# Report

## Bushfire Management Plan

LOCATION: PRECINCT 101 & 102 MONARCH GLEN

UNDULLAH QLD, 4285

LOGAN CITY COUNCIL

CLIENT: MONARCH GLEN NO 1 PTY LIMITED

Project Ref 243951/N24-0266 Rpt Issue E

April 2025

# DOCUMENT ISSUE APPROVAL

| | |
|---|---|
| **Project Title:** | Bushfire Management Plan |
| **Project Location:** | Stages 101 and 102 Monarch Glen |
| **Project Address:** | Undullah, Logan City Council |
| **Client:** | Monarch Glen No 1 Pty Limited |
| **Project No:** | 243951 |
| **Report No:** | N24-0266RPT |
| **Issue:** | E |
| **Date:** | April 2025 |
| | |
| **Distribution:** | Client |
| | Covey Associates |
| | |



Author:

Aaron Bulfin

Bushfire Consultant

GCEngSc (FireSafetyEng),

GCSc (AppClimSc), BEngSc (EnvEng)

Reviewed:

Marzia Coslan

Senior Bushfire Consultant/Team Lead

BSc(Hons) of Science, Masters by Research

## Executive Summary

This Bushfire Management Plan (BMP) has been prepared by Covey Associates to support a Development Application for the proposed subdivision development of Precinct 101 and 102 of Monarch Glen.

The development of Monarch Glen contributes to the wider delivery of communities contained within the Greater Flagstone Priority Development Area, within the Logan City Council (LCC) Local Government Authority (LGA). Precincts 101 and 102 of Monarch Glen that are assessed within this BMP are encompassed by Lot 1 on SP351245.

This BMP applies acceptable outcomes to achieve the purpose and outcomes as detailed in the State Planning Policy (SPP) 2017 example bushfire overlay code (BOC) in the *Natural Hazards, Risk and Resilience, State Planning Policy State Interest guidance material* (Queensland Government, 2019). Specifically, this report outlines how the development will address the performance outcomes of the BOC Assessment Benchmarks (Section 5.2). The requirements and a description of how they are addressed in the proposed development design are details in Section 7. Further, this BMP demonstrates how the development is consistent with the objectives and policy measures of *Bushfire Resilient Communities* (BRC) (Queensland Fire and Emergency Services, 2019a). The key acceptable outcomes applied to the development are:

- Demonstrating that the created lots are situated, or can accommodate building envelopes subject to less than 29kW/m$^2$,
- Provision of a new roads between bushfire assessable vegetation and proposed lots,
- Design the road layout that minimizes the number of dead-ends (cul-de-sacs), whilst ensuring that these cul-de-sacs are suitably designed to allow for emergency vehicle turn-around.
- Inclusion of a management access within the retained vegetation areas that will allow for maintenance, fire management, and bushfire response,
- Provision of adequate water supplies via connection to mains supply to support firefighting capabilities within the development, and,
- Proposed landscaping within the development is to utilise plant species that do not exacerbate the level of bushfire threat.

This BMP demonstrates that the bushfire hazard level, bushfire related risk level and Radiant Heat Flux levels applicable are not prohibitive of development, per State Planning Policy and BRC. The proposed mitigation measures in this BMP do not require clearing of vegetation outside of the proposed development boundary for Precincts 101 and 102.

**This report demonstrates that the proposed development will not be subject to unacceptable risk from identified bushfire prone areas, including assessment of the radiant heat flux for which the development will be subject to. The determination of Bushfire Attack Level (BAL) for proposed dwellings is subject to a Building Approval per AS3959 and does not form part of the assessment made within this report.**

## *Abbreviations Used in Report*

| Abbreviation | Full Meaning |
|---|---|
| APZ | Asset Protection Zone |
| AS3959 | AS 3959:2018 – Construction of Buildings in bushfire-prone areas |
| AWS | Automatic Weather Station |
| BAL | Bushfire Attack Level |
| BCA | Building Code of Australia |
| BOC | Bushfire Overlay Code |
| BMP | Bushfire Management Plan |
| BRC | Bushfire Resilient Communities |
| FFDI | Forest Fire Danger Index |
| LGA | Local Government Authority |
| LCC | Logan City Council |
| PO | Performance Outcome |
| RAL | Reconfiguring of a Lot |
| RHF | Radiant Heat Flux |
| SPP | State Planning Policy |
| VHC | Vegetation Hazard Class |
| *w* | Understorey fuel load |
| *W* | Total fuel load |

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# 1 Introduction

## 1.1 Scope

The proponent (Monarch Glen No 1 Pty Limited) engaged Covey Associates Pty Ltd (Covey) to prepare a site-specific Bushfire Management Plan (BMP) to support the proposed development application – Reconfiguring of a Lot (RAL). The proposed development is a multistage Master Plan Development at Homestead Drive, Monarch Glen, QLD, 4285, described as Lot 1 on SP351245 (the site; Section 2 of BMP; Appendix A). This BMP focuses on analysing the potential bushfire hazards to inform how the recommended mitigation strategies achieve the purpose and outcomes in the *Bushfire Resilient Communities Technical Guide* (BRC; Queensland Fire and Emergency Services, 2019) and *Queensland State Planning Policy - Natural hazards, risk and resilience state interest – Bushfire* (Queensland Government, 2019).

This BMP also details how the proposed development and recommended mitigation measures achieve compliance with the example Bushfire Overlay Code (BOC) performance outcomes of the SPP2017 *Natural Hazards, Risk and Resilience, State Planning Policy State Interest guidance material* (Queensland Government, 2019). The BMP demonstrates that the proposed development will be undertaken within the acceptable outcomes of the Planning Scheme Policy – Bushfire Hazard.

## 1.2 Objectives

This BMP undertakes Radiant Heat Flux (RHF) analysis to investigate the bushfire hazard and risk to which the development is subject to. This information provides insight to the appropriate bushfire risk mitigation measures required to satisfy the Natural hazards, risk and resilience state interest. This report also demonstrates that the development of the site achieves the performance criteria of bushfire prone areas within the relevant planning scheme policy.

The objectives of this BMP are to:

1. Achieve consistency with objectives and policy measures of *State Planning Policy – Natural hazards, risk and resilience state interest – Bushfire* (Queensland Government, 2019), and *Bushfire Resilient Communities* (BRC; (Queensland Fire and Emergency Services, 2019a) provisions relating to bushfire,
2. Understand and document the extent of bushfire risk for the site, including undertaking a RHF assessment,
3. Assess the proposed development against the SPP2017 example *Bushfire Overlay Code* Performance Outcomes, and,
4. Recommend bushfire risk management measures for the site with due regard for people, property, infrastructure, and the environment.

## 1.3 Document Review

Covey recommends reviewing this BMP after a period of 5 years from the date of issue, unless the development stages assessed within this report is complete in its entirety. Revision of this BMP would also be required if there are development layout changes or changes to the assessed extent of bushfire prone vegetation.

## 1.4 Planning Context

### 1.4.1 Bushfire Prone Designation

Formal designation of an area as "Bushfire Prone" provides the legislative trigger to:

- Complete a Bushfire Hazard and Management Plan, and
- Enforce all Building Classes to be constructed in accordance with Building Code of Australia (BCA) Ancillary provisions and additional construction requirements in bushfire prone areas (National Construction Code, 2022a, 2022b; AS 3959:2018).

### 1.4.2 State Planning Policy - Natural hazards, risk and resilience state interest – Bushfire

The State Planning Policy (SPP) - *Natural hazards, risk, and resilience state interest – Bushfire*, identifies two ways a site may be designated as bushfire prone. These are as follows:

1. If the land is identified by a local government in a local planning instrument as a bushfire prone area, based on a localised bushfire study, prepared by a suitably qualified person; or,
2. If the local government has not identified bushfire prone areas in a local planning instrument in accordance with (1) above, the area is shown on the State Planning Policy Interactive Mapping System as a bushfire prone area.

Bushfire-prone vegetation includes types of vegetation classified in AS3959, S2.2.3. AS3959 is included by direct reference in the Building Code of Australia.

This BMP applies acceptable outcomes to achieve the purpose and outcomes as detailed in the State Planning Policy (SPP) 2017 example bushfire overlay code (BOC) in the *Natural Hazards, Risk and Resilience, State Planning Policy State Interest guidance material* (Queensland Government, 2019). Specifically, this report outlines how the development will address the performance outcomes of the BOC Assessment Benchmarks (Section 5).

The site (pre-development) is subject to a high potential bushfire intensity and medium potential bushfire intensity per State Planning Policy (Section 3 of BMP). The Logan City Council Planning Scheme 2015 maps the development site as Bushfire Hazard Area per the Bushfire Hazard Overlay Map (OM-03 00). The LCC Planning Scheme also identifies the site as having areas of very high, high and medium potential bushfire intensities, as well as potential bushfire impact buffer – per Overlay Map (OM-03 01).

Per the requirements of the BOC under the SPP2017 the layout of the proposed residential lots within the development are to be designed to ensure that they are not subject to a level of Radiant Heat Flux (RHF) above 29 kW/m$^2$. This BMP has assessed the levels of potential RHF per Bushfire Resilient Communities Technical Reference Guide. The RHF quantifies the intensity of radiant heat from a bushfire, whilst a BAL rating is an assignment of specific construction standards that must be applied to dwellings that are subject to an assessed level of radiant heat, and is determined during the building approval process.

Following the development of site, the setback distance from bushfire hazardous vegetation from each lot should allow for building envelopes to be located in areas subject to less than 29 kW/m$^2$ RHF. The SPP BOC outlines Performance Outcomes for which developments must adhere to, ensuring that the development minimises the risk of people and premises within bushfire prone areas. Requirements outlined within the SPP BOC have been incorporated into the design of the project through passive (i.e., layout design, landscape arrangement) and active design elements (i.e., water supply) within the development.

## 1.5 Bushfire Context

The following documents are identified as being referenced to provide the performance criteria and technical specifications for this Bushfire Hazard and Risk Assessment report:

1. Queensland Government. (2019). Natural hazards, risk and resilience – Bushfire. State Planning Policy – state interest guidance material.
2. Queensland Government. (2021). Natural hazards, risk and resilience state interest – Bushfire. Example planning scheme assessment benchmarks.
3. Queensland Fire and Emergency Services. (2019a). Bushfire Resilient Communities. Technical Reference Guide for the State Planning Policy State Interest "Natural Hazards, Risk and Resilience-Bushfire".
4. Queensland Fire and Emergency Services. (2019b). Fire Hydrant and Vehicle Access Guidelines for Residential, Commercial and Industrial Lots.
5. The State of Queensland. (2017). State Planning Policy.
6. Standards Australia. (2018). AS 3959 - 2018 Construction of buildings in bushfire prone areas: SAI Global.
7. SAI Global. (2017). AS 2419.1:2017 Fire Hydrant Installations for Buildings; Australian Standards.

This BMP demonstrates that the potential bushfire impacts to people, property, economic activity and the environment have been mitigated and/or avoided, thus complying with the purpose and outcomes of the SPP BHC relating to bushfire. The development is assessed against the requirements of SPP BOC as well as SPP BRC (2019).

# 2 Site Details

## 2.1 Description

### 2.1.1 Location

The site is located on Homestead Drive at Monarch Glen on Lot 1 on SP351245 (Figure 2-1).

### 2.1.2 Proposed Land Use

The development includes a proposed reconfiguration of a lot (ROL), as indicated in the Development Layout Plan (Appendix A). This proposed ROL is specifically for Precinct 101 and 102 of the Monarch Glen master-planned development – consisting of 575 residential lots, as well as associated roadways and parklands.

### 2.1.3 Access

Precinct 101 and 102 will have multiple points of access on completion of the Monarch Glen whole of site masterplan and adjacent developments. However, in the interim, there will be one main access point to the proposed development site for the created lots within Precinct 101 and 102 via a trunk collector road that separates the two precincts. This trunk collector road will be connected to an arterial road immediately east of these Precincts, the trunk collector road will also provide connection to future residential areas within the master-planned development to the west. Additional details of the master-plan layout and the road hierarchy connectivity can be seen within Appendix A.

The proposed development precincts have been designed with access roads that circulate through the development, therefore reducing the number of dead-ends and cul-de-sacs to provide better connectivity for residents to escape an approaching bushfire (AO4(e)), as well as using roadways as a buffer between bushfire hazardous vegetation and proposed lots, which complies with AO4(b). These roadways designed between proposed lots and bushfire hazardous vegetation have been designed to the minimum corridor width requirement (AO4(b)).

A temporary secondary access that will serve as an additional point of egress in emergency events will be installed within the northern section of Precinct 101 and connect to the Arterial Road corridor (New Beith Road). This point of access will be for use in emergency events only and will not serve as a point of vehicular access under normal conditions. As the Master-planned development continues and a secondary point of egress is established within the development – heading west from Precinct 101 and 102 – this temporary access will be removed. The proposed location of this temporary secondary access point for egress in emergency events can be seen in Figure 2-1.

### 2.1.4 Water Supply

The proposed development will be required to provide connection to mains water supply, including for firefighting purposes. Provision will be made to connect to water mains supply, with suitable allocation of fire-fighting infrastructure (hydrants) in accordance with the local water authority under the guidance of the SEQ Water Supply Code. Further details of fire-fighting water supply are outlined in Section 5.3.

### 2.1.5 Conservation and Ecological Value

In its pre-development form, the site is mapped as containing a composite regional ecosystem (RE) of Least Concern RE 12.9-10.2, Of Concern RE 12.9-10.7 and Least Concern RE 12.9-10.17a. Vegetation associated with Sandy Creek is mapped as Of Concern RE 12.3.11 and patches of Endangered RE 12.3.3. These ecosystems are habitat for threatened plant species including *Notelaea lloydii*, *Grevillea quadricauda*, *Westringia sericea* and *Coleus habrophyllus*. In addition, these ecosystems are suitable habitat for Koalas (*Phascolarctos cinereus*).

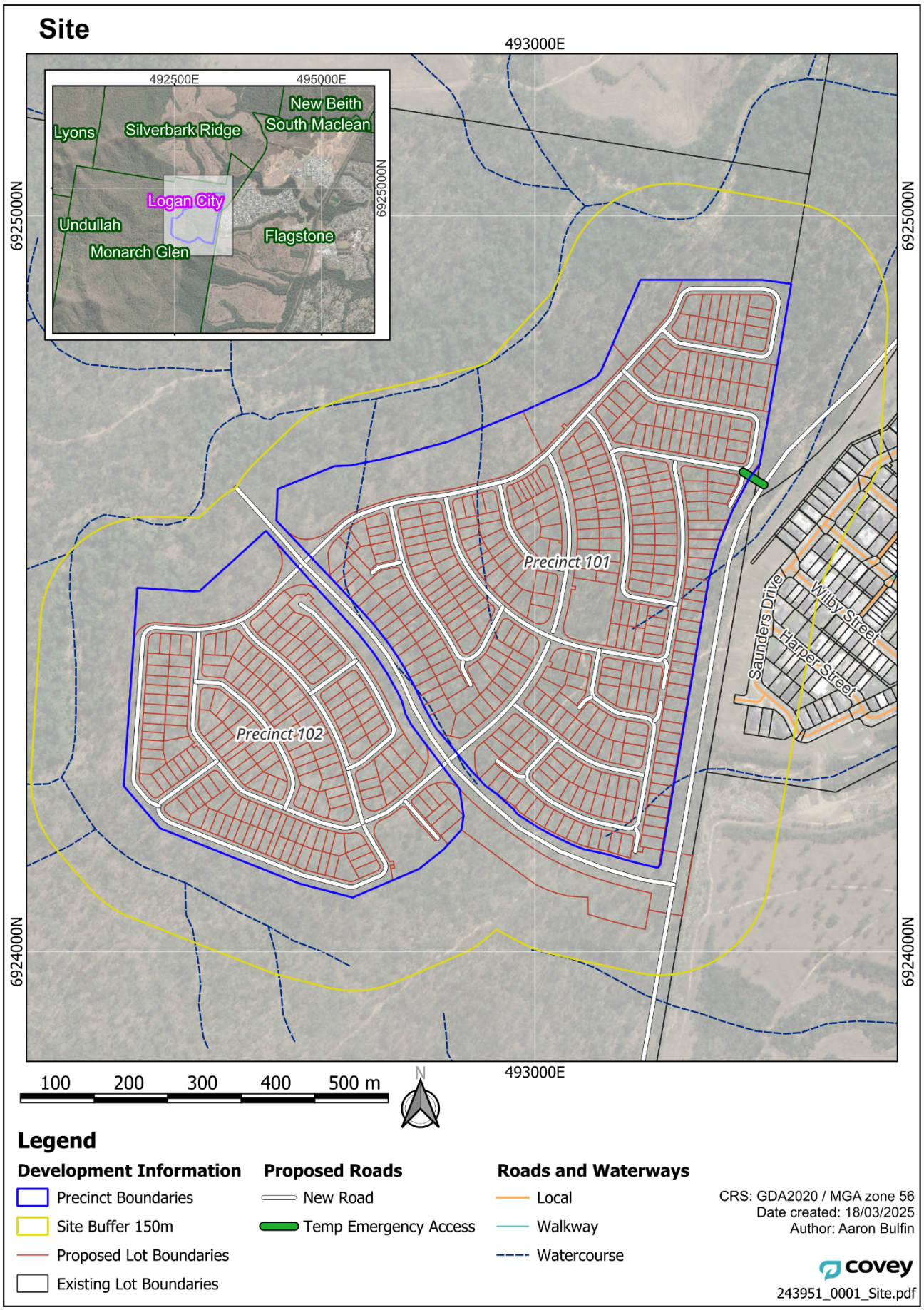


***Figure 2-1. Site location.***

# 3 Bushfire Hazards

Bushfire severities are predominantly influenced by fuel, weather, and topography; each of which can have a varying effect on bushfires and their potential – these main influences will be explored below in this section. Bushfire severity as it relates to vegetation and topography is represented on the Bushfire Prone Area mapping developed by the Queensland State government, where increased severity is a result of areas of steeper terrain and vegetation with higher potential fuel loads.

The State Planning Policy (2018) mapping identifies the site as subject to High Potential Bushfire Intensity and Medium Potential Bushfire Intensity (Figure 3-1). The LCC Planning Scheme Bushfire Overlay Map (OM-03 00) identifies the site as subject to High Potential Bushfire Intensity and Medium Potential Bushfire Intensity.

## 3.1 Topography

Topography influences the bushfire hazard level classification in the BPA mapping. Topography was verified during the site assessment and was considered consistent with the Digital Elevation Model obtained from the Intergovernmental Committee on Surveying Mapping Australia spatial elevation data platform (Elvis - Elevation and Depth - Foundation Spatial Data). The proposed earthworks design tin for Precinct 101 and 102 as provided by the client and has been included in the post-development slope analysis for the site (Figure 3-2).

The area where Precincts 101 and 102 are situated on gradual to moderate sloping terrain (up to 10$^{o}$ slope) that descends northward, north-westward, and westward towards existing gullies and Sandy Creek. Note that site's topography will be altered by earthworks, as shown in Figure 3-2.

The development is bounded by gullies that feed into Sandy Creek on all sides with the exception of the eastern boundary. These gully and creek lines are within the future conservation area (outside of the development boundary), and have slopes of 20$^{o}$+that are measured as downslope from the development area. With reference to slope measurement caps in calculating radiant heat flux per AS3959, these steeper slopes will have no impact on the RHF results given their separation from the development lots.

A combination of moderate slope cut-and-fill embankments will be revegetated around the southern, western, and northern site boundary.

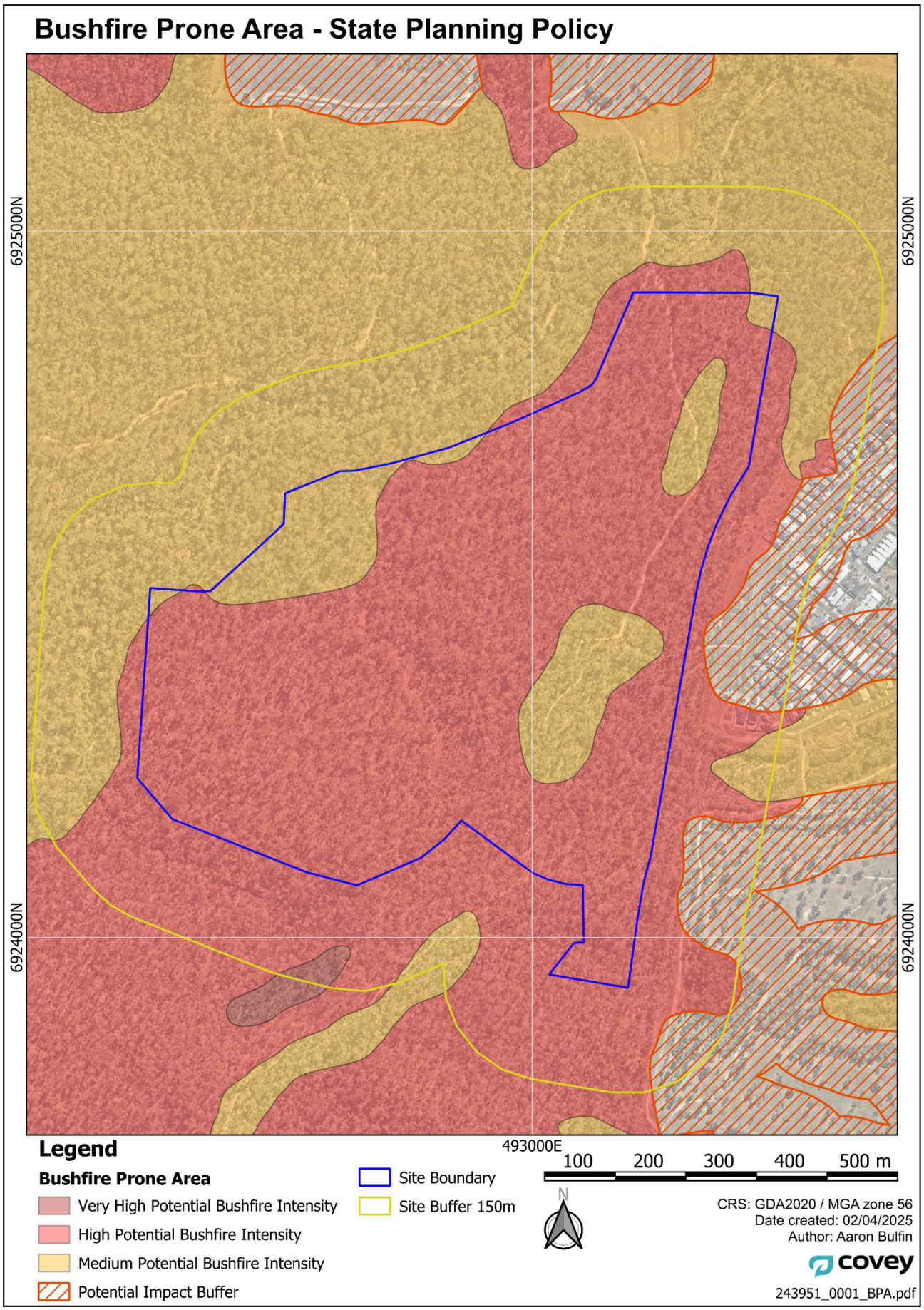


***Figure 3-1. Bushfire Prone Area (SPP) details of site at present.***

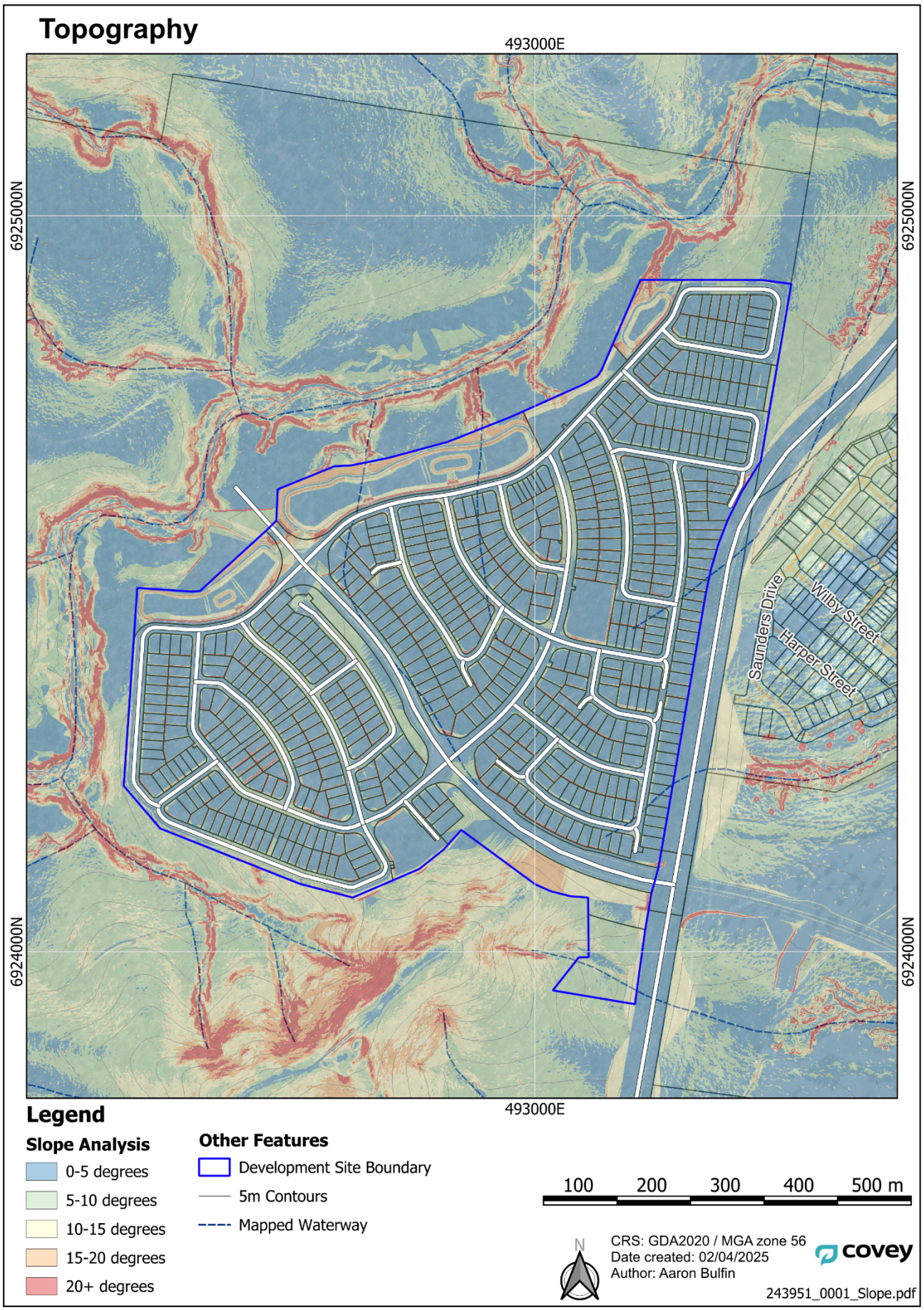


***Figure 3-2. Post-development slope analysis (1m resolution)***

## 3.2 Weather

Fire weather refers to meteorological conditions that promote bushfire spread, making wildfire suppression more challenging. Fire weather can be influenced by many local factors including temperature, wind, relative humidity, and drought factor – all of which are used to calculate Forest Fire Danger Index (FFDI[1]). Fire risk is typically linked to the occurrence of fire weather days or sequences of days of FFDI above 25 (Queensland Parks and Wildlife Service, 2013).

An assessment of the recent past weather patterns and trends was analysed for the site using data extracted from the Bureau of Meteorology recorded from all of Australia's Automatic Weather Stations (AWS). For this site, we analysed data from Beaudesert (Drumley Street) from 2007 – 2024 (AWS 40983; approximately 19 km South-South-East from the site). The development site and the selected AWS locations are within the Southeast Queensland Bioregion.

Analysis of monthly FFDI distribution indicates that the fire season typically extends between August and November, peaking in September (seasonally dependant) (Figure 3-3). However, fire occurrences can have a random nature, and a few short sharp fire weather periods can result in fires that cause, or have the potential to cause, major damage. Damaging fires can occur in any given year, despite some years being drier and hotter than others.

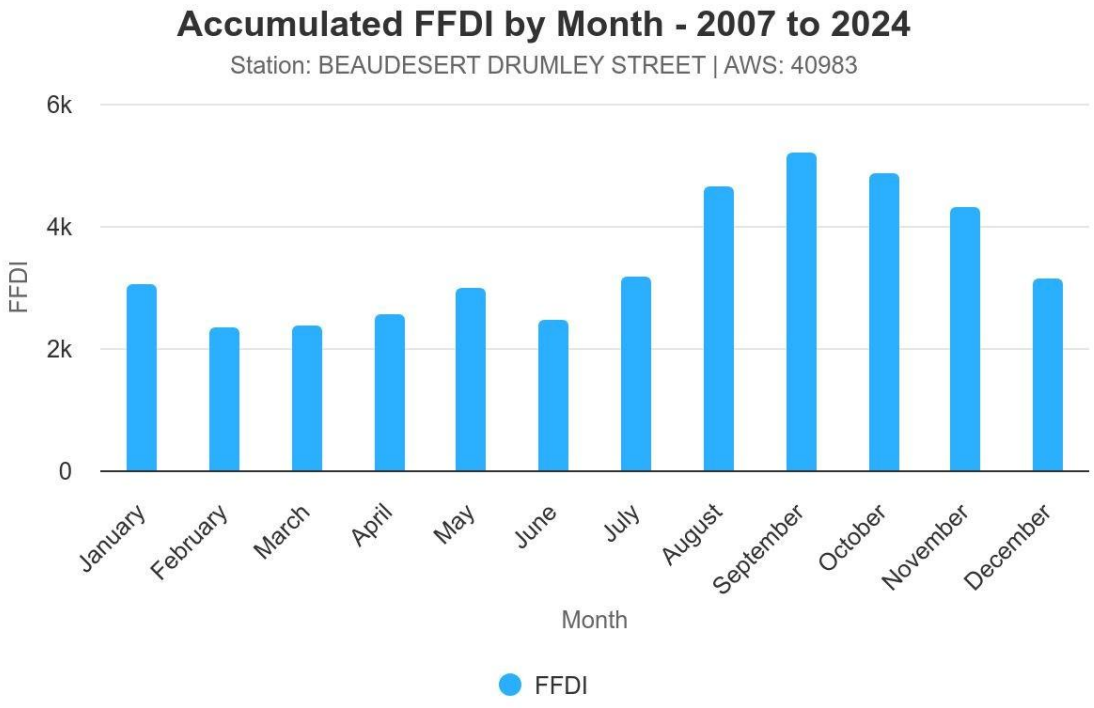


***Figure 3-3. Accumulated FFDI by Month for Beaudesert (Drumley Street).***

[1] FFDI were used in this report, instead of the new Australian Fire Danger Rating System and Fire Behavior index, as the data we analyzed was historical. Also, FFDI values are used as input for in RHF modeling.

Table ***3-1*** provide the highest ranked FFDIs over the recorded period – where the total number in the ranking is the total number of years of historical weather data from Beaudesert (Drumley Street) AWS (i.e., approximately seventeen years for Beaudesert from 2007-2024). These show that the highest ranked fire danger days are typically associated with:

- Air temperatures in excess of 30$^{O}$C;
- Low RH (≤20%);
- Westerly arc winds; and,
- Relatively dry conditions (Drought Factor ≥ 9.5).

Though the number of years for which the AWS has been active is relatively short (seventeen years), it still provides valuable information relating to typical high fire danger weather patterns. The year or 2019 stands out as the worst year on record (2007 to 2024) so far, on the basis of low annual rainfall accumulation through the year and high temperatures, combined with low relative humidity influenced by the dry inland air from the westerly winds.

***Table 3-1 - Highest Ranked FFDI for Beaudesert (Drumley Street) AWS 2007-2024***

| Rank | Date | T (°C) | Dew Point (°C) | RH (%) | Wind Speed (km/hr) | Wind direction (deg) | Wind Cardinal Direction | KBDI | Drought Factor | FFDI | FDR |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **1** | 2019-11-08 | 38.3 | -3.5 | 4 | 16.6 | 300 | WNW | 181 | 10 | 58.021 | Severe |
| **2** | 2019-11-15 | 37.1 | -8.7 | 5 | 18.4 | 290 | W | 185 | 10 | 56.141 | Severe |
| **3** | 2019-11-07 | 36.4 | -9.2 | 4 | 11.2 | 330 | NW | 181 | 10 | 47.953 | Very High |
| **4** | 2019-11-05 | 28.6 | 8.3 | 9 | 29.5 | 260 | WSW | 180 | 10 | 47.575 | Very High |
| **5** | 2019-09-06 | 34.5 | -10.6 | 5 | 14.8 | 310 | WNW | 168 | 10 | 47.264 | Very High |
| **6** | 2019-12-05 | 38.2 | -3.6 | 7 | 16.6 | 250 | WSW | 184 | 8.8 | 45.959 | Very High |
| **7** | 2015-10-05 | 34.8 | -21.3 | 2 | 9.4 | 60 | NE | 129 | 9.8 | 45.745 | Very High |
| **8** | 2014-11-16 | 40.1 | 12.1 | 17 | 22.3 | 270 | W | 169 | 10 | 44.994 | Very High |
| **9** | 2019-12-06 | 40.5 | -0.1 | 8 | 11.2 | 290 | W | 185 | 9.3 | 44.664 | Very High |
| **10** | 2007-09-17 | 29.9 | 5.9 | 9 | 25.9 | 270 | W | - | 9.504 | 43.46151 | Very High |
| **11** | 2019-09-09 | 23.6 | -14.2 | 8 | 31.3 | 250 | WSW | 170 | 10 | 43.37716 | Very High |
| **12** | 2019-12-16 | 41.1 | 11.2 | 23 | 27.7 | 90 | E | 191 | 10 | 42.93524 | Very High |
| **13** | 2007-10-01 | 31.7 | -5 | 16 | 31.3 | 60 | NE | 59.06 | 9.857 | 42.6729 | Very High |
| **14** | 2016-11-05 | 34.6 | 4.2 | 14 | 24.1 | 260 | WSW | 110 | 9.7 | 41.93789 | Very High |
| **15** | 2019-11-10 | 33 | -9.3 | 6 | 13 | 200 | S | 182 | 10 | 41.61385 | Very High |
| **16** | 2019-09-08 | 26.1 | -9.2 | 9 | 25.9 | 250 | WSW | 170 | 10 | 40.18818 | Very High |
| **17** | 2019-11-16 | 38.5 | 2.8 | 20 | 24.1 | 90 | E | 186 | 10 | 40.08784 | Very High |

### 3.2.1 Rainfall

The occurrence of days with high fire danger is also influenced by annual rainfall by virtue of the Keetch-Byram Drought Index (KBDI) and Drought Factor (DF). As seen for the analysed AWS, where typically low annual rainfall results in higher accumulated annual FFDIs (Figure 3-4). Conversely, years of above-average rainfall can lead to increased vegetation growth. Therefore, although high rainfall levels are less conducive to extensive wildfire impact in the short term, this effect might be reversed in successive years. As such, having an above-average year of rainfall cannot be perceived as reducing the on-going fire risk.

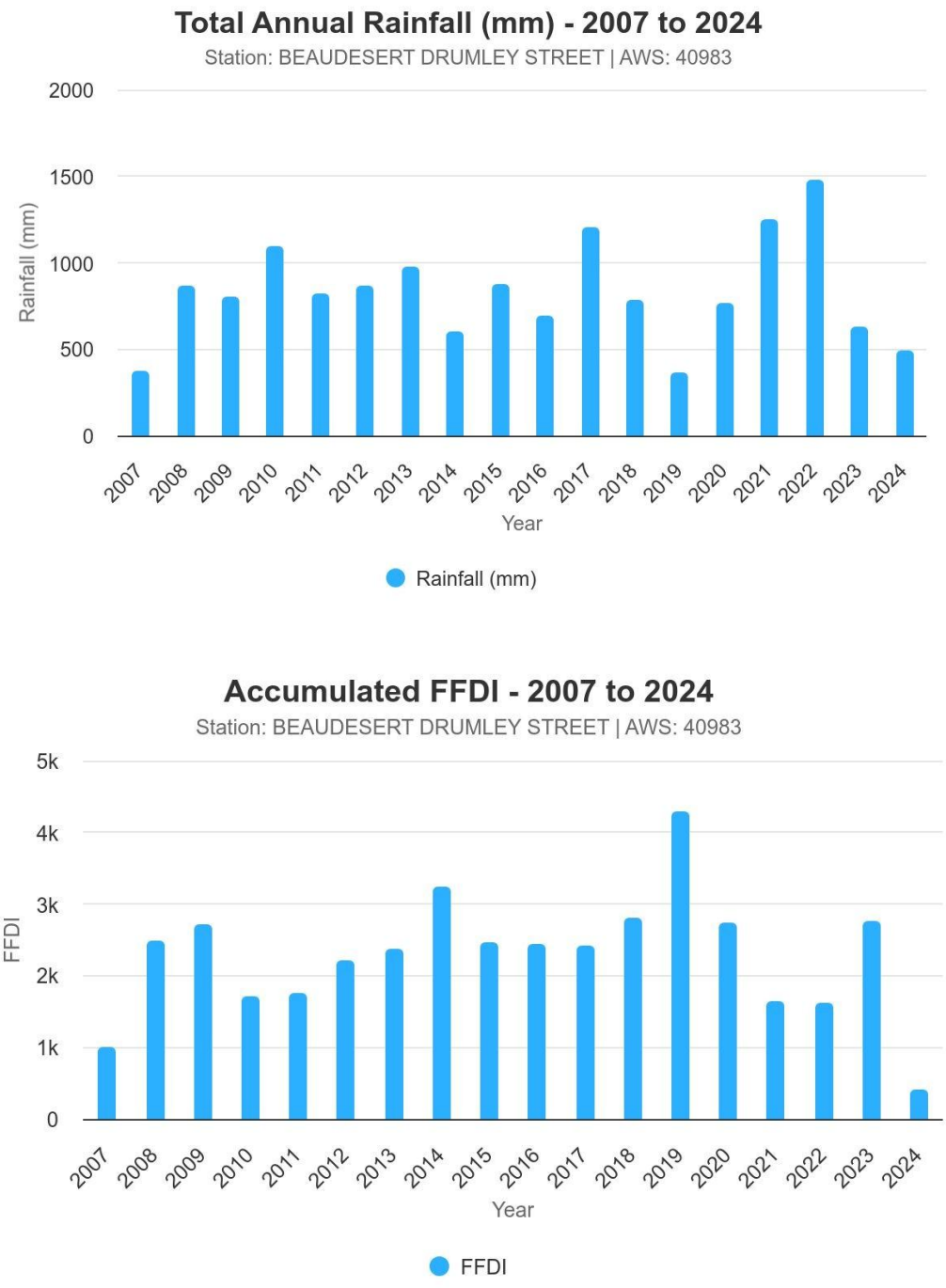


***Figure 3-4 - Annual Rainfall vs Accumulated FFDI***

### 3.2.2 Wind Speed & Direction

Fire weather patterns are also dependent on wind signatures. Figure 3-5 shows wind directions for FFDI classes 0-11, 12-24, 25-49, and 50-74 for Beaudesert AWS assessed period (2007 to 2024). FFDIs greater than 74 have not occurred over the assessed period. The analysis reveals that FFDI above 25 tend to come from a westerly arc, under inland continental dry winds influence. Winds associated with lower FFDIs tend to be easterlies and have higher relative humidity associated due to a maritime influence.

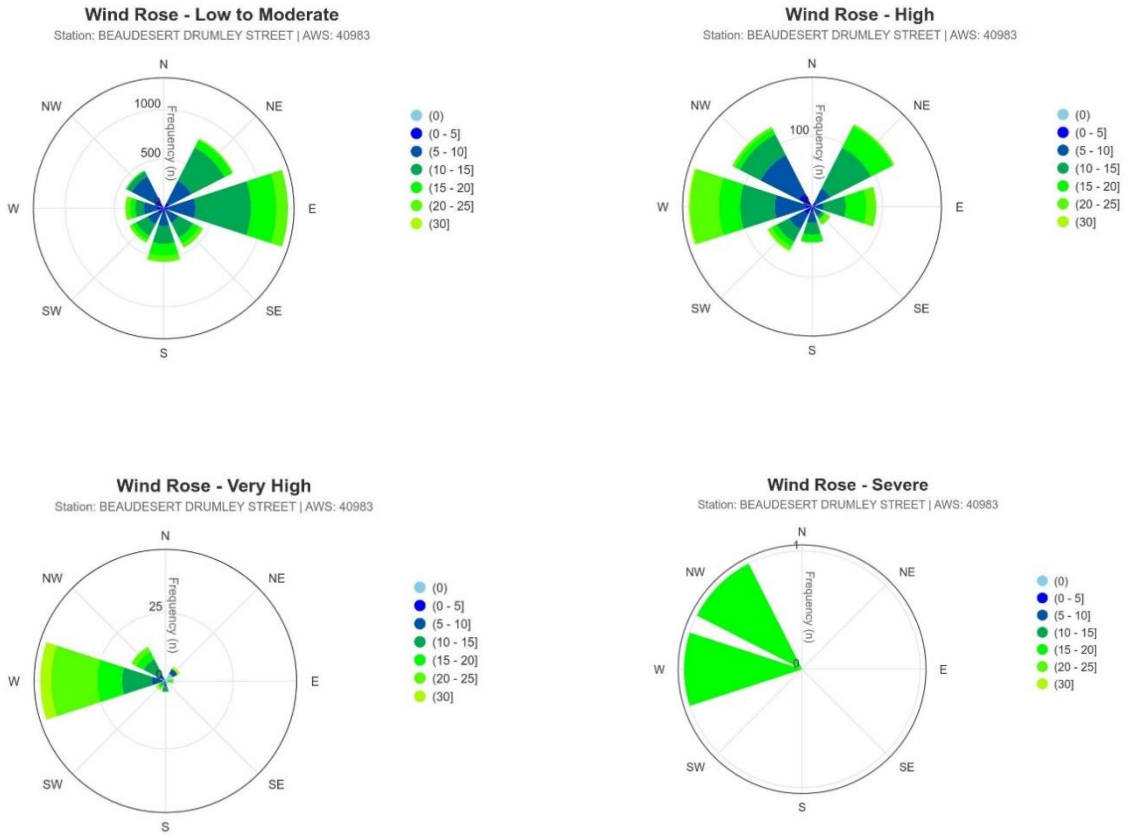


***Figure 3-5. Wind Rose and accumulated days (count) for 'Low to Moderate' (0<FFDI<12) 'High'(12<FFDI<25) 'Very High' (25<FFDI<50) and 'Severe' (50<FFDI<75) Fire Danger Rating Days.***

### 3.2.3 Selection of FFDI value using SPP

Per the recommendations of BRC for undertaking Method 2 RHF calculation method, the mapped SPP 1:20 year Recurrence Interval FFDI spatial data (available at https://catalyst.qfes.qld.gov.au/.) has been adopted – the SPP prescribed spatial FFDI for the site is 56.

### 3.2.4 Climate Change impact on FFDI

Climate change relative to the project site can be referenced in the *Climate Change in Australia Report for East Coast Cluster* developed by CSIRO and BOM (A. Dowdy et al., 2015), key findings for projected climate change within the East Coast Cluster is summarized below:

Very high confidence in:

- Higher temperatures,
- Hot and more frequent hot days, with less frost,

High Confidence in:

- Increased intensity of heavy rainfall events, though changes to drought less clear,
- Increase evaporation rates and reduced soil moisture,
- Little change in solar radiation and reduced humidity throughout the year,
- Some decrease in Winter wind speed, with fewer East Coast Lows,
- An overall harsher Fire Weather climate in the future.

Climate modelling projections for predicted fire weather and fire danger based on the latest IPCC reports (AR5 and AR6) are available and could provide valuable information when assessing potential future fire risk to the site – as projections exist from the current year to 2100. These climate models have been developed by the Department of Environment and Science, based on accepted climate models and data, and are available in gridded format relative to the project site (CSIRO et al., 2021).

It should be noted that fire weather and fire behaviour are, by nature, difficult to predict with certainty. Therefore, the following limitations exist when predicting bushfires and designing for bushfire mitigation:

Fire behaviour at elevated FFDIs and under the influence of fire-induced winds driven by strong convection rates can become erratic and thus can be beyond the bounds of predictive models (Cruz et al., 2012); and

Human-induced climate change may exacerbate fire behaviour and affect vegetation structure and floristics in different ways to those assumed in this project (A. J. Dowdy, 2018).

The FFDI input value identified in the previous section (Section 3.2.3) is a value implemented by BRC that accounts for anticipated climate in 2050 by using the previously published data from the Intergovernmental Pael on Climate Change A1F1 scenario (Queensland Fire and Emergency Services, 2019a).

## 3.3 Fuel

### 3.3.1 Bushfire Fuels

Fuel load and arrangement significantly impact bushfire behaviour's potential severity and scale. Fuel characteristics vary along with changes in type, density and extent of vegetation communities and land use. The SPP requires assessment of the 150 m of vegetation adjacent to assets. The vegetation within the study area was classified into Vegetation Hazard Classes (VHC) (Queensland Fire and Emergency Services, 2019a) based on information gathered from a combination of:

- Site-verified Regional Ecosystem data from field observations;
- State Regional Ecosystem spatial data (https://qldspatial.information.qld.gov.au/catalogue);
- Vegetation Hazard Class (https://qldspatial.information.qld.gov.au/catalogue); and
- Aerial imagery.

#### *3.3.1.1 Site Assessment*

A site inspection was undertaken on the 24th of September 2024 to verify the mapped regional ecosystems and corresponding vegetation hazard classes at the site (Figure 3-6, refer to Appendix B for photos). The site was traversed on foot to document the species composition of vegetation onsite with corresponding VHCs. The VHC observed within the site or within 150 m of the site boundary were assessed pre-development at shown in Table 3-2 and Figure 3-6.

The site consists primarily of *Corymbia citriodora* (Spotted Gum) dominated forests with scattered *Eucalyptus crebra* (Narrow-leaved Ironbark) and an understorey of mixed *Acacia sp.*, juvenile *Eucalypt sp.*, *Trema tomentosa* (Poison Peach), *Lantana camara* (Lantana) which is aligned with the mapped RE 12.9-10.2. A creek traverses north-east to south-west to the north-west of the site with several tributaries of the main creek passing through the centre of the site. Through the creek lines and gullies, vegetation is dominated by mature *Eucalyptus tereticornis* (Forest Red Gum), along with *Corymbia intermedia* (Pink Bloodwood), *Lophostemon sauveolens* (Brush Box), *Allocasuarina littoralis* (Black She-Oak), *Melaleuca quinquenervia* (Broad-leaved Paperbark), *Melaleuca salicina* (Willow Bottlebrush) and *Alphitonia excelsa* (Soap Tree). Understorey and ground species adjacent to the creek include *Megathyrsus maximus* (Guinea Grass), Lantana and *Lomandra longifolia* (Basket Grass). These areas were aligned with the species composition of RE 12.3.11 and RE 12.3.3.

***Table 3-2. Site pre-development vegetation and VHC assessment.***

| POI (Figure 3-6) | VHC | Vegetation Description |
|---|---|---|
| **POI 1** | 40.4 | Cleared road verge next to existing development. |
| **POI 2** | 10.1 | Edge of gully with *C. citriodora* scattered juvenile *E. tereticornis, C. intermedia* understorey of *Acacia sp., Trema tomentosa* and *Alphitonia excelsa*. |
| **POI 3** | 16.1 | Dry creek bed with *E. tereticornis*, *Lophostemon sauveolens*, *Melaleuca salicina*, *C.intermedia*, *Allocasuarina littoralis* and an understorey containing with Guinea grass, Lantana and *Acacia sp.* |
| **POI 4** | 16.1 | Waterway (dry) with *E. tereticornis*, *A. littoralis*, *L. sauveolens*, *M. salicina*, *M. quinquenervia* and *Lomandra longifolia* to the west. To the east, vegetation consistent with VHC 10.1 with *C. citriodora*, *Angophora woodsiana*, and *Alphitonia* excelsa. |
| **POI 5** | 10.1 | Open forest dominated by *Corymbia citriodora* with *Acacia leiocalyx*, *T. tomentosa* and *A. excelsa* understorey. |
| **POI 6** | 10.1 | *C. citriodora* dominating with scattered *C. intermedia* and *E. tereticornis.* |
| **POI 7** | 10.1 | *C. citriodora* dominant open forest with regrowth understorey *Acacia leiocalyx*, *T. tomentosa* and Lantana. |
| **POI 8** | 10.1 | *C. citriodora* open forest with *E. crebra* and regrowth understorey *Acacia sp.* and juvenile *Eucalyptus sp.* |
| **POI 9** | 16.2 | Highly eroded waterway channel with *C. citriodora*, *E. crebra*, *E. tereticornis* and *L. sauveolens*, understorey containing *Acacia sp.* and *Alphitonia excelsa.* |

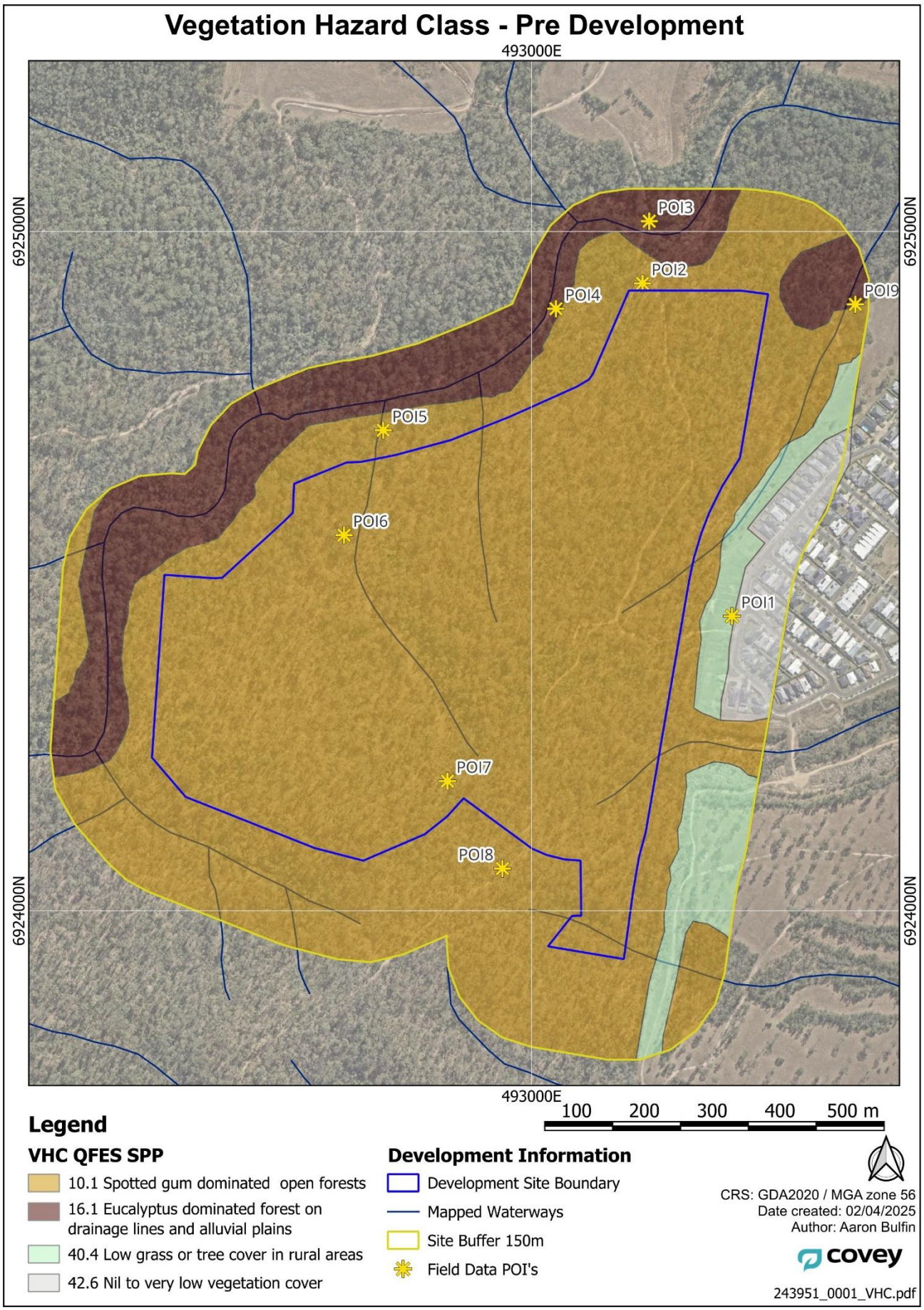


***Figure 3-6. Pre-Development Vegetation on Site and VHC Classification.***

#### *3.3.1.2 Post-Development*

Figure 3-7 shows the post-development vegetation types and extent, as per Development Layout Plan, Statement of Landscape Intent, and site assessment.

In preparation of the post-development VHC, Covey reviewed the proposed development layout, land use and landscaping documents, including:

- Context Plan - Precinct 101 & 102 – Issue J (Saunders Havill 28th March 2025); and
- Monarch Glen ROL 101 & 102 Landscape package - Issue J (Vee Design, 2nd March 2025)

Note that, Covey advised the following modification to any proposed planting palette (based on the target REs) and densities to mitigate landscape derive fuel hazard:

- Align batter revegetation around bio-retention basins with Vegetation Hazard Class 16.2 (Eucalyptus dominated woodland on drainage lines).
- Remove any proposed shrub species and reduce *Acacia* species densities to achieve 10 m spacings.
- Align bio-retention basins with Vegetation Hazard Class 34.5 (Sedgeland dominated wetlands)
- Remove any proposed *Melaleuca quinquenervia* from the plant palette to reduce bark hazard and reduce *Casuarina* density to achieve 10 m spacings.

The post-development VHC's within the site and 150 m of the site boundary include:

1. VHC 10.1 – Spotted gum dominated open forests,
2. VHC 16.1 – Eucalyptus dominated forests on drainage lines and alluvial plains,
3. VHC 16.2 – Eucalyptus dominated woodland on drainage lines and alluvial plains,
4. VHC 34.5 – Sedgeland dominated wetlands,
5. VHC 39.2 - Discontinuous low to moderate tree cover in built-up areas
6. VHC 40.4 – Low grass or tree cover in rural areas,
7. VHC 42.6 – Nil to very low vegetation cover, and

The VHCs were then used to extrapolate fuel loads to be adopted in the RHF model (Table ***3-3***).

***Table 3-3. VHC observed within 150 m of development and associated fuel load as per BRC.***

| Vegetation Hazard Class | Vegetation Type (per AS 3959) | S+NSFL (t/ha) | TFL (t/ha) | Prone Type | Modelled |
|---|---|---|---|---|---|
| VHC 10.1 | Forest | 19.3 | 20.8 | Bushfire | Y |
| VHC 16.1 | Forest | 13.8 | 16 | Bushfire | Y |
| VHC 16.2 | Woodland | 11.1 | 11.6 | Bushfire | Y |
| VHC 34.5 | Grassland | 8 | 13 | Bushfire | Y |
| VHC 39.2 | Low-threat | 5 | 8 | Low Hazard | N |
| VHC 40.4 | Grassland | 4.5 | 5 | Grassfire | N |
| VHC 42.6 | Low-threat | 2 | 2 | Low Hazard | N |

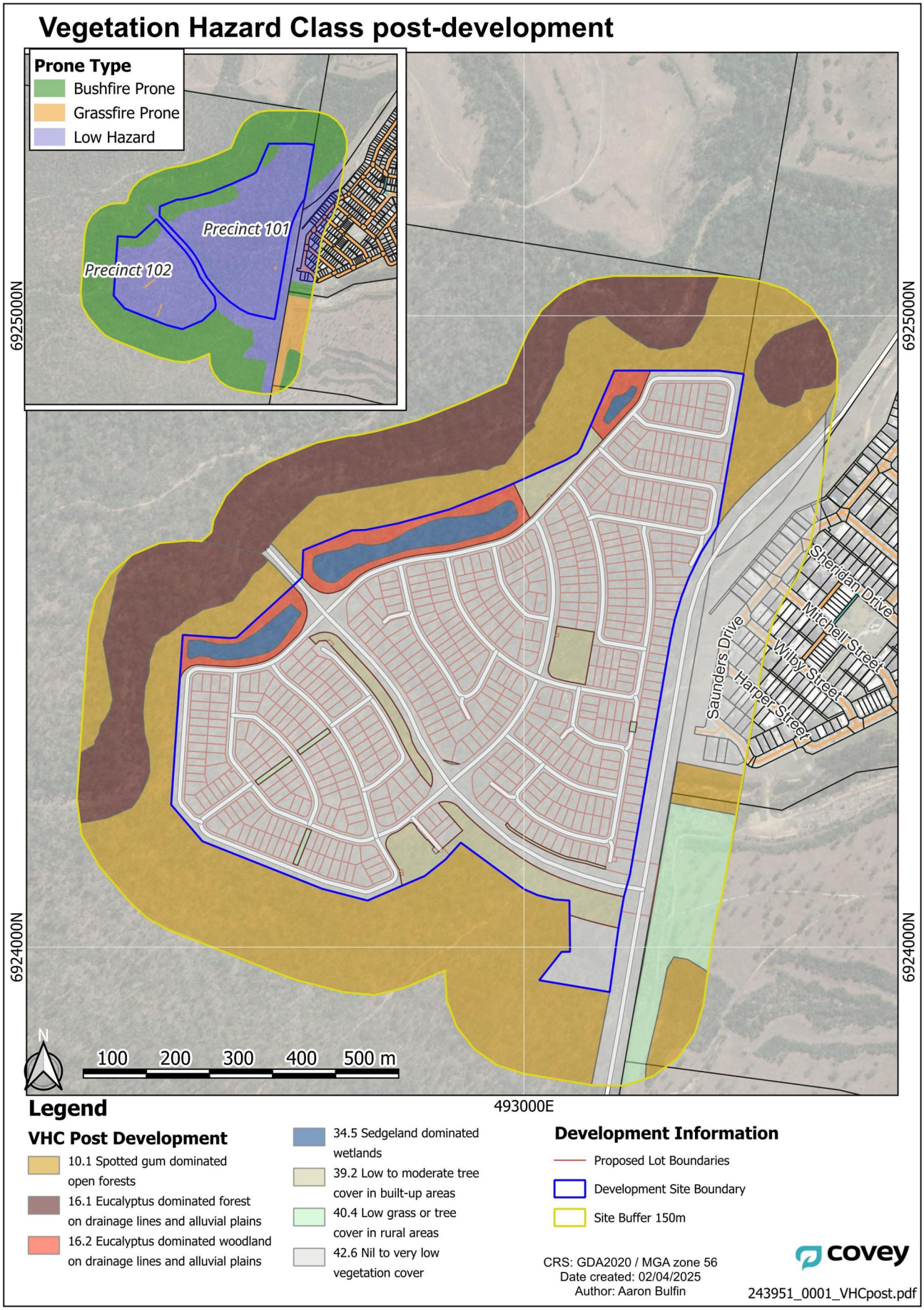


***Figure 3-7. Post-Development Vegetation on Site and VHC Classification.***

### 3.3.2 Summary

Bushfire intensity varies with fuel loads (based on vegetation), local weather and site topography, the key findings of this section that may influence bushfire around and within the development site:

- The post-development topography will significantly change within the proposed residential lots to create a reasonably flat development footprint. Slope underneath vegetation (i.e. effective slope per AS 3959) influences fire intensity and rate of spread. Existing slopes around the creek line and revegetated batters where the design surface interfaces with the natural surface will impact RHF results.
- Analysis of weather metrics from the nearest AWS reveal that:
    - The highest recorded FFDI values occurred in 2019, coinciding with the lowest recorded annual rainfall, high temperatures, low RH, and moderate wind speeds,
    - Fire danger tends to be elevated on days with a westerly wind-arc,
    - Fire danger is elevated on hot days (>30$^{o}$C) with low RH (typically Spring),
    - Fire weather typically commences in August and extends through to January.

It should be noted though that the AWS records span less than 20 years.

- The SPP spatially variable FFDI value for a 1:20 year Recurrence Interval (FFDI = 56), per the recommendations of the BRC for Method 2 RHF analysis has been adopted.
- The residential development will modify the vegetation on site, with all existing vegetation within the development footprint to be cleared. Areas of retained vegetation will exist around the southern, western, and northern fringes of the development, and the RHF results from this retained vegetation will be assessed in the following section.

# 4 Bushfire Assessment

## 4.1 Bushfire Impact Analysis and RHF Ratings

Radiant Heat Flux (RHF) modelling identifies the rate at which heat transfers to a surface from a potential fire and how the energy dissipates with increasing distance from the vegetation constituting a bushfire hazard. Radiant Heat Flux modelling was undertaken in accordance with Method 2 of AS3959, with the adoption of BRC prescribed Forest Fire Danger Index (FFDI) and fuel loads from the SPP.

The model incorporated the following input values, satisfying Bushfire Resilient Communities (2019):

- FFDI 56 per SPP and QFES published spatial data (https://catalyst.qfes.qld.gov.au/) representing the 5% annual exceedance probability fire weather event FFDI to reflect the expected climate in 2050 using an Intergovernmental Panel on Climate Change A1FI climate scenario (Queensland Fire and Emergency Services, 2019a).
- Site-specific vegetation hazard classes and their associated potential fuel loads determined per procedure 5.4.2 Step 2 of BRC (2019) (Table 3-3).
    - Surface fuel load (*w*) 19.3 and total fuel load (*W*) 20.8 t/ha for VHC 10.1;
    - *w* = 13.8 t/ha and *W* = 16 t/ha for VHC 16.1;
    - *w* = 11.1 t/ha and *W* = 11.6 t/ha for VHC 16.2;
    - *w* = 8 t/ha and *W* = 13 t/ha for VHC 34.5;
- A flame temperature of 1090 degrees Kelvin.

According to Section 7.6 of the BRC, radiant heat flux is not required to be calculated for grassfire-prone VHCs or low-hazard VHC's (Queensland Fire and Emergency Services, 2019a). VHC 40.4 is considered grassfire prone and VHC 39.2 and 42.6 are low hazard; as such, these vegetation communities were not included in the RHF model (refer to BRC Figure 14 and s 7.6(5)). Only bushfire-prone vegetation (Prone Type =1) was modelled per BRC (refer to inset in Figure 3-7).

Based on the Preliminary RHF modelling, while the majority of lots and future building envelopes within each lot can be positioned to have a RHF of less than 29 kW/m$^2$ during credible worst-case bushfire events impacting the development, there are several lots impacted by RHF of 29 kW/m$^2$.

The results of the Radiant Heat Flux of the assessed flammable vegetation are displayed in Figure 4-1 below. Note that a Bushfire Attack Level assessment may be required to be undertaken in accordance with AS3959 before construction works of the buildings on the created lots.

**Note that a BAL assessment does not form part of the assessment within this report, which forms part of a building approval, and specifically has different inputs to determine the RHF towards determining a suitable BAL rating of the proposed building/s within bushfire prone areas.**

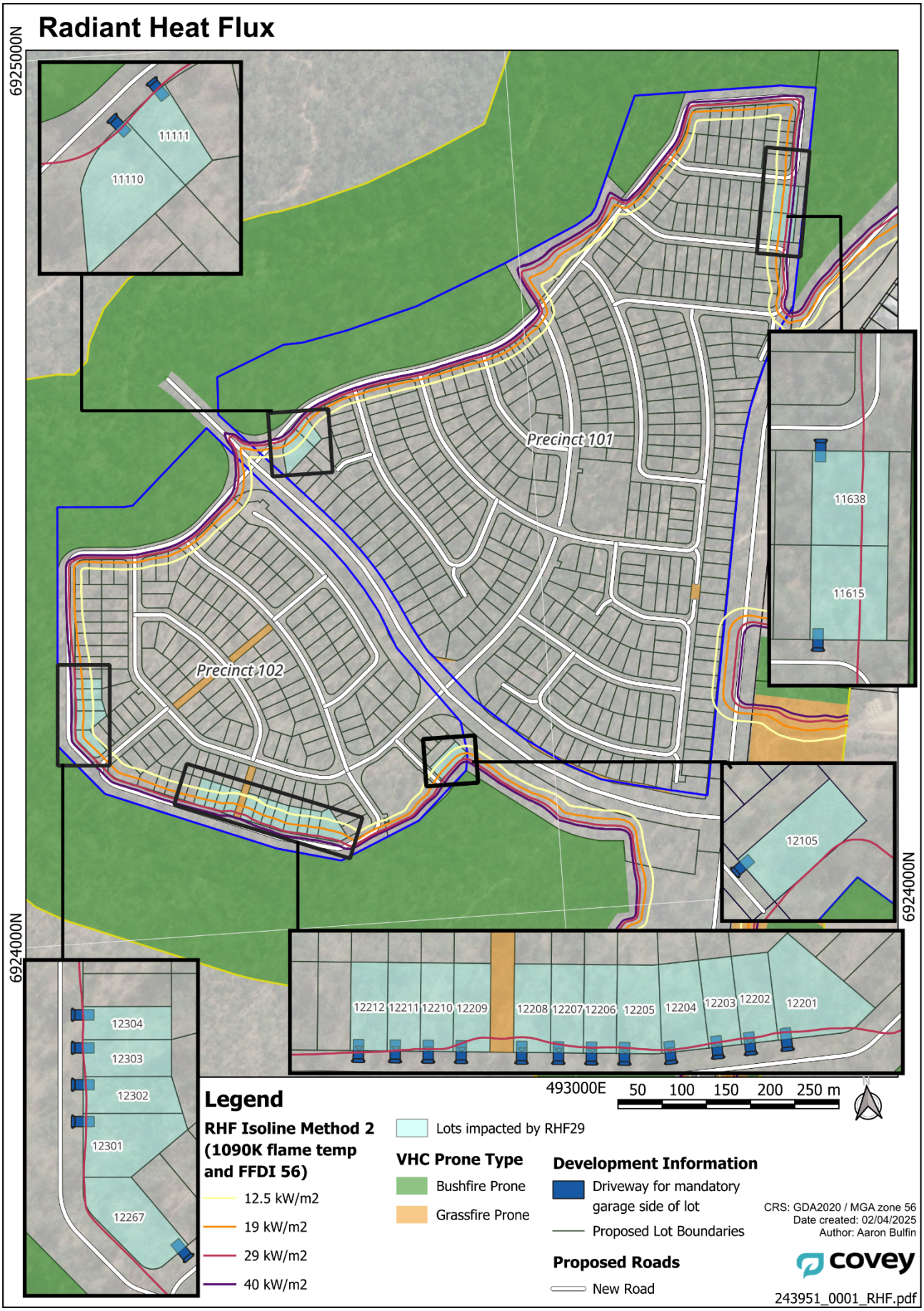


***Figure 4-1. Radiant heat flux modelling output.***

## 4.2 Potential human impact and sheltering sites

Radiant heat flux and expected impacts on the human body are outlined in Table 4-1 for reference.

***Table 4-1. Radiant heat flux impacts*** (Penney et al., 2020)***.***

| ***Radiant Heat Flux (kW/m²)*** | ***Human effect*** |
|---|---|
| 23.5 | Likely fatality for extended exposure and chance of instantaneous fatality for unprotected exposed persons. |
| 16.7 | Significant chance of fatality for unprotected extended exposure. |
| 10 | Tenability threshold for bushfire fighters. |
| 5 | Limited human trials indicated no adverse effects |
| 4.2 | Will cause pain in 15-20 seconds unprotected exposure. Will cause injury after 30 seconds unprotected exposure. |
| 3 | Operational threshold for bushfire fighters attempting suppression. |
| 2.5 | Level of exposure permitted for evacuating occupants in the Building Code of Australia |
| 2.1 | Minimum heat radiation required to cause pain after 60 seconds unprotected exposure |
| 1.3 | Exposure from mid-day sun |

# 5 Bushfire Mitigation Measures

The following section outlines bushfire mitigation measures that have been incorporated into the proposed development design. These measures aim to comply with BRC and SPP. Provided that the mitigation measures outlined in this section are implemented, the bushfire risk for the proposed development is deemed to be acceptable. Note that, this assessment is focused on planning legislation. The BPA overlay (Figure 3-1) also trigger building to be constructed in accordance with BCA Ancillary provisions and additional construction requirements in bushfire prone areas. The BCA requires Class 1, Class 2, Class 3 buildings, and Class 10a building or deck associated with a Class 1, 2 or 3 to be constructed per AS 3959-2018 (National Construction Code, 2022a, 2022b). Also, BCA requires certain Class 9 buildings to comply with Specification 43 of the BCA (National Construction Code, 2022a). **As such, the residential dwellings within the new development may require a BAL assessment before construction.**

## 5.1 Lot Layout

The Queensland SPP *Natural Hazards, Risk and Resilience – Bushfire State Planning Policy State Interest guidance material* (Queensland Government, 2019) states that reconfigurations of a lot must ensure building envelopes can be sited to achieve exposures of less than 29 kW/m$^2$ RHF.

To achieve this, the area between bushfire-prone vegetation and the 29 kW/m² isoline (identified in Figure 4-1) must be maintained as low-hazard vegetation in perpetuity (refer to section 5.4). This area, also known as the Asset Protection Zone (APZ) in BRC, may include roads, linear parks, and neighbourhood recreation parks, provided they comply with the bushfire landscaping guidelines in section 5.4. For lots where RHF exceeds 29 kW/m², building envelopes must be located outside the APZ.

Radiant heat flux analysis indicates that most proposed lots in Precincts 101 and 102 are set back far enough from bushfire-prone vegetation to maintain an RHF of ≤29 kW/m² (Figure 4-1). However, some lots are impacted by RHF exceeding this threshold:

- Precinct 101
    - Lots 11110, and 11111
      the RHF 29 kW/m² isoline slightly encroaches on the lot frontage. However, this minor encroachment is not expected to affect the proposed dwellings, which will be required to maintain a minimum setback from the frontage.
    - Lots 11615, and 11638
      These lots experience significant encroachment from the RHF 29 kW/m² isoline along the eastern boundary. To mitigate this, future building envelopes must be positioned on the western side of the lot, ensuring they are located outside of the APZ.
- Precinct 102
    - Lots 12105, 12201 to 12212, 12267, 12301, 12302 to 12304
      The RHF 29 kW/m² isoline encroaches on the frontage and/or side boundaries of these lots. However, as with Precinct 101, this minor encroachment is not expected to impact the proposed dwellings, which will be required to maintain appropriate setbacks from affected boundaries.

Unless vegetation clearing works are undertaken across the whole of the development site, any staged vegetation clearing works are to ensure that suitable APZ widths are established around any proposed infrastructure. These APZs are then to be maintained in perpetuity until such time that Precinct 101 and 102 in their entirety are established.

No vegetation clearing outside of the proposed development boundary for Precincts 101 and 102 is required to ensure sufficient APZ width

Provided that, future building envelopes on impacted lots listed above are able to be located in areas exposed to less than 29 kW/m$^2$ (i.e., outside the APZ), the proposed development is deemed to achieve the outcomes of the SPP regarding setbacks from bushfire prone vegetation.

*Though not necessarily applicable to the development of Precinct 101 and 102, in accordance with BRC Section 9.4, if any vulnerable uses, storage or manufacture of hazardous materials and community infrastructure for essential services are planned, the development footprint plan should ensure that these are sited to achieve exposures of 10 kW/m$^2$ RHF or less.*

## 5.2 Access

The proposed development will see the construction of new roadways and driveway access to provide sufficient access to the development site and individual lots. Precincts 101 and 102 of this development form part of an overall master-planned development, and will include the construction of a new collector road that separates Precinct 101 and 102. Connection to this collector road will be from access roads and access streets to service the proposed lots. The proposed roadway design appears to minimise the number of cul-de-sacs (dead-ends) – though where cul-de-sacs are to be constructed, provision should be made to ensure suitable access and turning of emergency vehicles. The proposed road network also provides suitable access for residents away from the retained bushfire hazardous vegetation in the event of a bushfire (Appendix A). Design and construction of the new roads for Precinct 101 and 102 of the development shall comply with Performance Outcome PO5 of the SPP BOC.

The design and construction of access roads and driveways within the development should be informed by *Fire hydrant and vehicle access guidelines* (Queensland Fire and Emergency Services, 2019b). This guideline defers to the *Road Planning and Design Manual – 2nd Edition* (Department of Transport and Main Roads, 2021). Unless otherwise noted within the SPP BOC, road design and construction should incorporate the following parameters:

- Minimum roadway clearance of 3.5 m wide by 4.8 m high to allow access for a fire truck.
- Be accessible in all weather conditions and able to accommodate a vehicle of 15 tonnes for the trafficable road width as specified in the *Road Planning and Design Manual – 2nd Edition*.
- Road grades must facilitate the safe passage of fire trucks.
- Roads must allow for fire trucks to turn at the end of dead-end roads.

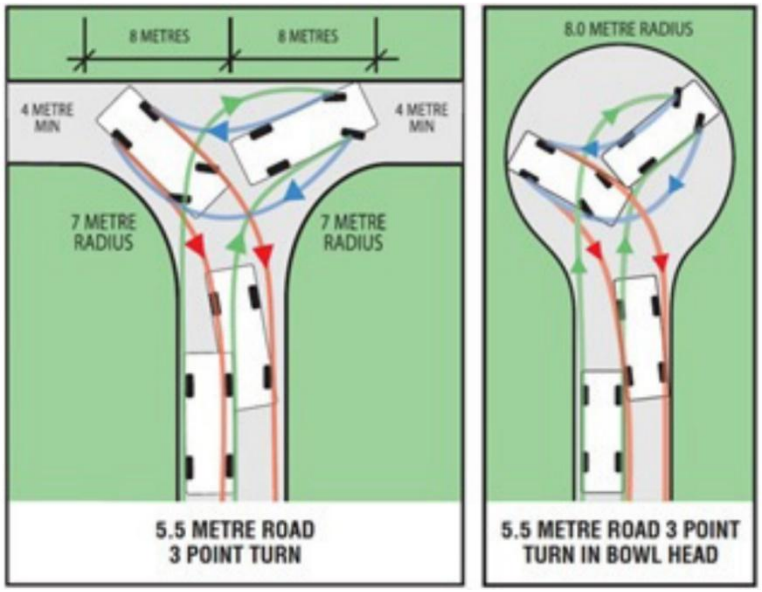


***Figure 5-1.*** **Vehicle Turning Points** (Queensland Fire and Emergency Services, 2019b).

For MCU type developments it is good practice for the development layout to have a minimum of two access/egress routes. For this requirement to be satisfied, the road network within neighbouring proposed developments would need to be in place. A temporary secondary access that will serve as an additional point of egress in emergency events will be installed within the northern section Precinct 101 and connect to the Arterial Road corridor (New Beith Road). This point of access will be for use in emergency events only and will not serve as a point of vehicular access under normal conditions. As the Master-planned development continues and a secondary point of egress is established within the development – heading west from Precinct 101 and 102 – this temporary access will be removed.

## 5.3 Fire-fighting Water Supply

The proposed development will be conditioned to provide connection to mains water supply, including for firefighting purposes. Provision will be made to connect to water mains supply, with suitable allocation of fire-fighting infrastructure (hydrants) in accordance with the local water retailer's specifications and the *Australian Standard – Fire hydrant installations system design, installation and commissioning* (AS 2419.1:2021).

## 5.4 Bushfire Landscaping Guidelines

Landscaping within established lots and areas mapped as low hazard vegetation (Figure 3-7) should utilise plant species that do not exacerbate the level of bushfire threat. It is recommended that landscaping design within the proposed development does not constitute a bushfire threat.

This may be achieved through aligning landscaping with Low Threat exclusion clauses defined in AS3959, S2.2.3.2. Examples include:

(i) Landscaping design within the low fuel zone being consistent with AS3959 S2.2.3.2(f) to ensure vegetation does not create vertically and horizontally continuous fuel structures that may contribute to bushfire intensity (Figure 5-2);

Where areas of bushland are to be included as part of landscaping design in the low fuel zone, ensure they are consistent with AS3959 S2.2.3.2, being less than 0.25 ha in area and not within 20 m of each other or proposed dwellings (Figure 5-3);

Utilise non-vegetated areas within the development consistent with AS3959 S2.2.3.2 (e) to provide enhanced separation between buildings and vegetation identified as a bushfire threat external to the site boundaries; and,

Utilise 'Fire-Wise' plant species that are resistant to the effects of fire (guidance can be found at http://www.cfa.vic.gov.au/plan-prepare/landscaping-for-bushfire).

*Figure 5-2. Low Threat vegetation (left) and Low Threat public open space (right).*

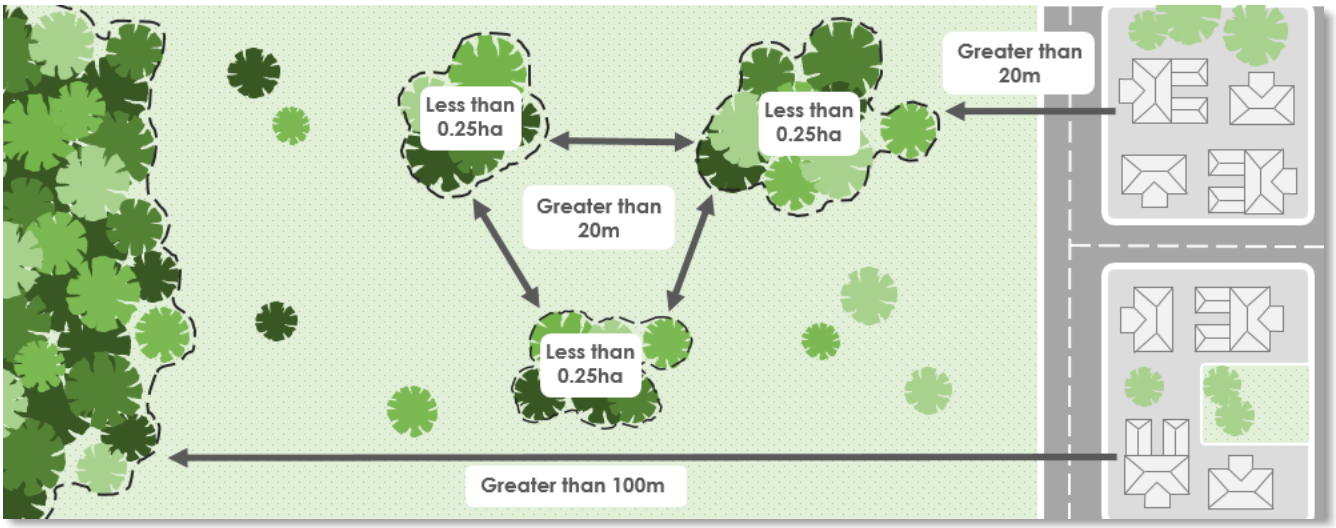


*Figure 5-3. AS3959 Exclusions—Low threat vegetation and non-vegetated areas.*

## 5.5 Bushfire ready open spaces

Suburb-scale developments should take into account how retained vegetation areas are interconnected and how they might influence potential bushfire behaviour and likely paths. As such, consideration should be given to the installation of fire management tracks network. These tracks can serve multiple purposes, including:

- Providing access for bushfire fighting operations;
- Serving as control lines from which to implement prescribed burns;
- Providing access for vegetation management and pest control;
- Serving as recreational trails network

Australia's landscape has evolved to be fire-adapted, and prescribed burns not only reduce bushfire risk to adjacent communities but also enhance ecosystem function and ecological value. Management tracks are key assets in facilitating bushfire fighting operations and implementing prescribed burns by emergency services and land managers (e.g., Rural Fire Service Queensland, Council environmental operations, QPWS parks).

It is recommended that a fire trails network be developed for the master-planned development's open space areas (Appendix A) in consultation with the relevant stakeholders. This would facilitate the application of appropriate fire regimes in suitable areas. Provision of a fire management trail network can also add recreational value for residents within the community, providing a form of access within natural areas and encourage a healthy connection of the community with the natural environment for which they reside.

Note that provision of such strategy for fire management within vegetation areas exists within SPP BOC Performance Outcome PO9 & PO10.

# 6 Summary of Recommendations

Section 5 above provides several recommended bushfire mitigation measures that should be implemented to help reduce the risk of the proposed development being impacted by bushfire to an acceptable level. These mitigation measures are summarised below.

- **Lot Layout –** the majority of lots have sufficient area to provide a setback distance from bushfire prone vegetation to allow building envelopes to be located to be subject to less than 29 kW/m$^2$ RHF (i.e., outside APZ).
    - Within Precinct 101; proposed Lots 11110, 1111, 11615, and 11638 are partially impacted by the RHF 29 kW/m$^2$ isoline at the lot frontage and/or side boundary. Future building envelopes must be positioned to ensure exposure remains below 29 kW/m$^2$, outside the Asset Protection Zone (APZ).
    - Within Precinct 102; Lots 12105, 12201–12212, 12267, and 12301–12304 are similarly impacted by the RHF 29 kW/m$^2$ isoline at the frontage and/or side boundary. As with Precinct 101, building envelopes on these lots must be located to maintain exposure below 29 kW/m$^2$.
    - All other lots are separated from bushfire prone vegetation by a distance that achieves a RHF ≤ 29 kW/m$^2$.
    - If vulnerable uses, storage of hazardous materials or community infrastructure is proposed, ensure that these are sited to achieve exposures of 10 kW/m$^2$ RHF or less.
- **Access** – Ensure suitable access for emergency vehicles for each created lot of the development, including allocation of turnaround area at the end of the proposed road. All roads should be designed and constructed in accordance with *Fire hydrant and vehicle access guidelines*. It is recommended to ensure there are two access/egress routes established and operational before residents are allowed to occupy or live in the area.
- **Fire-fighting Water Supply** – Ensure provision of water supply facilities to the development consisting of reticulated water mains supply with fire hydrants with capacity for fire-fighting purposes.
- **Landscaping** – Landscaping within established lots and areas mapped as low hazard vegetation (Figure 3-7) should utilise plant species that do not exacerbate bushfire threat and align with Low Threat exclusion clauses defined in AS3959, S2.2.3.2.
- **Management Access** – Undertake consultation with relevant stakeholders to consider a fire trail network within the conservation area around Precinct 101 and 102. This should consider fire trails network across the entire master-plan development's open areas, to enable suitable fire management strategies to be implemented in perpetuity. The implementation of a fire trail network may include retention of existing trails throughout the conservation area, and will aid emergency services in accessing the bushfire prone area.

# 7 Performance Criteria and Compliance

This BMP applies acceptable outcomes to achieve the Performance Outcomes as detailed in the example BOC of the SPP2017 *Natural Hazards, Risk and Resilience, State Planning Policy State Interest guidance material* (Queensland Government, 2019). The Performance Outcomes detailed in the SPP BOC are addressed in the development design are summarised in Table 7-1.

***Table 7-1. Satisfaction of State Planning Policy – 5.2 Example Bushfire Overlay Code***

| Performance Outcomes | Acceptable Outcomes | Development Compliance |
|---|---|---|
| **Section A Reconfiguring a lot (RaL) – where creating lots of more than 2,000 square metres** | | |
| **PO1**<br>The subdivision layout:<br>a. enables future buildings to be located away from slopes and landforms that expose people or property to an intolerable risk to life or property; and<br>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.<br><br>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**<br>A development footprint plan is identified for each lot that avoids ridgelines, saddles and crests where slopes exceed 15 per cent.<br><br>**AO1.2**<br>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:<br>a. a distance that is no closer than the distances specified in Table 5 at all development footprint plan boundaries; or<br>b. a distance that achieves a radiant heat flux level of 29 kW/m$^2$ or less at all development footprint plan boundaries.<br><br>Note – This separation area is often termed an asset protection zone.<br><br>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. | *Not creating any lots of more than 2000 square meters.* |
| **PO2**<br>The subdivision layout enables:<br>a. future buildings to be located as close as possible to property entrances to facilitate safe evacuation during a bushfire event; and<br>b. future site access to be located and designed to allow safe evacuation | **AO2**<br>A development footprint plan is identified for each lot that:<br>a. is located within 60 metres of the street frontage; and<br>b. sited to enable a route between the development footprint plan and the street frontage with a | *Not creating any lots of more than 2000 square meters* |

| | | |
|---|---|---|
| of the site by occupants and maintain access by emergency services under critical event conditions. | gradient that does not exceed of 12.5 per cent. | |
| **Section B Reconfiguring a lot (RaL) – where creating lots of 2,000 square metres or less** | | |
| **PO3**<br>The subdivision layout:<br>a. avoids creating lots on slopes and landforms that expose people or property to an intolerable risk to life or property; and<br>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.<br><br>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. | **AO3.1**<br>The subdivision layout results in lots that are sited so that they are separated from the closest edge to the adjacent mapped medium, high or very high potential bushfire intensity area by:<br>a. a distance that is no closer than the distances specified in Table 5 at all lot boundaries; or<br>b. a distance that achieves a radiant heat flux level of 29 kW/m$^2$ or less:<br>i. at the building envelope, if identified at RaL stage; or<br>ii. where a building envelope is not identified, at all lot boundaries.<br><br>Note – This separation area is often termed an asset protection zone.<br><br>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.<br><br>Note – For staged developments, temporary separation areas may be absorbed as part of subsequent stages.<br><br>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).<br><br>AO3.2<br><br>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). | **Satisfies Acceptable Outcomes**<br><br>It has been demonstrated within this BMP that all proposed residential lots have been designed so that it would allow sufficient setback distance for potential future dwelling to be exposed to less than 29 kW/m$^2$.<br>Although some of the proposed lots have been identified within the Radiant Heat Flux modelling to be impacted by a RHF of greater than 29kW/m$^2$ (refer to section 4.1 for details); the encroachment of RHF 29 kW/m2 into the lots identified in section 4.1, typically occurs on the boundary of lot frontage.<br>Provided that, future building envelopes on impacted lots (refer to section 4.1 for details) are able to be located in areas exposed to less than 29 kW/m2, the proposed development is deemed to achieves the outcomes of the SPP regarding setbacks from bushfire prone vegetation.<br><br>Proposed earthworks across the development footprint will ensure all proposed lots will be designed to have a relatively flat slope ( < 5 degree slope). |
| **Section C Reconfiguring a lot (RaL) – where creating more than 20 lots** | | |
| **PO4**<br>The subdivision layout is designed to minimise the length of the development | **AO4**<br><br>No acceptable outcome is prescribed. | Most of the proposed lots adjacent to an area of assessable bushfire |

| | | |
|---|---|---|
| perimeter and number of lots exposed to hazardous vegetation.<br><br>Note – For example, avoid finger-like subdivision patterns or substantive vegetated corridors between lots. | | hazardous vegetation within this assessment have been sited to ensure a suitable buffer is in place through the implementation of a road network (minimum 20m wide road reserve). This will allow all proposed residential lots or building envelopes to be at a setback distance where proposed dwellings are exposed to less than 29 kW/m$^2$. |
| **PO5**<br><br>The subdivision layout provides for adequate access and egress and safe evacuation routes, to achieve an acceptable or tolerable risk to people. | **AO5.1**<br>The subdivision layout:<br>a. avoids the creation of bottle-neck points in the movement network within the development (for example, avoids hourglass patterns); and<br>b. ensures the road network has sufficient capacity for the evacuating population.<br><br>**AO5.2**<br>The subdivision layout ensures evacuation routes:<br>a. direct occupants away from rather than towards or through areas with a greater potential bushfire intensity; and<br>b. minimise the length of route through bushfire prone areas. Refer Figure 5. | **<u>Satisfies Acceptable Outcomes dependent upon approval of adjoining stages</u>**<br><br>The proposed development assessed within this BMP provides a design layout that demonstrates suitable separation from bushfire hazards to proposed development lots, provides a suitable road network that will allow for access of emergency vehicles, and egress of residents away from approaching bushfire risks. The proposed road network has been designed to limit the amount of dead-ends (cul-de-sacs), and ensures sufficient roadway width to allow for two-way passing and access of larger emergency service vehicles.<br><br>The proposed development provides egress as to direct residents away from the assessed bushfire prone vegetation around the development, and provides egress direction towards developed areas, and not towards areas of continuous bushfire prone vegetation. |

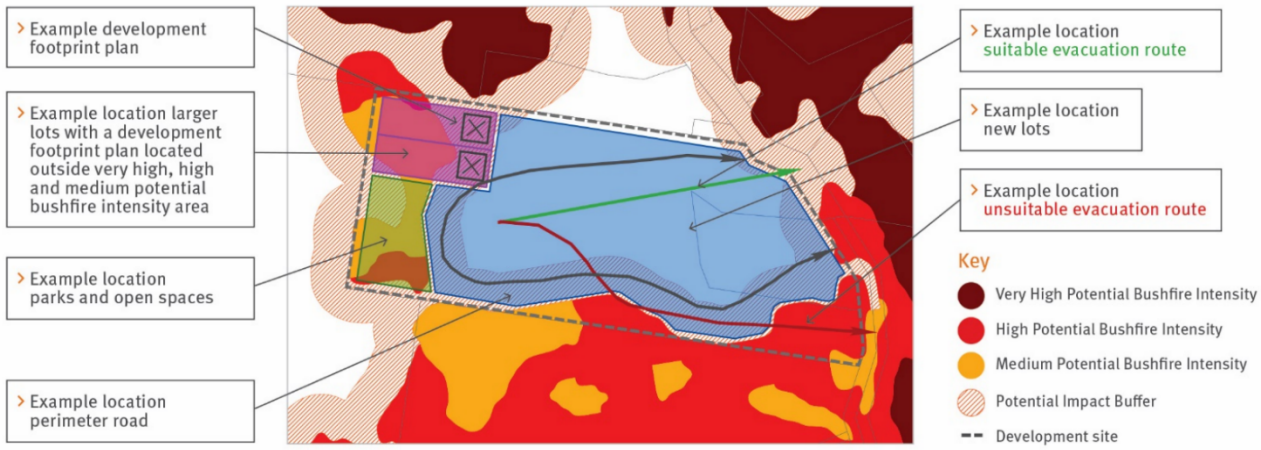


*Figure 5 – Subdivision layout and evacuation routes*

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| **PO6**<br>The subdivision layout provides adequate buffers between hazardous vegetation and development.<br><br>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. | **AO6.1**<br>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.<br><br>**AO6.2**<br>The asset protection zone is comprised of:<br>a. parks and open spaces; and/or<br>b. lots greater than 2000 square metres; and/or<br>c. public roads (termed perimeter roads).<br><br>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 balance of the bushfire prone area.<br><br>Note – Portions of lots greater than 2000 square metres may be located within the mapped medium, high and very high potential bushfire intensity areas.<br>Refer Figure 5.<br><br>**AO6.3**<br>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. | **Satisfies Acceptable Outcomes**<br><br>Provided that future building envelopes on impacted lots (see Section 4.1 for details) are situated in areas with exposure below 29 kW/m², the proposed development is considered to meet the SPP outcomes concerning setbacks from bushfire-prone vegetation<br><br>Most proposed lots adjacent to an area of assessable bushfire hazardous vegetation within this assessment have been sited as to ensure a suitable buffer is in place through the implementation of a road network (minimum 20m wide road reserve). |
| **PO7**<br>Parks or open space provided as part of the asset protection zone do not create additional bushfire prone areas.<br><br>Note –The undertaking of a bushfire hazard assessment, in accordance with the | **AO7**<br>Where the asset protection zone includes parks or open spaces, they:<br>a. comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public | **Satisfies Acceptable Outcomes**<br><br>Areas of parks and open space within the development of precinct 101 and 102 where people will congregate are designed to achieve landscape outcomes that comprise |

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| methodology in the QFES Bushfire resilient communities document may assist in demonstrating compliance with this performance outcome. | reserves and parklands, cultivated gardens and nature strips; or<br>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.<br><br>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. | low threat vegetation and will undergo regular maintenance such as mowing and slashing to maintain low fuel loads (refer to section 5.4 for guideline).<br><br>Other open space areas within the development that are designated for stormwater detention and drainage basins are not intended to attract public use, nonetheless, are intended to reduce bushfire risk through landscaping design that will minimise vertical fuel connectivity. |
| **PO8**<br><br>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**<br>Where the asset protection zone includes a perimeter road it:<br>a. has a two-lane sealed carriageway clear of hazardous vegetation; and<br>b. is connected to the wider public road network at both ends and at intervals of no more than 200 metres; and<br>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).<br><br>**AO8.2**<br>Where the subdivision contains a reticulated water supply, the road network and fire hydrants are designed and installed in accordance with:<br>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<br>b. the *Road Planning and Design Manual 2nd edition*, Department of Transport and Main Roads, 2013. | **Satisfied Satisfies Acceptable Outcomes**<br><br>A perimeter road is to be established around the outer edge of most proposed lots adjacent to bushfire prone vegetation (minimum 20m wide road reserve). This perimeter road will be connected to the wider public road network.<br><br>The proposed road network has been designed to limit the number of dead-ends (cul-de-sacs), and ensures sufficient roadway width to allow for two-way passing and access of larger emergency service vehicles. A secondary point of access will be established to temporarily operate as an additional point of egress in emergency events, located in the northern section of Precinct 101 connecting to New Beith Road. This secondary point of egress will be operational for emergency events only, until such time that a permanent secondary point of egress is established with the continuation of the master-planned development.<br><br>The proposed development will be conditioned to provide connection to mains water supply, with provision of a piped water network capable of supplying sufficient flow and pressure for fire-fighting purposes. Provision will be made to connection to water mains supply, with suitable allocation of fire-fighting infrastructure (hydrants) in accordance with the local water |

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| | | retailer's specifications and the Australian Standard – Fire hydrant installations system design, installation and commissioning (AS 2419.1:2021).<br><br>All requirements of the water supply shall be in accordance with the SEQ water supply code, and relevant water authority. Provision of fire hydrants throughout the proposed development shall also be in accordance with the SEQ water supply code and water authority, to ensure all proposed lots are within suitable reach of a fire hydrant installation. |
| **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**<br><br>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**<br>The subdivision layout includes:<br>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<br>b. a perimeter road designed and constructed in accordance with AO8.1.<br><br>Refer Figure 6. | *Not Applicable to this development*<br><br>The development will provide connection to mains water supply, though it has been recommended to consider the development of a fire trail network within the master-planned development in consultation with the relevant bushfire authority or land management authority. |

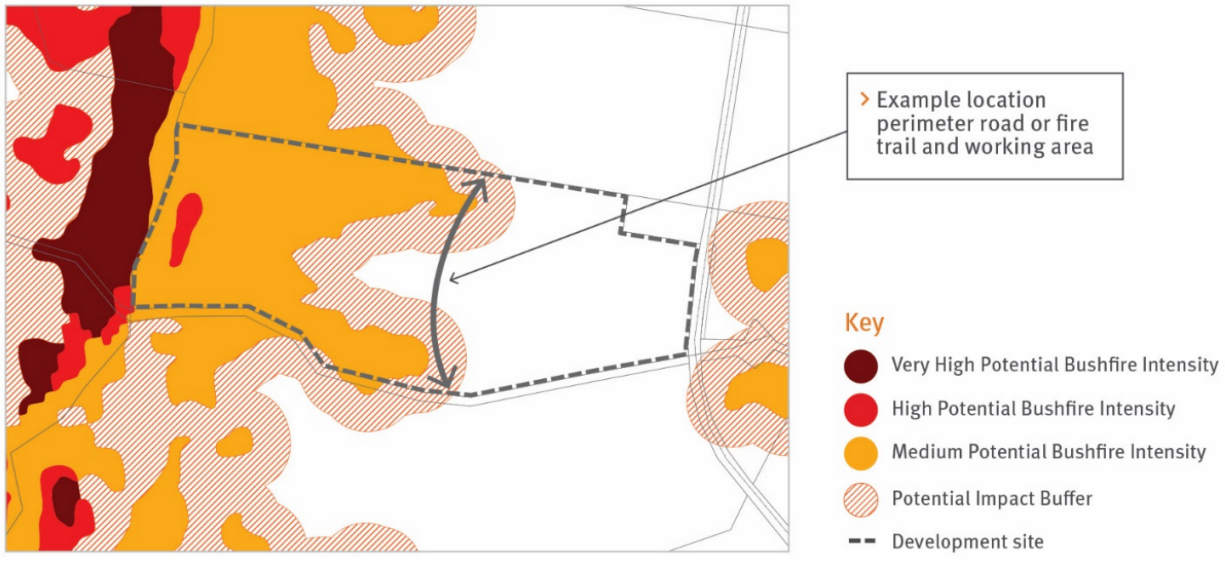


*Figure 6 – Siting of fire trail and working area*

| Section E Material change of use | | |
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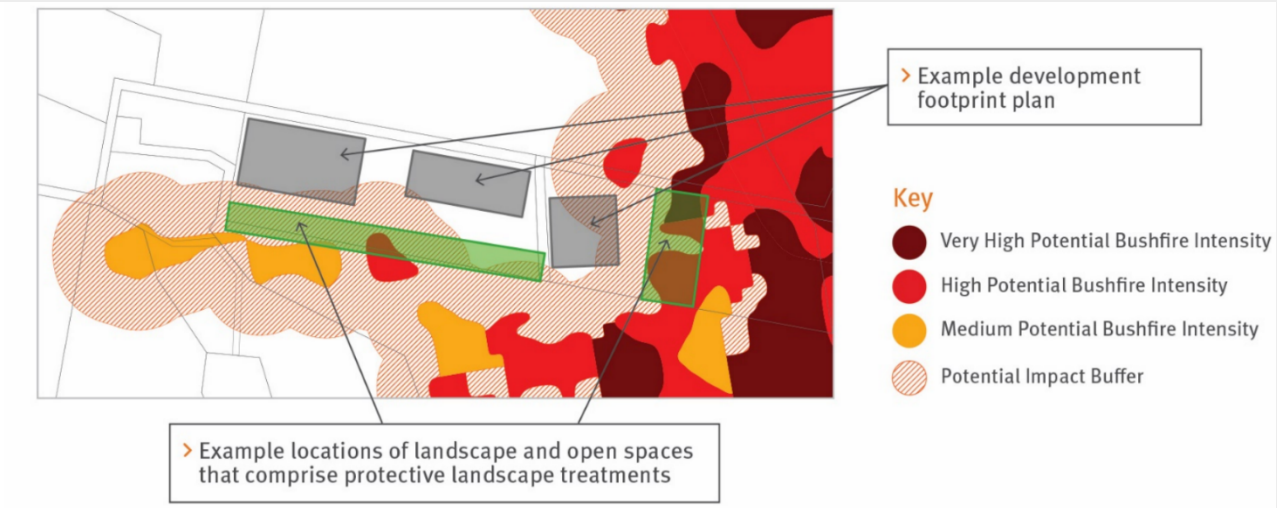
| **PO10**<br>Site layout achieve an acceptable or tolerable risk to people. Landscape or open space provided as part of the development:<br>a. acts as a buffer between hazardous vegetation and development; and<br>b. does not create additional bushfire prone areas.<br><br>Note – An applicant may seek 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**<br>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.<br><br>**AO10.2**<br>This landscaping and open space comprises protective landscape treatments that:<br>a. comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses and cultivated gardens; or<br>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.<br><br>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 to this development*<br><br>Development is for a Reconfiguration of a Lot (RaL), not a Material Change of Use (MCU). Performance Outcomes for this RaL development have been assessed above. |
|  <br>***Figure 7 – Siting of protective landscape treatments*** | | |
| **PO11**<br>The development establishes evacuation areas, to achieve an acceptable or tolerable risk to people. | **AO11**<br>If in an isolated location, development establishes direct access to a safe assembly/evacuation area.<br><br>Note – Guidance on identifying safe evacuation areas is contained in the QFES Bushfire resilient communities document. | *Not Applicable to this development*<br><br>Development is for a Reconfiguration of a Lot (RaL), not a Material Change of Use (MCU). Performance Outcomes for this RaL development have been assessed above |

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| **PO12**<br>If on a lot of over 2000m$^2$, where involving a new premises or an existing premises with an increase in development footprint, development:<br>a. locates occupied areas as close as possible to property entrances to facilitate safe evacuation during a bushfire event; and<br>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. | **AO12**<br>No acceptable outcome is prescribed. | *Not Applicable to this development*<br>Development is for a Reconfiguration of a Lot (RaL), not a Material Change of Use (MCU). Performance Outcomes for this RaL development have been assessed above |
| **PO13**<br>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.<br><br>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**<br>No acceptable outcome is prescribed. | *Not Applicable to this development*<br>Development is for a Reconfiguration of a Lot (RaL), not a Material Change of Use (MCU). Performance Outcomes for this RaL development have been assessed above |
| **PO14**<br>Vulnerable uses listed in Table 7 are not established or intensified within a bushfire prone area unless:<br>a. there is an overriding need in the public interest for the new or expanded service the development provides; and<br>b. there are no other suitable alternative locations within the required catchment; and<br>c. site planning can appropriately mitigate the risk (for example, siting ovals for an educational establishment between the hazardous vegetation and structures.<br><br>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**<br>No acceptable outcome is prescribed | *Not Applicable to this development*<br>Development is for a Reconfiguration of a Lot (RaL), not a Material Change of Use (MCU). Performance Outcomes for this RaL development have been assessed above |

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| **PO15**<br>Community infrastructure providing essential services listed in Table 7 are not established within a bushfire prone area unless:<br>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<br>b. the infrastructure can function effectively during and immediately after a bushfire event.<br><br>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. | **AO15**<br>No acceptable outcome is prescribed. | *Not Applicable to this development*<br><br>Development is for a Reconfiguration of a Lot (RaL), not a Material Change of Use (MCU). Performance Outcomes for this RaL development have been assessed above |
| **PO16**<br>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.<br><br>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**<br>No acceptable outcome is prescribed. | *Not Applicable to this development*<br><br>Development is for a Reconfiguration of a Lot (RaL), not a Material Change of Use (MCU). Performance Outcomes for this RaL development have been assessed above |
| **Section F Where involving an asset protection zone** | | |

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| **PO17**<br>Asset protection zones are designed and managed to ensure they do not increase the potential for bushfire hazard.<br><br>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. | **AO17.1**<br>Landscaping treatments within any asset protection zone comprise only low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parklands, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and windbreaks.<br><br>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<br><br>**AO17.2**<br>Landscaping management within any asset protection zone maintains a:<br>a. potential available fuel load which is less than eight tonnes/hectare in aggregate; and<br>b. fuel structure which is discontinuous.<br><br>*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.* | **Satisfies Acceptable Outcomes**<br><br>Asset Protection Zones (APZs) apply to areas observed as the separation distance required between the bushfire prone vegetation and the determined RHF29kW/m2 line. The development layout allows for a perimeter road between most of the proposed residential lots and the bushfire prone area. These APZs consist of managed landscaped areas, including parks and open space, as well as road reserves of the perimeter roads – both of which will have discontinuous and/or managed fuel loads (below 8 t/ha). |
| **Section G Where planning provisions or conditions of approval require revegetation or rehabilitation** | | |
| **PO18**<br>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.<br><br>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**<br>Required revegetation or rehabilitation:<br>a. is located outside of any asset protection zone; or<br>b. maintains a potential available fuel load which is less than eight tonnes/hectare in aggregate and fuel structure which is discontinuous.<br><br>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).<br><br>AO18.2<br>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 | **Satisfies Acceptable Outcomes**<br><br>The only areas planned to be revegetated are parks/opens space areas and detention basins.<br><br>Areas of parks and open space within the development follow Bushfire Landscaping Guidelines (section 5.4) and will undergo regular maintenance such as mowing and slashing to maintain low fuel loads.<br><br>Other open space areas within the development that are designated for stormwater detention were conservatively classified as bushfire prone vegetation and setbacks |

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| | load. OR Revegetation or rehabilitation of areas located within the mapped potential impact buffer area, revegetate and rehabilitate in a manner that maintains or reduces the existing fuel load.<br><br>*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.* | shown in Figure 4-1 incorporate setbacks from detention basins. Further, Covey provided plant palette recommendations to the Landscape Consultants intended to reduce bushfire risk through arrangement of fuel using landscape design. |

# 8 Conclusion

The SPP Bushfire Prone Area mapping indicates that the proposed development is mapped as High Potential Bushfire Intensity and Medium Bushfire Intensity and some associated Impact Buffer. Based on assessment from the nearest Automated Weather Station, typical bushfire weather begins in August and extents through to January; driven by high temperatures, extended dry periods from low rainfall, and westerly winds dropping the relative humidity. The mapped and confirmed vegetation on site that is to be retained is classified as VHC 10.1 Spotted gum dominated open forests.

This BMP has undertaken a potential radiant heat flux analysis per Method 2 of AS 3959. The bushfire design scenario incorporated site-specific fuel loads (based on VHC) and FFDI 56 to satisfy the State Planning Policy. The development has been designed to mitigate potential bushfire impacts in accordance with all applicable policy and planning requirements. This BMP focuses solely on bushfire related risk and mitigation strategies.

This BMP report demonstrates that most of the created lots from the development will have sufficient setback to the bushfire hazardous vegetation present on site and adjacent to the site. Where the proposed lots will not have sufficient setback, it is proposed that these lots should be designed to allow for building envelopes to be exposed to less than 29 kW/m$^2$ RHF. This will ensure all future dwellings within the proposed lots can be designed to achieve BAL-29, per the requirements of the SPP BOC.

Provided that the bushfire mitigation measures detailed in Section 5 of this report and the provisions in the assessment against the Bushfire Overlay Code Assessment Table (Section 7) are adopted, the bushfire risk to the proposed development is considered acceptable per applicable policy and planning requirements. The proposed mitigation measures in this BMP do not require clearing of vegetation outside of the proposed development boundary for Precincts 101 and 102. Areas noted as needing management and maintenance in perpetuity are to be done so by the asset owner (e.g., management of the asset during typical-maintenance monitoring period by the contractor, management of the asset after approved maintenance monitoring period by the asset owner, i.e., council).

This NHRA focused on radiant heat flux risk level, and related bushfire hazards, and further investigations might be required to support a development application, e.g. Engineering Services Report, Ecological Assessments, etc.

# 9 References

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# APPENDIX A

## Development Layout Plan

# ROL 4: RECONFIGURATION OF A LOT PLAN


PROJECTION - GDA2020 MGA56
SUBJECT BOUNDARIES SP351245 PROVIDED BY VERIS
DRAWING REFERENCE "402971 ROL4 LOT CALC REVISION C"
DATED 13/03/2025

BULK EARTHWORKS INFORMATION PROVIDED BY COLLIERS
DRAWING REFERENCE "24-0750_X_BASE_DESIGN"
DATED 20/03/2025

saunders havill group

mirvac

## LEGEND

- Site Boundary
- ROL 4 Boundary
- Sub-precinct Boundary
- Proposed Easement
- Design Contour (1.0m Interval) - Colliers 19/03/2025
- Conservation Area
- Indicative Bin Pad location
- Indicative PMT / RMU Site

THIS RAL & POD PACKAGE WAS PREPARED AS A CONCEPTUAL LAYOUT ONLY. THE INFORMATION HEREON IS NOT SUITABLE FOR ANY OTHER PURPOSE.

Net residential density means the total number of dwellings divided by the combined area of residential lots, Neighbourhood Recreation Parks, internal local roads and half the width of local roads bordering the site.
Average net residential density means net residential density calculated for a whole neighbourhood.

RP DESCRIPTION: Lots 1-3 on SP351245

SCALE @A1 1:2000 @A3 1:4000 - LENGTHS ARE IN METRES
20 0 20 40 60 80 100 120 140 160 180 200 220

NOT TO BE USED FOR ENGINEERING DESIGN OR CONSTRUCTION

## NOTES

This plan was prepared as a conceptual layout only. The information on this plan is not suitable for any other purpose.

Property dimensions, areas, numbers of lots and contours and other physical features shown have been compiled from existing information and may not have been verified by field survey. These may need verification if the development application is approved and development proceeds, and may change when a full survey is undertaken or in order to comply with development approval conditions.

No reliance should be placed on the information on this plan for detailed subdivision design or for any financial dealings involving the land.

Pavements and centrelines shown are indicative only and are subject to Engineering Design.

Saunders Havill Group therefore disclaims any liability for any loss or damage whatsoever or howsoever incurred, arising from any party using or relying upon this plan for any purpose other than as a document prepared for the sole purpose of accompanying a development application and which may be subject to alteration beyond the control of the Saunders Havill Group. Unless a development approval states otherwise, this is not an approved plan.



| DEVELOPMENT STATISTICS | | | | | |
|---|---|---|---|---|---|
| **RESIDENTIAL ALLOTMENTS** | | **Typical Width** | **No. Lots** | **%** | **Net Area** |
| **25m Deep Lots** | | | | | |
| Villa | V25 | 11.2m | 1 | 0.2% | 0.059 ha |
| Courtyard | C25 | 14m | 2 | 0.3% | 0.089 ha |
| Premium Courtyard | PC25 | 16m | 1 | 0.2% | 0.039 ha |
| **Sub Total** | | | **4** | **0.7%** | **0.187 ha** |
| **RESIDENTIAL ALLOTMENTS** | | **Typical Width** | **No. Lots** | **%** | **Net Area** |
| **28m Deep Lots** | | | | | |
| Terrace - Front Loaded | T28 | 7.5m | 7 | 1.2% | 0.191 ha |
| Villa | V28 | 11.2m | 4 | 0.7% | 0.126 ha |
| Premium Villa | PV28 | 12.5m | 17 | 3.0% | 0.636 ha |
| Courtyard | C28 | 14m | 32 | 5.6% | 1.396 ha |
| Premium Courtyard | PC28 | 16m | 14 | 2.4% | 0.719 ha |
| Traditional | TD28 | 18m | 4 | 0.7% | 0.266 ha |
| Premium Traditional | PT28 | 20m | 1 | 0.2% | 0.065 ha |
| **Sub Total** | | | **79** | **13.7%** | **3.399 ha** |
| **RESIDENTIAL ALLOTMENTS** | | **Typical Width** | **No. Lots** | **%** | **Net Area** |
| **30m Deep Lots** | | | | | |
| Villa | V30 | 11.2m | 48 | 8.3% | 1.651 ha |
| Premium Villa | PV30 | 12.5m | 136 | 23.7% | 5.431 ha |
| Courtyard | C30 | 14m | 115 | 20.0% | 5.140 ha |
| Premium Courtyard | PC30 | 16m | 50 | 8.7% | 2.548 ha |
| Traditional | TD30 | 18m | 11 | 1.9% | 0.684 ha |
| Premium Traditional | PT30 | 20m | 5 | 0.9% | 0.343 ha |
| **Sub Total** | | | **365** | **63.5%** | **15.797 ha** |
| **RESIDENTIAL ALLOTMENTS** | | **Typical Width** | **No. Lots** | **%** | **Net Area** |
| **32m Deep Lots** | | | | | |
| Villa | V32 | 11.2m | 9 | 1.6% | 0.333 ha |
| Premium Villa | PV32 | 12.5m | 57 | 9.9% | 2.484 ha |
| Courtyard | C32 | 14m | 41 | 7.1% | 2.008 ha |
| Premium Courtyard | PC32 | 16m | 14 | 2.4% | 0.863 ha |
| Traditional | TD32 | 18m | 4 | 0.7% | 0.295 ha |
| Premium Traditional | PT32 | 20m | 2 | 0.3% | 0.169 ha |
| **Sub Total** | | | **127** | **22.1%** | **6.152 ha** |
| | | | | | |
| **Total Allotments** | | | **575** | **100%** | **25.535 ha** |

| | | | |
|---|---|---|---|
| **Land Budget** | **Area (Ha)** | **%** | |
| **Area of Subject Site / Stage** | **48.211 ha** | **—** | |
| Net Residential Allotments | **25.535 ha** | 53.0% | |
| Linear Park / Pedestrian Linkage | 6.762 ha | 14.0% | |
| Neighbourhood Recreation Park | 1.026 ha | 2.1% | |
| Local Road Areas | 10.983 ha | 22.8% | |
| Major Road Areas | 2.967 ha | 6.2% | |
| Balance Lot 12196 | 0.085 ha | 0.2% | |
| Balance Lot 12197 | 0.853 ha | 1.8% | |
| **Total Area** | **48.211 ha** | **100%** | |
| | | | |
| **Average Lot Size (m²)** | **444.1 m²** | | |
| **Net Density (dw/ha)** | **15.3 dw/ha** | | |

# APPENDIX B

## Photos of Site Vegetation

## *POI1*

## *POI2*

## *POI3*

## *POI4*

## *POI5*

## *POI6*

## *POI7*

## *POI8*

# *POI9*

# APPENDIX C

## Inferno-BAL methodology

Inferno-BAL is a module of the Inferno geospatial system designed by Covey Associates, to calculate radiant heat flux and Bushfire Attack Level (BAL) from Method 2 in AS 3959. Rather than calculating radiant heat flux at a single point, Inferno-BAL assesses heat flux at each point within a given area. This allows contours of radiant heat flux to be determined, as well as the maximum potential radiant heat flux and subsequent BAL level over plots and structures. The system is designed to work over very large areas (10s of kilometres) at high spatial resolution (metre scale). All intensive computations utilise graphics processing units (GPUs) where possible allowing the rapid calculation of radiant heat flux over these large spatial scales. The system also utilises a server-driven approach where calculations can be queued until resources are available, then data delivered on request.

The heat flux calculations require the following to determine flame length:

- the vegetation characteristics, i.e., fuel type and fuel load;
- the distance to the vegetation patch;
- the site slope between the calculation point and the vegetation patch; and
- the effective slope under the vegetation influencing the fire behaviour.

To obtain the above information, Inferno-BAL requires the following inputs:

- a digital elevation map, giving the vertical height above a given datum, and
- a geo-located vector data set consisting of flammable vegetation polygons.
  Each vegetation polygon, or patch, must encode total and surface fuel loads, and fuel type (Forest, Woodlands, Shrublands, Scrub, Mallee, Rainforest, Moorlands or, Grassland – per AS 3959). This can be encoded as a field within the polygon data, or the values can be populated using a code from an auxiliary table.

If required, an additional vector data set representing building envelopes can be included in the model to obtain the aggregate maximum radiant heat flux over spatially specified polygons.

**Pre-Processing**

Given that (1) radiant heat flux calculations are computationally intensive and (2) Inferno-BAL was designed to be able to calculate radiant heat flux over entire Local Government Areas, each combination of fuel load and fuel type is categorised and the RHF calculations are run only on nearest vegetation type/load combination. Specifically, the software undertakes the following pre-processing actions:

1. Verify the input layers;
2. Rate-of-spread model and fuel load values are populated for each vegetation patch;
   Any patches with an un-burnable fuel type are removed (e.g., VHC 43.6 waterbodies);
3. All combination of fuel type and fuel load are categorised, and each combination assigned an ID; and
4. For each unique ID, the polygon nearest to the calculation point is used in radiant heat flux calculations.

An example of this categorisation is shown in Figure A. The four vegetation patches depicted are classified as ID 1 (Grass fuel type of 1 t/ha fuel load), ID 2 (Grass fuel type of 0.5 t/ha fuel load, and ID 3 (Forest fuel type of 10 t/ha). The radiant heat flux calculation is performed three times, one for each of the nearest ID patches. In this case, the grass patch of ID 1 located at a greater distance from the calculation point (shown with a dashed line) is not included in the radiant heat flux model.

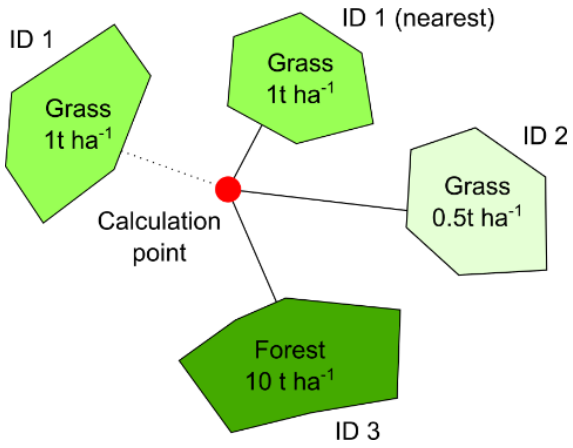


**Figure A – Pre-processing of vegetation.**

*Note that this methodology may, in very marginal cases, result in a potential underestimation of radiant heat flux. This would only occur if ID patches at further distances were located on very steep terrain. This shortcoming will be addressed in future revisions of the system.*

### Distance Calculation

The distance is determined by searching for the point on the nearest edge over all polygons surrounding the calculation point. Once this nearest point is found the direction and distance to the patch can be found from the vector connecting the calculation point to the point on the edge (as shown by the arrow in Figure B).

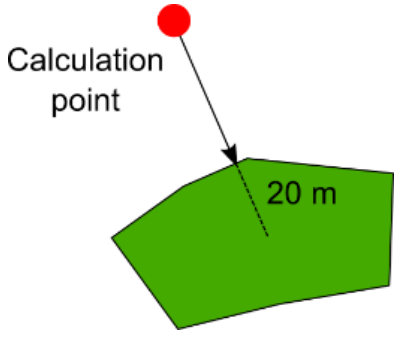


**Figure B - Path to assess effective slope.**

### Site Slope Calculation

The site slope is calculated using the arctangent of the difference in elevation over the vector divided by the length of the vector. The site slope is clamped from -20 to 20 degrees, as in the AS 3959 Method 2 standard.

### Effective Slope Calculation

The effective slope is determined by extending a path 20 m into the vegetation patch (as shown by the dashed line in Figure B) and calculating the slope over this path, per the method used in site slope calculations. The effective slope is clamped from -15 to 30 degrees, as in AS 3959 Method 2.

**Radiant Heat Flux calculation**

The encoded vegetation characteristics from the vegetation vector layer are then used to determine which of the eight AS 3959 rate-of-spread models to adopt. From each of these a model for flame length is used (which may depend on an intermediate fire intensity empirical model for some fuel types, as in AS 3959 Eqns. B3, B4 and B5). The flame length is then used in the AS 3959 iterative process to determine the flame angle giving the view factor, and hence maximum radiant heat flux, at the calculation point. This step involves some significant assumptions as outlined in AS 3959, including the application of an empirical model for the atmospheric transmissivity (Eq. B9) and use of formula for view factor assuming a rectangular flame with a fixed width (Eq. B8 of AS 3959).

This process is repeated for each of the vegetation IDs and the maximum value over all these calculations is used as the final value of the radiant heat flux. The final steps in the process are to find the maximum radiant heat flux in each polygon plot, if supplied, and to categorise these into the BAL levels and to generate the vector isolines of the radiant heat flux.

# APPENDIX D

## Inferno-BAL results – BAL Impact to Lots

# Potential Bushfire Attack Level (BAL) rating based on RHF results