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Bushfire management plan

Proposed development | 166 Pacey Road | Upper Brookfield | Queensland
Prepared for Celia Roberts | 19 August 2019

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Bushfire management plan

Final

Report 19013 | Celia Roberts | 19 August 2019

Prepared by Robert Janssen

Position Managing principal

Signature 

Date 19 August 2019

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Document control

Version	Date	Prepared by	Reviewed by
Draft	16 May 2019	R. Janssen	Jeff Nicholls Town Planning
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Table of contents

Contents

Table of contents i

1 Introduction 1

1.1 Method 1

1.2 Suitably qualified person 2

2 Description of the site and the proposed development 3

2.1 Site description 3

2.2 Proposed development 3

2.3 Bushfire hazard overlay 3

3 Bushfire assessment 5

3.1 Desktop review 5

3.2 Site assessment 5

3.3 Bushfire hazard assessment 6

3.3.1 Potential bushfire intensity calculations 6

3.4 Bushfire hazard areas 7

4 Bushfire hazards associated with the site 8

4.1 Fire danger season 8

4.2 Fire history 8

4.3 Directions of bushfire attack 8

4.4 Potential bushfire hazard for adjacent land use 8

5 Bushfire hazards associated with the proposed development 9

5.1 Site activities and usage patterns 9

5.2 Population 9

5.3 Hazardous chemicals 9

5.4 Vulnerable use 9

5.5 Landscaping 9

5.6 Access and egress 9

5.7 Warning and evacuation requirements 9

5.8 Fire-fighter water supply 9

5.9 Radiant heat exposure 9

6 Bushfire mitigation plan 11

6.1 Bushfire protection zone 11

6.2 Building design and construction 11
6.3 Vehicle access 11
6.4 Fire-fighting water supply 11
6.5 Bushfire education and awareness program 12
7 Conclusion 14

Figures

Figure 2.1 Property locality and bushfire hazard overlay 4
Figure 6.1: Bushfire mitigation plan 13

Tables

Table 3.1 Site observations 5
Table 3.2 Potential bushfire intensity 7

Photographs

Photograph 3.1 VHC 10.1 at assessment point A 6
Photograph 3.2 VHC 39.2 at assessment point B 6
Photograph 3.3 VHC 10.1 at assessment point C 6
Photograph 3.4 VHC 5.1 at assessment point D 6

Appendix

Appendix 1 Proposed plan of development
Appendix 2 Radiant heat exposure calculations
Appendix 3 Bushfire overlay code assessment

Disclaimer

Notwithstanding the precautions adopted in this report, it should always be remembered that bushfires burn under a range of conditions. An element of risk, no matter how small always remains, and although AS 3959-2018 is designed to improve the performance of such buildings, there can be no guarantee, because of the variable nature of bushfires, that any one building will withstand bushfire attack on every occasion.

It should be noted that upon lodgement of a development application, council and/or the fire service may recommend additional construction requirements.

Although every care has been taken in the preparation of this report, Land and Environment Consultants Pty Ltd accept no responsibility resulting from the use of the information in this report.

1 Introduction

Land and Environment Consultants Pty Ltd (LEC) was engaged to undertake a bushfire hazard assessment and prepare a bushfire management plan for the proposed development (reconfiguration of 1 lot into 2 lots) at 166 Pacey Road, Upper Brookfield, Queensland, properly described as lot 1/SP215132.

Lot 1/SP215132 is divided in 2 uneven parts by Pacey Road. The proposed development involves the smaller part of lot 1/SP215132 on the north side of Pacey Road (the site).

The site is affected by the Brisbane City Plan 2014 *Bushfire overlay* (Bushfire overlay) map for medium and high bushfire hazard areas and high bushfire hazard buffer area. Therefore, under the Brisbane City Plan 2014 *Bushfire overlay code* (Bushfire overlay code), a site based bushfire hazard assessment is required to demonstrate how the proposed development will comply with outcomes sought under the Bushfire overlay code.

This bushfire management plan has been prepared in accordance with guidelines in the Brisbane City Plan 2014 *Bushfire planning scheme policy* (Bushfire planning scheme policy). It documents a site-based bushfire hazard assessment for the site and identifies strategies that the proposed development will implement to mitigate the potential impacts of bushfire on life, property and the environment and includes:

- an introduction (this section) and description of methods and information resources used for the bushfire hazard assessment;
- description of the site and the proposed development;
- site-specific bushfire hazard assessment;
- identification of bushfire hazards associated with the site and the proposed development;
- radiant heat exposure assessment;
- a plan for mitigating bushfire hazards; and
- assessment of the proposed development against the Bushfire overlay code.

1.1 Method

The method used to prepare this bushfire management plan includes the following steps:

- desktop review of the Bushfire overlay map on the Brisbane City Council online mapping system;
- desktop review of the Queensland regional ecosystem (RE) map (version 10), vegetation hazard class (VHC) map, fire history map and severe fire weather map on the Queensland Fire and Emergency Services (QFES) online mapping system (redi-portal);
- assessment of the site and land within 100 m of the site for vegetation characteristics and current management practices, slope and evidence of previous fires;
- site-specific bushfire hazard assessment in accordance with Part B of the Queensland State Planning Policy (SPP) Natural Hazards, Risk and Resilience Technical Manual – *A 'fit-for-purpose' approach in undertaking natural hazard studies and risk assessments* (April 2016) (SPP bushfire hazard assessment manual) and the patch and corridor filters in the Commonwealth Scientific and Industrial Research Organisation (CSIRO) guideline *Estimating the potential bushfire hazard of vegetation patches and corridors* (June 2017) (CSIRO patch and corridor filters);
- radiant heat exposure assessment using the Fire Protection Association of Australia *BAL calculator V4.8* which models the 'method 2' bushfire attack level (BAL) procedure in the *Australian Standard for Construction of Buildings in Bushfire Prone Areas* (AS 3959-2018); and

- assessment of the proposed development against the Bushfire overlay code.

Aerial imagery of the site was accessed online from Google Earth and the Queensland Globe to assist in validating observations and measurements made during the site assessment.

1.2 Suitably qualified person

This bushfire management plan was prepared by Robert Janssen who is a suitably qualified and experienced bushfire management consultant.

Robert is the managing principal at LEC and has over 20 years of experience in bushfire planning and operations. He has prepared bushfire management plans for residential, commercial and industrial property developments, utilities, government facilities and conservation estates.

Robert's formal qualifications as an environmental scientist and consulting experience are coupled with 10 years of experience as a nationally accredited fire-fighter with the national parks and wildlife service in New South Wales and Queensland.

2 Description of the site and the proposed development

This chapter provides a description of the site and the proposed development.

2.1 Site description

The site is about 0.9 hectares (ha) and is accessed from Pacey Road along its south boundary as shown on Figure 2.1. It is vacant land with degraded bushland vegetation and a drainage channel in the northern part.

The site is a triangle shape. The north-east and north-west boundaries adjoin bushland vegetation and the south boundary adjoins Pacey Road, a drainage channel and livestock paddocks which have been cleared of bushland vegetation.

2.2 Proposed development

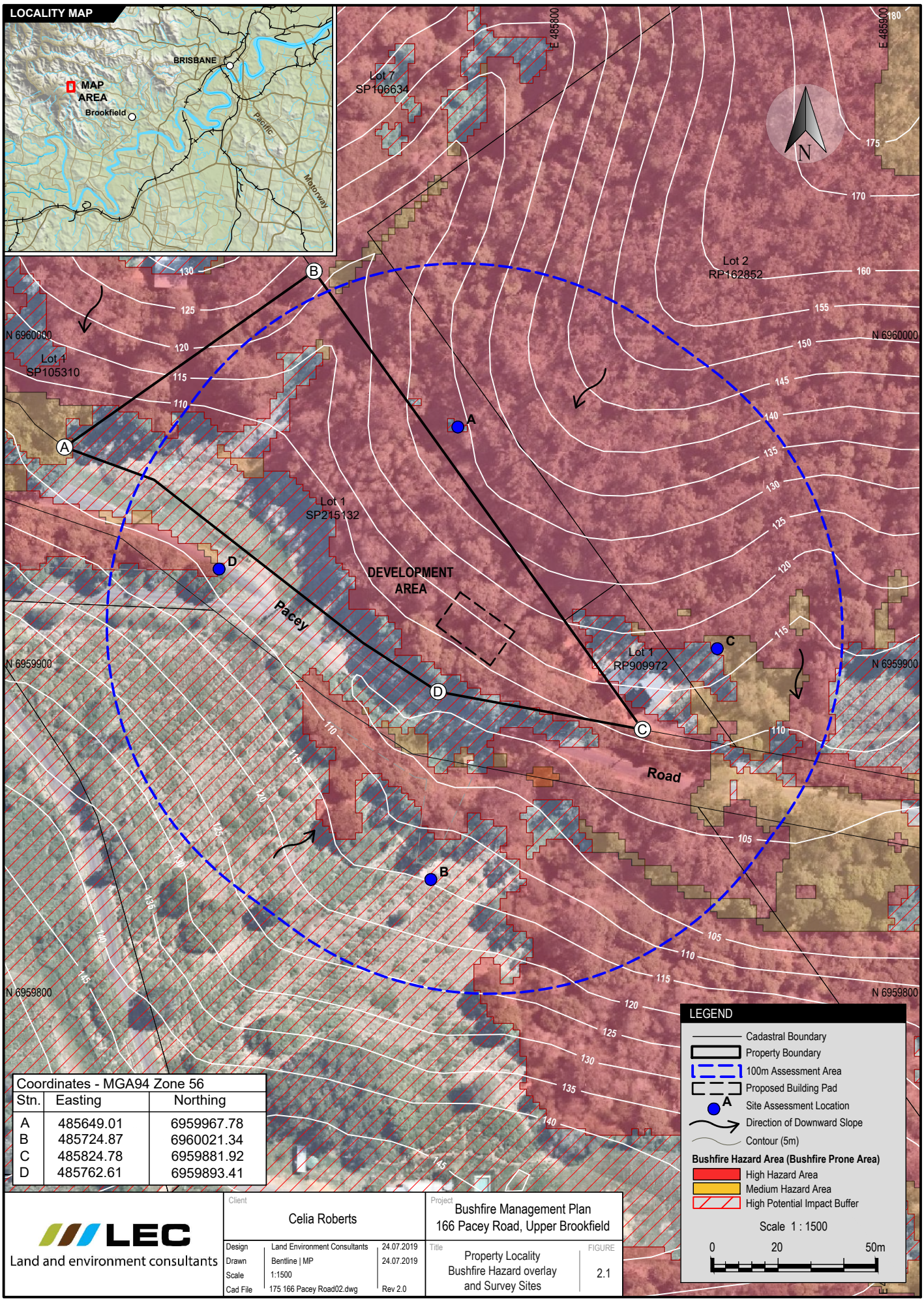
The proposed development involves reconfiguration of the site into 2 lots and establishing a building location envelope for a residential dwelling on the new lot. A plan of the proposed development is provided at Appendix 1.

The new lot has a common boundary with Pacey Road but does not have access to mains water.

The proposed building location envelope on the new lot is located near the base of a valley. As a result, the effective slope of land under hazardous vegetation in relation to the proposed building location envelope is upslope. Effective slope is defined in clause 1.5.11 of AS 3959-2018 as 'the slope under classified vegetation which most influences the bushfire attack'. This consideration is further reinforced by the fact that there is a road, rock lined drainage channel, grazing paddock and adjoining residential development either downslope or level with the proposed building location envelope on the new lot.

2.3 Bushfire hazard overlay

The Bushfire overlay map for the site is presented on Figure 2.1 and indicates the site is affected by medium and high bushfire hazard areas and high bushfire hazard buffer area.



Coordinates - MGA94 Zone 56		
Stn.	Easting	Northing
A	485649.01	6959967.78
B	485724.87	6960021.34
C	485824.78	6959881.92
D	485762.61	6959893.41

LEC Land and environment consultants

Client: Celia Roberts

Project: Bushfire Management Plan
166 Pacey Road, Upper Brookfield

Design	Land Environment Consultants	24.07.2019
Drawn	Bentline | MP	24.07.2019
Scale	1:1500	
Cad File	175 166 Pacey Road02.dwg	Rev 2.0

Title: Property Locality
Bushfire Hazard overlay
and Survey Sites

FIGURE: 2.1

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3 Bushfire assessment

This chapter provides a site-specific bushfire hazard assessment for the proposed development.

3.1 Desktop review

The site was reviewed on the QFES redi-portal to obtain information about vegetation characteristics, fire history and severe fire weather. Vegetation characteristics are discussed in Section 3.2.

The severe fire weather map on the QFES redi-portal indicates the 5% annual exceedance probability forest fire danger index (FFDI) for the site is 57.

Fire history data on the QFES redi-portal indicates no fires occurred within 2 kilometres (km) of the site from 2007-2018.

3.2 Site assessment

The site assessment was performed by LEC on 12 February 2019 and focused on land within 100 m of the proposed building location envelope on the site. Observations were recorded about land use and management, vegetation characteristics, slope and evidence of previous fires.

The locations of site assessment points are shown on Figure 2.1. Table 3.1 provides a summary of observations from the site assessment and the features of site assessment points are shown in Photographs 3.1-3.4

Table 3.1 Site observations

Assessment Point	Redi-portal VHC	Ground truthed VHC	Notes
A	VHC 10.1 *Spotted gum dominated open forest* (VHC 10.1)	VHC 10.1	Bushland vegetation. The land is 24° upslope in relation to the proposed building location envelope.
B	VHC 5.1 *Notophyll to microphyll vine forests* (VHC 5.1)	VHC 39.2 *Low to moderate tree cover* (VHC 39.2)	Pacey Road then moderate tree cover on the edge of a drainage channel. Further south is paddocks used for livestock. The land is 17° upslope in relation to the proposed building location envelope.
C	VHC 5.1	VHC 10.1	Bushland vegetation. The slope of land is 3° upslope in relation to the proposed building location envelope.
D	VHC 5.1	VHC 39.2	Vegetation restoration area on a drainage channel. The land is 6° downslope in relation to the proposed building location envelope.



Photograph 3.1 VHC 10.1 at assessment point A



Photograph 3.2 VHC 39.2 at assessment point B



Photograph 3.3 VHC 10.1 at assessment point C



Photograph 3.4 VHC 5.1 at assessment point D

3.3 Bushfire hazard assessment

The bushfire hazard assessment method in the Bushfire planning scheme policy is based on the SPP 1/03 guideline - *Mitigating the adverse impacts of flood, bushfire and landslide* (SPP 1/03 guideline). This method is superseded by the method in Part B of the SPP bushfire hazard assessment manual which overcomes many of the known limitations with the method in the SPP 1/03 guideline. Therefore, the bushfire hazard assessment in this report is based on the SPP bushfire hazard assessment manual and the patch and corridor filters in the CSIRO patch and corridor filters.

3.3.1 Potential bushfire intensity calculations

The potential bushfire intensity of assessment points was calculated using the QFES *Potential bushfire intensity calculator* (version November 2014) which models the bushfire hazard assessment method in the SPP bushfire hazard assessment manual.

The SPP bushfire hazard assessment manual defines bushfire hazard classes as follows:

- very high – potential bushfire intensity > 40,000 kilowatts/m (kW/m);
- high – potential bushfire intensity 20,000-40,000 kW/m;
- medium – potential bushfire intensity 4,000-20,000 kW/m;
- non bushfire hazard – potential bushfire intensity < 4,000 kW/m and > 100 m to medium, high or very high bushfire hazard area; and
- potential impact buffer – land within 100 m of a medium, high or very high bushfire hazard area.

The results of the potential bushfire intensity calculations are presented in Table 3.2.

Table 3.2 Potential bushfire intensity

Assessment points	Ground truthed VHC	Potential fuel load (t/ha)[1]	Slope (°)	Potential bushfire intensity (kW/m)	Bushfire hazard class
A	VHC 10.1	20.8	24	80,091	Very-high
B	VHC 39.2	8	17	7,309	Medium
C	VHC 10.1	20.8	3	18,806	Medium
D	VHC 39.2	8	6	3,422	Non-bushfire hazard class

Note 1 potential fuel load taken from the Queensland Fire and Emergency Services guideline *Vegetation hazard class descriptions and fuel characteristics – January 2017*

3.4 Bushfire hazard areas

The results of the potential bushfire intensity calculations indicate medium and very high bushfire hazard areas occur adjacent the north, south and east elevations of the proposed building location envelope on the site.

Therefore, the bushfire hazard assessment in this report has confirmed the site is a bushfire hazard area and the proposed development is subject to complying with the outcomes sought under Section C of the Bushfire overlay code.

4 Bushfire hazards associated with the site

This chapter identifies potential bushfire hazards associated with the site.

4.1 Fire danger season

The fire danger season in South-east Queensland starts in August, peaks in September and begins to fall in November, but will remain elevated until consistent summer rainfall occurs. Typically, the worst fire weather conditions will be experienced during the fire danger season when the wind direction is from the north.

The FFDI identifies the chance of a fire starting, its rate of spread, its intensity and the difficulty of its suppression, according to various combinations of air temperature, relative humidity, wind speed and both the long and short-term drought effects. The severe fire weather map accessed on the redi-portal indicates the 5% annual exceedance probability FFDI for the site is 57.

Fire danger ratings (FDR) are based on the forecast weather conditions, ie FFDI, and give advice about the level of bushfire threat on a day. An FFDI of 57 is commensurate with a very high FDR and will be associated with hot, dry and windy conditions. If a fire starts and takes hold under these conditions, it may be difficult to control in natural areas.

4.2 Fire history

Fire history data on the QFES redi-portal indicates no fires have occurred within 2 km of the site from 2007-2018. There was no evidence of fire in the assessment area during the site assessment, ie there was no charring around the base of tree trunks or timber fence posts. The fire history data and fire scar observations indicate it has been a very long time since the site was last subject to a broad-scale fire.

4.3 Directions of bushfire attack

The likely directions of bushfire attack on the proposed building location envelope are from the north, south, east and west where bushland vegetation occurs. These bushfire attack scenarios are further assessed in Chapter 5.

4.4 Potential bushfire hazard for adjacent land use

The site is surrounded by rural residential properties, livestock paddocks and natural area open space. Based on the fire history data discussed in Section 4.2, these land uses do not increase the risk of bushfire hazard to the proposed development.

5 Bushfire hazards associated with the proposed development

This chapter identifies bushfire hazards associated with the proposed development.

5.1 Site activities and usage patterns

The primary use of the proposed development is for a residential purpose and will not increase the risk of bushfire hazard to adjacent properties.

5.2 Population

The proposed development will create a new lot and building location envelope and will not materially increase the number of people or residential dwellings exposed to bushfire hazard.

5.3 Hazardous chemicals

Bulk storage or handling of hazardous chemicals, as defined under the Bushfire overlay code, will not occur under the proposed development. Hazardous chemical use will be consistent with typical household patterns.

5.4 Vulnerable use

The proposed development does not include assembly use, eg place of worship, vulnerable use, eg child care centre, or essential community infrastructure, eg police station.

5.5 Landscaping

A bushfire protection zone will be established around the proposed building location envelope on the new lot. Vegetation rehabilitation involving weed management will be undertaken on the balance lot.

5.6 Access and egress

Efficient access for fire-fighters and the orderly evacuation of occupants will be provided by an existing public road, ie Pacey Road, and a driveway to the proposed building location envelope.

The driveway to the building location envelope will be designed and constructed in general accordance with *Road design requirements for emergency vehicle access* in the Bushfire overlay code.

5.7 Warning and evacuation requirements

Queensland emergency services use a range of methods to warn the community about bushfire, severe weather and other emergencies that require preparation and action at the property level. Future residents of the proposed development will most likely have exposure to advice and warnings by Queensland emergency services via radio, online media, and local community safety announcements.

5.8 Fire-fighter water supply

The site does not have access to mains water. Therefore, the proposed development will have a dedicated onsite water storage for fire-fighting.

5.9 Radiant heat exposure

The Bushfire overlay code seeks residential lots to provide a building location envelope which achieves a radiant heat flux < 19 kW/m^2. Nonetheless, the radiant heat exposure outcome for residential

development under the SPP is < 29 kW/m^2 and we have many examples of Brisbane City Council accepting this outcome.

As discussed in Section 4.3, the likely directions of bushfire attack on the proposed building location envelope are from the north, south, east and west where bushland vegetation occurs. The radiant heat profile of these bushfire attack scenarios were assessed using the Fire Protection Association of Australia *BAL calculator version 4.8* which models the 'method 2' BAL procedure in AS 3959-2018.

Inputs used for bushfire attack models and calculations are provided at Appendix 2. Appendix 2 also provides a response to the bushfire issues raised by Brisbane City Council during the prelodgement meeting on 26 June 2019.

The bushfire attack models indicate the proposed building location envelope on the new lot can achieve a radiant heat flux < 19 kW/m^2 with a 13.8 m wide setback on the north elevation, 7.5 m wide setback on the south elevation, 18.9 m wide setback on the east elevation and 11.6 m wide setback on the west elevation.

6 Bushfire mitigation plan

This chapter identifies mitigation measures that will be implemented for the proposed development to comply with the outcomes sought under Section C of the Bushfire overlay code.

It is the total of the actions in this report that will reduce the risk of bushfire hazards to a tolerable level. Failure to implement all actions in their entirety could result in an increased level of exposure to the bushfire hazards.

6.1 Bushfire protection zone

A bushfire protection zone will be established around the proposed building location envelope and will provide a building location envelope which achieves a radiant heat flux < 19 kW/m^2. The bushfire protection zone is shown on Figure 6.1 and is 13.8 m wide setback on the north elevation, 7.5 m wide setback on the south elevation, 18.9 m wide setback on the east elevation and 11.6 m wide setback on the west elevation.

The bushfire protection zone will be established and maintained as follows:

- remove bushland shrubs and emergent trees;
- engage an arborist to identify dangerous trees and branches and remove them from site;
- remove trees or canopy branches which overhang the proposed building location envelope;
- establish a landscaped area consisting of hardened pathways, lawn and garden beds;
- garden beds are permitted to cover < 20 % of the bushfire protection zone;
- landscape plantings must favour 'lower flammability species which have high moisture content, high salt content, and low levels of fine fuel and/or oil content; and
- retaining walls will be constructed with non-combustible materials.

6.2 Building design and construction

The site is defined as 'bushfire prone' under Section 12 of the Queensland Building Regulation 2006. The construction of a residential building on the proposed building location envelope will comply with relevant BAL construction specifications in AS 3959-2018 as required for building approvals.

6.3 Vehicle access

The driveway will be designed and constructed in accordance with *Road design requirements for emergency vehicle access* in the Bushfire overlay code as follows:

- minimum formed width of 4 m inside a 6 m wide vegetation clearing;
- minimum vertical clearance of 4 m to any overhanging obstructions; and
- minimum 15 tonne rated all weather surface for urban appliances.

Escape from the site will be via Pacey Road as shown on Figure 6.1.

6.4 Fire-fighting water supply

The construction of a residential building on the new lot will include a dedicated on-site fire-fighting water storage which meets the following criteria:

- 5,000 litre water storage capacity in a separate tank or a reserve section of a main water supply tank;

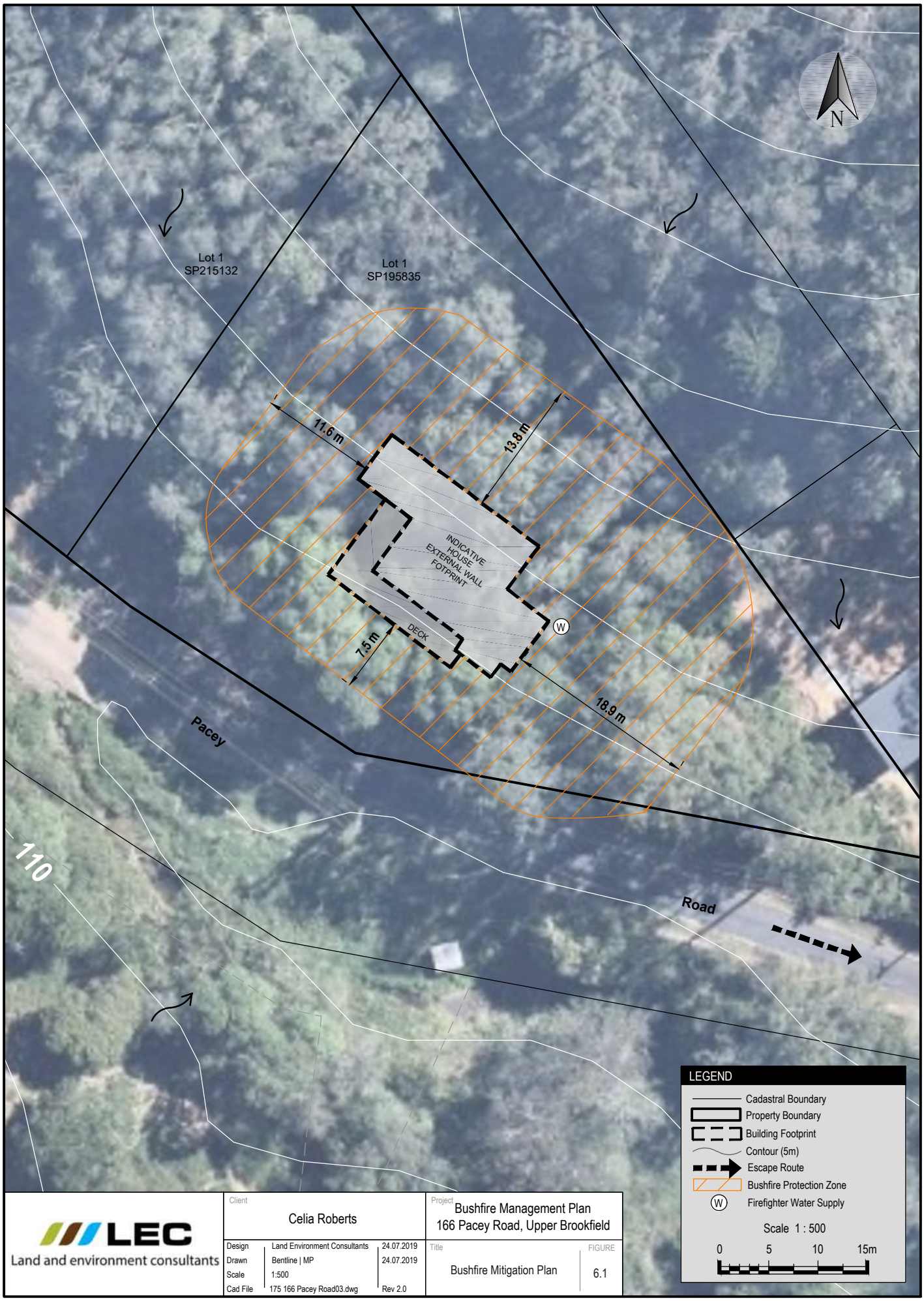
- 50 mm diameter outlet pipe that is fitted with a ball cock valve and 50 mm male camlock;
- access point within 2 m of the driveway; and
- reflective signposting so the access point can be located at all hours.

The indicative location of the fire-fighter water supply access point is shown on Figure 6.1.

6.5 Bushfire education and awareness program

Future residents will be responsible for preparing their home and family for the bushfire season.

The Queensland Rural Fire Service (QRFS) has publicly available information to assist the community prepare their homes and family for the bushfire season. This includes an online template to prepare a bushfire survival plan which can be accessed at Bushfire survival plan.



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Client	Celia Roberts	
Project	Bushfire Management Plan 166 Pacey Road, Upper Brookfield	
Design	Land Environment Consultants	24.07.2019
Drawn	Bentline | MP	24.07.2019
Scale	1:500	
Cad File	175 166 Pacey Road03.dwg	Rev 2.0
Title	Bushfire Mitigation Plan	FIGURE 6.1

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7 Conclusion

This bushfire management plan has been prepared in general accordance with the Bushfire planning scheme policy.

A site-specific bushfire hazard assessment confirmed the proposed development is affected by a bushfire hazard area and must comply with outcomes sought under Section C of the Bushfire overlay code.

Mitigation measures for the proposed development include a building location envelope which achieves a radiant heat flux < 19 kW/m^2 and design specifications for a bushfire protection zone, driveway and fire-fighting water supply.

With the implantation of mitigation measures in this report, the proposed development complies with the outcomes sought under Section C of the Bushfire overlay code as demonstrated at Appendix 3.

References

Australian Building Codes Board (ABCB) 2016, *National Construction Code Series, Building Code of Australia Class 2 to Class 9 Buildings, Volume 1,* Australian Government and States and Territories of Australia, May 2016

Australian Building Codes Board (ABCB) 2016, *National Construction Code Series, Building Code of Australia Class 1 and Class 10 Buildings, Volume 2,* Australian Government and States and Territories of Australia, May 2016

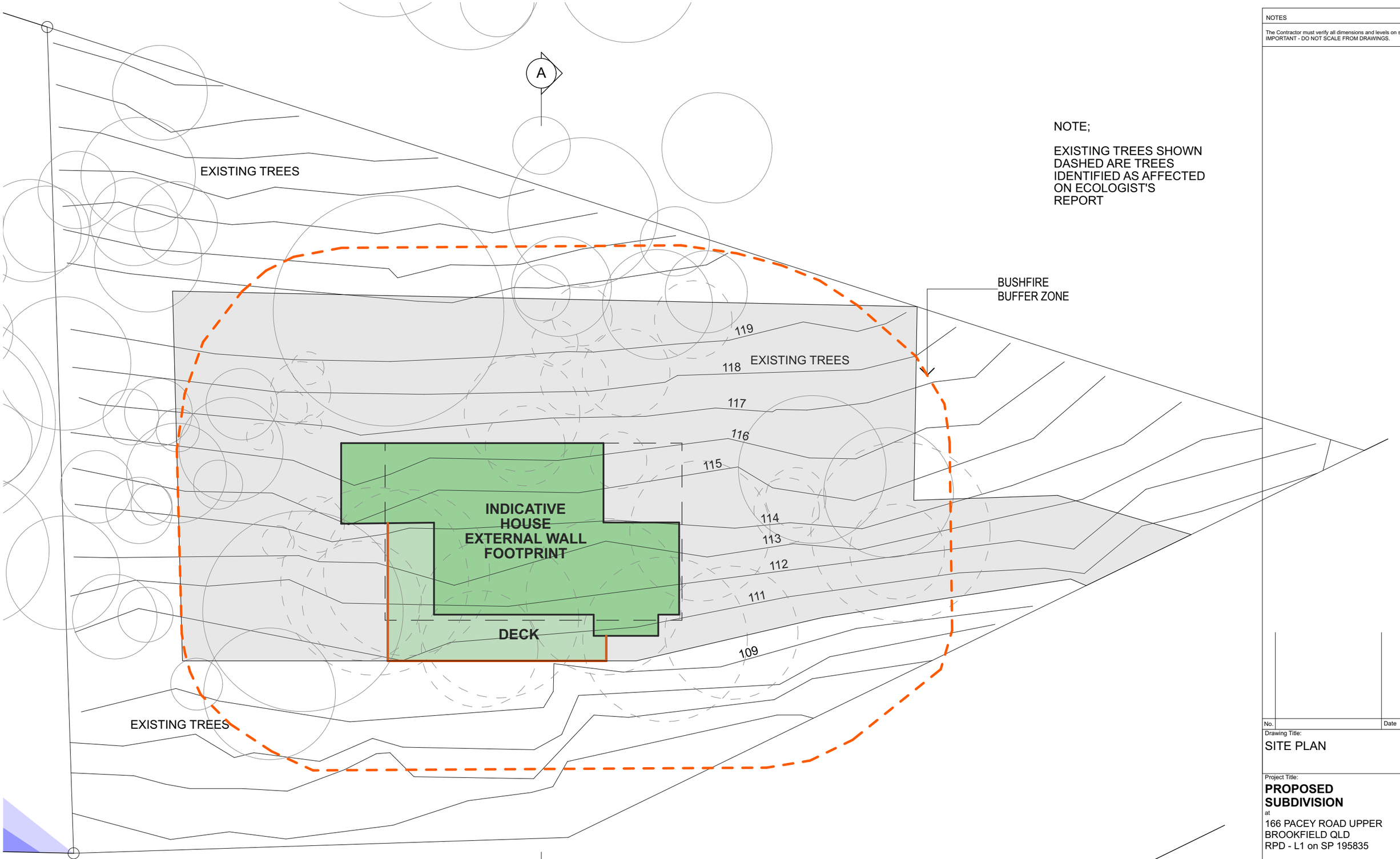
Bowden, John (Bowden) 1999, *Living with the Environment in the Pine Rivers Shire*, Pine Rivers Shire Council

Commonwealth Scientific and Industrial Research Organisation (CSIRO) 2014, *A new methodology for State-wide mapping of bushfire prone areas in Queensland*, CSIRO and State of Queensland 2014

Queensland Department of Infrastructure, Local Government and Planning (DILGP) 2016, *State Planning Policy Natural Hazards, Risk and Resilience Technical Manual – A 'fit-for-purpose' approach in undertaking natural hazard studies and risk assessments*, April 2016

Standards Australia Limited (Standards Australia) 2018, *Australian Standard 3959-2018 Construction of buildings in bushfire prone areas*, November 2018

Appendix 1 Proposed plan of development



NOTE;

EXISTING TREES SHOWN DASHED ARE TREES IDENTIFIED AS AFFECTED ON ECOLOGIST'S REPORT

SITE PLAN
Scale 1:250

NOTES

The Contractor must verify all dimensions and levels on site.
IMPORTANT - DO NOT SCALE FROM DRAWINGS.

No.	Date

Drawing Title:
SITE PLAN

Project Title:
PROPOSED SUBDIVISION
at
166 PACEY ROAD UPPER BROOKFIELD QLD
RPD - L1 on SP 195835

HOLGAR Architects
63 McMullen Road Brookfield QLD 4069
Phone 0414 919 694 Fax 07 3374 3745
Email: holgar@westnet.com.au

SCALE:	AS SHOWN	Drawing No.	Issue.
DATE:	AUG 2019	A-02	
PROJECT:			
DRAWN:	PB		
APPROVED:	VH		
DATE PLOTTED:			

Appendix 2 Radiant heat exposure calculations

Response to bushfire issues raised at pre-lodgement meeting

A pre-lodgement meeting was held with Brisbane City Council on 26 June 2019. With regards to bushfire, the pre-lodgement meeting record indicates the following issue was raised:

> The site is located within the Bushfire overlay and the Bushfire hazard area in the State's Natural Hazards, Risk and Resilience mapping.
>
> The submitted bushfire management plan prepared by Land and Environmental Consultants identified a bushfire setback area to ensure any future dwelling achieves a BAL-19 rating. The method 2 calculation is to be revised to ensure:
>
> - The calculation for the northern setback uses an input of -24 degrees (upslope) for the site slope which results in very minimal setbacks. AS3959-2018 states that '*where the effective slope under the classified vegetation is no more than 30 degrees downslope (or 15 degrees upslope)*'. Further, the standards state that '*effective slope under the classified vegetation is not the same as average slope for the land surrounding the site of the proposed building. The effective slope is that slope which most significantly influences fire behaviour*'.
> - Based on the undulating terrain in the vicinity, the rate of spread of a landscape scale fire in the locality would be driven by both the upslope and downslope. Therefore, a slope of zero is best suited for this scenario.
>
> A revised bushfire hazard assessment is required to take into consideration of the effective slope of the land that would influence fire behaviour. As such, revised plans are required to demonstrate the Dwelling house is appropriately set back from hazardous vegetation and complies with the requirements of the Bushfire overlay code.

Radiant heat exposure modelling in the bushfire management plan is based on observations made during a site assessment of land within 100 m of the proposed building location envelope. The site assessment determined that the proposed building location envelope on the new lot is located in the base of a valley.

A large continuous area of bushland vegetation occurs upslope of the north elevation of the proposed building location envelope within the 100 m assessment area. There is a road, rocky drainage channel, grazing paddocks with low grass and residential development either downslope or level with the south, east and west elevations of the proposed building location envelope in the 100 m assessment area. Therefore, it is our view that an effective slope input of zero is overly conservative for the radiant heat exposure modelling of the proposed building location envelope.

Consideration of a 'landscape scale fire' in the locality of the proposed building location envelope is out of context with assessment methods in the *Australian Standard for Construction of Buildings in Bushfire Prone Areas* (AS 3959-2018) given that clause 2.2.3.2 states 'vegetation of any type that is more than 100 m from the site' shall be excluded from the assessment as 'low threat vegetation'.

Nonetheless, a middle ground approach has been adopted in the bushfire management plan, which reduces upslope inputs for effective slope and site slope on the north and south bushfire attack scenarios to the maximum specified under clause B1 in Appendix B of AS 3959-2018. This approach results in an increase to the minimum distances to achieve radiant heat exposure levels documented in the draft bushfire management plan, but less than the minimum distances that would be required if slope was assessed as zero.

North

- Forest fire danger index - 57
- Vegetation – VHC 10.1 *Spotted gum dominated open forests*
- Overall fuel load – 30.8 t/ha
- Surface fuel load – 20.8 t/ha
- Slope – 15^0 upslope
- Site slope –20^0 upslope
- Flame width – 100 m

FPA AUSTRALIA | FLAMESOL

Calculated July 15, 2019, 12:08 pm (MDc v.4.8)

J19013 (N)

Minimum Distance Calculator - AS3959-2009 (Method 2)			
Inputs		Outputs	
Fire Danger Index	57	Rate of spread	0.5 km/h
Vegetation classification	Forest	Flame length	6.98 m
Surface fuel load	20.8 t/ha	Flame angle	42 °, 50 °, 56 °, 60 °, 61 ° & 66 °
Overall fuel load	30.8 t/ha	Elevation of receiver	4.91 m, 6.13 m, 7.91 m, 10.19 m, 11.71 m & 26.48 m
Vegetation height	n/a	Fire intensity	8,042 kW/m
Effective slope	-15 °	Transmissivity	0.885, 0.874, 0.857, 0.837, 0.824 & 0.752
Site slope	-20 °	Viewfactor	0.5881999999999999, 0.4328, 0.2894, 0.1961, 0.1588 & 0.0437
Flame width	100 m	Minimum distance to < 40 kW/m²	7.099999999999991 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	9.499999999999982 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	13.79999999999997 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	19.70000000000001 m
		Minimum distance to < 10 kW/m²	23.80000000000007 m

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

South

- Forest fire danger index - 57
- Vegetation – VHC 39.2 *Moderate grass or tree cover*
- Overall fuel load – 8 t/ha (long grass therefore overall fuel is the same as surface fuel)
- Surface fuel load – 8 t/ha
- Slope – 15^0 upslope
- Site slope –0^0 flat across road
- Flame width – 100 m

Calculated July 15, 2019, 12:11 pm (MDc v.4.8)

J19013 (S)

Minimum Distance Calculator - AS3959-2009 (Method 2)			
Inputs		Outputs	
Fire Danger Index	57	Rate of spread	1.48 km/h
Vegetation classification	Scrub	Flame length	4.27 m
Surface fuel load	8 t/ha	Flame angle	55 °, 65 °, 73 °, 79 °, 81 ° & 86 °
Overall fuel load	8 t/ha	Elevation of receiver	1.75 m, 1.93 m, 2.04 m, 2.09 m, 2.11 m & 2.13 m
Vegetation height	m	Fire intensity	6,117 kW/m
Effective slope	-15 °	Transmissivity	0.893, 0.887, 0.875, 0.861, 0.851 & 0.778
Site slope	0 °	Viewfactor	0.5779, 0.4275, 0.2847, 0.1901, 0.1537 & 0.0421
Flame width	100 m	Minimum distance to < 40 kW/m²	3.700000000000002 m
Windspeed	45 km/h	Minimum distance to < 29 kW/m²	4.999999999999998 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	7.499999999999989 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	11.19999999999998 m
		Minimum distance to < 10 kW/m²	13.79999999999997 m

Rate of Spread - Catchpole et al. 1998

Flame length - Byram, 1959

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

East

- Forest fire danger index - 57
- Vegetation – VHC 10.1 *Spotted gum dominated open forests*
- Overall fuel load – 30.8 t/ha
- Surface fuel load – 20.8 t/ha
- Slope – 3^0 upslope
- Site slope –3^0 upslope
- Flame width – 100 m

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Calculated February 23, 2019, 4:22 pm (MDc v.4.8)

J19013 (E)

Minimum Distance Calculator - AS3959-2009 (Method 2)			
Inputs		Outputs	
Fire Danger Index	57	Rate of spread	1.15 km/h
Vegetation classification	Forest	Flame length	11.21 m
Surface fuel load	20.8 t/ha	Flame angle	52 °, 61 °, 69 °, 74 °, 75 ° & 81 °
Overall fuel load	30.8 t/ha	Elevation of receiver	4.92 m, 5.58 m, 6.22 m, 6.8 m, 7.1 m & 9.77 m
Vegetation height	n/a	Fire intensity	18,406 kW/m
Effective slope	-3 °	Transmissivity	0.878, 0.862, 0.84, 0.8149999999999999, 0.802 & 0.736
Site slope	-3 °	Viewfactor	0.5921999999999999, 0.4389, 0.2969, 0.201, 0.1633 & 0.0446
Flame width	100 m	Minimum distance to < 40 kW/m²	9.699999999999982 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	12.99999999999997 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	18.9 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	27.00000000000011 m
		Minimum distance to < 10 kW/m²	32.30000000000019 m

West

- Forest fire danger index - 57
- Vegetation – VHC 39.2 *Moderate grass or tree cover*
- Overall fuel load – 8 t/ha (long grass therefore overall fuel is the same as surface fuel)
- Surface fuel load – 8 t/ha
- Slope – 0^0 flat across waterway
- Site slope –6^0 downslope
- Flame width – 100 m

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Calculated February 23, 2019, 4:25 pm (MDc v.4.8)

J19013 (W)

Minimum Distance Calculator - AS3959-2009 (Method 2)			
Inputs		Outputs	
Fire Danger Index	57	Rate of spread	4.16 km/h
Vegetation classification	Scrub	Flame length	6.88 m
Surface fuel load	8 t/ha	Flame angle	58 °, 70 °, 79 °, 84 °, 86 ° & 91 °
Overall fuel load	8 t/ha	Elevation of receiver	2.33 m, 2.42 m, 2.15 m, 1.62 m, 1.22 m & 0 m
Vegetation height	m	Fire intensity	17,221 kW/m
Effective slope	0 °	Transmissivity	0.888, 0.877, 0.86, 0.84, 0.828 & 0.755
Site slope	6 °	Viewfactor	0.5854, 0.43, 0.2882, 0.1954, 0.1579 & 0.0434
Flame width	100 m	Minimum distance to < 40 kW/m²	5.599999999999996 m
Windspeed	45 km/h	Minimum distance to < 29 kW/m²	7.699999999999989 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	11.59999999999997 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	17.09999999999997 m
		Minimum distance to < 10 kW/m²	21.00000000000003 m

Appendix 3 Bushfire overlay code assessment

Section C—If for reconfiguring a lot

Performance outcomes	Acceptable outcomes	Compliance
PO15 Development addresses the bushfire hazard determined by a site-specific bushfire hazard assessment. Note—Bushfire hazard is assessed based on the vegetation existing on site, adjacent and nearby to the site at the time of application, except where reconfiguring a lot, when the level of bushfire hazard posed by any areas subject to revegetation is assessed as if that area had reached its mature state.	**AO15** Development addresses the level of bushfire hazard identified in a site-specific bushfire hazard assessment undertaken in accordance with the Bushfire planning scheme policy, which confirms the level of bushfire hazard for the part of the site in which development is proposed, and the location of hazardous vegetation posing a risk to the development in a bushfire. Note—Where a bushfire hazard assessment determines that the bushfire hazard for the part of the site in which development is proposed is 'low', no further assessment against this code is required.	✓ A site-specific bushfire hazard assessment was performed for the site by following the procedure in the Part B of the Queensland State Planning Policy (SPP) Natural Hazards, Risk and Resilience Technical Manual – *A 'fit-for-purpose' approach in undertaking natural hazard studies and risk assessments* (April 2016) and the patch and corridor filters in the Commonwealth Scientific and Industrial Research Organisation (CSIRO) guideline *Estimating the potential bushfire hazard of vegetation patches and corridors* (June 2017) The site-specific bushfire hazard assessment determined the site is in a bushfire hazard area. A bushfire management plan has been prepared (this report) and provides mitigation measures for potential impacts of bushfire hazard on the proposed development.
PO16 Development does not materially increase the number of premises exposed to unacceptable risk during bushfire events.	**AO16** Development does not materially increase the number of people living or working in the Bushfire overlay area.	✓ The development will not materially increase the number of people living or working in a bushfire hazard area. The proposed building location envelope on the new lot achieves a radiant heat exposure level < 19 kW/m^2.

Performance outcomes	Acceptable outcomes	Compliance
PO17 Development is designed to: (a) mitigate the risk of bushfire hazard to each lot; (b) limit the spread of bushfire within the reconfiguration; (c) achieve and maintain sufficient separation distance between development and hazardous vegetation to minimise bushfire hazard to future buildings during a bushfire; (d) allow for emergency services access. (e) locate buildings within a building protection zone Note—Lot size, location, configuration, dimensions and building measures are balanced to achieve an acceptable level of risk to future occupants. Note—A bushfire management plan prepared in accordance with the Bushfire planning scheme policy can assist in demonstrating compliance with this performance outcome.	**AO17.1** Development requires that lot number, size, shape and layout allow for the siting of future buildings within the lowest hazard locations on the site being located: (f) within a building protection zone in accordance with Figure b and Figure c; (g) to achieve separation distances between the development and hazardous vegetation of at least 1.5 times the predominant mature tree canopy height; (h) away from ridgelines and hilltop sites in compliance with Figure a; (i) on land with a gradient less than 15%; (j) preferably on east to south facing slopes and avoiding north to west facing slopes unless the slope is clear of vegetation and is not located in the High hazard buffers sub-category or Medium hazard sub-category.	✓ This bushfire management plan; prepared in accordance with Brisbane City Plan 2014 *Bushfire planning scheme policy* demonstrates: • the new lot provides a building location envelope which achieves a radiant heat exposure level < 19 kW/m^2. • a bushfire protection zone will be established around the proposed building location envelope on the new lot; and • construction of a residential building on the new lot will be subject to compliance with the *Australian Standard for the construction of buildings in bushfire prone areas* (AS 3959-2018).
	AO17.2 Development ensures that the bushfire attack level of the nominated development footprint plan does not exceed: (a) in a rural category, bushfire attack level 19 (calculated in accordance with AS 3959-2009 Construction of buildings in bushfire-prone areas); (b) in an urban category, bushfire attack level 12.5 (calculated in accordance with AS 3959-2009 Construction of buildings in bushfire-prone areas).	✓ The new lot has a building location envelope which achieves a radiant heat exposure level < 19 kW/m^2.
PO18 Development promotes safe site access, avoids creating a potential	**AO18** Development provides a lot layout which:	✓

Performance outcomes	Acceptable outcomes	Compliance
entrapment situation and supports accessibility and manoeuvring for fire-fighting during bushfires. Note—This includes easements and boundary realignments. Note—A bushfire management plan prepared in accordance with the Bushfire planning scheme policy can assist in demonstrating compliance with this performance outcome.	(a) provides direct road access and egress for new lots to public roads, rather than the creation of easements; (b) in an urban category, avoids creating a new lot less than or equal to 2,500m^2 which directly adjoins hazardous vegetation; (c) in an urban category, locates a future building protection zone to avoid a driveway of longer than 70m from the road frontage to a habitable building; (d) in a rural category, provides for an alternative access where the private access roads or driveways are longer than 200m to reach a public road.	The proposed development generally complies with the acceptable outcomes: • the new lot has access to a road via a private access driveway; • the new lot will have a bushfire protection zone which separates a future residential building from hazardous vegetation; and • access for fire-fighters will be provided on the new lot via a driveway which meets design criteria in Table 8.2.3.C of the Bushfire overlay code.
PO19 Development ensures that the road layout and design provides: (k) efficient emergency services access to sites and manoeuvring within the subdivision; (l) safe and efficient movement of residents, workers and visitors out of the subdivision and away from an approaching bushfire; (m) safe and efficient movement of emergency services into the subdivision; (n) alternative egress routes considering the most likely bushfire scenarios; (o) ongoing availability and maintenance of access and egress routes for the purposes of evacuation and emergency services access. Note—A bushfire management plan prepared in accordance with the Bushfire planning scheme policy can assist in demonstrating compliance with this performance outcome.	**AO19.1** Development involving a new road or fire maintenance trail is designed and constructed in compliance with: (p) Table 8.2.5.3.C; or (q) an approved bushfire management plan.	✓ The proposed development does not include a new road. The proposed development does include a new driveway which will comply with driveway design criteria in Table 8.2.3.C of the Bushfire overlay code.
	AO19.2 Development has a road layout and design which: (a) provides for alternative access routes to the subdivision, by public roads that meet the requirements in Table 8.2.5.3.C and are able to access the arterial road network; (b) excludes cul-de-sacs, except where a perimeter road with a cleared width of 20m isolates the development from hazardous vegetation; (c) does not include dead-end roads or if a dead-end road is unavoidable, it is a maximum of 60m long, or 200m where located in the Environmental management zone,	✓ The proposed development does not include a new road. The proposed development does include a new driveway which will comply with driveway design criteria in Table 8.2.3.C of the Bushfire overlay code.

Performance outcomes	Acceptable outcomes	Compliance
	Conservation zone, Rural zone, or Rural residential zone, and an alternative emergency evacuation and egress route away from the most likely source of bushfire risk is provided for lots where multiple road access or exit points are not possible; (d) links road within the subdivision to, or provides for future links to roads in adjacent subdivisions. Note—Where staged development occurs or development is in accordance with an approved master plan, a temporary perimeter road may be considered, subject to availability of reticulated water supply.	
PO20 Development involving new premises provides adequate infrastructure to support fire-fighting.	**AO20.1** Development involving new premises ensures that: (a) lots have access to reticulated water supply and water pressure available for fire-fighting requirements with water supply and pressure that accord with the standards specified by the relevant utilities provider; or (b) where reticulated water supply is not available for: (i) residential lots, there is a minimum water supply available and retained for fire-fighting purposes in compliance with Table 8.2.5.3.B, which may be in the form of a separate tank or a reserve section as part of a main water supply tank; (ii) development other than residential lots, onsite water storage is provided which is appropriate to the proposed future use according to the standards specified by the relevant	✓ The proposed building envelope on the new lot will provide a dedicated on-site fire-fighter water supply which complies with the design criteria for fire-fighter water supply in Table 8.2.5.3.B of the Bushfire overlay code.

Performance outcomes	Acceptable outcomes	Compliance
	emergency services agency and is not less than 5,000L. Note—Water supply for fire-fighting is in addition to water supply for household use. Where a non-reticulated supply of water is required, swimming pools, creeks and dams should not be used as a substitute for a dedicated static supply as these sources of water are not reliable during drought conditions.	
	AO20.2 Development provides fire hydrants in accordance with Central SEQ Distributor-Retailer Authority, Queensland Urban Utilities (incorporating Water Services Association of Australia) Standards.	**Not applicable**