



TRAVERS BUSHFIRE & ECOLOGY

A TBE ENVIRONMENTAL COMPANY



BUSHFIRE PROTECTION ASSESSMENT

Planning Proposal

Patyegarang Project

28 July 2023
(REF: 18CR12)



BUSHFIRE PROTECTION ASSESSMENT

Planning Proposal Patyegarang Project

Belrose

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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.

EXECUTIVE SUMMARY

Background

This report has been prepared as part of a Planning Proposal to enable future residential areas, environmental conservation areas, open spaces / green corridors, an aboriginal cultural centre and asset protection zones.

Each of these elements has been designed in an integrated manner to utilise the natural landscape as a defining element and to mitigate any potential impacts upon biodiversity - including water quality.

This report identifies matters for consideration within the future Planning Proposal and highlights the required 'bushfire protection measures' for future development as required by the *Environmental Planning and Assessment Act 1979, Section 9.1 (2) Direction 4.4* and in accordance *Planning for bush fire protection 2019 (PBP)* and *Community Resilience Practice Note 2/12 Planning Instruments and Policies*.

Planning principles for the proposal including the provision of adequate traffic access and the instigation of asset protection zones (APZs) for future housing along with the introduction of controls which avoid placing inappropriate developments in hazardous areas and placement of combustible material in APZs. This report also considers fire history and the potential for impacts beyond the scope of *PBP 2019*.

A separate strategic bush fire study has been prepared by *Travers bushfire & ecology* and should be read in conjunction with this assessment.



Figure X1 – Concept plan (Cox 2022)

Assessment overview

The development design provides for three large precincts separated by Snake Creek and or Morgan Rd – see Figure X2.

Notwithstanding the removal of native vegetation throughout the development landscape there is a residual portion of vegetation retained via the narrow riparian corridor of Snake Creek; and several other narrow watercourse corridors. Additional native vegetation is retained on lands to the south and east and separated by a perimeter road system and wide asset protection zones – see Figure X2.

Overall radiant heat affectation is minimised to no greater than 29 k/Wm² whilst ember attack is certainly possibly throughout the development landscape however the provision of extensive APZ's and housing construction being ember proofed through AS3959 building construction standards provides resilience.

Bushfires burning from the south have a 100m APZ before development occurs whilst in the east a similar 100m APZ is provided.

The bushfire design provides inbuilt defendable space as required by the RFS published *Planning for bushfire protection (2019)*.

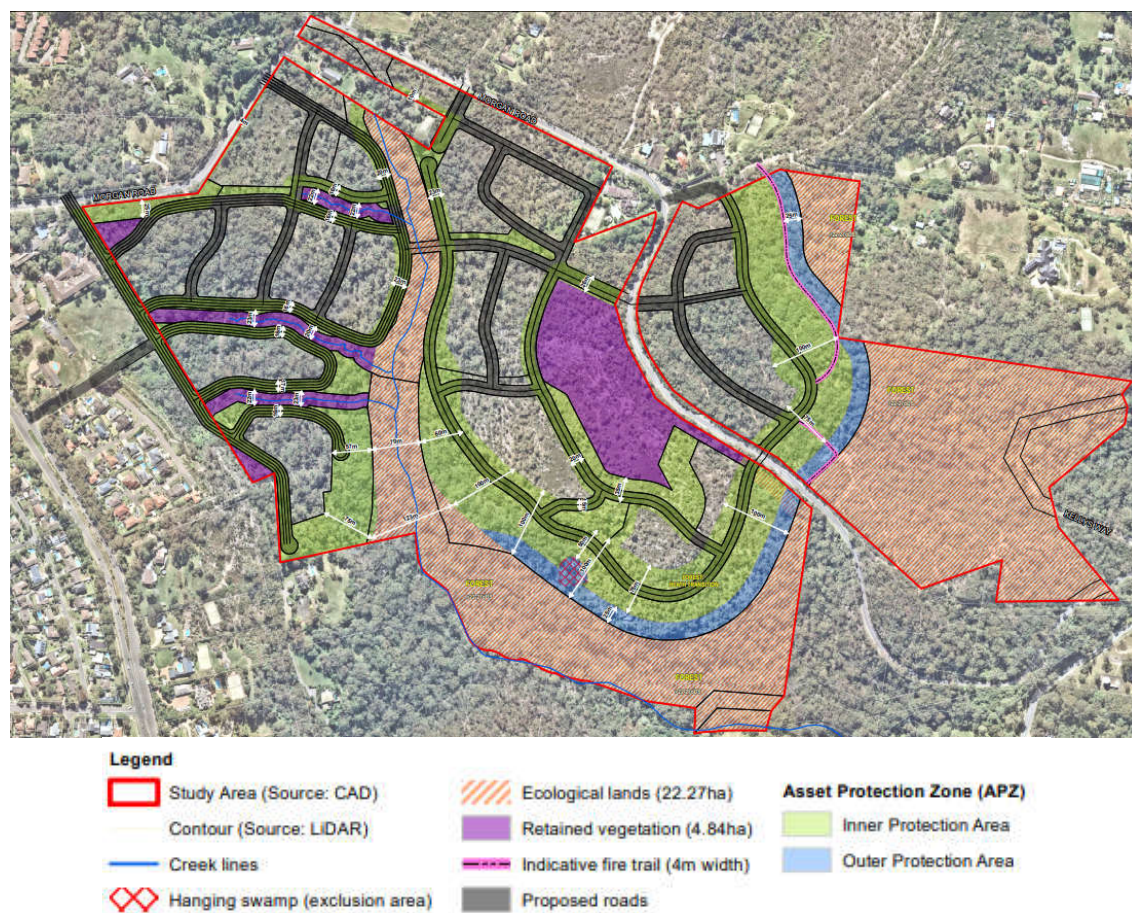


Figure X2 – Depiction of retained vegetation to the south and east of Snake Creek in the central zone

Evacuation planning during bushfire events

During a bushfire evacuation the following traffic egress routes would be available to residents:

- Morgan Road (westbound) via the Morgan Road / Forest Way intersection. This is assumed to be the primary egress route and would accommodate approximately 90% of traffic movements. A new slip-road will be provided on Forest Way to enable vehicles leaving Morgan Road heading east.
- Via the Oates Place / Forest Way intersection as a secondary egress route which is used only in the event of a bushfire emergency, assumed to take the remaining 10% of traffic movements.

A transport assessment report has been prepared by *JMT Consulting* (June 2022) dealing with evacuation capability. Key findings were;

- The surrounding road network, including Forest Way and the signalised intersection of Morgan Road / Forest Way can accommodate the expected level of day to day traffic generated under the rezoning proposal.
- Egress in a bushfire evacuation scenario can be accommodated safely pending the upgrade of the Morgan Road / Forest Way intersection to accommodate a free flow slip lane from Morgan Road.
- Suitable site access arrangements can be provided along Morgan Road with multiple accesses envisaged to distribute traffic movements across the site. No direct vehicle access would be provided from Forest Way given it's function as a State classified road.
- The internal street network will be designed to limit through traffic movements within the site, accommodate movement of pedestrians and cyclists and allow for the safe and efficient movement of various vehicle types (including first responder vehicles).
- The Planning Proposal would facilitate the formalisation of existing cycling routes through the site and well as provide good quality pedestrian connections through to nearby public transport stops on Forest Way.

JMT Consulting identified that to enable safe and efficient vehicle egress from the site during major bushfire events all traffic would need to be directed to the west to access Forest Way and depart the area.

They advised that under current conditions traffic leaving the site via Morgan Road needs to stop at the traffic lights before then turning left onto Forest Way. In this context an upgrade of the Morgan Road / Forest Way intersection has been identified to facilitate safe and efficient access out of the precinct as indicatively illustrated in Figure 24 below. This involved the creation of a slip lane from Morgan Road onto Forest Way which includes an acceleration lane as per Austroads requirements. This upgrade will allow traffic leaving Morgan Road to bypass the existing traffic lights and enter directly onto Forest Way without delay.

JMT Consulting undertook an analysis of the road network to accommodate additional traffic flows during a major bushfire event using SIDRA INTERSECTION 9.0, a computer-based modelling package which assesses intersection performance under prevailing traffic conditions.

SIDRA modelling has been undertaken at the Forest Way / Morgan Road intersection which considers existing traffic movements as well as those generated by the rezoning, taking into consideration the upgrade of the intersection through a new slip lane as summarised in Section 5.6.2 of their report. The traffic modelling has considered both:

- The performance of the overall intersection (taking into account traffic movements from all directions); and
- The performance of the specific traffic movement from Morgan Road onto Forest Way, which is critical with respect to bushfire evacuation.

The findings of the traffic modelling were summarised in their Table 5, which in essence, recommended the need to implement upgrades in the form of the slip lane. The modelling has concluded that, subject to the implementation of the Morgan Road slip lane, traffic can efficiently exit the precinct during a bushfire evacuation.

JMT Consulting concluded that the slip lane provides enough capacity for the evacuating vehicles to turn left onto Forest Way, as well as spare capacity to accommodate vehicles external to the proposed site travelling along Morgan Road.

They further advised that a detailed concept design, including extent of civil and infrastructure works required, has separately been prepared by Craig and Rhodes. The land required to facilitate the upgrade is owned by Council and currently zoned RE1 – making it suitable for the purposes of road widening. Separate traffic modelling for a bushfire emergency evacuation event indicates the upgrade will be required once more than 230 dwellings have been developed and are occupied on the site

Figure X3 below demonstrates the extensive layout of the perimeter and the internal road design and linkages to Forest Way and Morgan Road.

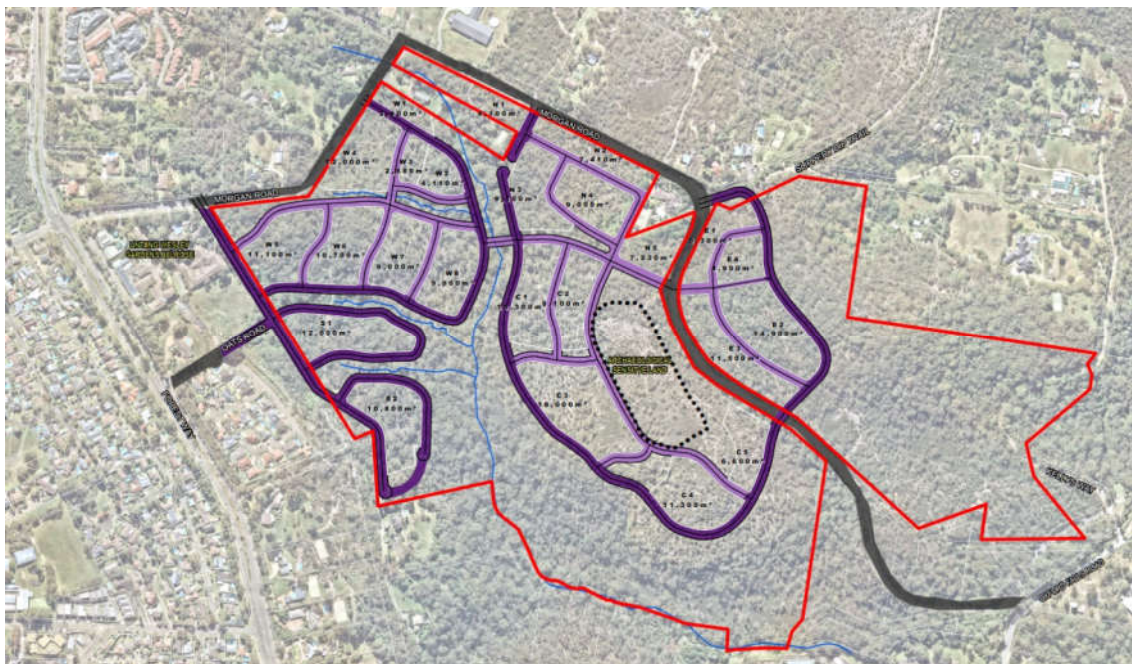


Figure X3 – proposed road perimeter road and internal road layout change figure

Importantly, the Planning Proposal ensures that the bushfire risk posed to the development landscape will be mitigated by a range of RFS acceptable bushfire protection measures such as:

- Asset Protection Zones (APZs) in accordance with the minimum setbacks outlined within *PBP 2019* (Table A1.12.2 FFDI 100) for most aspects; and the use of an alternative solution to determine minimum APZ and bushfire attack level (BAL) setbacks for smaller areas.

- Future dwelling construction in compliance with the appropriate construction sections of *AS3959-2018*, and *PBP 2019*.
- Provision of road access in accordance with the acceptable solutions outlined in *PBP 2019*.
- Water, electricity and gas supply in compliance with the acceptable solutions outlined in *PBP 2019*.
- High Voltage electricity lines will be laid underground therefore removing a possible ignition source.
- Preparation of a fuel management plan (FMP) which will be incorporated into a proposed stewardship agreement to strategically decrease hazards whilst retaining biodiversity; and the,
- Preparation of an emergency management and evacuation in compliance with *PBP* and NSW RFS guidelines for the *Preparation of an Emergency / Evacuation Plan*.

In essence, the bushfire design provides a marked improvement affect upon the existing residential communities living along Morgan Road, Hilversum Crescent, Slippery Dip Trail, Oates Place, Lyndhurst Way, Caley Way and Ocean View Way. In addition, there will be a similar benefit for special protection facilities such as the;

- Uniting Church Pre School and the Uniting Church aged Care facility on the corner of Morgan Road and Forest Way, and
- The proposed aged care facility at 181 Forest Way Belrose and the evacuation capabilities of the CSIRO radar unit on Oxford Falls Road.

The assessment has concluded that future development on site will provide compliance with the planning principles of *PBP* and *Community Resilience Practice Note 2/12– Planning Instruments and Policies* as summarised in Table A1 below.

Table A – Planning Principals

Direction 4.4	Compliance statement
4) In the preparation of a planning proposal the relevant planning authority must consult with the Commissioner of the NSW Rural Fire Service following receipt of a gateway determination under section 3.34 of the Act.	Extensive formal liaison with the RFS has occurred with written advice provided on the 1 st October 2021 and May 2022.
A planning proposal must:	
a) have regard to Planning for Bushfire Protection 2019	Yes. The following assessment has been undertaken in accordance with <i>PBP 2019</i> .
b) ensure that bushfire hazard reduction is not prohibited within the APZ.	Yes. Significant environmental studies have been undertaken to ensure APZs have been excluded from environmentally sensitive land.

Direction 4.4	Compliance statement
<p>c) introduce controls that avoid placing inappropriate developments in hazardous areas, and</p>	<p>Yes. The nature of the residential development is an appropriate use and the proposed hazard management controls are in accordance with, and often beyond, <i>PBP 2019</i> to effectively address the level of hazard.</p> <p>The proposal does not propose “inappropriate development” such as schools or retirement villages.</p> <p>A cultural interpretive centre is also planned for the site. At this stage of the proposal, it is assumed that the interpretative centre will not include development uses that would determine the use as Special Fire Protection Purpose and as such, that usage is not considered within this study.</p>
<p>A planning proposal must, where development is proposed, comply with the following provisions, as appropriate:</p>	
<p>(a) provide an Asset Protection Zone (APZ) incorporating at a minimum: (i) an Inner Protection Area bounded by a perimeter road or reserve which circumscribes the hazard side of the land intended for development and has a building line consistent with the incorporation of an APZ, within the property, and (ii) an Outer Protection Area managed for hazard reduction and located on the bushland side of the perimeter road,</p>	<p>Yes. Perimeter roads are proposed and the APZs match or exceed the minimum requirements outlined in <i>PBP 2019</i> for residential subdivision development.</p>
<p>(b) for infill development (that is development within an already subdivided area), where an appropriate APZ cannot be achieved, provide for an appropriate performance standard, in consultation with the NSW Rural Fire Service. If the provisions of the planning proposal permit Special Fire Protection Purposes (as defined under section 100B of the Rural Fires Act 1997), the APZ provisions must be complied with,</p>	<p>This is an integrated Planning Proposal that will result in a new residential subdivision and this be responsive to Section 100B of the Rural Fire Act.</p>
<p>(c) contain provisions for two-way access roads which links to perimeter roads and/or to fire trail networks</p>	<p>Yes</p>
<p>(d) contain provisions for adequate water supply for firefighting purposes</p>	<p>Yes</p>
<p>(e) minimise the perimeter of the area of land interfacing the hazard which may be developed,</p>	<p>Yes. The perimeter is approximately a large circle and therefore circumscribes the development.</p> <p>Large intrusions of bushland >50m in width into the development have been removed and minimised to allow safe evacuation.</p>
<p>(f) Introduce controls on the placement of combustible materials in the Inner Protection Area</p>	<p>Yes. Can be a condition of consent at DA stage.</p>

GLOSSARY OF TERMS

AHIMS	Aboriginal Heritage Information System
APZ	asset protection zone
AS1596	<i>Australian Standard – The storage and handling of LP Gas</i>
AS2419	<i>Australian Standard – Fire hydrant installations</i>
AS3745	<i>Australian Standard – Planning for emergencies in facilities</i>
AS3959	<i>Australian Standard – Construction of buildings in bushfire-prone areas 2018</i>
BAL	<i>bushfire attack level</i>
BCA	<i>Building Code of Australia</i>
BSA	bushfire safety authority
DA	development application
DLUP	Development Land Use Plan
EEC	Endangered ecological community
EP&A Act	<i>Environmental Planning & Assessment Act 1979</i>
EP&A Regulation	<i>Environmental Planning and Assessment Regulation 2000</i>
FFDI	forest fire danger index
IPA	inner protection area
LEP	Local Environmental Plan
LGA	local government area
m	metres
NCC	<i>National Construction Code</i>
OPA	outer protection area
PBP 2019	<i>Planning for Bush Fire Protection 2019</i>
RF Act	<i>Rural Fires Act 1997</i>
RFS	NSW Rural Fire Service
SEED	Sharing and Enabling Environmental Data (NSW Government)
SFR	short fire run
SFPP	special fire protection purpose
TBE	<i>Travers bushfire & ecology</i>

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1. INTRODUCTION

Travers bushfire & ecology has been engaged to undertake a bushfire protection assessment for the Planning Proposal located at Morgan Road, Belrose.

Direction 4.4 of the *EP&A Act* identifies matters for consideration for Planning Proposals which are in proximity to land mapped as bushfire prone.

The proposed development is identified as bushfire prone on the *Northern Beaches Council* as bushfire prone land map (refer Figure 1-1) and is therefore subject to the requirements of *Section 9.1 (2) of the EP&A Act (1979)* which requires Council to consult with the Commissioner of the *NSW Rural Fire Service (RFS)* and to take into account any comments made by the Commissioner.

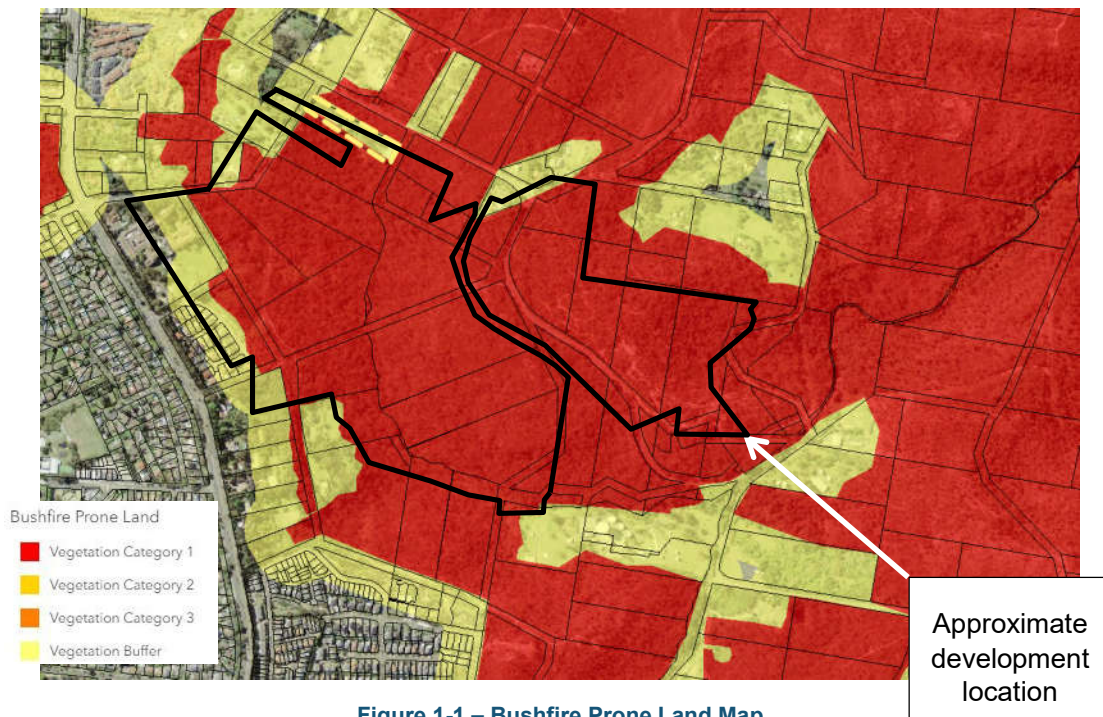


Figure 1-1 – Bushfire Prone Land Map

(source: Planning Portal, 2021)

1.2 Aims of the assessment

The aims of the bushfire protection assessment are to:

- review the bushfire threat to the landscape
- undertake a bushfire attack assessment in accordance with *PBP*
- provide advice on mitigation measures, including the provision of asset protection zones (APZs), construction standards and other specific fire management issues
- review the potential to carry out hazard management over the landscape.

1.3 Project Synopsis

The purpose of this Planning Proposal is to implement the Development Delivery Plan for the subject site created under State Environmental Planning Policy (Planning Systems) 2021.

The objective of the Planning Proposal is to create a residential community which embodies strong conservation principles to support the enhancement of the unique environmental and Aboriginal cultural heritage characteristics of the site.

The intended outcome of the Planning Proposal is to amend the applicable local planning controls to accommodate up to 450 new residential dwellings with a variety of scale and character reflective of the dominant dwelling type in the Belrose locality, as well as a new cultural community centre and protection of aboriginal heritage sites.

In 2022 a draft structure plan was prepared by COX Architecture that is reflective of the site's opportunities and constraints in the areas of flora and fauna biodiversity, bushfire management, transport planning, Aboriginal heritage and stormwater management.

The Planning Proposal intends to ensure development outcomes align with traditional indigenous 'Caring for Country' practices and relevant 'Connecting with Country' and 'Designing with Country' principles and strategies. In that regard Figure 1.2 below depicts the proposed rezoning plan and the subsequent development precincts.

In essence the land uses are as follows;

- **Developed Area** including: residential / aboriginal cultural heritage and associated cultural centre / pocket park, pedestrian and vehicular network
- **Asset Protection Zones** -These lands will be contained within the developable area and managed as asset protection zones in compliance with NSW Rural Fire Service guidelines for APZ management – see Figure 1.4. Habitat retention (caves, crevices, sandstone rocks etc') will be a key priority for the fuel management works given the dual role that the asset protection zones play in buffering the impacts of development on the urban/bushland interface. Retention of trees, shrubs and surface fuels will be targeted for their intrinsic ecological value with ongoing management specified through a legally applied 'fuel management plan' – see Figure 1.5.
- **Conservation land** - The environmental management zone will be maintained in perpetuity by the future community association and Metropolitan Local Aboriginal Land Council. The area is an ecologically significant landscape which is known to contain threatened flora, fauna, ROTAP species and the EEC, Coastal Upland Swamp.

Recommendations have also been made for future road and fire design, fuels management, traffic management, emergency management, building construction, water supply and peripheral land management. Of significance is the access / egress capability which has been given significant weight for the overall development design. In this regard the development area is proposed to be accessed via;

- Morgan Road at three (3) locations. Strategically a left turning slip lane detailed design has been completed by the surveyors in liaison with the traffic consultants for the Morgan Rd / Forest Way intersection. This will not be controlled by traffic lights.
- Forest Way at two (2) locations - see Figure 1.3 below.



Legend: Dark Green – C2 Zone, Light Green – RE2 Zone, Pink – R2 Zone

Figure 1-2 – Rezoning Map

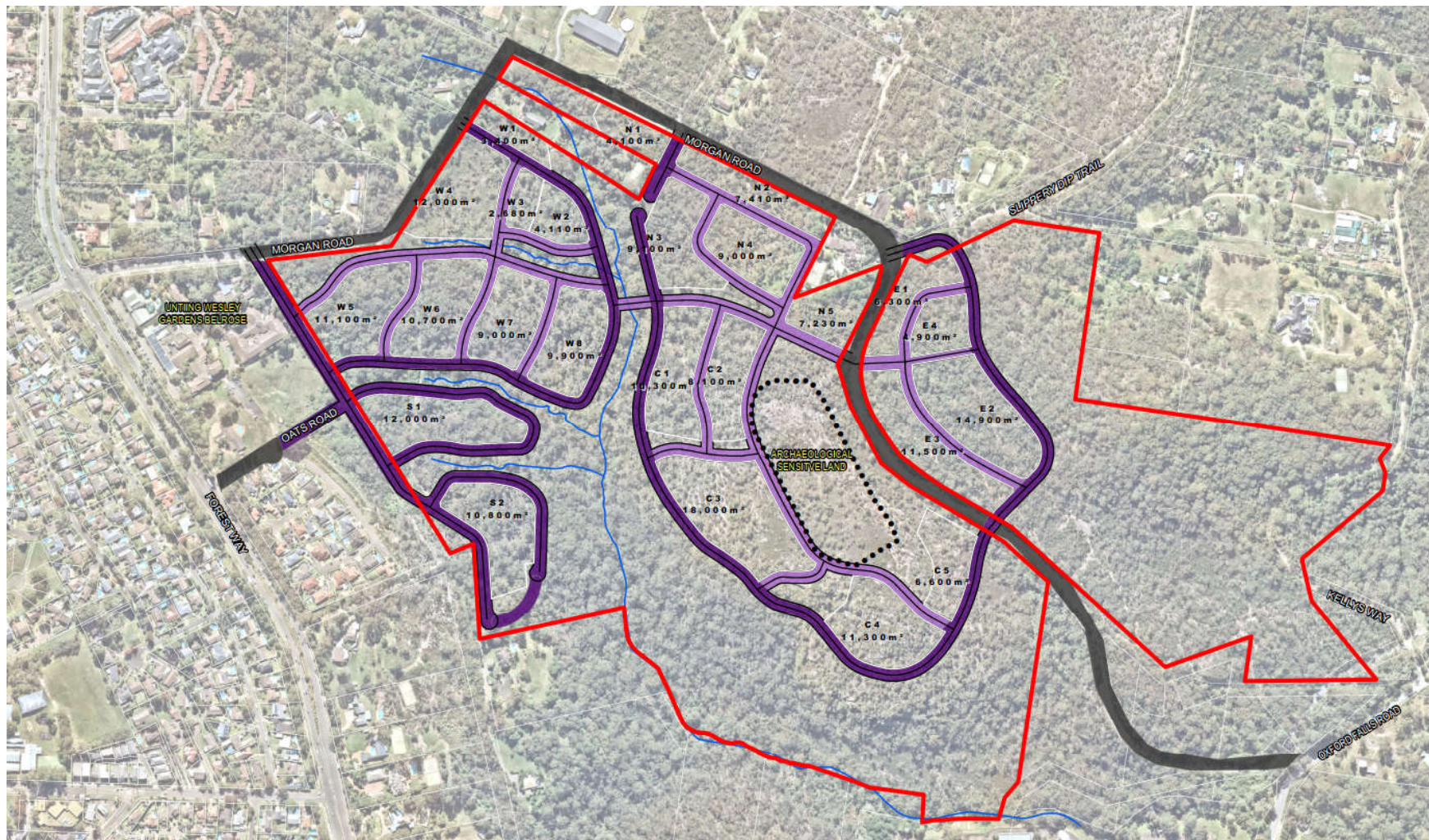


Figure 1-3 - Proposed road layout identifying perimeter roads and non-perimeter roads



Figure 1-5 - Illustrative master plan

1.4 Information collation

Information sources reviewed for the preparation of this report include the following:

- Draft Constraints Plan prepared by *COX Architecture*, dated 14.09.2022
- Draft Structure Plan prepared by *COX Architecture*, dated 14.09.2022
- Patyegarang Project Belrose Transport Assessment *JMT Consulting* 15.6.2022
- Warringah Local Environmental Plan 2011
- Vegetation mapping prepared by Hayes Environmental (2021)
- Survey of slope gradients by *Craig & Rhodes* (February 2021)
- *NearMap* aerial photography
- Topographical maps DLPI of NSW 1:25,000
- *Australian Standard 3959 Construction of buildings in bushfire-prone areas (2018)*
- *Planning for Bush Fire Protection 2019 (PBP)*
- *Community Resilience Practice Notes 2/12 Planning Instruments and Policies*

An inspection of the proposed development site and surrounds was undertaken by John Travers on numerous occasions between 2002 and 2022 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.

More precise slope mapping and interpretation was undertaken in March 2021 by *Craig & Rhodes* (surveyors) whilst ecological mapping and analysis was undertaken by *Hayes Environmental* (Rebecca Hayes).

1.4.1 Pre DA assessment by the Rural Fire Service

The report was lodged with the RFS in late August 2021 and on the 1st October 2021 the RFS provided comments which were both favourable and supportive. Most importantly the RFS provided advice on what should be covered in the next iteration of the bushfire report. Their advice is in Column 1 and a response in Column 2.

RFS comments	Response from Travers bushfire & ecology
The following should be provided to support the future planning proposal:	
1. Additional information should be provided on the nature of the proposed community centre/offices and retail space.	This has been provided within
2. The use of Short Fire Run (SFR) Methodology is not supported, and any mention of SFR should be removed from the bush fire report.	Noted and now has been removed as it was a typographical error. There was no short fire run procedures or calculations used in this assessment
3. The APZ distances shown in the bush fire report must be updated as discussed with John Travers, with the thin riparian areas (less than 20 metre width) treated as remnant, and the wider riparian trunk treated as Forest.	The plan has now been updated and is shown on Schedule 1

4. As some areas of the proposed APZs are on slopes greater than 18°, a management plan must be submitted at the development application (DA) stage to demonstrate how the APZ will be implemented and maintained as per Section 3.2.2 of <i>Planning for Bush Fire Protection (PBP) 2019</i> .	A Geotech statement from a qualified practitioner will be provided at DA stage and this is normally acceptable and satisfactory to the RFS. As advised within the report these slopes are on land mainly composed of sandstone bedrock and escarpments which are solid and stable landscapes.
5. Sector S2 will require the provision of a compliant perimeter road.	This is noted and a preliminary engineering design has been prepared and considered noting an expected completion of that design at DA stage.
6. The proposed slip-road on Forest Way is seen as essential to enable vehicles to enter Forest Way from Morgan Road and head easterly without being subject to traffic light control.	Noted and this is why it was designed that way with the Draft Structure Plan now amended to show its presence.
7. As suggested in the bush fire report, a Bush Fire Emergency Management and Evacuation Plan must be prepared consistent with <i>Development Planning- A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan December 2014</i> .	These documents are typically required for DA stage and they will be thoroughly considered and assessed prior to their lodgement with DA documentation.

The additional information sought by the RFS on the 1st October 2021 was provided in an amended bushfire report dated 6th October 2021. The report was re-submitted back to the RFS earlier this year whereby the RFS provided comments on 13 May 2022 whereby they advised they had no specific objections.

Direct consultation with the RFS occurred on the 17th March 2022 where representatives of the RFS and the applicant met on zoom for a specific bushfire session that also involved traffic and biodiversity consultants - as these disciplines are central to effective bushfire planning in terms of traffic safety and fuel management of the residual hazardous vegetation assemblages.

The meeting sought to provide an overview for the participants of the meeting such that they were all on the same page in terms of bushfire, traffic planning and ecology.

Indeed, the meeting enabled the RFS to express any concerns they may have had with other members of the government team especially with DPIE staff and had there been misunderstandings then the applicant's consultants were there to clarify or to go away and reflect.

Arising from the meeting was a request from the RFS to provide detail in respect of traffic evacuation scenarios for example to provide further detail on the slip road design and to undertake traffic scenario modelling on various scenarios such as when the emergency Oates Place gate was closed, any flood restrictions, tonnage limits, rat run etc); provide road designs assurances that roads would be designed as specified in PBP. *JMT Consulting* were engaged to undertake the requested modelling and their report was produced in June 2022.

In terms of fuel management of the asset protection zones the RFS sought information on 'who and how' fuel management would occur within those APZ's. The bushfire author herein advised that significant field work with *Hayes Consulting* discussing and reviewing the various vegetation assemblages on the site was thus able to provide clarity on bushfire APZ's and fire trails. Lastly, they sought to know who would have the key to open the emergency egress gate at Oakes Rd.

As a follow up to that zoom meeting Assistant Commissioner Matt Smith emailed Susan Fox (DPIE) referring to the need to consider the current 3 tonne load limit on the Morgan Rd / Oxford Falls Road bridge. Upon investigating this advice from Commissioner Smith we were advised that Council was planning to replace that bridge in the near future. The Applicant then liaised with Council on the need to upgrade the load rating to reflect RFS requirements for development within a bushfire prone area.

1.5 Site description

The development site is located within the local government area (LGA) of Northern Beaches Council and situated to the east, south and west of Morgan Road, Belrose (refer Figure 1-7).

The site supports native vegetation and an archaeological site of indigenous significance.

Snake Creek traverses the site in an approximate north south orientation. The land use in the west supports existing residential development along with Uniting Wesley Gardens Aged Care Facility, whilst the land to the east consists of a mixture of bushland and rural residential land. An existing Telstra telecommunication facility and several rural residential properties are located to the south.

The remaining perimeter to the south comprises of gentle to steep sloping sandstone escarpments that consist of a variety of vegetation formations ranging from forest to heathland communities. Table 1-1 provides a summary of the planning, cadastral, topographical and disturbance details of the subject site.

Table 1-1 – Site features

Location	Morgan Road
Size	Approximately 60ha
Local Government Area (LGA)	Northern Beaches Council
Elevation	Approximately 150-170m AHD
Topography	Bushland to the south sits on the southern side of a broad naturally vegetated ridgetop, which falls to a large sandstone escarpment and into Snake Creek. The western portion of the site sits on a ridge broken by associated tributaries / drainage lines of Snake Creek. The central and northern areas of the site support a bushland plateau exhibiting large sandstone outcrops.
Geology and soils	Geology; Sandstone Soils; Lambert Soil Landscape, Somersby Soil Landscape and Hawkesbury Soil Landscape
Catchment and drainage	Snake Creek
Vegetation	Sydney Sandston Gully Forest, Coastal Sandstone Heath and Sydney Sandstone Ridgetop Woodland (predominately)
Existing land use	Private land owned by Metropolitan Aboriginal Land Council

1.6 Strategic neighbouring land use

Neighbouring land use vary with low density residential located in the west and rural residential and industrial in the north east and south - see breakdown in Table 1-2 below and refer to aerial photograph at Figure 1.6 below.

Table 1-2 – Neighbouring land use

Aspect	Land use	Intensity	Location	See Figure
Northwest	Aged care facility at 'Wesley Gardens'; and Uniting Church Australia	High density occupation being 317 beds	Cmn Morgan and Forest Way	1.9
West	Aged care facility 'Chriroseph'	Approved in 2019 for 100 beds but not yet constructed	181 Forest Way	1.6 & 1.7
West	Residential	Low density residential	Oates Place, Caley Crescent, Lyndhurst Way & Ocean View Way	1.6 & 1.7
Southwest	Residential	Low density residential	Child's Circuit	1.6, 1.7 & 1.11
North	Rural residential	6 rural residential lots	Along Morgan Rd	1.8
East	Rural Residential	9 rural residential lots	Along Morgan Rd	1.10
Northeast	Residential	4 rural residential lots	Hilversum Crescent	1.8 & 1.10
South	Rural Residential	2 rural residential lots	Immediately south of the development area	1.7
South	Industrial technology facility	Telstra satellite hub	Immediately south of the development area	1.11
South of Telstra land	Rural Residential	5 rural residential lots	Immediately south of the development area	1.11
Southeast	Rural Residential	4 rural residential lots	Immediately southeast and east of Telstra lands	1.11

1.6.1 Nearby strategic fuel hazards

Hazardous fuels are located in the northwest, north, east and south and contain varying degrees of fragmentation – see Figure 1.6 & 1.7 below.

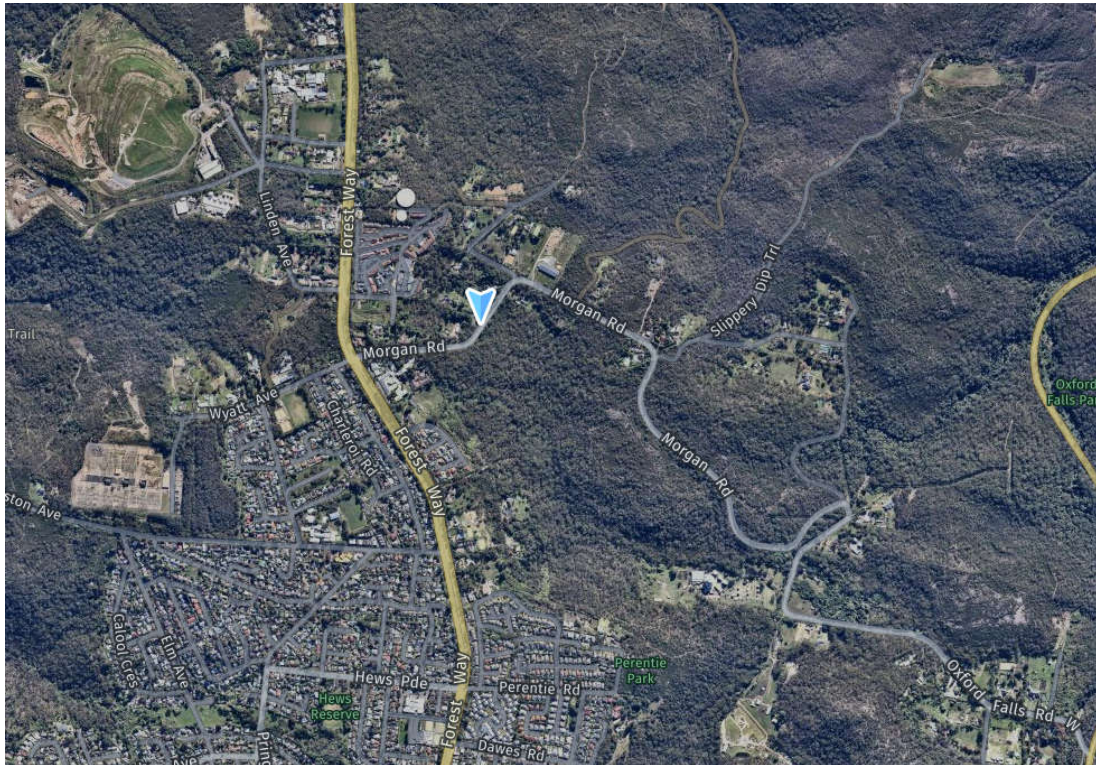


Figure 1.6 - Aerial appraisal of nearby vegetation hazards (Source: Nearmaps, 2022)



Figure 1-7 – Aerial appraisal of development boundary (source: NearMap, 2021)

1.6.2 Breakdown of peripheral hazardous fuels

Hazardous fuels are located on the periphery of the development area, as follows;

- North of Morgan Rd is comprised of private rural residential lands with manicured gardens and mostly non-contiguous vegetation. Contiguous 'scrub' vegetation occurs in the northeast portion - see Figure 1.8.

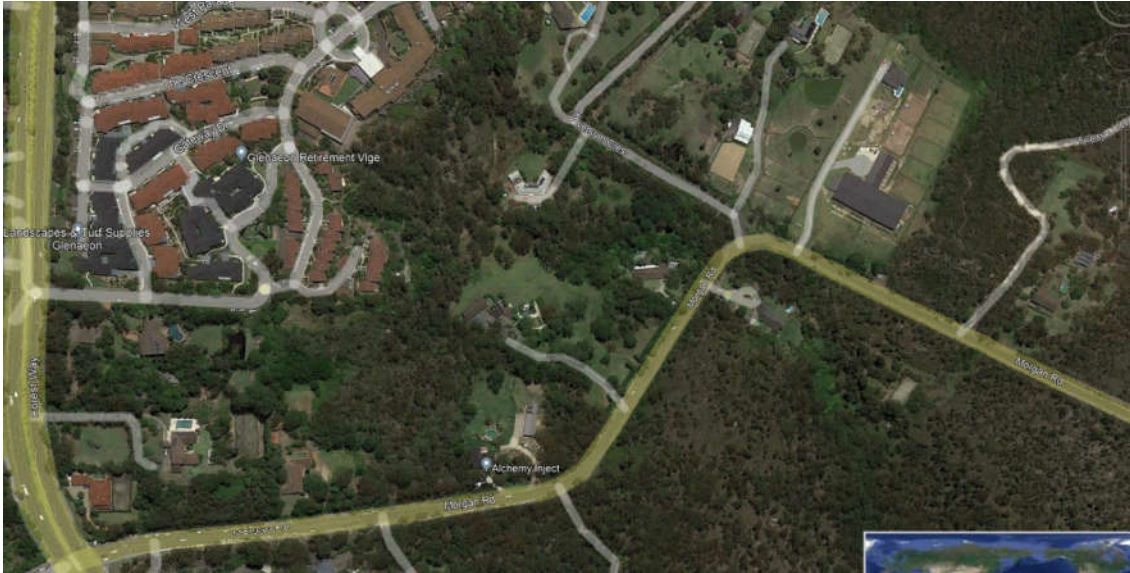


Figure 1.8 – Aerial appraisal north of Morgan Rd

- Northwest of the intersection of Morgan Rd and Forest Way – This is a mixture of private and public lands containing scrubland with interspersing trees – see Figure 1.9.

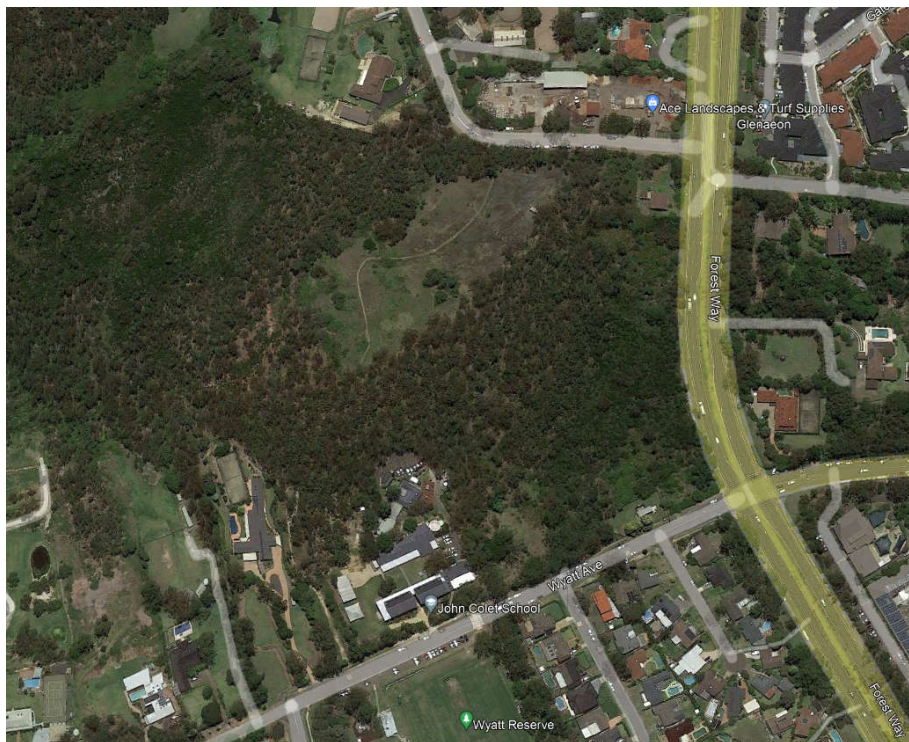


Figure 1.9 - Northwest of the intersection of Morgan Rd and Forest Way

- East of Morgan Rd is contiguous shrub native vegetation set amidst private rural lands north of the development area and contiguous native vegetation east of Kelly's Way – see Figure 1.10.



Figure 1.10 – Aerial appraisal east of Morgan Rd

- South of the development area is comprised of small rural lots in the immediate southwest, residential lands in the south west and government satellite and in the south east – see Figure 1.11.

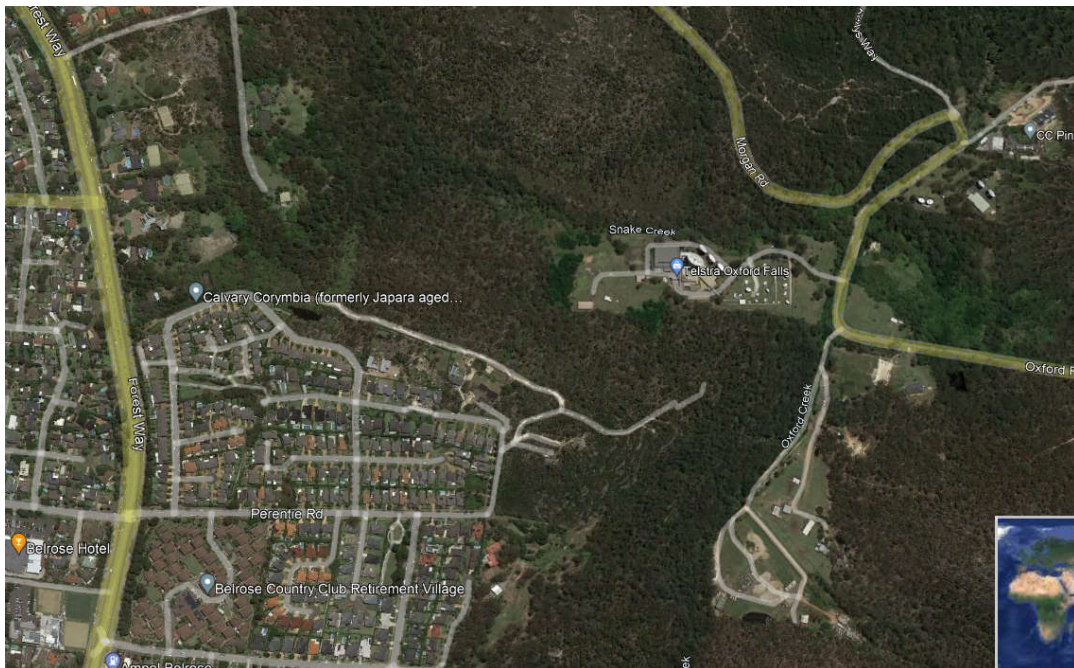


Figure 1.11- Aerial appraisal south of the development area

1.7 Legislation and planning instruments

1.7.1 Environmental Planning and Assessment Act 1979 (EP&A Act) and bushfire prone land

The *EP&A Act* governs environmental and land use planning and assessment within New South Wales (NSW). It provides for the establishment of environmental planning instruments, development controls and the operation of construction controls through the National Construction Code (NCC) and the *EP&A Act*. Bushfire prone land maps provide a trigger for the development assessment provisions. The proposed rezoning is located on land that is mapped by Northern Beaches Council as being bushfire prone (refer Figure 1-1).

PBP 2019 stipulates that if a proposed amendment to land use zoning or land use affects a designated bushfire prone area then *Section 9.1(2) of the EP&A Act (1979)* must be applied. This requires Council to consult with the Commissioner of the *NSW RFS* and to take into account any comments by the Commissioner and to have regard to the planning principles of *PBP 2019* (detailed within Section 1.5.3).

1.7.2 Local Environmental Plan (LEP) and Development Control Plan (DCP)

A LEP provides for a range of zonings which list development that is permissible or not permissible, as well as the objectives for development within a zone.

The site is identified on the *Warringah LEP 2011* Land Application Map as a DM ‘deferred matter’. LEP 2000 applies to all deferred land until a review of deferred lands is complete and a planning proposal process is undertaken to bring this land into Warringah’s standard LEP 2011.

Warringah Local Environmental Plan (LEP) 2000

The site is zoned under *Warringah LEP 2000* as Locality C8 – Belrose North (refer

Figure 1-3). The land surrounding the property to the north, south and west is zoned under the current LEP 2011 as E1 – National Parks and Reserves.

The proposal seeks to amend the *LEP 2000* and contribute to the planning process to bring this land into Warringah’s standards LEP. The proposal is to rezone the central development area as R2 low density residential whilst maintaining the land surrounding the development as an offset area will be rezoned as E3 – Environmental Management. The proposal also includes the rezoning of a small parcel of land to RE2 – Public Recreation.

The proposal, including the provision of APZs, would seek to comply with the objectives of the proposed rezoning.

1.7.3 Planning for Bush Fire Protection 2019

Bushfire protection planning requires the consideration of the RFS planning document entitled *PBP*. *PBP* provides planning principles for rezoning to residential land 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.

The Planning Proposal has been assessed in entirety in compliance with *PBP 2019*. This includes a separate *Bushfire Strategic Study* and assessment against the following bushfire protection measures to ensure that future development is capable of complying with *PBP 2019*:

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

1.7.4 National Construction Code (NCC) and the Australian Standard AS3959 Construction Standards in bushfire-prone areas 2018 (AS3959-2018)

The NCC is given effect through the *EP&A Act* and forms part of the regulatory environment of construction standards and building controls.

The NCC outlines objectives, functional statements, performance requirements and deemed to satisfy provisions. For residential dwellings these include Classes 1, 2 and 3 buildings. The construction manual for the deemed to satisfy requirements is AS3959.

Consideration of AS3959 is not specifically required in a planning proposal application. The APZs provided in this report are equivalent to a bushfire attack level (BAL) 29 construction standard for those dwellings with frontage to the bushfire hazard.

2. BUSHFIRE THREAT ASSESSMENT

To assess the bushfire threat and to determine the required width of an APZ for a development, an assessment of the potential hazardous vegetation and the effective slope within the vegetation is required. These elements include the potential hazardous landscape that may affect the site and the effective slope within that hazardous vegetation.

2.1 Hazardous fuel formation assessment

PBP guidelines require the identification of the predominant vegetation formation in accordance with David Keith (2004) if using the simplified acceptable solutions in *PBP* 2019, or alternatively the vegetation class if adopting the comprehensive vegetation fuel loads (as allowable when undertaking an assessment under Method 2 of AS3959). The hazardous vegetation is calculated for a distance of at least 140m from a proposed building envelope.

Extensive vegetation survey of the development site was undertaken by *Hayes Environmental* with the preparation of a BDAR assessment for the planning proposal. The results of the vegetation ID are detailed in Table 2-1 – Vegetation and as mapped by *Hayes Environmental* – see Figure 2-1 Vegetation Communities. PCT classifications are derived from the OEH Bionet database. Fuel loads shown within Column 5 of Table 2-1 are derived from the RFS ‘*Classification of vegetation fuel loads* March 2019’.

<https://www.environment.nsw.gov.au/NSWVCA20PRapp/search/pctsearch.aspx>

Table 2-1 – Vegetation communities - their PCT category and their fuel load

Vegetation PCT	Vegetation formation	Vegetation classification	Comprehensive fuel loads (t/ha) as per RFS	Acceptable solution fuel loads (t/ha) (RFS)
1783	Sydney North exposed sandstone woodland	Forest (Shrubby)	21.3 / 27.3	22.0 / 36.1
1250	Coastal sandstone gully forest	Forest (Shrubby)	21.3 / 27.3	22.0 / 36.1
1824	Coastal sandstone Heath-Mallee	Heathland	36.9 / 36.9	36.9 / 36.9
1803	Coastal upland damp heath swamp	Freshwater Wetland (PBP-short heath)	15.0 / 15.0	4.4 / 4.4

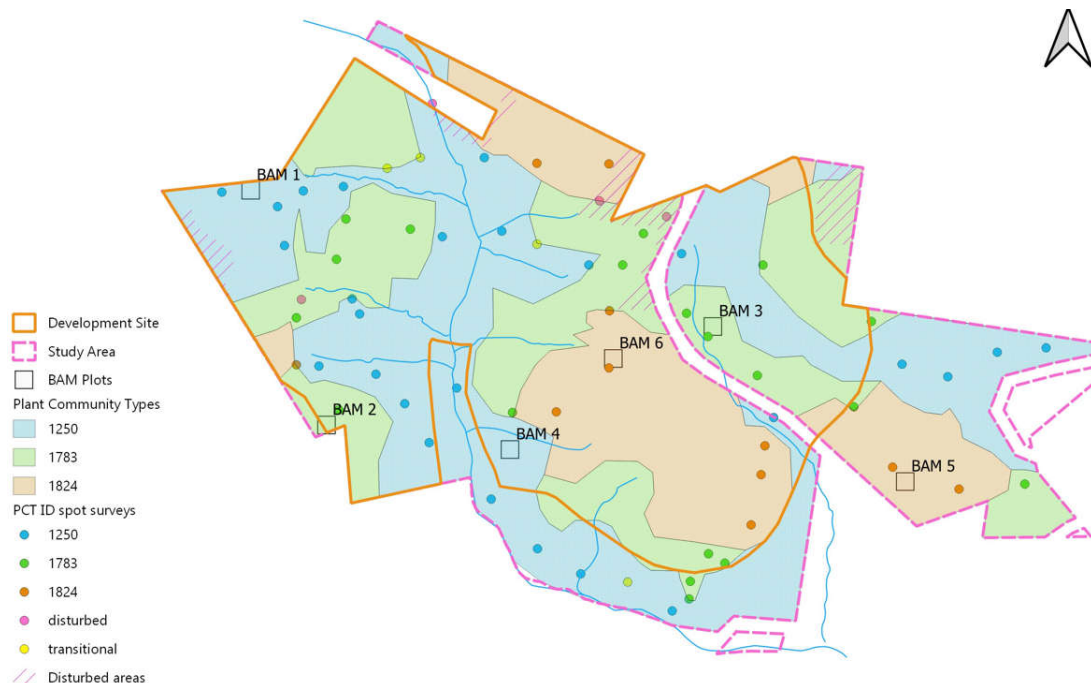


Figure 2-1 – Vegetation communities within the development area
(source: Hayes Environmental 2021)

2.2 Effective slope

The effective slope (post earthworks) has been assessed for up to 100m from the development site. The effective slope refers to the slope gradient which provides the most effect upon likely fire behaviour. In that regard the RFS advises that a mean average slope may not in all cases provide sufficient information such that an appropriate assessment can be determined and the effective slope should / could be determined as valuable for the assessment process.

The effective slope within the hazardous vegetation is described in detail within Table 2-2 below. Slopes have been extensively mapped by surveyors *Craig & Rhodes* – see Figure 2-2.

The '20 degrees and above' slope has been mapped to illustrate the areas that are outside of the PBP 2019 'deemed to Satisfy' '0-20' degrees range. Arising from the 20+ degrees mapping those areas require an APZ of 100m 'as a default dimension' because they do not accord with Table A12.5 of PBP 2019.

The RFS advise in A1.4 on page 83 of PBP that *APZ tables within PBP are provided for acceptable solutions with slopes of up to 20 degrees. Effective slopes are to be assessed with hazards on slopes in excess of 20 degrees will require a detailed performance assessment. This may include a consideration of the potential flame length and its impact on the proposed development. Please see section A1.5 for information on determining the effective slope.*

It is readily acknowledged that the 100m APZ dimension has an environmental consequence on biodiversity however for a Planning Proposal this is not able to be amended unless the RFS agrees to a reduction and at a Planning Proposal stage of development design this is not advised.

However, it is the authors belief this can be reduced by the RFS following the acknowledgment of the southern escarpment wall which is approximately 8-10m in height and this acts as a radiant heat barrier.

If this barrier is modelled, using ASA3959 Method 2 (2018), (as explained within B1 General on page 92 of the Standard) the APZ could be reduced markedly. Indeed, Method 2 permits a down slope of up to 30 degrees to be modelled. If so, then the APZ distance could be reduced to a 74m dimension (based on the insitu 25 degree down slope using a fuel load of 23.1 / 27.1 (tonnes per hectare) based on Sydney dry sclerophyll fuels.

This approach would save approx' 1.0 ha of biodiversity land.

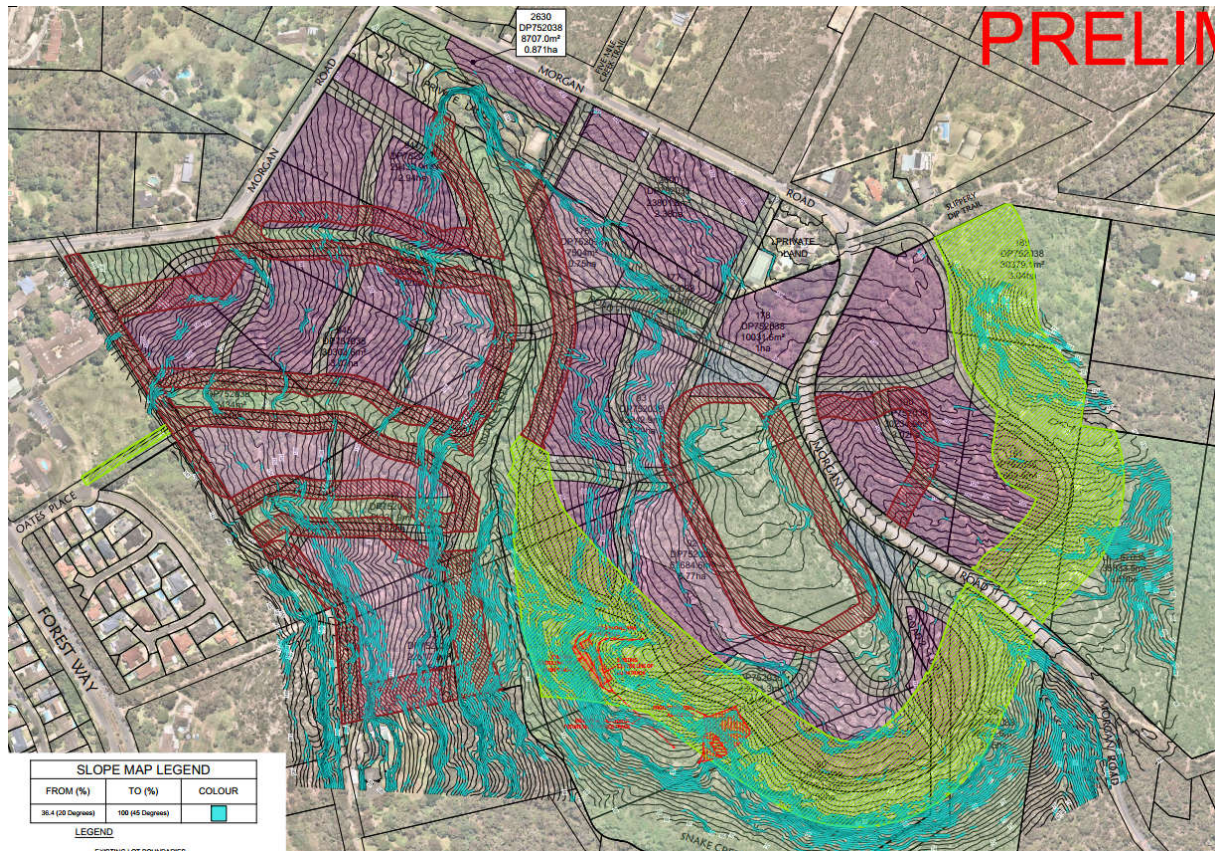


Figure 2-2 – 20 degrees slopes

2.3 Bushfire attack assessment

The following assessment has determined the APZ and BAL levels via the following approaches;

- Table A1.12.2 & A1.12.5 of *PBP 2019*;
- Appendix B Method 2 (alternative solution) of *AS3959 Construction of buildings in bushfire prone areas* (2009); and

A fire danger index (FDI) of 100 has been used to calculate bushfire behaviour on the site based on its location within the Greater Sydney region.

See Appendix 1 herein to visualise an A3 depiction of the proposed APZ's.

Table 2-2 provides a summary of the bushfire attack assessment based on residential development and the methodologies identified above.

See Appendix 1 herein to visualise an A3 depiction of the proposed APZ's.

Table 2-2 – Bushfire attack assessment

Site locality	Proposed development precincts (Should be read in conjunction with Figure 1.4)	Minimum APZ required for residential development (metres)	APZ provided (metres)
North	N1 & N2 (north)	24	24
	N1 (South)	29	Protected by other zones
	N4	29	Protected by other zones
North	N5 (south)	24	26
Northwest	W4	24	24 including road reserve
	Area north of W5	24	25 excluding the 20m wide Morgan Rd reserve
East & south-east	C3 to C5 E1 to E4	100	100
Central	C2 to C5 (east)	29	40
	C2 to C5 (west)	60-100	60-100
Central	Between C3 & C4	15	15
West	W5, S1 & S2 (west)	24	24
West (Waterway Corridors)	W2-W8	Not stated	16m Road width plus building setback
Central (east of Snake Creek)	C1 (east)	23	23
	N3	Variable	23-26
	C1 & C2	Between 20-26	Protected by other development
Southwest		60-75	60-75

3. SPECIFIC PROTECTION ISSUES

3.1 Asset protection zones (APZs)

Table 3-1 outlines the proposal's compliance with the performance criteria for APZs.

Table 3-1 – Performance criteria for asset protection zones

<i>Performance criteria</i>	<i>Acceptable solutions</i>	<i>Acceptable solution</i>	<i>Performance solution</i>	<i>Comment</i>
Potential building footprints will not be exposed to radiant heat levels exceeding 29kW/m ² on each proposed lot	APZs are provided in accordance with Tables A1.12.2 and A1.12.4 based on the FFDI	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complies with RFS - Refer Section 2.3. An alternative solution approach has been undertaken for lots adjacent to the narrow riparian corridors that feed into Snake Creek from the west. This is based on a width of 20m
APZs are managed and maintained to prevent the spread of a fire towards the building	APZs are managed in accordance with the requirements of Appendix 4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complies with RFS and can be made a condition of consent at development application stage.
The APZ is provided in perpetuity	APZs are wholly within the boundaries of the development site	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complies with RFS – The APZs will be managed under a Community Title arrangement and will be subject to a detailed fuel management plan (FMP).
APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised	The APZ is located on lands with a slope of less than 18°	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Complies with RFS – The APZ's are mostly situated on slopes of less than 18 degrees except for the southern aspects which are 25 degrees. These southern areas contain high rock escarpments and ledges and can be incorporated into future APZ management by the preparation of a FMP.
Landscaping is designed and managed to minimise flame contact and radiant heat to buildings, and the potential for wind-driven embers to cause ignitions	Landscaping is in accordance with Appendix 4	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complies with RFS and can be made a condition of consent at development application stage.
	Fencing is constructed in accordance with section 7.6	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be made a condition of consent at development application stage.

APZs on steep land:

In accordance with the acceptable solutions and performance solutions permitted by PBP all APZ's in excess of 20 degrees are outside the realm of PBP and the required APZ for those areas must be 100m. Where hazardous slopes are below 20 degrees the provisions of PBP are permissible.

Figure 2-2 has been used to determine the slope gradient following an extensive survey by *Craig & Rhodes* managed in part by the undersigned to this report to gain correct gradients as per RFS expectations of the detail.

3.2 Building protection

The construction of buildings in bushfire prone areas is subject to stringent rules pertinent to the building envelope being located on the non-hazardous side of the APZ. The role of the

In terms of future subdivision approval, the minimum APZ must be provided in accordance with *AS3959 Construction of buildings in bushfire prone areas (2018)* and the specifications provided within Section 7.5 of *Planning for Bush Fire Protection 2019*.

A dwelling cap of 450 residential dwellings will be created within the R2 zone. Based on the assumption of 450 dwellings this would assume a population increase of 1,170 persons. (Based on based on the 2016 *Australian Institute of Family Studies* data which advises there is 2.6 persons, on average, per house hold).

3.3 Hazard management

The management of community lands and fire trails will be via the preparation of a fuel management plan (FMP) with long term management being undertaken and incorporated into the Community Management Statement managed by the Community Association. The fuel management plan will detail the ongoing fuel management requirements of the APZ and fire trails.

APZs will be managed as either an Inner Protection Area (IPA) or Outer Protection Area (OPA) in accordance with RFS guidelines *Standards for Asset Protection Zones* (RFS, 2005), with landscaping design to comply with Appendix 4 of *PBP*. Most of the proposed APZ's will be in the form of an IPA with only a small area subject OPA management regime.

The APZs, as generally depicted in APPENDIX 2 will be assured through a planning agreement and development consent conditions. The funding will be sourced from each new neighbourhood Community Association and through each neighbourhood Community Association lot owner.

3.4 Fuel management

A fuel management plan (FMP) will be prepared to manage the vegetation within the APZ. It will be used a detailed instructional guideline for the community association who would engage a professional bushland management firm to undertake the actual works program.

The FMP is to be prepared to facilitate the ongoing management of bushfire hazards within the asset protection zone (APZ) landscape with the aim that all APZ's will be managed in perpetuity in accord with the relevant development consent and GTA's provided by the NSW Rural Fire Service.

The details will be included within the Stewardship Agreement that includes a fuel management plan to strategically decrease hazards and provide a diverse ecological environment.

APPENDIX 1 provides maintenance advice for vegetation within the APZ.

3.5 Access for firefighting operations

PBP requires the design of access roads to enable safe access and egress for residents attempting to leave the area at the same time that emergency service personnel are arriving to undertake firefighting operations. During a bushfire evacuation the following traffic egress routes have been designed to assist this objective:

- Morgan Road (westbound) via the Morgan Road / Forest Way intersection. This is assumed to be the primary egress route and would accommodate approximately 90% of traffic movements. A new slip-road will be provided on Forest Way to enable vehicles leaving Morgan Road heading east.
- Via the Oates Place / Forest Way intersection as a secondary egress route which is used only in the event of a bushfire emergency, assumed to take the remaining 10% of traffic movements.

See

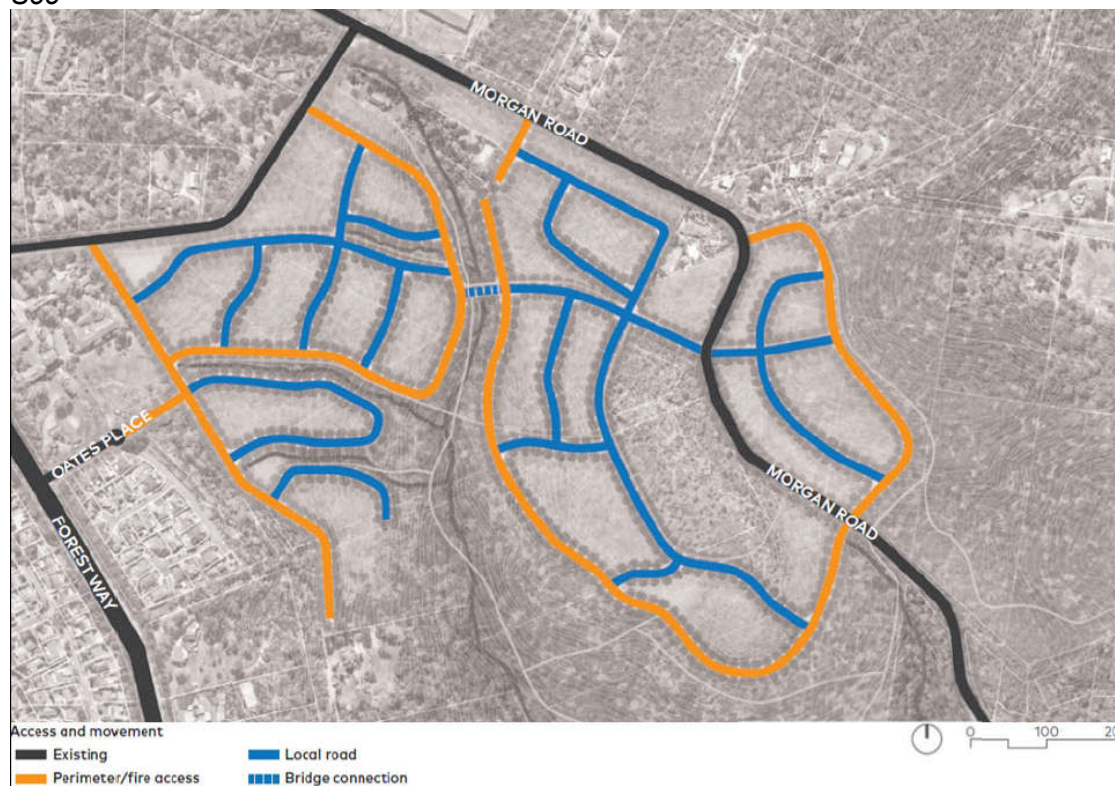


Figure 3-1 for road layout and Table 3-2 for road widths.

Over a period of some two years ongoing discussions with the traffic consultants *JMT Consulting* has occurred to form the basis of the transport plan for the Planning Proposal.

The key findings of their assessment as follows:

- The surrounding road network, including Forest Way and the signalised intersection of Morgan Road / Forest Way can accommodate the expected level of day to day traffic generated under the rezoning proposal.
- Egress in a bushfire evacuation scenario can be accommodated safely pending the upgrade of the Morgan Road / Forest Way intersection to accommodate a free flow slip lane from Morgan Road. This upgrade is required following the development of 230 or more dwellings on the site.
- Suitable site access arrangements can be provided along Morgan Road with multiple accesses envisaged to distribute traffic movements across the site. No direct vehicle access would be provided from Forest Way given it's function as a State classified road.
- The internal street network will be designed to limit through traffic movements within the site, accommodate movement of pedestrians and cyclists and allow for the safe and efficient movement of various vehicle types (including firstresponder vehicles).
- The Planning Proposal would facilitate the formalisation of existing cycling routes through the site and well as provide good quality pedestrian connections through to nearby public transport stops on Forest Way.

JMT Consulting found that during the development of the concept plan for the site it was identified that safe and efficient vehicle egress from the site would be required during major bushfire events. Given the likely bushfire conditions in this scenario, all traffic would need to be directed to the west to access Forest Way and depart the area.

They advised that under current conditions traffic leaving the site via Morgan Road needs to stop at the traffic lights before then turning left onto Forest Way. In this context an upgrade of the Morgan Road / Forest Way intersection has been identified to facilitate safe and efficient access out of the precinct as indicatively illustrated in Figure 24 below. This involved the creation of a slip lane from Morgan Road onto Forest Way which includes an acceleration lane as per Austroads requirements. This upgrade will allow traffic leaving Morgan Road to bypass the existing traffic lights and enter directly onto Forest Way without delay.

JMT Consulting undertook an analysis of the road network to accommodate additional traffic flows during a major bushfire event using SIDRA INTERSECTION 9.0, a computer-based modelling package which assesses intersection performance under prevailing traffic conditions.

SIDRA modelling has been undertaken at the Forest Way / Morgan Road intersection which considers existing traffic movements as well as those generated by the rezoning, taking into consideration the upgrade of the intersection through a new slip lane as summarised in Section 5.6.2 of the *JMT Consulting* report. The traffic modelling has considered both:

- The performance of the overall intersection (taking into account traffic movements from all directions); and
- The performance of the specific traffic movement from Morgan Road onto Forest Way, which is critical with respect to bushfire evacuation.

The findings of the traffic modelling were summarised in their Table 5 which, in essence, recommended the need to implement upgrades in the form of the slip lane. The modelling has concluded that, subject to the implementation of the Morgan Road slip lane, traffic can efficiently exit the precinct during a bushfire evacuation.

JMT Consulting concluded that the slip lane provides enough capacity for the evacuating vehicles to turn left onto Forest Way, as well as spare capacity to accommodate vehicles external to the proposed site travelling along Morgan Road.

They further advised that a detailed concept design, including extent of civil and infrastructure works required, has separately been prepared by Craig and Rhodes. The land required to facilitate the upgrade is owned by Council and currently zoned RE1 – making it suitable for the purposes of road widening. Separate traffic modelling for a bushfire emergency evacuation event indicates the upgrade will be required once more than 230 dwellings have been developed and are occupied on the site.

The proposal's compliance with the acceptable solutions outlined in PBP 2019 is detailed within Table 3-2 in terms of road widths and Table 3-3 for further assessment details as required by PBP.

Table 3-2 - Road widths

Perimeter road	Non-Perimeter Road (in metres)	Road width (in metres)	Parking availability on one side or both sides of the road as per PBP	Compliant or not with PBP 2019
Forest Way	>8	33	No parking	Compliant
Morgan Road	>8	20	No parking	Compliant
Oates Place	>8	20	One side	Compliant
Internal roads	>8	16	Parking variable	Compliant



Figure 3-1 - Road layout (Cox, September 2022)

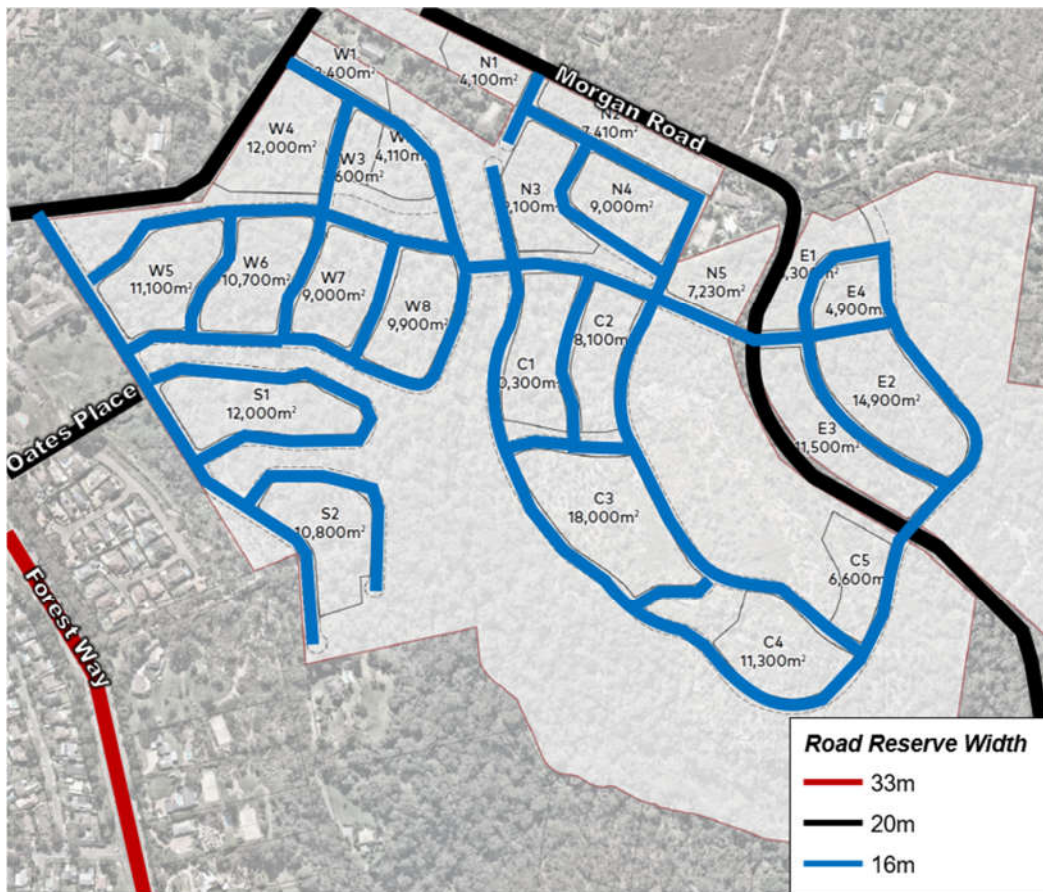


Figure 3-2 - Road widths (JMT Consulting, June 2021)

Table 3-3 – Performance criteria for access within Residential Subdivisions (Source: PBP 2019)

Note: The reading of the following table/s (on pages 20-26) should firstly look at the left side of each table to determine the RFS category being assessed e.g. Access.

Performance criteria		Acceptable solution	Acceptable solution	Performance solution	Comment
ACCESS (GENERAL REQUIREMENTS)	Firefighting vehicles are provided with safe, all weather access to structures.	Property access roads are two-wheel drive, all-weather roads	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complies
		Perimeter roads are provided for residential subdivisions of three or more allotments.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Compliant. See Note 1 below on Page 29
		Subdivisions of three or more allotments have more than one access in and out of the development.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Compliant
		Traffic management devices are constructed to not prohibit access by emergency services vehicles.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent
		Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complies. All roads will be sealed
		All roads are through roads	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Predominantly compliant. Only one short length road in the northwest (at N3) is yet to be resolved as it is currently non-compliant – see Note 1 on page 29 below
		Dead end roads are not recommended, but if unavoidable, dead ends are not more than 200m in length, incorporate a minimum 12 metres outer radius turning	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Turning heads are to be constructed in compliance with Figure 3.1. and must provide a 24m

Performance criteria		Acceptable solution	Acceptable solution	Performance solution	Comment
		circle, and are clearly sign posted as a dead end.			circumference if using a culdesac design No parking signs are to be erected within the turning head
		Where kerb and guttering are provided on perimeter roads, roll top kerbing should be used to the hazard side of the road.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent
		Where access / egress can only be achieved through forest, woodland or heath vegetation, secondary access shall be provided to an alternate point on the existing public road system.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Alternative public road access is provided via Oates Place onto Forest Way
		One way only public access roads are no less than 3.5 metres wide and have designated parking bays with hydrants located outside of these areas to ensure accessibility to reticulated water for fire suppression.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	All roads are two (2) way
	The capacity of access roads is adequate for firefighting vehicles.	The capacity of perimeter and non-perimeter road surfaces and any bridges / causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges / causeways are to clearly indicate load rating.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	All roads comply and can be a condition of consent.
	There is appropriate access to water supply.	Hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.

Performance criteria		Acceptable solution	Acceptable solution	Performance solution	Comment
		Hydrants are provided in accordance with AS 2419.1:2005.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.
		There is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Reticulated water is provided.

Performance criteria		Acceptable solution	Acceptable solution	Performance solution	Comment
PERIMETER ROADS	Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating as well as providing a safe operational environment for emergency service personnel during firefighting and emergency management on the interface.	Are two-way sealed roads.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complies.
		Minimum 8m carriageway width kerb to kerb.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complies. All roads are 8m.
		Parking is provided outside of the carriageway width.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complies.
		Hydrants are located clear of parking areas.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.
		There are through roads, and these are linked to the internal road system at an interval of no greater than 500m.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Compliant
		Curves of roads have a minimum inner radius of 6m.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.
		The maximum grade road is 15° and average grade is 10°.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.
		The road crossfall does not exceed 3°.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.
		A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent

Nolte 1: The RFS require *that a perimeter road should be provided to separate bush land from urban areas, allowing more efficient use of firefighting resources. A perimeter road is located on the outer extremity of a local area or subdivision and usually runs parallel to the bush land*

interface. The perimeter road provides space to conduct active firefighting operations and hazard reduction activities. In developments where no perimeter road exists, property defence in a bush fire event may be more difficult. (PBP 2019 Sect 3.4.1 page 29).

This does not require contiguous perimeter road construction and in this regard the proposed road located on the eastern aspect of precinct N3 complies – see red circle in Figure 3.2 below. This shows a perimeter road with two adjoining cul-de-sac's. This has been caused by a steep cliff denying a contiguous roadway

This scenario is aided by the nature of the private property to the immediate west along with the APZ between the two cul-de-sac's enables ready access for firefighting. Importantly the southern portion is not required for evacuation egress to the north. However, the northern portion can be used for evacuation to the north if required or alternatively that road design provides for evacuation directly to the east and then to the west over the Snake Creek bridge.



Figure 3-3 – location of perimeter road with adjoining cul-de-sac's

<i>Performance criteria</i>		<i>Acceptable solution</i>	<i>Acceptable solution</i>	<i>Performance solution</i>	<i>Comment</i>
NON-PERIMETER ROADS	Access roads are designed to allow safe access and egress for medium rigid firefighting vehicles while residents are evacuating.	Minimum 5.5m carriageway width kerb to kerb.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complies. All roads are to be in excess of 5.5m plus parking provisions.
		Parking is provided outside of the carriageway width.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Complies. Parking must be provided outside of the 5.5m carriageway width.
		Hydrants are located clear of parking areas.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.
		Roads are through roads, and these are linked to the internal road system at an interval of no greater than 500m.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Predominantly compliant with only one short length internal non-perimeter road in the northwest (at N3)
		Curves of roads have a minimum inner radius of 6m.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.
		The road crossfall does not exceed 3°.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.
		A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.

Performance criteria		Acceptable solution	Acceptable solution	Performance solution	Comment	
PROPERTY ACCESS	Firefighting vehicles can access the dwelling and exit the property safely.	There are no specific access requirements in an urban area where an unobstructed path (no greater than 70m) is provided between the most distant external part of the proposed dwelling and the nearest part of the public access road (where the road speed limit is not greater than 70kph) that supports the operational use of emergency firefighting vehicles.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	All allotments are provided with direct frontage to the public road system. No further requirements are necessary.	
		In circumstances where this cannot occur, the following requirements apply: (Assess if the subdivision has a battle axe block.				
		minimum 4m carriageway width;	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.	
		in forest, woodland and heath situations, rural property access roads have passing bays every 200m that are 20m long by 2m wide, making a minimum trafficable width of 6m at the passing bay;	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.	
		a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches;	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.	
		provide a suitable turning area in accordance with Appendix 3;	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.	
		curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress;	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.	
		the minimum distance between inner and outer curves is 6m;	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.	
		the crossfall is not more than 10 degrees;	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.	
		maximum grades for sealed roads do not exceed 15 degrees and	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.	

Performance criteria	Acceptable solution	Acceptable solution	Performance solution	Comment
	not more than 10 degrees for unsealed roads; and			
	a development comprising more than three dwellings has access by dedication of a road and not by right of way.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Can be a condition of consent.
	Note: Some short constrictions in the access may be accepted where they are not less than 3.5m wide, extend for no more than 30m and where the obstruction cannot be reasonably avoided or removed. The gradients applicable to public roads also apply to community style development property access roads in addition to the above.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	

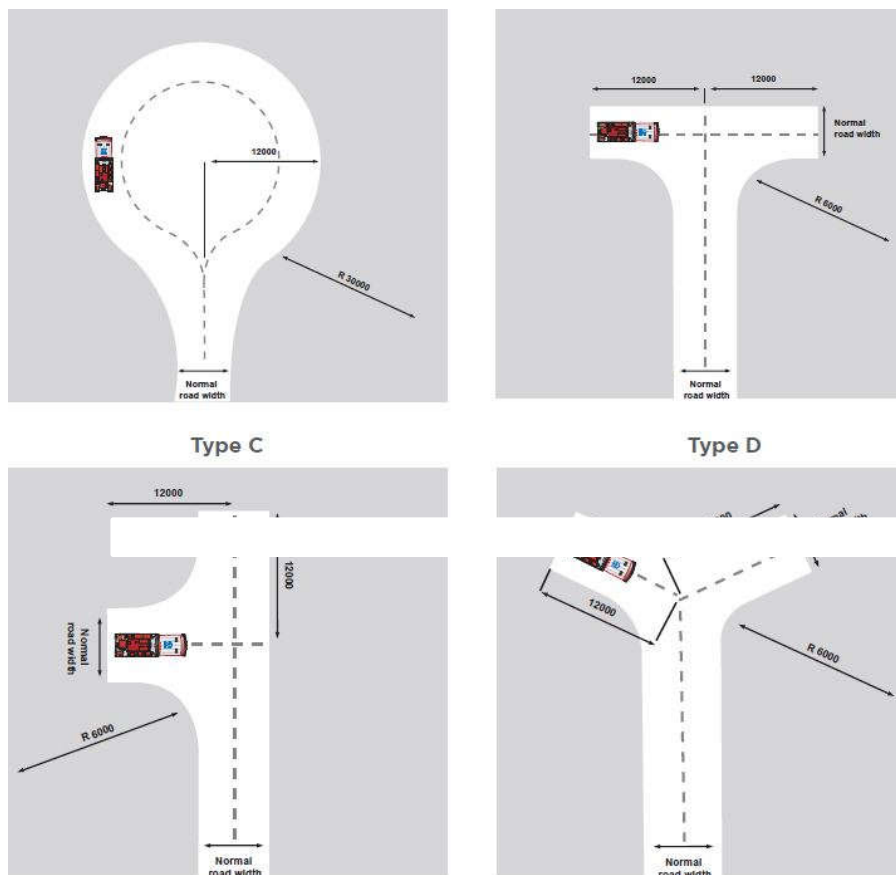


Figure 3-3 – Turning head dimensions

3.6 Evacuation

Evacuation capability is critical when considering bushfire planning for new residential developments. Given the inherent bushfire risk posed to future development, there is a need for the close examination of evacuation routes. This has been undertaken by *JMT Consulting* and through their modelling analysis – see Section 3.5 above.

The road design has very specifically created linkages from the residential zone to Forest Way such that traffic flow can move away from the source of fire. This has been accomplished by;

- A new road link through Oakes Place will facilitate road egress.
- A slip lane has been proposed to enable ready access to Forest Way from by vehicles potentially banking up on Morgan Rd.

The site is also situated in close proximity to the nearest RFS *Neighbourhood Safer Place/s*.

- Belrose Public School on the north eastern corner of Ralston Avenue and Contention Road, Belrose. This is a direct 2-minute drive in a westerly direction along Ralston Avenue; and
- Bambara Reserve (Belrose Oval) & Belrose Community Centre. This is a direct 3-minute drive in a southerly direction along Forest Way.

The NSP is a place of safety for a person to shelter during the passage of a bushfire.

Table 3-4 outlines the required performance criteria for the proposal's emergency procedures.

Table 3-4 – Performance criteria for emergency and evacuation planning

Performance criteria	Acceptable Solutions
A bush fire emergency and evacuation management plan is prepared	<p>A bush fire emergency management and evacuation plan is prepared consistent with the:</p> <ul style="list-style-type: none"> • The NSW RFS document: <i>A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan</i> • NSW RFS <i>Schools Program Guide</i> (where applicable) • Australian Standard AS 3745:2010 <i>Planning for emergencies in facilities</i>; and <p>Australian Standard AS 4083:2010 <i>Planning for emergencies – Health care facilities</i> (where applicable),</p>
Suitable management arrangements are established for consultation and implementation of the emergency and evacuation plan.	<p>An Emergency Planning Committee is established to consult with residents (and their families in the case of aged care accommodation and schools) and staff in developing and implementing an Emergency Procedures Manual.</p> <p>Detailed plans of all emergency assembly areas including 'on-site' and 'off-site' arrangements as stated in AS 3745 are clearly displayed, and an annual (as a minimum) trial emergency evacuation is conducted.</p>

3.7 Water supplies

The intent of measures is to provide adequate services of water for the protection of buildings during and after the passage of bushfire. Table 3-5 outlines the performance criteria and the acceptable solutions for reticulated water supply.

Table 3-5 – Performance criteria for reticulated water supplies

<i>Performance criteria</i>	<i>Acceptable solutions</i>
Adequate water supplies is provided for firefighting purposes.	Reticulated water is to be provided to the development, where available.
	A static water supply is provided for non-reticulated developments or where reticulated water supply cannot be guaranteed
	Static water supplies shall comply with Table 5.3d.
Water supplies are located at regular intervals. The water supply is accessible and reliable for firefighting operations.	Fire hydrant, spacing, design and sizing complies with the relevant clauses of Australian Standard AS 2419.1:2005.
	Hydrants are not located within any road carriageway.
	Reticulated water supply to urban subdivisions uses a ring main system for areas for areas with perimeter roads.
Flows and pressure are appropriate.	Fire hydrant flows and pressures comply with the relevant clauses of AS 2419.1:2005.
The integrity of the water supply is maintained.	All above-ground water service pipes are metal, including and up to any taps.
	Above ground water storage tank shall be of concrete or metal

3.8 Gas

The intent of measures is to locate gas so as not to contribute to the risk of fire to a building. Table 3-6 outlines the required acceptable solutions for gas supply.

Table 3-6 – Performance criteria for gas supplies

<i>Performance criteria</i>	<i>Acceptable solutions</i>
Location of gas services will not lead to the ignition of surrounding bushland or the fabric of buildings.	Reticulated or bottled gas bottles are to be installed and maintained in accordance with AS/NZS 1596 (2014), the requirements of relevant authorities and metal piping is to be used.
	All fixed gas cylinders are to be kept clear of flammable materials to a distance of 10m and shielded on the hazard side.
	Connections to and from gas cylinders are metal. Polymer sheathed flexible gas supply lines are not used, above ground gas service pipes are metal, including and up to any outlets.

3.9 Electricity

The intent of measures is to locate electricity so as not to contribute to the risk of fire to a building. Table 3-7 outlines the required acceptable solutions for the subdivision's electricity supply.

Table 3-7 – performance criteria for electricity services

<i>Performance criteria</i>	<i>Acceptable Solutions</i>
Location of electricity services limit the possibility of ignition of surrounding bushland or the fabric of buildings.	Where practicable, electrical transmission lines are underground.
	Where overhead electrical transmission lines are proposed:
	<ul style="list-style-type: none">• lines are installed with short pole spacing (30m), unless crossing gullies, gorges or riparian areas; and• no part of a tree is closer to a power line than the distance set out in ISSC3 Guideline for Managing Vegetation Near Power Lines.

4. STRATEGIC OVERVIEW

4.1 Bushfire strategic planning principles

PBP 2019 includes the requirement to prepare a strategic bush fire study for Planning Proposals. In this regard a separate strategic bush fire study has been prepared by *Travers bushfire & ecology* and this should be read as a supporting document. The attempt here is to provide a level of independence by using separate authors.

Planning principles for the proposal include the provision of adequate access including perimeter roads, establishment of adequate APZs for future housing, allowing for minimum lot depths to accommodate APZs and the introduction of controls which avoid placing inappropriate developments in hazardous areas and the inappropriate placement of combustible material in APZs.

4.2 Review of site bushfire behaviour

For the purposes of reviewing the bushfire assessment within this document the assessment has found that bushfire historically could have occurred on the development landscape although fire history investigations have not been particularly informative in that regard, but it is safe to say that a bushfire event could have occurred on most aspects of the site.

Notwithstanding the removal of native vegetation throughout the development landscape there is a residual portion of vegetation retained via the narrow riparian corridor of Snake Creek; and several other narrow watercourse corridors.

Importantly, other extensive native vegetation is retained on lands to the south and east and separated by a perimeter road system and wide asset protection zones – see Figure 4.1.



Figure 4.1 – Depiction of retained vegetation to the south and east (Purple colour) and conservation lands Snake Creek in the central zone (pink colour).

This design has in effect removed bushfire hazards such that the site internally is safe from the potentially affectation from bushfire carriage through the site.

Whilst it is acknowledged that a bushfire could burn along the rocky substrate base to Snake Creek it is the case that the width of the landscape being narrow at 45m plus the adjacent perimeter roads and asset protection zones makes for bushfire safe compliant landscape.

It is also recognised that shrub vegetation occurs in the northeast on private lands however these landscapes are upslope and burns at a lesser intensity to down slope fire events and shrub vegetation whilst burning quickly and moves quickly that vegetation formation also extinguishes very quickly.

Given the location of Morgan Rd and other internal roads and APZ's in that zone, in the northeast, then this will act as a barrier to fire movement heading southwest, south or southeast.

Bushfires burning from the south have a 100m APZ before development occurs whilst in the east a similar 100m APZ is provided.

4.3 Additional significant bushfire planning matters

Of significance to the strategic planning for a new community is the design of roads and associated infrastructure. Particular attention has been undertaken to the development has perimeter roads and equally that no pinch-points of hazard vegetation occur. These pinch points have the propensity to act a flame barrier to evacuation egress and or emergency service/s access.

Figure 4.2 below demonstrates the extensive layout of the perimeter and the internal road design and linkages to Forest Way and Morgan Road.

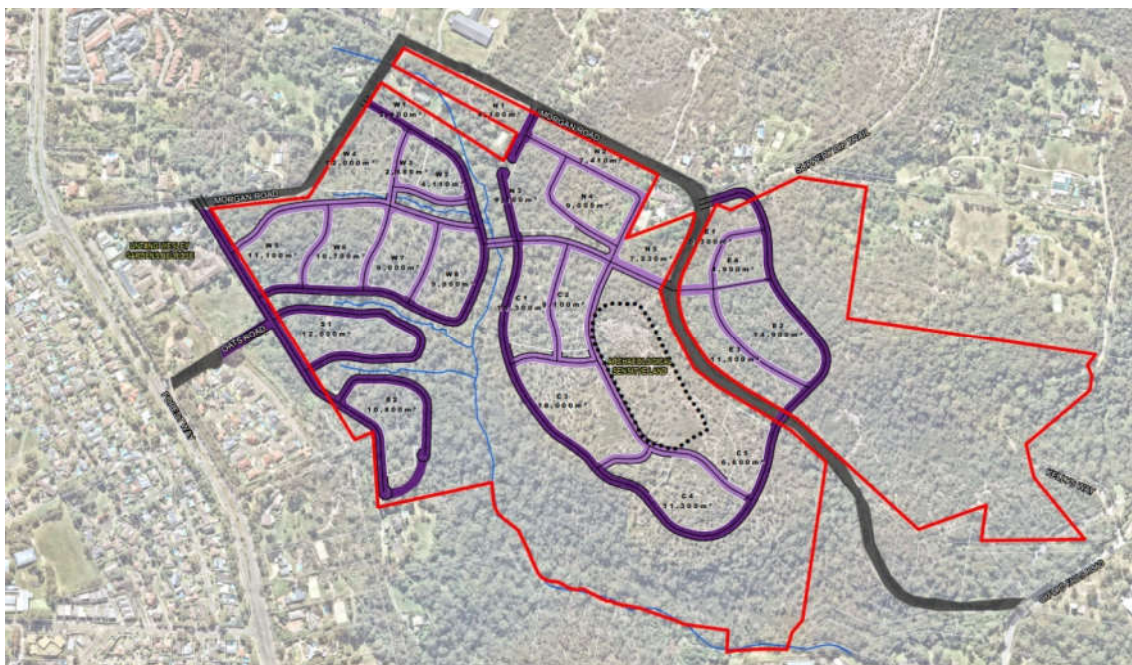


Figure 4.2 – Proposed road layout

4.4 Bushfire Protection Measures

Building in bushfire prone areas requires an appropriate design / construction that enhances building survivability from the impact of bush fires. Importantly, the application of the Australian Standard *AS3959 Construction of buildings in bushfire prone areas* is itself not a singular solution to achieve safety and in that regard it is but a part of a suite of bushfire protection measures (see Figure 4.3) which include APZs, appropriate access, water supply and landscaping.

Bushfire protection measures are the relevant specifications and requirements that need to be satisfied to improve life safety, property protection and community resilience to bush fire attack (RFS).

Importantly the Planning Proposal design ensures that the bushfire risk posed to the development landscape will be mitigated by a range of designed bushfire protection measures which, in-combination, provide the designed level of inbuilt resilience for the future community. These measures can be visualised by the following depiction.

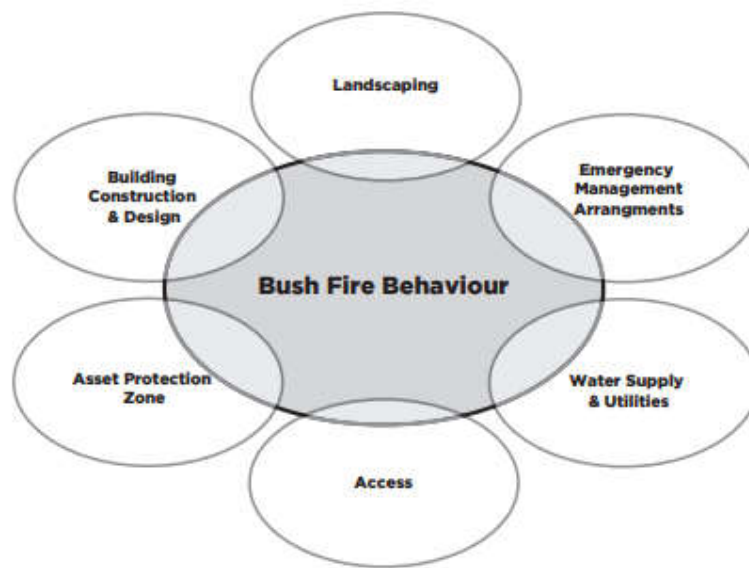


Figure 4-3 - Bushfire protection measures (BPM's)

The BPM's include;

- (a) The implementation of defensible space into the development design through the thinning of Snake Creek and the retention of the important conservation lands to the south. Inclusive of this is the recognition of the sandstone barriers that exist in the form of rock beds in Snake Creek and the high vertical sandstone escarpment walls in the south.
- (b) Asset Protection Zones (APZs) designed and sized in accordance with *PBP 2019* (Table A1.12.2 FFDI 100).
- (c) Road access and traffic efficiency for perimeter roads and all internal roads; in accord with *PBP 2019*.

- (d) A special slip lane onto Forest Way and the incorporation of Oates Place as an emergency egress road.
- (e) Guidance of parking spaces along internal roads to ensure road are capable of being open to emergency vehicles during evacuation periods; in accord with PBP.
- (f) Future dwelling construction to be full compliance with *AS3959-2018*, and *PBP 2019* and or the *NASH* standard.
- (g) Water, electricity and gas supply in compliance with *PBP*.
- (h) High Voltage electricity lines will be laid underground therefore removing a possible ignition source.
- (i) Design on the location of the future cultural centre.
- (j) Design consideration on the extent of the retained lands south of the aboriginal cultural centre, to be located in Precinct N5, and in recognition of the extent of bedrock in that landscape.
- (k) Preparation of a fuel management plan (FMP) which will be incorporated into a proposed stewardship agreement to strategically decrease natural vegetation hazards.
- (l) Preparation of an emergency management and evacuation in compliance with *PBP* and NSW RFS guidelines for the *Preparation of an Emergency / Evacuation Plan*.

The assessment has concluded that future development on site will provide compliance with the planning principles of *PBP* and *Community Resilience Practice Note 2/12 – Planning Instruments and Policies* as summarised in Table 5-1 over page.

4.5 Benefits to the local community

In essence, the bushfire design provides a marked improvement for bushfire risk affect upon the existing residential communities through the transfer of the hazard to the south. This assists the communities living along Morgan Road, Oates Place, Lyndhurst Way, Caley Way and Ocean View Way in the west; and Hilversum Crescent, Slippery Dip Trail in the east.

A significant benefit is also achieved for special protection developments facilities such as the;

- Uniting Church Pre School and the Uniting Church aged Care facility on the corner of Morgan Road and Forest Way in that they can expand their facilities given the removal of the significant bushfire hazards downslope in the east and south east.
- The evacuation capability of the CSIRO radar unit on Oxford Falls Road where staff can head into the Planning Proposal landscape rather than travel the full length of Morgan Rd.

5. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

This bushfire protection assessment has been undertaken for the proposed rezoning located at Morgan Road, Belrose.

A separate bush fire study has been prepared by *Travers bushfire & ecology* and should be read as a supporting this bushfire assessment submission.

The key principle for the proposal is to ensure that future development is capable of complying with the *Section 9.1(2) of the EP&A Act (1979)* and *PBP 2019*.

Planning principles for the proposal include the provision of adequate access including perimeter roads, establishment of adequate APZs for future housing, allowing for minimum lot depths to accommodate APZs and the introduction of controls which avoid placing inappropriate developments (such as petrol stations) in hazardous areas and the inappropriate placement of combustible material in APZs.

The bushfire risk posed to the rezoning proposal can be mitigated if a suite of bushfire protection measures (including APZs) are implemented and managed in perpetuity.

Upon final design engagement with the recommendations made within this report the future development of these lands will provide compliance with the planning principles of *Planning for bush fire protection 2019* and *Community Resilience Practice Note 2/12 – Planning Instruments and Policies* as summarised in Table 5-1 below.

Table 5-1– Planning Principals

Direction 4.4	Compliance statement
In the preparation of a planning proposal the relevant planning authority must consult with the Commissioner of the NSW Rural Fire Service following receipt of a gateway determination under section 3.34 of the Act.	Completed with RFS
A planning proposal must:	
(a) have regard to Planning for Bushfire Protection 2019	Yes. The following assessment has been undertaken in accordance in full accord with <i>PBP 2019</i> .

Direction 4.4	Compliance statement
b) introduce controls that avoid placing inappropriate developments in hazardous areas, and	<p>Yes. The nature of the residential development is an appropriate use and the proposed hazard management controls are in accordance with, and often beyond, <i>PBP 2019</i> to effectively address the level of hazard.</p> <p>The proposal does not involve “inappropriate development” such as schools or retirement villages.</p> <p>The proposed Aboriginal Cultural Centre is a semi -commercial type facility (much like a national park visitor centre) and will provide no accommodation capability or anything other than a small number of visitors at any one time.</p>
c) ensure that bushfire hazard reduction is not prohibited within the APZ.	<p>Yes. Significant environmental studies have been undertaken to ensure APZs have been excluded from environmentally sensitive land.</p>
A planning proposal must, where development is proposed, comply with the following provisions, as appropriate:	
(a) provide an Asset Protection Zone (APZ) incorporating at a minimum: (i) an Inner Protection Area bounded by a perimeter road or reserve which circumscribes the hazard side of the land intended for development and has a building line consistent with the incorporation of an APZ, within the property, and (ii) an Outer Protection Area managed for hazard reduction and located on the bushland side of the perimeter road,	<p>Yes. The APZs recommended exceed the minimum requirements outlined in <i>PBP 2019</i> for subdivision development.</p>
(b) for infill development (that is development within an already subdivided area), where an appropriate APZ cannot be achieved, provide for an appropriate performance standard, in consultation with the NSW Rural Fire Service. If the provisions of the planning proposal permit Special Fire Protection Purposes (as defined under section 100B of the Rural Fires Act 1997), the APZ provisions must be complied with,	<p>This is an integrated Planning Proposal that will result in a new subdivision and this be responsive to Section 100B of the Rural Fire Act.</p>
(c) contain provisions for two-way access roads which links to perimeter roads and/or to fire trail networks	<p>Yes</p>
(d) contain provisions for adequate water supply for firefighting purposes	<p>Yes</p>
(e) minimise the perimeter of the area of land interfacing the hazard which may be developed,	<p>Yes. The perimeter is located on a level terrace and circumscribes the edge of the downslopes resulting in the best design possible. Intrusions of bushland into the development have been removed and minimised to allow safe evacuation.</p>

Direction 4.4	Compliance statement
(f) Introduce controls on the placement of combustible materials in the Inner Protection Area	Yes. Can be a condition of consent at DA stage.

In conclusion we can advise that;

- The requirements established in *Section 9.1(2) of the EP&A Act (1979)* and *PBP 2019* have been satisfied.
- APZs can be provided that comply with *PBP 2019*.
- Evacuation design complies with *PBP 2019*.
- The planning proposal will improve bushfire protection measures afforded to existing development through the removal of hazardous vegetation and improved access for firefighting suppression.
- Costs for the development and implementation of bushfire protection measures will be imposed on the landowner and the developer; and
- Environmental impacts have been minimised.

5.2 Recommendations

Recommendation 1 - The development is as generally indicated on the attached APPENDIX 1 - Plan Of Bushfire Protection Measures.

Recommendation 2 - APZs are to be provided to future residential development as outlined in APPENDIX 1-Plan Of Bushfire Protection Measures.

Recommendation 3 - Fuel management within the APZs is to be maintained in accord with a fuel management plan which will detail the ongoing fuel management requirements of fire trails and APZ areas. The developer will implement and carry out the initial vegetation management required for the asset protection zones and ongoing maintenance will be undertaken by the Community Association.

Recommendation 4 - Building construction standards for the proposed future dwellings are to be applied in accordance with AS3959 Construction of buildings in bushfire prone areas (2009) or NASH Standard (1.7.14 updated) 'National Standard Steel Framed Construction in Bushfire Areas - 2014' as appropriate with additional construction requirements as listed within *Planning for Bush Fire Protection 2019*.

Recommendation 5 - Access is to comply with the performance criteria outlined in Section 5.3.2 of *Planning for Bush Fire Protection 2019*.

Recommendation 6 - Water, electricity and gas supply is to comply with Section 5.3.3 of *Planning for Bush Fire Protection 2019*.

Recommendation 7 - An emergency / evacuation plan is to be prepared consistent with the RFS Guidelines for the Preparation of Emergency / Evacuation Plans.

6. REFERENCES

- Australian Building Codes Board (2018) – *Building Code of Australia*, Class 1 and Class 10 Buildings Housing Provisions Volume 2.
- Chan, K.W. (2001) – *The suitability of the use of various treated timbers for building constructions in bushfire prone areas*. Warrington Fire Research.
- Councils of Standards Australia AS3959 (2018) – *Australian Standard Construction of buildings in bush fire-prone areas*.
- Keith, David (2004) – *Ocean Shores to Desert Dunes – The Native Vegetation of New South Wales and the ACT*. The Department of Environment and Climate Change.
- Rural Fire Service (2019) - *Planning for bushfire protection – a guide for councils, planners, fire authorities and developers*. NSW Rural Fire Service.
- Tan, B., Midgley, S., Douglas, G. and Short (2004) - *A methodology for assessing bushfire attack*. RFS Development Control Service.

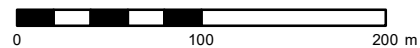
APPENDIX 1. PLAN OF BUSHFIRE PROTECTION MEASURES



Legend

- | | | |
|--------------------------------|----------------------------------|------------------------------------|
| Study Area (Source: CAD) | Ecological lands (22.27ha) | Asset Protection Zone (APZ) |
| Contour (Source: LIDAR) | Retained vegetation (4.84ha) | Inner Protection Area |
| Creek lines | Indicative fire trail (4m width) | Outer Protection Area |
| Hanging swamp (exclusion area) | Proposed roads | |

Aerial source: Nearmap



Disclaimer: 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.

PROJECT & MXD REFERENCE

Morgan Road, Belrose
18CR12_BF001

DATE & ISSUE NUMBER

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Issue 1

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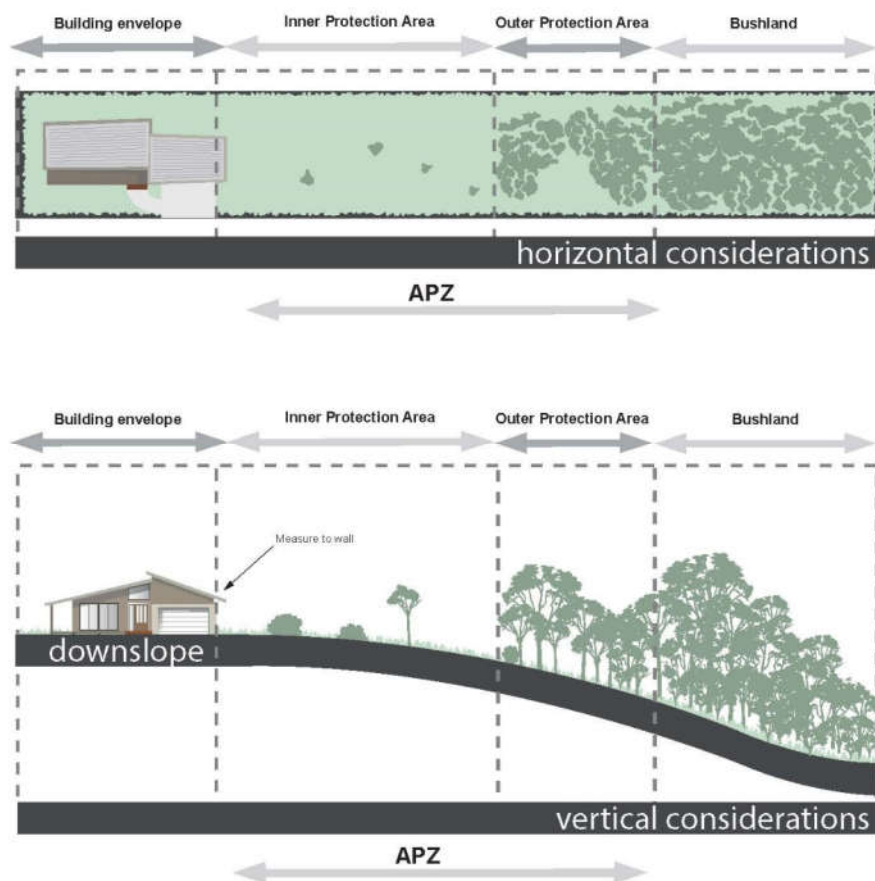


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APPENDIX 2. MANAGEMENT OF ASSET PROTECTION ZONES

The RFS provides basic advice in respect of managing APZs through documents such as, *Standards for Asset Protection Zones* (RFS, 2005), with landscaping to comply with Appendix 4 of *PBP*.

The APZ generally consists of two subordinate areas, an inner protection area (IPA) and an outer protection area (OPA). The OPA is closest to the bush and the IPA is closest to the dwellings. The property is to be managed to IPA standards only. A typical APZ is graphically represented below.



APZs and progressive reduction in fuel loads

(Source: PBP, 2019)

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

The following provides maintenance advice for vegetation within the IPA and OPA. The APZ is to be maintained in perpetuity and should be undertaken regularly, particularly in advance of the bushfire season.

Inner protection area (IPA)

Fuel loads within the IPA are to be maintained so it does not exceed 4t/ha.

Trees are to be maintained to ensure;

- canopy cover does not exceed 15% at maturity;
- trees (at maturity) do not touch or overhang the building;
- lower limbs should be removed up to a height of 2m above ground;
- tree canopies should be separated by 2 to 5m; and
- preference should be given to smooth barked and evergreen trees.

Shrubs are to be maintained to ensure;

- create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings;
- shrubs should not be located under trees;
- shrubs should not form more than 10% of ground cover; and
- clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of vegetation.

Grass is to be maintained to ensure:

- grass should be kept mown (as a guide grass should be kept to no more than 100mm in height); and
- leaves and vegetation debris should be removed (litter fuel within the IPA should be kept below 1cm)

Outer Protection Area (OPA)

Fuel loads within the OPA are to be maintained so it does not exceed 8t/ha.

Trees are to be maintained to ensure;

- Canopy cover does not exceed 30%
- Canopies should be separated by 2 to 5m

Shrubs are to be maintained to ensure;

- They do not form a continuous canopy
- Shrubs should be no more than 20% of ground cover

Grass is to be maintained to ensure:

- Grass should be kept mown to a height of less than 100mm: and
- Leaves and debris should be removed.

General advice for landscaping is provided below:

- Suitable impervious areas being provided immediately surrounding the building such as courtyards, paths and driveways;
- Restrict planting in the immediate vicinity of the building which may over time and if not properly maintained come into contact with the building;
- When considering landscape species consideration needs to be given to estimated size of the plant at maturity;
- Avoid species with rough fibrous bark, or which retain/shed bark in long strips or retain dead material in their canopies;
- Use smooth bark species of trees species which generally do not carry a fire up the bark into the crown;
- Avoid planting of deciduous species that may increase fuel at surface / ground level (i.e. leaf litter);
- Avoid climbing species to walls and pergolas;
- Locate combustible materials such as woodchips / mulch, flammable fuel stores away from the building;
- Locate combustible structures such as garden sheds, pergolas and materials such timber garden furniture way from the building; and
- Use of low flammability vegetation species.