Unit 1
51 Owen Street
Huskisson NSW 2540
t: (02) 4201 2264

15 May 2020

Our ref: 20HNG_15781

C/- Sahand Farooji
Sekisui House Australia Pty Limited
PO Box 827
North Ryde BC 1670
Attention: SH Camden Valley Lakeside Pty Ltd

Dear Sahand,

**RE: Addendum Bushfire Protection Assessment — Proposed Subdivision, Gledswood Lakeside Precinct 1 (Stage 41)**

Precinct 1 (subject to this report) will involve the creation of 20 lots, construction of 3 residential flat buildings, 17 dwellings, associated roads and infrastructure (**Figure 1**). The proposed development is part of a larger master planned subdivision within the Camden Lakeside Golf Course that will encompass residential housing, dedicated areas of environmental conservation, and recreational facilities (i.e. a golf course).

Purpose of this letter is to provide an addendum to the original report (ELA reference 18HNG_10522 v10) in conjunction with addressing the request for further information (dated 24 March 2020, reference DA20200128000343-S4.55-1) from RFS. To address the concern raised by RFS with regards to modelling the south-west corner of the proposed development, this addendum uses the Short Fire Run (SFR) to determine the required Asset Protection Zone (APZ) and Bushfire Attack Levels (BAL).

In consultation with the RFS (Adam Small), a number of site inputs were agreed to for use in the updated modelling (SFR) and that documenting this in a letter format rather than a full Bushfire Design Brief (BDB) was acceptable.

The following documents the SFR process, results and recommendations for APZ and BAL dimensions based on the calculated results.

# 1. Short Fire Run (SFR) Assessment

## 1.1 Introduction

The expected bushfire attack is reduced by site factors below that of the standard design fire underpinning acceptable solutions in Planning for Bush Fire Protection (PBP) and Australian Standard (AS) 3959. Specifically, the length of fire run and fire width in a bushfire attack is restricted by the juxtaposition of the proposed development with the adjoining remnant bushland and golf course.

## 1.2 Methodology

The Eco Logical Australia (ELA) SFR model design is based on the published RFS methodology '*Short Fire Run: methodology for assessing bush fire risk for low risk vegetation*' *(*RFS 2019b*)*. The full ELA methodology is detailed in **Appendix A** and summarised below:

- The growth of a fire is determined using a point ignition from a given location maximising the fire run (travel distance) with the developing fire shape in the form of an ellipse;
- The Length / Breadth (L/B) ratio of the ellipse at its widest point is used to quantify the head fire width (in metres);
- The flame height is calculated using a Project Vesta formula using the elevated fuel height as determined by research from Dr Belinda Kelly (RFS 2017);
- The predicted head fire width and flame height is then used as inputs to the Method 2 of AS 3959-2018 using the Newcastle Bushfire Attack Assessor model to determine the modified view factor and radiant heat flux output of the design fires;
- The approach to determine the radiant heat flux exposure and corresponding Bushfire Attack Level (BAL), known as Method 2, is described in *Appendix B Detailed method for determining the Bushfire Attack Level (BAL) – Method 2* in AS 3959-2018 (Standards Australia 2018);
- Site specific inputs and bushfire modelling calculations were undertaken using the approved software tool *Newcastle Bushfire Attack Assessor v2.1*;
- The flame width equates to the horizontal dimension whilst the flame height is the vertical dimension of the modified view factor; and
- The fuel load is modified until the flame length equals the SFR determined flame height to produce the modified view factor which is then used to calculate the radiant heat flux exposure.

## 1.3 Site inputs

Specific inputs used to evaluate the design fire is listed below and detailed in **Table 1**:

- Detailed slope analysis using 2 m contours confirmed with an onsite inspection (30 April 2020);
- Surface and Overall fuel load values for the Keith formation (2004) Coastal Valley Grassy Woodland;
  - Vegetation classification identified from previous ecological studies undertaken on the site by ELA, verified from site inspection 30 April 2020 and agreed to by RFS. Refer photographs in **Appendix 3**.
- RFS provided data regarding fuel loads and elevated fuel height for Coastal Valley Grassy Woodland based as listed in RFS SFR methodology (RFS 2019b); and
- Modified view factor (flame width = horizontal, flame height = vertical) of potential fire run determined by the SFR methodology;
  - The 118 m fire run length has been measured from Geotechnical Information Systems (GIS) as shown in **Figure 1** and was agreed to by Adam Small of RFS.

**Table 1: Summary of site-specific inputs for design fires**

| Design Fire # | Site slope | Effective Slope | Vegetation | Surface fuel load (t/ha) | Overall fuel load (t/ha) | Elevated fuel height max. (m) | Length of fire run (m) | Flame width (m) | Flame Height (m) |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 0° Level | 3° downslope | Coastal Valley Grassy Woodland | 10 | 18.07 | 0.9 Low | 118 | 41.8 | 6.71 |

## 1.4 Results and Discussion

**Appendix 4** contains the calculations for both SFR and Method 2 bushfire attack assessor modelling. A summary of the SFR results are shown in **Table 2** with the BAL results shown in **Figure 2**. A maximum BAL-29 is achievable with a minimum 8 m APZ.

**Table 2: Summary of Short Fire Run Model results**

| Design Fire # | Separation Distance (m) | Radiant Heat (kW/m²) | Level of Construction |
|---|---|---|---|
| T1: BAL-29 | ≥8 | 27.6 | BAL-29 |
| T1: BAL-19 | ≥12 | 17.41 | BAL-19 |
| T1: BAL-12.5 | ≥16 | 12.15 | BAL-12.5 |

**Table 3: Summary of Bushfire Attack Level (BAL)**

| Lot | BAL (PBP) |
|---|---|
| Lots 1-4, Lots 12-17<br>Lot 66, Lots 68 – 69 and Lots 71 – 73 | BAL-12.5 to entire roof and all elevations. |
| Lot 5 | BAL-19 to entire roof, southern & western elevations.<br>BAL-12.5 to northern and eastern elevations. |
| Lot 6 | BAL-19 to entire roof, southern, eastern and western elevations.<br>BAL-12.5 to the northern elevation. |
| Lot 7 | BAL-19 to entire roof and southern elevation.<br>B AL-12.5 to the northern, eastern and western elevations. |
| Lot 8 – 11 | BAL-19 to entire roof, northern, southern and western elevation.<br>BAL-12.5 to the eastern elevation. |

Based on the SFR model outputs in **Table 2**, the proposed development can accommodate the minimum 8 m APZ as shown in **Figure 1** and all proposed dwellings achieve a maximum of BAL-29 as shown in **Figure 2**. This achieves the required 29 kW/m$^2$ radiant heat flux threshold for residential development.

BAL mapping using the modelled results as per **Table 3** and **Figure 2** demonstrates the applicable BAL rating to each lot and proposed dwelling.

## 1.5 Conclusion and recommendations

It is recommended that the subdivision be issued a Bush Fire Safety Authority and the proposed buildings be approved with a BAL rating as per **Table 3** and **Figure 2**.

Regards,

Natalie South
Bushfire Consultant

Bruce Horkings
Senior Bushfire Consultant
FPAA BPAD Accredited Practitioner No. BPAD29962-L3

BPAD
Bushfire
Planning & Design
Accredited Practitioner
Level 3

## 2. References & Background Information


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# Appendix 1 – Detailed Short Fire Run Methodology

## 1.1 Design fire

In selecting a 'design fire' for a short run fire, consideration has been given to inputs that are available through research or best practice, included widely accepted bushfire behaviour models.

However, quantifying potential bushfire behaviour and Bushfire Attack Levels outside specifically researched situations is difficult. Most rate of spread fire models also have limitations including fuel complex assumptions (continuous, uniform and homogeneous), fuel bed composition (single later and contiguous to the ground), fire spread by spotting and whirlwinds (vertical and horizontal) not accounted for as well as inherent errors in the modelling based on the following three characteristics (Alexander & Cruz, 2013):

- Model not applicable to situation it is being used in i.e. assumptions made in creating model do not apply to the situation applied;
- Inherent accuracy within the model i.e. under/over estimation where perhaps variables such as wind or slope is too high/low; and
- Inaccurate data within the model.

Notwithstanding the above-mentioned qualifiers, the following outlines the methodology used to quantify 'Short Fire Run' (SFR) design fires.

## 1.2 Methodology

The alternative solution methodology involves the quantification of variables such as the Rate of Spread, Length/Breadth ratio to determine flame width and Project Vesta formula to calculate flame length. These values once determined are then used within the Newcastle Bushfire Consulting Bushfire Attack Assessment Model Version 2.1 to predict Radiant Heat Flux (RHF).

The following describes (and in some cases comments on) the formula/approach used.

### 1.2.1 Distance of Fire Run

The potential fire run distance ($D_{slope}$) for each design fire has been determined using *Equation 1*:

$$D_{slope} = \sqrt{Dh^2 + Dv^2} \qquad \text{(eqn. 1)}$$

Where $D_h$ is the horizontal distance and $D_v$ is the vertical distance, in metres. These distances are obtained from GIS spatial data and field based assessments.

### 1.2.2 Forward Rate of Spread (steady state)

The Forward Rate of Spread (steady state) ($R_{ss}$) equation used is that of Noble et al. (1980) as found in Standards Australia (2018). It has been applied using a 'forest' fuel type.

Although a steady state FROS is not archived in a 'short run fire' it has been used to quantify the progressive ROS of the design fires towards the subject land. This has been done with *Equation 2* (FROS) being modified by *Equation 3* (ROS on slope) (Noble, et al., 1980).

$$R = 0.0012 \times FDI \ \times w \qquad \text{(eqn. 2)}$$

$$R_{slope} = R\ e^{(0.069\ slope)} \qquad \text{(eqn. 3)}$$

### 1.2.3 Length/Breadth ratio of a developing fire

The Length-to-Breadth ratio (L/B) is used to calculate the fire width of a short run fire. An ellipse-shaped fire is characteristic of multiple fuel types (including forest) and is considered valid for use in the design fires from a single fire ignition point (Anderson, et al., 1982; Green, et al., 1983).

Although the ellipse is best suited for a growth model in homogenous conditions, the fuel can either be continuous or discontinuous (Catchpole, et al., 1992).

Alexander (1985) described an empirically derived relationship of the L/B ratio of wind-driven forest fires on level terrain originating from a point ignition source and a wind value taken at 10m. Although the equation assumes a fairly constant wind direction with an upper wind limit of 50 km/h it is considered appropriate for the design fires and is provided below as *Equation 4*.

$$1 + (0.0012 \times v^{2.154}) \qquad \text{(eqn. 4)}$$

An Australian version of the L/B ratio based on McArthur's original work is presented below as *Equation 5* (Alexander, 1985). Cheney (1981) says this model is only valid to 40 km/h however there is no restriction indicated in McArthur et al. (1982) in Alexander (1985).

$$L/B = 1.1\ v^{0.464} \qquad \text{(eqn. 5)}$$

A further model was reviewed and is described as being applicable to any fuel complex and based on both laboratory and field based experiments (international) from point ignition fires (Alexander, 1985; Anderson, 1983). The model is expressed as:

$$l/w = 0.936e^{0.1147\,U} + 0.461e^{-0.0692\,U} \qquad \text{(eqn. 6)}$$

In this equation *l/w* is equivalent to L/B and U = wind speed at 1.5ft (or midflame height) in miles per hour. To use this formula where wind speed is recorded at 10m and in km//h as used in Australia multiple conversions are required as well as applying a Wind Adjustment Factor (WAF=0.5) with the resultant formula:

$$L/B = 0.936e^{0.03099\,W} + 0.461e^{-0.01870\,W} \qquad \text{(eqn. 7)}$$

In examining each of the above potential models (equations 4, 5 & 6) for use in the design fires consideration was given to the output and the known assumptions and restrictions. Based upon these factors *Equation 4* was chosen for the design fire model. *Equation 5* was not used because of the potential wind limitation of 40 km/h and by comparison *Equation 6* produced a slightly higher flame width than *Equation 5* and therefore improved the sensitivity of the methodology used.

Other information reviewed included Anderson (1983), Cheney & Sullivan (2008), Kucuk (2007), Luke & McArthur (1978), McAlpine (1989), McAlpine & Wakimoto (1991) and Richards (1993).

### 1.2.4 Flame Width

The design flame width, *Wf,* assumes an overall ellipse fire shape and the L/B ratio can be used to determine the overall width and this width is applicable under Method 2 of AS 3959-2018.

$$\mathrm{Wf} = \frac{\mathrm{D_{slope}}}{\mathrm{L/B}} \qquad \text{(eqn. 8)}$$

To improve the sensitivity of the design fire approach, it is assumed that the flame width is the widest point of the ellipse, and not the width of the actual head of the fire.

### 1.2.5 Flame Height

Flame height calculations traditional use the modified McArthur MK 5 formula found in the Method 2 process of AS 3959-2018 (Standards Australia 2018). More recent research outcomes from the CSIRO Project Vesta Gould et al. (2007a and 2007b) included a revised formula (*Equation 9* below) to determine flame height with a consideration of fuel loads restricted to 2 m in height and excluding canopy or bark fuels. This model uses elevated fuel height ($E_{fh}$) to represent the collective influence of surface, near surface and elevated fuel loads.

$$Fh = 0.0193\ R^{0.723}\ EXP^{(0.64\ Efh)} \qquad \text{(eqn. 9)}$$

Where $F_h$ = flame height (metres), $R$ = forward rate of spread (m/hr) and $E_{fh}$ = elevated fuel height (metres). Research by Dr Belinda Kelly identifies an appropriate elevated fuel height range ($E_{fh}$) for NSW vegetation classifications from Keith (2004) formations.

### 1.2.6 View factor determination

The view factor is determined using a 2D panel with vertical and horizontal dimensions. In using the SFR method, the flame width determines the horizontal dimension and the flame height determines the vertical dimension. The view factor calculation is undertaken within the NBC BFAA tool where the flame width is simply entered as an input however, the same cannot be done for flame height.

To achieve the flame height value, fuel loads are reduced until the flame length output is equal to the flame height calculated in the SFR calculations. This is similar to the method involved in calculating the shielding effect of a radiant heat shield. Once the flame length and flame height values are the same and the flame width is modified to the calculated SFR value, this provide the 2D dimensions for the heat panel used to determine the view factor and corresponding radiant heat exposure.

### 1.2.7 Other factors considered

The wind speed input was limited to 30 kph (as per suggestion by John Delany of RFS);

The nature of Short Fire runs will not involve canopy or bark fuels;

Below is a list of key limitations and assumptions used:

- (Cheney & Gould, Letter to the Editor: Fire growth and acceleration, 1997) identify the following limitations applicable to fire development modelling:
- Fires starting from a point ignition develop different quasi steady state ROS depending on the effective width of the head fire;
- Head fire width required for fires to approach potential ROS increases with increasing wind speeds;
- Fire burning under stable wind with little variation in direction remain narrow and take considerable time to reach potential ROS;
- Time for fire starting from a point ignition to reach potential intensity is very variable and depends largely on frequency of switches in wind direction which impacts on ROS;
- In general, the stronger the wind the longer a fire will take to reach its potential intensity; and
- Fires starting from a point and burning directly up a steep slope will have a narrow head and spread well below the potential ROS.

- The assumption is made that flame width equates to the widest point of the ellipse, as determined by the length to breadth ratio, and not the width of the actual head of the fire; and
- All calculated numbers are rounded to the nearest single decimal point value.

# Appendix 2 – Figures


**Figure 1: Design Fire**

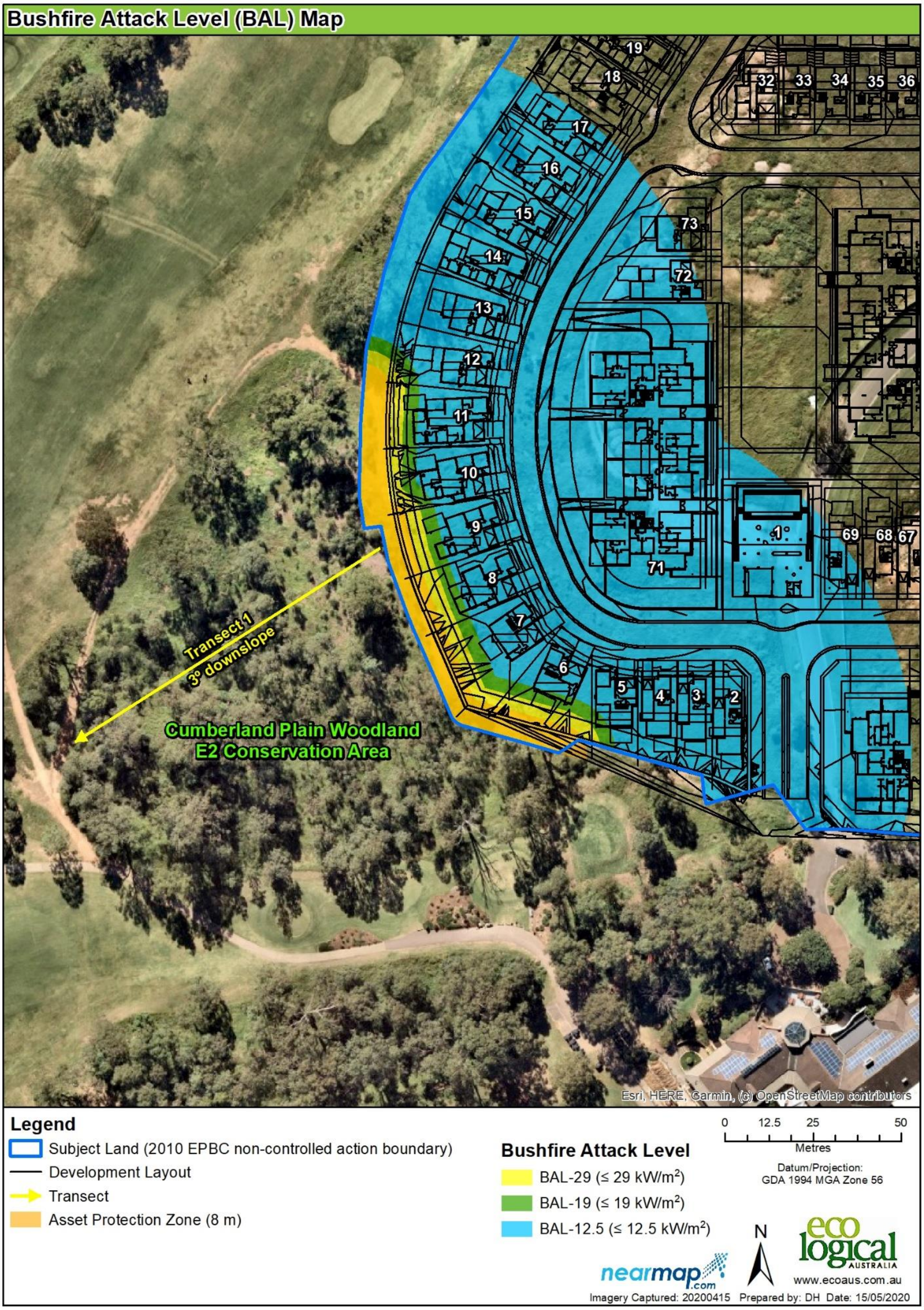


**Figure 2: Bushfire Attack Level (BAL)**

# Appendix 3 – Photographs

Photo 1: Looking west with development site to north and vegetation to the south

Photo 2: Looking north towards development site with vegetation to the west.

Photo 3: Looking east through vegetation

Photo 4: Southern side of vegetation

Photo 5: Looking north through the vegetation

# Appendix 4 – Modelling calculations

| Step # | Desc | Symbol | Desciption | Value | Unit | Notes |
|---|---|---|---|---|---|---|
| 1 | Site specific inputs | $E_{slope}$ | Effective slope | 3 | degrees | + = downslope, -=upslope |
| | | $S_{slope}$ | Site slope | 0 | degrees | |
| | | $h$ | Elevation of reciever | | metres | |
| | | $Veg$ | Vegetation formation | CVGW | Type | Create lookup |
| | | $w$ | Surface fuel load | 10 | t/ha | Create lookup |
| | | $W$ | Overall fuel load | 18.07 | t/ha | Create lookup |
| | | $d$ | Seperation distance | | metres | |
| | | $E_{fh}$ | Average elevtaed fuel height | 0.9 | metres | From Vesta table |
| 2 | FFDI | $FFDI$ | FFDi from PBP (Table A2.3) | 100 | | Create lookup |
| 3 | Forward Rate of Spread | $R$ | FROS | 1.2 | km/hr | |
| | | $FFDI$ | FFDi from PBP (Table A2.3) | 100 | | |
| | | $w$ | Surface fuel load | 10 | t/ha | |
| | | $R_{slope}$ | FROS corrected for slope | 1.48 | km/hr | |
| | | $E_{slope}$ | Effective slope | 3 | degrees | |
| 4 | Fully developed fire intensity | $I$ | Intensity | 13780 | kW/m | |
| | | $H$ | heat of combustion | 18600 | kJ/kg | |
| | | $W$ | Overall fuel load | 18.07 | t/ha | |
| | | $R_{slope}$ | FROS corrected for slope | 1.48 | km/hr | |
| 5 | Fully developed Fire Flame Length | $L_f$ | Flame length | 11.76 | metres | |
| | | $R_{slope}$ | FROS corrected for slope | 1.48 | km/hr | |
| | | $W$ | Overall fuel load | 18.07 | t/ha | |
| 6 | Fully developed fire transmissivity | Determined using NBC Bush Fire Attack Assessor (BFAA) | | | | |
| 7 | Fully developed fire radiation | | | | | |
| 8 | SFR Length | $L_{SFR}$ | SFR length | 118 | metres | |
| 9 | SFR Intensity | $I_{SFR}$ | SFR Intensity | 7626 | kW/m | Modified Byram 1959 |
| | | $H$ | heat of combustion | 18600 | kJ/kg | |
| | | $w$ | Surface fuel load | 10 | t/ha | |
| | | $R_{slope}$ | FROS corrected for slope | 1.48 | km/hr | |
| 10 | SFR Head Width | $L/B$ | Length / Breadth ratio | 2.82 | | SFR research |
| | | $V$ | Wind speed | 30 | km/hr | |
| | | $W_{SFR}$ | SFR Head width | 41.8 | metres | |
| 11 | SFR Flame Height | $F_h$ | Flame height | 6.71 | metres | Project Vesta Fh formula |
| | | $R_{slope}$ | FROS corrected for slope | 1475.98 | m/hr | |
| | | $E_{fh}$ | Elevated fuel height | 0.9 | metres | |
| 12 | SFR radiation | Determined using NBC Bush Fire Attack Assessor (BFAA) | | | | |
| | | a | Create new record/run in BFAA | | | |
| | | b | Enter site specific inputs from step 1 | | | |
| | | c | Modify flame width in BFAA with output from Step 10 | | | |
| | | d | Modify fuel loads (as per RHS process) until Flame Length (BFAA) = SFR Flame Height (Step 11) | | | |
| | | e | Record RHF output | | | |

# NBC Bushfire Attack Assessment Report V2.1

**AS3959 (2009) Appendix B - Detailed Method 2**

**Printed:** 14/05/2020 **Assessment Date:** 7/05/2020

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

| | | | |
|---|---|---|---|
| **Site Street Address:** | Stage 41 Lakeside - SFR, Gledswood | | |
| **Assessor:** | Mr Admin; admin | | |
| **Local Government Area:** | Camden | **Alpine Area:** | No |

**Equations Used**

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

**Run Description:** T1: BAL-12.5 (Flame Height = 6.71m)

## Vegetation Information

| | | | |
|---|---|---|---|
| **Vegetation Type:** | Forest | **Vegetation Group:** | Forest and Woodland |
| **Vegetation Slope:** | 3 Degrees | **Vegetation Slope Type:** | Downslope |
| **Surface Fuel Load(t/ha):** | 5.74 | **Overall Fuel Load(t/ha):** | 10 |

## Site Information

| | | | |
|---|---|---|---|
| **Site Slope:** | 0 Degrees | **Site Slope Type:** | Level |
| **Elevation of Receiver(m):** | Default | **APZ/Separation(m):** | 16 |

## Fire Inputs

| | | | |
|---|---|---|---|
| **Veg./Flame Width(m):** | 41.8 | **Flame Temp(K)** | 1090 |

## Calculation Parameters

| | | | |
|---|---|---|---|
| **Flame Emissivity:** | 95 | **Relative Humidity(%):** | 25 |
| **Heat of Combustion(kJ/kg)** | 18600 | **Ambient Temp(K):** | 308 |
| **Moisture Factor:** | 5 | **FDI:** | 100 |

## Program Outputs

| | | | |
|---|---|---|---|
| **Category of Attack:** | LOW | **Peak Elevation of Receiver(m):** | 3.24 |
| **Level of Construction:** | BAL 12.5 | **Fire Intensity(kW/m):** | 4377 |
| **Radiant Heat(kW/m2):** | 12.15 | **Flame Angle (degrees):** | 75 |
| **Flame Length(m):** | 6.71 | **Maximum View Factor:** | 0.189 |
| **Rate Of Spread (km/h):** | 0.85 | **Inner Protection Area(m):** | 16 |
| **Transmissivity:** | 0.846 | **Outer Protection Area(m):** | 0 |

**Run Description:** T1: BAL-19 (Flame Height = 6.71m)

## Vegetation Information

| | | | |
|---|---|---|---|
| **Vegetation Type:** | Forest | **Vegetation Group:** | Forest and Woodland |
| **Vegetation Slope:** | 3 Degrees | **Vegetation Slope Type:** | Downslope |
| **Surface Fuel Load(t/ha):** | 5.74 | **Overall Fuel Load(t/ha):** | 10 |

## Site Information

| | | | |
|---|---|---|---|
| **Site Slope:** | 0 Degrees | **Site Slope Type:** | Level |
| **Elevation of Receiver(m):** | Default | **APZ/Separation(m):** | 12 |

## Fire Inputs

| | | | |
|---|---|---|---|
| **Veg./Flame Width(m):** | 41.8 | **Flame Temp(K)** | 1090 |

## Calculation Parameters

| | | | |
|---|---|---|---|
| **Flame Emissivity:** | 95 | **Relative Humidity(%):** | 25 |
| **Heat of Combustion(kJ/kg)** | 18600 | **Ambient Temp(K):** | 308 |
| **Moisture Factor:** | 5 | **FDI:** | 100 |

## Program Outputs

| | | | |
|---|---|---|---|
| **Category of Attack:** | MODERATE | **Peak Elevation of Receiver(m):** | 3.19 |
| **Level of Construction:** | BAL 19 | **Fire Intensity(kW/m):** | 4377 |
| **Radiant Heat(kW/m2):** | 17.41 | **Flame Angle (degrees):** | 72 |
| **Flame Length(m):** | 6.71 | **Maximum View Factor:** | 0.266 |
| **Rate Of Spread (km/h):** | 0.85 | **Inner Protection Area(m):** | 12 |
| **Transmissivity:** | 0.86 | **Outer Protection Area(m):** | 0 |

| | | | |
|---|---|---|---|
| **Run Description:** | T1: BAL-29 (Flame Height = 6.71m) | | |

## Vegetation Information

| | | | |
|---|---|---|---|
| **Vegetation Type:** | Forest | **Vegetation Group:** | Forest and Woodland |
| **Vegetation Slope:** | 3 Degrees | **Vegetation Slope Type:** | Downslope |
| **Surface Fuel Load(t/ha):** | 5.74 | **Overall Fuel Load(t/ha):** | 10 |

## Site Information

| | | | |
|---|---|---|---|
| **Site Slope:** | 0 Degrees | **Site Slope Type:** | Level |
| **Elevation of Receiver(m):** | Default | **APZ/Separation(m):** | 8 |

## Fire Inputs

| | | | |
|---|---|---|---|
| **Veg./Flame Width(m):** | 41.8 | **Flame Temp(K)** | 1090 |

## Calculation Parameters

| | | | |
|---|---|---|---|
| **Flame Emissivity:** | 95 | **Relative Humidity(%):** | 25 |
| **Heat of Combustion(kJ/kg)** | 18600 | **Ambient Temp(K):** | 308 |
| **Moisture Factor:** | 5 | **FDI:** | 100 |

## Program Outputs

| | | | |
|---|---|---|---|
| **Category of Attack:** | HIGH | **Peak Elevation of Receiver(m):** | 3.01 |
| **Level of Construction:** | BAL 29 | **Fire Intensity(kW/m):** | 4377 |
| **Radiant Heat(kW/m2):** | 27.6 | **Flame Angle (degrees):** | 64 |
| **Flame Length(m):** | 6.71 | **Maximum View Factor:** | 0.414 |
| **Rate Of Spread (km/h):** | 0.85 | **Inner Protection Area(m):** | 8 |
| **Transmissivity:** | 0.877 | **Outer Protection Area(m):** | 0 |