Travers

bushfire & ecology

Bushfire Protection Assessment

Woolworths Retail Development
Lot 521 DP 594725
Warnervale Town Centre

Under Section 79BA of the EP&A Act

FPA AUSTRALIA
Certified Business
Bushfire Planning & Design

February 2013
(REF: A13004B)

Bushfire Protection Assessment

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Lot 521 DP 594725
Warnervale Town Centre

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File: A13004B

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This report has been prepared to provide advice to the client on matters pertaining to the particular and specific development proposal as advised by the client and / or their authorised representatives. This report can be used by the client only for its intended purpose and for that purpose only. Should any other use of the advice be made by any person including the client then this firm advises that the advice should not be relied upon. The report and its attachments should be read as a whole and no individual part of the report or its attachments should be relied upon as meaning it reflects any advice by this firm. The report does not suggest or guarantee that a bush or grass fire will not occur and or impact the development. The advice does advise on matters published by the *NSW Rural Fire Service* in their guidelines '*Planning for bushfire protection 2006*' and other advice available from that organisation.

The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

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Executive Summary

A bushfire protection assessment has been undertaken by *Travers bushfire & ecology* for a proposed construction of a Woolworths Retail Development within Lot 521 DP 594725 No. 262–282 Hakone Road, Woongarrah.

The proposed commercial development is categorised by the *NSW Rural Fire Service (RFS)* planning policy document *Planning for bushfire protection 2006 (PBP)* as being *'other development'.*

The *RFS* requires that development applications should satisfy the *aims and objectives* of *PBP* and propose a combination of bushfire protection measures and provide evidence that the intent of each measure can be satisfied.

The assessment found that bushfire can potentially affect the site from the forest vegetation abutting the site to the south east and to a lesser extent the forest vegetation located beyond the adjoining railway corridor and access roads to the south west and north west.

The bushfire risk however, can be mitigated if appropriate temporary asset protection zones (APZs) are put in place and managed until future proposed development within the adjoining land to the east has commenced.

In conclusion, the assessment has concluded that the proposed development will provide compliance with *PBP,* with the provision an agreement with Council, for the ongoing maintenance of the temporary 30m APZ and fire trail to the southeast of the development.

It should be noted that the future proposed Warnervale Town Centre completely surrounds the proposed Woolworths development. As a result temporary asset protection zones have been provided and are to be maintained until future development commences in order that future development is not restricted in line with the site being a state significant growth area.

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List of Abbreviations

APZ	Asset protection zone
BCA	*Building Code of Australia*
BSA	Bushfire Safety Authority
EEC	Endangered ecological communities
FDI	Fire Danger Index
IPA	Inner protection area
DLEP	Draft Gosford Local Environmental Plan 2008
OPA	Outer protection area
PBP	*Planning for bushfire protection 2006*
RFS	*NSW Rural Fire Service*
AS3959	*Australian Standard - Construction of buildings in bushfire-prone areas 2009*
WTC	Warnervale Town Centre

Introduction 1

Travers bushfire & ecology has been requested by *Woolworths Limited to* undertake a bushfire protection assessment in support of the proposed Woolworths Retail Development within Lot 521 DP 594725 No. 262–282 Hakone Road, Woongarrah.

1.1 Aims of the assessment

The aims of the bushfire protection assessment are to:

- Address the NSW Rural Fire Service letter dated 30/9/11
- 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 temporary 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

The proposal seeks to develop a Woolworths Retail Development involving the construction of Woolworths, Big W, numerous specialty retail shops, cinema, food court and associated car parking. The development is to occur within the southern portion of the site (refer Figure 1.1 - 1.3 below).

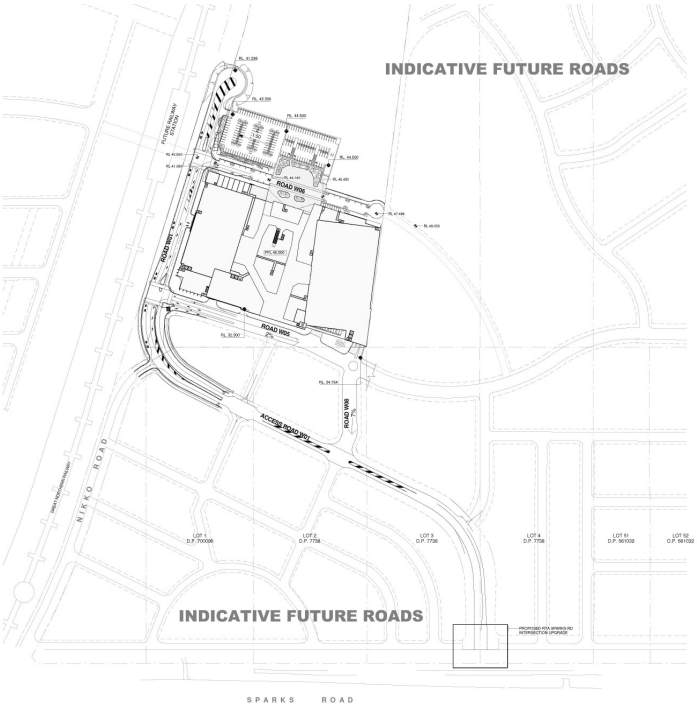

Figure 1.1 – Lot and Boundary Plan Proposed and Indicative roads (source: BN Group)

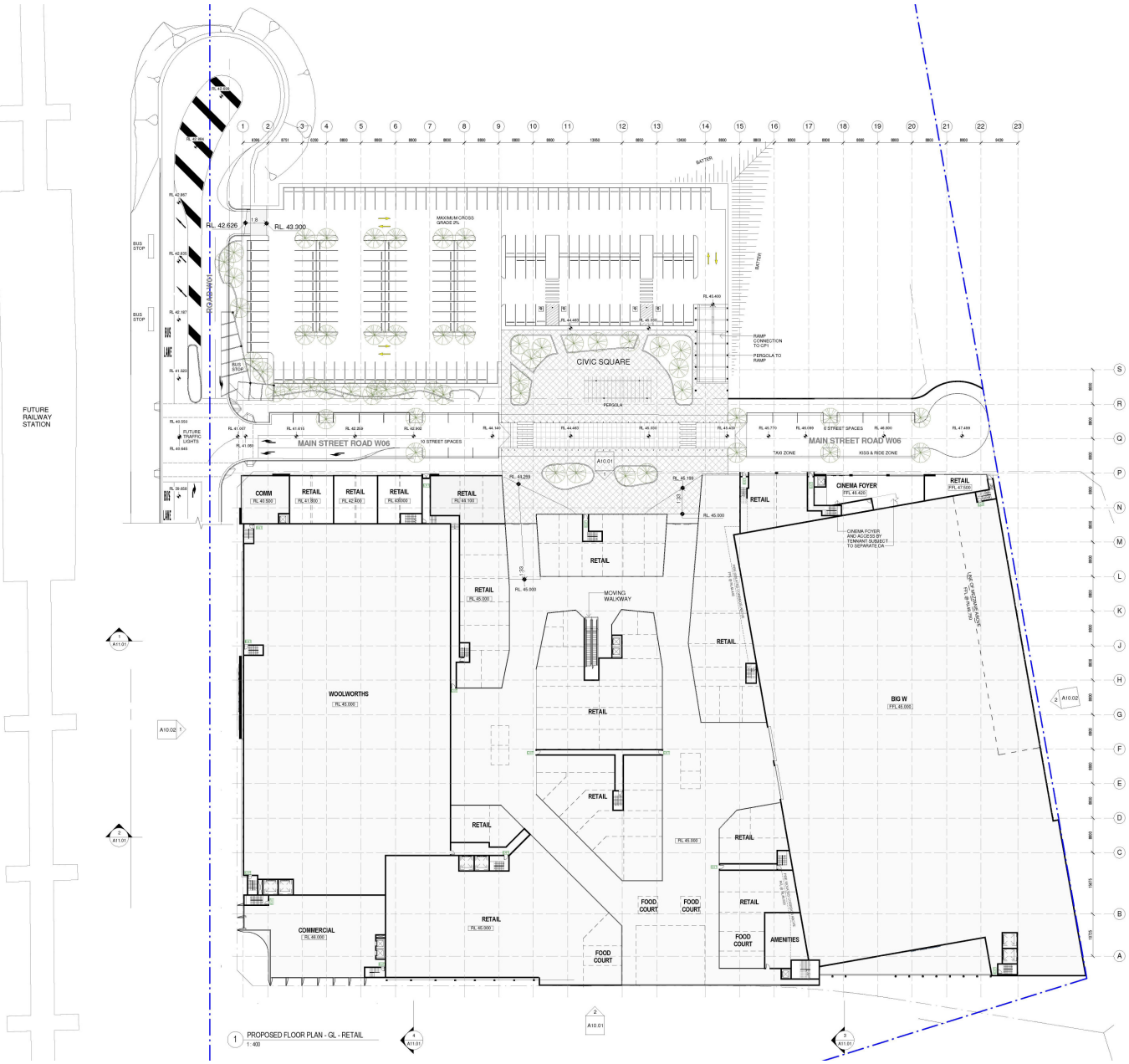

Figure 1.2 – Proposed Floor Plan (source: BN Group)

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:

- Architectural Drawings prepared by *BN Group 10/10/2012*
- NSW Rural Fire Service letter dated 30/9/11
- *Google* aerial photograph
- Topographical maps *DLPI of NSW* 1:25,000
- *Australian Standard 3959 Construction of buildings in bushfire-prone areas 2009 (AS3959)*
- *Planning for bushfire protection 2006 (NSW RFS).*

An inspection of the proposed development site and surrounds was undertaken to assess the topography, slopes, aspect, drainage, vegetation and adjoining land use. The identification of existing bushfire measures and a visual appraisal of bushfire hazard and risk were also undertaken.

1.4 Site description

The proposed Woolworths Retail Development forms part of the broader proposed Warnervale Town Centre (WTC) (refer Figure 1.4). The area of the WTC is approximately 114 ha in size and is bounded by Sparks Road in the south, Hakone Road in the north and Hiawatha Road in the east.

Figure 1.3 – Aerial Appraisal (source: NSW Department of Lands)

Within the WTC area, Woolworths is proposing the development of a retail facility within the southern portion of Lot 521 DP 594725 No. 262 – 282 Hakone Road, Woongarrah (refer Figure 1.3). The site is adjoined by a railway corridor in the west, which is proposed to be a future rail way station, residential to the south and community facilities to the eas (refer Figure 1.4).

Table 1.1 – Site features

Topography	Gentle topography of a 5-10 degree slope in some areas with the high point being near the western boundary south of Hakone Road. There has been extensive cut and fill within the middle of the site for previous land uses, including several dams with moderate to steep side slopes.
Geology and soils	Geology; Combination of Patonga Claystone and Tuggerah Formation geology. Soils; Woodburys Bridge residual soil landscape – deep red podzolic soils with some soloths in poorly drained soils on claystone bedrock or shallow to moderately deep yellow podzolic soils on sandstone bedrock.
Catchment and drainage	Unnamed tributary off Wallarah Creek which flows north-west into Budgewoi Lake.
Vegetation	Disturbed open forest and cleared with occasional scattered trees.
Clearing	The entire site has undergone past clearing, although remnant trees are present in a number of patches. There is limited mid-storey present in areas containing canopy vegetation.

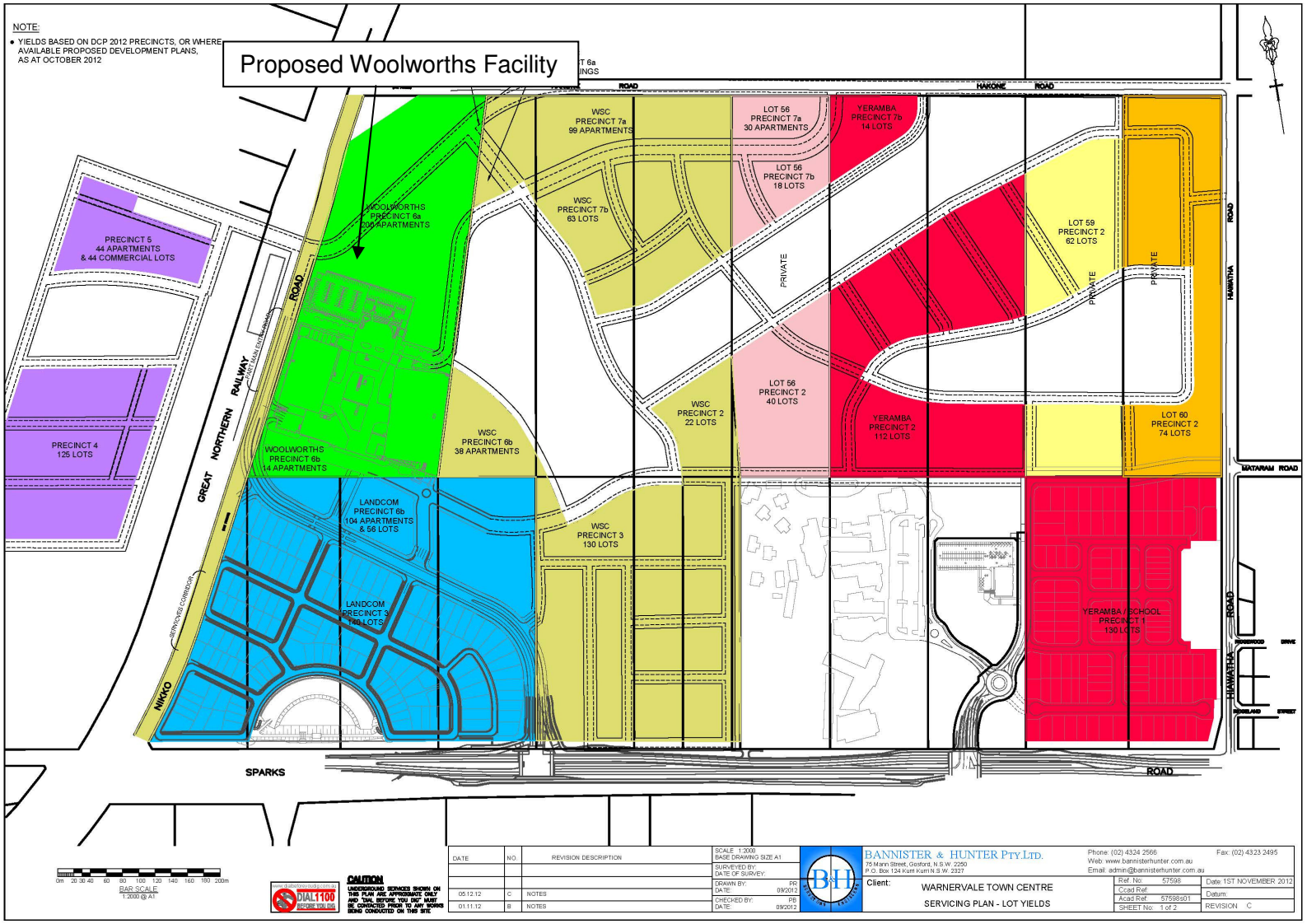

Figure 1.4 – Future WTC

1.5 Legislation and Planning instruments

1.5.1 Environmental Planning and Assessment Act 1979 (EP&A Act)

The *EP&A Act* governs environmental and land use planning and assessment within New South Wales. It provides for the establishment of environmental planning instruments, development controls and the operation of construction controls through the *Building Code of Australia (BCA)*. The identification of bushfire prone land is required under Section 146 of the *EP&A Act*.

1.5.2 Bushfire prone land

Bushfire prone land maps provide a trigger for the development assessment provisions.

The proposed commercial development is located on land mapped by Wyong Council as being bushfire prone. The proposed Woolworths development is a part 3A application and therefore the Planning Assessment Commission will be required to assess the development in accordance with *PBP* as required by Section 79BA of the *EP&A Act.*

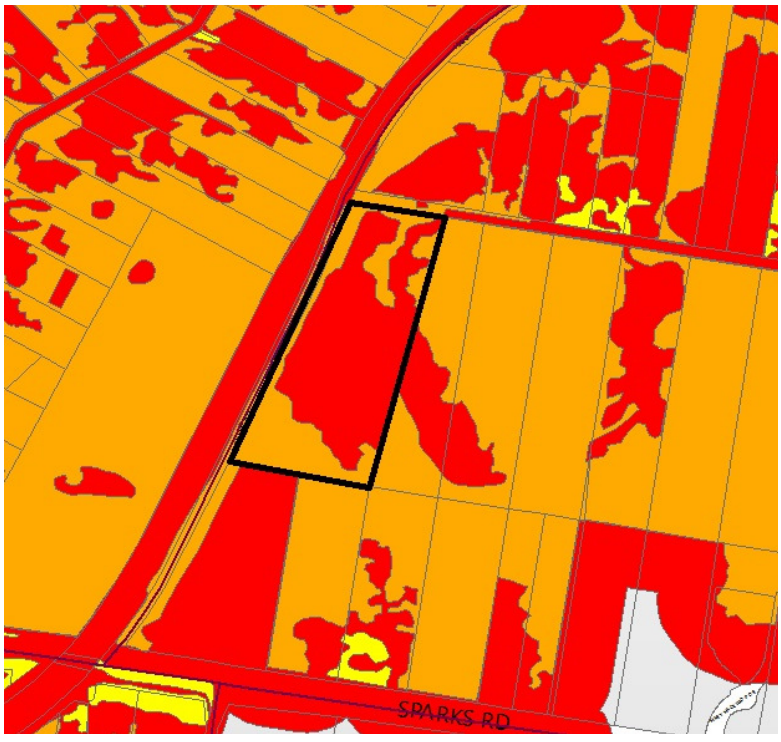

Figure 1.4 – Bushfire Prone Land Map
(source: *Wyong Council Website)*

1.5.3 Wyong Local Environmental Plan (LEP)

The Wyong LEP provides for a range of zonings which lists developments that are permissible or not permissible as well as the objectives for development within each relative zone.

The draft rezoning (refer Figure 1.5) is currently on public exhibition which proposes the subject site in part as B2 Local Centre, RE1 Public Recreation and B4 Mixed Use. The land adjoining the site to the south-east also shares a similar zoning.

Figure 1.5 – Draft LEP Zoning

1.5.4 Building Code of Australia (BCA) and the Australian Standards AS3959 (2009)

The *BCA* is given effect through the *EP&A Act* and forms part of the regulatory environment of construction standards and building controls. The *BCA* outlines objectives, functional statements, performance requirements and *deemed to satisfy* provisions.

In NSW, the construction of buildings in bushfire prone areas relates to Class 1, 2, 3, 4 and Class 9 buildings that are a *special fire protection purpose (SFPP)* or a Class 10a building or deck associated with aforementioned building Classes. The design and construction manual for the *deemed to satisfy* requirements is the *Australian Standard AS3959 Construction of buildings in bushfire-prone areas 2009 (AS3959).* These classes of buildings must therefore be constructed in accordance with *AS3959*.

The *BCA* does not provide for any bushfire specific performance requirements for commercial and industrial buildings (Class 5–8) and as such *AS3959* does not apply as a set of 'deemed to satisfy' provisions. The general fire safety construction provisions are taken as acceptable solutions.

1.5.5 Planning for bushfire protection 2006 (PBP)

PBP outlines the bushfire protection measures required to be assessed for new development in bushfire prone areas. The range of bushfire protection measures include:

- asset protection zones
- building construction and design
- access arrangements
- water supply and utilities
- landscaping, and
- emergency management arrangements.

PBP stipulates that developments such as Class 5-8 buildings should:

- Note the range of available bushfire protection measures (refer dot points above)
- Satisfy the aims and objectives of *PBP* (refer Section 2 and Section 4): and
- Propose an appropriate combination of bushfire protection measures, with evidence that the intent of each measure (with reference to Sections 4.1.3 and 4.2.7 of *PBP*) is satisfied (refer Section 3 below).

It should be noted that the future proposed Warnervale Town Centre completely surrounds the proposed Woolworths development. As a result temporary asset protection zones have been provided and are to be maintained until future development commences in order that future development is not restricted in line with the site being a state significant growth area.

Bushfire Threat Assessment 2

Bushfire protection planning requires the consideration of the *RFS* planning document entitled *Planning for bushfire protection 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 (including industrial and commercial buildings) 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).

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 thus affect the subject site, 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 that is likely to affect occupants and / or 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.

The hazardous fuels are categorised according to vegetation descriptions identified by *David Keith, 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 are primarily the bushland areas adjoining the site to the south-east as well as the vegetation beyond the railway corridor to the north-west and beyond the proposed road to the south (refer Figure 2.1 and Table 2.1)

The following figure has been extracted from the 'Ecological Framework, Warnervale Town Centre' report (2005) prepared by Ecological Australia.

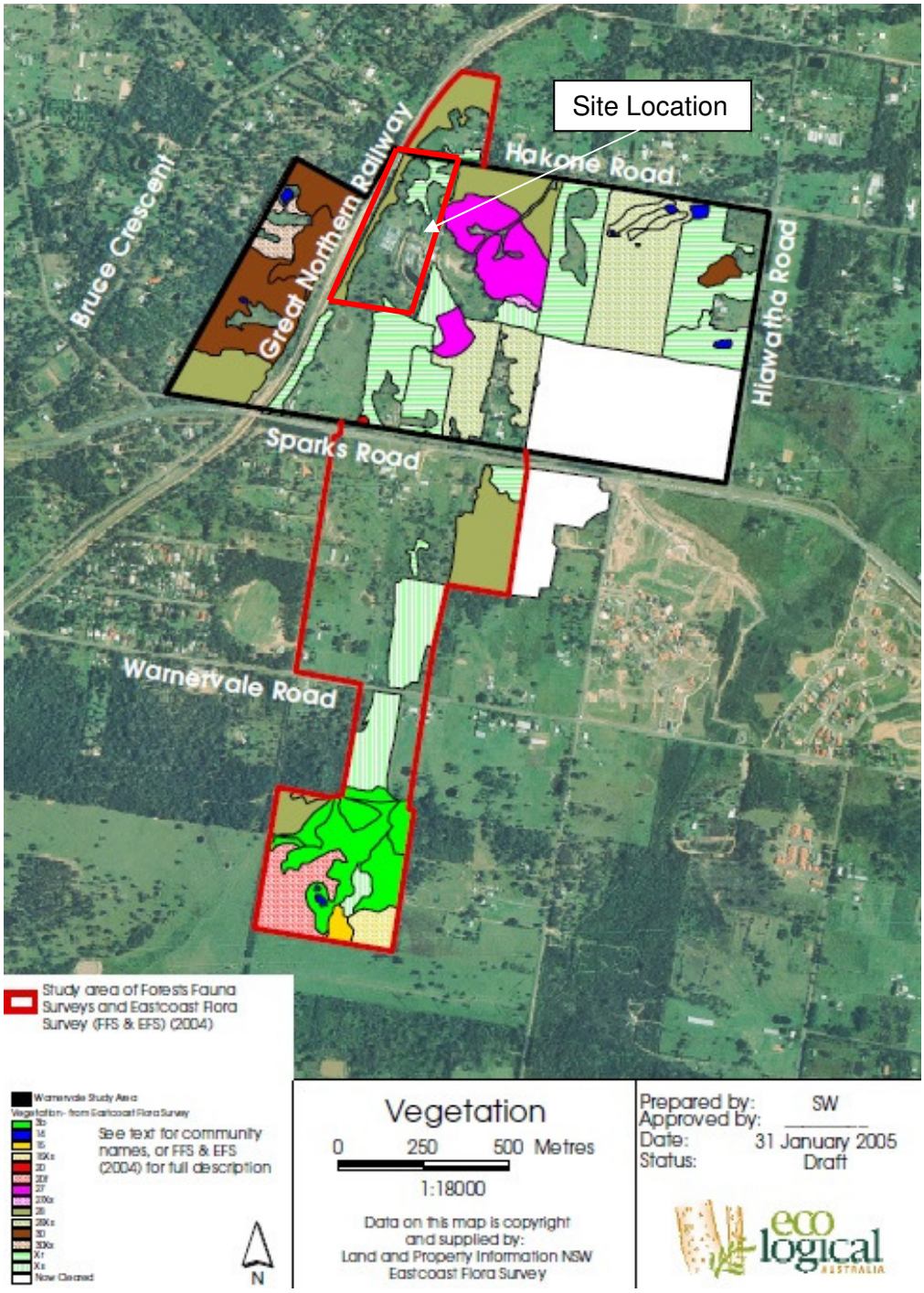

Figure 2.1 – Vegetation Communities

Table 2.1 – Vegetation

Aspect	Vegetation Community and location	Vegetation Formation (David Keith)
West	28 Xs - Disturbed Narrabeen Buttonderry Foot slopes Forest (within proposed Road Corridor) 30 - Dooralong Spotted Gum – Ironbark Forest (beyond railway corridor)	Forest
South	Xr – Unspecified Canopy – only (beyond proposed road)	Forest
East	Xs – Unspecified Regrowth (abutting site)	Forest

2.2 Bushfire attack assessment

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. 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 hazardous vegetation affecting the proposed development can be summarised as level to the southeast and northwest and 0–5 degrees down slope to the southwest.

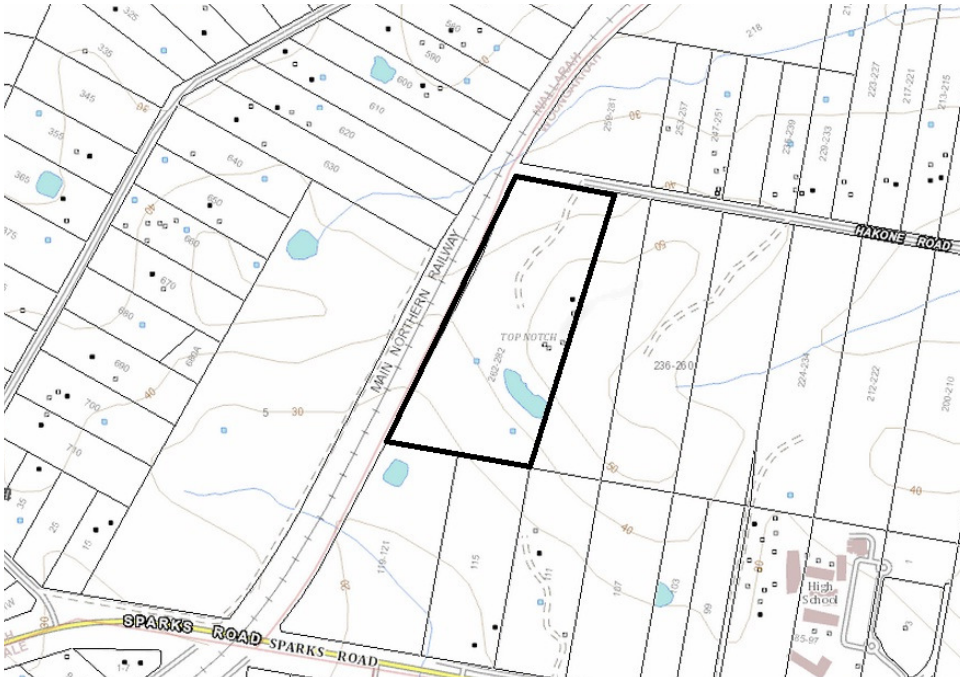

Figure 2.2 – Topography

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.
Table 2.2 below provides a summary of the bushfire attack assessment and the minimum required APZs for the development.

Note: There are no predetermined minimum APZ requirements for commercial / industrial development under *PBP*. The distances provided in column 5 (of Table 2.2) will provide appropriate defendable space for the commercial buildings. The defendable space is designed to allow fire fighters room and safety to fight fires.

Table 2.2 – Bushfire attack assessment

Aspect	Vegetation within 140 metres of development	Effective slope of land	Minimum APZ required as per Appendix 3 of *PBP*	Defendable space provided for Commercial	Compliance
Northeast	Cleared lands	0-5° D	N/A	30–90 metres (proposed road and car parking facilities)	Yes
Southwest	Cleared lands and Forest	0-5° D	30 metres	30 metres (proposed road)	Yes
Southeast	Forest	Level	25 metres	30 metres (temporary APZ)	Yes (refer Note 1)
Northwest	Forest	Level	25 metres	90 metres (proposed road and railway corridor)	Yes

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

Note 1 – The recommended temporary 30 metre APZ to the southeast is to be provided within the adjoining Council owned land (refer Section 3.3 for detail)

Specific Protection Issues

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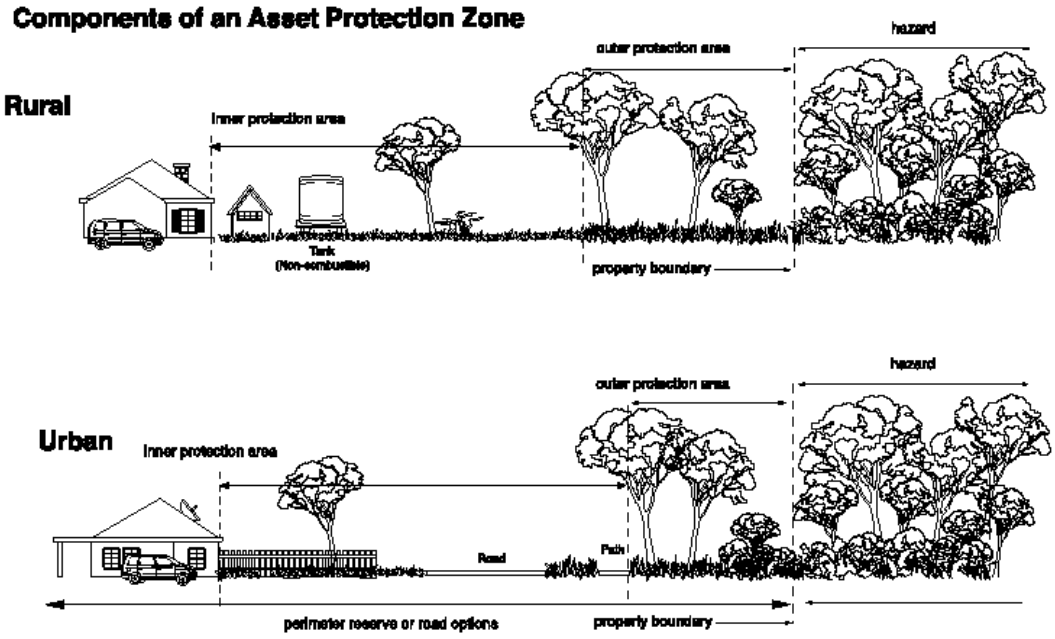
3.1 Asset protection zones

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 building. 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.

The temporary APZs provided for the commercial development consist of proposed roadways and car parking areas which exceed the minimum requirements of *PBP* (refer Table 2.2). However the proposed development abuts the eastern boundary of the lot and is adjoined directly by forest vegetation within the adjoining Council owned land. The management of the recommended temporary 30m APZ is to occur with agreement from the adjoining landholder, as detailed within Section 3.3 of this report.

As a result sufficient *defendable space* will be provided between hazardous vegetation and the commercial development to comply with the aims and objectives of *PBP*.

3.2 Building protection

The planning for the Hilltop Park as shown on Figure 3.1 below displays a future landscape where no hazardous vegetation will be located within 100 metres of the development. In this case no building protection is required for the development. However as the vegetation that forms the hazard may remain until such time as Council constructs this parkland landscape there will remain bushfire hazards.

In this regard a 30m wide temporary asset protection zone has been proposed which would occur over Council land.

3.3 Hazard management

Should the development be approved, the owner of the development will be required to manage the temporary APZs.

In terms of implementing and / or maintaining the temporary APZs, there is no physical reason that could constrain hazard management from being successfully carried out, mainly due to the fact that the APZ to the northeast, northwest and southwest consists of proposed access roads and car parking areas. The recommended temporary APZ to the southeast however consists of forest vegetation within adjoining Council owned land.

This area forms part of the broader proposed Warnervale Town Centre. In accordance with the *Warnervale Town Centre Development Contributions Plan* (December 2012) the area directly adjoining the property is subject to the 'Hilltop Park Concept Plan' (refer Figure 3.1 below). Note that the area adjoining the Woolworths development is proposed to be developed and a learning centre constructed which will remove the bushfire threat from this aspect.

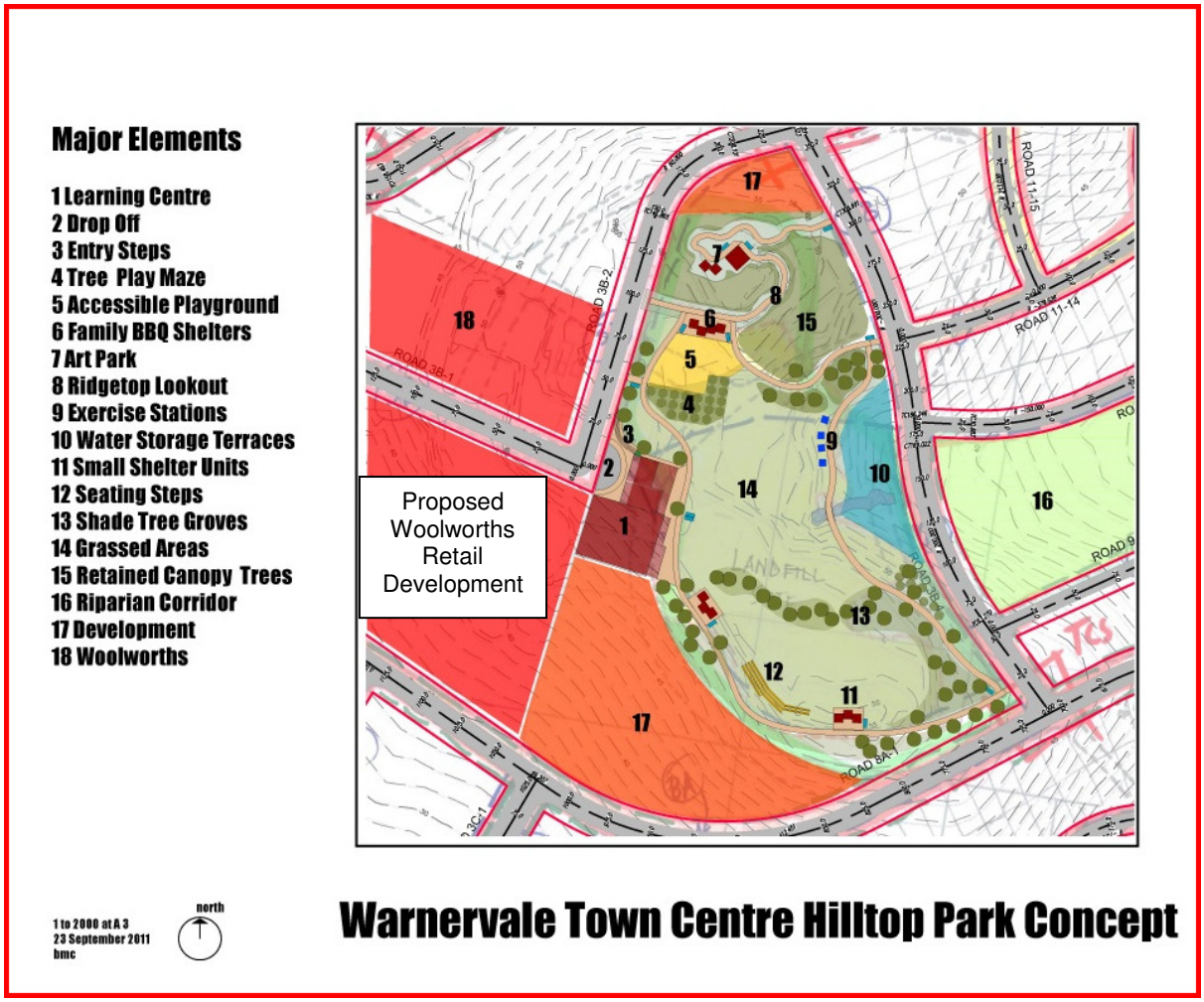


Figure 3.1 – Warnervale Town Centre Hilltop Park Concept

The proposed Hilltop Park concept is identified in the plan as having a medium priority with timing / threshold for the work to be 'transferred as part of development of the surrounding residential area'.

As a result this report recommends a temporary 30m APZ within the adjoining Council owned land. This is to be assured through an agreement with Council including a fuel management plan; for the purpose of maintaining fuel levels to the specifications required for an asset protection zone (refer Appendix 2).

An agreement between the applicant and Council (as owner of Lot 1 DP 376264 to the east of the development) will be required to establish the temporary APZ in accordance with a fuel management plan including the provision of a temporary fire trail.

3.4 Access for fire fighting operations

The proposed development will provide access to Sparks Road in the south, with further future access as shown on Figure 3.2 & 3.3.

A perimeter road is provided for the development and extends along the north eastern, north western and south western boundary of the proposed development (refer Figure 3.2). However this road does not encircle the development. Given the vegetation hazards

occurring to the east access on that aspect must be provided for fire fighting operations and fuel management works. This could occur via temporary fire trail linking to the development roads.

In terms of the main access capability the access road varies in width from 12-20 metres and exceeds the minimum requirements of *PBP*. The proposed access complies with the following acceptable solutions of *PBP*.

- Public roads are two wheel drive, all weather roads.
- Perimeter roads are two way (carriageway 8 metres minimum kerb to kerb).
- Perimeter road is linked with the internal road system at an interval of no greater than 500 metres in urban areas.
- Traffic management devices are constructed to facilitate access by emergency services.
- Public roads have a cross fall not exceeding 3 degrees.
- All roads are through roads. If unavoidable, dead end roads are not more than 200 metres in length, incorporate a minimum 12 metre outer radius turning circle, sign posted dead end and directing traffic away from the hazard.
- Curves of roads (other than perimeter) have a minimum inner radius of 6 metres and are minimal in number.
- The minimum distance between inner and outer curves is 6 metres.
- Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees.
- Minimum vertical clearance of 4 metre above the road.
- The capacity of road surfaces and bridges is sufficient to carry fully loaded fire fighting vehicles (15 tonnes).

Figure 3.2 – Future Road Hierarchy
(source: Warmervale Town Centre Development Control Plan)

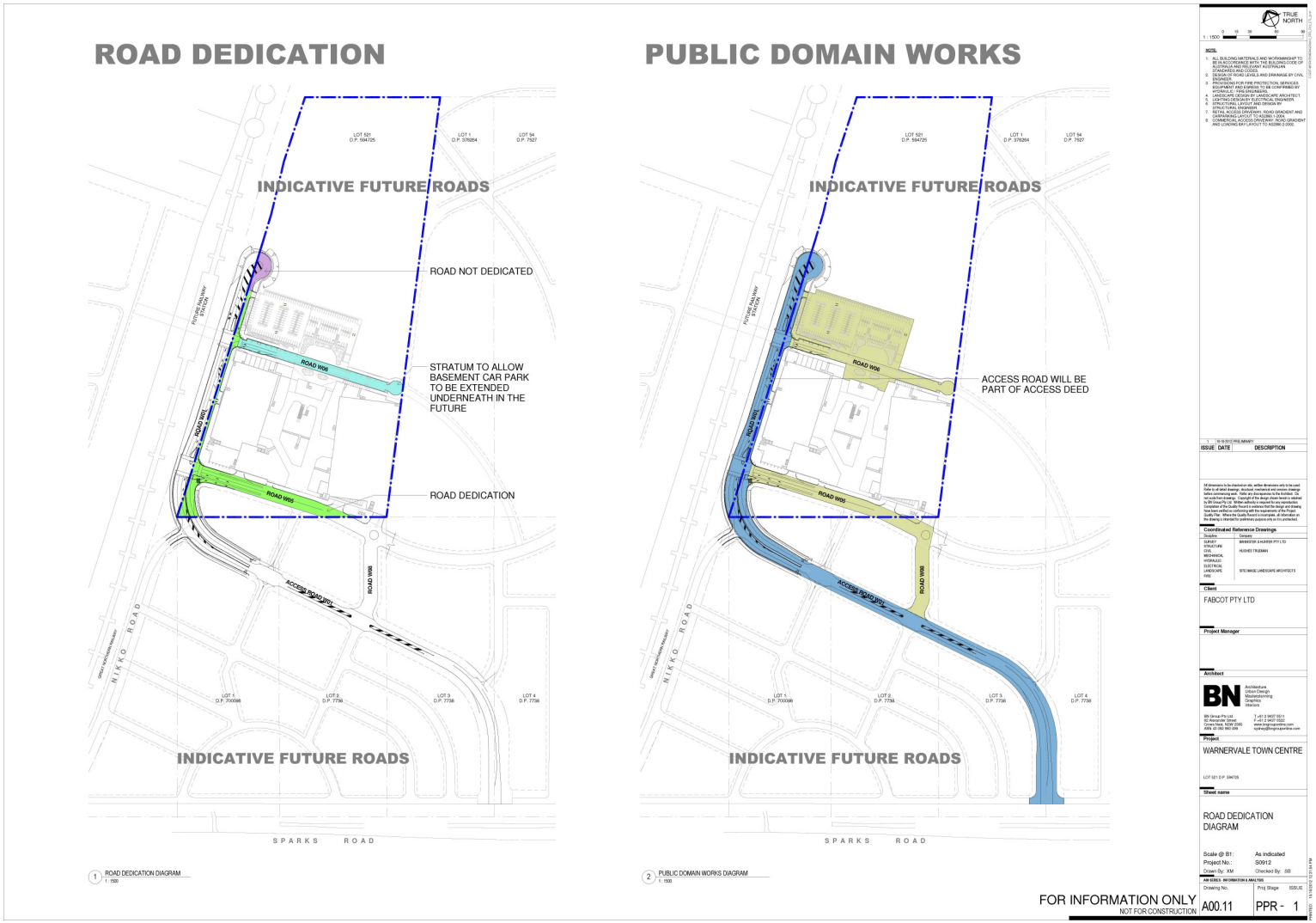


Figure 3.3 – Road Dedication Diagram (source: BN Group)

3.5 Water supplies

Town reticulated water supply is available to the development in the form of an underground reticulated water system. The performance criteria for reticulated water supply are that *"water supplies are easily accessible and located at regular intervals".* The *acceptable solutions* are:

- Reticulated water supply uses a ring main system for areas with perimeter roads
- Fire hydrant spacing, sizing and pressures comply with AS2419.1 (2005)
- Hydrants are not placed within any road carriageway
- All above ground water and gas pipes external to the building are metal, including and up to taps
- The provisions of parking on public roads are met.

The proposal must comply with the above requirements.

3.6 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 AS1596 (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.

The proposal must comply with the above requirements.

Conclusion & Recommendations

4

A bushfire protection assessment has been undertaken by *Travers bushfire & ecology* for a proposed construction of a Woolworths Retail Development within Lot 521 DP 594725 No. 262–282 Hakone Road, Woongarrah.

The assessment found that bushfire can potentially affect the site from the forest vegetation abutting the site to the south east and to a lesser extent the forest vegetation located beyond the adjoining railway corridor and access roads to the south west and north west.

The bushfire risk however, can be mitigated if appropriate temporary asset protection zones (APZs) are put in place and managed until future proposed development within the adjoining land to the east has commenced.

In conclusion, the assessment has concluded that the proposed development will provide compliance with *PBP*.

- Compliance with *Planning for bushfire protection, 2006 (PBP)* with of an agreement between the applicant and Council (as owner of the impacted land), for ongoing maintenance of the temporary 30m APZ to the southeast of the development.

In terms of the specific criteria identified by *PBP* the following responds to that criteria;

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

Response: Adequate defendable space and access opportunities have been provided for the development

Provide for a defendable space to be located around buildings

Response: Temporary 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: Temporary APZs have been recommended in accordance with *PBP* with the provision of adequate access opportunities surrounding the building footprint.

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

Response: Adequate access has been provided in compliance with 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 in accordance with Appendix 5 of *PBP* 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. An agreement between the applicant and Wyong Council is required for the management of the temporary 30m APZ within the adjoining land.

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 can be assured by a condition of Council consent for future development applications.

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

Recommendation 1 - APZs are to be provided for future development. The APZs as recommended within Table 2.2 are to be measured from the exposed wall of the commercial buildings toward the hazardous vegetation.

Recommendation 2 - Fuel management within the APZs will be maintained by regular maintenance of the landscaped areas, mowing of lawns in accordance with the guidelines provided in Appendix 5 of *PBP*, and / or as generally advised by the RFS in their publications.

An agreement between the applicant and Council is required to ensure the implementation of a temporary 30m APZ, within the adjoining Council owned land, to the southeast. This will also include the provision of a temporary fire trail.

The agreement will require the prior approval of Council and will identify the hazardous areas to be managed, the scope of the works required, the frequency of the works, the objectives of the works as well as the monitoring of the works.

The asset protection zone to be covered under this agreement will be within adjoining Lot 1 DP 376264. The APZ will be 30 metres in width and is to extend adjacent to the proposed commercial development.

Recommendation 3 - Building construction standards are not required given the size of the temporary APZ and the construction materials being proposed. It is critical that no fuel reserves be located on the eastern aspect and if these facilities are planned then the APZ must be enlarged significantly (and be subject to a separate DA assessment).

Recommendation 4 - A hydrant water supply will be installed in accordance with Australian Standard AS2419.1.

Recommendation 5 - 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*).

References

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Plan of Bushfire Protection Measures

S1

NSW RFS Correspondence

A1

All communications to be addressed to:

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The Director General
Dept of Planning & Infrastructure
GPO Box 39
Sydney NSW 2001

Your Ref: MP10_0195
Our Ref: S11/0013
DA11083179578 GB
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Attention: David McNamara

30 September 2011

Dear Sir/Madam

Re: Environmental Assessment for Warnervale Town Centre - Woolworths retail development – MP10_0195

I refer to your letter dated 26 August 2011 inviting a submission from the NSW Rural Fire Service and recommended conditions of approval regarding bush fire protection measures for the above project.

Following a review of the associated documents the RFS advises that no specific information has been provided in regards to bush fire and compliance with *Planning for Bush Fire Protection 2006* for this particular Project Application and site. The advice provided relates to the Warnervale Town Centre (WTC) as a whole.

The WTC DCP addresses the provision of infrastructure such as water supply and vehicular access. It is also noted the DCP identifies this mixed use precinct with a residential component over. No advice has been provided on the residential component proposal.

In regards to the development of the WTC site in stages, the bush fire threat relates to the remaining and unmanaged vegetation on the adjoining land but within the site. In this regards it is recommended that the vegetation within the site be managed to the standard of an outer protection area or a temporary asset protection zone be created around Lot 152.

Management of Asset Protection Zones

A2

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 (e.g. 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.

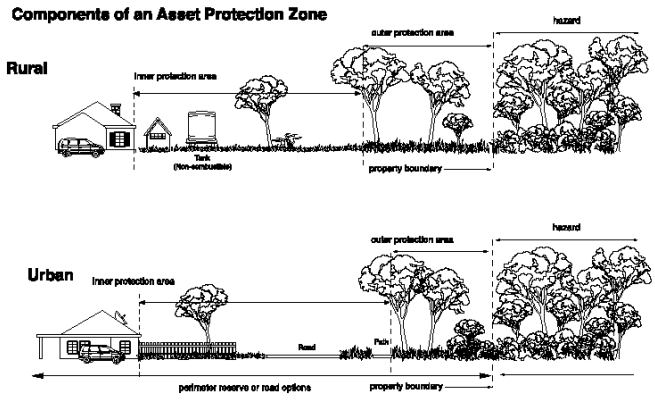
When considering bushfire fuel it is important to understand that it occurs in our native bushland in three vertical layers – see Table 1.

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.

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.

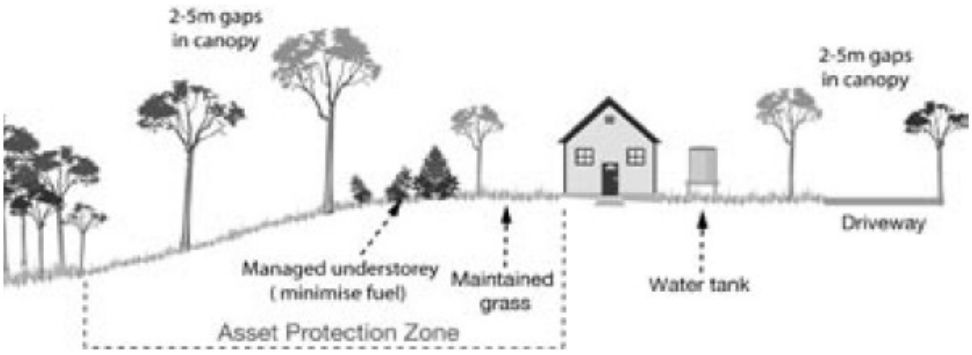
- Plant or clear vegetation into clumps rather than continuous rows.

- 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.