ANNEXURE D

BUSHFIRE MANAGEMENT PLAN

Land and environment consultants

Bushfire management plan

Proposed development | 39 Pats Road and 10 Scheiwe Road | Plainland | Queensland
Prepared for The Trustee for Sunstone homes Australia Trust | 20 May 2022

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Bushfire management plan

Final

Report 21125 | The Trustee for Sunstone homes Australia Trust | 20 May 2022

Approved by Robert Janssen

Position Managing principal

Signature 

Date 20 May 2022

Document control

Version	Date	Prepared by	Reviewed by
Draft	19 May 2022	C. Turner	R. Janssen
Final	20 May 2022	C. Turner	R. Janssen

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Table of contents

Contents

Figures

Tables

Photographs

Appendix

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 proposal, State Government, 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 site-specific bushfire hazard assessment and to prepare a bushfire management plan for the proposed reconfiguration of lots (**proposed development**) at 39 Pats Road and 10 Scheiwe Road, Plainland (**the site**), properly described as lots 1 and 2/RP192001.

The site is within the former Laidley Shire Council area of the Lockyer Valley Regional Council area. Therefore, the development application for the proposed development will be made under the Laidley Shire Council Planning Scheme 2003.

The site is identified as a bushfire prone area by the Laidley Shire Council Planning Scheme 2003 *Overlay Map D – Areas of Natural and Environmental Significance – Bushfire Prone Areas* (**Bushfire prone areas overlay map**). Therefore, the development application for the proposed development is subject to assessment and compliance with the performance outcomes of the Laidley Shire Council Planning Scheme 2003 *Areas of Natural and Environmental Significance overlay code*.

The Laidley Shire Council Planning Scheme 2003 does not appropriately integrate the state interests for bushfire in the Queensland State Planning Policy (**SPP**) *Natural Hazards, Risk and Resilience – State Planning Policy State Interest guidance material* (DSDMIP 2019) (**SPP guidance material – bushfire**). Therefore, this bushfire management plan defers to the performance outcomes of the SPP *Bushfire prone area overlay code* (**SPP bushfire prone area overlay code**) in the SPP guidance material – bushfire.

This bushfire management plan has been prepared in accordance with *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience - Bushfire'* (QFES 2019) (**Bushfire resilient communities**). It documents the site-specific bushfire hazard assessment and demonstrates how the proposed development will comply with the performance outcomes of the SPP Bushfire prone area overlay code. It includes:

- an introduction (this section) and description of methods and information resources used for the preparation of this bushfire management plan;
- 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 performance outcomes of the SPP Bushfire prone area overlay code.

1.1 Method

To meet requirements of Bushfire resilient communities, the following steps were undertaken:

- review of the Bushfire prone areas overlay map in Lockyer Valley Regional Council's online mapping system (LVRC 2022) and the Queensland regional ecosystem map, vegetation hazard class (**VHC**) map, severe fire weather map and fire history map in the Queensland Fire and Emergency Services online mapping system (QFES 2022) (**Catalyst**);
- inspection of the site and land within 100 metres (**m**) of the site for vegetation characteristics, current land management practices, slope and evidence of previous fires;
- site-specific bushfire hazard assessment in accordance with the method in Bushfire resilient communities;

- radiant heat exposure assessment using the Fire Protection Association of Australia *BAL calculator V4.9* (**BAL calculator**) which models the 'method 2' bushfire attack level (BAL) assessment procedure in the *Australian Standard* (AS 3959-2018) *Construction of buildings in bushfire prone areas*; and
- assessment of the proposed development against performance outcomes of the SPP Bushfire prone area overlay code.

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

1.2 Suitably qualified person

This bushfire management plan was technically reviewed and approved 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 location of the site is shown in Figure 2.1. It is accessible from Pats Road and Scheiwe Road and has access to mains water.

The site has been used for livestock grazing and is mostly cleared of open forest vegetation. It has residential dwellings, ancillary buildings and dams which will be removed in preparation for civil works.

The eastern part of the site and adjoining land has steep topography and open forest vegetation which is protected under the Queensland *Vegetation Management Act 1999*.

Land adjoining the northern, southern and western boundaries of the site is used for rural residential and agricultural purposes and has rolling hills.

2.2 Proposed development

The reconfiguration of lot plan for the proposed development is provided at Appendix 1 and shows the proposed layout of lots, roads, bio-retention basins, environmental covenant area and stage boundaries.

The proposed development includes two bio-retention basins which will be constructed landforms that are rehabilitated with a suite of groundcover species.

An environmental covenant area will be established within the eastern part of the site and proposed lots 12, 22-24 and 39. The protected open forest vegetation will be retained within the environmental covenant area and will be allowed to naturally regenerate.

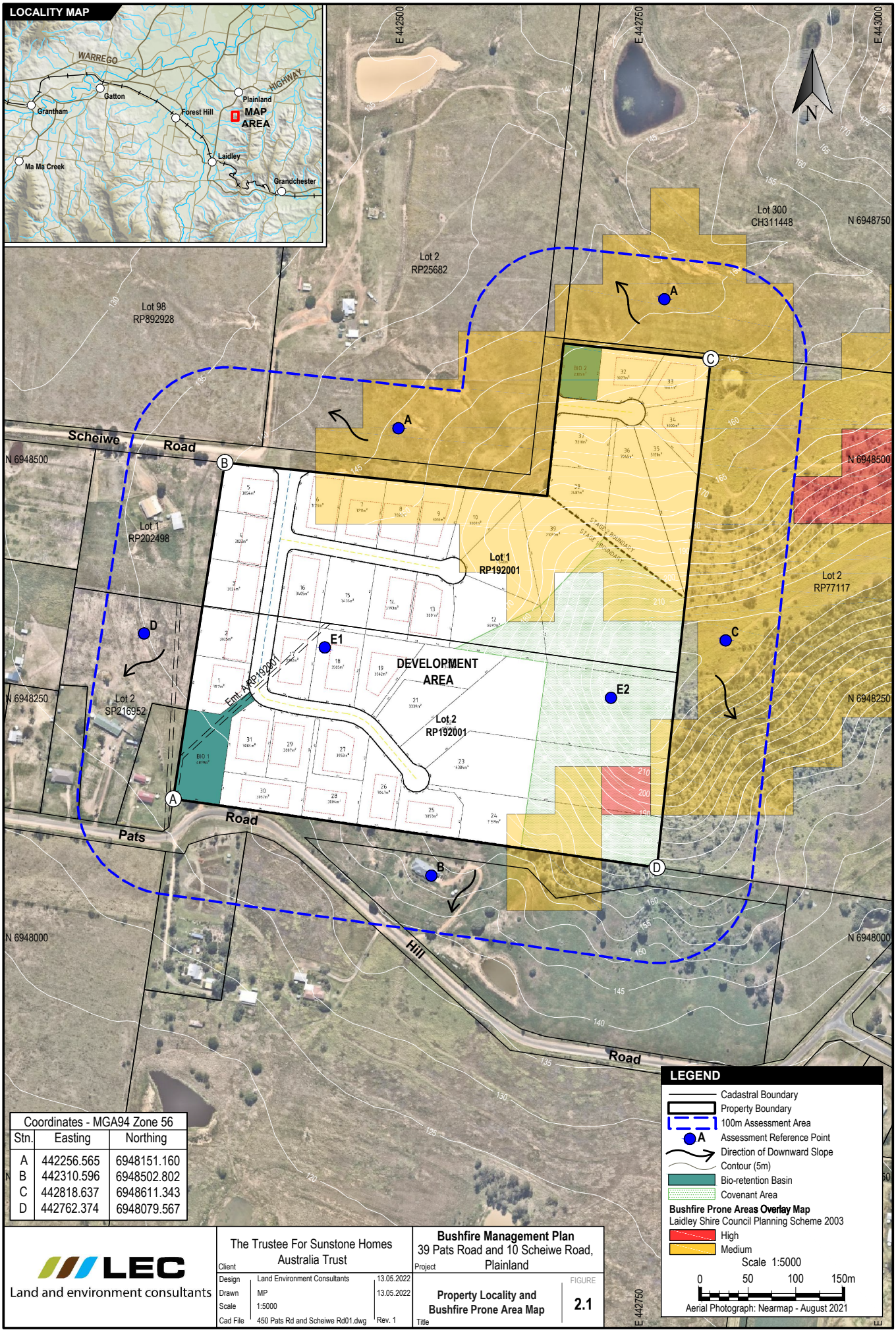
Access and egress for the proposed development will be via Pats Road and new road connections to Schiewe Road, which will be extended within the existing Schiewe Road easement.

Most of the proposed lots will have road frontage and development footprints within 60 m of a road. The exceptions are proposed lots 20, 24, 28 and 38 which are battle-axe lots that will be accessed via long driveways.

The proposed development will be connected to mains water and will include a reticulated hydrant system.

2.3 Bushfire prone areas overlay map

The Bushfire prone areas overlay map for the site is shown in Figure 2.1. Verification of the bushfire prone areas shown in the Bushfire prone areas overlay map is provided via the bushfire hazard assessment in Chapter 3.



Coordinates - MGA94 Zone 56		
Stn.	Easting	Northing
A	442256.565	6948151.160
B	442310.596	6948502.802
C	442818.637	6948611.343
D	442762.374	6948079.567

LEC Land and environment consultants

Client: The Trustee For Sunstone Homes Australia Trust

Project: **Bushfire Management Plan** 39 Pats Road and 10 Scheiwe Road, Plainland

Design	Land Environment Consultants	13.05.2022
Drawn	MP	13.05.2022
Scale	1:5000	
Cad File	450 Pats Rd and Scheiwe Rd01.dwg	Rev. 1

Title: **Property Locality and Bushfire Prone Area Map**

FIGURE 2.1

3 Bushfire hazard assessment

This chapter provides details of the desktop review and the site-specific bushfire hazard assessment.

3.1 Severe fire weather

The severe fire weather map in Catalyst indicates the 5 % annual exceedance probability forest fire danger index (**FFDI**) for the site is 63.

The FFDI value of 63 has been used for the potential bushfire intensity calculations in Section 3.4 and the radiant heat exposure assessment in Section 5.9.

3.2 Fire history

Fire history data in Catalyst indicates that no fires have occurred within 1 kilometre (**km**) of the site during the past 10 years.

3.3 Site assessment

LEC inspected land within 100 m of site on 28 September 2021. Observations were recorded about current land use and management, vegetation characteristics, slope of land and evidence of previous fires.

The locations of assessment reference points are shown in Figure 2.1. Table 3.1 provides a summary of observations from the site assessment and notes about the bushfire hazard assessment of assessment reference points. Features of assessment reference points are shown in Photographs 3.1-3.5.

Table 3.1 Site observations

Assessment reference point	Catalyst VHC	Ground truthed VHC	Notes
A	VHC 41.4 *Discontinuous low grass or tree cover* (**VHC 41.4**)	VHC 40.4 *Continuous low grass or tree cover* (**VHC 40.4**)	Land used for agricultural purposes. It consists of tall unmanaged grass.
B	VHC 41.4	VHC 41.4	Land used for a residential purpose which mostly consists of low grass cover.
C	VHC 25.1 *Brigalow belah open forests on heavy clay soils* (**VHC 25.1**) and VHC 41.4	VHC 25.1	Open forest vegetation on steep slopes.
D	VHC 41.4	VHC 41.4	Land used for a residential purpose which mostly consists of low grass cover.
E1	VHC 41.4	VHC 40.4	Future residential lots which will be landscaped and maintained with landscaping and low grass cover, ie VHC 41.4. Therefore, VHC 41.4 has been used for the potential bushfire intensity calculation of this assessment reference point in Section 4.4.
E2	VHC 25.1 and VHC 41.4	VHC 25.1	Open forest vegetation on steep slopes which will be retained and allowed to naturally regenerate under the proposed development.

Photograph 3.1 VHC 40.4 at A

Photograph 3.2 VHC 41.4 at B

Photograph 3.3 VHC 25.1 at C

Photograph 3.4 VHC 41.4 at D

Photograph 3.5 VHC 25.1 at E2

3.4 Potential bushfire intensity calculations

The potential bushfire intensity of assessment reference points was determined using the Queensland Public Safety Business Agency *Potential Bushfire Intensity Calculator* (version November 2014) which is an Excel spreadsheet calculator that models the site-specific bushfire hazard assessment method in Bushfire resilient communities.

Part B of the SPP Natural Hazards, Risk and Resilience Technical Manual – A *'fit-for-purpose' approach in undertaking natural hazard studies and risk assessments* (DILGP 2016) 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; and

- non bushfire hazard - potential bushfire intensity <4,000 kW/m.

Results of potential bushfire intensity calculations which determine the bushfire hazard class of assessment reference points shown in Figure 2.1 are presented in Table 3.2.

Table 3.2 Potential bushfire intensity

Assessment reference point	VHC under the proposed development	Potential fuel load (tonnes /hectare)[1]	Slope (°)[2]	Potential bushfire intensity (kW/m)	Bushfire hazard class
A	VHC 40.4	5	4	1,287	Non-bushfire hazard class
B	VHC 41.4	3	0	352	Non-bushfire hazard class
C	VHC 25.1	15	20	34,469	High
D	VHC 41.4	3	0	352	Non-bushfire hazard class
E1	VHC 41.4	3	0	352	Non-bushfire hazard class
E2	VHC 25.1	15	24	45,425	Very high

Notes 1 Potential fuel load taken from Bushfire resilient communities.
2 Slope defaults to 0° for VHC 41.4 which has discontinuous bushfire fuels.

3.5 Bushfire prone areas

Results of the potential bushfire intensity calculations determined that the site is affected by high and very high potential bushfire intensity areas at assessment reference points C and E2, respectively and the 100 m wide potential impact buffer from these areas. Therefore, the proposed development is within a bushfire prone area and the development application must demonstrate compliance with performance outcomes of the SPP Bushfire prone area overlay code.

4 Bushfire hazards associated with the site

This chapter identifies 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 or west.

Fire danger ratings (**FDR**) provide advice about the level of bushfire threat on a day. An FFDI of 63 is commensurate with a 'severe' FDR and will be associated with hot, dry and windy conditions. If a bushfire starts and takes hold during a severe FDR, it will be difficult to control and fast moving in large areas of vegetation.

4.2 Fire history

As discussed in Section 3.2, fire history data indicates no fires have occurred within 1 km of the site during the past 10 years. Based on the fire history it is reasonable to assume that it is unlikely that the site will be exposed to bushfire attack in the future.

4.3 Potential directions of fire attack

Bushfire attack on the proposed development is possible from the east where high and very high potential bushfire intensity areas occur at assessment reference points C and E2, ie the open forest vegetation which occurs on steep slopes within and adjoining the proposed environmental covenant area.

Although assessment reference point A was not determined to be a bushfire hazard class in Section 3.4, it is a potential source of grassfire attack on the proposed development if an ignition occurred in this area.

Bushfire and grassfire attack on the proposed development are further assessed in Section 5.9.

4.4 Potential bushfire hazard from adjacent land use

The open forest vegetation at assessment reference points C and E2 and the tall unmanaged grass in agricultural paddocks at assessment reference point A are potential bushfire/grassfire hazards to the proposed development in the unlikely event of an ignition occurring in these areas.

Residential development adjoining the site is not a potential bushfire hazard to the proposed development.

4.5 Water and access for emergency services

The site has access to mains water and a public road network which will provide access and egress routes for emergency services and future occupants of the proposed development.

5 Bushfire hazards associated with the proposed development

This chapter identifies potential bushfire hazards associated with the proposed development.

5.1 Siting and design

The proposed development is designed to mitigate the risk of the bushfire hazards determined by the site-specific bushfire hazard assessment in this bushfire management plan.

Access and egress routes for emergency services and the evacuation of future occupants are provided via Pats Road and new road connections to Schiewe Road, which will be extended within the existing Schiewe Road easement.

Most of the proposed lots will have road frontage and development footprints within 60 m of a road. The exceptions are proposed lots 20, 24, 28 and 38 which are battle-axe lots that will be accessed via long driveways.

The proposed development will be connected to mains water and will include a reticulated hydrant system.

5.2 Vulnerable uses

The proposed development does not include vulnerable uses as defined in Table 7 of the SPP guidance material – bushfire.

5.3 Hazardous materials

The proposed development does not involve hazardous materials in the context of bushfire hazard as defined in Table 7 of the SPP guidance material – bushfire.

5.4 Community infrastructure for essential services

The proposed development does not include community infrastructure for essential services as defined in Table 7 of the SPP guidance material - bushfire.

5.5 Bio-retention basins

The proposed development includes two bio-retention basins that will be rehabilitated with a suite of groundcover species. These areas will have continuous bushfire fuels and the potential to carry a fire. Development footprints within the proposed lots adjoining the bio-retention basins will be setback from the bio-retention basins by ≥ 10 m.

5.6 Open forest vegetation

Open forest vegetation will be retained within the eastern part of the site including within the proposed environmental covenant area. The potential fireline intensity calculations in Section 3.4 determined that this open forest vegetation is a high and very high potential bushfire intensity area.

Development footprints within proposed lots will be appropriately setback from the open forest vegetation that will be retained within the eastern part of the site.

5.7 Emergency access and egress

Access and egress for emergency services and the evacuation of future occupants is provided via Pats Road and the new road connections to Schiewe Road, which will be extended within the existing Schiewe Road easement.

Proposed lots 20, 24, 28 and 38 are battle-axe lots which will be accessed via long driveways that are designed for urban fire trucks.

5.8 Fire-fighter water supply

Proposed lots will be connected to mains water and a reticulated hydrant system will be installed in the extension of Scheiwe Road and within the new road reserves.

5.9 Radiant heat exposure

The SPP bushfire prone area overlay code requires development footprints within proposed lots to be setback from bushfire prone areas by a distance which achieves a radiant heat flux level of ≤ 29 kW/m^2 at the development footprints.

The potential directions of bushfire and grassfire attack on the proposed development are discussed in Section 4.3. The radiant heat profile of these bushfire and grassfire attack scenarios were assessed using the BAL calculator. Inputs used in the BAL calculator and results are provided at Appendix 2.

Results indicate that development footprints within proposed lots must be setback from open forest vegetation associated with assessment reference points C and E2 and grassland vegetation at assessment reference point A by 8.8 m and 9.8 m, respectively, to achieve a radiant heat flux level ≤ 29 kW/m^2.

6 Bushfire mitigation plan

This chapter identifies mitigation measures that must be implemented as part of the proposed development to comply with performance outcomes of the SPP Bushfire prone area overlay code.

It is the total of the mitigation measures in this chapter 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 Asset protection zone

Asset protection zones (**APZs**) must be established and maintained within proposed lots 32-34 as shown in Figure 6.1.

The APZs are 10 m wide, must be established by removing woody vegetation and maintained by regularly mowing grass cover to a nominal height of 10 centimetres.

Buildings and structures must not be constructed within the APZs.

6.2 Indicative asset protection zone

The indicative location of APZs for proposed lots 11-12, 20, 22-24, 35-36 and 38-39 is shown in Figure 6.1. The actual location of the APZs for these lots must be determined when the location of the development footprint is confirmed.

Development footprints within proposed lots 11-12, 20, 22-24, 35-36 and 38-39 must be of a size and location which enables the APZs to be fully contained within the boundaries of the proposed lots, excluding the proposed environmental covenant area.

The indicative APZs shown in Figure 6.1 must be 10 m wide which is measured from the development footprint when confirmed. They must be established and maintained as stated in Section 6.1. Buildings and structures must not be constructed within the indicative APZs.

6.3 Prospective purchaser notification

The prospective purchasers of proposed lots 11-12, 20, 22-24, 32-36 and 38-39 must be notified of the effects of the APZ on these lots at the point of sale.

6.4 Landscaping

Landscaping within proposed lots must be designed in accordance with Part 5 of *Bushfire Resilient Building Guidance for Queensland Homes* (QRA 2020) (**Bushfire resilient building**) which is publicly available online.

Plant selection must favour species in Appendix E of Bushfire resilient building.

6.5 Construction stages

A 10 m wide temporary APZ must be established and maintained along the boundary of proposed lot 39 until the Stage 2 development commences. The location of the temporary APZ is shown in Figure 6.1.

The temporary APZ must be established and maintained as stated in Section 6.1.

6.6 Access and egress

Roads and driveways must be designed and constructed to meet requirements for emergency vehicle access in the *Queensland Fire and Emergency Services – Fire Hydrant and Vehicle Access Guidelines for Residential Commercial and Industrial Lots* (QFES 2019) (**Fire hydrant and vehicle access guidelines**) which defers to the *Road Planning and Design Manual – 2nd Edition* (DTMR 2013) for load bearing capacity, geometry and turning radii.

Site access and egress for the proposed development is shown in Figure 6.1.

6.7 Fire-fighter water supply

Proposed lots must be connected to mains water and a reticulated hydrant system must be installed in the proposed road reserves.

Mains water supply must be in accordance with the local water retailer's specifications for supply and pressure.

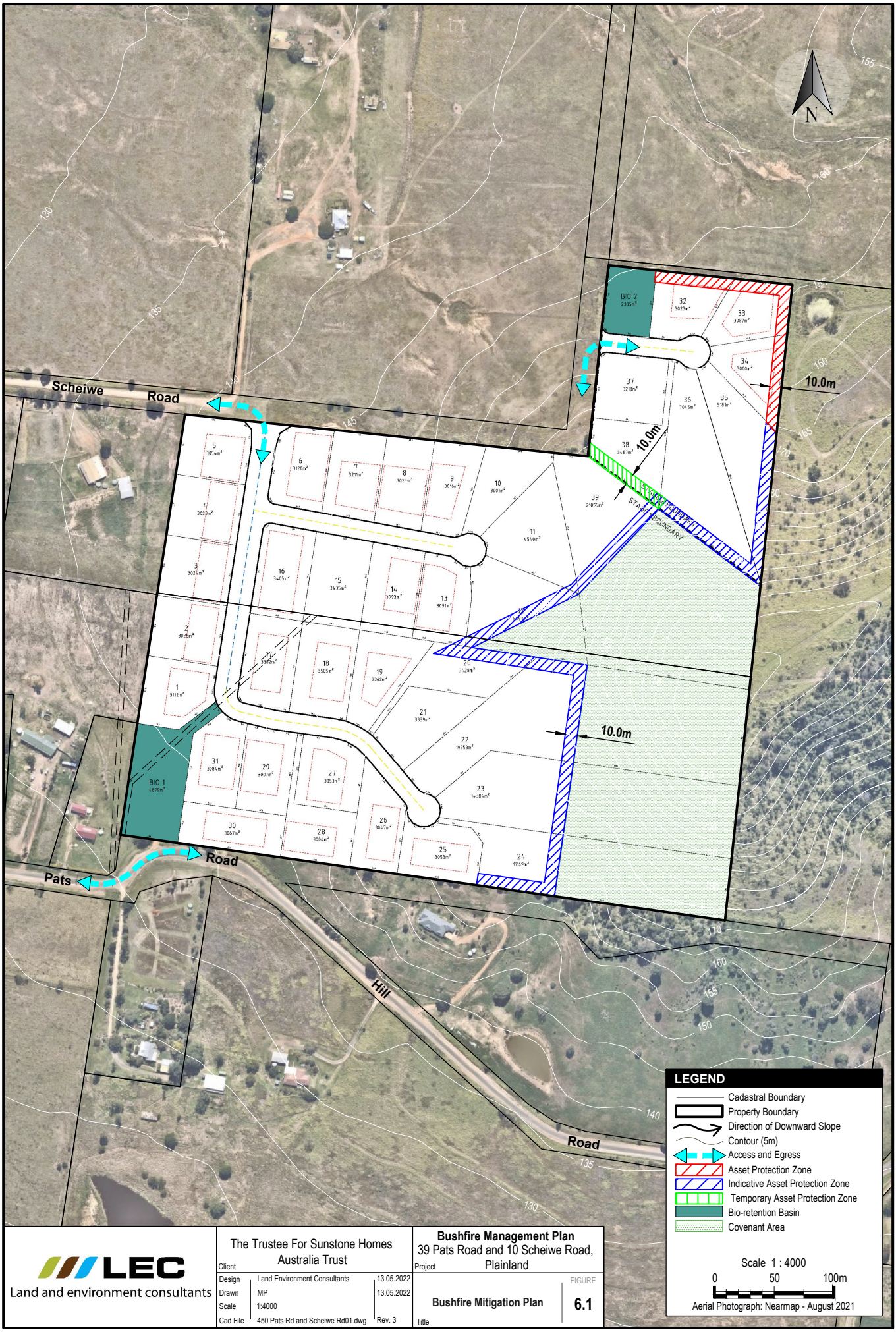
The reticulated hydrant system must be designed and constructed in accordance with Fire hydrant and vehicle access guidelines which defers to the local water retailer's specifications and the *Australian Standard* (**AS 2419.1-2021**) *Fire hydrant installations System design, installation and commissioning*.

Where the local water retailer's specifications exceed specifications in AS 2419.1-2021 the higher level specifications should prevail.

The development footprint for proposed lots 20, 24, 28 and 38 will be setback from the reticulated hydrant system in the proposed road reserves. Therefore, advice must be obtained from a hydraulic engineer about the requirement for the installation of private hydrants within these lots.

6.8 Service installation

Reticulated services, ie water, electricity and gas, must be installed underground.



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Client	The Trustee For Sunstone Homes Australia Trust	
Design	Land Environment Consultants	13.05.2022
Drawn	MP	13.05.2022
Scale	1:4000	
Cad File	450 Pats Rd and Scheiwe Rd01.dwg	Rev. 3

Bushfire Management Plan
39 Pats Road and 10 Scheiwe Road, Plainland
Project

Bushfire Mitigation Plan
Title

FIGURE **6.1**

7 Conclusion

This bushfire management plan was technically reviewed and approved by a suitably qualified person and is in general accordance with Bushfire resilient communities.

A site-specific bushfire hazard assessment confirmed that the site is affected by bushfire prone areas and that the proposed development is subject to compliance with the performance outcomes of the SPP Bushfire prone area overlay code.

Mitigation measures that must be implemented as part of the proposed development are specified in Chapter 6. With the implementation of these mitigation measures, the proposed development complies with performance outcomes of the SPP Bushfire prone area overlay code.

References

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Standards Australia Limited (Standards Australia) 2021, *Australian Standard 2419.1-2021 – Fire hydrant installation, System design, installation and commissioning*, Sixth edition, September 2021

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

Appendix 1 Reconfiguration of a lot plan

PROJECT TITLE

39 PATS ROAD, PLAINLAND QLD

ROL SUBDIVISION WORKS

DRAWING TITLE

ROL PLAN

REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APP
J	ADDITION OF DIMENSIONS AND COVENANT	10.05.22	ZP	JB	JB	JB
I	REVISED DEVELOPMENT ENTRY LOCATION	20.04.22	ZP	JB	JB	JB
H	REVISED DEVELOPMENT ENTRY LOCATION	24.03.22	ZP	JB	JB	JB
G	REVISED DEVELOPMENT ENTRY LOCATION	22.03.22	ZP	JB	JB	JB
F	POST PRELODEMENG AMENDMENTS	22.11.21	ZP	JB	JB	JB
E	REVISIONS POST MEETING	20.10.21	ZP	JB	JB	JB

ISSUE: PRELIMINARY

CLIENT: ATF SUNSTONE HOMES AUSTRALIA TY LTD

BASE PROVIDED BY: QLD DCDB / ELVIS

MANAGER: JON BROOKSBY

ZONE LANDSCAPE ARCHITECTURE

GOLD COAST
16/28 Tweed Street, Burleigh Heads QLD 4220
PO Box 3805, Burleigh Town QLD 4220

GLADSTONE
2/172 Goondoon St, Gladstone, QLD 4680
PO Box 5332, Gladstone QLD 4680

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JOB / DRAWING NO: L21134- A101

SHEET NO. 01 OF 01

Appendix 2 Radiant heat exposure assessment

Bushfire attack – Open forest vegetation

- Forest fire danger index - 63
- Vegetation - VHC 25.1 *Brigalow belah open forests on heavy clay soils*
- Understorey fuel load – 15 t/ha[1]
- Total fuel load – 25 t/ha[2]
- Slope – 8° upslope[3]
- Site slope – 8° upslope[3]
- Flame width – 100 m

Note 1 Fuel load taken from *Bushfire Resilient Communities Technical Reference Guide for the State Planning Policy State Interest 'Natural Hazards, Risk and Resilience – Bushfire* (QFES 2019) (**Bushfire resilient communities**).
2 10 t/ha added to understorey fuel to determine total fuel load.
3 Slope is upslope of development footprints and ranges from 8-35°. A conservative approach was used for the radiant heat flux modelling by using the lowest upslope value in the range.

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Calculated May 11, 2022, 4:25 pm (MDc v.4.9)

J21125

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Fire Danger Index	63	Rate of spread	0.65 km/h
Vegetation classification	Forest	Flame length	7.24 m
Understorey fuel load	15 t/ha	Flame angle	49 °, 58 °, 66 °, 71 °, 72 ° & 77 °
Total fuel load	25 t/ha	Elevation of receiver	3.66 m, 4.32 m, 5.13 m, 6.08 m, 6.66 m & 12.35 m
Vegetation height	n/a	Fire intensity	8,433 kW/m
Effective slope	-8 °	Transmissivity	0.886, 0.875, 0.858, 0.837, 0.825 & 0.752
Site slope	-8 °	Viewfactor	0.5874, 0.4312, 0.2902, 0.1952, 0.1584 & 0.0436
Flame width	100 m	Minimum distance to < 40 kW/m²	6.5 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	8.800000000000001 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	12.9 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	18.9 m
		Minimum distance to < 10 kW/m²	22.9 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

Bushfire attack – Grassland

- Forest fire danger index – 63
- Corresponding grassland fire danger index – 89.5
- Vegetation - VHC 40.4 *Continuous low grass or tree cover*
- Understorey fuel load – 5 t/ha[1]
- Total fuel load – 5 t/ha
- Slope – 10° downslope[2]
- Site slope – 10° downslope[2]
- Flame width – 100 m

Note 1 Fuel load taken from bushfire resilient communities.
2 Slope is downslope of development footprints and ranges from 3-10°. A conservative approach was used for the radiant heat flux modelling by using the highest downslope value in the range.

Calculated May 11, 2022, 4:34 pm (MDc v.4.9)

J21125

Minimum Distance Calculator - AS3959-2018 (Method 2)			
Inputs		Outputs	
Grassland Fire Danger Index	89.5	Rate of spread	23.19 km/h
Vegetation classification	Grassland	Flame length	9.220000000000001 m
Understorey fuel load	5 t/ha	Flame angle	61 °, 72 °, 82 °, 87 °, 89 ° & 94 °
Total fuel load	5 t/ha	Elevation of receiver	2.76 m, 2.64 m, 1.92 m, 0.71 m, 0 m & 0 m
Vegetation height	n/a	Fire intensity	59,925 kW/m
Effective slope	10 °	Transmissivity	0.883, 0.869, 0.848, 0.825, 0.8120000000000001 & 0.743
Site slope	10 °	Viewfactor	0.5911, 0.4376, 0.2935, 0.1984, 0.1614 & 0.0441
Flame width	100 m	Minimum distance to < 40 kW/m²	7.1 m
Windspeed	n/a	Minimum distance to < 29 kW/m²	9.800000000000001 m
Heat of combustion	18,600 kJ/kg	Minimum distance to < 19 kW/m²	14.9 m
Flame temperature	1,090 K	Minimum distance to < 12.5 kW/m²	22.1 m
		Minimum distance to < 10 kW/m²	26.8 m

Rate of Spread - Noble et al. 1980

Flame length - Purton, 1982

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

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

Appendix 3 SPP Bushfire prone area overlay code assessment

Performance outcomes	Acceptable outcomes	Compliance assessment
Section A **Reconfiguring a lot (RaL) – where creating lots of more than 2,000 square metres**		
PO1 The subdivision layout: (a) enables future buildings to be located away from slopes and land forms that expose people or property to an intolerable risk to life or property; and (b) facilitates emergency access and operational space for firefighters in a reduced fuel area between future buildings and structures and hazardous vegetation, that reduce risk to an acceptable or tolerable level. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	**AO1.1** A development footprint plan is identified for each lot that avoids ridgelines, saddles and crests where slopes exceed 15 per cent. **AO1.2** A development footprint plan is identified for each lot that is separated from the closest edge to the adjacent mapped medium, high or very high potential bushfire intensity area by: (a) a distance that is no closer than the distances specified in Table 5 at all development footprint plan boundaries; or (b) a distance that achieves a radiant heat flux level of 29 kW/m2 or less at all development footprint plan boundaries. Note – This separation area is often termed an asset protection zone. Note – The radiant heat flux levels can be established by undertaking a bushfire hazard assessment in accordance with the methodology in the QFES Bushfire resilient communities document.	✓ **Complies with PO1** The proposed development is designed so that the steeper topography within the site is located within the proposed environmental covenant area where development footprints are not permitted. Asset protection zones (**APZs**) will be established and maintained within proposed lots 11-12, 20, 22-24, 32-36 and 38-39 in accordance with Sections 6.1 and 6.2 and Figure 6.1 of the Bushfire management plan. The APZs have been designed to provide development footprints within proposed lots 11-12, 20, 22-24, 32-36 and 38-39 which achieve a radiant heat flux level ≤ 29 kilowatt/metre square (**kW/m²**).
PO2 The subdivision layout enables: (a) future buildings to be located as close as possible to property entrances to facilitate safe evacuation during a bushfire event; and (b) future site access to be located and designed to allow safe evacuation of the site by occupants and maintain access by emergency services under critical event conditions.	**AO2** A development footprint plan is identified for each lot that: (a) is located within 60 metres of the street frontage; and (b) sited to enable a route between the development footprint plan and the street frontage with a gradient that does not exceed of 12.5 per cent.	✓ **Complies with PO2** Most of the proposed lots will have road frontage and development footprints within 60 m of a road. The exceptions are proposed lots 20, 24, 28 and 38 which are battle-axe lots that will be accessed via long driveways. Driveways will be designed and constructed in accordance with *Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots* (QFES 2019) (**Fire hydrant and vehicle access guidelines**) which defers to the *Road Planning and Design Manual – 2nd Edition* (DTMR 2013). They will not be located on land with a gradient > 12.5 %.
Section B		
Reconfiguring a lot (RaL) – where creating lots of 2,000 square metres or less		
PO3 The subdivision layout: (a) avoids creating lots on	**AO3.1** The subdivision layout results in lots that are sited so that they are	**Not applicable**

Performance outcomes	Acceptable outcomes	Compliance assessment
slopes and land forms that expose people or property to an intolerable risk to life or property; and (b) facilitates emergency access and operational space for firefighters in a reduced fuel area between future buildings and structures and hazardous vegetation, that reduce risk to an acceptable or tolerable level. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	separated from the closest edge to the adjacent mapped medium, high or very high potential bushfire intensity area by: (a) a distance that is no closer than the distances specified in Table 5 at all lot boundaries; or : (b) a distance that achieves a radiant heat flux level of 29 kW/m^2 or less: (i) at the building envelope, if identified at RaL stage; or (ii) where a building envelope is not identified, at all lot boundaries. Note – This separation area is often termed an asset protection zone. Note – The radiant heat flux levels can be established by undertaking a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document. Note – For staged developments, temporary separation areas may be absorbed as part of subsequent stages. Note - Existing cleared areas external to the site may only be used in calculating necessary separation where tenure ensures that the land will remain cleared of hazardous vegetation (for example the land is a road, watercourse or highly managed park in public ownership).	The proposed development does not involve lots ≤ 2,000 m^2.
	AO3.2 The subdivision layout does not create lots that are within bushfire prone areas and on ridgelines, saddles and crests where slopes exceed 15 per cent (roads and parks may be located in these areas).	
Section C		
Reconfiguring a lot (RaL) – where creating more than 20 lots		
PO4 The subdivision layout is designed to minimise the length of the development perimeter and number of lots exposed to hazardous vegetation. Note – For example, avoid finger-like subdivision patterns or substantive vegetated corridors between lots.	**AO4** No acceptable outcome is prescribed	✓ **Complies with PO4** The proposed development is not a finger-like subdivision pattern.

Performance outcomes	Acceptable outcomes	Compliance assessment
PO5 The subdivision layout provides for adequate access and egress and safe evacuation routes, to achieve an acceptable or tolerable risk to people.	**AO5.1** The subdivision layout: (a) avoids the creation of bottle-neck points in the movement network within the development (for example, avoids hourglass patterns); and (b) ensures the road network has sufficient capacity for the evacuating population.	✓ **Complies with PO5** Access and egress for emergency services and the evacuation of future occupants is provided via Pats Road and the new road connections to Schiewe Road, which will be extended within the existing Schiewe Road easement. Proposed lots 20, 24, 28 and 38 are battle-axe lots which will be accessed via long driveways that are designed for urban fire trucks. The subdivision layout provides evacuation routes which will direct future occupants of proposed lots away from the high and very high potential bushfire intensity areas which affect the site.
	AO5.2 The subdivision layout ensures evacuation routes: (a) direct occupants away from rather than towards or through areas with a greater potential bushfire intensity; and (b) minimise the length of route through bushfire prone areas. Refer Figure 5.	

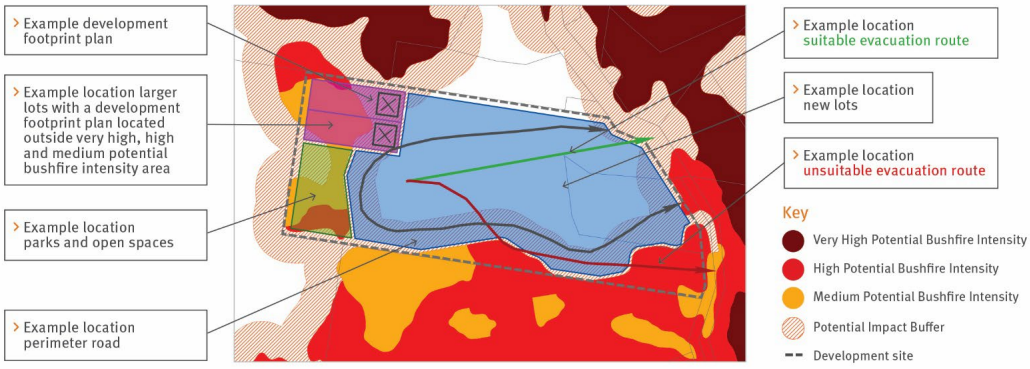
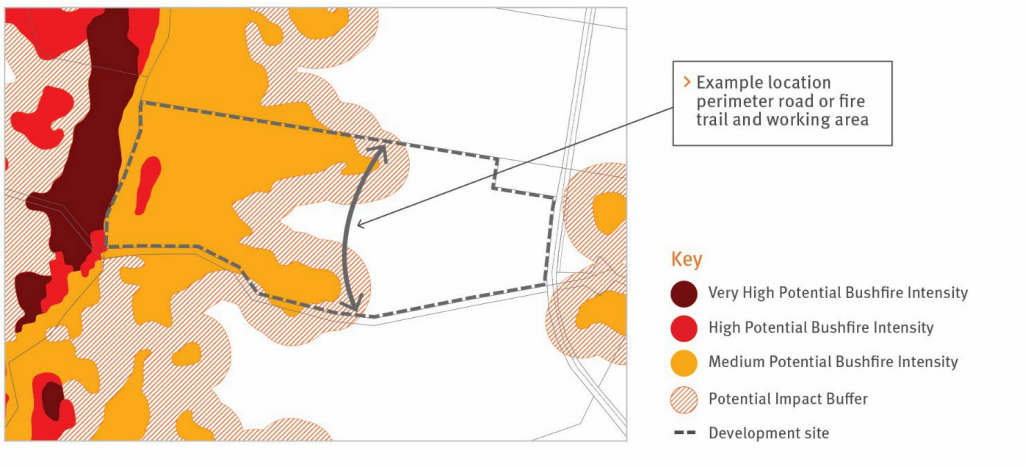
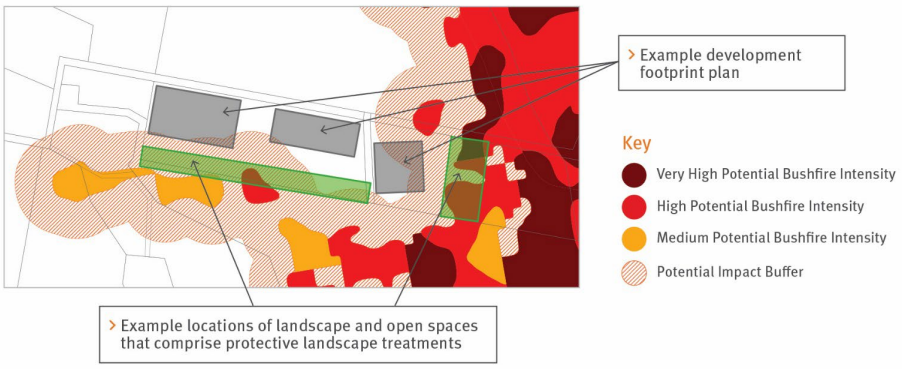


Figure 5 – Subdivision layout and evacuation routes

PO6 The subdivision layout provides adequate buffers between hazardous vegetation and development. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable	**AO6.1** The subdivision layout results in an asset protection zone being located to create a separation area from adjacent mapped medium, high or very high potential bushfire intensity areas.	✓ **Complies with PO6** Refer to response to PO1.
	AO6.2 The asset protection zone is comprised of: (a) parks and open spaces; and/or (b) lots greater than 2000 square metres; and/or (c) public roads (termed perimeter roads). Note – Parks and open space may be located within the mapped medium, high and very high potential bushfire intensity areas to create a separation between the development and the	

Performance outcomes	Acceptable outcomes	Compliance assessment
outcome can deliver an acceptable or tolerable level of risk.	balance of the bushfire prone area. Note – Portions of lots greater than 2000 square metres may be located within the mapped medium, high and very high potential bushfire intensity areas. Refer Figure 5.	
	AO6.3 Where the asset protection zone includes lots greater than 2000 square metres a development footprint plan is identified for each lot that is located in accordance with AO1.2.	
PO7 Parks or open space provided as part of the asset protection zone do not create additional bushfire prone areas. Note –The undertaking of a bushfire hazard assessment, in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	**AO7** Where the asset protection zone includes parks or open spaces, they: (a) comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, cultivated gardens and nature strips; or (b) are designed to ensure a potential available fuel load is maintained at less than eight tonnes/hectare in aggregate and with a fuel structure that remains discontinuous. Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres.	**Not applicable** The proposed development does not involve parks or open space.
PO8 Perimeter roads are accessible for fire-fighting vehicles, to facilitate emergency access and operational space for fire- fighting, maintenance works and hazard reduction activities.	**AO8.1** Where the asset protection zone includes a perimeter road it: (a) has a two-lane sealed carriageway clear of hazardous vegetation; and (b) is connected to the wider public road network at both ends and at intervals of no more than 200 metres; and (c) does not include design elements that may impede access for fire-fighting and maintenance for fire- fighting purposes (for example traffic calming involving chicanes).	✓ **Complies with PO8** Proposed lots will be connected to mains water and a reticulated hydrant system will be installed in the extension of Scheiwe Road and within the new road reserves. Mains water supply will be in accordance with the local water retailer's specifications for supply and pressure. The reticulated hydrant system will be designed and constructed in accordance with Fire hydrant and vehicle access guidelines which defers to the local water retailer's specifications and the *Australian Standard* (**AS 2419.1-2021**) *Fire hydrant installations System design, installation and commissioning*.
	AO8.2 Where the subdivision contains a reticulated water supply, the road network and fire hydrants	

Performance outcomes	Acceptable outcomes	Compliance assessment
	are designed and installed in accordance with: (a) *Fire Hydrant and Vehicle Access Guidelines for residential, commercial and industrial lots*, Queensland Fire and Emergency Services, 2015, unless otherwise specified by the relevant water entity; and (b) the *Road Planning and Design Manual 2nd edition*, Department of Transport and Main Roads, 2013.	Where the local water retailer's specifications exceed specifications in AS 2419.1-2021 the higher level specifications should prevail. The development footprint for proposed lots 20, 24, 28 and 38 will be setback from the reticulated hydrant system in the proposed road reserves. Therefore, advice will be obtained from a hydraulic engineer about the requirement for the installation of private hydrants within these lots.
Section D		
Reconfiguring a lot (RaL) – where creating additional lots for the purpose of residential development and a reticulated water supply is not provided.		
PO9 The subdivision layout provides for perimeter roads or fire trail and working areas that are accessible by the type of fire-fighting vehicles servicing the area, to facilitate emergency access and operational space for fire-fighting, maintenance works and hazard reduction activities.	**AO9.1** The subdivision layout includes: (a) a fire trail and working area designed and constructed in accordance with the design parameters in Table 6 that separates the residential lot or development footprint plan from adjacent mapped medium, high or very high potential bushfire intensity areas; or (b) a perimeter road designed and constructed in accordance with AO8.1. Refer Figure 6.	**Not applicable** The proposed development will be serviced by a reticulated water supply.
 *Figure 6 – Siting of fire trail and working area*		
Section E		

Performance outcomes	Acceptable outcomes	Compliance assessment
Material change of use		
PO10 Site layout achieve an acceptable or tolerable risk to people. Landscape or open space provided as part of the development: (a) acts as a buffer between hazardous vegetation and development; and (b) does not create additional bushfire prone areas. Note – An applicant may seek to undertake a site-level verification of the location and nature of hazardous vegetation and resulting potential bushfire intensity levels, for example where changes in foliage have occurred (e.g. as a consequence of adjoining permanent urban development) or where an applicant seeks to verify the regional ecosystem map inputs. This verification should form part of a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document. The outcomes of this assessment can demonstrate how an alternate solution to the acceptable outcome can deliver an acceptable or tolerable level of risk.	**AO10.1** Site layout places the landscape and open spaces within the site between premises and adjacent mapped medium, high or very high potential bushfire intensity areas. Refer Figure 7. **AO10.2** This landscaping and open space comprises protective landscape treatments that: (a) comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses and cultivated gardens; or (b) are designed to ensure a potential available fuel load is maintained at less than 8 tonnes/hectare in aggregate and that fuel structure remains discontinuous. Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres.	**Not applicable** The proposed development does not include a material change of use.
 *Figure 7 – Siting of protective landscape treatments*		
PO11 The development establishes evacuation areas, to achieve an acceptable or tolerable risk to people.	**AO11** If in an isolated location, development establishes direct access to a safe assembly/evacuation area. Note – Guidance on identifying safe evacuation areas is contained in the QFES *Bushfire resilient communities* document.	**Not applicable** The proposed development does not include a material change of use.
PO12 If on a lot of over 2,000 m^2, where involving a new premises	**AO12** No acceptable outcome is prescribed.	**Not applicable**

Performance outcomes	Acceptable outcomes	Compliance assessment
or an existing premises with an increase in development footprint, development: (a) locates occupied areas as close as possible to property entrances to facilitate safe evacuation during a bushfire event; and (b) ensures vehicular access is located and designed to allow safe evacuation of the site by occupants and maintain access by emergency services under critical event conditions		The proposed development does not include a material change of use.
PO13 Development is located within a reticulated water supply area or includes a dedicated static water supply that is available solely for fire-fighting purposes and can be accessed by fire-fighting vehicles. Note – Swimming pools, farm ponds and dams are not considered reliable sources of static water supply in Queensland due to regular drought events. Note for Local Government – Information on how to provide an appropriate static water supply, may form a condition of a development approval. For further information on preferred solutions refer to the QFES *Bushfire resilient communities* document.	**AO13** No acceptable outcome is prescribed	**Not applicable** The proposed development does not include a material change of use.
PO14 Vulnerable uses listed in Table 7 are not established or intensified within a bushfire prone area unless: (a) there is an overriding need in the public interest for the new or expanded service the development provides; and (b) there are no other suitable alternative locations within the required catchment; and (c) site planning can appropriately mitigate the risk (for example, siting ovals for an educational establishment between the hazardous vegetation and structures. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome	**AO14.1** No acceptable outcome is prescribed.	**Not applicable** The proposed development does not include a material change of use.
PO15 Community infrastructure providing essential services listed	**AO15** No acceptable outcome is prescribed.	**Not applicable**

Performance outcomes	Acceptable outcomes	Compliance assessment
in Table 7 are not established within a bushfire prone area unless: (a) there is an overriding need in the public interest for the new or expanded service the development provides (for example, there are no other suitable alternative locations that can deliver the required level of service or meet emergency service response times during and immediately after a bushfire event); and (b) the infrastructure can function effectively duringand immediately after a bushfire event. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.		The proposed development does not include a material change of use.
PO16 Development avoids or mitigates the risks to public safety and the environment from the manufacture or storage of materials listed in Table 7 that are hazardous in the context of bushfire to an acceptable or tolerable level. Note – The preparation of a bushfire management plan in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome. Editor's note – In addition to the requirements of this code the *Work Health and Safety Act 2011* and associated Regulation and Guidelines, the *Environmental Protection Act 1994* and the relevant building assessment provisions under the *Building Act 1975* contain requirements for the manufacture and storage of hazardous substances. Information is provided by Business Queensland on the requirements for storing and transporting hazardous chemicals, available at: www.business.qld.gov.au/running-business/protecting-business/risk-management/hazardous-chemicals/storing-transporting.	**AO16** No acceptable outcome is prescribed.	**Not applicable** The proposed development does not include a material change of use.
Section F		
Where involving an asset protection zone		
PO17 Asset protection zones are designed and managed to ensure they do not increase the potential for	**AO17.1** Landscaping treatments within any asset protection zone comprise only low threat vegetation, including grassland managed in a	✓ **Complies with PO17** Specifications for landscaping treatments within the asset protection zones are provided in

Performance outcomes	Acceptable outcomes	Compliance assessment
bushfire hazard. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks. Note – Minimal fuel condition means there is insufficient fuel available to significantly increase the severity of the bushfire attack, for example short-cropped grass to a nominal height of 10 centimetres. OR	Section 6.1 and 6.2 of the Bushfire management plan. Landscaping must comprise only of mown grass or landscaping designed in accordance with Part 5 of *Bushfire Resilient Building Guidance for Queensland Homes* (QRA 2020).
	AO17.2 Landscaping management within any asset protection zone maintains a: (a) potential available fuel load which is less than eight tonnes/hectare in aggregate; and (b) fuel structure which is discontinuous. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome.	
Section G		
Where planning provisions or conditions of approval require revegetation or rehabilitation		
PO18 Revegetation or rehabilitation areas are designed and managed to ensure they do not result in an unacceptable level of risk or an increase in bushfire intensity level. Note – The undertaking of a bushfire hazard assessment in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this performance outcome.	**AO18.1** Required revegetation or rehabilitation: (a) is located outside of any asset protection zone; or (b) maintains a potential available fuel load which is less than eight tonnes/hectare in aggregate and fuel structure which is discontinuous. Note – The preparation of a landscape management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with acceptable outcome (b).	✓ **Complies with PO18** An environmental covenant area will be located within part of proposed lots 12, 22-24 and 39. Open forest vegetation will be retained and allowed to naturally regenerate within the environmental covenant area which will result in a very high potential bushfire intensity area. Development footprints within proposed lots adjoining the environmental covenant area, ie proposed lots 11-12, 20, 22-24, 35-36 and 38-39, will be appropriately separated from the environmental covenant area so that they achieve a radiant heat flux level ≤ 29kW/m^2.
	AO18.2 Revegetation or rehabilitation of areas located within mapped medium, high or very high potential bushfire intensity areas, revegetate and rehabilitate in a manner that maintains or reduces the existing fuel load. OR Revegetation or rehabilitation of areas located within the mapped potential impact buffer area,	

Performance outcomes	Acceptable outcomes	Compliance assessment
	revegetate and rehabilitate in a manner that maintains or reduces the existing fuel load. Note – The preparation of a vegetation management plan undertaken in accordance with the methodology in the QFES *Bushfire resilient communities* document may assist in demonstrating compliance with this acceptable outcome.	

Table 6 – Fire trail and working area design parameters

Parameter	Provisions
Width	Contains a width of at least 20 metres including: 1. A trafficable area (cleared and formed); a. with a minimum width of 4 metres than can accommodate a rural firefighting vehicle b. with no less than 4.8 metres vertical clearance from canopy vegetation c. with no adjacent inhibiting embankments or retaining walls 2. A working area each side of the trafficable area: a. with a minimum width of 3 metres each side b. cleared of all flammable vegetation greater than 10 centimetres in height 3. The balance (i.e. 10 metre width) managed vegetation area: a. sited to separate the trafficable area from adjacent mapped medium, high or very high potential bushfire intensity areas managed vegetation b. comprising managed vegetation clear of major surface hazards.
Access	Access is granted in favour of the local government and Queensland Fire and Emergency Services Note – this access is commonly granted in the form of a easement that is to be maintained by the grantor.
Egress	Contains trafficable vehicle routes in to low hazard areas, every 200 metres

Table 7 – Vulnerable uses, community infrastructure for essential services and materials that are hazardous in the context of bushfire hazard

Group	Uses
Vulnerable uses	*childcare centre, community care centre, detention facility, educational establishment, hospital, nature-based tourism, relocatable home park, rooming accommodation, residential care facility, resort complex, retirement facility, tourist park*
Community infrastructure for essential services	*educational establishment, emergency services, hospital*
Hazardous materials in the context of bushfire hazard	Hazardous chemicals that are present at the levels or in the quantities that would constitute the use being a hazardous chemical facility Hazardous materials that are present in the quantities in the Work Health and Safety Regulation, schedule 15