



**BUSHFIRE ASSESSMENT
PERFORMANCE BASED SOLUTION
PROPOSED 3 DWELLING DEVELOPMENT
AND 3 LOT SUBDIVISION**

**LOT 139 DP 1284569
2 Chiswick Way, Thornton**

Date: **25/05/2024**

Prepared for: **Five Rivers Constructions**

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I hereby declare that I am a BPAD accredited bushfire practitioner.		
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Document Status

Revision No.	Issue	Description	Reviewed	Approved by Director
1	25/05/2024	Final	C. Couch	P. Couch

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1.0 EXECUTIVE SUMMARY AND COMPLIANCE TABLES

This report has assessed the proposed 3 dwelling development and subdivision against the requirements of Section 100B of the Rural Fires Act 1997, AS3959 (2018) Construction of buildings in bushfire-prone areas and Planning for Bush Fire Protection (2019).

This report establishes that the development does not comply with the acceptable solutions of Planning for Bush Fire Protection (2019) and offers a performance-based solution to measure the bushfire attack level more accurately.

TABLE 1 – PROPERTY DETAILS AND TYPE OF PROPOSAL

Applicant Name	Five Rivers Constructions		
Site Address	2 Chiswick Way, Thornton	Lot/Sec/DP	Lot 139 DP 1284569
Local Government Area	Maitland	FDI	100
Bushfire Prone Land	Yes, mapped bushfire prone land		
Type of development	3 dwelling development and subdivision	Type of Area	Urban
Special Fire Protection Purpose	No	Flame Temperature	1090K
Application Complies with Acceptable Solutions	No. Performance based solution with detailed fire model	Referral to NSW Rural Fire Service (NSW RFS)required	Yes. Bushfire Safety Authority Required

TABLE 2 – BUSHFIRE THREAT ASSESSMENT

	South Unit 1	South Unit 2	South Unit 3	West
Vegetation Structure	Forest	Forest	Forest	Forest
Distance to Vegetation	25 metres	36 metres	49 metres	81 metres
Accurate Slope Measure	4 degrees downslope	4 degrees downslope	4 degrees downslope	3 degrees downslope
Slope Range	>0 to 5 degrees downslope	>0 to 5 degrees downslope	>0 to 5 degrees downslope	>0 to 5 degrees downslope
Planning for Bush Fire Protection (2019) Minimum Setbacks 29 kw/m2	19 metres * Performance Solution	19 metres * Performance Solution	19 metres * Performance Solution	29 metres
AS3959 (2018) Bushfire Attack Level (BAL)	BAL-29 * Performance Solution	BAL-19 * Performance Solution	BAL-12.5 * Performance Solution	BAL-12.5

Dwelling 1

The highest BAL, being **BAL-29** applies to the entire building except the northern elevation, which may be built to BAL-19 due to shielding of the building bulk.

Dwelling 2

The highest BAL, being **BAL-19** applies to the entire building except the northern elevation, which may be built to BAL-12.5 due to shielding of the building bulk.

Dwelling 3

The highest BAL, being **BAL-12.5** applies to the entire building.

TABLE 3 – PLANNING FOR BUSH FIRE PROTECTION (2019) SECTION 5 COMPLIANCE

Performance Criteria	Proposed Development Determinations	Method of Assessment
Asset Protection Zone	<p>Asset Protection Zones have been derived in accordance with AS 3959-2018 Method 2 Detailed Procedure and Planning for Bush Fire Protection (2019).</p> <p>Refer to Appendix 2.0 for Detailed Fire Models and Section 7.0 Performance Based Solution examining more accurate fuel loads.</p> <p>The Asset Protection Zone will be maintained for the life of development and defensible space is provided onsite.</p>	<u>Performance Based Solution</u>
Landscaping	Landscaping to comply with Planning for Bush Fire Protection (2019) Appendix 4.	Acceptable Solution
Public Road Access	No new public roads are proposed for this development.	Acceptable Solution
Property Access	Property access offers compliance with Planning for Bush Fire Protection (2019) Section 5.3b.	Acceptable Solution
Fire Trail Access	No new fire trails are proposed for this development.	Acceptable Solution
Water and Utility Services	Water, electricity and gas services offer compliance with Planning for Bush Fire Protection (2019) Section 5.	Acceptable Solution

2.0 INTRODUCTION

2.1 PURPOSE OF REPORT

The purpose of this report is to establish suitable bushfire mitigation measures for the proposed 3 dwelling development and subdivision to be constructed at Lot 139 DP 1284569, 2 Chiswick Way, Thornton. The assessment acknowledges the requirements of Section 100B of the Rural Fires Act 1997 and Planning for Bush Fire Protection (2019) to protect persons, property and the environment from dangers that may arise from a bushfire.

Under the provisions of Section 100B of the Rural Fires Act 1997 as amended, a Bushfire Safety Authority (BFSA) is required from the Commissioner of the NSW Rural Fire Service.

This report complies with Rural Fires Regulation 2008 Clause 44 Application for Bushfire Safety Authority. The assessment encompasses the subject site and neighbouring areas.

The recommendations within this report address the aims and objectives of Planning for Bush Fire Protection (2019) to reduce the risk of ignition of the development in a bushfire event.

2.2 PROPOSED DEVELOPMENT

The proposed development includes the construction of three freestanding dwellings and 3 lot residential subdivision.

2.3 SIGNIFICANT ENVIRONMENTAL FEATURES

There are no known significant environmental features affecting the site.

2.4 ENVIRONMENTAL ASSETS

There are no known environmental assets on the subject site.

2.5 ABORIGINAL HERITAGE

Searches of NSW National Parks and Wildlife Service's database identify no known aboriginal relics or aboriginal places as defined by National Parks and Wildlife Act 1974 to exist on the site. The site is a cleared residential allotment.



PHOTO 1 - SITE PHOTO LOOKING NORTHWEST

View of the subject site looking Northwest. Residential development surrounds the site to the north, east and west.



PHOTO 2 - SOUTHERN FOREST

View of forest located south of the site. Eucalypts dominate the tree canopy with a low density understorey of grasses and native shrubs. The distance to the forest is measured to the bollards.

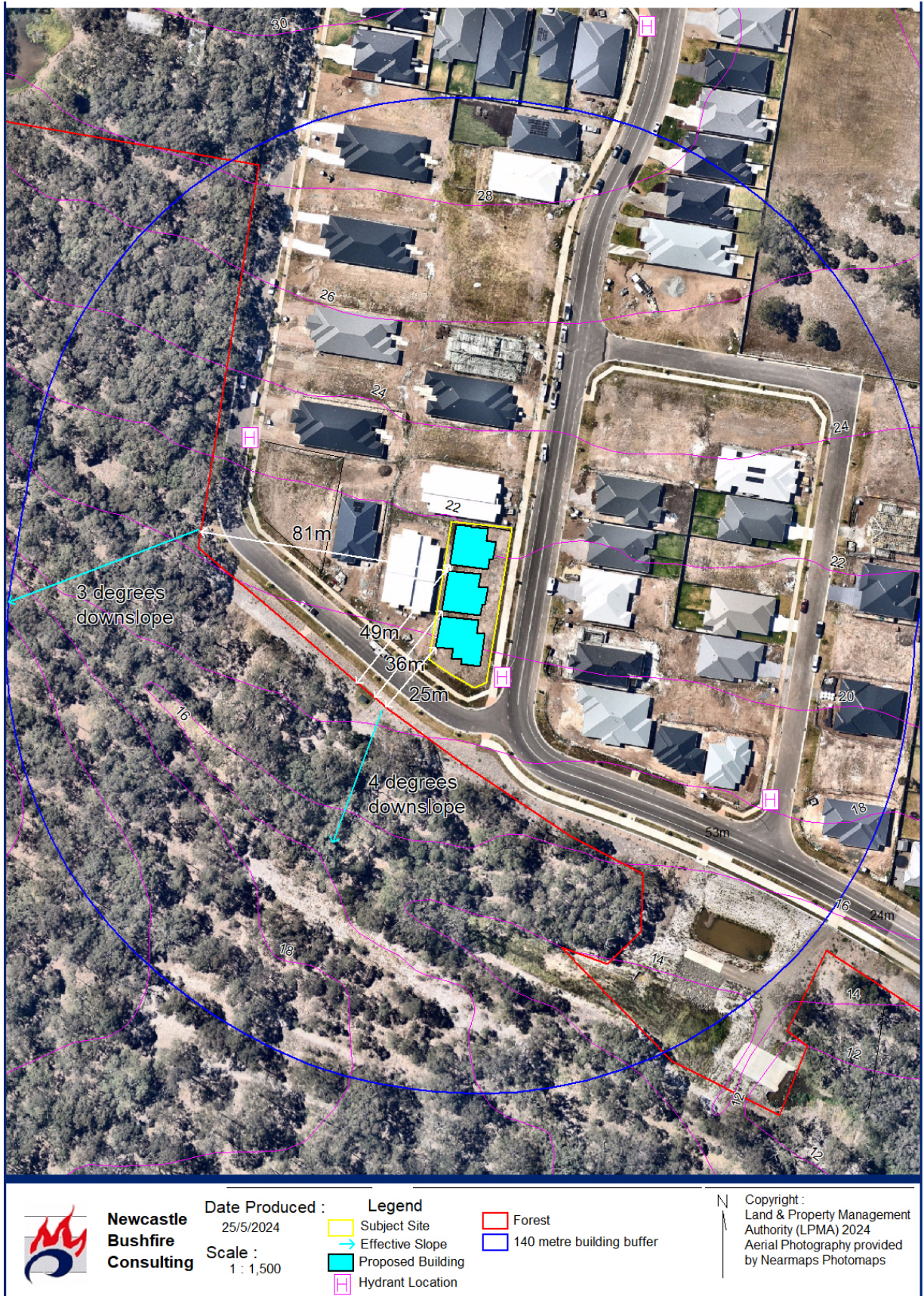


FIGURE 1 – SITE CONSTRAINTS MAP

3.0 BUSHFIRE ATTACK ASSESSMENT

3.1 VEGETATION CLASSIFICATION

Potential bushfire hazards were identified from Maitland Council bushfire prone mapping as occurring within the investigation area. Aerial mapping and inspection of the site reveals that the bushfire prone land map is reasonably accurate in respect to the current bushfire hazard.

The major vegetative threats have been determined using NSW RFS (2019) Comprehensive Vegetation Fuel Loads.

Primary Vegetation Structures have been identified in Figure 1 – Site Constraints Map and separation distances shown in Table 2 – Bushfire Attack Assessment.

3.2 EFFECTIVE SLOPE

Effective slope was measured using 2-metre contour data obtained from The Department of Lands and verified by a laser hypsometer on site. The laser hypsometer verified slope within the vegetation, calculating effective fire run slope from 5 separate measurements in each dominant direction.

Effective slopes have been identified in Figure 1 – Site Constraints Map and slope ranges are shown in Table 2 – Bushfire Threat Assessment.

3.3 MINIMUM SETBACKS AND ASSET PROTECTION ZONES

Minimum setbacks have been determined in accordance with Planning for Bush Fire Protection (2019) performance criteria of no more than 29 kw/m². The minimum Asset Protection Zone for subdivision has been demonstrated in Section 1.0 Executive Summary and Compliance Tables.

The required Asset Protection Zone is available within the subject site and neighbouring managed lands. All dwellings will be exposed to less than 29 kw/m² of radiant heat.

3.4 BUSHFIRE ATTACK LEVELS

BALs and relevant construction levels in accordance with Planning for Bush Fire Protection (2019) have been demonstrated in Section 1.0 Executive Summary and Compliance Tables, Table 2 Bushfire Threat Assessment.

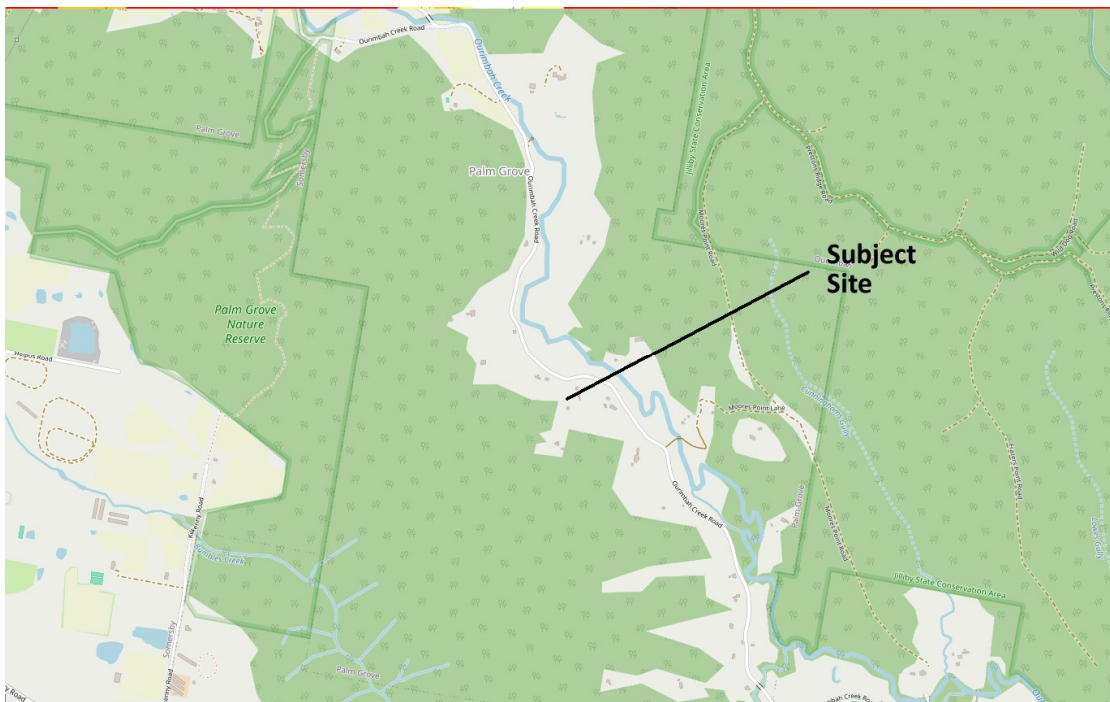


FIGURE 2 – LOCALITY MAP
Courtesy of OpenStreetMap

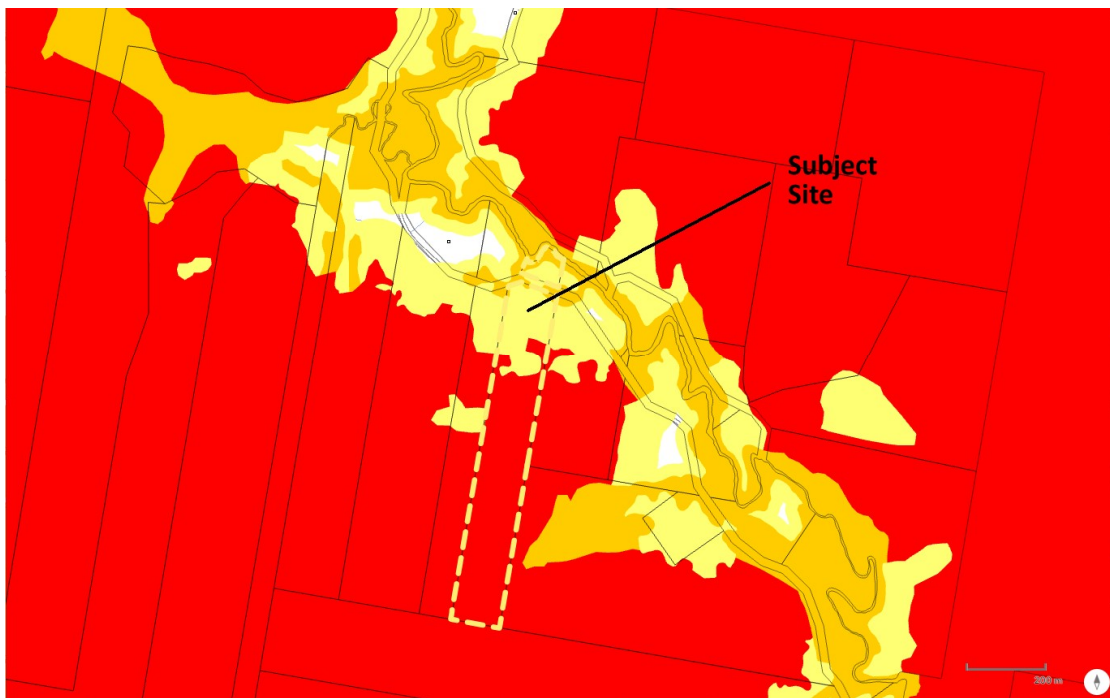


FIGURE 3 – COUNCIL'S BUSHFIRE PRONE LAND MAP

4.0 UTILITY SERVICES AND INFRASTRUCTURE

4.1 WATER SERVICES

A reticulated water supply and street hydrant access is available providing coverage of the development in accordance with AS 2419.1.

4.2 ELECTRICITY SERVICES

The existing electrical transmission lines are located underground and require no additional protection measures.



PHOTO 3 - SOUTHEASTERN FOREST

View of forest located southeast of the site with drainage basin visible in the distance. There is a clear delineation between managed land and the bushland.

Bushfire Assessment: Lot 139 DP 1284569, 2 Chiswick Way, Thornton

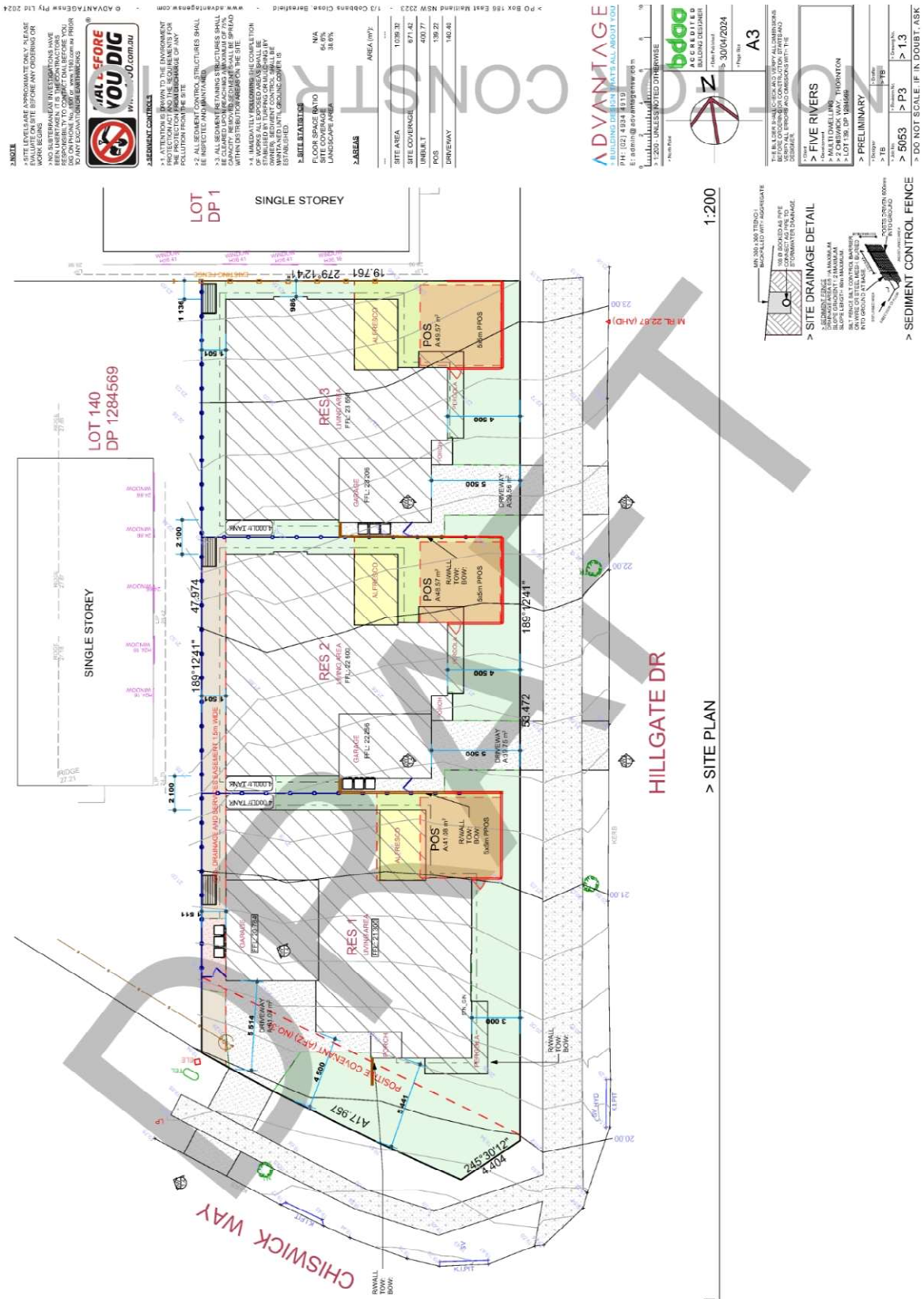


FIGURE 4 – SITE PLAN

4.3 GAS SERVICES

- Reticulated or bottled gas to be installed and maintained in accordance with AS1596 (2002) and the requirements of the relevant authorities. Metal piping is to be used.
- Fixed gas cylinders to be kept clear of flammable material by a distance of 10 metres and shielded on the hazard side of the installation.
- Gas cylinders close to the dwelling are to have the release valves directed away from the building and be at least 2 metres from flammable material with connections to and from the gas cylinder being of metal.
- Polymer-sheathed, flexible gas supply lines to gas meters adjacent to the buildings are not to be used.

5.0 PROPERTY ACCESS

The existing public road network complies with Planning for Bush Fire Protection (2019) and will remain unchanged.

Fire Trails

Fire trails do not intersect the vegetation in the local area. No new fire trails are proposed.

Property Access

Property access is provided by way of Chiswick Way and Hillgate Drive providing access from the public road system directly to the private land, giving firefighters access to the building.

Property access roads shall comply with Planning for Bush Fire Protection (2019) Section 5.3b.

Planning for Bush Fire Protection (2019) requires no specific access requirements where a 70-metre, unobstructed path can be demonstrated between the most distant external part of the proposed building and the nearest part of the public access road (where the road speed limit is not greater than 70kph) that supports the operational use of emergency firefighting vehicles (i.e. a hydrant or water supply). There are no formal requirements for property access.

6.0 LANDSCAPING MAINTENANCE

It is recommended that landscaping is undertaken in accordance with Planning for Bush Fire Protection (2019) Appendix 4 and maintained for the life of the development.

Trees should be located greater than 2 metres from any part of the roofline of a building. Garden beds of flammable shrubs are not to be located under trees and should be no closer than 10 metres from an exposed window or door. Trees should have lower limbs removed up to a height of 2 metres above the ground.

The landscaped area should be maintained free of leaf litter and debris. The gutter and roof should be maintained free of leaf litter and debris.

Landscaping should be managed so that flammable vegetation is not located directly under windows.

Ground fuels such as fallen leaves, twigs (less than 6 millimetres in diameter) and branches should be removed on a regular basis, and grass needs to be kept closely mown and, where possible, green.

7.0 EMERGENCY AND MAINTENANCE PLANS

7.1 BUSHFIRE MAINTENANCE PLANS

There is no known Bushfire Maintenance Plan for the site. A condition of development is to maintain the entire site as an Inner Protection Area which should be monitored by the building owner.

7.2 FIRE EMERGENCY PROCEDURES

It is recommended the future property owners or building occupants prepare a bushfire survival plan for each residence when they occupy the building.

8.0 PERFORMANCE BASED SOLUTION

At the request of the client, I have been asked to provide an unbiased safety model for the proposed development. The proposed performance-based solution offers compliance with Planning for Bush Fire Protection (2019).

Proposed Performance Based Solution

The proposed development departs from the acceptable solutions of Planning for Bushfire Protection 2019 through the use of a method 2 detailed fire model and more accurate fuel loads. Consideration of 1 in 50 year fire weather data has been used in minimum setbacks.

Methodology of Assessment

Pursuant to Section A2.4(c) of Appendix 2 in Planning for Bush Fire Protection (2019), the assessment method used by the performance solution to demonstrate compliance with the nominated performance criteria is a comparative analysis with the acceptable solutions of Planning for Bush Fire Protection (2019) relating to construction and achieving less than 29 kw/m² of radiant heat.

The assessment will be consistent with Planning for Bush Fire Protection (2019) which provides bushfire protection measures to resist three forms of impact to the building emanating from a bushfire event being –

- Direct flame contact
- Radiant heat
- Ember attack.

Planning for Bush Fire Protection (2019) does not take maintenance mechanisms into consideration for a Class 1a building and does not factor the potential impact on a dwelling via windborne objects during a bushfire event. In turn this assessment does not address these items which are consistent with Planning for Bush Fire Protection (2019).

Planning Compliance

The basis for the assessment of compliance for this site is Planning for Bush Fire Protection (2019) Section 5.

The specific performance criteria measure is compliance with Planning for Bush Fire Protection (2019) Table 5.3a “potential building footprints must not be exposed to radiant heat levels exceeding 29 kW/m² on each proposed lot.”

These performance criteria have been achieved through a detailed fire model.

Quantitative Analysis

Vegetation Structure Assessment

Penny Watson (2012) conducted a thorough assessment of vegetation structures throughout New South Wales and is deemed current best practice in assessing peak fuel loads. Watson (2012) identifies that Hunter Macleay Dry Sclerophyll Forest has a maximum surface and elevated fuel loading of 14 tonnes per hectare using a peak accumulation curve. The New South Wales Rural Fire Service (2019) Comprehensive Vegetation Fuel Loads summarises Penny Watson fuel loads and adds an overall fuel load.

The vegetation located adjacent to the site is more aligned with Hunter Macleay Dry Sclerophyll Forest than the Forest fuel loadings of Planning for Bush Fire Protection (2019) and the proposed fuel loads are deemed appropriate for the design fire.

Fuel Load inputs as per NSW RFS (2019) Comprehensive Vegetation Fuel Loads

Surface Fuel Load: 14 tonnes per hectare

Overall Fuel Load: 24.6 tonnes per hectare

Fire Model Inputs

In addition to the above fuel loads the below inputs are used. Where specific items are not referenced the default inputs of AS3959 and Planning for Bush Fire Protection 2019 have been adopted.

- Building Fascia/Elevation of receiver: 4 metres (as a conservative figure)
- Site slope: 4 degrees downslope
- Vegetation slope: 4 degrees downslope
- FFDI: 106 (based on 1 in 50 year fire event)

Design Fire Calculations

South Unit 1

Modelled BAL: 21.26 kw/m² (BAL-29)

South Unit 2

Modelled BAL: 13.69 kw/m² (BAL-29)

South Unit 3

Modelled BAL: 8.96 kw/m² (BAL-12.5)

AS3959 Method 2 BAL assessment considering more accurate fuel load assessment of Hunter-Macleay Dry Sclerophyll Forest. Refer to Appendix 2.0.

Qualitative review of Design Fires

The southern vegetation has been modelled to be burning on a south to north fire path towards the site. The vegetation could generate a high intensity fire.

Planning for Bush Fire Protection 2019 defines BAL—29 as “Attack by burning debris is significant and radiant heat flux (not greater than 29kW/m²) threatens building integrity. Specific construction requirements for ember and higher levels of radiant heat are warranted. Some flame contact is possible.”

This is deemed a suitable description of the fire risk for the proposed Unit 1 which is closest to the bushland. Units 2 and 3 are located further from the bushland and are exposed to lower levels of radiant heat. The northern elevations of units 1 and 2 may be built to 1 level lower due to shielding of the building bulk.

Evaluation of Performance Based Solution

AS3959 (2018) Building in Bushfire-Prone Areas and Planning for Bush Fire Protection (2019) detail the calculations required for detailed fire modelling and Newcastle Bushfire Consulting's proprietary modelling tool uses these. The detailed fire models have been provided in Appendix 2.0 of this report. All future buildings will be built in a location that will be exposed to BAL-29 or lower.

Redundancies are included in the design fire for rate of spread and flame length with the development complying with the performance criteria.

9.0 RECOMMENDATIONS

Based upon an assessment of the plans and information received for the proposal, it is recommended that development consent be granted subject to the following conditions:

Unit 1

1. The proposed building works for unit 1 excepting the northern elevation, shall comply with BAL-29 in accordance with AS3959 (2018) Construction of buildings in bushfire-prone areas or NASH Standard (1.7.14 updated) National Standard Steel Framed Construction in Bushfire Areas – 2014 as appropriate and the additional construction requirements of Planning for Bush Fire Protection (2019) Section 7.5.2.
2. The northern elevation of unit 1 shall comply with BAL-19 in accordance with AS3959 (2018) Construction of buildings in bushfire-prone areas or NASH Standard (1.7.14 updated) National Standard Steel Framed Construction in Bushfire Areas – 2014 as appropriate and the additional construction requirements of Planning for Bush Fire Protection (2019) Section 7.5.2.

Unit 2

3. The proposed building works of unit 2 excepting the northern elevation, shall comply with BAL-19 in accordance with AS3959 (2018) Construction of buildings in bushfire-prone areas or NASH Standard (1.7.14 updated) National Standard Steel Framed Construction in Bushfire Areas – 2014 as appropriate and the additional construction requirements of Planning for Bush Fire Protection (2019) Section 7.5.2.
4. The northern elevation of the proposed unit 2 shall comply with BAL-12.5 in accordance with AS3959 (2018) Construction of buildings in bushfire-prone areas or NASH Standard (1.7.14 updated) National Standard Steel Framed Construction in Bushfire Areas – 2014 as appropriate and the additional construction requirements of Planning for Bush Fire Protection (2019) Section 7.5.2.

Unit 3

5. The proposed building works for unit 3, shall comply with BAL-12.5 in accordance with AS3959 (2018) Construction of buildings in bushfire-prone areas or NASH Standard (1.7.14 updated) National Standard Steel Framed Construction in Bushfire Areas – 2014 as appropriate and the additional construction requirements of Planning for Bush Fire Protection (2019) Section 7.5.2.
6. At the commencement of building works and in perpetuity, the entire property shall be managed as an inner protection area (IPA) as outlined within Appendix 4 of Planning for Bush Fire Protection 2019 and the NSW Rural Fire Service's document Standards for Asset Protection Zones.
7. Water, electricity and gas are to comply with Section 5 of Planning for Bush Fire Protection (2019).
8. The property access shall comply with Section 5.3b of Planning for Bush Fire Protection (2019).
9. Landscaping is to be undertaken in accordance with Planning for Bush Fire Protection (2019) Appendix 4 and managed and maintained in perpetuity.
10. It is recommended that the property owner or building users familiarise themselves with the relevant bushfire preparation and survival information provided by the NSW RFS.

10.0 CONCLUSION

The final recommendation is that the proposed development offers compliance with Planning for Bush Fire Protection (2019). There is potential for bushfire attack at this site and a list of recommendations has been included in the above assessment to reduce that risk.

11.0 APPENDIX 1.0 – ASSET PROTECTION ZONES SUMMARY

Below is a summary of Asset Protection Zones outlined in appendix 4 of Planning for Bush Fire Protection (2019) and the NSW Rural Fire Services “Standards for Asset Protection Zones”. The property owner(s) should obtain these two documents and familiarise themselves with their content.

Generally

Asset Protection Zones (APZ) refer to the area between the bushfire threat and the asset (i.e. building). The APZ may contain two areas; the Inner Protection Area (IPA) and the Outer Protection Area (OPA). Some areas should be managed entirely as an Inner Protection Area (IPA). Refer to the plans for locations of APZ and distances from Assets.

Inner Protection Area (IPA)

The inner protection area is located adjacent to the asset and is identified as a fuel-free zone.

A. Shrubs (consisting of plants that are not considered to be trees)

1. Create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings should be provided;
2. Shrubs should not be located under trees;
3. Shrubs should not form more than 10% ground cover; and
4. Clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.

B. Trees: Maintain a minimum 2-5 metre canopy separation.

1. Tree canopy cover should be less than 15% at maturity;
2. Trees at maturity should not touch or overhang the building;
3. Lower limbs should be removed up to a height of 2m above the ground;
4. Tree canopies should be separated by 2 to 5m; and
5. Preference should be given to smooth barked and evergreen trees.

Outer Protection Area (OPA)

The Outer Protection Area (OPA) is located adjoining the vegetation. The OPA should be maintained as a fuel-reduced area. This assumes trees may remain but with a significantly reduced shrub, grass, and leaf litter layer. In many situations leaf litter and the shrub layer may not require maintenance at all.

A. Shrubs:

1. Shrubs should not form a continuous canopy;
2. Shrubs should form no more than 20% of ground cover.

B. Trees:

1. Existing trees can be retained.
2. Tree canopy cover should be less than 30%; and
3. Canopies should be separated by 2 to 5m.

Grass (throughout the entire asset protection zone)

Grass should be kept mown (as a guide grass should be kept to no more than 100mm in height); and leaves and vegetation debris should be removed.

12.0 APPENDIX 2.0 – METHOD 2 DETAILED FIRE MODEL



NBC Bushfire Attack Assessment Report V4.1

AS3959 (2018) Appendix B - Detailed Method 2

Print Date: 26/05/2024

Assessment Date: 25/05/2024

Site Street Address: 2 Chiswick Way, Thornton
 Assessor: Phillip Couch; Newcastle Bushfire Consulting
 Local Government Area: Maitland Alpine Area: No

Equations Used

Transmissivity: Fuss and Hammins, 2002
 Flame Length: RFS PBP, 2001/Vesta/Catchpole
 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: Southern Forest Unit 1

Vegetation Information

Vegetation Type: Hunter Macleay DSF
 Vegetation Group: Dry Sclerophyll Forests (Shrub/Grass)
 Vegetation Slope: 4 Degrees Vegetation Slope Type: Downslope
 Surface Fuel Load(t/ha): 14 Overall Fuel Load(t/ha): 24.6
 Vegetation Height(m): 0.9 Only Applicable to Shrub/Scrub and Vesta

Site Information

Site Slope: 4 Degrees Site Slope Type: Downslope
 Elevation of Receiver(m): 4 APZ/Separation(m): 25

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: 106

Program Outputs

Level of Construction: BAL 29 Peak Elevation of Receiver(m): 6.86
 Radiant Heat(kW/m2): 21.26 Flame Angle (degrees): 69
 Flame Length(m): 18.21 Maximum View Factor: 0.339
 Rate Of Spread (km/h): 2.35 Inner Protection Area(m): 20
 Transmissivity: 0.826 Outer Protection Area(m): 5
 Fire Intensity(kW/m): 29828

Run Description:	Southern Forest Unit 2		
<u>Vegetation Information</u>			
Vegetation Type:	Hunter Macleay DSF		
Vegetation Group:	Dry Sclerophyll Forests (Shrub/Grass)		
Vegetation Slope:	4 Degrees	Vegetation Slope Type:	Downslope
Surface Fuel Load(t/ha):	14	Overall Fuel Load(t/ha):	24.6
Vegetation Height(m):	0.9	Only Applicable to Shrub/Scrub and Vesta	
<u>Site Information</u>			
Site Slope:	4 Degrees	Site Slope Type:	Downslope
Elevation of Receiver(m):	4	APZ/Separation(m):	36
<u>Fire Inputs</u>			
Veg./Flame Width(m):	100	Flame Temp(K):	1090
<u>Calculation Parameters</u>			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg)	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	106
<u>Program Outputs</u>			
Level of Construction:	BAL 19	Peak Elevation of Receiver(m):	6.32
Radiant Heat(kW/m2):	13.69	Flame Angle (degrees):	76
Flame Length(m):	18.21	Maximum View Factor:	0.226
Rate Of Spread (km/h):	2.35	Inner Protection Area(m):	29
Transmissivity:	0.796	Outer Protection Area(m):	7
Fire Intensity(kW/m):	29828		
<hr/>			
Run Description:	Southern Forest Unit 3		
<u>Vegetation Information</u>			
Vegetation Type:	Hunter Macleay DSF		
Vegetation Group:	Dry Sclerophyll Forests (Shrub/Grass)		
Vegetation Slope:	4 Degrees	Vegetation Slope Type:	Downslope
Surface Fuel Load(t/ha):	14	Overall Fuel Load(t/ha):	24.6
Vegetation Height(m):	0.9	Only Applicable to Shrub/Scrub and Vesta	
<u>Site Information</u>			
Site Slope:	4 Degrees	Site Slope Type:	Downslope
Elevation of Receiver(m):	4	APZ/Separation(m):	49
<u>Fire Inputs</u>			
Veg./Flame Width(m):	100	Flame Temp(K):	1090
<u>Calculation Parameters</u>			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg)	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	106
<u>Program Outputs</u>			
Level of Construction:	BAL 12.5	Peak Elevation of Receiver(m):	5.51
Radiant Heat(kW/m2):	8.96	Flame Angle (degrees):	79
Flame Length(m):	18.21	Maximum View Factor:	0.153
Rate Of Spread (km/h):	2.35	Inner Protection Area(m):	40
Transmissivity:	0.772	Outer Protection Area(m):	9
Fire Intensity(kW/m):	29828		

13.0 REFERENCES AND DISCLAIMER

References

Standards Australia AS3959 (2018) Construction of buildings in bushfire-prone areas.

Keith D. "Ocean Shores to Desert Dunes", Department of Environment and Conservation, Sydney, (2004).

Environmental Planning and Assessment Act 1979.

New South Wales Rural Fire Service Planning for Bush Fire Protection (2019).

Disclaimer

Despite the recommendations in this report, it is impossible to remove the risk of fire damage to the building entirely. This report assesses and provides recommendations to reduce that risk to a manageable level. It is of paramount importance that the recommendations are adhered to for the life of the structure and that all maintenance is performed to ensure a level of protection is provided to the building, occupants and firefighters.

Planning for Bush Fire Protection (2019) states that notwithstanding the precautions adopted, it should always be remembered that bushfires burn under a wide range of conditions and an element of risk, no matter how small, always remains.

AS3959 (2018) Construction of buildings in bushfire-prone areas states that the standard is designed to lessen the risk of damage to buildings occurring in the event of the onslaught of bushfire. There can be no guarantee, because of the variable nature of bushfires, that any one building will withstand bushfire attack on every occasion. External combustible cladding is not recommended.