

# Bushfire Assessment Report

**s.100B 'Subdivision'**

**Lot 1 DP958100  
54 Luchetti Avenue, Hazelbrook**

Prepared for  
**Williams Consulting Engineers Australia Pty Ltd**



**November 2015**

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## Document Control

| Document Name        | Project Ref  | Date      | Author | Status    |
|----------------------|--------------|-----------|--------|-----------|
| 20150922WCEA BAR 1.0 | 20150922WCEA | 01-Nov-15 | TO     | Version 1 |
| 20150922WCEA BAR 1.1 | 20150922WCEA | 02-Nov-15 | TO     | Version 2 |
|                      |              |           |        |           |
|                      |              |           |        |           |
|                      |              |           |        |           |



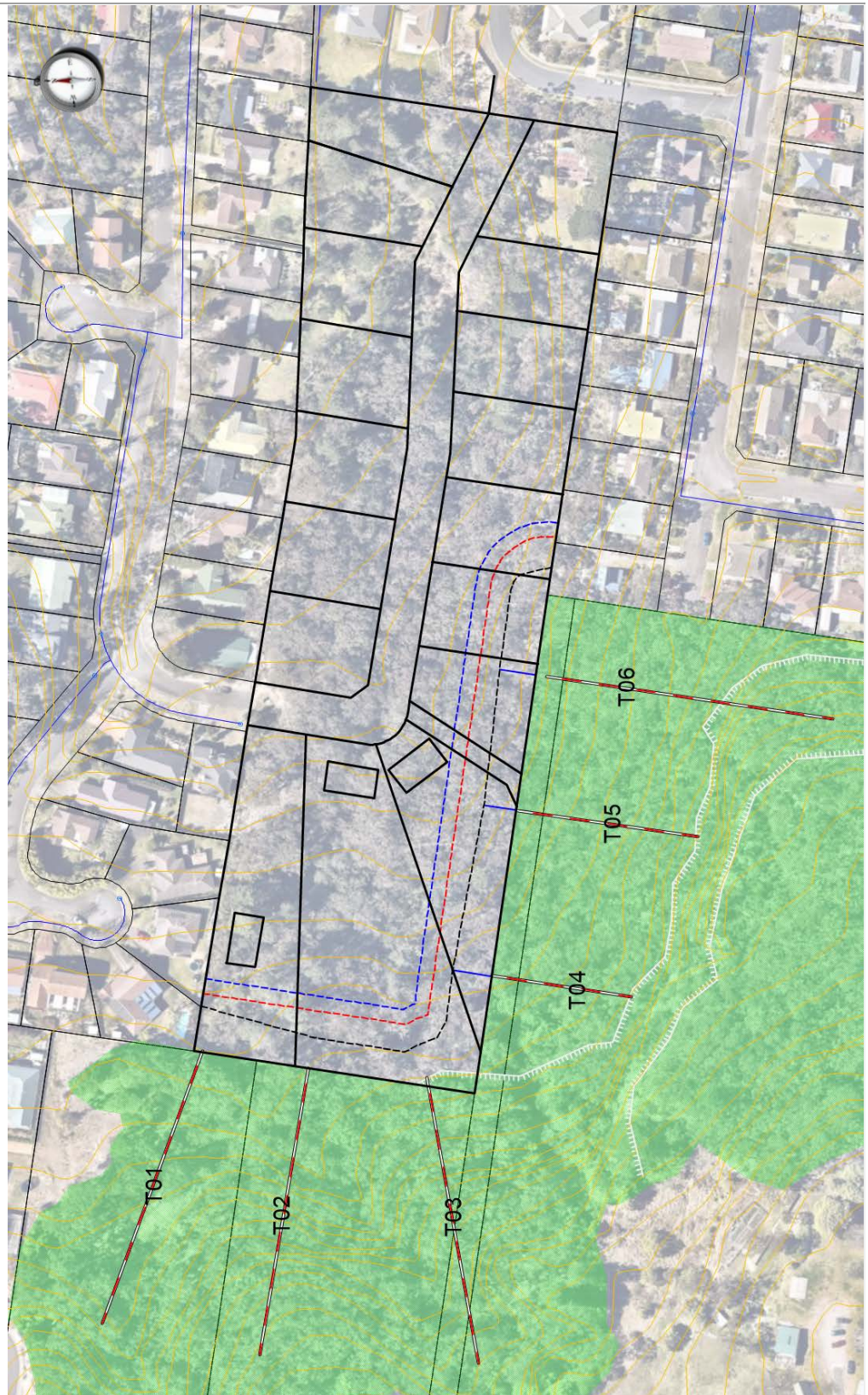
# 1 Proposed Development

|                                                                                |                                                                                                                                            |
|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| Is the proposal on bush fire prone land                                        | The site is within bushfire prone land on the <b>Blue Mountains LGA</b> Bush Fire Prone Land Map.                                          |
| Does the proposal require a Bush Fire Safety Authority and referral to the RFS | YES <input checked="" type="checkbox"/> NO Subdivision proposals are subject to section.100B of the <i>Rural Fires Act 1997</i>            |
| Does the proposal rely on alternative solutions                                | YES <input checked="" type="checkbox"/> NO Compliance with AS3959-2009 Method 2 and SFR modelling are alternative assessment methodologies |
| Description                                                                    | Subdivision of 1 residential lot into 17 residential lots and infrastructure lot (road and access way)                                     |
| Stage 1 Plan                                                                   | <p>Stage 1 Plan</p> <p>Concept Subdivision Plan Dwg: 2014/129/DA1 K June 2015</p>                                                          |
| Plan Reference                                                                 | Concept Subdivision Plan Dwg: 2014/129/DA1 K June 2015                                                                                     |



## 2 Assessment Details

Bushfire Assessment Plan





|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                          |
|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| Legend and Comments  | Black dashed line                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Minimum complying setback Method 2       |
|                      | Red dashed line                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Minimum complying setback PBP Appendix 2 |
| Bush Fire Prone Land | Blue dashed line                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Minimum complying setback Method 1       |
|                      | Green shaded area                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Unmanaged bushland                       |
|                      | Red/white dashed line                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Slope transect                           |
|                      | Thin orange line                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2m contour                               |
|                      | Black line                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Lot boundaries                           |
|                      | Grey line                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Extents of escarpment/cliff              |
|                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                          |
|                      | <ul style="list-style-type: none"> <li>The site is within bushfire prone land on the <b>Blue Mountains LGA</b> Bush Fire Prone Land Map</li> <li>The site contains Category 1 bushfire hazard vegetation (orange) and is adjoining Category 1 bushfire hazard vegetation. Cleared areas are within the 100m buffer zone (red)</li> <li>Clearing all bushfire hazard vegetation from the site will not change the lots classification as it will still be within the buffer zone.</li> <li>The site will remain bushfire prone land until the vegetation within the lot and within 100m of the lot is managed and when Blue Mountains City Council prepares a new Bush Fire Prone Land Map</li> </ul> |                                          |

### Asset Protection Zones

APZ determined in accordance with Appendix 2

APZ located wholly within the development

APZ managed to RFS standards

APZ are easily manageable and do not compromise soil stability or support crown fires

**Complies**

### Summary of results

| Transect | Aspect | Vegetation | Slope          | Setback to comply |                   |               |          | Complies |
|----------|--------|------------|----------------|-------------------|-------------------|---------------|----------|----------|
|          |        |            |                | PBP2006<br>T:A2.4 | AS3959<br>T:2.4.2 | Appendix<br>B | Proposed |          |
| T1       | West   | DS Forest  | 6.28° US (0°)  | 20m               | 25-35m            | 15.038m       | >15m     | Yes      |
| T2       | West   | DS Forest  | 13.77° US (0°) | 20m               | 25-35m            | 10.583m       | >11m     | Yes      |
| T3       | West   | DS Forest  | 12.41° US (0°) | 20m               | 25-35m            | 11.747m       | >12m     | Yes      |
| T4       | South  | DS Forest  | 8.13° US (0°)  | 20m               | 25-35m            | 13.781m       | >14m     | Yes      |
| T5       | South  | DS Forest  | 13.39° US (0°) | 20m               | 25-35m            | 11.067m       | >11m     | Yes      |



|    |            |           |                |     |        |         |      |     |
|----|------------|-----------|----------------|-----|--------|---------|------|-----|
| T6 | South      | DS Forest | 11.86° US (0°) | 20m | 25-35m | 12.648m | >13m | Yes |
|    | All others | Managed   | -              |     |        |         |      | Yes |

\*denotes setback determined by modeled flame length

The APZ for this project were assessed using the methodology in *Planning for Bush Fire Protection* 2006 Appendix 2 and AS3959-2009 Method 1 (Simplified) and Method 2 (Detailed).

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Vegetation             | <ul style="list-style-type: none"> <li>Vegetation assessed from onsite inspection (18/10/2015).</li> <li>The Blue Mountains City Council website describes mixed vegetation impacting the site that is predominantly <i>E. piperita</i> and <i>A. costata</i> forest in the west and <i>C. gummifera</i> and <i>E. sieberi</i> forest in the south.</li> <li>The structure of the vegetation is predominantly open forest described in PBP2006 as dry sclerophyll forest and in AS3959-2009 as A03.</li> <li>It assumed that all vegetation within the site that is not protected vegetation or on slopes greater than 18 degrees can be managed to asset protection zone standards.</li> </ul>                                                                                                                                                                                                                                                                  |
| Slope                  | <ul style="list-style-type: none"> <li>Slopes influencing bushfire behaviour were calculated from 1m contours provided by survey within the site and to the south. Areas where the survey did not extend were assessed using LPI 2m contours.</li> <li>The slopes are represented by 6 transects of up to 100m length (T01-T06). All slopes are upslope to the proposed development.</li> <li>Transects T04 and T05 are less than 100m to exclude the influence of the escarpment</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Environmental Features | <ul style="list-style-type: none"> <li>None</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Setback                | <ul style="list-style-type: none"> <li>Asset protection zones are to be wholly contained within the proposed residual lots or road reserves.</li> <li>Setbacks are measured from the edge of the unmanaged bushfire hazard vegetation (green shading on the bushfire Assessment Plan) to the walls of any proposed building.</li> <li>The minimum complying setback is shown as a black dashed line in the Bushfire Assessment Plan (Method 2)</li> <li>Larger managed asset protection zones will generally support lower construction standards and reduce the costs of construction.</li> <li>Setbacks are based on management to APZ standards as described in the NSW Rural Fire Service documents <i>Planning for Bush Fire Protection</i> 2006 and <i>Standards for Asset Protection Zones</i> (see Appendix B).</li> <li>Setbacks in <i>Planning for Bush Fire Protection</i> 2006 are designed to ensure that lots are created with the potential to allow a deemed-to-satisfy building construction solution under AS3959-1999</li> </ul> |



|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|            | <p>(Level 3). This standard has been replaced by AS3959-2009 with BAL levels. Level 3 is deemed to be the equivalent to BAL-29 by the RFS (Red dashed line in Bushfire Assessment Plan).</p> <ul style="list-style-type: none"> <li>Setbacks in AS3959-2009 (Method 1) are designed to ensure no (new) potential buildings are impacted by greater than <math>29\text{kWm}^{-2}</math> RHF based on generic bushfire types (Blue dashed line in Bushfire Assessment Plan). These setbacks support compliance with the complying development code (CDC)</li> <li>Setbacks in AS3959-2009 (Method 2) are designed to ensure no (new) potential buildings are impacted by greater than <math>29\text{kWm}^{-2}</math> RHF and/or flame contact (Black dashed line in Bushfire Assessment Plan). These setbacks are considered an alternative assessment by the RFS and do not support CDC compliance.</li> <li>All proposed APZs must be practical, not compromise soil stability and negate potential crown fires within the APZ. Areas to the southwest at the base of the escarpment have been excluded from the potential APZ due to the steep slope. A detailed survey of this area could support extension of the APZ into this area if it is able to support practical APZ management without compromising soil stability.</li> </ul>                                         |
| Management | <ul style="list-style-type: none"> <li>All proposed residential lots are to be managed (as a minimum) to outer protection area (OPA) standards and maintained at this standard until building construction stage. This will ensure that adjoining lots are not unnecessarily restricted by unmanaged lots. If lots are not managed to OPA standards adjoining lots would need to consider the impact of a bushfire hazard on the residential lot and may be required to building to higher construction standards than would be required at the completion of the subdivision. Ultimately all residential lots will be managed to inner protection area standards.</li> <li>The site is currently partially cleared but does not extend to the required APZs.</li> <li>All asset protection zones provided within the proposed residential lots and residual lot will be the responsibility of the landowner.</li> <li>Any portion of an asset protection zone that is extended onto adjacent lots (not the subject lot) will need to be secured by covenants on the title. No APZ has been proposed on adjacent land at this time.</li> <li>The Blue Mountains Bush Fire Risk Management Plan does not provide any specific management regimes to the site or adjacent bushland.</li> </ul>  |
| 10/50 code | <ul style="list-style-type: none"> <li>This site is located in a designated 10/50 Code vegetation entitlement area. This permits clearing trees within 10m of residential buildings and under-scrubbing up to 50m without further approvals where consistent with the provisions of the Code.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| BFEA Code  | <ul style="list-style-type: none"> <li>Section 63 of the Rural Fires Act 1997 places a 'duty of care' on landowners to prevent the occurrence of bushfires or minimise the danger of spread of fires on land vested in or under its control or management.</li> <li>The Bush Fire Environmental Assessment Code (BFEA Code) describes the appropriate asset protection zones to adjoining assets (e.g. residential buildings).</li> <li>This site adjoins a number of residential buildings to the north.</li> <li>The land owner is responsible for providing asset protection zones (20m) to the existing buildings on adjoining lots. This responsibility exists now but may be diminished by development of the site.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |



|                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Short Fire Run</b>                                                                                          | <ul style="list-style-type: none"> <li>Short Fire Run (SFR) modelling addresses the effect of less developed bushfires impacting the site due to limited fire runs.</li> <li>The RFS recently released a discussion paper addressing the potential fire behaviour of bushfires over short fire runs. This paper was based on principles described by Alexander et al (Ref: RFS discussion paper Short Fire Run – A Risk Perspective for the Bushland Interface v.1.6) and described the reduced fire front widths of early developing fires consistent with a ratio of an modelled ellipse (length/breadth ratio). A model to apply this is currently under development by the RFS.</li> <li>Use of short fire run modelling is an alternative solution and is limited to runs of no greater than 150m and slopes of no greater than 20°.</li> <li>A simplified and conservative application of the model is based on fixed parameters such as 30km/h winds. This provides a fixed L/B ratio of 1:2.82 under all fuel and slope combinations.</li> <li>The predicted width of the ellipse is conservatively adopted as the max potential Flame Width.</li> <li>Fires developing over short runs with moderate winds (30km/h) are assumed to have lower flame contact risks and have been excluded from the assessment. AS3959-2009 Method 2 modelling relies upon RHF calculations using 90° flame angles and disregards flame length calculations.</li> <li>Short Fire Run modelling was assessed as per the table in Appendix D and Flame Width was applied to Method 2 modelling (see Appendix C) with 90° Flame Angles.</li> </ul> |
| <b>Construction</b>                                                                                            | <ul style="list-style-type: none"> <li>No new buildings are proposed at this time.</li> <li>This report specifically addresses a bushfire assessment for subdivision compliance. Parts of this report relating to PBP2006 Appendix 2 may not be applied to future building development which is subject to the Complying Development Code or s.79BA of the EP&amp;A Act. These will require a reassessment using the methodology described in AS3959-2009 only.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Services</b><br>Compliance with s.4.1.3. for services <div style="text-align: right;"><b>Complies</b></div> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Water</b>                                                                                                   | <ul style="list-style-type: none"> <li>A 100mm reticulated mains water network is currently available to the site.</li> <li>Where a reticulated supply is provided then hydrants should be located within appropriate distances (max 90m from the most distant part of a proposed building).</li> <li>Future buildings not wholly within 90m of a hydrant may be required to provide onsite water storage tanks (50000L) at the building approval stage.</li> <li>Future buildings not wholly within 70m of a hydrant may be required to provide specific standard property access roads.</li> <li>Future buildings not within 60m of a hydrant may not be able to satisfy the provisions of the Complying Development Code (CDC).</li> <li>No hydrants should be located within driveways.</li> <li>Hydrants should be located within the road reserve and not within the paved road.</li> <li>All above ground pipes and fittings are to be metal.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Electricity</b>                                                                                             | <ul style="list-style-type: none"> <li>Power transmission lines external to the sites are above ground.</li> <li>All new power lines within the site should be located underground.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Gas</b>                                                                                                     | <ul style="list-style-type: none"> <li>No information provided. Should gas be provided then it must comply with appropriate standards.</li> <li>All above ground pipes and fittings should be metal</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Access</b><br>Compliance with s.4.1.3(1) <div style="text-align: right;"><b>Complies</b></div>              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Public access road</b>                                                                                      | <p><b>Perimeter Roads (interfacing with the bushland)</b></p> <ul style="list-style-type: none"> <li>No perimeter public access roads are proposed</li> <li>A perimeter road would separate the development from the bushfire hazard. This road could provide asset protection zone or control line for bushfire suppression.</li> <li>The road would need to service 4 lots or more to be classified as a public access road.</li> <li>Perimeter roads should be a minimum 8m wide (kerb to kerb)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |



#### Non-Perimeter Roads

- A non-perimeter public access road is proposed
- A non-perimeter road would not provide direct access to the bushfire hazard and would not be directly exposed to the bushfire impacts.
- The road would need to service 4 lots or more to be classified as a public access road.
- Perimeter roads should be a minimum 6.5m wide (kerb to kerb) along a straight section up to 8m wide about the bends
- The proposed road is a non-perimeter public road. This is a loop road with residential development on each side.
- The carriageway (generally kerb invert to kerb invert) should comply with the widths in Table 4.1 of PBP2006. A 7m wide road would comply along the straight sections but the curves would need to be expanded or have restricted parking on one side. Width can be measured from top of roll top kerbing.

| Curve radius (m) | Swept path (m) | Single lane (m) | Dual lane (m) |
|------------------|----------------|-----------------|---------------|
| <40              | 3.5            | 4.5             | 8.0           |
| 40-69            | 3.0            | 3.9             | 7.5           |
| 70-100           | 2.7            | 3.6             | 6.9           |
| >100             | 2.5            | 3.5             | 6.5           |

- Minimum inner curve radius is greater than 6m  
The intersection of the proposed road can support a >6m radius inner curve. All internal curves are greater than 6m radius.
- Minimum distance between inner and outer curves is 6m  
The intersection can support a >6m width.

Yes

#### One Way Access Roads

- No one way public access roads are proposed

Yes

#### Dead Ends

- No dead-end roads are proposed
- Dead ends are not recommended (but are permitted)
- These should not be more than 200m in length.
- It should incorporate a 12m outer radius turning circle
- The RFS guidelines do not define a turning circle to mean either the road reserve or the paved road. No industry definition is available to clarify this issue. As a CAT 1 Tanker requires 17.5m to turn full lock, then the paved carriageway should be a minimum 19m as required by Council unless otherwise stipulated by the RFS.
- Parking should not be permitted within the cul-de-sac.
- Should be clearly sign posted as a dead end

Yes



|                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |
|-----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|                                                                                                     | <b>All Roads</b> <ul style="list-style-type: none"> <li>• Road surfaces should support 2 wheeled drive vehicles and provide all weather access</li> <li>• Road surfaces and bridges should support 15 tonnes</li> <li>• Traffic management devices should not inhibit access to emergency services vehicles</li> <li>• Cross fall should not exceed 3 degrees</li> <li>• Sealed roads should have a maximum grade of 15° with max avg grade of 10°</li> <li>• Minimum vertical clearance should be no less than 4m</li> <li>• Access should be speed limited to &lt;70kph.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Yes |
|                                                                                                     | <b>Hydrants and Parking</b> <ul style="list-style-type: none"> <li>• Hydrants should be located in the road reserve beyond the paved road surface</li> <li>• Hydrants should be located outside parking reserves</li> <li>• Public roads (between 6.5m and 8m wide) should prohibit parking on the side of the road supporting hydrants</li> <li>• Public roads up to 6.5m wide should provide parking in parking bays</li> <li>• Parking bays should be a minimum 2.6m wide from kerb invert to road pavement</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Yes |
| <b>Property access</b>                                                                              | <ul style="list-style-type: none"> <li>• No property access design specifications apply where a hydrant is within 70m of the most distant part of the building and the public access road is limited to 70kph</li> <li>• Tankers should be able to comply with AS2419 distances (20m hydrant+ 60m hose + 10m jet = 90m) without entering the lot.</li> <li>• Where the road services less than 4 lots the recommended paved width is 4m but exceptions may apply for narrower access over short lengths to address obstructions.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Yes |
| <b>Fire Trails</b>                                                                                  | <ul style="list-style-type: none"> <li>• No fire trails are proposed or required</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Yes |
| <b>Landscaping</b><br>Compliance with Appendix 5 <span style="float: right;"><b>Complies</b></span> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |
| <b>Landscaping</b>                                                                                  | <ul style="list-style-type: none"> <li>• No landscape plans have been reviewed for this report.</li> <li>• Any new landscaping within the developments should adopt (where practical) the following principles:                             <ul style="list-style-type: none"> <li>o Moisture content of leaves should be high (250-400% of dry oven weight)</li> <li>o Volatile oil content of leaves should be low</li> <li>o Mineral content of leaves should be high</li> <li>o Leaves should be thick (broad) with low area to volume ratio</li> <li>o Density of foliage should be high and less permeable to air flow</li> <li>o Continuity of plant form should be broken or separated</li> <li>o Height of lowest foliage above ground should be maximised</li> <li>o Size of plant should be wide spread rather than tall and narrow</li> <li>o Dead foliage on the plant should be minimal</li> <li>o Bark texture should be tight and smooth</li> <li>o Quantity of ground fuels should be minimised</li> <li>o Fineness of ground fuels should be minimised</li> <li>o Compaction ability of ground fuels should be maximised</li> <li>o Mineral content of ground fuel should be maximised</li> </ul> </li> </ul> |     |
| <b>Other</b>                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |     |
| <b>Environmental Impact</b>                                                                         | <ul style="list-style-type: none"> <li>• None noted</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |     |



|            |                                                                                                                                                                                                   |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Other BPMs | <ul style="list-style-type: none"><li>No additional measures</li></ul>                                                                                                                            |
| Deviations | <ul style="list-style-type: none"><li>The assessment does not deviate from the standards, specific objectives and performance criteria of <i>Planning for Bush Fire Protection 2006</i></li></ul> |



### 3 Comments

Each proposed lot presents a complying subdivision opportunity to varying degrees. Lots 3 and 4 are the most constrained whilst all others provide more than adequate siting opportunities.

The subdivision is only required to comply with setbacks described in Table A2.4 of Appendix 2 Planning for Bush Fire Protection 2006. All lots are able to support these setbacks and provide suitable siting opportunities for reasonable building footprints (approx. 10m x 15m).

An assessment of the setbacks to comply with Table 2.2.2 of AS3959-2009 Method 1 (simple) is designed to provide minimum conservative setbacks to support a complying BAL-29 building. Complying with these setbacks will permit compliance with the CDC and resolve any conflicts with PBP2006 subdivision setbacks.

The last is a detailed methodology designed to provide the absolute minimum setbacks that the NSW Rural Fire Service should endorse by granting a Bush Fire Safety Authority. This minimum setback will require a complementary BAL-29 construction standard (AS3959-2009). This methodology models the site specific bushfire behaviour to determine the actual setback to achieve the performance outcome.

All setbacks exceed the modelled flame length. These should be not potential flame contact with residential buildings sited beyond the minimum setback.

Although Short Fire Run modelling was considered for the site no short fire run modelling applies to these transects. Transects T01-T06 have either a greater than 150m fire run or have the potential to develop a greater fire run in unmanaged vegetation with regeneration of currently cleared areas.

### 4 Bushfire Protection Measures - recommendations

| Performance Criteria | Recommendation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Compliance |
|----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| APZ                  | 1. The entire area of proposed lots 1-17 shall be managed to inner protection area standards as described in the RFS documents <i>Planning for Bush Fire Protection 2006</i> and <i>Standards for Asset Protection Zones</i> .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Yes        |
| Construction         | 2. NA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Yes        |
| Access               | 3. Access should comply with Section 4.1.3 (2) of <i>Planning for Bush Fire Protection 2006</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Yes        |
| Services             | 4. All services shall comply with Section 4.1.3 of <i>Planning for Bush Fire Protection 2006</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Yes        |
| Landscaping          | 5. Landscaping within the development should adopt (where practical) the principles detailed in Appendix 5 of PBP2006. <ul style="list-style-type: none"> <li>a. Moisture content of leaves should be high (250-400% of dry oven weight)</li> <li>b. Volatile oil content of leaves should be low</li> <li>c. Mineral content of leaves should be high</li> <li>d. Leaves should be thick (broad) with low area to volume ratio</li> <li>e. Density of foliage should be high and less permeable to air flow</li> <li>f. Continuity of plant form should be broken or separated</li> <li>g. Height of lowest foliage above ground should be maximised</li> <li>h. Size of plant should be wide spread rather than tall and</li> </ul> | Yes        |



|                  |                                                                                                                                                                                                                                                                                                                                                                                                                        |    |
|------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
|                  | <p>narrow</p> <ul style="list-style-type: none"> <li>i. Dead foliage on the plant should be minimal</li> <li>j. Bark texture should be tight and smooth</li> <li>k. Quantity of ground fuels should be minimised</li> <li>l. Fineness of ground fuels should be minimised</li> <li>m. Compaction ability of ground fuels should be maximised</li> <li>n. Mineral content of ground fuel should be maximised</li> </ul> |    |
| <b>Emergency</b> | <p>6. The developer is encouraged to provide each lot owner with a copy of the NSW RFS Home Fire Escape Plan (Appendix A)</p>                                                                                                                                                                                                                                                                                          | NA |



## Appendix A – Bush Fire Survival Plan



**PREPARE.**

**ACT.**

**SURVIVE.**

**[www.rfs.nsw.gov.au](http://www.rfs.nsw.gov.au)**

<http://www.rfs.nsw.gov.au/resources/bush-fire-survival-plan>



## Appendix B – Asset Protection Zone Standards

Planning for Bush Fire Protection 2006

| Asset Protection Zone                                                                                                                                                                                                    | Inner Protection Area                                                                                                                                                                                                                                                                                                                                                     | Outer Protection Area                                                                                                                                                                                 |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (p.10) Buffer zone between bush fire hazard and buildings. Managed progressively to minimise fuel loads and reduce bushfire attack.                                                                                      | (p.10) Closest to buildings, incorporating the defendable space and for managing heat intensities at the building surface                                                                                                                                                                                                                                                 | (p.10) reducing the potential length of flames by slowing the rate of spread, filtering embers and suppressing crown fire                                                                             |
| (p.10) defendable space is a subset of APZ                                                                                                                                                                               | (p.50) The IPA is critical to providing a defendable space and managing heat intensities at the building surface. The IPA may be increased at the expense of the OPA                                                                                                                                                                                                      | (p.50) the OPA serves to reduce the potential length of flames by slowing the ROS, filtering embers and reducing the likelihood of crown fires                                                        |
| (p.12) fuel reduced physical separation.<br>Based on keeping radiant heat levels at buildings below $29\text{kWm}^{-2}$                                                                                                  | (p.51) An IPA should provide a <b>tree canopy cover of less than 15%</b> and should be <b>located &gt;2m from any part of the roofline of a dwelling</b> .<br>Garden beds and flammable shrubs are not to be located under trees and should not be located <10m from an exposed window or door.<br><b>Lower limbs should be pruned to a height of 2m above the ground</b> | (p.51) An OPA should provide a <b>tree canopy cover of less than 30%</b> and should have understorey managed (mowed) to treat all shrubs and grasses on an annual basis in advance of the fire season |
| (p.13) Where an APZ easement is established to the benefit of Community Title is shall be maintained in accordance with a PoM                                                                                            |                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                       |
| (p.18) Intent of Measures- to provide sufficient space and maintain reduced fuel load, so as to ensure radiant heat levels at the building are below critical limits and to prevent direct flame contact with a building |                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                       |
| (p.18) APZ is designed to minimise the presence of fuels which could become involved in a fire                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                       |
| (p.19) APZs are managed and maintained to prevent the spread of fire towards the building.<br>In accordance with the                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                       |



|                                                                                                                                                                                                                                                    |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| requirements of Standards for Asset Protection Zones (RFS,2005)                                                                                                                                                                                    |  |  |
| Location of APZs on slopes >18 is not supported for new development on wooded vegetation due to environmental constraints and difficulties in management. In addition vegetation could carry a canopy fire without the support of understorey fuel |  |  |
| (p.71) Retention of taller trees will assist in filtering out embers                                                                                                                                                                               |  |  |
| Tree canopy is not contiguous                                                                                                                                                                                                                      |  |  |

#### Standards for Asset Protection Zones

| Asset Protection Zone                                                                                                                | Inner Protection Area | Outer Protection Area |
|--------------------------------------------------------------------------------------------------------------------------------------|-----------------------|-----------------------|
| APZ is a fuel reduced area surrounding a built asset or structure                                                                    |                       |                       |
| APZ should be wholly located with your land                                                                                          |                       |                       |
| Fallen ground fuels <6mm dia and bark should be removed on a regular basis                                                           |                       |                       |
| Grasses need to be kept short and where possible green                                                                               |                       |                       |
| Separate tree crowns by 2-5m                                                                                                         |                       |                       |
| Canopy should not overhang within 2-5m of a dwelling                                                                                 |                       |                       |
| Native trees and shrubs should be retained as clumps or islands and should maintain a covering of <20% of the area.                  |                       |                       |
| Ensure there is no contiguous fuel path to the dwelling                                                                              |                       |                       |
| Fire trails, gravel paths, rows of trees, dams, creeks, swimming pools, tennis courts, and vegetable gardens are permitted in an APZ |                       |                       |



## Appendix C – AS3959-2009 Method 2 assessment results

### NBC Bushfire Attack Assessment Report V2.1

AS3959 (2009) Appendix B - Detailed Method 2

Printed: 02/11/2015 Assessment Date: 01/11/2015



Assessor:  Terence O'Toole BPAD Level 3 BPD-PA-13734

Site Street Address: 54 Luchetti Ave, Hazelbrook

Local Government Area: Blue Mountains

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: T01

#### Vegetation Information

Vegetation Type: Forest Vegetation Group: Forest and Woodland

Vegetation Slope: 6.28 Degrees Vegetation Slope Type: Upslope

Surface Fuel Load(t/ha): 20 Overall Fuel Load(t/ha): 25

#### Site Information

Site Slope: 3.8 Degrees Site Slope Type: Upslope

Elevation of Receiver(m): 6 APZ/Separation(m): 15.038

#### Fire Inputs

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

#### Calculation Parameters

Flame Emissivity: 95 Relative Humidity(%): 25

Heat of Combustion(kJ/kg) 18600 Ambient Temp(K): 308

Moisture Factor: 5 FDI: 100

#### Program Outputs

Category of Attack: HIGH Peak Elevation of Receiver(m): 6.69

Level of Construction: BAL 29 Fire Intensity(kW/m): 20099

Radiant Heat(kW/m<sup>2</sup>): 29 Flame Angle (degrees): 58

Flame Length(m): 13.11 Maximum View Factor: 0.444

Rate Of Spread (km/h): 1.56 Inner Protection Area(m): 15

Transmissivity: 0.858 Outer Protection Area(m): 0



|                                      |               |                                       |                     |
|--------------------------------------|---------------|---------------------------------------|---------------------|
| <b>Run Description:</b> T02          |               |                                       |                     |
| <b><u>Vegetation Information</u></b> |               |                                       |                     |
| <b>Vegetation Type:</b>              | Forest        | <b>Vegetation Group:</b>              | Forest and Woodland |
| <b>Vegetation Slope:</b>             | 13.77 Degrees | <b>Vegetation Slope Type:</b>         | Upslope             |
| <b>Surface Fuel Load(t/ha):</b>      | 20            | <b>Overall Fuel Load(t/ha):</b>       | 25                  |
| <b><u>Site Information</u></b>       |               |                                       |                     |
| <b>Site Slope:</b>                   | 4.05 Degrees  | <b>Site Slope Type:</b>               | Upslope             |
| <b>Elevation of Receiver(m):</b>     | default       | <b>APZ/Separation(m):</b>             | 10.583              |
| <b><u>Fire Inputs</u></b>            |               |                                       |                     |
| <b>Veg./Flame Width(m):</b>          | 100           | <b>Flame Temp(K)</b>                  | 1090                |
| <b><u>Calculation Parameters</u></b> |               |                                       |                     |
| <b>Flame Emissivity:</b>             | 95            | <b>Relative Humidity(%):</b>          | 25                  |
| <b>Heat of Combustion(kJ/kg)</b>     | 18600         | <b>Ambient Temp(K):</b>               | 308                 |
| <b>Moisture Factor:</b>              | 5             | <b>FDI:</b>                           | 100                 |
| <b><u>Program Outputs</u></b>        |               |                                       |                     |
| <b>Category of Attack:</b>           | HIGH          | <b>Peak Elevation of Receiver(m):</b> | 4.7                 |
| <b>Level of Construction:</b>        | BAL 29        | <b>Fire Intensity(kW/m):</b>          | 11987               |
| <b>Radiant Heat(kW/m2):</b>          | 29            | <b>Flame Angle (degrees):</b>         | 61                  |
| <b>Flame Length(m):</b>              | 9.03          | <b>Maximum View Factor:</b>           | 0.438               |
| <b>Rate Of Spread (km/h):</b>        | 0.93          | <b>Inner Protection Area(m):</b>      | 11                  |
| <b>Transmissivity:</b>               | 0.87          | <b>Outer Protection Area(m):</b>      | 0                   |
| <b>Run Description:</b> T03          |               |                                       |                     |
| <b><u>Vegetation Information</u></b> |               |                                       |                     |
| <b>Vegetation Type:</b>              | Forest        | <b>Vegetation Group:</b>              | Forest and Woodland |
| <b>Vegetation Slope:</b>             | 12.41 Degrees | <b>Vegetation Slope Type:</b>         | Upslope             |
| <b>Surface Fuel Load(t/ha):</b>      | 20            | <b>Overall Fuel Load(t/ha):</b>       | 25                  |
| <b><u>Site Information</u></b>       |               |                                       |                     |
| <b>Site Slope:</b>                   | 9.66 Degrees  | <b>Site Slope Type:</b>               | Upslope             |
| <b>Elevation of Receiver(m):</b>     | 6             | <b>APZ/Separation(m):</b>             | 11.747              |
| <b><u>Fire Inputs</u></b>            |               |                                       |                     |
| <b>Veg./Flame Width(m):</b>          | 100           | <b>Flame Temp(K)</b>                  | 1090                |
| <b><u>Calculation Parameters</u></b> |               |                                       |                     |
| <b>Flame Emissivity:</b>             | 95            | <b>Relative Humidity(%):</b>          | 25                  |
| <b>Heat of Combustion(kJ/kg)</b>     | 18600         | <b>Ambient Temp(K):</b>               | 308                 |
| <b>Moisture Factor:</b>              | 5             | <b>FDI:</b>                           | 100                 |
| <b><u>Program Outputs</u></b>        |               |                                       |                     |
| <b>Category of Attack:</b>           | HIGH          | <b>Peak Elevation of Receiver(m):</b> | 6.01                |
| <b>Level of Construction:</b>        | BAL 29        | <b>Fire Intensity(kW/m):</b>          | 13167               |
| <b>Radiant Heat(kW/m2):</b>          | 29            | <b>Flame Angle (degrees):</b>         | 56                  |
| <b>Flame Length(m):</b>              | 9.63          | <b>Maximum View Factor:</b>           | 0.44                |
| <b>Rate Of Spread (km/h):</b>        | 1.02          | <b>Inner Protection Area(m):</b>      | 12                  |
| <b>Transmissivity:</b>               | 0.867         | <b>Outer Protection Area(m):</b>      | 0                   |



|                                      |               |                                       |                     |
|--------------------------------------|---------------|---------------------------------------|---------------------|
| <b>Run Description:</b> T04          |               |                                       |                     |
| <b><u>Vegetation Information</u></b> |               |                                       |                     |
| <b>Vegetation Type:</b>              | Forest        | <b>Vegetation Group:</b>              | Forest and Woodland |
| <b>Vegetation Slope:</b>             | 8.13 Degrees  | <b>Vegetation Slope Type:</b>         | Upslope             |
| <b>Surface Fuel Load(t/ha):</b>      | 20            | <b>Overall Fuel Load(t/ha):</b>       | 25                  |
| <b><u>Site Information</u></b>       |               |                                       |                     |
| <b>Site Slope:</b>                   | 4.15 Degrees  | <b>Site Slope Type:</b>               | Upslope             |
| <b>Elevation of Receiver(m):</b>     | 6             | <b>APZ/Separation(m):</b>             | 13.781              |
| <b><u>Fire Inputs</u></b>            |               |                                       |                     |
| <b>Veg./Flame Width(m):</b>          | 100           | <b>Flame Temp(K)</b>                  | 1090                |
| <b><u>Calculation Parameters</u></b> |               |                                       |                     |
| <b>Flame Emissivity:</b>             | 95            | <b>Relative Humidity(%):</b>          | 25                  |
| <b>Heat of Combustion(kJ/kg)</b>     | 18600         | <b>Ambient Temp(K):</b>               | 308                 |
| <b>Moisture Factor:</b>              | 5             | <b>FDI:</b>                           | 100                 |
| <b><u>Program Outputs</u></b>        |               |                                       |                     |
| <b>Category of Attack:</b>           | HIGH          | <b>Peak Elevation of Receiver(m):</b> | 6.15                |
| <b>Level of Construction:</b>        | BAL 29        | <b>Fire Intensity(kW/m):</b>          | 17690               |
| <b>Radiant Heat(kW/m2):</b>          | 29            | <b>Flame Angle (degrees):</b>         | 60                  |
| <b>Flame Length(m):</b>              | 11.9          | <b>Maximum View Factor:</b>           | 0.443               |
| <b>Rate Of Spread (km/h):</b>        | 1.37          | <b>Inner Protection Area(m):</b>      | 14                  |
| <b>Transmissivity:</b>               | 0.861         | <b>Outer Protection Area(m):</b>      | 0                   |
| <b>Run Description:</b> T05          |               |                                       |                     |
| <b><u>Vegetation Information</u></b> |               |                                       |                     |
| <b>Vegetation Type:</b>              | Forest        | <b>Vegetation Group:</b>              | Forest and Woodland |
| <b>Vegetation Slope:</b>             | 13.39 Degrees | <b>Vegetation Slope Type:</b>         | Upslope             |
| <b>Surface Fuel Load(t/ha):</b>      | 20            | <b>Overall Fuel Load(t/ha):</b>       | 25                  |
| <b><u>Site Information</u></b>       |               |                                       |                     |
| <b>Site Slope:</b>                   | 7.72 Degrees  | <b>Site Slope Type:</b>               | Upslope             |
| <b>Elevation of Receiver(m):</b>     | default       | <b>APZ/Separation(m):</b>             | 11.067              |
| <b><u>Fire Inputs</u></b>            |               |                                       |                     |
| <b>Veg./Flame Width(m):</b>          | 100           | <b>Flame Temp(K)</b>                  | 1090                |
| <b><u>Calculation Parameters</u></b> |               |                                       |                     |
| <b>Flame Emissivity:</b>             | 95            | <b>Relative Humidity(%):</b>          | 25                  |
| <b>Heat of Combustion(kJ/kg)</b>     | 18600         | <b>Ambient Temp(K):</b>               | 308                 |
| <b>Moisture Factor:</b>              | 5             | <b>FDI:</b>                           | 100                 |
| <b><u>Program Outputs</u></b>        |               |                                       |                     |
| <b>Category of Attack:</b>           | HIGH          | <b>Peak Elevation of Receiver(m):</b> | 5.41                |
| <b>Level of Construction:</b>        | BAL 29        | <b>Fire Intensity(kW/m):</b>          | 12306               |
| <b>Radiant Heat(kW/m2):</b>          | 29            | <b>Flame Angle (degrees):</b>         | 58                  |
| <b>Flame Length(m):</b>              | 9.19          | <b>Maximum View Factor:</b>           | 0.439               |
| <b>Rate Of Spread (km/h):</b>        | 0.95          | <b>Inner Protection Area(m):</b>      | 11                  |
| <b>Transmissivity:</b>               | 0.869         | <b>Outer Protection Area(m):</b>      | 0                   |



|                                      |               |                                       |                     |
|--------------------------------------|---------------|---------------------------------------|---------------------|
| <b>Run Description:</b> T06          |               |                                       |                     |
| <b><u>Vegetation Information</u></b> |               |                                       |                     |
| <b>Vegetation Type:</b>              | Forest        | <b>Vegetation Group:</b>              | Forest and Woodland |
| <b>Vegetation Slope:</b>             | 11.86 Degrees | <b>Vegetation Slope Type:</b>         | Upslope             |
| <b>Surface Fuel Load(t/ha):</b>      | 20            | <b>Overall Fuel Load(t/ha):</b>       | 25                  |
| <b><u>Site Information</u></b>       |               |                                       |                     |
| <b>Site Slope:</b>                   | 15.47 Degrees | <b>Site Slope Type:</b>               | Upslope             |
| <b>Elevation of Receiver(m):</b>     | default       | <b>APZ/Separation(m):</b>             | 12.648              |
| <b><u>Fire Inputs</u></b>            |               |                                       |                     |
| <b>Veg./Flame Width(m):</b>          | 100           | <b>Flame Temp(K)</b>                  | 1090                |
| <b><u>Calculation Parameters</u></b> |               |                                       |                     |
| <b>Flame Emissivity:</b>             | 95            | <b>Relative Humidity(%):</b>          | 25                  |
| <b>Heat of Combustion(kJ/kg)</b>     | 18600         | <b>Ambient Temp(K):</b>               | 308                 |
| <b>Moisture Factor:</b>              | 5             | <b>FDI:</b>                           | 100                 |
| <b><u>Program Outputs</u></b>        |               |                                       |                     |
| <b>Category of Attack:</b>           | HIGH          | <b>Peak Elevation of Receiver(m):</b> | 7.42                |
| <b>Level of Construction:</b>        | BAL 29        | <b>Fire Intensity(kW/m):</b>          | 13676               |
| <b>Radiant Heat(kW/m2):</b>          | 29            | <b>Flame Angle (degrees):</b>         | 53                  |
| <b>Flame Length(m):</b>              | 9.88          | <b>Maximum View Factor:</b>           | 0.441               |
| <b>Rate Of Spread (km/h):</b>        | 1.06          | <b>Inner Protection Area(m):</b>      | 13                  |
| <b>Transmissivity:</b>               | 0.865         | <b>Outer Protection Area(m):</b>      | 0                   |



## Appendix D – Bushfire Assessment Table

|                            |              |              |              |              |              |              |    |  |
|----------------------------|--------------|--------------|--------------|--------------|--------------|--------------|----|--|
| Bushfire Attack Level      | 29           | 29           | 29           | 29           | 29           | 29           | 29 |  |
| Flame angle                | 58           | 61           | 56           | 60           | 58           | 53           |    |  |
| Flame Length               | 13.11        | 9.03         | 9.63         | 11.9         | 9.19         | 9.88         |    |  |
| Radiant Heat Flux          | 29           | 29           | 29           | 29           | 29           | 29           |    |  |
| Elevation of Reciever      | 6            | D            | 6            | 6            | 6            | 6            |    |  |
| Flame width                | 52           | 55           | 58           | 100          | 100          | 100          |    |  |
| Total Ellipse Breadth      | 51.61        | 54.91        | 57.47        | 0.00         | 0.00         | 0.00         |    |  |
| Total Ellipse Length       | 145.72       | 155.02       | 162.26       | 0.00         | 0.00         | 0.00         |    |  |
| Short Fire Run Length      | 141          | 150          | 157          | 0            | 0            | 0            |    |  |
| Site Slope                 | -3.80        | -4.05        | -9.66        | 4.15         | -7.72        | -15.47       |    |  |
| Site Slope Length          | 15.038       | 10.583       | 11.747       | 13.781       | 11.067       | 12.648       |    |  |
| Site Slope Lower Elevation | 666          | 668          | 670          | 665          | 660          | 659.5        |    |  |
| Site Slope Upper Elevation | 665          | 667.25       | 668          | 666          | 658.5        | 656          |    |  |
| Up/Down                    | US           | US           | US           | US           | US           | US           |    |  |
| Slope                      | -6.28        | -13.77       | -12.41       | -8.13        | -13.39       | -11.86       |    |  |
| Run                        | 100          | 100          | 100          | 49           | 63           | 100          |    |  |
| Fall                       | -11          | -24.5        | -22          | -7           | -15          | -21          |    |  |
| Lower Elevation            | 677          | 692.5        | 692          | 672          | 675          | 681          |    |  |
| Upper Elevation            | 666          | 668          | 670          | 665          | 660          | 660          |    |  |
| Setback                    | 15.038       | 10.583       | 11.747       | 13.781       | 11.067       | 12.648       |    |  |
| Vegetation Type            | DS Forest    | DS Forest    | DS Forest    | DS Forest    | DS Forest    | DS Forest    |    |  |
| Run                        | Transect T01 | Transect T02 | Transect T03 | Transect T04 | Transect T05 | Transect T06 |    |  |