



BUSH FIRE ASSESSMENT REPORT

Class 1a Development- Increased residential development

LOT 14, 155 Suzanne Road, Tallawang, NSW, 2852



Disclaimer

Please note that every effort has been made to ensure that information provided in this report is accurate. You should note however, that the information is for the client for the specific purpose for which it is supplied. This report is strictly limited to the purpose including the facts and matters stated within it and is not to be used, directly or indirectly, for any other application, purpose, use or matter.

Due consideration has been given to site conditions and to appropriate legislation and documentation available at the time of preparation of the report. As these elements are liable to change over time, the report should be considered current at the time of preparation only. Should further information become available regarding the conditions at the site, BEMC reserves the right to review the report in the context of the additional information. BEMC has made no allowance to update this report and has not considered events occurring after the time its assessment was conducted.

This report is not intended to be an exhaustive source of information and should not be seen to constitute legal advice. You should, where necessary, seek your own legal advice for any legal issues raised in your business affairs. You should never delay seeking legal advice, disregard legal advice, or commence or discontinue any legal action because of information in the report.

Bush fire and Environmental Management Consultancy (BEMC) Pty Ltd will not be liable in respect of any losses arising out of any event or events beyond our reasonable control. Samantha Jennings or Duncan Scott-Lawson or will not be liable in respect of any business losses, including without limitation loss of or damage, damage to profits, income, revenue, use, production, anticipated savings, business, contracts, commercial opportunities, or goodwill. Samantha Jennings or Duncan Scott-Lawson will not be liable to you in respect of any special, indirect, or consequential loss or damage.

If a Third Party uses or relies on the facts, content, opinions or subject matter contained in this report with or without the consent of BEMC Pty Ltd, BEMC Pty Ltd disclaims all risk from any loss, damage, claim or liability arising directly or indirectly, and incurred by any third party, from the use of or reliance on this report.

Apart from fair dealing for the purposes of private study, research, criticism, or review as permitted under the Copyright Act, no part of this report, its attachments or appendices may be reproduced by any process without the written consent of BEMC Pty Ltd. All enquiries should be directed to BEMC Pty Ltd.

Title	Bush Fire Assessment Report			
Description	New Dwelling Class 1a – 155 Suzanne Road, Tallawang, NSW			
Created By	Duncan Scott-Lawson [REDACTED] [REDACTED]			
Prepared For	Nicola Chatfield from Imagine Kit homes Client: Declan Boyce [REDACTED] [REDACTED]			
Version Number	Modified By	Modifications Made	Date Modified	Status
1	SJ	Draft	11/01/2022	Completed
2	DSL	Final		Completed

TABLE OF CONTENTS

1	Introduction	13
1.1	Description of proposed development	13
1.2	Objectives of Assessment	13
1.3	Specific Objectives of Residential Infill Developments	14
1.4	Method 2 assessment pathway	14
1.5	Bushfire Attack Level (BAL)	14
2	Bush Fire Strategic Study	17
3	Bush fire Hazard Assessment	18
3.1	Fire Danger Index	18
3.2	Assessment Methodology	18
3.3	Vegetation Assessment	18
3.3.1	Vegetation exclusions, and downgrades	18
3.3.2	Predominant Vegetation Classification	19
3.4	Separation Assessment	19
3.5	Slope Assessment	19
3.5.1	Effective and Site Slope Assessment	19
3.6	Shielding	20
3.7	Short Fire Run and Restricted Fire Head Growth	20
3.8	Flame Length	20
3.9	Other Method 2 inputs	21
4	Bush fire Assessment	30
4.1	Setbacks and Asset Protection Zones	30
4.2	Construction Standards	31
4.3	Access	31
4.4	Water Supply	33
4.5	Electricity services	34
4.6	Gas services	34
4.7	Landscaping and Vegetation Management	35
4.8	Emergency Management and Bush fire Survival Plans	35
5	Conclusion and Recommendations	36
	References	38
	APPENDIX 1 Site Layout Plans	40
	APPENDIX 2 Method 2 Outputs	41
	APPENDIX 3 Significant Bush fire Protection Measures	45

TABLES

Table 1 Planning for bush fire protection compliance (PBP 2019)	8
Table 2 Description of Proposed development	13
Table 3 Bush fire strategic study.....	17
Table 4 Bush fire Hazard Assessment (Method 2 AS3959:2018).....	27

FIGURES

Figure 1 Relationship between fire behaviour and BAL (WA Guidelines for Planning in Bushfire Prone Areas, 2017)	15
Figure 2 Site Location of 155 Suzanne Road, Tallawang, NSW (Mecone Mosaic, 2022).....	16
Figure 3 Vegetation in and around the site (Extract from the SEED Portal).....	19
Figure 4 Bush fire Assessment	28
Figure 5 Proposed Alternative access	29

PLATES

Plate 1 Access along Suzanne Road	21
Plate 2 Existing private property access	22
Plate 3 Property entrance from Suzanne Road (alternative access to be provided to the left).....	22
Plate 4 Existing Class 10 building	23
Plate 5 Effective slope of Transect 1.....	23
Plate 6 Site Slope of Transect 1.....	24
Plate 7 Effective and site slope of Transect 2	24
Plate 8 Effective and site slope of Transect 3	25
Plate 9 Effective slope of Transect 4.....	25
Plate 10 Site Slope of Transect 4.....	26

Abbreviations and Acronyms

APZ	Asset Protection Zone
AS/NZS 1221:1997	Australian Standard – Fire hose reels
AS1596-2014	Australian Standard – The storage and handling of LP Gas
AS2419-2017	Australian Standard – Fire hydrant installations
AS2441:2005	Australian Standard – Fire hose reels installation
AS3745:2010	Australian Standard – Planning for emergencies in facilities
BAL	Bush fire Attack Level
BCA	Building Code of Australia
BFAR	Bush Fire Assessment Report
BFSS	Bush Fire Strategic Study
BPA	Bush fire Prone Area (Also Bush fire Prone Land)
BPL Map	Bush fire Prone Land Map
BPMs	Bush fire Protection Measures
BV	Biodiversity Values
EP&A Act	<i>NSW Environmental Planning and Assessment Act 1979</i>
FFDI	Forest Fire Danger Index
GFDI	Grass Fire Danger Index
ha	Hectare
HOC	Heat Of Combustion
IPA	Inner Protection Area
kJ/kg	Kilo Joules per Kilo gram
LGA	Local Government Area
OPA	Outer Protection Area
PBP	Planning for Bush fire Protection
RF Act	<i>Rural Fires Act 1997</i>
RF Regs	<i>Rural Fires Regulations 2013</i>
RHG	Restricted Head Growth
SEED	Sharing and Enabling Environmental Data in NSW
SFR	Short Fire Run

Executive Summary

BEMC Pty Ltd was engaged by Nicola Chatfield from Imagine Kit Homes on behalf of client Declan Boyce to complete a Bush Fire Assessment Report (BFAR) utilising Method 2 assessment pathway from AS3959:2018 or Method 1 assessment pathway from PBP 2019 on the proposed Class 1a residential development at 155 Suzanne Road, Tallawang, NSW.

This report considers and assesses the bush fire construction and planning requirements to determine compliance with the performance criteria in NSW Rural Fire Service Planning for Bush fire Protection 2019 (PBP 2019). This report applies the methodology in Appendix 1 and provides the required information in consideration of A2.2 of PBP 2019.

The identification of bush fire prone lands (BPL Map) in NSW is required under section 10.3 of the *Environment Planning and Assessment Act 1979* (EP&A Act). Section 4.14 of the EP&A Act requires developments to comply with NSW Rural Fire Service, *Planning for Bush fire Protection* (PBP 2019) if any part of a development site is affected by a bush fire hazard as indicated within the BPL Map.

This development falls within the Bush fire Vegetation Buffer zone on the Mid-Western Regional Council bush fire prone land map which triggers development assessment provisions under 4.14 EP&A Act and compliance with PBP 2019. The consent authority can consult with the RFS under section 4.15 for development in bush fire prone lands.

The proposed development is classified as building Class 1 in accordance with Building Code of Australia (BCA). The EP&A Regulation requires a Certifying Authority, prior to issuing a construction certificate or complying development certificate, to be satisfied that the relevant requirements of the BCA will be met. The BCA calls-up *AS3959:2018 Construction of buildings in bush fire prone land* (AS3959:2018). Residential buildings classified as Class 1 located on bush fire prone land, must comply with the BCA and the construction requirements in PBP 2019.

To determine the planning and construction requirements a site assessment in accordance with Appendix 1 of PBP 2019 has been performed in January 2021 to determine the appropriate bush fire threat level, design, planning and construction standards required to comply with PBP 2019.

In summary, based upon this assessment of the plans and site visit it is recommended that development consent be granted subject to the following conditions to comply with PBP 2019:

Asset Protection Zones and Landscaping

The APZ is currently maintained to APZ standards.

At the commencement of building works and in perpetuity, the area identified as an APZ in Figure 4 of this report shall be managed as an Inner Protection Area (IPA) as outlined within Appendix 4 of Planning for Bush fire Protection 2019, and NSW Rural Fire Service 'Standards for Asset Protection Zones'.

The consent authority ensures the APZ is implemented in consideration of APZ and landscaping requirements outlined in PBP 2019 prior to issuing occupancy certificate.

If overhead power supply is provided, the consent authority shall determine vegetation management in accordance with Energy Australia 'Vegetation Safety Clearances' (NS179, April 2002).

Construction Standards

The radiant heat exposure from all directions creates a bush fire threat to the development. A BAL 29 construction level is required to all elevations.

Access

The following provision shall be met:

- Vehicle access provided within 4m of static water supply that shall be within 70m of the furthest elevation of the building.
- Adequate turn-a-round shall be provided associated with the class 1a building and static water supply.
- Curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress along the access road.
- The minimum distance between inner and outer curves of the access road is 6m.
- The crossfall is not more than 10° along the access road.
- Maximum grades for sealed roads do not exceed 15° and not more than 10° for unsealed roads.

Water Supply

20,000Lt static water supply is provided for firefighting purposes in areas where reticulated water is not available need to meet the following specifications:

- A connection for firefighting purposes is located within the IPA or non-hazard side and away from the structure; 65mm Storz outlet with a ball valve is fitted to the outlet,
- Ball valve and pipes are adequate for water flow and are metal,
- Supply pipes from tank to ball valve have the same bore size to ensure flow volume,
- Underground tanks have an access hole of 200mm to allow tankers to refill direct from the tank,
- A hardened ground surface for truck access is supplied within 4m,
- Above-ground tanks are manufactured from concrete or metal,
- Raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber (see Appendix F AS 3959),
- Unobstructed access can always be provided,
- Underground tanks are clearly marked,
- Tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters,
- All exposed water pipes external to the building are metal, including any fittings,
- Where pumps are provided, they are a minimum 5hp or 3kW petrol or diesel-powered pump, and are shielded against bush fire attack; any hose and reel for firefighting connected to the pump shall be 19mm (internal diameter), and
- Where Fire hose reels are provided, Fire hose reels are constructed in accordance with AS/NZS 1221:1997 Fire hose reels and installed in accordance with AS 2441:2005 Installation of fire hose reels.

Electricity services

Where possible electricity should be placed underground.

Gas services

If gas services are provided to the development, prior to issuing occupation certificate the consent authority shall ensure the location and design of gas services meets the requirements of Table 7.4a of BP2019.

Emergency management

It is recommended that the property owner and occupants familiarise themselves with relevant bush fire planning, protection, preparation and survival information and consider implementation of the 'NSW RFS

*Best Practise Guidelines – Dwelling upgrades’ for the upgrade of existing buildings to ensure compliance with the intent of the *Planning for Bush fire Protection (2019)* and *AS3959 – 2018 Construction of buildings in Bush fire Prone Areas*.*

Finally, the implementation of the adopted measures and recommendations forwarded within this report comply with *Planning for Bush fire Protection (2019)* and will contribute to the amelioration of the potential impact of any bush fire upon the development, but they do not and cannot guarantee that the area will not be affected by bush fire at some time.

Table 1 Planning for bush fire protection compliance (PBP 2019)
Chapter 7 - Infill developments on bush fire prone lands

PERFORMANCE CRITERIA		ACCEPTABLE SOLUTION	COMPLIANCE
APZs	APZs are provided commensurate with the construction of the building and defendable space is provided	<ul style="list-style-type: none"> An APZ is provided in accordance with Tables A1.12.2 or A1.12.4 in Appendix 1 of PBP 2019. 	Performance Solution – Refer to section 4.2
	APZs are managed and maintained to prevent the spread of a fire towards the building	<ul style="list-style-type: none"> APZs are managed in accordance with the requirements of ‘Asset protection zone standards’ of Appendix 4 of PBP 2019. 	Acceptable Solution – Refer to section 4.2
	The APZ is provided in perpetuity APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised.	<ul style="list-style-type: none"> APZs are wholly within the boundaries of the development site APZ are located on lands with a slope less than 18 degrees 	Acceptable Solution – Refer to section 4.2
CONSTRUCTION STANDARDS	The proposed building can withstand bush fire attack in the form of embers, radiant heat and flame contact	<ul style="list-style-type: none"> BAL is determined in accordance with tables A1.12.5 to A1.12.7 Construction provided in accordance with the Building Code of Australia and as modified by table 7.5. 	Performance Solution – Refer to section 4.3
	Proposed fences and gates are designed to minimise the spread of bush fire	<ul style="list-style-type: none"> Fencing and gates are constructed in accordance with section 7.6. 	Acceptable Solution – Refer to section 4.3
	Proposed Class 10a buildings are designed to minimise the spread of bush fire.	<ul style="list-style-type: none"> Class 10a buildings are constructed in accordance with section 8.3.2 	Acceptable Solution – Refer to section 4.3
ELECTRICITY	Location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings.	<ul style="list-style-type: none"> Where practicable, electrical transmission lines are underground; and Where overhead, electrical transmission lines are proposed as follows: <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 accordance with the specifications in ISSC3 Guideline for Managing Vegetation Near Power Lines. 	Solution – Refer to section 4.6

GAS	Location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.	<ul style="list-style-type: none"> • Reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 and the requirements of relevant authorities, and metal piping is used. • All fixed gas cylinders are kept clear of all flammable materials to 10m and shielded on the hazard side. • Connections to and from gas cylinders are metal. • Polymer-sheathed flexible gas supply lines are not used; and • Above-ground gas service pipes are metal, including and up to any outlets 	Made condition of consent – Refer to section 4.7
LANDSCAPING	Landscaping is designed and managed to minimise flame contact and radiant heat to buildings, and the potential for wind-driven embers to cause ignitions	<ul style="list-style-type: none"> • Compliance with the NSW RFS ‘Asset Protection Zone standards’ (see Appendix 4 of PBP 2019). • A clear area of low-cut lawn or pavement is maintained adjacent to the house • Fencing is constructed in accordance with Section 7.6 • Trees and shrubs are planted such that: <ul style="list-style-type: none"> • the branches will not overhang the roof • the tree canopy is not continuous • any proposed windbreak is located on the elevation from which fires are likely to approach 	Made condition of consent – Refer to section 4.8
ACCESS	Firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation	<ul style="list-style-type: none"> • Property access roads are two-wheel drive, all weather roads 	Acceptable Solution – Refer to section 4.4
	The capacity of access roads is adequate for firefighting vehicles	<ul style="list-style-type: none"> • The capacity of road surfaces and any bridges/ causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges and causeways are to clearly indicate load rating. 	Acceptable Solution – Refer to section 4.4
	There is appropriate access to water supply	<ul style="list-style-type: none"> • Hydrants are provided in accordance with AS2419.1:2005; and • There is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available 	Made condition of consent – Refer to section 4.4

ACCESS REQUIREMENTS	<p>Firefighting vehicles can access the dwelling and exit safely</p>	<ul style="list-style-type: none"> • At least one alternative property access road is provided for individual dwellings or groups of dwellings that are located more than 200m from a public road. • There are no specific access requirements apply in areas where firefighting can occur directly from the hydrant in accordance with AS 2419. In circumstances where this cannot occur, the following requirements apply: <ul style="list-style-type: none"> • Minimum carriageway width of 4m; • In forest, woodland and heath situations, rural property roads have passing bays every 200m that are 20m long by 2m wide, making a minimum trafficable width of 6m, at the passing bay • A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, and • Property access must provide a suitable turning area in accordance with Appendix 3, and • Curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress • The minimum distance between inner and outer curves is 6m, and • The crossfall is not more than 10°, and • Maximum grades for sealed roads do not exceed 15° and not more than 10° for unsealed roads, and • A development comprising more than three dwellings has formalised access by dedication of a road and not by right of way. <p><i>Note: Some short constrictions in the access may be accepted where they are not less than the minimum (3.5m), 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.</i></p>	<p>Made condition of consent – Refer to section 4.4</p>
---------------------	--	---	--

WATER SUPPLIES	A water supply is provided for firefighting purposes	<ul style="list-style-type: none"> • Reticulated water is to be provided to the development, where available a static water supply is provided where no reticulated water is available 	Static Water supplied N/A – Refer to section 4.5
	A water supplies are located at regular intervals the water supply is accessible and reliable for firefighting operations	<ul style="list-style-type: none"> • Fire hydrant spacing, design and sizing comply with the Australian Standard AS 2419.1:2005, and • Hydrants are not located within any road carriageway, and • Reticulated water supply to urban subdivisions uses a ring main system for areas with perimeter road 	Static Water supplied N/A – Refer to section 4.5
	Flows and pressure are appropriate	<ul style="list-style-type: none"> • Fire hydrant flows and pressures comply with Table 2.2 of AS 2419.1:2005 	Static Water supplied N/A
	The integrity of the water supply is maintained	<ul style="list-style-type: none"> • All above-ground water service pipes external to the building are metal, including and up to any taps 	Made condition of consent – Refer to section 4.5
	A static water supply is provided for firefighting purposes in areas where reticulated water is not available	<ul style="list-style-type: none"> • Where no reticulated water supply is available water for firefighting purposes is provided in accordance with table 5.3d, and • A connection for firefighting purposes is located within the IPA or non-hazard side and away from the structure; 65mm Storz outlet with a ball valve is fitted to the outlet, and • Ball valve and pipes are adequate for water flow and are metal, and • Supply pipes from tank to ball valve have the same bore size to ensure flow volume, and • Underground tanks have an access hole of 200mm to allow tankers to refill direct from the tank, and • A hardened ground surface for truck access is supplied within 4m, and • Above-ground tanks are manufactured from concrete or metal, and • Raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber (see Appendix F AS 3959), and • Unobstructed access can be provided at all times, and • Underground tanks are clearly marked, and • Tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters, and • All exposed water pipes external to the building are metal, including any fittings, and 	Made condition of consent – Refer to section 4.5

		<ul style="list-style-type: none">• Where pumps are provided, they are a minimum 5hp or 3kW petrol or diesel-powered pump, and are shielded against bush fire attack; any hose and reel for firefighting connected to the pump shall be 19mm (internal diameter), and• Fire hose reels are constructed in accordance with AS/NZS 1221:1997 Fire hose reels, and installed in accordance with AS 2441:2005 Installation of fire hose reels	
--	--	--	--

BUSH FIRE CERTIFICATION

The report has been endorsed by Duncan Scott-Lawson, BPAD level 3 certifier BPAD 47789. I certify that the proposed development design conforms to the relevant specifications and requirements of PBP 2019 and AS 3959-2018 detailed in Section 4.14 (1) (b) of the *Environmental Planning and Assessment Act (1979)*.

1 INTRODUCTION

BEMC Pty Ltd was engaged by Nicola Chatfield from Imagine Kit Homes on behalf of client Declan Boyce to complete a Bush Fire Assessment Report (BFAR) on the proposed development located at 155 Suzanne Road, Tallawang, NSW, hereafter referred to as the site (**Figure 1**).

To determine the planning and construction requirements a site assessment in accordance with Appendix 1 of PBP 2019 has been performed in January 2022 to determine the appropriate bush fire threat level, design, planning and construction standards required to comply with PBP 2019.

Site Particulars are illustrated within **Figure 1**.

1.1 DESCRIPTION OF PROPOSED DEVELOPMENT

Table 2 Description of Proposed development

Boundaries	Grasslands and forested vegetation in all directions. Suzanne Road south of the development.
Topography	Level in all directions.
Type of development	Class 1a – Residential Development.
Roof construction	TBA
External wall construction	TBA
Landscaping plan provided	No
Bush fire Prone Land	Yes – Mid Western Regional Council – FFDI – 80

The proposed location of the development is provided in **Figure 1** with further development details provided in **Appendix 1**.

1.2 OBJECTIVES OF ASSESSMENT

To assess the proposed development in consideration of s4.14 of the EP&A Act 1979, PBP 2019 and AS 3959:2018 to enable council to make a determination.

This report assesses whether the development meets the six objectives listed in section 1.1 of PBP 2019, which provide for the protection of human life and minimize impacts on property.

- Afford buildings and their occupants protection from exposure to a bush fire.
- Provide for a defendable space to be located around buildings.
- Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings.
- Ensure appropriate operation access and egress for emergency services personnel and residents is available.
- Provide for ongoing management and maintenance of Bush fire Protection Measures (BPMs); and
- Ensure the utility services are adequate to meet the needs of firefighters.

1.3 SPECIFIC OBJECTIVES OF RESIDENTIAL INFILL DEVELOPMENTS

The aims and objectives listed in section 1.1 of PBP 2019 remain applicable to residential infill development, however further consideration has been given to these types of developments to ensure BPMs are fully incorporated at the design stage of the development. The specific objectives of residential infill developments outlined in section 7.3 of PBP 2019 are:

- Provide a defensible space to enable unimpeded access for firefighting around the building.
- Provide better bush fire outcomes on a redevelopment site than currently exists, commensurate with the scale of works proposed.
- Design and construct buildings commensurate with the bush fire risk.
- Provide access, services, and landscaping to aid firefighting operations.
- Not impose an increased bush fire management and maintenance responsibility on adjoining landowners.
- Increase the level of bush fire protection to existing dwellings based on the scale of the proposed work and level of potential risk.

1.4 METHOD 2 ASSESSMENT PATHWAY

The design fire methodology outline in Appendix B of AS3959:2018 Detailed BAL Assessment provides the mathematical methodology and accepted inputs that the simplified BAL assessment Method 1 matrix was derived. Method 2 fire design model consists of accurately determining input into nested calculations within the modelling that provide increased accuracy in determining radiant heat flux and flame length.

Furthermore, Method 2 can consider the impact of Kataburn rate of spread, radiant heat shielding, and short fire runs will have on the radiant heat exposure of a proposed development.

Understanding the knowledge gaps for bush fire prediction is required to enable accurate interpretation of bush fire modelling and fire engineering calculations used through the detailed assessment (Method 2). The gaps in knowledge include:

- Duration of the initial fire growth phase.
- Fire spread on slopes, in complex terrain and extreme condition.
- Fire spread around the entire perimeter.
- Short-distance (wind-driven) spotting.
- Characteristics of flames in different fuel types.

When interpreting the results of the detailed method, each of these elements are considered when determining the effect on the outputs for the calculations.

1.5 BUSHFIRE ATTACK LEVEL (BAL)

Bushfire Attack Level (BAL) ratings refer to the fire intensity your house is likely to be subjected to in a bushfire, expressed in terms of radiant heat. The BAL assessment forms the construction component of the bushfire assessment process. The other component is the Bushfire planning, which includes Asset Protection Zones (APZ), separation to provide defensible spaces, access, water, electricity, gas, landscaping and emergency management.

Most people expect direct flame attack to be the biggest risk to homes in a bushfire, but generally this is not the case. Greater than 80% of house loss due to bushfire occurs as a result of ember attack; the burning firebrands of leaves and twigs that erratic winds drive kilometres away from the main fire front. They find weaknesses in houses such as gaps, cracks and combustible construction materials and can quickly lead to ignition of the building.

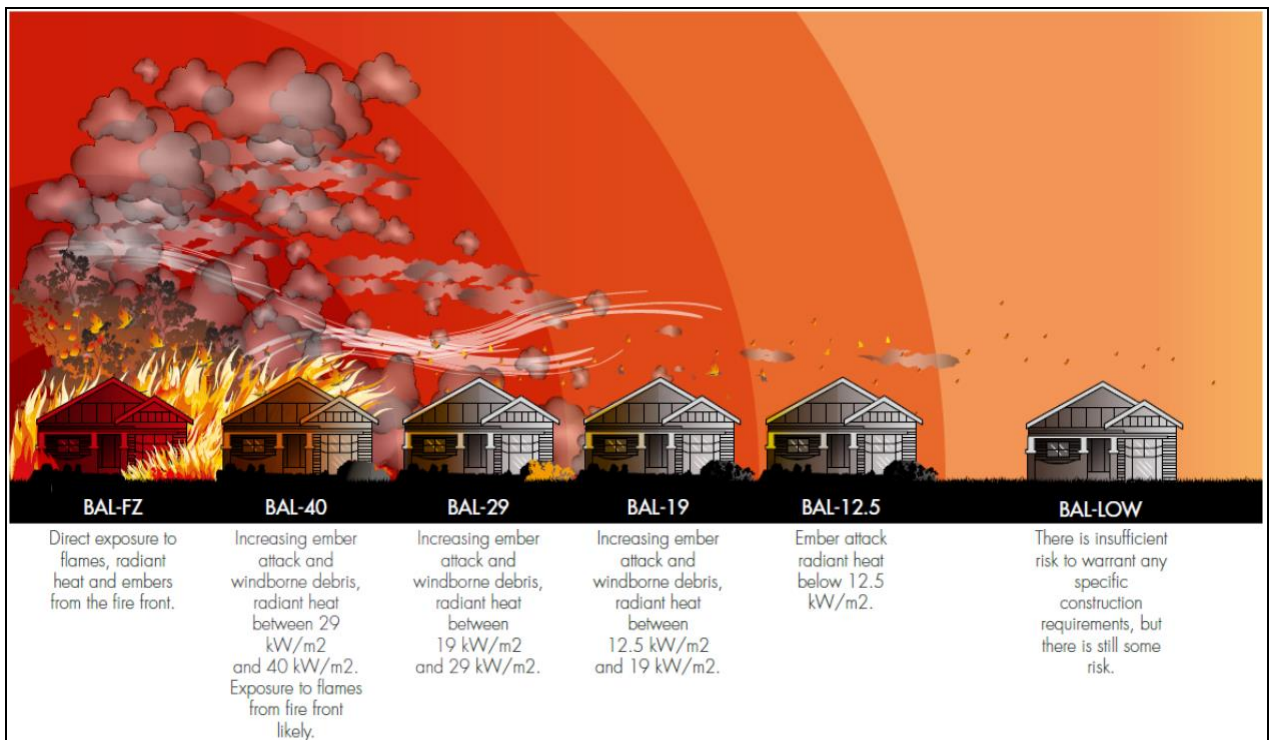


Figure 1 Relationship between fire behaviour and BAL (WA Guidelines for Planning in Bushfire Prone Areas, 2017)

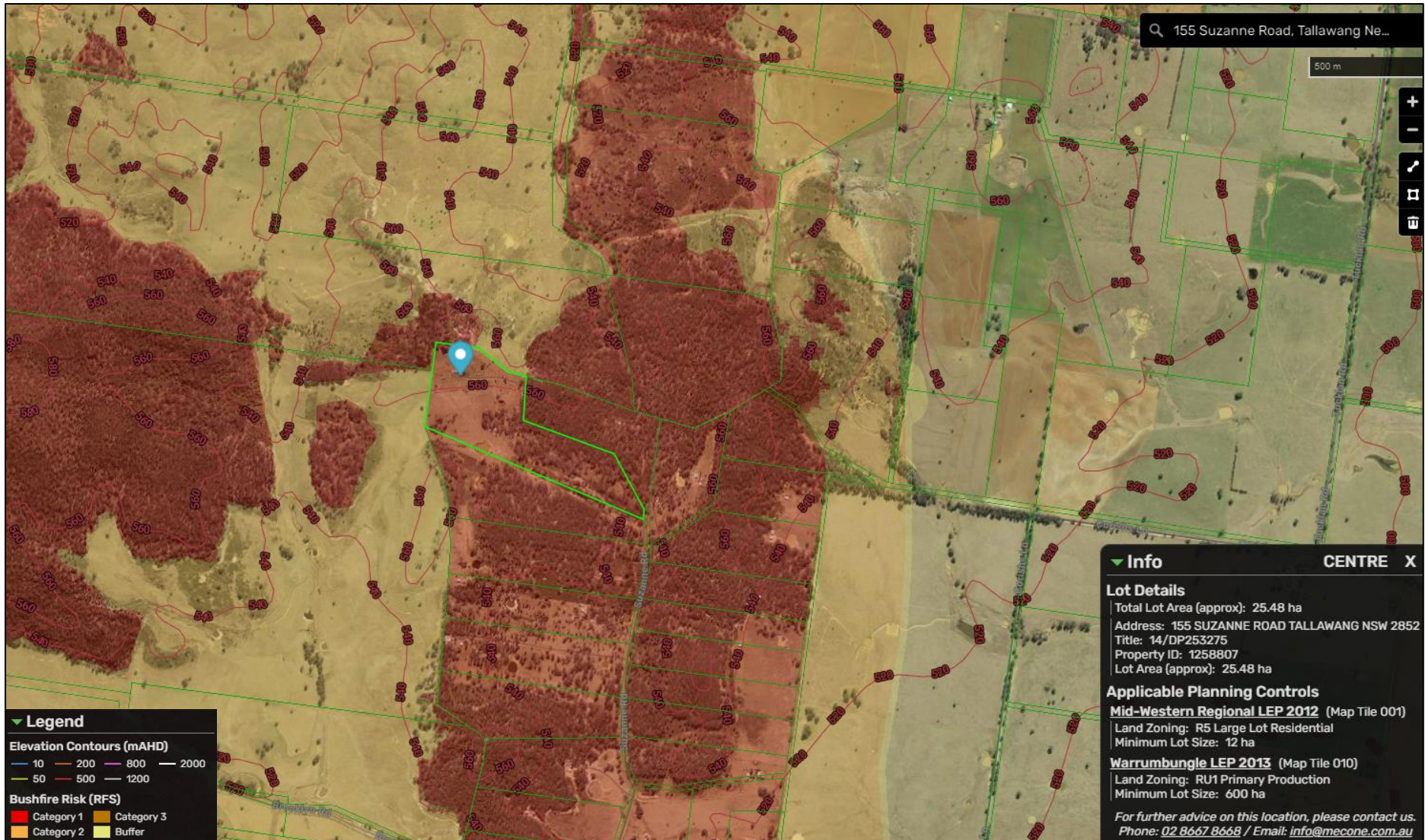


Figure 2 Site Location of 155 Suzanne Road, Tallawang, NSW (Mecone Mosaic, 2022)

2 BUSH FIRE STRATEGIC STUDY

A Bush Fire Strategic Study (BFSS) has been prepared to inform the context of the assessment of the Bush Fire Assessment Report (BFAR). The level of information gathered and analysis within the BFSS depends upon the nature of development, scale of the proposal, the bush fire risk, and potential impact on the wider community and emergency management arrangements. This process provides an opportunity to assess if a proposed development is appropriate in the bush fire hazard context.

Table 3 Bush fire strategic study

Adjoining land	The proposed development and changing land use do not impact on the ability of adjoining landowners to implement Bush fire Protection Measures.
Surrounding infrastructure	The proposed development does not significantly impact on the pressures or flows of existing water supplies and does not impact on high voltage power supplies or natural gas lines.
Access and egress	The capacity of the existing road network will not be significantly affected by the proposed development during a bush fire event. The proposed development is not isolated in the event of a bush fire.
Emergency services	The proposed development does not significantly impact on the ability of emergency service to plan, prepare, respond, or recover prior, during or after a bush fire event.
Land use assessment	The proposed development is a permitted use. The development is located within the north-western portion of the lot. The bush fire hazard is located in all directions of the proposed development.
Bush fire landscape assessment	The bush fire hazards around the site are forested vegetation to the west and east with grasslands throughout. The potential fire behaviour and fire runs from the north-west will generate the greatest threat to the development. Ember attack and radiant heat are the principal bush fire attack mechanism on this development.

This Bush Fire Strategic Study identifies that the proposed development meets the broad aims and objectives and the specific objectives of residential infill developments of PBP 2019. The proposed development provides occupants the ability to shelter from a bush fire event, provides separation between the bush fire threat and building, will not significantly increase the spread of fire or limit the ability of emergency services ingress while occupants are looking to evacuate.

3 BUSH FIRE HAZARD ASSESSMENT

This section details the site assessment methodology in Appendix 1 of PBP2019. It provides a detailed analysis of the vegetation, slope, exclusions, vegetation downgrades and shielding elements to provide the required Bush fire Protection Measures.

3.1 FIRE DANGER INDEX

Method 2 assessment considers the worst-case scenario for bush fire impacts and calculates fire behaviour determined from specific inputs. This assessment utilises Mid-Western Regional Council area with a FFDI 800.

3.2 ASSESSMENT METHODOLOGY

The assessment of the vegetation, slope and other bush fire characteristics within and surrounding the site has been carried out with the aid of the follows:

- Nearmap and sixmap aerial Photograph Interpretation.
- Kogan 6*25 Laser distance finder.
- Photo Theodolite application supported by contour and terrain profiles.
- SEED Portal - Sharing and Enabling NSW Environmental Data portal.
- Reference to regional vegetation community mapping, and
- Site assessment in January 2022.

Plates 1 – 10 depict the elements in and around the site that are considered within the bush fire hazard assessment. The classified vegetation, separations, effective and site slope, short fire run and shielding are identified in **Table 4** and displayed in **Figure 4**.

3.3 VEGETATION ASSESSMENT

In accordance with PBP 2019, an assessment of the vegetation over 140m in all directions from the building was undertaken.

Vegetation that may be considered a bush fire hazard was identified and classification based on available fuel loads for sub-formations are provided through vegetation fuel monitoring project administered by the University of Wollongong, University of Melbourne and CSIRO Ecosystems Science and Bush fire Dynamics and Applications. The results of this research are commonly referred to as the '*NSW Comprehensive Fuel Loads*'.

SEED Portal - Sharing and Enabling NSW Environmental Data portal and regional vegetation community mapping has been analysed to determine the vegetation in and around the development which is illustrated in **Figure 3**. The forested vegetation surrounding the development is classified as Red Ironbark - Black Cypress Pine - stringybark Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region; southern Brigalow Belt South Bioregion which equates to Western Slopes Dry Sclerophyll Forests Keith class. The derived grassland of the NSW Southwestern Slopes is classified as Western Slopes Grasslands Keith class.

3.3.1 Vegetation exclusions, and downgrades

An analysis of the vegetation in and around the site has determined no vegetation exclusions or down grade are included in this assessment.

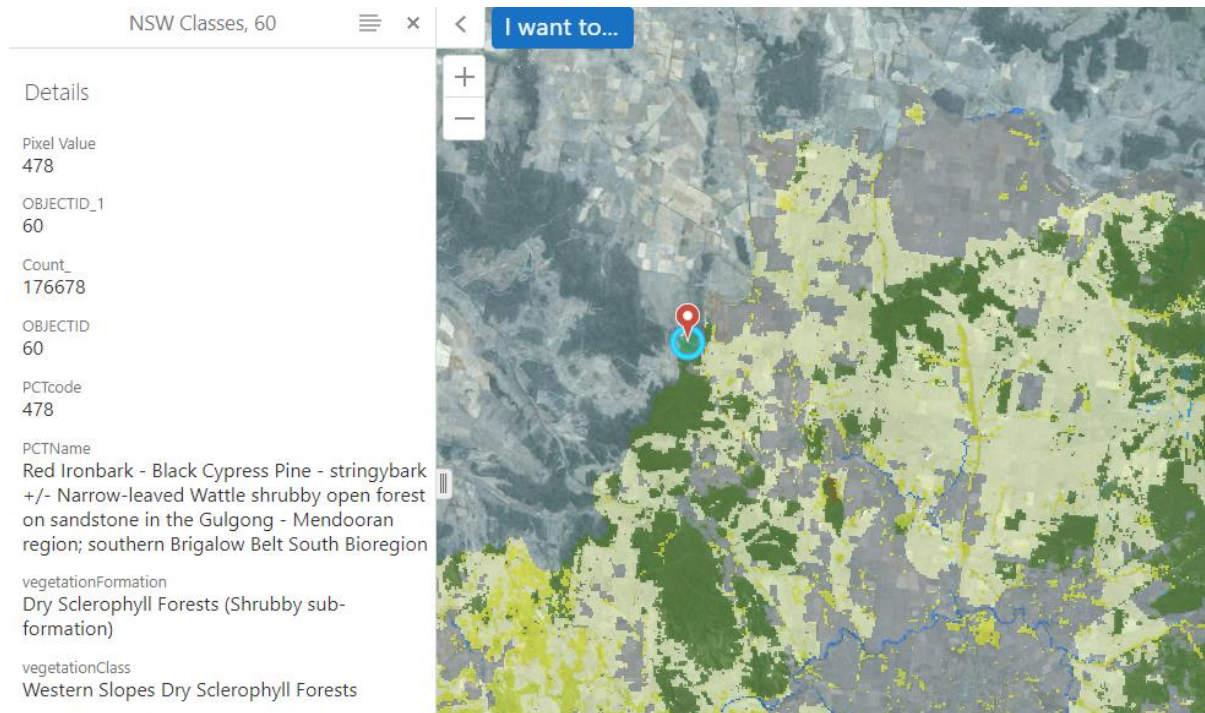


Figure 3 Vegetation in and around the site (Extract from the SEED Portal)

3.3.2 Predominant Vegetation Classification

Vegetation in and around the site is classified as *Western Slopes Dry Sclerophyll* and *Western Slopes Grasslands* in accordance with the 'NSW Comprehensive Fuel Loads'.

3.4 SEPARATION ASSESSMENT

The separation between the proposed building envelope and the classifiable vegetation that creates bush fire threat one of the significant BPMs to reduce the risk of bush fire impacting on the development. The land within the separation must conform to the standards of an Asset Protection Zones to be accepted within the separation areas.

The separations between the classifiable vegetation and building are provided in **Table 4**.

3.5 SLOPE ASSESSMENT

This section details the site assessment methodology in Appendix 1 of PBP2019 to assess the effective slope (under classified vegetation) and site slope (slope between the vegetation and proposed development) within the 100m of the proposed building envelope.

The effective and site slopes used within this assessment are provided in **Table 4**.

3.5.1 Effective and Site Slope Assessment

The slope of the land under the classified vegetation has a direct influence on the rate of fire spread, the intensity of the fire and the ultimate level of radiant heat flux.

The effective slope is the slope of the ground under the hazard (vegetation). The slope between the vegetation and the proposed building envelope is the site slope. When identifying the effective and site slopes, it may be found that there are a variety of slopes covering different distances. The effective slope is

the slope under the vegetation which will most significantly influence the bush fire behaviour for each aspect.

The topography of the site and surrounds has been assessed to identify the maximum slope present under the classified vegetation (hazard). These values help determine the vegetation that possess bush fire threat and significantly influence fire behaviour.

3.6 SHIELDING

Where an elevation is shielded from direct radiant heat arising from bush fire attack, then the construction requirements for that elevation can be reduced to the next lower BAL. An elevation is deemed to be not exposed to the source of bush fire attack if all the straight lines between that elevation and the source of bush fire attack are obstructed by another part of the building.

The shielding of an elevation shall apply to all the elements of the wall but shall not apply to subfloors or roofs. The construction requirements for a shielded elevation shall be not less than that required for BAL-12.5 unless the building has been assessed as being BAL-LOW. The reduced construction requirements do not apply where any elevation is BAL-FZ.

3.7 SHORT FIRE RUN AND RESTRICTED FIRE HEAD GROWTH

An analysis of the size and shape of the classifiable vegetation in and around the site has determined no Short Fire Run (SFR) or Restricted Head Growth (RHG) considerations within this assessment.

3.8 FLAME LENGTH

Weise and Biging (1996) research Byram's original equation relating fireline intensity to flame length overestimated flame length.

The 'trench effect' arises because of the geometry affects the flames and hot plume attaching to the bottom surface Drysdale et al. (1992). Edgar *et al.* (2015) reported the flame and hot plume flow characteristics depended on the inclination, with the hot plume separating from the surface at 10 and 20 degrees, although a distinctly laminar structure developed, and the hot plume attached to the surface at 30 degrees which gave rise to hotter and faster moving fire. Grumstrup *et al.* (2017), Drysdale and Macmillan (1992) and Wu *et al.* (2000) illustrate the plume commences a pronounced lean when slopes exceed 15° angle and ground attachment commences although detachment quickly from the surface.

Edgar *et al.* (2015) research supports Dold and Zinoviev (2009); Wu *et al.* (2000) of a threshold angle of inclination that demarcates the separation between turbulent and laminar flow regime that predominantly determine flame attachment to the ground. This threshold angle is around 24 to 26 degrees. Edgar *et al.* (2015b) reports the laminar flow, once established, was more stable within tunnels of greater inclination, indicating disruption of the laminar flow could be achieved at 20 degrees, although did not impact the laminar flow at 30 degrees. Edgar *et al.* (2016) illustrates the attachment of the plume for tunnel inclinations above 24° was associated with the development of a pressure deficit in the region immediately upslope of the heat source supporting the theory that the mechanism for flame attachment of the plume arises due to an imbalance between the upslope and downslope entrainment of air into the plume heat source and is independent of the convective intensity of the plume. Edgar *et al.* (2016) reported distinctly different plume behaviour depending on whether the trench was inclined above or below the critical angle of 24°.

The contemporary research illustrates flame length ground attachment is not possible at slopes below horizontal and below 15 degrees and is not considered further within this assessment.

3.9 OTHER METHOD 2 INPUTS

Heat of Combustion

Heat of Combustion (HoC) is an important characteristic in the simulation of wildfires. It is frequently used in the assessment of fuel flammability and a key input to calculate fire-line intensity which provides for flame length calculations. Despite the variability of natural fuels HoC is considered a constant. Research since the development of the method 2 calculations illustrate that fuel moisture content has a significant impact on HoC and argue that lowering the current default heat of combustion of 18600 kJ/kg in forest fire behaviour models.

Flame Emissivity

AS3959:2018 indicates a nominal flame emissivity of 0.95 is justified as the bush fire flames under design fire weather scenarios are generally optically thick ($\epsilon \approx 1$). The predicted flame emissive power is extremely sensitive to flame temperature. The selection of the nominal flame temperature for calculation is critical to make sure that the construction standard determined with this flame temperature together with other input parameters can provide an adequate bush fire construction level.

Moisture Factor

Fuel moisture factor is only used in Marsden–Smedley and Catchpole (1995) fire model for Tussock Moorland and is default to 5. This input has no effect on fire modelling calculations in other vegetation.

Ambient temperature and Relative Humidity

The default value for ambient air temperature during worst-case scenario fire weather conditions defaults to 35°, converted to Kelvin is 308K. The default value for Relative Humidity is 25%. Worst case scenario fire weather conditions in NSW are generally from the North-west which have high temperatures and low relative humidity. For bush fire threats a from directions other than the north, north-west, and west the ambient temperature and relative humidity can significantly change, especially in coast environments.



Plate 1 Access along Suzanne Road



Plate 2 Existing private property access



Plate 3 Property entrance from Suzanne Road (alternative access to be provided to the left)



Plate 4 Existing Class 10 building



Plate 5 Effective slope of Transect 1



Plate 6 Site Slope of Transect 1



Plate 7 Effective and site slope of Transect 2



Plate 8 Effective and site slope of Transect 3



Plate 9 Effective slope of Transect 4



Plate 10 Site Slope of Transect 4

Table 4 Bush fire Hazard Assessment (Method 2 AS3959:2018)

Elements	Method (unit)	Transect 1	Transect 2	Transect 3	Transect 4
Vegetation	NSW Comprehensive Fuel Loads	Western slopes DSF	Western slopes Grasslands	Western slopes Grasslands	Western slopes Grasslands
Provided separation	Site -Laser finder (m)	16m	16m	16m	16m
Effective slope	Site visit – Theodolite (°)	1 deg up	11 deg down	11 deg down	2 deg down
Site slope	Site visit – Theodolite (°)	4 deg up	11 deg down	11 deg down	1 deg down
Shielding width	Site Plans / Site Visit (m)	N/A	N/A	N/A	N/A
Shielding height	Site Plans / Site Visit (m)	N/A	N/A	N/A	N/A
Elevation of receiver	Site Plans (m)	2.4	2.4	2.4	2.4
Flame temperature	1090 / 1200 Kelvin	1090	1090	1090	1090
Upslope fire	Kataburn correction	Yes	No	No	No
Fire Danger Index (FFDI)	Council Area	80	80	80	80
Heat of Combustion (HoC)	Default at 18600 kJ/kg	18600	18600	18600	18600
Flame emissivity	Default at 0.95	0.95	0.95	0.95	0.95
Moisture factor	Default at 5	5	5	5	5
Ambient temperature	BoM (Default at 308 Kelvin)	308	308	308	308
Relative Humidity (RH)	BoM (Default at 25%)	25	25	25	25
Short Fire Run (SFR)	Bush Fire Safety Study	N/A	N/A	N/A	N/A
Restricted Head Growth (RHG)	Bush Fire Safety Study	N/A	N/A	N/A	N/A
SFR / RHG Fire Modelling	Vesta / McArthur	N/A	N/A	N/A	N/A
OUTPUTS (Appendix 2)					
	Separation to Achieve BAL29	12 - < 18m	11 - < 16m	11 - < 16m	9 - < 13m
	Separation to Achieve BAL19	18 - < 25m	16 - < 24m	16 - < 24m	13 - < 19m
	Separation to Achieve BAL12.5	25 - < 100m	24 - < 100m	24 - < 100m	19 - < 100m
	Bush fire Attack Level (BAL)	BAL 29	BAL 19	BAL 19	BAL 19

Figure 4 Bushfire Assessment

-  Vehicle Water
-  Separation
-  Transect
-  Category 1 Access
-  Proposed Alternative access
-  10m Contours
-  Proposed Class 1a Development
-  140m Assessment Area
-  Minimum 15m APZ for BAL 29
-  Existing class 10 building
-  Lot Boundary
-  Western Slopes Grassland
-  Western Slopes DSF
-  APZ to achieve BAL 29

SixMap Imagery



0 50 100 m

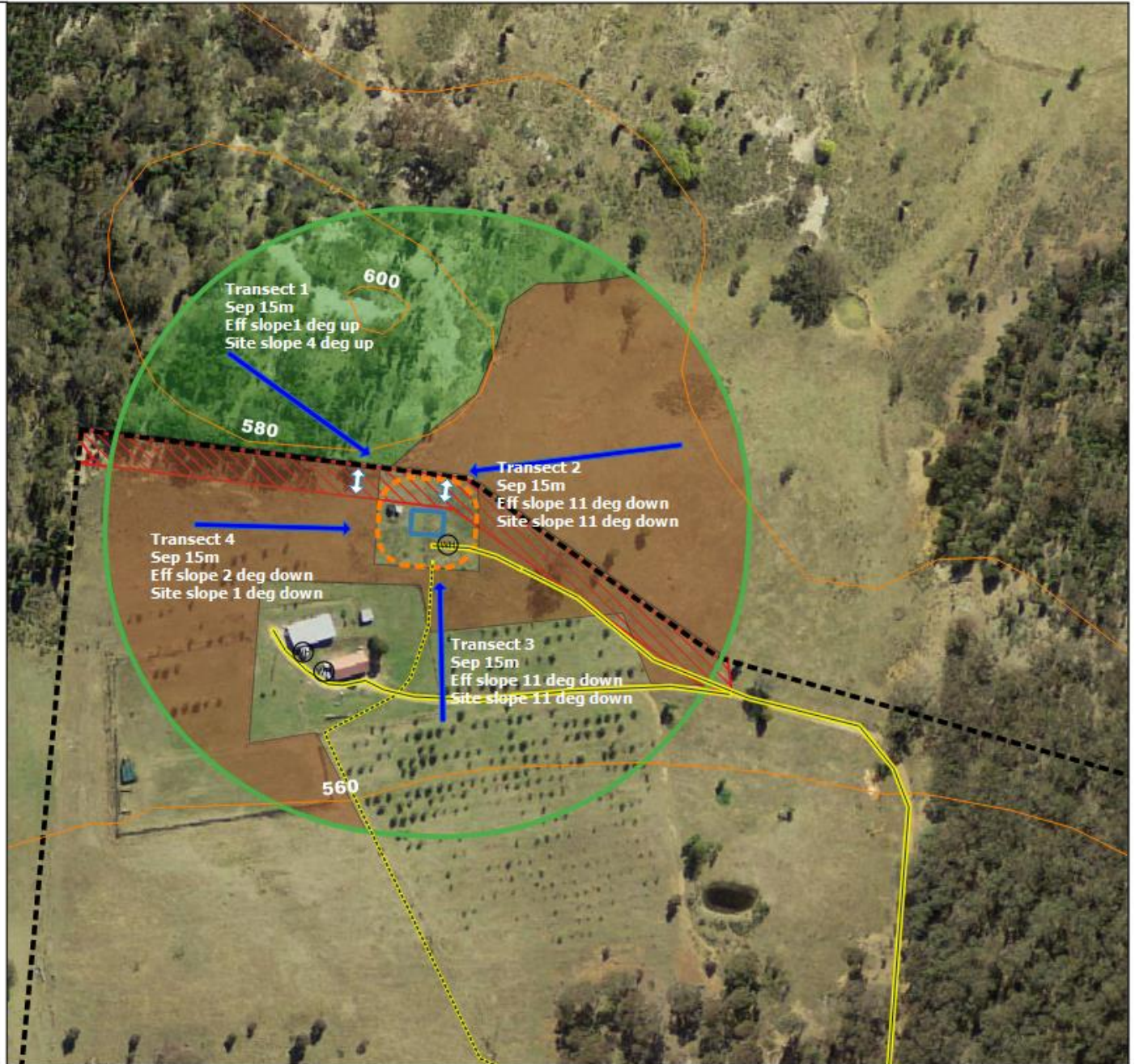
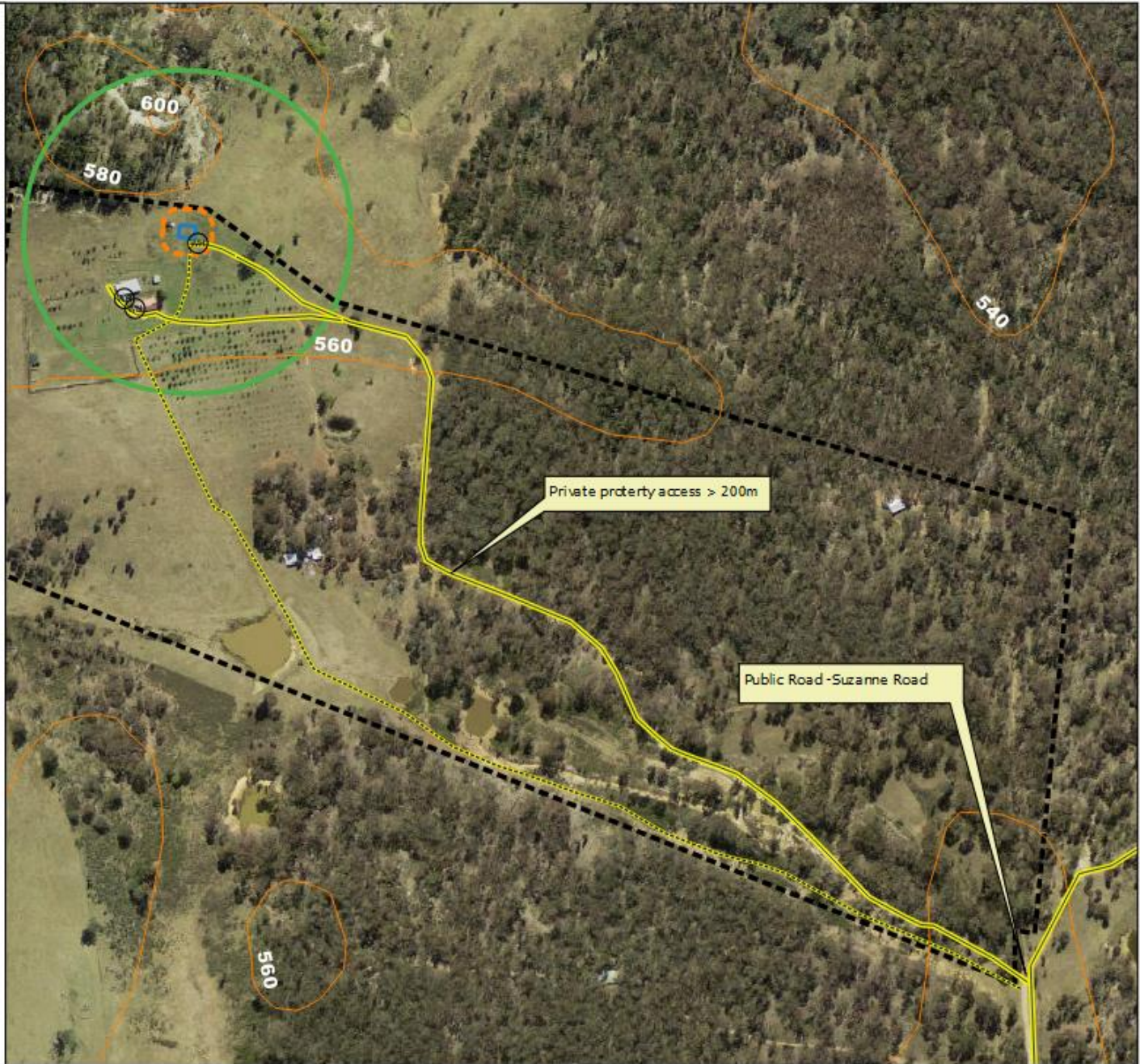
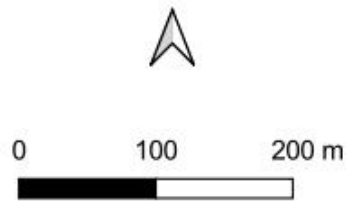


Figure 5 Property Access

- ⊙ Vehicle Water
 - Category 1 Access
 - - - Proposed Alternative access
 - 10m Contours
 - ▭ Proposed Class 1a Development
 - ▭ 140m Assessment Area
 - ▭ Minimum 15m APZ for BAL 29
 - ▭ Existing class 10 building
 - ▭ Lot Boundary
- SixMap Imagery



4 BUSH FIRE ASSESSMENT

This section assesses BPMs for the proposed development in consideration of the acceptable solutions required for each performance criteria within PBP 2019. Where acceptable solutions are not met details of the performance-based solution are provided.

4.1 SETBACKS AND ASSET PROTECTION ZONES

The performance criteria within PBP 2019 are:

- A defensible space is provided on site (with additional emphasis on other BPMs).
- APZs are managed and maintained to prevent the spread of a fire towards the building, and
- The APZ is provided in perpetuity.

An APZ is an area surrounding a development that is managed to reduce the bush fire hazard to an acceptable level to mitigate the risk to life and property. The required width of the APZ varies with slope and the type of hazard. An APZ should be maintained in perpetuity, not on slopes >18° to ensure ongoing protection from the impact of bush fires. Section 3.2 within PBP 2019 indicates the APZ on adjoining lands is not encouraged, although road and properties managed to be consistent with APZ standards set out in Appendix 4 of PBP2019 and *NSW RFS document Standards for Asset Protection Zones* are appropriate to be included within a APZ. Maintenance of APZ should be undertaken on an annual basis, in advance of the fire season, as a minimum.

BCA P2.3.1 indicates that the class 1 buildings should be protected from other building fires and provides a minimum 900mm separation between the boundary and dwelling. Consideration should be given to increasing the side-set back to increase the distance between the dwelling to 6m neighbouring buildings to limit the potential of house-to-house fires. If this separation is not possible, that upgrade of the building aspect adjacent to the neighbouring building to BAL40 standards and other fire protection measures such as sprinklers and staggering glazing elements should be considered.

The ongoing maintenance of APZs are recognised under 100C of the RF Act and is supported in 2.8(1)(d) of the *Biodiversity Conservation Act 2016*. Any clearing of vegetation within the site to allow the development to occur may require assessment under the *Biodiversity Conservation Act 2016*.

An APZ is provided in accordance with Tables A1.12.2 or A1.12.4 in Appendix 1 of PBP 2019

- Performance-based solution has been performed. Method 2 calculations were used to determine the radiant heat exposure and Bush fire Attack Levels. The inputs to the method 2 calculations are provided in **Table 4, Appendix 2** and illustrated on **Figure 4**.

APZs are managed in accordance with the requirements of 'Asset Protection Zone standards' of Appendix 4 of PBP 2019.

- A landscape plan is required to be provided with the development application illustrating compliance.

APZs are wholly within the boundaries of the development site, and APZ are located on lands with a slope less than 18 degrees.

- The APZ on this site is wholly within the site boundaries and is not located on land >18 degrees slope.

APZ Requirements:

The APZ is currently maintained to APZ standards.

At the commencement of building works and in perpetuity, the area identified as an APZ in Figure 4 of this report shall be managed as an Inner Protection Area (IPA) as outlines within Appendix 4 of Planning for Bush fire Protection 2019, and NSW Rural Fire Service 'Standards for Asset Protection Zones'.

4.2 CONSTRUCTION STANDARDS

This section indicates the bush fire Attack Level (BAL) construction requirements of the proposal which are to meet the performance criteria in PBP2019. The performance criteria within PBP 2019 are:

- The proposed building can withstand bush fire attack in the form of embers, radiant heat, and flame contact,
- Proposed fences and gates are designed to minimise the spread of bush fire, and
- Proposed Class 10a buildings are designed to minimise the spread of bush fire.

BAL is determined in accordance with Tables A1.12.5 to A1.12.7 of PBP 2019.

- Performance-based solution has been performed. Method 2 calculations were used to determine the radiant heat exposure and Bush fire Attack Levels. The inputs to the method 2 calculations are provided in **Table 4, Appendix 2** and illustrated on **Figure 4**.

Construction provided in accordance with the Building Code of Australia and as modified by section 7.5 of PBP 2019.

- Construction material schedules have not been provided to be assessed.

Fencing and gates are constructed in accordance with section 7.6 of PBP 2019.

- Construction material schedules have not been provided to be assessed.

Class 10a buildings are constructed in accordance with section 8.3.2 of PBP 2019.

- The proposal has not identified the construction of any class 10 buildings with 6m of the occupied dwelling.

Construction Requirements:

The radiant heat exposure from all directions creates a bush fire threat to the development. A BAL 29 construction level is required to all elevations.

4.3 ACCESS

The performance criteria within PBP 2019 are:

- Firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation,
- The capacity of access roads is adequate for firefighting vehicles,
- There is appropriate access to water supply, and
- Firefighting vehicles can access the dwelling and exit safely.

In the event of a serious bush fire threat to the proposed development, it will be essential to ensure that access is adequate for ingress of emergency services while occupants' egress from the bush fire attack.

In this case, where the most distant external part of the dwelling is less than 70m unobstructed path from a public road with a speed limit <70km/hr, further bush fire access provisions are required.

Property access roads are two-wheel drive, all weather roads.

- Access to the site complies with this requirement.

The capacity of road surfaces and any bridges/ causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges and causeways are to clearly indicate load rating.

- Access to the site complies with this requirement.

Hydrants are provided in accordance with AS2419.1:2017; and there is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available.

- Static water provided. Access to with 4m shall be provided.

At least one alternative property access road is provided for individual dwellings or groups of dwellings that are located more than 200m from a public through road.

- Alternative access to the public road system is illustrated in Figure 5 of this report.

Minimum carriageway width of 4m.

- Access to the site complies with this requirement.

In forest, woodland and heath situations, rural property roads have passing bays every 200m that are 20m long by 2m wide, making a minimum trafficable width of 6m, at the passing bay.

- Access to the site complies with this requirement.

A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches.

- Access to the site complies with this requirement.

Property access must provide a suitable turning area in accordance with Appendix 3 of PBP 2019.

- Adequate turn-a-round shall be provided associated with the class 1a building and static water supply.

Curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress along the access road.

- Access to the class 1a building shall comply with this provision.

The minimum distance between inner and outer curves of the access road is 6m.

- Access to the class 1a building shall comply with this provision.

The crossfall is not more than 10° along the access road.

- Access to the class 1a building shall comply with this provision.

Maximum grades for sealed roads do not exceed 15° and not more than 10° for unsealed roads.

- Access to the class 1a building shall comply with this provision.

A development comprising more than three dwellings has formalised access by dedication of a road and not by right of way.

- The proposal is only one dwelling.

Access Recommendations:

The following provision shall be meet:

- ***Vehicle access provided within 4m of static water supply that shall be within 70m of the furthest elevation of the building.***
- ***Adequate turn-a-round shall be provided associated with the class 1a building and static water supply.***
- ***Curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress along the access road.***
- ***The minimum distance between inner and outer curves of the access road is 6m.***
- ***The crossfall is not more than 10° along the access road.***
- ***Maximum grades for sealed roads do not exceed 15° and not more than 10° for unsealed roads.***

4.4 WATER SUPPLY

The performance criteria within PBP 2019 are:

- A water supply is provided for firefighting purposes,
- Firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation,
- The capacity of access roads is adequate for firefighting vehicles,
- There is appropriate access to water supply (water supply not within road carriageway), and
- Firefighting vehicles can access the dwelling and exit safely.

An adequate supply of water is essential for firefighting purposes, and the location of gas and electricity should be considered when assessing the ability of firefighters to access and use water supplies. The proposal relies on static water supplies.

Water Recommendations:

20,000Lt static water supply is provided for firefighting purposes in areas where reticulated water is not available need to meet the following specifications:

- ***A connection for firefighting purposes is located within the IPA or non-hazard side and away from the structure; 65mm Storz outlet with a ball valve is fitted to the outlet,***
- ***Ball valve and pipes are adequate for water flow and are metal,***
- ***Supply pipes from tank to ball valve have the same bore size to ensure flow volume,***
- ***Underground tanks have an access hole of 200mm to allow tankers to refill direct from the tank,***
- ***A hardened ground surface for truck access is supplied within 4m,***
- ***Above-ground tanks are manufactured from concrete or metal,***
- ***Raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber (see Appendix F AS 3959),***
- ***Unobstructed access can always be provided,***
- ***Underground tanks are clearly marked,***
- ***Tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters,***
- ***All exposed water pipes external to the building are metal, including any fittings,***
- ***Where pumps are provided, they are a minimum 5hp or 3kW petrol or diesel-powered pump, and are shielded against bush fire attack; any hose and reel for firefighting connected to the pump shall be 19mm (internal diameter), and***

- ***Where Fire hose reels are provided, Fire hose reels are constructed in accordance with AS/NZS 1221:1997 Fire hose reels and installed in accordance with AS 2441:2005 Installation of fire hose reels.***

4.5 ELECTRICITY SERVICES

The performance criteria within PBP 2019 are:

- Location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings.

Electricity services have been found to contribute to bush fire ignition and spread, as well as impeding access during bush fire events.

The existing electrical supply to the local area is via overhead electrical transmission. Periodic inspection should be undertaken to ensure the lines into the private property are not fouled by the growth of trees. Landscaping and vegetation should be maintained to comply with Energy Australia 'Vegetation Safety Clearances' (NS179, April 2002).

Electricity Recommendations:

Were possible electricity should be placed underground.

4.6 GAS SERVICES

The performance criteria within PBP 2019 are:

- A water supply is provided for firefighting purposes,
- Firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation,
- The capacity of access roads is adequate for firefighting vehicles,
- There is appropriate access to water supply, and
- Firefighting vehicles can access the dwelling and exit safely.

Gas services have been found to contribute to fire spread and building loss when not positioned correctly or non-combustible elements are used.

Any reticulated or bottled gas shall be installed and maintained in accordance with the below requirements as outlined in Table 7.4a of PBP:

- Reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 and the requirements of relevant authorities, and metal piping is used.
- All fixed gas cylinders are kept clear of all 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; and
- Above-ground gas service pipes are metal, including and up to any outlets.

Gas Recommendations:

If gas services are provided to the development, prior to issuing occupation certificate the consent authority shall ensure the location and design of gas services meets the requirements of Table 7.4a of PBP2019.

4.7 LANDSCAPING AND VEGETATION MANAGEMENT

The performance criteria within PBP 2019 are:

- Landscaping is designed and managed to minimise flame contact and radiant heat to buildings, and the potential for wind-driven embers to cause ignitions.

Compliance with the NSW RFS 'Asset protection zone standards' (see Appendix 4 of PBP 2019).

- Landscaping plan not provided. The APZ currently complies with APZ standards.

A clear area of low-cut lawn or pavement is maintained adjacent to the house.

- Landscaping plan not provided. The APZ currently complies with APZ standards.

Fencing is constructed in accordance with Section 7.6.

- Site layout plans or construction schedules do not identify fencing construction material.
- If fencing within 6m of a building or in areas of BAL-29 or greater, should be made of non-combustible material only.

Trees and shrubs are planted such that the branches will not overhang the roof, the tree canopy is not continuous, any proposed windbreak is located on the elevation from which fires are likely to approach.

- Landscaping plan not provided. The APZ currently complies with APZ standards.

Landscaping Recommendations:

It is recommended that the consent authority ensure the APZ is implemented in consideration of APZ and landscaping requirements outlined in PBP 2019 prior to issuing occupancy certificate.

4.8 EMERGENCY MANAGEMENT AND BUSH FIRE SURVIVAL PLANS

State bush fire authorities have established kits to help residential and small property owners to develop appropriate plans to plan and prepare for bush fire events. In NSW Bush fire survival Plans can be accessed from <https://www.rfs.nsw.gov.au/plan-and-prepare/bush-fire-survival-plan>.

It is recommended that the property owner and occupants familiarise themselves with relevant bush fire planning, protection, preparation and survival information and consider implementation of the 'NSW RFS Best Practise Guidelines – Dwelling upgrades' for the upgrade of existing buildings to ensure compliance with the intent of the PBP 2018 and AS3959 Construction of buildings in Bush fire Prone Areas.

5 CONCLUSION AND RECOMMENDATIONS

It is clear from this investigation and assessment that the site is located within Bush fire Prone Land. An assessment in accordance with Appendix 1 of PBP2019 has been undertaken implementing detailed assessment pathway described in Appendix B of AS3959:2018. This BFAR found the classifiable vegetation of Western slope DSF as described by NSW Comprehensive Fuel Loads upslope to the north-west of the site creates the greatest bush fire threat.

In accordance with the provisions of PBP 2019, the recommendations outlined within this assessment will reduce the risk of damage and/or harm in the event of a bush fire event to acceptable levels. Compliance with the below recommendations can be achieved or practically implemented without substantial change to the proposed layout or construction methodology. It is recommended that development consent be granted subject to the following conditions:

Asset Protection Zones and Landscaping

The APZ is currently maintained to APZ standards.

At the commencement of building works and in perpetuity, the area identified as an APZ in Figure 4 of this report shall be managed as an Inner Protection Area (IPA) as outlined within Appendix 4 of Planning for Bush fire Protection 2019, and NSW Rural Fire Service 'Standards for Asset Protection Zones'.

The consent authority ensures the APZ is implemented in consideration of APZ and landscaping requirements outlined in PBP 2019 prior to issuing occupancy certificate.

If overhead power supply is provided, the consent authority shall determine vegetation management is in accordance with Energy Australia 'Vegetation Safety Clearances' (NS179, April 2002).

Construction Standards

The radiant heat exposure from all directions creates a bush fire threat to the development. A BAL 29 construction level is required to all elevations.

Access

The following provision shall be met:

- Vehicle access provided within 4m of static water supply that shall be within 70m of the furthest elevation of the building.
- Adequate turn-a-round shall be provided associated with the class 1a building and static water supply.
- Curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress along the access road.
- The minimum distance between inner and outer curves of the access road is 6m.
- The crossfall is not more than 10° along the access road.
- Maximum grades for sealed roads do not exceed 15° and not more than 10° for unsealed roads.

Water Supply

20,000Lt static water supply is provided for firefighting purposes in areas where reticulated water is not available need to meet the following specifications:

- A connection for firefighting purposes is located within the IPA or non-hazard side and away from the structure; 65mm Storz outlet with a ball valve is fitted to the outlet,
- Ball valve and pipes are adequate for water flow and are metal,
- Supply pipes from tank to ball valve have the same bore size to ensure flow volume,
- Underground tanks have an access hole of 200mm to allow tankers to refill direct from the tank,
- A hardened ground surface for truck access is supplied within 4m,
- Above-ground tanks are manufactured from concrete or metal,
- Raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber (see Appendix F AS 3959),
- Unobstructed access can always be provided,
- Underground tanks are clearly marked,
- Tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters,
- All exposed water pipes external to the building are metal, including any fittings,
- Where pumps are provided, they are a minimum 5hp or 3kW petrol or diesel-powered pump, and are shielded against bush fire attack; any hose and reel for firefighting connected to the pump shall be 19mm (internal diameter), and
- Where Fire hose reels are provided, Fire hose reels are constructed in accordance with AS/NZS 1221:1997 Fire hose reels and installed in accordance with AS 2441:2005 Installation of fire hose reels.

Electricity services

Where possible electricity should be placed underground.

Gas services

If gas services are provided to the development, prior to issuing occupation certificate the consent authority shall ensure the location and design of gas services meets the requirements of Table 7.4a of PBP2019.

Emergency Management

There are no performance criteria requirements for this type of development within PBP 2019.

REFERENCES

- Australian Building Codes Board (2010), *Building Code of Australia, Class 1 and Class 10 Buildings*, Housing Provisions Volume 2.
- Clarke, H., Lucas, C., Smith, P., 2012. *Changes in Australian fire weather between 1973 and 2010*, International Journal of Climatology. DOI: 10.1002/joc.3480
- Councils of Standards Australia (2018), *AS 3959:2018: Construction of Buildings in Bushfire-prone Areas*. SAI Global
- Councils of Standards Australia (2002), *AS 1596:2002: Storage and handling of LPG Gas*. SAI Global
- Councils of Standards Australia (2017), *AS 2419:2017: Fire hydrant installations System design, installation and commissioning*. SAI Global
- Douglas, G., 2017. *Property Protection from Extreme Bushfire Events under the Influence of Climate Change*. Doctor of Philosophy at the Western Sydney University, Sydney, Australia
- Dold, J. W., Zinoviev. A., 2009. Fire eruption through intensity and spread rate interaction mediated by flow attachment. *Combustion Theory and Modelling* 13(5), 763–793.
- Drysdale, D. D., Macmillan, A. J. R., 1992. Flame spread on inclined surfaces. *Fire Safety Journal*, 18(3), 245-254.
- Drysdale, D. D., Macmillan, A. J. R., Shilitto, D., 1992 The King's Cross fire: Experimental verification of the 'Trench effect'. *Fire Safety Journal* Volume 18, Issue 1, 1992, Pages 75-82
- Edgar, R.A., Sharples, J.J., Sidhu, H.S., 2015. Revisiting the King's Cross Underground disaster with implications for modelling wildfire eruption. 21st International Congress on Modelling and Simulation, Gold Coast, Australia
- Edgar, R.A., Sharples, J.J., Sidhu, H.S., 2015b. Investigation of flame attachment and accelerated fire spread. PCChE Congress incorporating Chemeca, Melbourne, Victoria.
- Edgar, R.A., Sharples, J.J., Sidhu, H.S., 2016. mining the effects of convective intensity on plume attachment in three dimensional trenches. PCChE Congress incorporating Chemeca, Adelaide, South Australia
- Environmental Assessment Legislation Amendment Act (2002). Accessed online: <https://www.legislation.nsw.gov.au/#/view/act/1979/203>
- Environmental Planning & Assessment Amendment (Planning for Bush Fire Protection) Regulation 2007, accessed online: <https://www.legislation.nsw.gov.au/regulations/2014-285.pdf>
- Grumstrup, T.P., McAllister, S.S., Finney, M.A. 2017. Qualitative Flow Visualization of Flame Attachment on Slopes. 10th U. S. National Combustion Meeting Organized by the Eastern States Section of the Combustion Institute April 23-26, College Park, Maryland
- Lucas, C. 2010. *On developing a historical fire weather data-set for Australia*. Australian Meteorological and Oceanographic Journal. 60.1-14
- Minimum Vegetation Clearances for Power Lines, ISSC3 - NSW Resources and Energy - NSW Government Accessed online: <https://www.resourcesandenergy.nsw.gov.au/energy-supply-industry/pipelines-electricity-gas-networks/electricity-networks/safety/ISSC3-guideline-for-managing-vegetation-near-power-lines.pdf>
- NSW Rural Fire Service (2018). *Planning for Bushfire Protection – A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners*, NSW Rural Fire Service.
- NSW Rural Fire Service (2005). *Standards for Asset Protection Zones*. NSW Rural Fire Service, Sydney.
- NSW Rural Fire Service (2019). *Comprehensive vegetation Fuel Loads, Fact sheet V8*, NSW Rural Fire Service. Sydney

NSW Rural Fire Service, *Best Practise Guidelines – Dwelling upgrades*, Accessed online:
https://www.rfs.nsw.gov.au/_data/assets/pdf_file/0018/4365/Building-Best-Practice-Guide.pdf

Rural Fires Act (1997), Accessed online: <https://www.legislation.nsw.gov.au/#/view/act/1997/65>

Rural Fires Amendment Regulation (2007), accessed online:
http://www.austlii.edu.au/au/legis/nsw/num_reg/rfafsar20072007109593.pdf

Rural Fires Regulation (2013), accessed online: <https://www.legislation.nsw.gov.au/#/view/regulation/2013/488>

Western Australian Government, (2017) The WAPC's Guidelines for Planning in Bushfire Prone Areas (Guidelines),
[https://www.planning.wa.gov.au/dop/pub/pdf/Bushfire Guidelines Version 1.2 Aug2017.pdf](https://www.planning.wa.gov.au/dop/pub/pdf/Bushfire%20Guidelines%20Version%201.2%20Aug2017.pdf)

APPENDIX 1 SITE LAYOUT PLANS

AREA SCHEDULE	
Name	Area
LAUNDRY LANDING	1.8 m ²
GROUND FLOOR LIVING	138.0 m ²
DECK	30.5 m ²
PORCH/DECK	8.5 m ²
Ground Floor	179.2 m ²
FIRST FLOOR LIVING	48.5 m ²
FF BALCONY	20.7 m ²
First Floor	69.2 m ²
Grand total	248.4 m ²

NOTE: LOCATION OF SITE BOUNDARIES ARE A GUIDE ONLY. THESE HAVE BEEN SCALED FROM LOCAL SHIRE COUNCIL RECORDS. NOT FOR CONSTRUCTION PURPOSES.

ALERT: THIS PROPERTY IS LOCATED IN A BUSHFIRE PRONE AREA. REFER TO BUSHFIRE REPORT FOR 'BAL' RATING



① SITE PLAN
1:1000



Site Plan


DESIGN PROPOSED RESIDENCE	JOB ADDRESS LOT 14, 155 SUZANNE RD TALLAWANG, NSW 2852	S.P. DIP253275	SCALE 1:1000 @ A3	ISSUE G	REV. DATE DESCRIPTION DRAWN CHECKED																														
STAGED PLAN PRELIMINARY					<table border="1"> <tr><td>1</td><td>11/01/21</td><td>CONCEPT DESIGN</td><td>300</td><td>00</td></tr> <tr><td>2</td><td>11/01/21</td><td>CONCEPT DESIGN</td><td>300</td><td>00</td></tr> <tr><td>3</td><td>11/01/21</td><td>CONCEPT DESIGN</td><td>300</td><td>00</td></tr> <tr><td>4</td><td>11/01/21</td><td>CONCEPT DESIGN</td><td>300</td><td>00</td></tr> <tr><td>5</td><td>11/01/21</td><td>CONCEPT DESIGN</td><td>300</td><td>00</td></tr> <tr><td>6</td><td>11/01/21</td><td>CONCEPT DESIGN</td><td>300</td><td>00</td></tr> </table>	1	11/01/21	CONCEPT DESIGN	300	00	2	11/01/21	CONCEPT DESIGN	300	00	3	11/01/21	CONCEPT DESIGN	300	00	4	11/01/21	CONCEPT DESIGN	300	00	5	11/01/21	CONCEPT DESIGN	300	00	6	11/01/21	CONCEPT DESIGN	300	00
1	11/01/21	CONCEPT DESIGN	300	00																															
2	11/01/21	CONCEPT DESIGN	300	00																															
3	11/01/21	CONCEPT DESIGN	300	00																															
4	11/01/21	CONCEPT DESIGN	300	00																															
5	11/01/21	CONCEPT DESIGN	300	00																															
6	11/01/21	CONCEPT DESIGN	300	00																															
CLIENT KIRSTEN & DECLAN BOYCE	USE FIGURED DIMENSIONS AT ALL TIMES. REFER ANY ENQUIRIES TO BUILDING CONTRACTOR. ALL DIMENSIONS TO BE VERIFIED ON SITE PRIOR TO CONSTRUCTION. ALL WORK TO COMPLY WITH LOCAL AUTHORITY REGULATIONS.	DWG No. 100	LAND AREA																																

PRELIM - NOT FOR CONSTRUCTION

imagine
by design

3988 PACIFIC HIGHWAY
LOGANHOLME, QLD 4129
Phone: +61 73266 9188
QBC: 1611 1256

APPENDIX 2 METHOD 2 OUTPUTS

 NBC Bushfire Attack Assessment Report V4.1 <small>A 33959 (2018) Appendix B - Detailed Method 2</small>						
Print Date:	10/02/2022	Assessment Date:	10/02/2022			
Site Street Address:	155 Suzanne Road, Tallawang					
Assessor:	Duncan Scott-Laws on; BEMC					
Local Government Area:	Mid-western Regional	Alpine Area:	No			
Equations Used						
Transmissivity: Fuss and Hammins, 2002						
Flame Length: RFS PBP, 2001/Vesta/Catchpole						
Rate of Fire Spread: Noble et al., 1980						
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005						
Peak Elevation of Receiver: Tan et al., 2005						
Peak Flame Angle: Tan et al., 2005						
Run Description:	Transect 1					
Vegetation Information						
Vegetation Type:	Western Slopes DSF					
Vegetation Group:	Dry Sclerophyll Forests (Shrubby)					
Vegetation Slope:	1 Degrees	Vegetation Slope Type:	Upslope			
Surface Fuel Load(t/ha):	15	Overall Fuel Load(t/ha):	18.86			
Vegetation Height(m):	1.4	Only Applicable to Shrub/Scrub and Vesta				
Site Information						
Site Slope:	4 Degrees	Site Slope Type:	Upslope			
Elevation of Receiver(m):	2.4	APZ/Separation(m):	15			
Fire Inputs						
Veg. Flame Width(m):	100	Flame Temp(K):	1090			
Calculation Parameters						
Flame Emissivity:	95	Relative Humidity(%):	25			
Heat of Combustion(kJ/kg)	18600	Ambient Temp(K):	308			
Moisture Factor:	5	FDI:	80			
Program Outputs						
Level of Construction:	BAL 29	Peak Elevation of Receiver(m):	5.89			
Radiant Heat(kW/m2):	21.72	Flame Angle (degrees):	62			
Flame Length(m):	10.69	Maximum View Factor:	0.334			
Rate Of Spread (km/h):	1.3	Inner Protection Area(m):	15			
Transmissivity:	0.855	Outer Protection Area(m):	0			
Fire Intensity(kW/m):	12629					
BAL Thresholds						
	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	9	12	18	25	41	2.4



NBC Bushfire Attack Assessment Report V4.1

AS3959 (2018) Appendix B - Detailed Method 2

Print Date: 10/02/2022 Assessment Date: 10/02/2022

Site Street Address: 155 Suzanne Road, Tallawang
 Assessor: Duncan Scott-Lawson; BEMC
 Local Government Area: Mid-western Regional Alpine Area: No

Equations Used

Transmissivity: Fuchs and Hammins, 2002
 Flame Length: RFS PBP, 2001/Vesta/Catchpole
 Rate of Fire Spread: Noble et al., 1980
 Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
 Peak Elevation of Receiver: Tan et al., 2005
 Peak Flame Angle: Tan et al., 2005

Run Description: Transect 2

Vegetation Information

Vegetation Type: Western Slopes Grassland
 Vegetation Group: Grassland
 Vegetation Slope: 11 Degrees Vegetation Slope Type: Downslope
 Surface Fuel Load(t/ha): 6 Overall Fuel Load(t/ha): 6
 Vegetation Height(m): 0 Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 11 Degrees Site Slope Type: Downslope
 Elevation of Receiver(m): 2.4 APZ/Separation(m): 15

Fire Inputs

Veg./Flame Width(m): 100 Flame Temp(K): 1090

Calculation Parameters

Flame Emissivity: 95 Relative Humidity(%): 25
 Heat of Combustion(kJ/kg): 18600 Ambient Temp(K): 308
 Moisture Factor: 5 FDI: 80

Program Outputs

Level of Construction: BAL-29 Peak Elevation of Receiver(m): 1.98
 Radiant Heat(kW/m²): 20.17 Flame Angle (degrees): 82
 Flame Length(m): 9.89 Maximum View Factor: 0.313
 Rate Of Spread (km/h): 22.22 Inner Protection Area(m): 15
 Transmissivity: 0.849 Outer Protection Area(m): 0
 Fire Intensity(kW/m): 68869

BAL Thresholds

BAL-40: BAL-29: BAL-19: BAL-12.5: 10 kW/m²: Elevation of Receiver:
 Asset Protection Zone(m): 8 11 18 24 39 2.4



NBC Bushfire Attack Assessment Report V4.1

A S3959 (2018) Appendix B - Detailed Method 2

Print Date: 10/02/2022

Assessment Date: 10/02/2022

Site Street Address: 155 Suzanne Road, Tallawang
 Assessor: Duncan Scott-Lawson; BEMC
 Local Government Area: Mid-western Regional Alpine Area: No

Equations Used

Transmissivity: Fuss and Hammins, 2002
 Flame Length: RFS PBP, 2001/Vesta/Catchpole
 Rate of Fire Spread: Noble et al., 1980
 Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
 Peak Elevation of Receiver: Tan et al., 2005
 Peak Flame Angle: Tan et al., 2005

Run Description: Transect 3

Vegetation Information

Vegetation Type: Western Slopes Grassland
 Vegetation Group: Grassland
 Vegetation Slope: 11 Degrees Vegetation Slope Type: Downslope
 Surface Fuel Load(t/ha): 6 Overall Fuel Load(t/ha): 6
 Vegetation Height(m): 0 Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 11 Degrees Site Slope Type: Downslope
 Elevation of Receiver(m): 2.4 APZ/Separation(m): 15

Fire Inputs

Veg./Flame Width(m): 100 Flame Temp(K): 1090

Calculation Parameters


Flame Emissivity: 95 Relative Humidity(%): 25
 Heat of Combustion(kJ/kg): 18600 Ambient Temp(K): 308
 Moisture Factor: 5 FDI: 80

Program Outputs

Level of Construction: BAL 29 Peak Elevation of Receiver(m): 1.98
 Radiant Heat(kW/m²): 20.17 Flame Angle (degrees): 82
 Flame Length(m): 9.89 Maximum View Factor: 0.313
 Rate Of Spread (km/h): 22.22 Inner Protection Area(m): 15
 Transmissivity: 0.849 Outer Protection Area(m): 0
 Fire Intensity(kW/m): 68869

BAL Thresholds

BAL-40: BAL-29: BAL-19: BAL-12.5: 10 kW/m²: Elevation of Receiver:
 Asset Protection Zone(m): 8 11 16 24 39 2.4

 NBC Bushfire Attack Assessment Report V4.1 A S3959 (2018) Appendix B - Detailed Method 2 Print Date: 10/02/2022 Assessment Date: 10/02/2022	
Site Street Address:	155 Suzanne Road, Tallawang
Assessor:	Duncan Scott-Lawson; BEMC
Local Government Area:	Mid-western Regional
Alpine Area:	No
Equations Used	
Transmissivity: Fuss and Hammins, 2002	
Flame Length: RFS PBP, 2001/Vesta/Catchpole	
Rate of Fire Spread: Noble et al., 1980	
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005	
Peak Elevation of Receiver: Tan et al., 2005	
Peak Flame Angle: Tan et al., 2005	
Run Description:	Transect 4
Vegetation Information	
Vegetation Type:	Western Slopes Grassland
Vegetation Group:	Grassland
Vegetation Slope:	2 Degrees
Vegetation Slope Type:	Downslope
Surface Fuel Load(t/ha):	6
Overall Fuel Load(t/ha):	6
Vegetation Height(m):	0
	Only Applicable to Shrub/Scrub and Vesta
Site Information	
Site Slope:	1 Degrees
Site Slope Type:	Downslope
Elevation of Receiver(m):	2.4
APZ/Separation(m):	15
Fire Inputs	
Veg./Flame Width(m):	100
Flame Temp(K):	1090
Calculation Parameters	
Flame Emissivity:	95
Relative Humidity(%):	25
Heat of Combustion(kJ/kg)	18600
Ambient Temp(K):	308
Moisture Factor:	5
FDI:	80
Program Outputs	
Level of Construction:	BAL 19
Peak Elevation of Receiver(m):	3.27
Radiant Heat(kW/m²):	15.33
Flame Angle (degrees):	76
Flame Length(m):	7.25
Maximum View Factor:	0.237
Rate Of Spread (km/h):	11.94
Inner Protection Area(m):	15
Transmissivity:	0.849
Outer Protection Area(m):	0
Fire Intensity(kW/m):	37011
BAL Thresholds	
	BAL-40: BAL-29: BAL-19: BAL-12.5: 10 kw/m ² : Elevation of Receiver:
Asset Protection Zone(m):	7 9 13 19 31 2.4

APPENDIX 3 SIGNIFICANT BUSH FIRE PROTECTION MEASURES

Design and Siting

The design and siting of a building can be of critical importance during bush fire attack event. The appropriate design and siting can reduce the impact of bush fire attack mechanisms of direct flame, radiant heat, ember attack, smoke, and wind. The following principles should be considered when siting and designing a dwelling, and future dwelling improvements in bush fire prone lands. These recommendations are not prescribed in PBP 2019 but facilitate meeting the aims and objectives of PBP 2019.

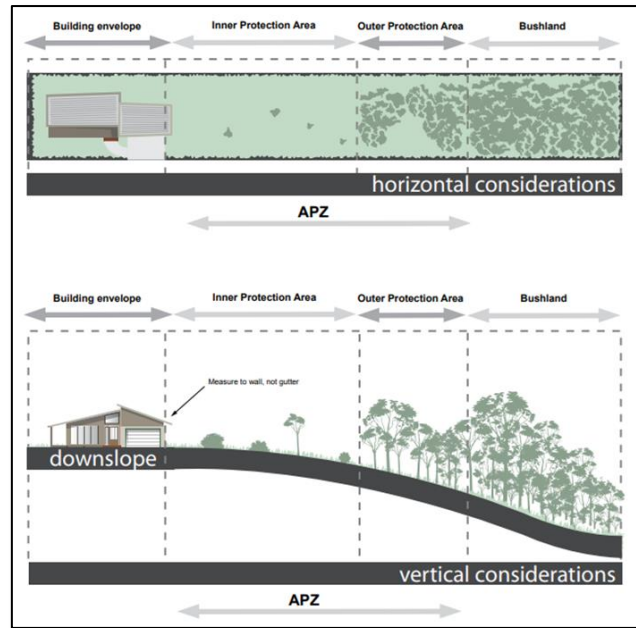
- Avoid building on ridges, saddles and build on level ground wherever possible.
- Utilise cut-in benches, rather than elevating the building when building on sloping land.
- Avoid raise floors and protect the sub-floor areas by enclosing or screening.
- Provide an appropriate shelter room that is located on the lowest or non-bush fire hazard side of the building, near building exits and provides the occupant views of the outside environment.
- Reduce bulk of building, limit re-entrant corners, and incorporate simplified roof that are able to self-clean of debris.
- No gutters on second or consecutive storeys of building and avoid box gutters.
- If gutters are installed, incorporate gutter guards with a flammability index more than 5 when tested to AS1530.2, or aluminium, bronze, or stainless steel with maximum aperture of 5mm.
- Limit glazing elements on the sides of the building exposed to the bush fire threat and use shutters to protect glazing elements.
- Carparking provided in a location that does not interfere with escape routes.
- Position development so any gas supplies and overhead electricity are positioned not to impede egress to and from the site.
- Class 10a buildings (such as shed, carport, and garages) should be a minimum of 6m away from any other building. Consider the storage of hazardous materials (petrol, kerosene, alcohol, LPG, natural gas, acetylene, vehicle, machinery etc.) within class 10a buildings when siting in proximity to class 1a occupied building and escape routes.
- Provide unobstructed access around the entire building supported by a minimum 1m wide concreted path to the external wall.

Asset Protection Zones

An APZ is an area surrounding a development that is managed to reduce the bushfire hazard to an acceptable level to mitigate the risk to life and property. The required width of the APZ varies with slope and the type of hazard. An APZ should be maintained in perpetuity to ensure ongoing protection from the impact of bush fires. Maintenance to the below standards should be undertaken on an annual basis, in advance of the fire season, as a minimum.

For a complete guide to APZs and landscaping, download the NSW RFS document Standards for Asset Protection Zones at www.rfs.nsw.gov.au/resources/publications.

An APZ can consist of both an Inner Protection Area (IPA) and an Outer Protection Area (OPA) as indicated below.



Components of an APZ (Figure A4.1 - PBP 2019)

An APZ can include the following:

- Footpaths.
- Lawns.
- Discontinuous gardens.
- Swimming pools.
- Driveways.
- Unattached non-combustible garages with suitable separation from the dwelling.
- Open space / parkland; and
- Car parking.

Isolated areas of shrub and timbered vegetation are generally not a bushfire hazard as they are not large enough to produce fire of an intensity that will threaten dwellings. These areas include narrow strips of vegetation along road corridors.

Furthermore, the edge of the APZ should be clearly delineated to ensure vegetation creep does not occur over time resulting in the reducing the separation between the bushfire hazard and building.

Inner Protection Area (IPA)

The IPA extends from the edge of the OPA to the development. The IPA is the area closest to the asset and creates a fuel-managed area which can minimise the impact of direct flame contact and radiant heat on the development and be a defensible space. The intent of an IPA is to stop the transmission of flame and reduce the transmission of radiant heat by the elimination of available fire fuel. This area also allows airborne embers to fall safely without igniting further outbreaks and provides a safer firefighting position and is operationally important for implementation of clear fire control lines.

In practical terms the IPA is typically the curtilage around the dwelling, consisting of a mown lawn and well-maintained gardens. When establishing and maintaining an IPA the following requirements apply:

- Vegetation within the IPA should be kept to a minimum level. Litter fuels (leaves and vegetation debris) within the IPA should be continually removed and kept below 1cm in height and be discontinuous. There is minimal fine fuel at ground level which could be set alight by a bushfire.
- Canopy cover should be less than 15% (at maturity). Trees (at maturity) should not touch or overhang the building and should be separated by 2 to 5m.
- Lower limbs of canopy trees should be removed up to a height of 2m above ground.
- Preference should be given to smooth barked and evergreen trees.
- Large discontinuities or gaps in the shrub vegetation shall be established to slow down or break the progress of fire towards buildings.
- Shrubs should not be located under trees and not form more than 10% ground cover
- Clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.
- Grasses should be kept mown (as a guide grass should be kept to no more than 100mm in height), and
- Woodpiles, wooden sheds, combustible material storage areas, large areas / quantities of garden mulch, stacked flammable building materials etc. are not permitted in the IPA.

Outer Protection Area (OPA)

An OPA is located between the IPA and the unmanaged vegetation. Vegetation within the OPA can be managed to a more moderate level. The reduction of fuel in this area substantially decreases the intensity of an approaching fire and restricts the pathways to crown fuels, reducing the level of direct flame, radiant heat and ember attack on the IPA.

Because of the nature of an OPA, they are only applicable in forest vegetation.

In practical terms the OPA is an area where there is maintenance of the understorey and some separation in the canopy. When establishing and maintaining an OPA the following requirements apply:

- Tree canopy cover should be less than 30%, canopies should be separated by 2 to 5m
- Shrubs should not form a continuous canopy and form no more than 20% of ground cover
- Grasses should be kept to no more than 100mm in height with leaf and other debris should be mown, slashed or mulched.

Furthermore, the edge of the APZ should be clearly delineated to ensure vegetation creep does not occur over time, reducing the separation between the bushfire hazard and building, as indicated below.

Gardens and vegetation within the APZ

All vegetation will burn under the right conditions.

In choosing plants for landscaping consideration should be given to plants that possess properties, which help to protect buildings. If the plants themselves can be prevented from ignition, they can improve the defence of buildings by:

- Filtering out wind-driven burning debris and embers.
- Acting as a barrier against radiation and flame, and
- Reducing wind forces.

Consequently, landscaping with vegetation of the site should consider the following:

- Meet the specifications of an Inner Protection Area (IPA) detailed in PBP 2019.
- Priority given to retaining or planting species which have a low flammability and high moisture content.
- Priority given to retaining or planting species which do not drop much litter in the bushfire season, and which do not drop litter that persists as ground fuel in the bush fire season, and
- Create discontinuous or gaps in the vegetation to slow down or break the progress of fire towards the dwellings.
- Avoid gardens within 10m of the exterior building envelop.
- Trees and shrubs within 40m were not continuous, but instead arranged as discrete patches separated by a ground layer with low fuel hazard, such as mown grass.
- Positioning of courtyards, gardens, and grassed areas in location to facilitate the protection of the building.
- Install pebble/rock garden beds avoiding the use of mulch and wood chip.

Consideration should be given to vegetation fuel loads present on site. Careful thought must be given to the type and physical location of any proposed site landscaping. **Inappropriately selected and positioned vegetation has the potential to ‘replace’ any previously removed fuel load.**

Whilst it is recognised that fire-retardant plant species are not always the most aesthetically pleasing choice for site landscaping, the need for adequate protection of life and property requires that a suitable balance between visual and safety concerns be considered. The below list of well know ground fire-retardant plants is intended as a guide only, check with your local council for information more specific to your area.

- *Lomandra longifolia*
- *Lomandra hystrix*
- *Anigozanthos* hybrids
- *Agapanthus orientalis*
- *Liriope muscari*
- *Carpobrotus glaucescens*
- *Casuarina glauca*
- *Ajuga*
- *Brachyscome*
- *Dampiera*
- *Scaevola aemula*
- *Succulents (most)*
- *Carpobrotus (Pigface)*
- *Cotyledon*
- *Ajuga australis*
- *Myroporum*
- *Nepeta* (catmint)
- *Mesembryanthemum*
- *Arctotis*

Strategically positioned elevated vegetation (fire-retardant tree and shrub species) can act as ‘windbreaks’ and ‘ember filter’, reducing wind velocities and suppressing the density of embers attacking a building. It is critical that this vegetation is:

- On flat ground place >30m from the building (ideally 40m forming the outer perimeter of the IPA).
- >20m separation from the hazardous vegetation.
- Located on the side of the bush fire hazard.

- No gardens of shrubs under the trees.
- Shrub patches no greater than 10m².

The below list of well known fire-retardant trees and shrubs is intended as a guide only, check with your local council for information more specific to your area:

- *Melia azederach* (Cape Lilac)
- *Brachychiton acerifolius* (Flame tree)
- *Magnolia grandiflora*
- *Pyrus* (most ornamental pears)
- *Magnolia* Little Gem
- *Ulmus chinensis* (Chinese Elm)
- *Acacia howitii*
- *Cercis* (Judus Tree)
- *Acmena smithii* (Lilypilly)
- *Prunus* (all including ornamental)
- *Cupaniopsis anacardiopsis* (Tuckeroo)
- *Malus* (apple trees)
- *Eleocarpus*
- *Mullberry*
- *Citrus* trees
- *Loquat*
- *Arbutus Quercus* (only the deciduous oak trees)
- *Feijoa*
- *Gleditzia*
- *Ficus* (all including edible)
- *Aloe* (all)
- *Correa*
- *Acacia iteaphyla*
- *Nerium* (Oleander)
- *Scaevola crassifolia*
- *Viburnum tinus*
- *Atriplex* (saltbush)
- *Escallonia*
- *Maireana* (Cottonbush)
- *Acacia Cyclops*
- *Eremophila* (Emu bush)
- *Melaleuca nodosa*
- *Syzygium* (lilypilly)
- *Photinia*
- *Rhagodia* (saltbush)
- *Strelitzia*
- *Coprosma*
- *Santolina*
- *Plectranthus*
- *Leucophyta brownii*
- *Senna* (Silver Cassia)

Recent post-fire research from the 2019/20 bushfire season suggests greenness factor (the extent to which plants are actively growing) had an impact on building survivability to a bushfire, indicating that maintained green grasses and landscape watering features are beneficial during a bushfire.

It is essential that any vegetation and landscaped areas and surrounds are subject to ongoing fuel management and reduction to ensure that fine fuels do not build up.

Landscaping features within the APZ

A combination of hard (materials) and soft (design) landscaping will benefit the survivability of a building during a bushfire event. The type, quantity and condition of fuel has a very important effect on bushfire behaviour in proximity to a building. Poorly located vegetation that burns readily may expose a house to increased levels of radiant heat and flame contact.

- Non-flammable features such as tennis courts, swimming pools, dams, patios, driveways or paths should be incorporated into the proposal, especially on the northern and western sides of the proposed building.
- Remove other flammable objects from around the house. These include sheds, caravans, outdoor furniture, barbeques, gas bottles, wood piles and organic mulch.
- Avoid flammable mulches within the APZ. Alternatives include gravel, scoria, pebbles, shells or recycled crushed bricks.
- Use non-combustible, moveable containers and pots that can be relocated in the summer.
- Restrict the use of door mats and placing firewood stacks >10m from building.
- Restrict the use of timber and use materials such as brick, earth, stone, concrete and galvanised iron
- Metal screens can help to shield your house from radiant heat, direct flame contact and ember attack.
- An intensive area of planting centred on a contoured garden mound provide an effective screening.
- Fencing in BAL 29 or within 6m of a building should be of non-combustible materials.
- Establish a path immediately around the external wall of the building. Do not place garden beds adjacent to the external fabric of the building and under windows.
- Clumping shrubs and trees so they do not form a continuous canopy and are separated by areas of low fuel (maintained green grass lawn).

Further information can be found here - [Landscaping for bushfires](#)

Access Requirements

In the event of a serious bushfire threat to the proposed development, it will be essential to ensure that adequate ingress/ egress and the provision of defendable space are afforded in the development/building design.

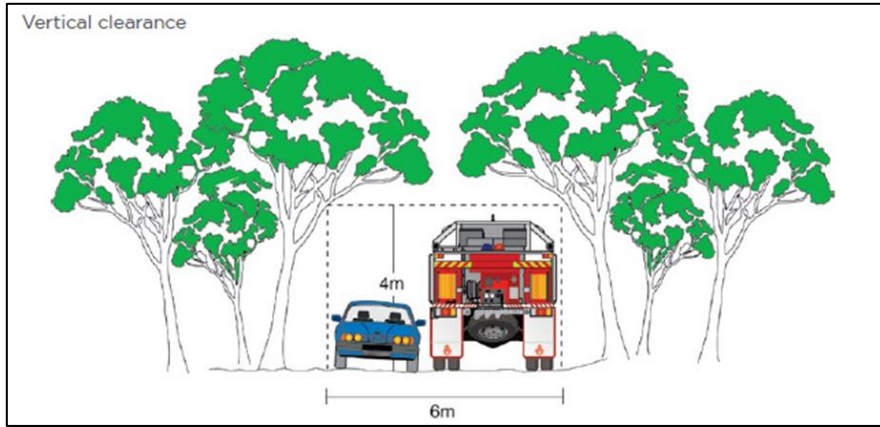
Local Area Traffic Management (LATM)

The objective of LATM is to attain an acceptable level of speed, volume, and composition of traffic within a local area and reduce the number of road accidents. This is achieved by modifying the street environment through the installation of various traffic control devices. LATM devices by their nature are designed to restrict and or impede the movement of traffic, especially large vehicles, which conflicts with the intent for access required by the NSW RFS and may significantly increase response times for emergency services.

Where LATM devices are provided they are to be designed so that they do not impede fire vehicle access.

Vertical clearance

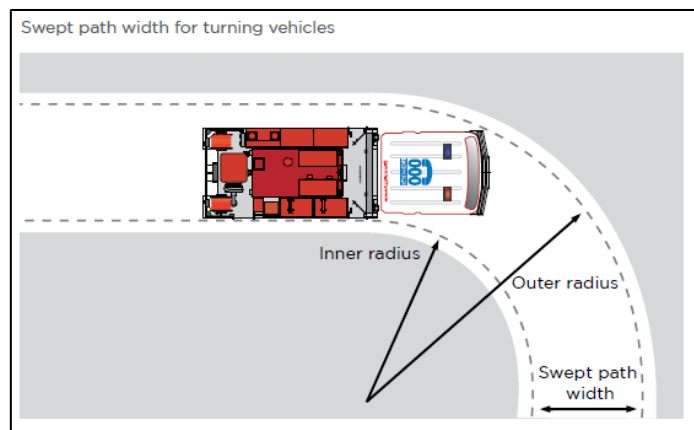
An unobstructed clearance height of 4 metres should be maintained above all access ways including clearance from building construction, archways, gateways/doorways, and overhanging structures (e.g., ducts, pipes, sprinklers, walkways, signs and beams). This also applies to vegetation overhanging roads and fire trails.

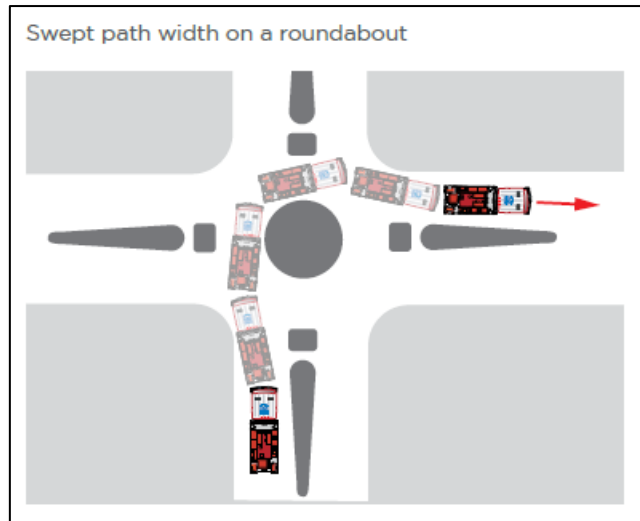


Vehicle Turning Requirements

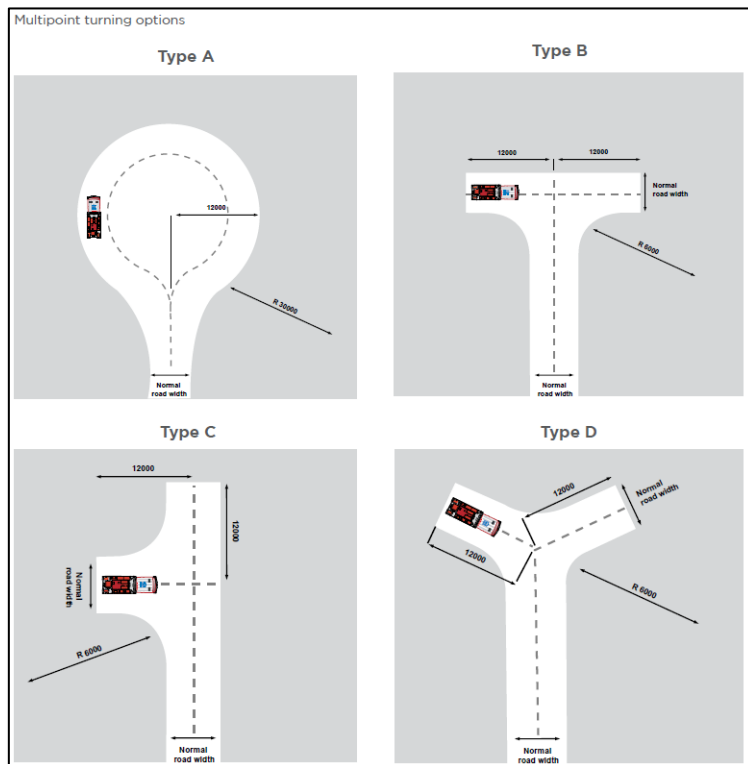
Fire crews must have rapid access and egress for vehicles, therefore curved carriageways should be constructed using the minimum swept path. The below diagrams from PBP2019 provide indication of the requirements to be achieved.

Minimum curve radius (inside edge (m))	Swept path (m) wide
<40	4.0
40 -69	3.0
70 - 100	2.7
>100	2.5

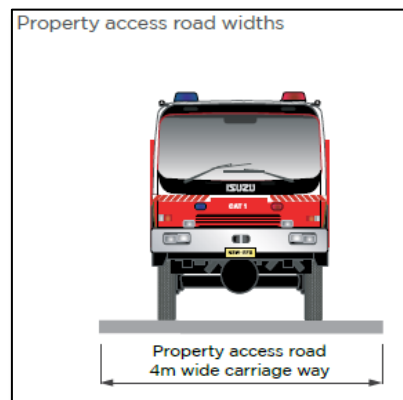




Where a turning head is proposed the NSW RFS requires that dead ends having a length greater than 20 metres should be provided with a turning head area which avoids multipoint turns.



Property access is required to be 4m wide all-weather road. Can be sealed or unsealed.



Water Supply

Intent of water measures is to provide adequate services of water for the protection of buildings during and after the passage of a bush fire.

Where reticulated water supplies are provided fire hydrant spacing, design, flow, pressures, and sizing comply with Australian Standard AS 2419.1:2005 and all above-ground water service pipes external to the building are metal, including and up to any taps.

Reticulated water supply to urban subdivisions shall use a ring main system for areas with perimeter roads.

Hydrant services should be located outside the carriageway and parking bays to permit traffic flow and access. Transporting and setup of standpipes within the carriageway will stop traffic flow. Hydrant services should be located on the side of the road away from the bush fire threat where possible.

Where reticulated water supply is not provided, a static water supply for fire-fighting purposes should be above-ground, accessible, clearly marked and manufactured from concrete or metal. If raised the tank stand should be made from non-combustible material. These static water supplies (tanks) should be positioned on the non-hazard side of the building and have 65mm Storz outlet with a ball valve fitted to the outlet within the IPA. If not appropriate, they should be appropriately shielded to protect the tank and fire fighters accessing the water. Category 1 fire appliance should be able to access within 4 m of static water supply with a hardened ground surface to support this access.

All exposed water pipes, valves, taps and fittings should be metal and the supply line from tank to ball valve have the same bore size.

Where pumps are provided, they are a minimum 5hp or 3kW petrol or diesel-powered pump and are shielded against bush fire attack. Any hose and reel for firefighting connected to the pump shall be 19mm (internal diameter), and fire hose reels are constructed in accordance with AS/NZS 1221:1997 Fire hose reels and installed in accordance with AS 2441:2005 Installation of fire hose reels.

Where static water supply is provided the following signage should be installed at the front gate and at a location that is clearly visible (assume smoke) to approaching emergency services to guide them to the static water supply.



Electricity, Gas supplies and Hazardous materials

The intent of electricity, gas and hazardous material measures is to locate these utilities and materials so as not to contribute to the risk of fire to a building.

Electricity

Location of electricity services should limit the possibility of igniting the surrounding bush land or the fabric of buildings. Where practicable, electrical transmission lines are underground. If overhead, electrical transmission 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 accordance with the specifications in ISSC3 Guideline for Managing Vegetation Near Power Lines.

Gas

Any reticulated or bottled gas should be installed and maintained according to the requirements of the relevant authorities and AS/NZS 1596:2014. All fixed gas cylinders are kept clear of all flammable materials to 10m and shielded on the hazard side. All above-ground pipes and connections to and from gas cylinders are metal, and polymer-sheathed flexible gas supply lines to gas meters adjacent to buildings are not permitted. Furthermore, if gas cylinders need to be kept close to the building, safety valves are directed away from the building and at least 2m away from any combustible material, so they do not act as a catalyst to combustion. Gas utilities should be positioned to not impede fire fighters accessing water supplies while undertaking suppression operations.

Hazardous Materials

Hazardous materials are any materials that can fuel the fire, such as leaf litter, grass, garden mulch and woodpiles. They can also be made up of solid combustibles or flammable liquids and gases such as petrol, kerosene, alcohol, LPG, natural gas, and acetylene. Vehicle, machinery, and other mechanical equipment that utilise fuels for operations can also be considered hazardous. The incorrect design and placement of carport and garages in residential developments could propagate fire towards the residential dwelling. Any liquids or fuels that are considered hazardous should be positioned away from the dominant bush fire threat. If located in a building/structure, it should be a minimum of 6m away from any other building. Vegetation surrounding these locations shall be maintained to IPA standards and the construction standards shall minimise the impact of ember attack to ignite the structure.

Construction Requirements

Groundwork and Sub-structure construction phase

During the ground phase potential ignition sources of the subject development may include hot works, incorrect disposal of cigarette butts and hot exhausts from vehicles, electrical failures, and sparks from metal contact.

Groundwork and Sub-structure construction phase fire management plan should be developed. Preparation of the site should include mitigating fire ignition sources. This should include vegetation management such as slashing and mowing long grasses in and around the development site, car parking and access tracks. This is especially important during summer months where Rates of Spread of fire can significantly increase due to the prevailing weather condition.

Handheld fire extinguishers should be carried on each vehicle and on site for quick access and suppression of fires.

In location where reticulated water is available, temporary fire hoses should be considered as a preventative measure that can be removed with the prescribed fire-fighting water supply is installed.

Where reticulated water is not available a temporary 10,000 litre Static Water Supply within proximity of the development site before the commencement of any construction works. This temporary supply will allow for the replenishment of attending fire services which will facilitate the rapid suppression of any potential ignitions. The temporary supply may be removed when the prescribed fire-fighting water supply is installed.

Ongoing Operations

The routine inspection intervals of bush fire safety systems and equipment general occur annually and are supported by a Bushfire plan. Ideally these inspections should occur moving out of the colder months in preparation for the bushfire season. The most common types of inspections that are required are surface, near surface (grasses and debris) and elevated (shrub) fire fuel level accumulation in APZs, canopy separation reequipments in APZs, and maintaining building fire hygiene such as cleaning gutters and down pipes.

Developing and annually reviewing a bushfire plan, no matter how big or small the development, is critical to the ongoing maintenance of the Bushfire Protection Measures identified within this report.

Construction Standards

Australian Standard 3959 "Construction of buildings in bushfire-prone areas" provides for six (6) levels of building construction these being BAL - Low, BAL - 12.5, BAL - 19, BAL - 29, BAL - 40 and BAL - FZ. The Australian Standard 3959 specifies construction standards for buildings within various Bushfire Attack Levels as determined by the Planning for Bushfire Protection – 2019 document.

Retrofitting

Any future alterations, extension to structures, even if they are complying, should consider the appropriate bushfire construction standards at that time. Homes built prior to August 2002 were not required to be built to meet bush fire construction standards. Constructions in Bush fire prone lands after August 2002 required bush fire construction standards, which have also changed over time.

The current construction standards are based on your Bush fire Attack Level (BAL). Evidence from large wildfire events over the last 20 years illustrate that house ignition is concentrated within 100m from the vegetation, although can occur kilometres from the burning vegetation under worst case scenarios. Development outside the bush fire prone area (100m from the vegetation) will benefit from increasing construction standards to withstand ember-attack to protect the building during a bush fire event.

When undertaking alterations and additions to a dwelling in Bush fire prone land only the new construction is required to conform with the current requirements, although this only partially protects your home.

Research has illustrated that ember-attack from the wildfire is the principal mechanism that ignites home. The most vulnerable elements are timber decks, Eave fascia boards, gutters timber window frames and timber stairs. Furthermore, house-to-house fires occur following the ignition of a neighbouring property. Appropriate amount of effort should be placed to ensure that vegetation and landscaping should be maintained to reduce the likelihood of ember attack igniting fire fuels near the house, and separation between neighbouring houses is achieved to reduce house-to-house fires. The use of non-combustible fencing and appropriately positioned windows can go a long way to reducing the risk of house-to-house fires.

While retrofitting identifies available construction protection methods as per *AS3959 – Construction of buildings in Bushfire Prone Area*, **it should be clearly understood that such building enhancements are complementary to good site preparation and vegetation management in the context of your bushfire survival plan.** Routine maintenance is an important part of bushfire protection for your home, out-buildings and garden. For example, if a window/door metal shutter is fitted, it needs to work at the time of a bushfire threat just like your fire equipment needs to be ready to go.

Each retrofitting measure is a step towards making your home safer against the impact of embers and radiant heat in the event of a bushfire. If you want your home to be comparable to the construction requirements under AS 3959, then *ALL* the works associated with a particular BAL category will need to be undertaken.

Some of the basic retrofitting that can be undertaken:

- Enclose existing sub floors with suitable materials or construct the floor and structure with non-combustible materials
- Cover, seal, overlap, back or butt-joint all joints in the external surface material of walls to prevent gaps greater than 2mm.
- Seal vents, weepholes, breathers and open openings with metal screens of aperture <2mm.
- Replace flammable external wall with non-combustible materials.
- Apply sarking-type material (flammability index >5) over the outer face of the building frame prior to re-fixing of any external cladding.
- Screen all windows and doors with metal screens of aperture <2mm and metal frames.

- Establish weather strips, draught excluders or draught seals around doors and panel lift garage doors.
- Garage roller doors could have guide tracks with a maximum gap area of 3mm and be fitted with a nylon brush in contact with the door.
- Above-ground, exposed water, gutter downpipes and gas supply pipes should be metal.
- incorporate gutter guards with a flammability index more than 5 when tested to AS1530.2, or aluminium, bronze, or stainless steel with maximum aperture of 5mm.
- Only use Bushfire resisting timber as specified in AS 3959 Appendix F.

Further information can be found at [Guide-retrofit-your-home-for-better-bushfire-protection](#).

Bushfire Emergency / Survival Plan

No matter how big or small the development is within a bush fire prone area, a bush fire plan is critical to preparing the property in the event of a bush fire. To ensure appropriate measures are taken, the worst-case scenario bush fire behaviour should be used to determine the course of action.

There is extreme noise, smoke, heat, and wind during the passing of a bush fire front under worst-case conditions. Vision, hearing, breathing, and communication are significantly affected during this period.

State bush fire authorities have established kits to help residential and small property owners to develop appropriate plans to plan and prepare for bush fire events. In NSW Bush fire survival Plans can be accessed from <https://www.rfs.nsw.gov.au/plan-and-prepare/bush-fire-survival-plan>.

The principal elements of the Bush fire survival Plans are:

- Know your risk.
- Know and understand the bush fire alert levels.
- Access to 'Fires Near Me' app.
- Knowledge of Local radio, local ABC/emergency broadcaster frequency, and TV.
- Prepare yourself, your home and your family.
- Leave early or prepare to stay.
 - If leaving, when to leave, where will you go, how will I get there, what will I take, who will you call, what is your back-up plan.
 - If you stay, do you have all the equipment you need, what are the signal to start defending the dwelling, what to do before, during and after the passing of the fire front, do all members of the household know what to do, check your equipment, develop action checklist, what is your back-up plan.
- Discuss all elements with your family and neighbours.

Furthermore, knowledge of escape routes (generally the public road system around your dwelling), refuges and location of any nearby Neighborhood Safer Places is critical knowledge prior to a bush fire event.

A bushfire emergency management and evacuation plans are prepared consistent with Australian Standard AS 3745:2010 Planning for emergencies in facilities. State agencies also have developed guidelines to facilitate the development of the documents and other Australian Standards are relevant for different development type. Bushfire emergency management and evacuation plans should be complemented with a Bushfire Management Plan (BMP).

A simple 4 step process can be undertaken to develop a basic bushfire emergency survival plan:

DISCUSS

STEP 1

DISCUSS WHAT TO DO IF A BUSH FIRE THREATENS YOUR HOME



Many households find that having a discussion over dinner works best as everybody is together and focussed.

[Download the Step 1 discussion guide \(PDF, 985.3 KB\).](#)

PREPARE

STEP 2

PREPARE YOUR HOME AND GET IT READY FOR BUSH FIRE SEASON



There are simple things you can do around your home to prepare it for a bush fire, like keeping the grass low and having a cleared area around your home.

[Download the Step 2 checklist \(PDF, 595.5 KB\).](#)

KNOW

STEP 3

KNOW THE BUSH FIRE ALERT LEVELS



If there is a fire in your area you will find its alert level on the NSW RFS website and in the 'Fires Near Me' app. You need to keep track of the alert level so you know what you should do.

[Download Step 3 \(PDF, 166.1 KB\).](#)

KEEP

STEP 4

KEEP ALL THE BUSH FIRE INFORMATION NUMBERS, WEBSITES AND THE SMARTPHONE APP



In a bush fire, it's important that you stay up to date on conditions in your area.

[Download Step 4 \(PDF, 219.1 KB\).](#)