1300 646 131

WESTERN AUSTRALIA
Suite 1 & 2
49 Ord Street
West Perth WA 6005
T 08 9227 1070
F 08 9322 1358

WOLLONGONG
Level 2
25 Atchison Street
Wollongong NSW 2500
T 02 8536 8615
F 02 4254 6699

GOSFORD
Suite 5, Baker One
1-5 Baker Street
Gosford NSW 2250
T 02 4302 1220
F 02 4322 2897