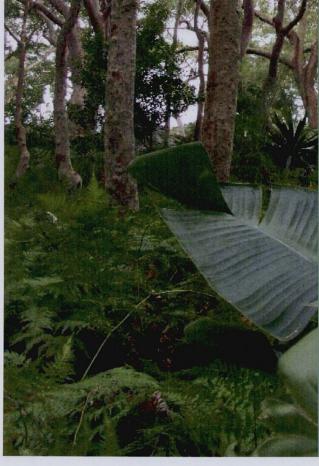


APPENDIX I





# Bushfire Protection Assessment



RESIDENTIAL DEVELOPMENT WARRIEWOOD VALLEY SECTOR 9

> NOVEMBER 2008 (REF: 8093B)

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# **BUSHFIRE PROTECTION ASSESSMENT**

RESIDENTIAL DEVELOPMENT WARRIEWOOD VALLEY, SECTOR 9

**NOVEMBER 2008** 

Report Author: Nicole Van Dorst / John Travers

Checked by: John Travers
Date: 6<sup>th</sup> November 2008

File: 8093B

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#### **EXECUTIVE SUMMARY**

A bushfire protection assessment has been undertaken to contribute to the creation of a Master plan for Warriewood Valley, Sector 9. The master plan involves the subdivision of rural residential land into approximately 213 lots. The proposed residential development plus associated infrastructure including new road access; will be assessed in compliance with Planning for Bushfire Protection 2006.

The development is regarded by the *NSW Rural Fire Service* as being a *residential* subdivision and this requires the RFS to consider issuing a *Bushfire Safety Authority*.

PBP dictates that the subsequent extent of bushfire attack that can potentially emanate from a bushfire must not exceed a radiant heat flux of 29 kW/m² for residential developments. This rating assists in determining the size of the asset protection zone to provide the necessary defendable space between hazardous vegetation and a building.

The assessment found that bushfire can potentially affect the proposed development from the existing forest vegetation within the adjoining Ingleside Escarpment to the west; and also from the proposed regenerated forested vegetation within the riparian corridor to the north resulting in possible ember attack, radiant heat and potentially flame attack.

It would be expected that a fire would only develop medium to high intensities within the adjoining vegetation. The proposed development is therefore not exposed to any significant vulnerability from bushfire attack if appropriate asset protection zones are in place and managed.

The assessment has concluded that applying the principles of PBP 2006 would allow;

- The provision of asset protection zones in accordance with PBP 2006.
- Construction of the buildings in accordance with AS 3959.
- Comply with access as per Section 4.1.3 of PBP
- Other bushfire protection measures are planned and identified with the recommendations.

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# **SECTION 1.0 - INTRODUCTION**

Travers environmental has been requested by Stockland to undertake a bushfire protection assessment to contribute to the creation of a Master plan for Warriewood Valley, Sector 9 within the residential suburb of Warriewood.

The proposed residential subdivision is located on land that is mapped by Pittwater Council as being bushfire prone. This triggers assessment by Council in respect of the *NSW Rural Fire Service* policy document entitled *Planning for Bush Fire Protection 2006 (PBP 2006)*. This also requires the RFS to consider issuing a *Bushfire Safety Authority*.

### 1.1 Aims of the Assessment

The aims of the bushfire protection assessment are to:

- · Review the bushfire threat to the Warriewood Valley's landscape
- Undertake a bushfire attack assessment in accordance with Planning for Bush Fire Protection 2006
- Provide advice on mitigation measures including the provision of asset protection zones and construction standards and other specific fire management issues.
- Review the potential to carry out hazard management over the landscape

#### 1.2 Project Synopsis

#### Subdivision

The Sector 9 boundary encompasses an existing 16 rural residential lots. The Master plan involves the further subdivision of these lots as follows:

- 114 standard lots
- · 85 medium density lots
- 14 integrated lots

The northern boundary of the sector is formed by Fern Creek. A 25-50 metre riparian buffer zone has been applied to this creekline. The riparian buffer will be regenerated and for the purposes of this report a forest vegetation structure has been adopted.

The proposed lots within the north-western corner of the property are larger in size to accommodate the larger asset protection zones required to protect dwellings from the adjoining bushfire hazard.

#### Access

The primary access point to the development will be through the existing residential development of Warriewood from the south onto Fern Creek Road and the internal road system for the subdivision. Additionally there is a secondary access point onto Orchard Street in the south.

Road recirculation comprises of a series of perimeter roads which link to the internal road system of the subdivision. A dead end road (230 metres in length) provides access to the north-western portion of the sector whilst providing a perimeter road to the extensive forest vegetation to the north-west. Road widths vary in size between 10 metres 20 metres in reservation width. Access lanes are 8 metres in width.

## Construction of Dwellings

Level 2 construction standards will apply to the majority of dwellings facing the bushfire hazard around the perimeter of the sector boundary exposed to a high bushfire threat.

The proposed dwellings exposed to a medium bushfire threat within the south-western portion of the development and internally within 100 metres of the bushfire threat will be constructed to Level 1 construction standards

#### **Ancillary Works**

Development works will involve the provision of access roads and services such as reticulated water, on site sewerage, power and on site drainage.

#### 1.3 Information Collation

To achieve the aims of this report, a review of the information relevant to the property was undertaken prior to the initiation of field surveys. Information sources reviewed include the following:

- Site plans prepared by McGauran Giannini Soon Pty Ltd Architects, 2007
- Google Aerial photograph DLWC 1:25,000
- Mona Vale topographical maps DLPI of NSW 1:25,000
- Australian Standard 3959 'Construction of Buildings in Bush Fire Prone Areas'
- Planning for Bush Fire Protection 2006 (NSW RFS).

An inspection of the proposed development site and surrounds was undertaken by Nicole van Dorst in August to assess the topography, slopes, aspect, drainage, vegetation and adjoining land use. The identification of existing bush fire measures and a visual appraisal of bush fire hazard and risk were also undertaken.

#### 1.4 Site Description

The Sector 9 boundary is irregular in shape and in effect surrounds existing rural residential development within its western boundary. Sector 9 is 21 hectares in size and is located to the north-west of the junction of Garden St and Orchard St, Warriewood. Fern Creek Road bisects the site of Warriewood Valley Sector 9.

The site is bounded to the north by Fern Creek. A riparian corridor (25-50 metres wide) has been applied to this creek line and is proposed to be regenerated to a forest vegetation structure. Beyond this riparian corridor to the north and adjoining Sector 9 to the east and south is a mixture of ovals, residential and industrial development.



Figure 1: Location Map (approximate)

The land to the west of Sector 9 and beyond the rural residential development consists of bushland within Ingleside Park. Ingleside Park forms part of the Warriewood Ingleside Escarpment which covers over 76 hectares of land extending from Mona Vale Road in the north to Mullet Creek in the south. The land to the west rises steeply at approximately 18 degrees towards the top of the escarpment located over 100 metres from the Sector 9 boundary.

Approximately 75% of Sector 9 has been cleared for paddocks and rural residential development or has been under scrubbed and managed. Patches of remnant forest vegetation occur within the adjoining rural residential lands to the west.

The township of Elanora Heights and North Narrabeen is located approximately 1.5 kilometres to the south of the site. Mona Vale is located to the north with Ingleside to the west.

Sector 9 is situated on gentle slopes within the eastern portion, generally less than 5%. Slopes vary considerably within the western portion and are on the lower slopes of the surrounding Warriewood Escarpment. One hill exists within the 'Hack Hill'area where gradients are 20% on the lower slopes on the south side of the hill off Orchard Street.

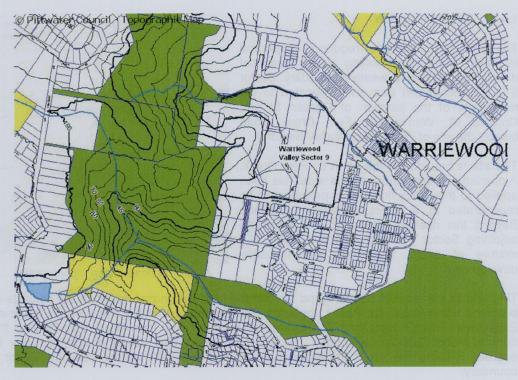


Figure 2: Topographic Map (source: Pittwater Council

The proposed Sector 9 boundary is located within land zoned as 1(b) non urban. The surrounding areas to the north, east and south are zoned 2(f) Urban Purposes – Mixed Residential. The adjoining land to the west is bushland vegetation within Ingleside Escarpment and is zoned 7(a) Environmental Protection (orange) and 6(a) Existing Recreation.



Figure 3: Zoning Map (source: Pittwater Council)



# **SECTION 2.0 – BUSHFIRE ASSESSMENT**

Bushfire protection planning requires the consideration of the NSW Rural Fire Service planning document entitled *Planning for Bush Fire Protection* published in 2006 *(PBP)*. PBP provides planning controls for building in bushfire prone areas as well as guidance on effective bushfire protection measures.

The policy aims to provide for the protection of human life (including fire fighters) and to minimise impacts on property and the environment from the threat of bushfire, while having due regard to development potential, on site amenity and protection of the environment. More specifically, the *aims & objectives* for all development located on bushfire prone land should:

- 1. Afford occupants of any building adequate protection from exposure to a bush fire
- 2. Provide for a defendable space to be located around buildings
- 3. Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition
- 4. Ensure that safe operational access and egress for emergency service personnel and residents is available
- 5. Provide for ongoing management and maintenance of bush fire protection measures, including fuel loads in the asset protection zone (APZ); and
- 6. Ensure that utility services are adequate to meet the needs of fire fighters (and others assisting in bush fire fighting).

The additional objectives for subdivisions are to:

- 7. Minimise the perimeters of the subdivision exposed to the bushfire hazard
- 8. Minimise bushland corridors that permit the passage of fire
- 9. Provide for the siting of future dwellings away from ridge-tops and steep slopes particularly up-slopes, within saddles and narrow ridge crests.
- 10. Ensure that separation distances (APZ) between the bushfire hazard and future dwellings enable conformity with the deemed-to-satisfy requirements of the BCA.
- 11. Provide and locate, where the scale of development permits, open space and public recreation areas as accessible public refuge areas or buffers (APZ)
- 12. Ensure the ongoing management of asset protection zones

- 13. Provide clear and ready access from all properties to the public road system for residents and emergency services.
- 14. Ensure the provision of and adequate supply of water and other services to facilitate effective fire fighting.

Thus development in bushfire prone areas requires consideration of the overall threat upon a site and the way occupants of a site are potentially able to cope in the event of a bushfire. To assess the bushfire threat that is likely to occur and affect the proposed development property a review of the elements that comprise the overall threat needs to be completed.

These elements include the potential hazardous landscape that may affect the site, the subsequent extent of the bushfire risk and the expected level of vulnerability of any proposed dwellings and other infrastructure to both occupants and or fire fighters.

#### 2.1 Hazardous Fuels

The bushfire hazard is defined as the potential severity of a bush fire and is measured in terms of the potential intensity i.e. kW/m² (Kilowatts per square metre of fire front).

The factors that influence bushfire hazard are primarily the nature of the vegetation (fuel) and the effective slope that contributes to increasing bushfire behaviour. Factors such as wind and fuel dryness also contribute to the hazard achieving maximum intensity levels.

They are categorised according to the type of vegetation - for example Group 1 is forest, Group 2 is woodland and Group 3 is rainforest and or grassland. These vegetation 'structure' descriptions are commensurate with the vegetation descriptions of NSW described by David Keith 2006 (DECC).

Hazardous fuels are primarily the native bushland that exist, largely, to the west and north, for example;

- The extensive forest vegetation located within the escarpment of Ingleside Park to the west of the development, this vegetation extends significantly to the north, east and west.
- The proposed forest within the adjoining 25 50 metre wide riparian corridor adjacent to the northern boundary.
- Remnant patches of forest vegetation within the rural residential landscape of Hack Hill located centrally to the southern boundary. It is expected that the majority of this vegetation will be removed for the construction of dwellings. Any remaining vegetation will be fragmented and discontinuous in nature.
- Remnant patches of forest vegetation within the rural residential landscape adjoining the western boundary which provides a vegetative link to the Warriewood Escarpment.

#### 2.1.1 Potential Bushfire Risk

The bushfire risk is defined as the chance of a bushfire igniting, spreading and causing damage to property or the environment.

The presence of native vegetation within the existing hazardous areas to the north-west and south-west presents a permanent potential for bushfire attack upon the residential landscape. The proposed regeneration of the riparian corridor adjoining the northern boundary will also pose a significant bushfire threat. The mature forests have the potential to cause a fire event that may require evacuation of all residents whilst providing damage potential to all buildings.

Thus the bushfire prone nature of the landscape will require measures to mitigate the bushfire risk such that it is deemed acceptable. These measures are primarily based on the provision of defendable space between the hazards and the habitable dwellings.





Photo 1 & 2: Existing vegetation within the riparian corridor proposed to be regenerated.

#### 2.1.2 Level of Development Vulnerability

Vulnerability is the likely exposure of the intended development site to the expected fire behaviour that could impact life and / or property.

There is extensive forest vegetation located within the Ingleside escarpment to the west of the south-western and north-western corner of the property. However it would not be expected that a fire burning within this open forest vegetation could develop significant intensities due to the steep upslope influence.

A riparian corridor width of between 25-50 metres has been applied to the creek adjoining the northern boundary. Although this vegetation is currently disturbed and/or non-existing it is proposed that this corridor will undergo replanting and regeneration and potentially has the ability to form a forest threat.

Therefore it is possible that fires could occur within the surrounding bushland with the potential impact in the form of radiant heat, flame impact and potentially ember attack. However with an appropriately sized APZ the intensity of the bushfire can be mitigated down to the acceptable radiant heat performance threshold of  $<29 \text{ k/W m}^2$ .

# 2.2 Bushfire Attack Assessment

The Rural Fire Service requires that a development application must include a bushfire attack assessment to determine the possible impact or vulnerability of a habitable structure from fire. The assessment may be undertaken using a 'deemed to satisfy' approach or a 'performance based' approach. The former is qualitatively explained within PBP whilst the latter requires specialist assessment techniques not covered within PBP.

PBP provides a methodology to determine the size of any asset protection zone that may be required to offset possible bushfire attack. In addition PBP advises on building construction design levels. The latter being relevant to AS3959 'Construction of buildings in bushfire prone areas.

The assessment uses the vegetation type and slope gradient to determine the size of the APZ and the accompanying construction level. Vegetation type is assessed for a distance of 140 metres external to the proposed development area whilst the effective slope is assessed for 100 metres. Effective slope refers to that slope which provides the most *effect* upon likely fire behaviour. A mean average slope may not in all cases provide sufficient information such that an appropriate assessment can be determined.

The slope is variable on the site but can be summarised as;

- A relatively level slope within the majority of the riparian corridor adjacent to the northern boundary.
- An effective slope of 0 5 degrees within the riparian corridor to the north-west. An initial steep bank for less than 10 metres gives rise to a gently upslope influence on the opposing side of the creekline.
- The slope within the hazardous vegetation to the west of the north-western and south-western corners of the development is a steep upslope influence of 18 degrees towards Ingleside escarpment.
- A sloping aspect of 9 12 degrees upslope within the remnant vegetation adjacent to the central portion of the western boundary.



Photo 3: Forest vegetation on uphill slope to the escarpment in the west.

Slopes have been calculated and mapped using client plans and verified on site using a hand held clinometer.

A Fire Danger Index (FDI) of 100 has been used to calculate bushfire behaviour on the site using forest vegetation located within the Greater Sydney Region.

# The Attack Potential has yielded the following results:

- The application of a 12 metre wide APZ adjacent to the 18 degree upslope vegetation to the south-west will see fire intensity of 8,953 kW/m and a flame length of 7.51 metres and a radiant heat flux of 17.83 kW/m²
- The application of an 19 metre wide APZ adjacent to the 18 degree upslope vegetation to the west will see fire intensity of 31,000 kW/m and a flame length of 18.60 metres and a radiant heat flux of 11.83 kW/m<sup>2</sup>
- The application of a 15 metre wide APZ adjacent to 12 degree upslope vegetation to the west will see a fire intensity of 13,545 kW/m and a flame length of 9.82 metres and a radiant heat flux of 18.7 kW/m<sup>2</sup>

Table 1 below provides a summary of the bushfire attack assessment for the proposed development.

Table 1 - Bushfire Attack Assessment

Boundary Aspect	Vegetation within 140m of Development	Effective Slope of Land	APZ Provided	Level of Bushfire Attack	Construction Standard
North (eastern	Riparian Corridor (less than 50		25 metres	Medium	Level 1
section)	metres in width)	O O	30 metres	High	Level 2
North (western section	Riparian Corridor (forest less than 50 metre fire run)	0-5° <sup>D</sup>	36 metres	Medium	Level 1
	Forest	0-5° D	36 metres	High	Level 2
South – west (northern portion)	Forest	18° <sup>U</sup>	12 metres	High	Level 2
West (central portion)	Forest	12° U	16 metres	High	Level 2
North-west (central portion)	Forest	9° <sup>U</sup>	19 metres	High	Level 2
West (southern portion)	Forest	18° <sup>U</sup>	19 metres	Medium	Level 1

Notes: \* Slope is either 'U' meaning upslope or 'C' meaning cross slope or 'D' meaning downslope

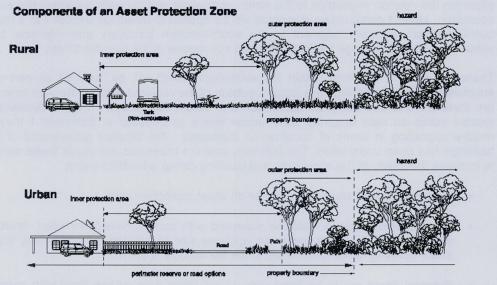
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# **SECTION 3.0 – SPECIFIC PROTECTION ISSUE**

#### 3.1 Asset Protection Zones

Asset protection zones (APZ) are areas of defendable space separating hazardous vegetation from buildings. The APZ generally consists of two subordinate areas, namely an *inner protection area* and an *outer protection area*. The OPA is closest to the bush and the IPA is closest to the dwellings. The IPA can not be used for habitable dwellings but can be used for all external non-habitable structures such as pools, sheds, non attached garages, cabanas, etc. A typical APZ and therefore defendable space is graphically represented as follows;



Source: RFS, 2006

**Note:** Vegetation management as shown is for illustrative purposes only. Specific advice is to be sought in regard to vegetation removal and retention from a qualified and experienced expert to ensure asset protections zones comply with the RFS performance criteria.

PBP dictates that the subsequent extent of bushfire attack that can potentially emanate from a bushfire must not exceed a radiant heat flux of 29  $kW/m^2$  for residential developments. This rating assists in determining the size of the asset protection zone which is designed to provide the necessary *defendable space* between hazardous vegetation and a building.

In achieving this rating the size of the APZ has been determined according to RFS deemed to satisfy standards. Asset protection zones have been applied in order to reduce the

radiant heat exposure to the dwellings to achieve Level 2 and Level 1 construction standards. The results illustrate that the site is exposed to a High to Medium level of bushfire attack from the impact of bushfires burning within the adjacent bushland surrounding the site. The APZ's shown in Table 1 and depicted in Schedule 1 attached adhere to the requirements of PBP.

#### 3.2 Building Protection

The construction of buildings in bushfire prone areas is subject to stringent rules pertinent to the building envelope being located on the non hazardous side of the asset protection zone. Clearly the APZ is to provide a safe space to separate the hazard from the building. The APZ can not be used for construction because it is the area where the flame of a fire will enter. Thus this area is referred to as the flame zone.

A construction classification system has been designed for bushfire prone areas and is based on three (3) levels, Level 1, Level 2 and Level 3. The lowest level being level 1 has the longest APZ distance whilst Level 3 has the shortest APZ distance. These allow a varying level of building design and use of appropriate materials.

The proposed building construction levels are located on the attached Schedule 1 plan and are depicted on each proposed allotment for ease of reference. Generally Level 2 construction category is limited to those dwellings exposed to a high bushfire threat mainly adjoining the riparian vegetation to the north, north-west and centrally adjoining the western boundary. Level 1 construction standards will be applied to dwellings exposed to a medium bushfire threat generally adjacent to the south-western boundary and internally to the subdivision where buildings are located within 100 metres of the bushfire threat.

There are existing dwellings within the subdivision which will be retained as part of the subdivision. These dwellings are located outside of the required asset protection zones and are therefore afforded adequate separation and defendable space. If these dwellings are located within an area requiring construction levels as depicted in Schedule 1 they may require upgrading in terms of construction standards. No detailed assessment of these buildings has been undertaken. The following bushfire measures will assist these dwellings to increase the safety of the occupants and dwelling during a bushfire event.

- All available land should be used as an asset protection zone.
- All openable windows shall be screened with corrosion-resistant steel, bronze or aluminium mesh with a maximum aperture size of 1.8 mm in such a way that the entire opening remains screened when the window is open.
- External doors are to be fitted with a tight fitting door screen fitted with corrosion-resistant steel, bronze or aluminium mesh with a maximum aperture size of 1.8 mm.
- External doors are to be fitted with weather strips or draught excluders to prevent the penetration or build-up of burning debris beneath the door; and
- Vents and weepholes shall be protected with spark guards made from corrosionresistant-steel, bronze or aluminium mesh with a maximum aperture size of 1.8 mm
- Roof gutters and valleys to the dwelling is to be leaf proofed by the installation of an external gutter protection shroud or a gutter system that denies all leaves from entering the gutter and building up on that gutter

# 3.3 Hazard Management

Should the development be approved the owner or occupier of each lot will be required to manage the asset protection zone to the specifications of Councils approval.

There are circumstances within the subdivision where the asset protection zone extends beyond the lot boundary into the 50 metre buffer zone adjoining the creek line. There are two options for management of these asset protection zones as outlined below:

- The first option is to extend the lot boundaries to meet with the 25 metre buffer zone
  with management of the asset protection zone being undertaken by individual lot
  owners.
- The second option is for the dedication of this land to Council. The management of the asset protection zone will be the responsibility of Council.

These two options require further investigation and will require negations with Pittwater Council to determine an appropriate outcome.

In terms of implementing and or maintaining asset protection zones there is no physical reason that could constrain hazard management from being successfully carried out by normal means e.g. mowing / slashing.

Guidelines for managing asset protection zones are provided as Appendix 1 attached.

#### 3.4 Availability of Fire Fighting Services

There are NSW Fire Brigades located at Narrabeen and Mona Vale approximately 4km (road distance) to the south and north of the site. These fire brigades would have a response time of approximately 5 - 10 minutes to service the development if they are not assisting elsewhere.

# 3.5 Access for Fire Fighting Operations

The primary access point to the development will be through the existing residential development of Warriewood from the south onto Fern Creek Road the proposed internal road system for the subdivision. This entry point from Orchard Street in the south is unlikely to be impacted by bushfire. Additionally there is a secondary access point to Orchard Street in the south which is also unlikely to be impacted by bushfire.

Road widths proposed and depicted on plans are as follows;

- Main access road (existing Fern Creek Road) 20 metre wide reservation
- Access Lanes 8 metres
- Other access roads vary in width 16 metres, 12 metres and 10 metres.

Road recirculation comprises of a series of perimeter roads which link to the internal road system of the subdivision. A dead end road provides access to the north-western portion of the sector whilst providing a perimeter road to the extensive forest vegetation to the north-west.

The Performance Criteria required by the RFS involves "providing internal road widths and design (that) enable safe access for emergency services and (therefore) allow crews to work with equipment about the vehicle".

The Acceptable Solutions to the RFS include:

Acceptable Solutions	Compliant or not
Internal roads are two-wheel drive, sealed, all-weather roads	Compliant
Internal perimeter roads are provided with at least two traffic lane widths (carriageway 8 metres minimum kerb to kerb) and shoulders on each side, allowing traffic to pass in opposite directions	The road widths are noted above and comply with the acceptable solutions.
Roads are through roads. Dead end roads are not more than 200 metres in length from a through road, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end	One dead end road exists which is 230 metres in length. This road provides access away from the bushfire threat and is protected by an asset protection zone along its entire length. The 30m additional length in this case does not cause a need for non compliance with PBP as the development and the road layout in general accords with PBP aims and objectives.
Traffic management devices are constructed to facilitate access by emergency services vehicles	Compliance subject to detailed design.
A minimum vertical clearance of four metres to any overhanging obstructions, including tree branches, is provided	Compliance subject to detailed design.
Curves have a minimum inner radius of six metres and are minimal in number to allow for rapid access and egress	Compliance subject to detailed design.
The minimum distance between inner and outer curves is six metres	Compliance subject to detailed design.
Maximum grades do not exceed 15 degrees and average grades are not more than 10 degrees	Compliance subject to detailed design.
Cross-fall of the pavement is not more than 10 degrees.	Compliance subject to detailed design.
Roads do not traverse through a wetland or other land potentially subject to periodic inundation (other than flood or storm surge)	Compliant. Roads do not traverse a wetland or areas of periodic inundation
Roads are clearly sign-posted and bridges clearly indicate load ratings	Compliance subject to detailed design.
The internal road surfaces and bridges have a capacity to carry fully-loaded fire-fighting vehicles (15 tonnes)	This would require engineering sign off but it appears that this is the case.

## 3.6 Evacuation Safety

The development provides safe and direct egress onto Orchard Street in the south and then onto Garden Street in the east. These access routes are located away from the main bushfire threats in the north and west and allow evacuation into the adjoining residential lands of Warriewood.

#### 3.7 Water Supplies

Town reticulated water supply is available to the proposed development in the form of underground reticulated water system. Access points must incorporate a ring main system for all perimeter roads.

Fire hydrant spacing, sizing and pressures must adhere to *AS2419.1* which recommends spacing of no greater than 120 metres (Source AS 2419.1 2005 Appendix B, B2) for residential development and 90 metres for commercial development (Appendix B, B3). However the RFS generally require that hydrants be spaced no greater than 90 metres. In addition all hydrant locations are to be marked with a blue 'cats eye' in the centre of the road.

#### 3.8 Communications

Telephone communications can be provided for this development to aid in communications particularly during a bushfire incident.

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# **SECTION 4.0 – CONCLUSION AND RECOMMENDATIONS**

#### 4.1 Conclusion

A bushfire protection assessment has been undertaken to contribute to the creation of a master plan for Warriewood Valley, Sector 9. The Master plan involves the subdivision of rural residential lands into approximately 213 lots. The proposed residential development plus associated infrastructure including new road access; will be assessed in compliance with *Planning for Bushfire Protection 2006*.

The assessment found that bushfire can potentially affect the proposed development from the existing forest vegetation within the adjoining Ingleside Escarpment to the west; and also from the proposed regenerated forested vegetation within the riparian corridor to the north resulting in possible ember attack, radiant heat and potentially flame attack.

It would be expected that a fire would only develop medium to high intensities within the adjoining vegetation. The proposed development is therefore not exposed to any significant vulnerability from bushfire attack if appropriate asset protection zones are in place and managed.

The following illustrates the developments compliance with aims and objective of Planning for Bushfire Protection 2006.

Afford occupants of any building adequate protection from exposure to a bush fire

Response: Asset protection zones have been provided in accordance with PBP 2006. The proposed dwellings will be constructed in accordance with AS 3959. Access complies with Section 4.1.3 of PBP. Other bushfire protection measures are planned and identified with the recommendations below.

Provide for a defendable space to be located around buildings

Response: Asset protection zones have been provided in accordance with PBP 2006.

Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition

Response: Asset protection zones have been provided in accordance with PBP 2006. The majority of dwellings will be constructed to Level 2 or Level 1 standards due their exposure to a medium to high level bushfire threat. These measures prevent building ignition from the adjoining bushfire hazards.

Ensure that safe operational access and egress for emergency service personnel and residents is available

Response: The development provides safe and direct egress onto Orchard Street in the south and then onto Garden Street in the east. These access routes are located away from the main bushfire threats in the north and west and allow evacuation into the adjoining residential lands of Warriewood. The internal roads adhere to the acceptable solutions provided within Section 4.1.3 of PBP 2006.

Provide for ongoing management and maintenance of bush fire protection measures, including fuel loads in the asset protection zone (APZ); and

Response: Fuel management and landscaping can be undertaken by the land owners of each lot as outlined within Appendix 1 of this report

There are circumstances within the subdivision where the asset protection zone extends beyond the lot boundary towards the 50 metre buffer zone adjoining the creek line. There are two options for management of these asset protection zones that will require future negations with Council.

The first option is to extend the lot boundaries to meet with the 50 metre buffer zone with management of the asset protection zone being undertaken by individual lot owners. The second option is for the dedication of this land to Council. The management of the asset protection zone will be the responsibility of council.

Ensure that utility services are adequate to meet the needs of fire fighters (and others assisting in bush fire fighting).

Response: Water supply and access to roadside water hydrants and or water tanks can be assured by a condition of Council consent.

The following recommendations are provided to ensure that the development is in accord or greater than the requirements of PBP.

#### 4.2 Recommendations

**Recommendation 1** - The development is as indicated on the attached Schedule 1 - 'Plan of Bushfire Protection Measures'.

**Recommendation 2** - Asset protection zones are to be provided to the proposed development. Asset protection Zones are to be measured from the exposed wall of the any dwellings towards the hazardous vegetation. The asset protection zones shall be as nominated in Table 1 and also as depicted in Schedule 1.

**Recommendation 3** - Fuel management within the asset protection zones is to be maintained by regular maintenance of the landscaped areas, mowing of lawns in accordance with the guidelines provided in Appendix 1, and or as generally advised by Rural Fire Service in their publications.

**Recommendation 4** - Building construction standards are to be applied in accordance with Level 1 or Level 2 Australian Standard AS3959 'Construction of Buildings in Bushfire Prone Areas as indicated in Table 1 of this report.

**Recommendation 5** - A hydrant water supply is to be installed in accordance with Australian Standard AS2419.1.

**Recommendation 6** - The landowner / manager is to be made aware of their liability to manage their development lands for the ongoing protection of themselves and their neighbours (refer Section 63(2) Rural Fires Act).

**Recommendation 7** - The landowner should be provided with publications such as *'Bush Fire Protection for New and Existing Rural Properties'* relating to living in a bush fire prone area and available through the Rural Fire Service or Council.

#### REFERENCES

- Australian Building Codes Board (1996) Building Code of Australia, Class 1 and Class 10 Buildings Housing Provisions Volume 2.
- Chan, K.W. (2001) The suitability of the use of various treated timbers for building constructions in bushfire prone areas'. Warrington Fire Research.
- Councils of Standards Australia AS3959 (1999) Australian Standard Construction of buildings in bush fire-prone areas.
- Keith, David (2004) Ocean Shores to Desert Dunes The Native Vegetation of New South Wales and the Act. The Department of Environment and Conservation.
- Rural Fire Service (2006) 'Planning for Bush Fire Protection A Guide for Councils, Planners, Fire Authorities and Developers. NSW Rural Fire Service.
- Rural Fire Service (2006) Bushfire Attack Software on RFS Web site.
- Tan, B Midgley, S Douglas, G & Short, (2004). 'A Methodology for Assessing Bushfire Attack'. RFS Development Control Service.





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# **Management of Asset Protection Zones**

The NSW Rural Fire Service (RFS) advise that when living in a bushfire prone environment asset protection zones are required to be provided between hazardous fuels and a dwelling.

The RFS provide basic advice in respect of managing asset protection zones in several documents namely *Planning for Bushfire Protection 2006* and *Standards for Asset Protection Zones* (undated but circa 2006).

Asset protection zones provide a level of defendable space between the hazard and a habitable dwelling or similar structure. These zones are usually shown on plans adjacent to either cultural or natural assets (eg. dwelling). They act to significantly lessen the impact of intense fire. The major mitigating factor that limits the effects of wildfire is the amount of fuel available to burn. By reducing the amount of fuel there will be a reduction in the intensity of the fire.

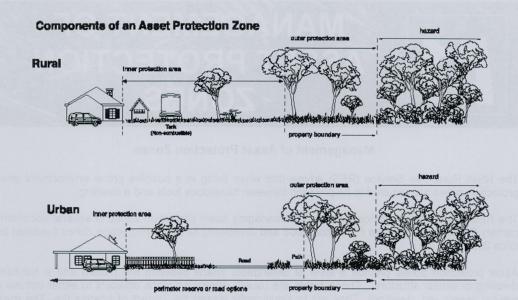
When considering bush fire fuel it is important to understand that it occurs in our native bushland in three vertical layers – see Table 1.

Table 1 - Fuel Layers

Fuel Layer Name	Location of Layer in vertical Column	Type of Fuel
Ground Fuels	Below ground level	Peatmoss (always below the surface)
Surface Fuels	0-200 mm	Litter layer (leaves & twigs)
Aerial Fuels	200 – 3000 mm	Shrubs and grasses
Canopy Fuels	> 3000 mm	Tree canopy

The asset protection zone can be further classified into two sub-zones with each having a specific role. These sub-zone areas are called the inner protection area (IPA) and the outer protection area (OPA) – see figure below.

The IPA is managed as a fuel free zone while the OPA is managed as a fuel reduced zone. This means that the fuel free zone has little fuel available to be consumed in the event of a fire whilst the fuel reduced zones has less than normal fuel levels that could be consumed in the event of a fire.



#### Inner Protection Area (IPA)

This area is *almost free* of all fuels and usually takes the form of grassy areas, car parks, roads, concrete areas, tracks or trails. It does not imply or require the wholesale removal of every tree and or shrub.

This zone is intended to stop the transmission of flame and reduce the transmission of radiant heat by the elimination of available fuel. This area also allows airborne embers to fall safely without igniting further outbreaks.

This zone also provides a safe fire fighting position and is operationally important for implementation of clear fire control lines.

Grasses may occur within an Inner APZ if they are generally no higher than 50-75mm. Above this height, fuel weights tend to increase exponentially and consequentially cause greater flame heights and therefore fire intensity

Shrubs may occur within an Inner Protection Area in the form of clumping amidst open grassy areas. The design of the clumping will be dependent on species selection and spatial density. For example the larger the shrubs the less clumping may occur in a given area.

A tree may occur within an Inner Protection Area if the canopy does not form a link with shrubs and other canopy. The reason is to lessen any chance for 'vegetation linking' and the capability for fire to extend into the canopy. As a general rule trees are allowed within an Inner Protection Area but only where those trees are at least 5 metres away from a dwelling.

A recommended performance standard for the fuel load of an inner protection area is between 0-4 t/ha. Shrubs may occur within an inner protection area commensurate with a spatial distribution of 15-20%. For example an area of 100m2 (10mx10m) can have up to 20% of this area composed of shrubs

If a shrub layer is present the following table shows the additional fuel weights that should be added to the calculated surface fuels.

Shrub cover	Fuel Weight
10-30 %	2.5 tonnes / ha
35-50 %	5.0 tonnes / ha
55-75%	7.5 tonnes / ha

#### Presence of Trees within an Inner Protection Area

A tree may occur within an Inner Protection Area if the canopy does not form a link with shrubs. The reason is to lessen any chance for 'vegetation linking' and the capability for fire to extend into the canopy.

It is a basic premise in fire behaviour understanding that fire cannot occur in the canopy unless surface fuels such as grasses or shrubs are burning. This merging creates opportunity for fire to link with the canopy and therefore increase fire intensity by some significant amount.

Trees that have a canopy beginning near the ground (such as Forest Oaks *Allocasuarina*) form a continuous link with the tree canopy and shrubs. A forest canopy cannot therefore burn without fuel to feed that fire. In a 'tall open forest' where the trees are generally above 20 metres in height the canopy is separated from the land surface by some distance. In an 'open woodland' the low canopy height (usually < 5 metres) merges with the shrubland layer.

Knowing the relationship between the shrub layer and the tree canopy allows fire managers to design safer areas in the asset protection zones. It is for this reason that vegetation such as Forest Oaks are usually excluded from an Inner Protection Area.

Similarly in 'open forests' the height of the forest is sufficiently removed from the shrub layer. As a general rule trees are allowed within an Inner Protection Area where the density of those trees is commensurate with Table 2 below and located on slopes up to 20% with a Westerly aspect.

In respect of trees that can be located in an Inner Protection Area Table 2 provides guidelines.

Table 2 - Tree Density in Inner Protection Area

Distance from dwelling wall	Trees permitted on the exposed side of a dwelling	Trees permitted on the non exposed side of a dwelling	
within 5 metres	No trees	No trees	
between 5-10 metres	One tree per 100 m <sup>2</sup>	2 trees per 100 m <sup>2</sup>	
Between 10-20 metres	<10 tree per 400 m <sup>2</sup> .	<10 trees per 400 m <sup>2</sup>	

# Outer Protection Area (OPA)

This zone is designed to stop the development of 'intense' fires and the transmission of 'severe' radiated heat.

The OPA assumes all trees will remain but with either a modified shrub / grass layer or regular removal of the litter layer. In some sparse vegetation communities the shrub layer may not require modification.

The fire fighting advantage will manifest in reduced fire intensity. It achieves this by denying fire a significant proportion of the fuel to feed upon. Fuels containing small (or fine) leaves such as *Forest Oaks* (or similar) are targeted for removal due to the capacity to burn quickly and therefore feed fire up into adjacent trees.

In most cases the removal of 85% of the litter layer will achieve a satisfactory OPA. A recommended performance standard for the fuel load of an Outer Protection Area is between 4-6 t/ha.

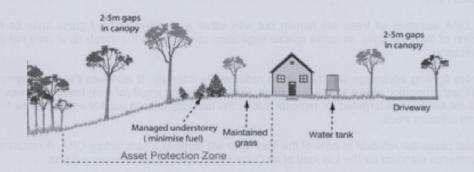
#### Managing the APZ

Fuel management within the asset protection zone/s should be maintained by regular maintenance such as

- Mowing grasses regularly Grass needs to be kept short and, where possible, green.
- Raking or manual removal of fine fuels Ground fuels such as fallen leaves, twigs (less than 6 mm in diameter) and bark should be removed on a regular basis. This is fuel that burns quickly and increases the intensity of a fire. Fine fuels can be removed by hand or with tools such as rakes, hoes and shovels.
- Removal or pruning of trees, shrubs and understorey The control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation. Prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset. Separate tree crowns by two to five metres. A canopy should not overhang within two to five metres of a dwelling. Native trees and shrubs should be retained as clumps or islands and should maintain a covering of no more than 20% of the area.
- Tree or tall shrubs may require pruning upon dwelling completion in line with PBP 2006.
  Notwithstanding this the presence of shrubs and trees close to a dwelling in a bushfire prone
  landscape requires specific attention to day to day management and owners and or occupier
  should be made aware that whilst landscaping can contribute to a way of life and
  environmental amenity the accumulated.

In addition the following general APZ planning advice should be followed.

- Ensure that vegetation does not provide a continuous path to the house.
- Plant or clear vegetation into clumps rather than continuous rows.
- Prune low branches two metres from the ground to prevent a ground fire from spreading into trees.
- Locate vegetation far enough away from the asset so that plants will not ignite the asset by direct flame contact or radiant heat emission.
- Ensure that shrubs and other plants do not directly abut the dwelling. Where this does occur, gardens should contain low-flammability plants and non flammable ground cover such as pebbles and crush tile; and
- The following RFS illustrative diagram depicts one version of an ideal situation. Specific
  advice is to be sought from qualified experts to ensure that the implemented asset protection
  zones meet the performance criteria of asset protection zones.



Figures courtesy of NSW RFS 2006.



# **AUSTRALIAN STANDARD AS3959 (1999 – AMENDED)**

# CONSTRUCTION OF BUILDINGS IN BUSHFIRE-PRONE AREAS

# **Levels of Construction:**

Three levels of construction are given which correspond to the category of bushfire attack determined by *Planning for Bushfire Protection 2006*:

Level 1 Construction – For the category of **medium** bushfire attack.

Level 2 Construction – For the category of high bushfire attack.

Level 3 Construction – For the category of extreme bushfire attack.

Important note: The following is a summary of AS3959 and must be read only as a summary. Reliance should be placed completely upon the AS3959 published by Standards Australia.

BUILDINGS IN BUSHFIRE PRONE AREAS

AUSTRALIAN STANDARD AS3959 (1999 - AMENDED)

CONSTRUCTION OF BUILDINGS IN BUSHFIRE-PRONE AREAS

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ITEM	LEVEL 1	LEVEL 2	LEVEL 3
FLOORING	The requirements for a floor in a Level 1 construction shall be one, or a combination, of the following:	The requirements for a floor in a Level 2	The requirements for a floor in a Level 3
	(a) A concrete slab-on-the-ground.	construction shall be as for Level 1 construction (see Clause 3.3.1)	construction shall be as for Level 2 construction (see Clause 3.3.2)
	(b) A suspended floor, which may be one, or a combination of the following, supported by posts, columns, stumps, piers, or poles complying with Clause 3.4 or walls complying with Clause 3.5:	NOTE: The protection of subfloor openings against	Except that in the case of a framed floor, where
	<ul><li>(i) A concrete floor.</li><li>(ii) A framed floor where the underside of any one bearer at any point is greater than 600mm above the finished ground level.</li></ul>	by way of introducing non- combustible material, such as fibre-reinforced	greater than 600mm above finished ground level and the floor is not
	(c) A suspended timber floor, framed with timber or metal, where the underside of any one bearer, at any point, is not greater than 600mm above the finished ground level and which has –	effectively enclose the subfloor space, may conflict with the	Clause 3.3.1 (c)(ii), the bearer, joists and flooring shall be of fire-
	<ul> <li>(i) The subfloor space unenclosed and any timber flooring, bearers and joists of fire-retardant-treated timber; or</li> <li>(ii) The subfloor space fully enclosed, either by a wall that complies with Clause 3.5.1(a), or by the use of noncombustible sheet material which extends for at least 400mm above the finished ground level.</li> </ul>	protection and should therefore, take into consideration of the provisions of AS 3660.1.	or sheeted underneath with non-combustible material.
SOUTH OF THE SOUTH	Where non-combustible fibre-reinforced cement sheets are used to enclose the subfloor space, the material shall have a minimum thickness of 6mm and all material shall meet the bottom of the cladding material to ensure there are no gaps on the exterior face of the building.	constraint and posts of the same of the sa	still ascess toolidus of stillanestupus patioque
		Live Lisethanuscop ga	parabas in success

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
SUPPORTING POSTS, COLUMNS,	The requirements for supporting posts, columns, stumps, piers and poles in a Level 1 construction shall be one, or a combination, of the following:	The requirements for supporting posts, columns, stumps, piers	in end spaces, nts
STUMPS, PIERS AND	(a) Non-combustible.	and poles in a Level 2 construction shall be as	supporting posts, columns, stumps, piers
roces	(b) Fire-retardant-treated timber for a minimum of 400 mm above the finished ground level.	for Level 1 construction (see Clause 3.4.1)	ction shall
	(c) Timber mounted on galvanized metal shoes with a clearance of not less than 75 mm above the adjacent finished ground level or paving level (see Figure 3.2).	off to nottsteburron	(see Clause 5.4.2) except that all timber shall be fire-retardant-treated to full height.
	The above do not apply where the subfloor space is totally enclosed as described in Clause 3.3.1(c) (ii).	olimas tol almementupes bitorie bas noticestrati	
	underside of any one bearer, at any point, is not greater than	sublicat with the	
	(a) A suspended finber floor, framed with timber or metal, where the	effectively enclose the	
	bojur je drasjet plau egovinu spoke pre gujajuće domine je sud	and as apre-tempored	
	(i) A featured show which is the property of any one house A (ii)	by way of introducing non-	
	(b) A suspended floor, which may be one, or a combination of the following, supported by posts, columns, stumps, piets, or poles complying with Clause 3.5:	to notasione off :310M teniage aprinage college dideb primited to varie off	
	bnuarg-erth-no-dais steamno A (s)	nothaurtenas it levs.it vat (1.2. scuss) see)	
EXBIEMS	The requirements for a floor in a Level 1 construction shall be one, or secondination, of the following:	s of zinsensiluper sill silved a licon in some construction shall be se	a 108 almementuper eff. Since in a Level 3 Since in a level 3 Since in a level 3
MEM	TENETA	TEAELS	FEAST 3

LEVEL 3	Level 2 external walls in a shall be as Level 3 construction shall be as for Level 2		d timber.	distribution of the control of the c	the shows they shall be glazed with the shows they shall be glazed with the shall be glazed with the shall be shown to shall be s	to distribution and the hold also distributions in a construction in a set distribution
LEVEL 2	The requirements for walls in a Level 2 construction shall be as for Level 1 construction	except that PVC cladding is not permitted and all external timber wall	retardant-treated timber.	derit erestiy (e)	a Jun Harke negers of moditions of	Content of the second of the s
LEVEL 1	The requirements for external walls in a Level 1 construction shall be as follows:  (a) External walls shall be one, or a combination, of the following:	i) A wall having an external leaf of masonry, concrete, pise, rammed earth or stabilized earth.  ii) A framed wall that incorporates either –	A) breather-type sarking complying with AS.NZS 4200.1 and with a flammability index of not more than 5 (see AS 1530.2) installed immediately behind the external cladding; or B) an insulation material conforming to the appropriate Australian Standard for that material.  NOTE: No restrictions apply to the cladding material.	A wall of timber logs that have the butting faces of adjacent logs, gauge-planed, and the space between the logs sealed in a manner that prevents the entry of burning debris and which allows for building movement.	(b) Where the external leaf or cladding is of a combustible sheet material and is less than 400 mm above finished ground level, the cladding shall be protected for not less than 400 mm above the adjacent finished ground level (see Figure 3.3)	<ul> <li>(i) by covering it with a suitable non-combustible material, or fire-retardant-treated timber suitably sealed to the existing cladding so as to prevent the entry of burning debris (see Figures 3.3 (a) and 3.3(b));</li> <li>(ii) by substituting with a suitable non-combustible sheet material, or fire-retardant-treated timber (see Figure 3.3 (c)); or (iii) where the external cladding is timber, by using fire-retardant-</li> </ul>
ITEM	EXTERNAL WALLS					

LEVEL 3	The requirement for windows in a Level construction shall be as for Level 2 construction (see Clause 3.6.2) except that where the windows are not protected by noncombustible shutters, they shall be glazed with toughened glass.	shall be as for Lavel 2 construction (see	The requirements for a wide make in a law is a second
LEVEL 2	The requirements for all windows, including voluvres, in a Level 2 construction shall be as for Level 1 construction (see Clause 3.6.1) except that aluminium mesh shall not be used.  In addition to the above, the following applies:	it shall be fire- retardant-treated timber except where protected by non- combustible shutters.  (b) Where leadlight windows are used, they shall be protected by shutters constructed of a non- combustible material or of toughened glass.	Malle in a rever 5
LEVEL 1	All openable windows, including louvres, in a Level 1 construction shall be screened with corrosion-resistant steel, bronze or aluminium mesh with a maximum aperture size of 1.8 mm in such a way that the entire opening remains screened when the window is open.	ed district of the foliation of the foliation:  Bed district of the foliation of the foliation:  Bed district of the foliation of the foliatio	ed liste molburation of level a m allow lengths not attended to see follows:
ITEM	WINDOWS		WALTS EXLEMINAL MEM

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
DOORS	External doors in a level 1 construction are to be fitted with –  (a) weather strips or draught excluders to prevent the penetration or build-up of burning debris beneath the door; and  (b) tight fitting door screens fitted with corrosion-resistant steel, bronze or aluminium mesh with a maximum aperture size of 1.8 mm.	The requirements for external doors in a Level 2 construction shall be as for Level 1 construction except that aluminium shall not be used for the mesh (see Clause 3.7.1).  If leadlight glazing panels are incorporated in the doors, they shall be protected by shutters constructed of a noncombustible material or of toughened glass.	The requirements for external doors in a Level 3 construction shall be as for Level 2 construction (see Clause 3.7.2) except that—  (a) timber doors shall be fire-retardant-treated or shall have a noncombustible covering on the exterior surface; or (b) doors shall be protected by shutters of non-combustible material; or  (c) doors shall be solid-core having a thickness not less than 35 mm.
VENTS AND WEEPHOLES	Vents and weepholes in a Level 1 construction shall be protected with spark guards made from corrosion-resistant-steel, bronze or aluminium mesh with a maximum aperture size of 1.8 mm (see Figure 3.4).	The requirements for Level 2 construction vents and weepholes shall be as for Level 1 construction (see Clause 3.8.1), except that aluminium mesh shall not be used.	The requirements for vents and weepholes in a Level 3 construction shall be as for Level 2 construction (see Clause 3.8.2

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
ROOFS	The following general requirements shall apply to all types of roofing systems in a Level 1 construction:	The requirements for a roof in a Level 2	The requirements for roof covering in a Level
	(a) Timber shakes or shingles shall not be used for the roof covering.	for Level 1 construction	as for Level 2
	(b) The roof/wall junction shall be sealed either by the use of fascias and eaves linings, or by sealing the gaps between the rafters with a suitable material.	except that all roof sheeting shall be non-combustible and sarked.	except e-reinfo
MEEDHOFE AEMLS VVD	of not more tha	and roof light glazing shall be of wired glass. Thermoplastic material or	sheet shall be used.
	<b>Tiled roofs</b> Tiled roofs shall be fully sarked (see Clause 3.9.1.1(c). The sarking shall be located directly below the tiling barrens and shall cover the entire roof area including the ridge	toughened glass shall not be used as the glazing for roof lights. The case of the evaporative cooler shall be manufactured from a	blica ed lista atoob (a) blica ed lista atoob (a) atoob atoo
	Sheeted roofs The requirements for sheeted roofs in a Level 1 construction are as follows:	non-combustible material.	ed liste enoub (d) to anatural by a purious you be to a protect of the combination of the
	(a) Only metal or fibre-cement sheet shall be used.	doors, they shall be non-	the exterior surface or
	(b) All gaps under the corrugations or ribs of the roofing material where it meets the fascia or wall line shall be sealed or protected-	if jesdight glexing panels	ed ilsrie stoob tedmit (s) the-retaildant-realism or
EXTERNAL	<ul> <li>(i) by fully sarking the roof; or</li> <li>(ii) by providing corrosion-resistant steel or bronze mesh, with a maximum aperture size of 1.8 mm, profiled metal sheet, neoprene seal, compressed mineral wool or similar material.</li> </ul>	the requirements for the safety of the safet	to requirement of extend of the standard of th
HEM	TEAST 3	PEASTS	

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
ROOFS (Cont.)	NOTES:  1) The method of protection in Item (b)(ii) can only be achieved on a roof without valleys and having the deck fixed directly to, but not structurally supported by, the fascia.	bebest insbudsten aden	eas) anticentence to the control of
240244	2) It is generally recognized that where compressed mineral wool is used for sealing against bushfire attack or for other purposes, adequate ventilation should be provided to stop condensation on the mineral fibre causing corrosion in the roof sheeting or supporting structure.	To the state of a place of a plac	The electronius of the control of th
	(c) Rib caps and ridge capping shall be sealed in accordance with Clause 3.9.1.3 (b) (see Figure 3.5(a)), or preformed rib caps or ridge capping shall be used (see Figures 3.5(b) and (c)).	State of the ordinary product of the country of the	except gastered services
	Roof lights	Refression Filbres 408	No. 1' Save 5' Construction
	The requirements for roof lights in a Level 1 construction are as follows:	to) alasmoshipes self.  2 levol s et couse as ad leude authoritanen.	Tol atmansurget sell by sell of in asyan
	(a) All penetrations of the roof space for the installation of roof lights and associated shafts shall be sealed with a non-combustible sleeve or lining.		
	Thermoplastic sheet in a metal frame may be used for a roof light, but the diffuser installed at ceiling level shall be of wired or toughened glass in a metal frame		
(court)	NOTE: AS 1288 and AS 4285 sets out specific requirements for glazing and skylights.		
	(b) Vented roof lights shall be provided with corrosion-resistant steel or bronze mesh having a maximum aperture size of 1.8 mm.		

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
ROOFS (Cont.)	Roof ventilators All components of roof ventilators, including the rotary type, in a Level 1 construction shall be constructed of non-combustible material and shall be sealed against the entry of sparks and embers with corrosion- resistant steel or bronze mesh having a maximum aperture size of 1.8 mm.  Roof-mounted evaporative cooling units Roof-mounted evaporative cooling units shall only be used if the openings to the cooling unit are encased in corrosion-resistant steel or bronze mesh with a maximum aperture size of 1.8 mm.		
EAVES	All eaves in a Level 1 construction shall be enclosed, and the fascia or the gaps between the rafters shall be sealed (see Clause 3.9.1.1)	The requirements for eaves in a Level 2 construction shall be as for Level 1 construction (see Clause 3.10.1), except that all timber eaves lining and joining strips shall be of fire-retardant-treated timber.	The requirements for eaves in a Level 3 construction shall be as for Level 2 construction (see Clause 3.10.2) except that aluminium shall not be used.
FASCIAS	There are no requirements for fascias in a Level 1 construction.	All materials used for fascias in a Level 2 construction shall be either non-combustible or of fire-retardant-treated timber.	The requirements for fascias in a Level 3 construction shall be as for Level 2 construction (see Clause 3.11.2) except that no fibre-reinforced cement or aluminium sheet shall be used.

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
GUTTERS AND DOWNPIPES	Any materials or devices used to stop leaves collecting in the gutters of a Level 1 construction shall have a flammability index of not greater than 5 when tested in accordance with AS 1530.2.	The requirements for gutters and downpipes in a Level 2 construction shall be as for Level 1 construction (see Clause 3.14.1).	
VERANDAS AND DECKS	Verandas, decks, and the like, forming part of a building required to be Level 1 construction shall comply with one, or a combination, of the following:	The requirements for verandas and decks in a Level 2 construction	The requirements for verandas and decks in a Level 3 construction
Cana Series	<ul> <li>(a) S/ab - A reinforced concrete suspended slab floor, supported by posts or columns complying with Clause 3.4 or walls complying with Clause 3.5, or a slab-on-the-ground floor complying with Clause 3.3.</li> </ul>	shall be as for Level 1 construction (see Clause 3.11.1) except that if spaced decking is used, fire-retardant-treated	
	(b) Sheeted or tongued and grooved solid flooring – The requirements for flooring are as follows:	timber shall be used for the decking material.	timber is used, it shall be fire- retardant-treated (including any
	(i) Compliance with the flooring requirements shall be in accordance with Clause 3.3  (ii) Where the clearance between the finished ground level and the underside of the floor is not greater than 400 mm above finished ground level, all joints in the flooring shall be covered (above the floor level) or shall be sealed.		balustrades).
	(c) Spaced decking - The requirements for spaced decking are as follows:		
	<ul><li>(i) The decking timbers shall be fixed with a clearance of not less than 5 mm between adjacent timbers.</li></ul>	TEACET S	TEMET 3

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ITEM	LEVEL 1	LEVEL 2	LEVEL 3
VERANDAS AND DECKS (Cont.)	(ii) The external perimeter beneath the decking shall not be enclosed nor shall access to the space beneath the decking be impeded.		
	NOTE: This requirement is designed to ensure that access to extinguish fires and remove burning material is maintained.		
	(iii) Any supports for the decking shall be treated as set out in Clause 3.4.  (iv) Decking timbers shall not be allowed to connect with the remainder of the building unless measures are used to prevent		
	the spread of fire into the building.		(neduding
SERVICE PIPES (WATER AND GAS)	All exposed piping, for water and gas supplies, in a Level 1 construction shall be metal. Pipes of other materials shall be buried to a depth of at least 300 mm below the finished ground level.  Level 1 construction (see Clause 3.14.2).	The requirements for service pipes in a Level 3 construction shall be as for Level 1 construction (see Clause 3.12.1).	The requirements for service pipes in a Level 3 construction shall be as for Level 2 construction (see Clause 3.14.2).

environmental ravers Bushfire & Environmental Consultants 38A, The Avenue, Mt. Penang Parklands, Central Coast Highway, Kariong NSW 2250 Ph (02) 4340 5331 Fax (02) 4340 2151 e-mail: bushfire@traversenvironmental.com.au Original plan produced in A3 colour 20 40 60 80 100 m Amendment
A Added new CAD
B
C Drawing No.
Drawn By 8093B TM 07/11/08 Date 22/10/08 Date **Bushfire Protection Measures** Warriewood Valley (Sector 9) Schedule 1 -**Construction Standard** Level 1 Construction Standard Sector Boundary Level 2 Construction Standard Riparian Corridor Asset Protection Zone Legend