Travers

bushfire & ecology

Bushfire Protection Assessment

LOT 6 DP 244030 & LOT 9 DP250425
DIAMOND BEACH ROAD, DIAMOND BEACH

AUGUST 2010
(REF: 9020B)

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BUSHFIRE PROTECTION ASSESSMENT

LOT 6 DP 244030 & LOT 9 DP250425
DIAMOND BEACH ROAD, DIAMOND BEACH

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Checked by:

Date: August 2nd 2010

File: 9020B

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EXECUTIVE SUMMARY

A bushfire protection assessment has been undertaken for a proposed residential rezoning of land located at Lot 6 DP 244030 & Lot 9 DP 250425, Diamond Beach Road, Diamond Beach.

The development is categorised by the NSW Rural Fire Service (RFS) as being a *residential subdivision* and this requires the RFS to issue a *Bushfire Safety Authority* (BSA) in accordance with *Planning for Bush Fire Protection 2006* (PBP).

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 subdivision* developments. This rating assists in determining the size of the *asset protection zone* (APZ) in compliance with Appendix 2 of PBP which provides the necessary *defendable space* between hazardous vegetation and a building.

The assessment found that bushfire can potentially affect the proposed development from the coastal scrub (tall heath) vegetation located to the east of the site resulting in possible ember attack, radiant heat and potentially flame attack.

The development would be exposed to a medium to extreme bushfire attack potential (depending on the APZ adopted) as a result of a bushfire within the adjoining vegetation. The proposed development is however not exposed to any significant vulnerability from bushfire if appropriate APZs are in place and managed.

The assessment has concluded that the proposed development will provide:

- Defendable space in accordance with Appendix 2 PBP, 2006.
- Construction of the buildings in accordance with AS 3959 (2009)
- Compliance with access and egress as per Section 4.1.3 of PBP, 2006.

Other bushfire protection measures that are planned and identified with the recommendations

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GLOSSARY OF TERMS

APZ	Asset protection zone
BCA	Building Code of Australia
BSA	Bushfire Safety Authority
FDI	Fire Danger Index
IPA	Inner protection area
OPA	Outer protection area
PBP	*Planning for bushfire protection, 2006* (RFS)
RFS	NSW Rural Fire Service
SFPP	Special fire protection purpose
AS3959 (1999)	Australian Standard – Construction of buildings in bushfire-prone areas.

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1 INTRODUCTION

Travers bushfire & ecology has been requested by *Machiko Pty Ltd* to undertake a bushfire protection assessment for proposed residential rezoning of land located at Lot 6 DP 244030 & Lot 9 DP 250425, Diamond Beach Road, Diamond Beach.

The land is mapped by Greater Taree Council as being bushfire prone. This requires the RFS to provide comment for a rezoning proposal where a residential subdivision could occur.

1.1 Aims of the assessment

The aims of the bushfire protection assessment are to:

- Review the bushfire threat to the landscape
- Undertake a bushfire attack assessment in accordance with PBP
- Provide advice on mitigation measures, including the provision of asset protection zones (APZs), 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 proposal is for a residential subdivision via the creation of 89 lot within the current lands - see Schedule 1 attached.

Access

Primary access to the site is provided from Diamond Beach Road via Edgewater Drive in the north. This road is will connect onto Anniversary Drive in the south. The internal road network is generally cyclical in nature with road widths of between 6-8 metres. There are two (2) dead end roads which are 50 metres and 70 metres in length.

Construction of dwellings

Future buildings requiring building construction standards (AS3959) will be limited to eight (8) lots which are located within 100 metres of bushfire prone vegetation to the east. If future building envelopes within Lots 83-85 are located within 19 metres of the unmanaged tall heath/scrub vegetation to the east they will require compliance with BAL 19 construction standards (AS3959). Future buildings within Lots 82 and 86-89 will require compliance with BAL 12.5 construction standards (refer Table 1, pg 7).

Ancillary works

Development works will involve the provision of access roads and services such as water tanks, 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 *Lidbury, Summers & Whiteman*
- Google Pro Aerial Photography
- Hallidays Point 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 John Travers on at least six (6) occasions between 2003 and 2009 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 site is located approximately 140 metres to the south of the intersection of Edgewater Drive and Diamond Beach Road, Diamond Beach within the local government area of the Greater Taree Council (refer Figure 1). The site is bounded to the west by Diamond Beach Road and cleared rural residential properties, to the south by Hallidays Point Primary School and to the north by cleared rural residential land.

The land to east (southern portion) supports a caravan park with a proposed public open space located to the north east. The proposed public open space area will be rehabilitated to represent coastal scrub vegetation which currently exists along the coastal strip fronting Diamond Beach.

The site adjoins the fore dune of Diamond Beach with residential development lots located approximately 100 metres from the high tide mark. The topography within the site is generally flat within the eastern portion adjoining Diamond Beach. This slope gradually increases from 2 to 6 degrees upslope towards the west.

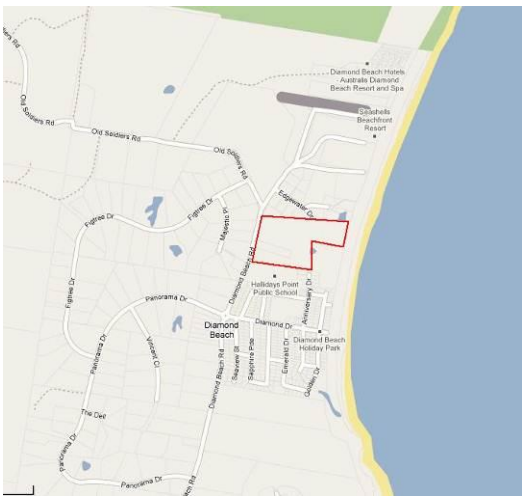


Figure 1: Location Map

1.5 Bushfire prone land

The proposed residential subdivision is located on land that is mapped by the Greater Taree Council as being bushfire prone.

Due to the proposed development being a proposed residential subdivision, the rezoning proposal must be assessed in accordance with *Planning for bushfire Protection 2006* published by the *NSW Rural Fire Service*.

2 BUSHFIRE PROTECTION ASSESSMENT

Bushfire protection planning requires the consideration of the RFS planning document entitled *Planning for bushfire 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 and objectives for all development located on bushfire prone land should:

1. Afford occupants of any building adequate protection from exposure to a bushfire

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 bushfire protection measures, including fuel loads in the APZ

6. Ensure that utility services are adequate to meet the needs of fire fighters (and others who may assist in bushfire fighting)

The additional objectives for 'residential 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 (APZs) between the bushfire hazard and future dwellings enable conformity with the deemed-to-satisfy requirements of the Building Code of Australia

11. Provide and locate, where the scale of development permits, open space and public recreation areas as accessible public refuge areas or buffers (APZs)

12. Ensure the ongoing management of APZs

13. Provide clear and ready access from all properties to the public road system for residents and emergency services

14. Ensure the provision 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 physically cope in the event of a bushfire. To assess the bushfire threat that is likely to occur and thus 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 infrastructure and persons that would use the new development, again including fire fighters.

2.1 Hazardous fuels

The bushfire hazard is defined as the potential severity of a bushfire and is measured in terms of the potential fire intensity and the resultant radiant heat flux emanating from the fire.

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

To determine the minimum asset protection zones required an assessment of the hazardous fuels are determined according to vegetation descriptions identified by David Keith (DECC, 2004). These units have been defined in accordance with their ability to cause different levels of fire intensity based essentially on their sustained flammability. This arises from the extent of fine fuel presence and weight.

Hazardous fuels consist of the coastal scrub vegetation (tall heath) located on the fore dune of Diamond Beach to the east of the site. All other aspects have been previously cleared for adjacent rural residential development.

Photo 1: Tall Heath vegetation to the east of the site.

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 hazardous areas presents a permanent potential for bushfire attack upon the residential landscape. The tall heath vegetation has the potential to cause a fire event that may require evacuation of residents within close proximity to the vegetation while providing damage potential to buildings within 100 metres of the bushfire prone vegetation.

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.

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 tall heath vegetation located to the east of the site on level to upslope topography on the narrow sand dune. The tall heath then changes to dune grasses at the high point of the dune.

It is possible that fires could occur within the tall heath vegetation with the potential impact in the form of radiant heat, flame impact and potentially ember attack for building within 100 metres of the bushfire prone vegetation. However, with an appropriately sized APZ the intensity of the bushfire can be mitigated down to the acceptable radiant heat performance threshold of <29 k/W m^2.

2.2 Bushfire attack assessment

The RFS 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 APZ that may be required to offset possible bushfire attack.

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 within the bushfire prone vegetation to the east of the site is level within 45 metres of the proposed residential subdivision lands before rising upslope at approximately 10 degrees.

Slopes have been calculated and mapped on plans by *Lidbury Summers & Whiteman.*

A Fire Danger Index (FDI) of 80 has been used to calculate bushfire behaviour on the site using forest vegetation located within the North Coast region.

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

Table 1 – bushfire attack assessment

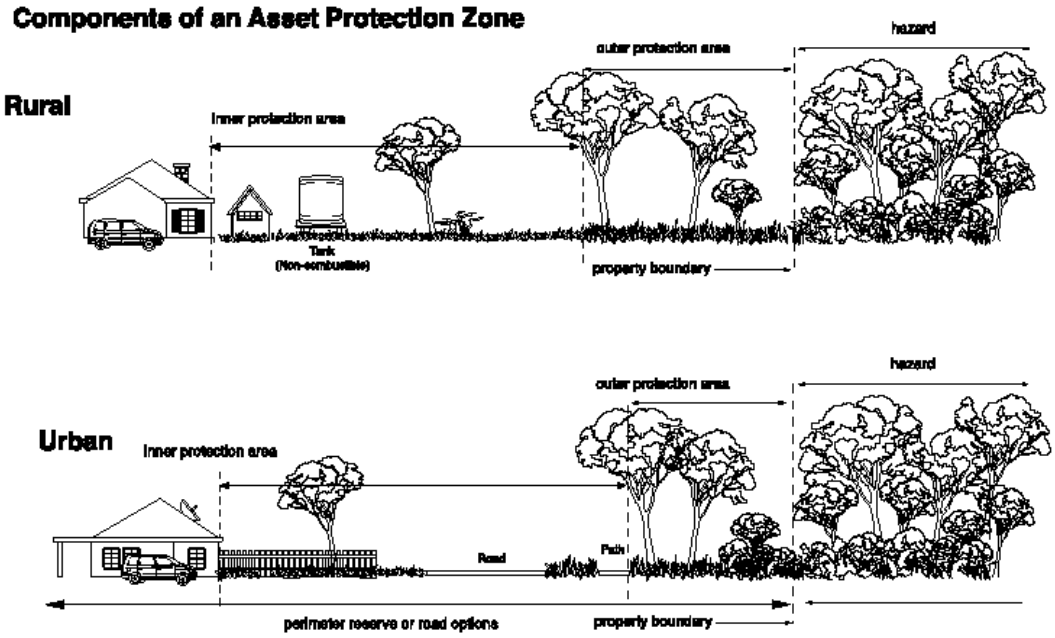
Aspect	Vegetation within 140m of development	Effective slope of land	Minimum APZ required (Appendix 2 PBP)
North	Managed rural residential land	Level	N/A
East (Lots 85 - 87)	Tall Heath	Level	15 metres
South	Managed land - Hallidays Point Primary School	Level	N/A
West	Managed rural residential land	Level	N/A

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

3 SPECIFIC PROTECTION ISSUES

3.1 Asset protection zones

APZs are areas of defendable space separating hazardous vegetation from buildings. The APZ generally consists of two subordinate areas, an *inner protection area* (IPA) and an *outer protection area* (OPA). The OPA is closest to the bush and the IPA is closest to the dwellings. The IPA cannot 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 below:



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 APZs 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 subdivision developments. This rating assists in determining the size of the APZ in compliance with Appendix 2 of PBP 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. The results illustrate that Lots 82–89 are exposed to a moderate to low level of bushfire attack (depending on the APZ adopted and as depicted by Schedule 1 attached) from the impact of bushfires burning within the adjacent bushland to the east of

the site. The APZ's shown in Table 1 and graphically depicted in Schedule 1 attached adhere to the requirements of Appendix 2, 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 APZ. The role of the APZ is to provide a safe space to separate the hazard from the building. The APZ cannot be used for construction because it is the area where the flame of a fire will enter. This area is referred to as the flame zone.

As a result of the release of the Australian Standard AS3959 (2009) as adopted by the *BCA* in May 2010, the NSW RFS has released an interim amendment to PBP, 2006 in the form of Appendix 3.

This appendix, in conjunction with Table 2.4.3 of AS3959 (2009), is now used to determine construction considerations for 79BA applications. This appendix does not relate to subdivision applications or consideration for rezoning proposals.

Although the proposal is for a subdivision *Travers bushfire & ecology* have provided indicative building construction standards within Table 2 below and as depicted within Schedule 1 attached.

This classification system has been designed for bushfire prone areas and is based on five (5) bushfire attack levels (BAL). These are BAL – Flame Zone (FZ), BAL 40, BAL 29, BAL 19 and BAL 12.5. (AS3959 (2009) – *Construction of buildings in bushfire-prone areas*). The lowest level, BAL 12.5, has the longest APZ distance while BAL – FZ has the shortest APZ distance.

Table 2 – determination of bushfire attack level

Aspect	Vegetation within 140m of development	Effective slope of land	APZ provided	Level of bushfire risk	Construction standard
North	Managed rural residential land	Level	>100 metres	Very Low	N/A
East (Lots 85 - 87)	Tall Heath / Scrub (refer Note 1)	Level	15 - <19 metres 19 - <100 metres	Moderate Low	BAL 19 BAL 12.5
South	Managed land - Hallidays Point Primary School	Level	>100 metres	Very Low	N/A
West	Managed rural residential land	Level	>100 metres	Very Low	N/A

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

Note 1 - To determine the required level of construction for 79BA applications the determination of vegetation formation as set out in Table A2.1 Appendix 2 of PBP has identified the vegetation as a tall heath formation. As the BCA (2010) uses Specht vegetation classification the conversion table (A3.5.1) provided within Addendum Appendix 3 of PBP has been used which converts the tall heath vegetation to Scrub.

It should be noted that it is the policy of the RFS that where an unobstructed line can be can be drawn between any part of a building wall and the hazard then the assessed level of construction must be adopted (i.e. BAL 19 for the eastern elevation of dwellings within Lots 83–85 which fall within 19 metres of hazardous vegetation). The elevations furthest from the hazard may step down one construction level to BAL 12.5 (i.e. one level lower than BAL 19).

3.3 Hazard management

Should the development be approved, the owner or occupier will be required to manage the APZ to the specifications of Council's approval.

In terms of implementing and / or maintaining APZs, 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 APZs are attached as Appendix 1.

3.4 Access for fire fighting operations

Primary access to the site is provided from Diamond Beach Road via Edgewater Drive in the north. This road will connect to provide a through road onto Anniversary Drive in the south.

These entry points are unlikely to be impacted by bushfire, hence additional emergency access / egress for emergency services is not required.

The internal road network is generally cyclical in nature with road widths of between 8 metres. There are two (2) dead end roads which are 50 metres and 70 metres in length.

The *performance criteria* required by the RFS involves "providing internal road widths and design (to) 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**
Public Roads are two -wheel drive, all weather roads.	Compliant
Perimeter roads are two way (carriageway 8 m minimum kerb to kerb). Non perimeter roads comply with Table 4.1.	Compliant. There are no perimeter roads proposed.
Perimeter road is linked with the internal road system at an interval of no greater than 500 metres in urban areas.	Compliant
Traffic management devices are constructed to facilitate access by emergency services.	Compliant
Public roads have a cross fall not exceeding 3 degrees.	Compliant
All roads are through roads. If unavoidable dead end roads are not more than 200 metres in length, incorporate a minimum 12 m outer radius turning circle, sign posed dead end and direct traffic away from the hazard.	The two dead end roads are less than 200 metres in length.
Curves of roads (other than perimeter) have a minimum inner radius of 6 m and are minimal in number.	Compliant
The minimum distance between inner and outer curves is 6m.	Compliant
Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees.	Compliant
Minimum vertical clearance of 4 m above the road.	Compliant
The capacity of road surfaces and bridges is sufficient.	Compliant
To carry fully loaded firefighting vehicles (15 tonnes for reticulated water and 28 tonnes for all other areas). Bridges clearly indicate	Compliant - can be made a condition of consent.

load rating.	
Public roads >6.5m wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water. Public roads 6.5 - 8 m wide are No Parking on one side with the hydrant located on this side to ensure accessibility to reticulated water. Public roads <6.5 m wide provide parking within parking bays and locate services outside of parking bays to ensure accessibility to reticulated water. One way only public access are no less than 3.5 m wide and provide parking within parking bays and locate services outside of parking bays to ensure accessibility to reticulated water.	Compliant - can be made a condition of consent.
Parking bays are a minimum of 2.6 metres wide from kerb edge to road pavement. No services or hydrants are located within parking bays. Public roads interfacing the bushfire hazard are to provide roll top kerbing to the hazard side of the road.	Compliant - can be made a condition of consent.

3.5 Evacuation safety

The subdivision design provides safe and direct egress onto Edgewater Drive in the north and Anniversary Drive in the south allowing for two (2) alternate evacuation routes. These routes are over 100 metres from the bushfire threat and will therefore provide safe access/egress opportunities for fire fighters and residents.

3.6 Water supplies

Town reticulated water supply is available to the proposed development in the form of an underground reticulated water system. Access points must incorporate a ring main system for all internal 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 'cat's eye' in the centre of the road.

3.7 Gas

PBP outlines the following *performance criteria* for gas services:

- Location of gas services is not to lead to the ignition of surrounding bushland land or the fabric of buildings
- Gas bottles are to be maintained in accordance with AS 1596 - 2002. Metal piping is to be used
- All fixed LPG tanks are to be kept clear of flammable materials and located on the non-hazard side of the building
- If gas cylinders are to be kept close to the building the release valves must be directed away from the building
- Polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used

3.8 Electricity

Electricity will be located underground so as not to lead to ignition of surrounding bushland or the building itself.

4 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

A bushfire protection assessment has been undertaken for the proposed rezoning of land intended for a residential subdivision located at Lot 6 DP 244030 & Lot 9 DP 250425, Diamond Beach Road, Diamond Beach.

The assessment found that bushfire can potentially affect the proposed development from the coastal scrub (tall heath) vegetation located to the east of the site resulting in possible ember attack, radiant heat and potentially flame attack.

The development would be exposed to a medium - extreme bushfire attack potential (depending on the APZ adopted) as a result of a bushfire within that adjoining vegetation. The proposed development is however not exposed to any significant vulnerability from bushfire as appropriate APZs will be put in place and managed in perpetuity.

The following table illustrates the compliance with PBP.

Afford occupants of any building adequate protection from exposure to a bushfire

> Response: APZs have been provided in accordance with PBP. The proposed future buildings will be constructed in accordance with AS 3959. Other bushfire protection measures are planned and identified with the recommendations below.

Provide for a defendable space to be located around buildings

> Response: APZs have been provided in accordance with PBP.

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

> Response: APZs have been provided in accordance with PBP and appropriate building construction standards will be applied to the future dwellings. Fuel management will occur in the asset protection zone by homeowners.

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

> Response: Access complies with the objectives of PBP and Section 4.1.3 of PBP.

Provide for ongoing management and maintenance of bushfire protection measures, including fuel loads in the APZ

> Response: Fuel management can be undertaken by the land owners under the guide of Appendix 1 and as outlined within NSW RFS publications such as 'Standards for Asset Protection Zones' available from the RFS website at www.rfs.nsw.gov.au.

Ensure that utility services are adequate to meet the needs of fire fighters (and others who may assist in bushfire 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 generally on the attached Schedule 1 – Plan of Bushfire Protection Measures.

Recommendation 2 - APZs are to be provided to the proposed development. APZs are to be measured from the exposed wall of any dwelling toward the hazardous vegetation. The APZs shall be as nominated in Table 1 and also as generally depicted in Schedule 1.

Recommendation 3 - Fuel management within the APZs 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 the RFS in their publications.

Notwithstanding specialist advice in those guidelines, the following general advice for maintaining an APZ is to be followed:

- *Mowing or grazing of grass*: Grass needs to be kept short (approximately 5 cm in height) and green where possible adequate water supplies are available.

- *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. 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 is not to overhang a dwelling unless specifically approved by the RFS. Native trees and shrubs should be retained as clumps in landscape beds and should not exceed a covering of more than 20% of the IPA.

- Trees or tall shrubs may require pruning upon dwelling completion in line with PBP. 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 occupiers should be made aware that whilst landscaping can contribute to a way of life and environmental amenity, the accumulated fuels must be regularly removed.

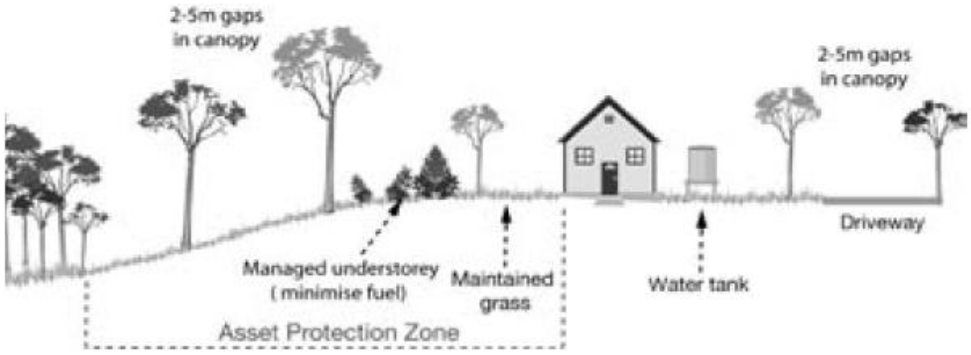
- Trees may remain within close proximity of a building where it can be demonstrated that the tree is not able to produce a build-up of fuel on the roof of a dwelling due to:

    1. A roof pitch which self sheds leaf litter
    2. Ongoing roof maintenance by staff or contractors
    3. Adequate ember protection has been installed

- Trees that are likely to be structurally unstable such that they could cause a limb to fall would require removal for the RFS to agree to a dwelling in proximity to the trees.

In addition the following general APZ planning advice is to be followed:

- Ensure that vegetation does not provide a continuous ignition 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 proposed dwellings so that plants will not ignite the dwelling 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 crushed tiles
- The following RFS diagram depicts one version of an ideal situation. Divergence from this ideal should not be undertaken without expert advice



Recommendation 4 - Building construction standards are to be applied in accordance with Australian Standard AS3959 *Construction of Buildings in Bushfire Prone Areas*

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 the development lands for the ongoing protection of themselves and their neighbours (refer Section 63(2) *Rural Fires Act*)

Recommendation 7 - The landowner / manager should be provided with publications relating to living in a bushfire prone area and available through the RFS or Council

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S1 PLAN OF BUSHFIRE PROTECTION MEASURES

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A1
MANAGEMENT OF ASSET PROTECTION ZONES

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Management of Asset Protection Zones

The NSW Rural Fire Service (RFS) advises 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 bush fire protection 2006* (PBP)and *Standards for Asset Protection Zones* (undated but circa 2006).

Asset protection zones (APZs) 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.

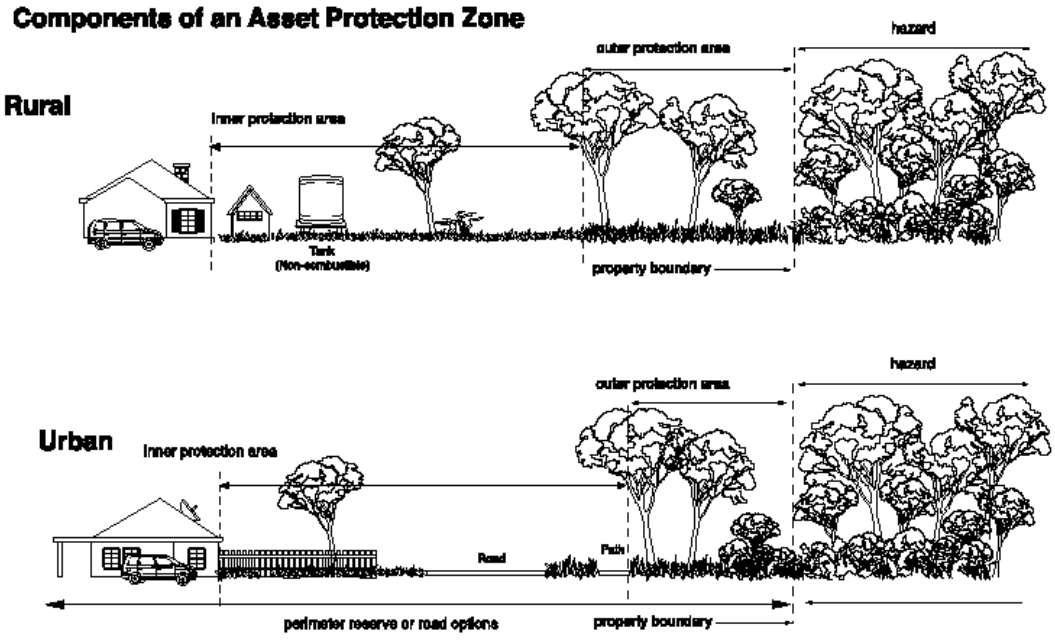
When considering bushfire fuel it is important to understand that it occurs in our native bushland in three vertical layers – see Table 1.

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 APZ 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 IPA 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 IPA 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 IPA 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 IPA but only where those trees are at least 5 metres away from a dwelling.

A recommended performance standard for the fuel load of an IPA is between 0 – 4 t/ha. Shrubs may occur within an IPA 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 IPA 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 APZs. It is for this reason that vegetation such as Forest Oaks are usually excluded from an IPA.

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 IPA 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 IPA 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^2	2 trees per 100 m^2
Between 10-20 metres	<10 tree per 400 m^2.	<10 trees per 400 m^2

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 OPA is between 4-6 t/ha.

Managing the APZ

Fuel management within the APZs should be maintained by regular maintenance such as

- Mowing grasses regularly - Grass needs to be kept short and, where possible, green.

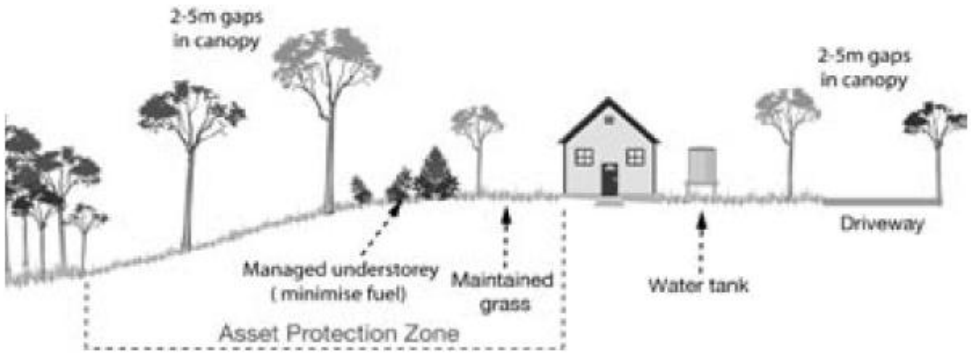
- Raking or manual removal of fine fuels - Ground fuels such as fallen leaves, twigs (less than 6 mm in diameter) and bark should be removed on a regular basis. This is fuel that burns quickly and increases the intensity of a fire. Fine fuels can be removed by hand or with tools such as rakes, hoes and 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. 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 APZs meet the *performance criteria* of APZs.



Figures courtesy of NSW RFS 2006.