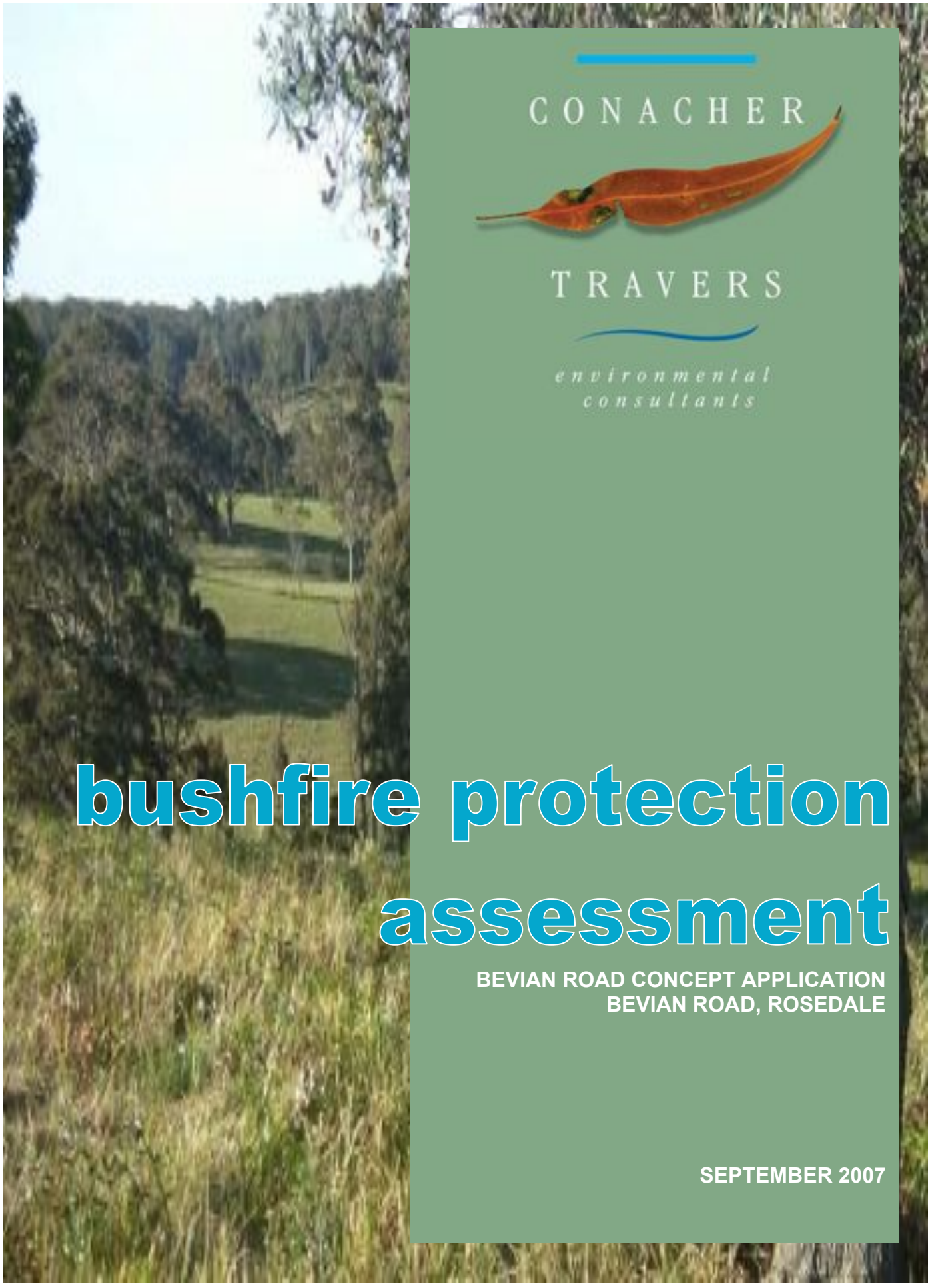


CONACHER TRAVERS

environmental consultants

bushfire protection assessment

BEVIAN ROAD CONCEPT APPLICATION
BEVIAN ROAD, ROSEDALE

SEPTEMBER 2007

BUSHFIRE PROTECTION ASSESSMENT (BPA)
BEVIAN RD CONCEPT APPLICATION

LOT 2 DP 627034, LOT 2 DP 623340, LOTS 11, 29, 32, 72, 102, 118, 119 & 213 DP 755902, BEVIAN RD, ROSEDALE

CONACHER TRAVERS
ENVIRONMENTAL CONSULTANTS
40 The Avenue, Mt Penang Parklands
Central Coast Highway, Kariong NSW 2250
Mail: PO Box 7128, Kariong NSW 2250
(ph: (02) 4340 0677 fax: (02) 4340 2367)
email: ecology@conachertravers.com.au

Reference	Issue	Description	Author	Director
6052B	SEPTEMBER 2007	Final	NV, JH	JT

EXECUTIVE SUMMARY

This Bushfire Protection Assessment (BPA) has been prepared by *Conacher Travers Pty Ltd* on behalf of *Marsim (*trading as *Nature Coast Developments Pty Ltd*) for the Masterplan covering Lot 2 DP 627034, Lot 2 DP 623340, Lots 11, 29, 32, 72, 102, 118, 119 and 213 DP 755902 Bevian Road, Rosedale, hereafter referred to as the subject site. The subject site occupies an area of 173.59 hectares and is situated within the Eurobodalla Local Government Area (LGA). Figure 1 depicts the subject site location, whilst Figure 2 provides an aerial appraisal of the site.

The Bevian Road Concept Application seeks the approval of two specific plans referred to collectively as 'The Concept Approval Plans'. Specifically these are:

- 'The Constraints Map' (Figure 3 attached) – a plan of the net developable area
- 'The Plan of Subdivision' (Figure 4 attached) – an 806 lot residential subdivision and 15 community lots. NB: this is a concept layout only, a detailed DA will be lodged once the concept has been approved.

This report provides an assessment of the bushfire protection measures required for the development to guard against the potential impact of bushfires. Recommendations have been made in respect of fuel management, construction standards / building protection, access, bushfire education and land ownership responsibility.

The assessment has been prepared in accordance with the '*Planning for Bushfire Protection Guidelines'* (NSW RFS 2006) and key bushfire issues outlined within the Director Generals Requirements (DGRs), issued by the NSW Department of Planning (DoP) in December 2006. Issues Specific issues identified in the DGRs are:

No.	Director General Requirement	Relevant section of this report
8	**Hazard Management and Mitigation**	
8.1	*Address the requirements of Planning for Bushfire Protection 2006 (RFS) in particular the provision for adequate access for fighting bushfire, adequate asset protection zones and water supply for bushfire suppression operations.*	Addressed within this Bushfire Protection Assessment
8.3	*Address AS3959L: Building in Bush Fire Prone Areas.*	Sections 2.3, 3.2, 4.2 & Appendix 2

CONACHER TRAVERS PROJECT TEAM

JOHN TRAVERS B.App.Sc. / Ass. Dip.
Director
Conacher Travers Pty Ltd

JASON HULSTON B.App.Sc
Bushfire Planner
Conacher Travers Pty Ltd

NICOLE VAN DORST B.App.Sc
Bushfire Planner
Conacher Travers Pty Ltd

TABLE OF CONTENTS

BUSHFIRE PROTECTION ASSESSMENT

SECTION 1

INTRODUCTION

This Bushfire Protection Assessment (BPA) has been prepared by *Conacher Travers Pty Ltd* on behalf of *Marsim (*trading as *Nature Coast Developments Pty Ltd*) for the Masterplan covering Lot 2 DP 627034, Lot 2 DP 623340, Lots 11, 29, 32, 72, 102, 118, 119 and 213 DP 755902 Bevian Road, Rosedale, hereafter referred to as the subject site. The subject site occupies an area of 173.59 hectares and is situated within the Eurobodalla Local Government Area (LGA).

1.1 AIMS OF THE ASSESSMENT

The aims of the bushfire protection assessment are to:

- Review the bushfire threat to the property
- Review the potential to carry out hazard management over the landscape
- Provide advice on mitigation measures including the provision of asset protection zones and construction standards in accordance with *'Planning for Bushfire Protection, 2006'*
- Advise on specific fire management issues

1.2 PLANNING RELATIONSHIPS

This report has been prepared having regard to the following legislative and planning requirements.

1.2.1 Legislation

The proposed subdivision is located on land mapped by Council as being bushfire prone.

The application is to be dealt with by Section 3A Major Infrastructure Projects Development and managed by the Department of Planning.

This legislation does not trigger Section 100B of the Rural Fires Act and the need for a Bushfire Safety Authority to be issued by the RFS.

Notwithstanding this the S3A requirements call for assessment against the NSW Rural Fire Service policy document entitled *Planning for Bushfire Protection 2006 (PBP 2006).*

1.2.2 Planning Policies

PBP 2006 provides concepts for building in bushfire prone areas as well as guidance on the planning and development control processes in relation to bushfire protection measures.

PBP aims to provide for the protection of human life (including fire fighters) and to minimise impacts on property from the threat of bush fire, while having due regard to development potential, onsite amenity and protection of the environment. More specifically, the objectives are to:

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 document allows two approaches to bushfire protection assessment. Firstly, by a '*deemed to satisfy'* approach and secondly by an '*alternative solution*' approach.

The former is qualitatively explained within PBP 2006 whilst the latter requires specialist assessment techniques not covered within PBP 2006. The latter follows on from the *Building Code of Australia* in that it allows an *alternative solution* approach to bushfire protection where it can be demonstrated that performance assessment achieves the quantitative and qualitative requirements of the RFS. This is usually undertaken using fire science and materials testing.

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:

- Proposed development plan prepared by *Roberts Day Pty Ltd*
- Conservation and Land Use Management Plan (CLUMP), *Conacher Travers* (2007c)
- Ecological Site Management Plan (ESMP), *Conacher Travers* (2007b)
- Flora & Fauna Assessment (F&F), *Conacher Travers* (2007a)
- Ecological Assessment (EA), *Conacher Travers* (2007d)
- Fuel Management Plan (FMP), *Conacher Travers* (2007e)
- Australian Standard 3959 '*Construction of Buildings in Bush Fire Prone Areas*'
- Rosedale 1:25,000 Mogo Topographic Map
- DLWC 1:25,000 Aerial Photograph

An inspection of the subject site and surrounds was undertaken on several occasions between 2006 and 2007 to assess the topography, slopes, aspect, drainage, vegetation and adjoining land use. The identification of existing bush fire protection measures and a visual appraisal of bush fire hazard and risk were also undertaken.

1.4 PROJECT SYNOPSIS

The Bevian Road Concept Application seeks the approval of two specific plans referred to collectively as 'The Concept Approval Plans'. Specifically these are:

- 'The Constraints Map' (Figure 3 attached) – a plan of the net developable area
- 'The Plan of Subdivision' (Figure 4 attached) – an 806 lot residential subdivision and 15 community lots. NB: this is a concept layout only, a detailed DA will be lodged once the concept has been approved.

For the purposes of this report the development has been divided into six zones (see Schedule 1).

- Zones 1 - 5 are located within the northern portion of the property separated by a riparian corridor and Ecological Corridor 1.
- Zone 6 is located to the south of the development separated from Zones 1 – 5 by Ecological Corridor 2 (central ridgeline).

The site has been heavily impacted by tree clearing and general agricultural use in the past. Ecological Corridors 1 and 2 will be revegetated and restored to eventually contain Forest type vegetation. The 'Bevian Swamp' located within the southern portion of the site will also be preserved and protected by vegetative buffers.

1.5 SITE DESCRIPTION

Landscape Context

The subject site (refer Figure 1) is located near Barlings Beach and situated on the northern side of George Bass Drive, approximately 1.5 km to the west of Rosedale and 1.5 km to the north-east of Tomakin. Approximate Australian Map Grid (AMG) coordinates for the site are 247500E and 6033000N. The site encompasses an area of 173.59 hectares.

The subject site is bounded by Mogo Stage Forest to the west and northwest, rural development and fragmented bushland to the east and George Bass Drive to the south. The subject site occurs south of Batemans Bay and north of the Tomaga River within the Eurobodalla Local Government area (LGA).

Two existing residences are located in the north east of the subject site adjoining Bevian Road. A nursery that is no longer operational is located to the south west of the residences extending to cattle yards and sheds further south. A pump station is located in the drainage line to the south of the nursery.

A series of ten (10) dams have been constructed throughout the subject site. Four dams are located in the northern drainage line that flows to the east, three in the drainage line to the south of the nursery, one to the east below the Banksia Scrub vegetation ("The Knoll"), one within the Swamp Oak Open Forest to the west of Bevian Road and one to the west of the Blackbutt Woodland vegetation community.

Natural Landscape Descriptions

Topography and Drainage

The subject site is naturally divided into two catchments by a ridgeline which traverses the site in an east west direction. The topography across the site is gently undulating to steep land and contains a network of drainage lines. Gradients of the subject site range from steep (20^o) in the upper drainage lines to less than 5^o within the floodplain of the Bevian Swamp. The approximate elevation ranges from less than 10m AHD within the Bevian Swamp to 100m (AHD) on the ridge within the north-western section of the subject site.

The northern section of the subject site contains the upper tributaries of Saltwater Creek which discharge over Barlings Beach into the South Pacific Ocean. The catchment drains from several small drainage lines which flow generally to the south east to Saltwater Creek. There are two farm dams located on this drainage line in the north of the subject site.

To the south of the old nursery there is another tributary of Saltwater Creek which initially flows in a southerly direction and contains one farm dam in the upper reaches of this

tributary. The creek then turns to the east in which two more farm dams have been constructed. To the south another tributary of Saltwater Creek flows in an easterly direction from Bevian Road into a small farm dam. From this farm dam two smaller drainage lines, which were dry at the time of the survey, flow in different directions one to the north east and one to the south east into Saltwater Creek.

The catchment of the southern section of the subject site flows into the Bevian Swamp. One drainage corridor is located to the north west of the Bevian Swamp and contains a small farm dam after which the drainage line is not defined and the topography flattens out and becomes a floodplain. The south eastern section of the subject site contains a floodplain of the Bevian Swamp with no defined drainage corridor located in this area.

Vegetation

The subject site has been subjected to extensive clearing, with most of the natural vegetation being removed. The majority of the subject site consists of pasture with scattered trees and fragmented areas of remnant vegetation along the peripheries. Cleared areas of the subject site are currently being used for cattle grazing. Impacts of grazing are also evident within the more accessible vegetation remnants.

The majority of the subject site has been cleared for agricultural purposes. Native open forest forms the eastern, north eastern and north western sections of the property. Native vegetation is also present around the Bevian Swamp in the southern section of the subject site. Two areas of remnant Swamp Oak Open Forest exist within the floodplain to the north and northwest of the Bevian Swamp. A remnant patch of Banksia Scrub vegetation exists upon a hill known locally as “The Knoll”, located in the central section of the property.

Surrounding lands contain native vegetation, with the property adjoining Mogo State Forest along the north western boundary. Lands to the north, east and south west contain native vegetation and are currently used for rural residential purposes. To the south east there is cleared land which is currently a sewage treatment plant. To the south across George Bass Drive is Barlings Beach Caravan Park and native vegetation adjoins the Caravan Park to the east.

The nearest conservation reserves are Illawong and Broulee Island Nature Reserves located approximately 5 km to the south. Murramarang National Park is located approximately 15km to the north of the subject site.

Mogo State Forest adjoins the western and north western boundaries of the subject site and covers an area of approximately 15,500 ha.

Overall the vegetation within the site is considerably disturbed. Nine (9) identified vegetation communities and three (3) vegetation community variants have been identified onsite with varying levels of disturbance (refer Table 2 and Figure 5). The communities include variations of Open Forest, Woodland, Dry Gully Rainforest, Banksia Scrub, Aquatic Herbfield, Grassland with Scattered Trees, Open Woodland and Closed Scrub.

Table 1 below provides the diversity of vegetation communities and the RFS vegetation structure category. Vegetation ‘structure’ descriptions are provided by ‘Planning for Bushfire Protection 2006’. Those descriptions involve categorising vegetation according to either Group 1, 2 or 3 vegetation. For example Group 1 is forest, Group 2 is woodland and Group 3 is rainforest and or grassland.

Table 1 - Vegetation communities within the subject site

Vegetation Community Title	Dominant Species	RFS Vegetation category
Spotted Gum/Ironbark Open Forest	*Corymbia maculata* (Spotted Gum) *Eucalyptus fibrosa* (Broad-leaved Ironbark) *Eucalyptus muelleriana* (Yellow Stringybark)	Group 1
Blackbutt Woodland	*Eucalyptus pilularis* (Blackbutt) *Corymbia maculata* (Spotted Gum) *Eucalyptus fibrosa* (Broad-leaved Ironbark) *Eucalyptus muelleriana* (Yellow Stringybark)	Group 1
Dry Gully Rainforest (Preliminary EEC under the *EPBC Act* 1999)	*Alphitonia excelsa* (Red Ash) *Claoxylon australe* (Brittlewood) *Cassine australis* *Acmena smithii* (Lilly Pilly) *Glochidion ferdinandi* (Cheese Tree).	Group 3
Banksia Scrub	*Acacia irrorata* subsp. *irrorata* (Blueskin) *Acacia longifolia* (Sydney Golden Wattle) *Acacia melanoxylon* (Blackwood) *Allocasuarina littoralis* (Black She-oak) *Banksia integrifolia* (Coast Banksia)	Group 2
Swamp Oak Open Forest (EEC under the *TSC Act* 1995)	*Casuarina glauca* (Swamp Oak) *Eucalyptus botryoides* (Bangalay)	Group 1
Disturbed Swamp Oak Open Heath (EEC under the *TSC Act* 1995)	*Casuarina glauca* (Swamp Oak) - <1m in height	Group 2
Aquatic Herbfield	*Blechnum cartilagineum* (Gristle Fern) *Centella asiatica* (Swamp Pennywort) *Eleocharis sphacelata,* (Tall-spike Rush) *Juncus usitatus* (Common Rush) *Ottelia ovalifolia* (Swamp Lily) *Paspalum distichum* (Water Couch) *Persicaria decipiens*	Group 3
*Natural Freshwater Wetland (EEC under the *TSC Act* 1995)	*Blechnum cartilagineum* (Gristle Fern) *Centella asiatica* (Swamp Pennywort) *Eleocharis sphacelata,* (Tall-spike Rush) *Juncus usitatus* (Common Rush) *Ottelia ovalifolia* (Swamp Lily) *Paspalum distichum* (Water Couch) *Persicaria decipiens*	Not applicable

Grassland with Scattered Trees	*Corymbia maculata* (Spotted Gum) *Eucalyptus globoidea* (White Stringybark) *Eucalyptus fibrosa* (Broad-leaved Ironbark) *Eucalyptus longifolia* (Wollybutt) *Eucalyptus tereticornis* (Forest Red Gum)	Group 3
Disturbed Redgum Open Woodland (EEC under the *TSC Act* 1995)	*Eucalyptus tereticornis* (Forest Red Gum) *Melaleuca ericifolia*	Group 1
Closed Swamp Paperbark Scrub (EEC under the *TSC Act* 1995)	*Casuarina glauca* (Swamp Oak) *Melaleuca ericifolia*	Group 2
* Disturbed Swamp paperbark Open Heath (EEC under the *TSC Act* 1995)	*Melaleuca ericifolia* - <1m in height	Group 2

* Denotes vegetation community variation

SECTION 2

BUSHFIRE PROTECTION ASSESSMENT

Developing in bushfire prone areas requires consideration of the overall threat upon a site and the way occupants of a site / dwelling(s) 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, and the eventual dwelling occupiers, a review of the elements that comprise the overall threat needs to be completed.

These elements include the presence of hazardous fuels on site, the 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 fire.

Hazard is measured in terms of the potential intensity of the fire i.e. k/w m^2 (Kilowatts per square metre of fire front). The factors that influence the bushfire hazard are primarily the nature of the vegetation (fuel) and the slope. Factors such as wind and fuel dryness also contribute to the hazard achieving maximum intensity levels.

The Rural Fire Service that any assessment of a development which is located within a bushfire prone area must include an assessment of both the effective slope for up to 100 metres and the vegetation for up to 140 metres external to the proposed development area – see Tables 2-7 below.

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.

2.1.1 Potential Bushfire Risk

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

Bushland to the north, east and west of the property (Figure 2) poses a potential bushfire threat to the proposed subdivision due to the presence of tall open forest. The existing remnant vegetation within the proposed subdivision poses minimal risk from bushfire, due to the small total area and the poor continuity of vegetation.

However, the riparian zones and corridors are intended to be revegetated and eventually restored to open forest vegetation. Southern slopes of 'The Knoll' (see Schedule 1) are likely to be restored to Banksia Scrub vegetation. Therefore the proposed corridors also present internal linear bushfire risks.

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.

It would be expected that a fire burning within the open forest vegetation from the north, north-east and north-west of the proposed development and the vegetation within the subject site could develop significant intensities due to the total area, continuity of unmanaged vegetation and the exposure to hot dry winds.

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. Therefore asset protection zones will be required to provide defensible space between the bushfire threats and the development.

There are five (5) areas where the proposed roadways cross vegetation and these zones can be regarded as pinch points. These pinch points can be dangerous if left unmanaged in terms of hazardous fuels. These zones will require additional asset protection on either side of the roadways where they dissect the bushland. This action will ensure that effective access and egress can occur in the event of a bushfire.

2.2 BUSHFIRE PROTECTION ASSESSMENT

PBP 2006 provides a methodology for assessing bushfire attack at construction stage for a building within a designated bushfire prone area. This process identifies the possible vulnerability of a structure and assesses the required 'Construction Level' in accordance with AS3959 *'Construction of buildings in bushfire prone areas*.

The assessment may be undertaken using a deemed to satisfy approach or a performance based assessment (PBA) approach. In the case of this development there is a case to utilise the PBA approach.

The following Tables (columns 6 & 7) provide a summary of 'bushfire attack' and the construction standards required for this development. A Fire Danger Index (FDI) of 100 has been used to calculate bushfire behaviour on the site using forest vegetation.

2.3.1 Bushfire Attack Assessment - Zone 1

Vegetation Description

North-east	Open Forest is located to the north-east extends further beyond the property boundary.
East	Open Forest extends further to east beyond the property boundary. A 30m wide access corridor (with APZ) provides access to Zone 1 from George Bass Drive approximately 300m to the east.
South & West	Regenerated Open Forest within a riparian corridor of less than 40m in width will be located to the south and west. This vegetation will be considered a low hazard and is therefore reduced to a rainforest vegetation class. A dam is located within the riparian corridor to the west.

Table 2 - Zone 1

Aspect	Vegetation within 140m of Development	Effective Slope of Land	Minimum APZ Required	APZ Provided	Level of Bushfire Attack	Minimum Construction Standard
North east (E & W section)	Forest	0-5° D (cross slope)	25 metres	34 metres	Extreme	Level 3
Gully (central area)		10-15° D	50 metres			
East	Forest	5° D	25 metres	30 metres	Extreme	Level 3
South	Rainforest (see Note 1)	0-5° D	10 metres	25 metres	Medium	Level 1
West	Rainforest (see Note 1)	0-5° D	10 metres	25 metres	Medium	Level 1

2.3.2 Bushfire Attack Assessment - Zone 2

Vegetation Description

North — Tall Heath / Open Forest extends further to the north for approximately 140 meters.

East — Regenerated Open Forest within a riparian corridor of less than 40m in width will be located to the east and south. This vegetation will be considered a low hazard and is therefore reduced to a rainforest vegetation class. A dam is located within the riparian corridor.

South — Regenerated Open Forest will adjoin the southern boundary of Zone 4 west of Dam 6. Regenerated Open Forest within a riparian corridor of less than 40m in width will be located to the east of Dam 6. This vegetation will be considered a low hazard and is therefore reduced to a rainforest vegetation class. A small dam is located within the riparian corridor.

West — Open Forest is located within the eastern boundary of Zone 2 and extends beyond the property boundary to Mogo State Forest further to the north-west, west and south-west.

Table 3 - Zone 2

Aspect	Vegetation within 140m of Development	Effective Slope of Land	Minimum APZ Required	APZ Provided	Level of Bushfire Attack	Construction Standard
North	Forest (see Note 3)	12 - 15° D	47 metres	47 metres	Medium	Level 3
East	Rainforest (see Note 1)	0-5° D	10 metres	25 metres	Medium	Level 1
South	Rainforest (see Note 1)	0-5° D	10 metres	25 metres	Medium	Level 1
East of dam 6	Forest	0-5° D Cross slope	25 metres	25 metres	Extreme	Level 3
West of dam 6						
West	Forest	upslope	20 metres	20 metres	Extreme	Level 3

2.3.3 Bushfire Attack Assessment - Zone 3

Vegetation Description

North — Tall Heath extends further to the north for approximately 140 meters.

East — Regenerated Open Forest within a riparian corridor of less than 40m in width will be located in the east. This vegetation will be considered a low hazard and is therefore reduced to a rainforest vegetation class. A dam is located within the riparian corridor.

South — Open Forest adjoins this zone east of Dam 3. The cheese Factory is located within 100m to the south-east within the eastern boundary of the development. Regenerated Open Forest within a riparian corridor (40m in width) will extend along the remainder of the southern boundary. This vegetation will be considered a low hazard and is therefore reduced to a rainforest vegetation class. Three dams are located within the riparian corridor.

West — Regenerated Open Forest within a riparian corridor of less than 40m in width will be located in the west. This vegetation will be considered a low hazard and is therefore reduced to a rainforest vegetation class. A dam is located within the riparian corridor.

Table 4 - Zone 3

Aspect	Vegetation within 140m of Development	Effective Slope of Land	Minimum APZ Required	APZ Provided	Level of Bushfire Attack	Construction Standard
North Western section	Tall Heath (see Note 2)	12 -15° D	20 metres	47 metres	Medium	Level 1
Eastern section		10° D	20 metres	35 metres	Medium	Level 1
East North & South of Dam 7	Rainforest (see Note 1)	0-5° D	10 metres	25 metres	Medium	Level 1
South East of Dam 3	Forest	0-5° D (cross slope)	25 metres	40 metres	High	Level 2
Adjacent & West of Dam 3	Rainforest (see Note 1)	0-5° D	10 metres	25m	Medium	Level 1
West	Rainforest (see Note 1)	0-5° D	10 metres	25 metres	Medium	Level 1

2.3.4 Bushfire Attack Assessment - Zone 4

Vegetation Description

North — Regenerated Open Forest will adjoin the northern boundary of Zone 4 west of Dam 6. Regenerated Open Forest within a riparian corridor of less than 40m in width will be located to the east of Dam 6. This vegetation will be considered a low hazard and is therefore reduced to a rainforest vegetation class. A small dam is located within the riparian corridor.

East — Regenerated Open Forest within a riparian corridor of less than 40m in width will be located in the east. This vegetation will be considered a low hazard and is therefore reduced to a rainforest vegetation class. A small dam is located within the riparian corridor.

South — Regenerated Open Forest within a riparian corridor of less than 40m in width will be located to the south. This vegetation will be considered a low hazard and is therefore reduced to a rainforest vegetation class.

West — Open Forest adjoins the western boundary of Zone 4 and extends into Mogo State Forest in the north-west and west. Open Forest within rural residential land adjoins the boundary to the south west.

Table 5 - Zone 4

Aspect	Vegetation within 140m of Development	Effective Slope of Land	Minimum APZ Required	APZ Provided	Level of Bushfire Attack	Construction Standard
North East of Dam 6	Rainforest (see Note 1)	0-5° D	10 metres	25 metres	Medium	Level 1
West of Dam 6	Forest	0-5° D Cross slope	25 metres	25 metres	Extreme	Level 3
East (northern section)	Rainforest (see Note 1)	0-5° D	10 metres	25 metres	Medium	Level 1
South	Rainforest (see Note 1)	0-5° D Cross slope	10 metres	20 metres	High	Level 2
West	Forest	10^{o} U Upslope	20 metres	20 metres	Extreme	Level 3

2.3.5 Bushfire Attack Assessment - Zone 5

Vegetation Description

North — Remnant Open Forest adjoins this zone east of Dam 3. The cheese Factory is located further to the north-east within the eastern boundary of the development. Regenerated Open Forest within a riparian corridor (40m in width) will extend along the remainder of the northern boundary. This vegetation will be considered a low hazard and is therefore reduced to a rainforest vegetation class. Three dams are located within the riparian corridor.

South-east — A remnant pocket of Woodland vegetation is located to the south-east within 140m of Zone 5. Open Forest within rural residential land extends beyond the Woodland vegetation.

South — Regenerated Open Forest within a riparian corridor (less than 40m width) will be located east of 'The Knoll' and west of Dam 1. This vegetation will be considered a low hazard and is therefore reduced to a rainforest vegetation class. Open Forest is located on the northern aspect of 'The Knoll' adjoining Zone 5. Banksia Scrub is found on the lower slopes and to the west of 'The Knoll'. Banksia Scrub falls within the Tall Heath formation class under Keith (2004).

West — Proposed residential lots within Zone 4 adjoin the western boundary.

Table 6 - Zone 5

Aspect	Vegetation within 140m of Development	Effective Slope of Land	Minimum APZ Required	APZ Provided	Level of Bushfire Attack	Construction Standard
North						
East of Dam 3	Forest	5-10° D	35 metres	35 metres	Extreme	Level 3
Adjacent Dam 3	Rainforest (see Note 1)	Level	10 metres	20 metres	Medium	Level 1
West of Dam 3	Rainforest (see Note 1)	0-5° D	10 metres	25 metres	Medium	Level 1
South east	Woodland	5-10° U	10 metres	35 metres	Medium	Level 1
South						
East of 'The Knoll'	Rainforest (see note 1)	0-5° D	10 metres	20 metres	High	Level 2
'The Knoll'	Forest	5-10° U	20 metres	20 metres	Extreme	Level 3
West of 'The Knoll'	Tall Heath	15° D	20 metres	20 metres	Extreme	Level 3

2.3.6 Bushfire Attack Assessment - Zone 6

Vegetation Description

North — Regenerated Open Forest within the riparian corridor (less than 40m width) will be located between 'The Knoll' and Dam 1 and also to the west of 'The Knoll'. This vegetation will be considered a low hazard and is therefore reduced to a rainforest vegetation class. Banksia Scrub is located on the southern aspect of 'The Knoll' adjoining Zone 6. Banksia Scrub falls within the Tall Heath formation class under Keith (2004).

East — A remnant pocket of Woodland vegetation is located to the north-east within 140m of Zone 5. Open Forest adjoins the southern portion of the eastern boundary and extends within the rural residential land further to the east.

South — Grassland adjoins this zone in the south east. The majority of vegetation surrounding the wetland (western portion) is Open Forest, however there are also pockets of Heath and Woodland. George Bass Drive is located further to the south.

South-west — Open Forest vegetation within rural residential land extends to George Bass Drive further to the south.

West — Open Forest within rural residential land adjoins the western boundary.

Table 7 - Zone 6

Aspect	Vegetation within 140m of Development	Effective Slope of Land	Minimum APZ Required	APZ Provided	Level of Bushfire Attack	Construction Standard
North						
East of 'The Knoll'	Rainforest (see note 1)	0-5° D Cross slope	10 metres	20 metres	High	Level 2
'The Knoll'	Tall Heath	8° U	15 metres	20 metres	High	Level 2
West of 'The Knoll'	Rainforest (see note 1)	Level/ upslope	10 metres	20 metres	High	Level 2
East	Woodland	0-5° U	10 metres	30 metres	Medium	Level 1
	Forest	5-10° U	20 metres	30 metres	High	Level 2
	Forest	0-5° D Cross slope	25 metres	30 metres	Extreme	Level 3
South						
Eastern section	Grassland	0-5° D (cross slope)	10 metres	20 metres	Not applicable	Not required
Western portion (surrounding Wetland)	Forest	3-10° D	25-35 metres	25-40 metres	High/ Extreme	Level 2/3
South Western corner	Forest	8-10° D	35 metres	35 metres	Extreme	Level 3
		0-5° D (cross slope)	25 metres	40 metres	High	Level 2

West Southern Section	Forest	0-5° D	25 metres	27 metres	Extreme	Level 3
Central section	Forest	4-6° U	20 metres	20 metres		
Northern section	Forest	0-5° D	25 metres	25 metres		

Note 1: The riparian corridor separating Zone 1, 2, 3, 4 and 5 and part of the ecological corridor separating Zones 5 and 6 are less than 40m in width. These narrow corridors are considered a low hazard and therefore asset protection zone setbacks and construction standards can be reduced from a forest vegetation class to a rainforest vegetation class.

Note 2: The vegetation to the north of Zone 3 has been cleared and currently represents a tall heath structure. It is presumed however that without management this vegetation will regrow overtime. The regrowth potential and the absence of a perimeter road adjoining the northern boundary have increased the potential threat from tall heath to open forest. The increased asset protection zone provided as a consequence of this threat will provide a substantial defendable space for fire fighting operations. The tall heath vegetation structure continues to be used in determining the category of bushfire attack and the level of construction required for the dwellings adjoining this aspect.

SECTION 3

SPECIFIC PROTECTION ISSUES

3.1 ASSET PROTECTION ZONES

Class 1 & 2 structures as defined by the *Building Code of Australia* are required to be provided with asset protection zones in accordance with *PBP 2006.*

This provides the required level of *defendable space* required for this type of development. In the case of the proposed development there is sufficient asset protection zones and therefore defendable space within the adjoining lands to fully adhere to the requirements of PBP 2006.

The land within the proposed development footprint (Zones 1 – 6) is to be managed to an Inner Protection Area standard. Asset Protection Zones are provided adjoining the external boundaries of Zones 1 – 6 and are depicted in Schedule 1 and outlined within Table 1 of this report. The remaining land within the development area is considered a Heritage Management Zone managed for conservation purposes.

A 30m wide corridor managed to an Inner Protection Area (IPA) standard applies to the north western access road (Bevian Road) that links Zone 1 to George Bass Drive in the east.

A 20m wide corridor managed to IPA standard applies to the main access road to the south.

Corridors of between 10 meters and 20 meters wide (IPA standard) will also be provided to the internal road network where roads pass through bushland vegetation to provide an access link between each zone. These access corridors are depicted in Schedule 1.

3.2 BUILDING PROTECTION

The bushfire attack assessment has determined the level of bushfire attack and the construction standards required for the proposed dwellings. The results are shown in Tables 1 – 6 and depicted in Schedule 1.

In accordance with Planning for Bushfire Protection '2006' the bushfire attack assessment has found the dwellings within the development are subject to variable levels of bushfire attack ranging from low (no specific construction requirements) through to extreme (Level 3 construction).

The level of construction required for a particular dwelling is determined depending on the type of vegetation, slope and the separation distance between the building and the vegetation. For example;

- Level 1 construction standards of AS3959 Construction of buildings in bushfire prone areas are subject to medium level of bushfire attack.

- Level 2 construction standards of AS3959 Construction of buildings in bushfire prone areas applies to areas subject to high level of bushfire attack.

- Level 3 construction standards of AS3959 Construction of buildings in bushfire prone areas applies to areas subject to extreme bushfire attack.

3.3 HAZARD MANAGEMENT

The land owners and / or future managers of the open space lands will have an ongoing liability to ensure the management of the lands within the property to prevent the build-up of combustible fuel. Section 63 of the *Rural Fires Act* requires hazard management to occur.

There is no physical reason that could constrain hazard management in any potential asset protection zone from being successfully carried out by normal means e.g. mowing / slashing following initial clearing works.

A Fuel Management Plan (*Conacher Travers 2007*) has been prepared which identifies the ongoing management of all asset protection zones and other open space areas within the Masterplanned area.

3.4 EVACUATION SAFETY

The development will provide adequate and safe evacuation via Bevian Road onto George Bass Drive (South) and George Bass Drive (North) into the adjacent lands to the east and south-east of the property.

These traffic routes are unlikely to be impacted directly by fire due to the existing residential development already established near the township of Rosedale.

These routes will comply with the public road specification requirements of PBP 2006.

It is therefore unlikely that an alternative evacuation route will be required due to the extensive internal road network proposed for the subdivision which provides for multiple safe egress routes.

3.5 AVAILABILITY OF FIRE FIGHTING SERVICES

There is a NSW Rural Fire Service station located at Malua Bay approximately 3.5 kilometres (by road) from the property in a north easterly direction. NSW Fire Brigades would have a response time of approximately 10-15 minutes to service the development if they are not assisting elsewhere.

The next nearest NSW Fire Station is located at Broulee approximately 7 kilometres (by road) from the property in a southerly direction. The NSW Rural Fire Service station would have a response time of approximately 20-25 minutes to service the development if they are not assisting elsewhere.

3.6 ACCESS FOR FIRE FIGHTING OPERATIONS

The primary access points to the development will be via the proposed main access road (Bevian Road) onto the junction with George Bass Drive in the south west and the north east. These entry points are adequately separated and are unlikely to be impacted by bushfire. The northern access road from George Bass Drive will require construction and upgrading in lien with the public road specifications within PBP 2006.

Additional emergency access/egress for emergency services is not required.

Planning for Bushfire Protection (2006) recommends perimeter roads as the preferred option to separate bushland from urban areas. The proposed road layout within the Rosedale

development provides for a perimeter road around the existing vegetation and areas of proposed revegetation works within the development.

Due to very steep slopes adjoining the boundaries of the site, perimeter roads are not an appropriate outcome in all circumstances. The alternative includes the creation of larger lots which are capable of supporting increased asset protection separation. Access to these buildings is provided from the internal road network to these areas of increased defendable space.

Planning for Bushfire Protection (2006) recommends the minimum widths for the internal road system (public roads) for a single lane as ranging between 3.5m and 4.5m. The minimum width of a two way road ranges from 6.5 to 8m.

There are several pinch points where the vegetation cuts the major road artery. These areas will be managed by the provision of wider asset protection zones parallel with the roadway / bridge combination.

3.7 WATER SUPPLIES

Town reticulated water supply is proposed for the development, therefore an additional supplementary water supply will not be necessary for fire fighting purposes.

Water hydrants should be installed in accordance with Australian Standard AS2419-1 (1994).

All hydrants are to be marked with a blue ‘cats eye’ in the centre of the road.

3.8 COMMUNICATIONS

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

SECTION 4

CONCLUSION AND RECOMMENDATIONS

4.1 CONCLUSION

The assessment of bushfire protection has found that compliance with *PBP 2006* can be achieved for the proposed development. The following recommendations are provided to ensure that the development is in accordance with, or exceeds the requirements of *PBP 2006.*

4.2 RECOMMENDATIONS

Recommendation 1 - The development of the proposed dwelling should be cited as indicated on Schedule 1 'Plan of Bushfire Protection Measures'.

Recommendation 2 - Asset protection zones should be provided to the proposed development. They shall take the form of Inner Protection Areas, measured from the exposed wall of any dwellings. The asset protection zones shall be as nominated in Tables 1 – 6 and also as depicted in Schedule 1.

Recommendation 3 - Asset protection zones should be maintained by regular maintenance of the landscaped areas / mowing of lawns in accordance with the guidelines provided in Appendix 1, or as generally advised by the Rural Fire Service in their publications.

Recommendation 4 – The bushfire 'fuel management plan' should be implemented for all asset protection zones and all open spaces arras proposed to be managed by Council or the applicant in perpetuity.

Recommendation 5 - Construction standards as per Australian Standard AS3959 *'Construction of Buildings in Bushfire Prone Areas',* in accordance with Part 2.3.4 of the *'Building Code of Australia',* should apply to all proximate dwellings to the asset protection zones.

Recommendation 6 - A hydrant water supply should be installed in accordance with Australian Standard AS2419.1.

BIBLIOGRAPHY

Australian Building Codes Board (1996) – Building Code of Australia, Class 1 and Class 10 Buildings Housing Provisions Volume 2.

Australian Standard 3959 '*Construction of Buildings in Bush Fire Prone Areas*'.

Conservation and Land Use Management Plan (CLUMP), *Conacher Travers* (2007c).

Councils of Standards Australia AS3959 (1999) – Australian Standard Construction of buildings in bush fire-prone areas.

DLWC 1:25,000 Aerial Photograph.

Ecological Assessment (EA), *Conacher Travers* (2007d).

Ecological Site Management Plan (ESMP), *Conacher Travers* (2007b).

Flora & Fauna Assessment (F&F), *Conacher Travers* (2007a).

Fuel Management Plan (FMP), *Conacher Travers* (2007e).

McArthur, (1967). A.G. Leaflet 107 Fire Behaviour in Eucalypt Forest A.G.McArthur, Canberra. Commonwealth of Australia Department of National Development. Forestry and Timber Bureau. (and reprinted later by) CSIRO Div. Forestry - Bush Fire Research Unit.1967.

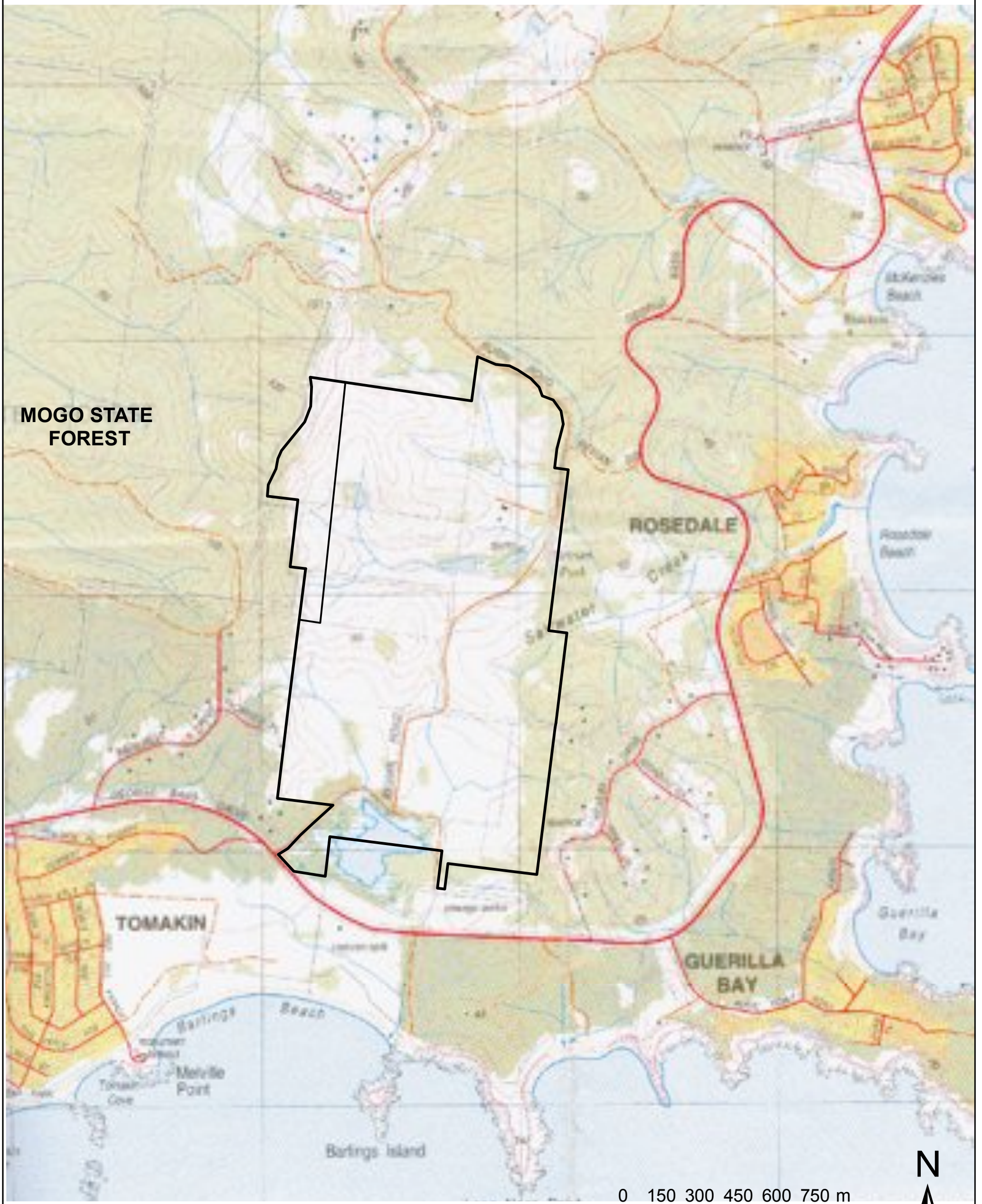
NSW Rural Fire Service (2006) - *'Planning for Bush Fire Protection - A Guide for Councils, Planners, Fire Authorities and Developers*. NSW Rural Fire Service.

Proposed development plan prepared by *Roberts Day Pty Ltd.*

Rosedale 1:25,000 Mogo Topographic Map.

Walker, J. (1984) Fuel Dynamics in Australian Vegetation. In "Fire and the Australian Biota" Australian Academy of Science.

FIGURES



Original plan produced in A3 colour

*Subject Site boundary subject to final survey

CONACHER TRAVERS

Bushfire & Environmental Consultants
40 The Avenue, Mt. Penang Parklands,
Central Coast Highway, Kariong NSW 2250
Ph (02) 4340 0677 Fax (02) 4340 2367
e-mail: ecology@conachertravers.com.au

Figure 1 -
Property Location
Bevian Road, Rosedale

Ver.F1 By.TM 17/10/07 Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,

Legend

Property Boundary

0 200 400 600 800 1,000 m

1:14,000

Original plan produced in A3 colour

N

*Subject Site boundary subject to final survey

CONACHER TRAVERS

Bushfire & Environmental Consultants

40 The Avenue, Mt. Penang Parklands,
Central Coast Highway, Kariong NSW 2250
Ph (02) 4340 0677 Fax (02) 4340 2367
e-mail: ecology@conachertravers.com.au

Figure 2 -

Aerial Appraisal

Bevian Road, Rosedale

Ver.F2 By.TM
17/10/07
Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,

Trees Retained as Part of Development Area

Category 3 Watercourse No. 2

Category 3 Watercourse No. 1

Cheese Factory

Remainder of the vegetation within the site and outside of those vegetation communities indentified in the legend forms Vegetation Community 7 - Grassland with Scattered trees

Trees Retained as Part of Development Area

'The Knoll'

Category 3 Watercourse No. 3

Category 3 Watercourse No. 4

Wetland Buffer 50m

Category 3 Watercourse No. 5

Freshwater Wetland Vegetation is not representative of the SEPP 14 Bevian Wetland

Legend

- Property Boundary
- Wetland Buffer (50m)
- Category 3 Water Courses
- Drainage Lines *Overland Flow Zones*
- 1 Spotted Gum/Ironbark Open Forest
- 2 Blackbutt Woodland
- 3 Banksia Scrub
- 4 Dry Gully Rainforest (Preliminary EEC - EPBC Act)
- 5 Swamp Oak Open Forest (Core Quality Swamp Oak Floodplain Forest - EEC - TSC Act)
- 5a Disturbed Swamp Oak Open Heath (Low Quality Swamp Oak Floodplain Forest - EEC - TSC Act)
- 6 Aquatic Herbfield
- 5a Freshwater Wetland Vegetation (Core Quality Freshwater Wetlands on Coastal Floodplains - EEC - TSC Act)
- 8 Disturbed Redgum Open Woodland (Low Quality Riverflat Eucalypt Forest on Coastal Floodplains - EEC - TSC Act)
- 9 Disturbed Swamp Paperbark Open Heath (Low Quality Swamp Oak Floodplain Forest - EEC - TSC Act)
- 9a Swamp Paperbark Closed Scrub (Core Quality Swamp Oak Floodplain Forest - EEC - TSC Act)
- Bangalay Sand Forest
- Perimeter Asset Protection Zone

0 100 200 300 400 500 m

1:10,000

Original plan produced in A3 colour

N

*Subject Site boundary subject to final survey

All mapped features are approximate and require land survey to confirm the location of Asset Protection Zones relative to developement footprint

CONACHER TRAVERS

Bushfire & Environmental Consultants

40 The Avenue, Mt. Penang Parklands,
Central Coast Highway, Kariong NSW 2250
Ph (02) 4340 0677 Fax (02) 4340 2367
e-mail: ecology@conachertravers.com.au

Figure 3 -

The Constraints Map - Ecological and Bushfire Constraints

Bevian Road, Rosedale

Ver.F3 By.TM 17/10/07 Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,

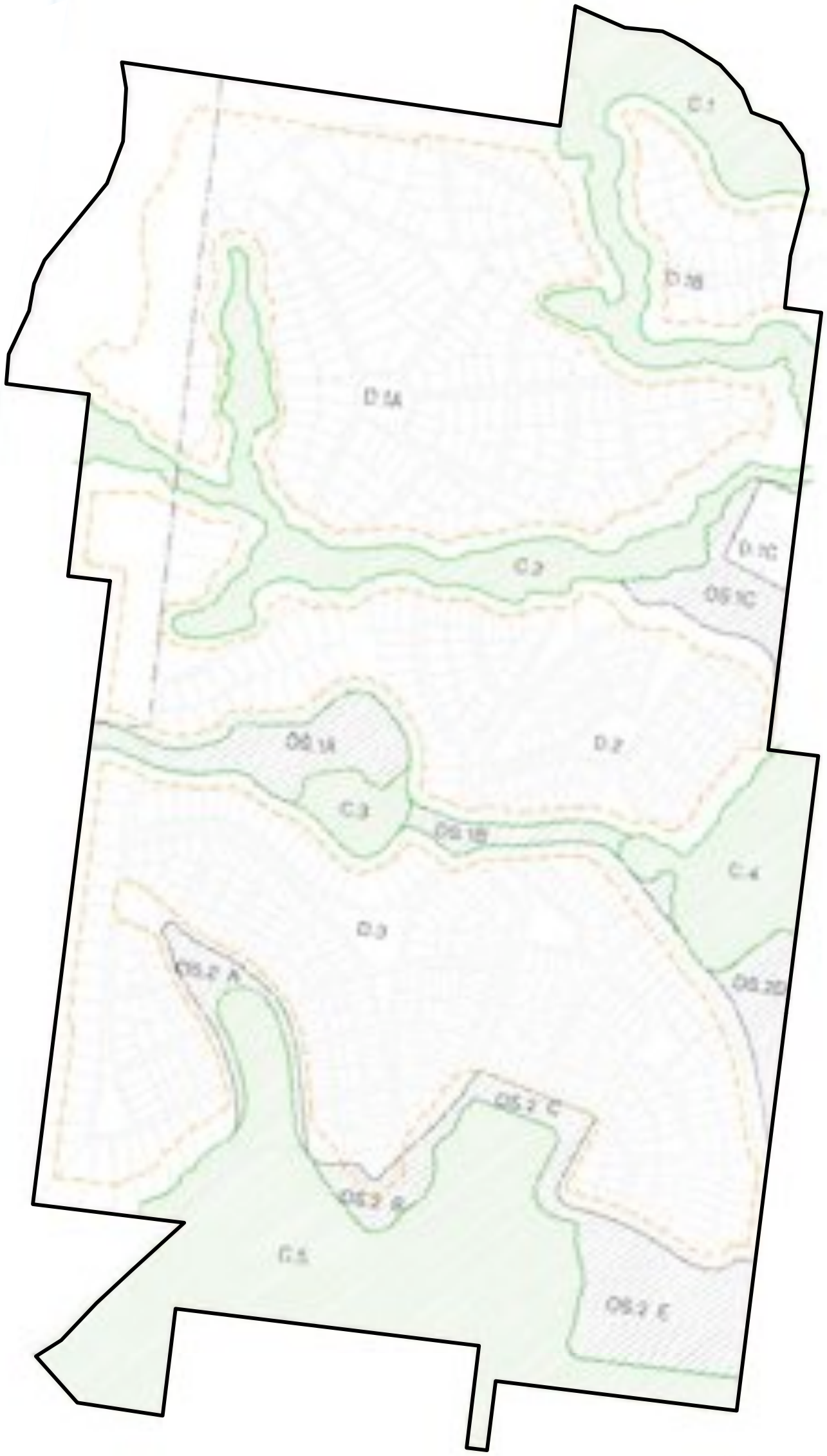
CONACHER TRAVERS

Bushfire & Environmental Consultants
40 The Avenue, Mt. Penang Parklands,
Central Coast Highway, Kariong NSW 2250
Ph (02) 4340 0677 Fax (02) 4340 2367
e-mail: ecology@conachertravers.com.au

Figure 4 -
The Plan of Subdivision
Bevian Road, Rosedale

Ver.F4 By.TM
17/10/07
Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,



0 100 200 300 400 500 m

1:7,000

Original plan produced in A3 colour

N

Legend

Property Boundary

*Subject Site boundary subject to final survey

CONACHER TRAVERS

Bushfire & Environmental Consultants

40 The Avenue, Mt. Penang Parklands,
Central Coast Highway, Kariong NSW 2250
Ph (02) 4340 0677 Fax (02) 4340 2367
e-mail: ecology@conachertravers.com.au

Figure 5 -

Precinct Plan

Bevian Road, Rosedale

Ver.F5
17/10/07
Ref.No.6052

Source: Dept. of Lands 1:25,000, Aerial Photograph

SCHEDULE 1

Plan of Bushfire Protection Measures

Legend

- Property Boundary
- Perimeter Asset Protection Zone
- Category 3 Water Courses
- Drainage Lines *Overland Flow Zones*
- Passive Recreation Area
- FOREST — Vegetation Formation Classification (PBP 2006)
- Level 1 Construction Standards
- Level 2 Construction Standards
- Level 3 Construction Standards

0 100 200 300 400 500 m

1:8,000

Original plan produced in A3 colour

N

All mapped features are approximate and require land survey to confirm the location of Asset Protection Zones relative to developement footprint

**Subject Site boundary subject to final survey*

CONACHER TRAVERS

Bushfire & Environmental Consultants

40 The Avenue, Mt. Penang Parklands,
Central Coast Highway, Kariong NSW 2250
Ph (02) 4340 0677 Fax (02) 4340 2367
e-mail: ecology@conachertravers.com.au

Schedule 1 -

Bushfire Protection Measures

Bevian Rd, Rosedale

Ver.S1 By.TM 22/11/07 Ref.No.6052

Source: Dept. of Lands 1:25,000 Aerial Photograph,

APPENDICES

APPENDIX 1 **Details of Asset (Fire) Protection Zones**

APPENDIX 2 **Summary of Australian Standard AS3959-1999 (amended) Construction of Buildings in Bushfire Prone Areas**

APPENDIX 1

DETAILS OF ASSET (FIRE) PROTECTION ZONES

1.0 INTRODUCTION

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.

The area in which the fuel reduction occurs is referred to as an Asset Protection Zone. Asset Protection Zones are areas that are usually shown on 'plans' adjacent to either cultural or natural assets (eg. dwelling, rainforest). They act to significantly lessen the impact of intense fire. The Asset Protection Zone can be further identified by two sub-zones.

Each has a specific role to play within an asset protection zone. These sub-zone areas are called the Inner Protection Area (Fuel Free Zone) and the Outer Protection Area (Fuel Reduced Zone). The sub-zones characterise the physical appearance of the landscape and in particular the way the combustible fuels shall appear after they are modified. (See Photos 1 - 6).

The Inner Protection Area is always located immediately adjacent to the asset/value at risk. The Outer Protection Area is located between the Inner Protection Area and the bushland.

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

2.0 INNER PROTECTION AREA (I.P.A)

This area is *almost free* of all fuels, it usually takes the form of grassy areas, car parks, roads, concrete areas, track or trails. It does not imply the wholesale removal of all or every tree - see Table 2 for guidelines on the extent of trees that can occur within this zone.

Rationale: By its very nature this zone is intended to stop the transmission of flame and reduce the transmission of radiated heat by the elimination of available fuel. Thus its Inner Protection Area name. This area also allows airborne embers to fall safely thus stopping further outbreaks of fire to begin.

Fire Fighting Advantage: This zone allows safe fire fighting operations to occur and clear fire control lines to be implemented by fire fighters.

Measurability: A fuel free Inner Protection Area is measured in two ways. The weight of the fuel and the width of the zone. Practitioners measure fuel load in *tonnes per hectare*. It is assessed by measuring the weight of fuel in a small quadrat eg. 300mm by 300mm and equating that to a hectare. The width of the zone is the separating distance between an asset and the bushland.

Performance Standard: A safe load is between 0-3 t/Ha.

Photographic Montage Depicting Inner Protection Area

PHOTO – 1

Site Description: The site is a paved roadway. It separates two areas of bushland and is normally called in this instance a fire break.

Fire Behaviour: No fire could occur on this fire break but the narrow nature of the break would allow fire to pass between the two bushland areas without difficulty.

Maintenance: None required due to paved surface. Do not allow shrubs to grow.

Fuel Weight: Zero

PHOTO – 2

Site Description: The site is mineral earth. There is no fuel on this narrow strip. The narrow strip forms a narrow fire break between two areas of unmanaged bushland.

Fire Behaviour: No fire could occur on this mineral earth but the narrow nature of the fire break would allow fire to pass between the two bushland areas without difficulty.

Maintenance: Regular raking and removal of litter layer. Do not allow shrubs to grow.

Fuel Weight: Zero

PHOTO – 3

Site Description: This is a grassed fire trail on level land adjacent to unmanaged bushland. The grass height on the level lands is 20-50 mm.

Fire Behaviour: This area, if mowed regularly, would exhibit flame heights not above 300 mm (12 inches). Note: The grass in the bushland zone is approx' 400-500mm in height and would achieve flame heights approximate to 750 –1200mm (depending on fuel loadings and Fire Danger Index).

Maintenance: This fuel free zone is able to be managed by normal mowing means. Raking and removal of litter layer; and/or mowing of grasses; and raking and/or mowing. Fuel Weight in photo 4: < 2 T/Ha.

Fuel Weight: < 2 T/Ha.

PHOTO – 4

Site Description: This is a grassed Inner Protection Area with scattered trees, no shrub larger and minimal understorey. The grass height is maintained to provide < 3 tonnes per hectare.

Fire Behaviour: This area, if maintained regularly, would exhibit flame height not above 300mm.

Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.

Fuel Weight: < 3 tonnes/hectare.

Photographic Montage Depicting Inner Protection Area

PHOTO – 5

Site Description: The site is a grassed Inner Protection Area with large smooth barked tree 5 metres clear of the dwelling.
The grass height is maintained to provide < 3 tonnes per hectare.

Fire Behaviour: This area, if maintained regularly, would exhibit flame height not above 300mm.

Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.

Fuel Weight: < 3 tonnes/hectare

PHOTO – 6

Site Description: This site shows a grassed Inner Protection Area with rock and landscaped areas constituting approximately 15% of the Inner Protection Area. Tree more than 5 metres from dwelling with no canopy connection to adjoining trees.

Fire Behaviour: This area, if maintained regularly, would exhibit flame height not above 300mm.

Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.

Fuel Weight: < 3 tonnes/hectare to grass areas landscaped areas 3-4 tonnes/hectare.

PHOTO – 7

Site Description: This site shows an Inner Protection Area which includes a paved Access/Fire Trail. Smooth barked trees < 5 metres from fire aspect of dwelling.
Fuel loading to trail zero with grassed areas displaying approximately 3 tonnes/hectare.

Fire Behaviour: Fires impacting the bushland to the left of the Access/Fire Trail would loose intensity with the provision of the Inner Protection Area.

Maintenance: This Inner Protection Area is managed by mowing, raking and removal of the litter layer.

Fuel Weight: Nil to Access/Fire Trail. 3 tonnes/hectare to grassed area.

PRESENCE OF SHRUBS IN AN INNER PROTECTION AREA

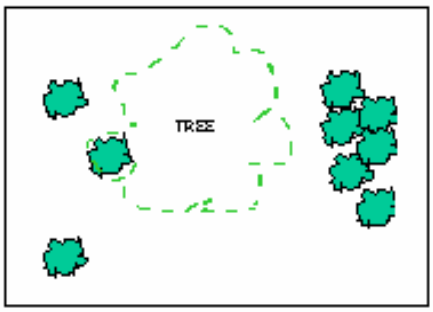
Shrubs may occur within an Inner Protection Area, but only where it is recommended by an experienced bush fire protection manager.

Thus landscaping works within the Inner Protection Area may occur in some instances. Where it is approved to occur, some 10-15 % and in some cases up to 30% of the Inner Protection Area may be able to be landscaped but always away from glass in buildings.

The design of the Inner Protection Area will be dependent on species selection and spatial arrangement.

Note: eg. 10 % means that for every 100 square metres (eg. 10 metres x 10 metres) only 10 % of that area may have a shrub component. The remainder would be free of shrubs see Figure 1. A 10 % landscaped shrub layer would add a further 1.5 tonnes of fuel to the overall hazard weight. To maintain the aggregate below 3 t/ha the ground fuels must be mown grass, or similar.

Figure 1 – Example of Spatial Arrangement in a Inner Protection Area



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

There are variations to Table 2.

- Trees vary in height and tree crown width /depth. Some trees have canopies that extend close to the ground (eg < 5 metres from the ground) whilst other trees have canopies that area high off the ground (> 15 metres off the ground). In some cases these tall trees do not have canopies that are affected by undergrowth / tall shrubs that could cause fire to burn into the canopy. Therefore if trees are isolated they do not form a significant risk.

- Similarly smooth barked trees are less of a hazard than heavily barked trees. The latter can cause fire to run up into the canopy and if there is sufficient wind the resulting fire can be of high intensity.

- Similar to the above, the number of trees per 100 m^2 depends on an individual assessment being undertaken to determine the 'type / size of tree', and its resultant potential impact upon a dwelling.

- The exposed side of a dwelling is the side that is directly affected by a moving fire particularly when fanned by wind. The non-exposed side of a dwelling is the side where fire is unlikely to come from either from a lack of wind, slope or other factors such as a lack of hazardous fuel.

3.0 OUTER PROTECTION AREA (O.P.A)

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

Physical Appearance: This area assumes all trees will remain but with a modified shrub / grass and litter layer. In some sparse vegetation communities the shrub layer may not require modification.

Fire Fighting Advantage: 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.

Measurability: Practitioners measure fuel load in *tonnes per hectare*. It is assessed by way of measuring the load in a given small quadrat eg. 300mm by 300mm and equating that to a hectare.

Performance Standard: A safe load is between 4-6 T/Ha.

Note: An experienced / qualified bush fire protection practitioner should undertake an individual assessment of a site to determine the requirements within an Asset Protection Zone.

Photographic Montage Depicting Outer Protection Area

PHOTO – 1

Site Description: This area has a low tree and shrub density but a high presence of native grasses. Almost no litter layer present.

Fire Behaviour: The lack of shrubs means that fire behaviour will be less but the presence of the sloping lands and the heavy presence of grass means that fire can burn quickly up the slope with flame heights between 1200-1800mm.

Maintenance: Maintain the grass height. Shrubs can grow to what is pictured in Photo 1.

Fuel Weight: 2-3 T/Ha

PHOTO – 2

Site Description: This area has increased shrub density and the beginnings of those shrubs linking with the tree canopy. Litter layer is present, but less than 3 T/Ha. The shrub layer is approx' 3 T/Ha.

Fire Behaviour: The increase in shrubs means that fire behaviour will be high. Flame heights would be expected to be between 2000mm – 6000mm (depending on fuel loadings and Fire Danger Index).

Maintenance: Maintain the grass height and current density of shrubs.

Fuel Weight: 6 T/Ha.

PHOTO – 3

Site Description: This area has a low tree and shrub density but a high presence of native grasses.

Fire Behaviour: The heavy presence of native grass means that fire can burn quickly through the outer protection area with flame heights of between 1200-3m.

Maintenance: Remove and maintain grass layer/leaf litter by slashing/hand removal.

Fuel Weight: 6-8 tonnes/hectare

PHOTO – 4

Site Description: Outer Protection Area above dwelling showing large rock outcrops, low shrub and tree density.

Fire Behaviour: Fires impacting this area would burn down slope to the dwelling. Flame heights in the order of 1-2 metres.

Maintenance: Management of this area by slashing/hand removal/burning to maintain fuel loading to < 8 tonnes/hectare.

Fuel Weight: < 6 tonnes/hectare
Nil on rock ledges.

APPENDIX 2

SUMMARY OF AUSTRALIAN STANDARD AS3959 (1999 – AMENDED)

CONSTRUCTION OF BUILDINGS IN BUSHFIRE PRONE AREAS

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 for the site of the building:

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.

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
FLOORING SYSTEMS	The requirements for a floor in a Level 1 construction shall be one, or a combination, of the following: (a) A concrete slab-on-the-ground. (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: (i) A concrete floor. (ii) A framed floor where the underside of any one bearer at any point is greater than 600mm above the finished ground level. (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 – (i) The subfloor space unenclosed and any timber flooring, bearers and joists of fire-retardant-treated timber; or (ii) The subfloor space fully enclosed, either by a wall that complies with Clause 3.5.1(a), or by the use of non-combustible sheet material which extends for at least 400mm above the finished ground level. 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.	**The requirements for a floor in a Level 2 construction shall be as for Level 1 construction (see Clause 3.3.1)** NOTE: The protection of subfloor openings against the entry of burning debris by way of introducing non-combustible material, such as fibre-reinforced cement sheeting to effectively enclose the subfloor space, may conflict with the requirements for termite protection and should therefore, take into consideration of the provisions of AS 3660.1.	**The requirements for a floor in a Level 3 construction shall be as for Level 2 construction (see Clause 3.3.2)** Except that in the case of a framed floor, where any bearer or joist is greater than 600mm above finished ground level and the floor is not enclosed as described in Clause 3.3.1 (c)(ii), the bearer, joists and flooring shall be of fire-retardant-treated timber or sheeted underneath with non-combustible material.

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
SUPPORTING POSTS, COLUMNS, STUMPS, PIERS AND POLES	The requirements for supporting posts, columns, stumps, piers and poles in a Level 1 construction shall be one, or a combination, of the following: (a) Non-combustible. (b) Fire-retardant-treated timber for a minimum of 400 mm above the finished ground level. (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). The above do not apply where the subfloor space is totally enclosed as described in Clause 3.3.1(c) (ii).	The requirements for supporting posts, columns, stumps, piers and poles in a Level 2 construction shall be as for Level 1 construction (see Clause 3.4.1)	Except in enclosed subfloor spaces, the requirements for supporting posts, columns, stumps, piers and poles in a Level 3 construction shall be as for Level 2 construction (see Clause 3.4.2) except that all timber shall be fire-retardant-treated to full height.

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
EXTERNAL WALLS	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. (iii) 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) (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)); (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-treated timber.	**The requirements for walls in a Level 2 construction shall be as for Level 1 construction (see Clause 3.5.1),** except that PVC cladding is not permitted and all external timber wall cladding shall be of fire-retardant-treated timber.	**The requirements for external walls in a Level 3 construction shall be as for Level 2 construction (see Clause 3.5.2).**

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
WINDOWS	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.	**The requirements for all windows, including louvres, 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: (a) Where timber is used, 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.	**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 non-combustible shutters, they shall be glazed with toughened glass.

ITEM	LEVEL 1	LEVEL 2	LEVEL 3
EXTERNAL 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 non-combustible 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 non-combustible 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: (a) Timber shakes or shingles shall not be used for the roof covering. (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 non-combustible material. (c) Sarking shall have a flammability index of not more than 5 (see AS1530.2). ***Tiled roofs*** 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 ***Sheeted roofs*** The requirements for sheeted roofs in a Level 1 construction are as follows: (a) Only metal or fibre-cement sheet shall be used. (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- (i) by fully sarking the roof; or (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.	**The requirements for a roof in a Level 2 construction shall be as for Level 1 construction (see Clause 3.9.1),** except that all roof sheeting shall be non-combustible and sarked, and rooflight glazing shall be of wired glass. Thermoplastic material or toughened glass shall not be used as the glazing for rooflights. The case of the evaporative cooler shall be manufactured from a non-combustible material.	**The requirements for roof covering in a Level 3 construction shall be as for Level 2 construction (see Clause 3.9.2)** except that no fibre-reinforced cement or aluminium sheet shall be used.

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. 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. (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)). ***Rooflights*** The requirements for rooflights in a Level 1 construction are as follows: (a) All penetrations of the roof space for the installation of rooflights and associated shafts shall be sealed with a non-combustible sleeve or lining. Thermoplastic sheet in a metal frame may be used for a rooflight, but the diffuser installed at ceiling level shall be of wired or toughened glass in a metal frame NOTE: AS 1288 and AS 4285 sets out specific requirements for glazing and skylights. (b) Vented rooflights 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).**	**The requirements for gutters and downpipes in a Level 3 construction shall be as for Level 2 construction (see Clause 3.12.2).**
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: (a) *Slab* - 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. (b) *Sheeted or tongued and grooved solid flooring* – The requirements for flooring are as follows: (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. (c) *Spaced decking* – The requirements for spaced decking are as follows: (i) The decking timbers shall be fixed with a clearance of not less than 5 mm between adjacent timbers.	**The requirements for verandas and decks in a Level 2 construction shall be as for Level 1 construction (see Clause 3.11.1)** except that if spaced decking is used, fire-retardant-treated timber shall be used for the decking material.	**The requirements for verandas and decks in a Level 3 construction shall be as for Level 2 construction (see Clause 3.13.2)** except that all materials shall be non-combustible or where timber is used, it shall be fire- retardant-treated (including any balustrades).

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.		
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.	**The requirements for service pipes in a Level 2 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).**