BUSHFIRE ASSESSMENT

PROPOSED LAND REZONING PROPOSAL

128 Munibung Road, Boolaroo
Part Lot 1006 DP 1270101

Date: **6/6/2022**

Prepared for: **Weemala North Estate**
Greencapital Aust Pty Ltd

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

Accreditation No. BPAD16132

Signature

Date 6/6/2022

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Bushfire and Building Sustainability Consultants

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1.0 EXECUTIVE SUMMARY AND COMPLIANCE TABLES

This report has assessed the land rezoning proposal against the requirements of Section 9.1(2) of the Environmental Planning and Assessment Act 1979 and Planning for Bush Fire Protection 2019.

This report establishes that the development is capable of complying with the objectives of Planning for Bush Fire Protection 2019.

TABLE 1 – PROPERTY DETAILS AND TYPE OF PROPOSAL

Applicant Name	Weemala North Estate Greencapital Aust Pty Ltd		
Site Address	128 Munibung Road, Boolaroo	**Lot/Sec/DP**	Part Lot 1006 DP 1270101
Local Government Area	Lake Macquarie	**FDI**	100
Bushfire Prone Land	Yes, mapped bushfire prone land		
Type of development	Land rezoning proposal	**Type of Area**	Urban/Bushland Interface
Special Fire Protection Purpose	No	**Flame Temperature**	1090K
Application Complies with Acceptable Solutions	Yes. Relevant specifications and requirements are satisfied	**Referral to NSW Rural Fire Service (NSW RFS) required**	No

TABLE 2 – BUSHFIRE THREAT ASSESSMENT

	North	**East**	**South**	**South**
Vegetation Structure	Managed Land – Existing Approved Subdivision	Woodland	Managed Land – Existing Approved Subdivision	Managed Land – Existing Approved Subdivision
Asset Protection Zone	140 metres	12 metres	140 metres	140 metres
Slope Range	N/A	Level/Upslope	N/A	N/A
PBP (2019) Table A1.12.2 Minimum Setbacks	N/A	12 metres	N/A	N/A
AS3959 (2018) Bushfire Attack Level (BAL)	BAL-LOW	BAL-29	BAL-LOW	BAL-LOW

2.0 INTRODUCTION

2.1 PURPOSE OF REPORT

The purpose of this report is to establish the suitability of the proposed development and risk to surrounding development for the land rezoning proposal of 128 Munibung Road, Boolaroo Part Lot 1006 DP 1270101.

The recommendations within this report address the aims and objectives of Planning for Bush Fire Protection 2019 to reduce the risk of ignition of surrounding developed land in a bushfire event and provide an environment for future residents and emergency services that complies with community accepted risk.

2.2 PROPOSED DEVELOPMENT

The proposed development includes the rezoning of C2: Environmental Conservation land to R2: Low Density Residential. Approximately 20 residential properties are proposed, all less than 1000m2 in size.

It is noted the majority of Lot 1006 DP 1270101 is zoned R2: Low Density Residential with the adjacent multi-lot residential subdivision DA/1522/2020 approved on 5/2/2021. The land subject to rezoning interfaces the approved subdivision and intends to expand the existing subdivision and road network.

2.3 LEGISLATIVE REQUIREMENTS

Environmental Planning and Assessment Act 1979

Section 9.1(2) of the Environmental Planning and Assessment Act 1979 issues directions to be followed when considering rezoning. Direction 4.4, Planning for Bushfire Protection identifies matters for consideration for planning proposals that will affect, or are in proximity to, land mapped as bush fire prone. Under these directions, draft LEPs should follow the below objectives:

i. to protect life, property and the environment from bush fire, by discouraging the establishment of incompatible land uses in bush fire prone areas; and
ii. to encourage sound management of bush fire prone areas.

Under Direction 4.4, a relevant authority must consult with the Commissioner of the NSW RFS during the preparation of a draft LEP and take into account any comments made. The draft LEP shall also have regard to Planning for Bush Fire Protection 2019.

This document forms the submission for the rezoning identifying the suitability of the proposal in relation to bushfire.

Planning for Bush Fire Protection 2019

Planning for Bush Fire Protection 2019 was developed by the NSW Rural Fire Service to provide development standards for building in bush fire prone areas in NSW. It provides for the protection of human life and helps to minimise the impacts on property from the threat of bush fire. Examination of Planning for Bush Fire Protection 2019 Section 4.4 Local Environmental Plans is made in Table 3 below:

TABLE 3 – PLANNING FOR BUSH FIRE PROTECTION 2019 COMPLIANCE SECTION 4.4.1 CONSIDERATION OF BUSH FIRE ISSUES

Performance Criteria	Objective
Suitable Land Uses	To protect life, property and the environment from bush fire, by discouraging the establishment of incompatible land uses in bush fire prone areas
Compliance: The subject rezoning land interfaces an existing residential subdivision which was recently approved. Despite being zoned C2 the vegetation is highly disturbed and can be reduced to comply with an asset protection zone with minimal clearing. There is potential to comply with minimum subdivision setbacks of Planning for Bush Fire Protection (2019).	
Land Management	To encourage sound management of bush fire prone areas.
Compliance: The subject rezoning land is predominantly exposed mineral earth, with scattered clumps of grass and short heath. The surrounding land within the subject site is predominantly grass and exposed mineral earth for the immediate 200 metres. C2 zoned land extends east of the site with grassland being the current dominant vegetation. The grassland has been assessed as woodland following discussions with NSW RFS which include consideration of revegetation within C2 zoned land. The rezoning of the land will allow the subject land to be managed as an asset protection zone and reduce the interface to the grassland threat or potential future revegetated woodland. Regrading the rezoning land and surrounding lands will improve access and manageability of asset protection zones.	
Private and or Public Road Infrastructure	Provision of safe access and egress to emergency service personnel and the public.
Compliance: The rezoning of the subject land will allow a reduced perimeter of residential development/ allow a shorter perimeter road. The zoning change will improve the proposed public road infrastructure by allowing widescale regrading and is deemed adequate to fight fire due to the narrow arm of vegetation.	

Strategic Planning Considerations	Strategic Nature of the Development
Compliance: The subject land is approximately 1.6 hectares in area and interfaces an existing approved 182 lot residential subdivision. A Strategic Bushfire Study has been prepared for the development and is incorporated into this report.	

3.0 BUSHFIRE ATTACK ASSESSMENT

3.1 VEGETATION CLASSIFICATION

Potential bushfire hazards were identified from Lake Macquarie Council's 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 Keith (2004) to derive vegetation structures listed in Planning for Bush Fire Protection 2019.

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

PHOTOGRAPH 1 – SUBJECT LAND LOOKING SOUTH

View of the subject rezoning land looking south. The site is predominantly grassland and exposed mineral earth.

3.2 EFFECTIVE SLOPE

Effective Slope was measured using 0.5-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 BUSHFIRE ATTACK LEVELS

BALs and relevant construction levels in accordance with Planning for Bush Fire Protection 2019 have been demonstrated in Section 1 Executive Summary and Compliance Tables.

PHOTOGRAPH 2 – NORTHERN GRASSLAND AND WOODLAND

View of grassland located north and east of the site. A small cluster of Angophoras can be seen in the distance with the eastern vegetation and Angophoras conservatively assessed as woodland in the event that revegetation occurs.

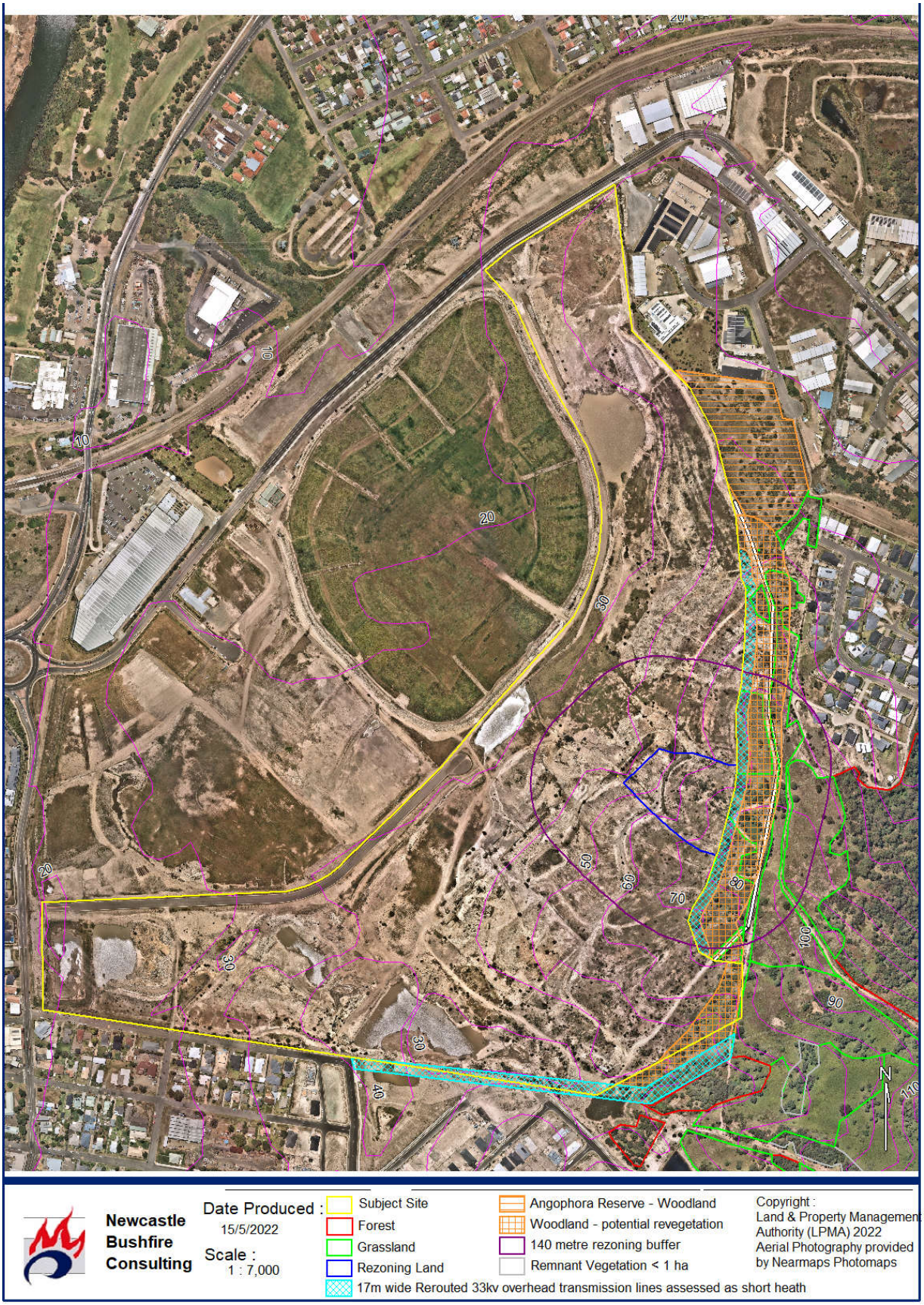

FIGURE 1 – SITE CONSTRAINTS MAP

FIGURE 2 – LOCALITY MAP
Courtesy of OpenStreetMap

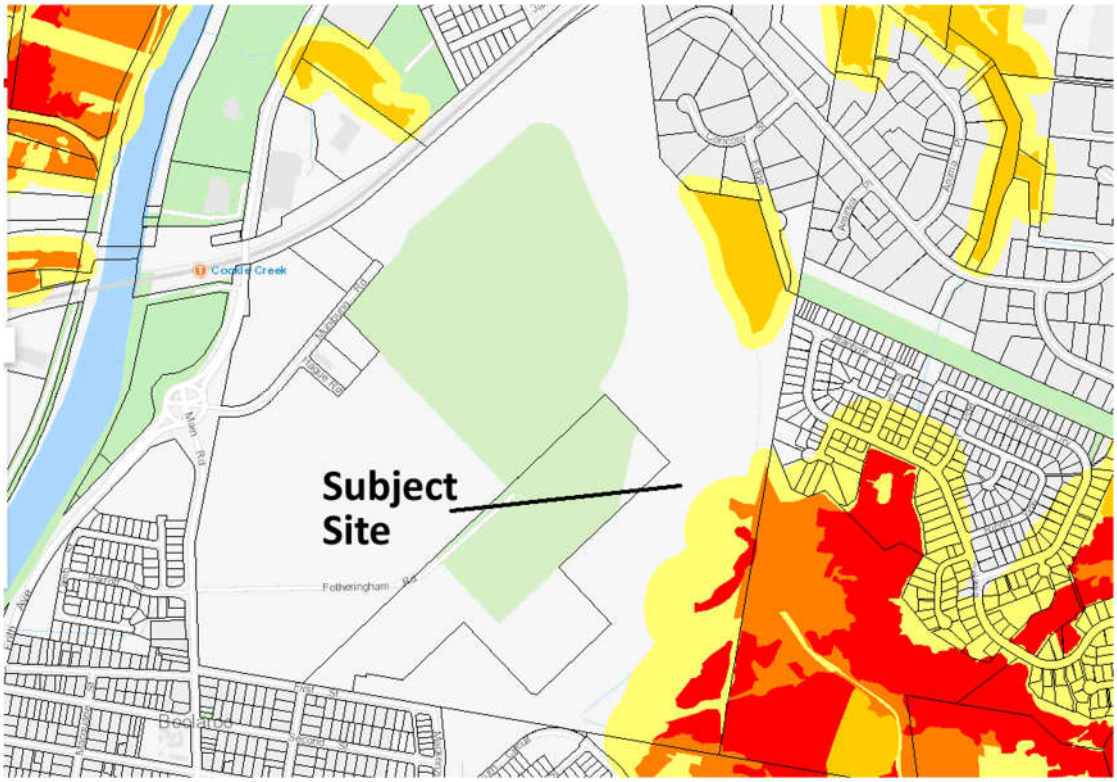

FIGURE 3 – COUNCIL'S BUSHFIRE PRONE LAND MAP

PHOTOGRAPH 3 – EASTERN GRASSLAND

View of unmanaged grassland located east of the proposed development. An access trail divides the grassland with the land planned to incorporate walking trails in the future. The vegetation is not mapped as a bushfire threat but has been considered as woodland in the event that revegetation occurs.

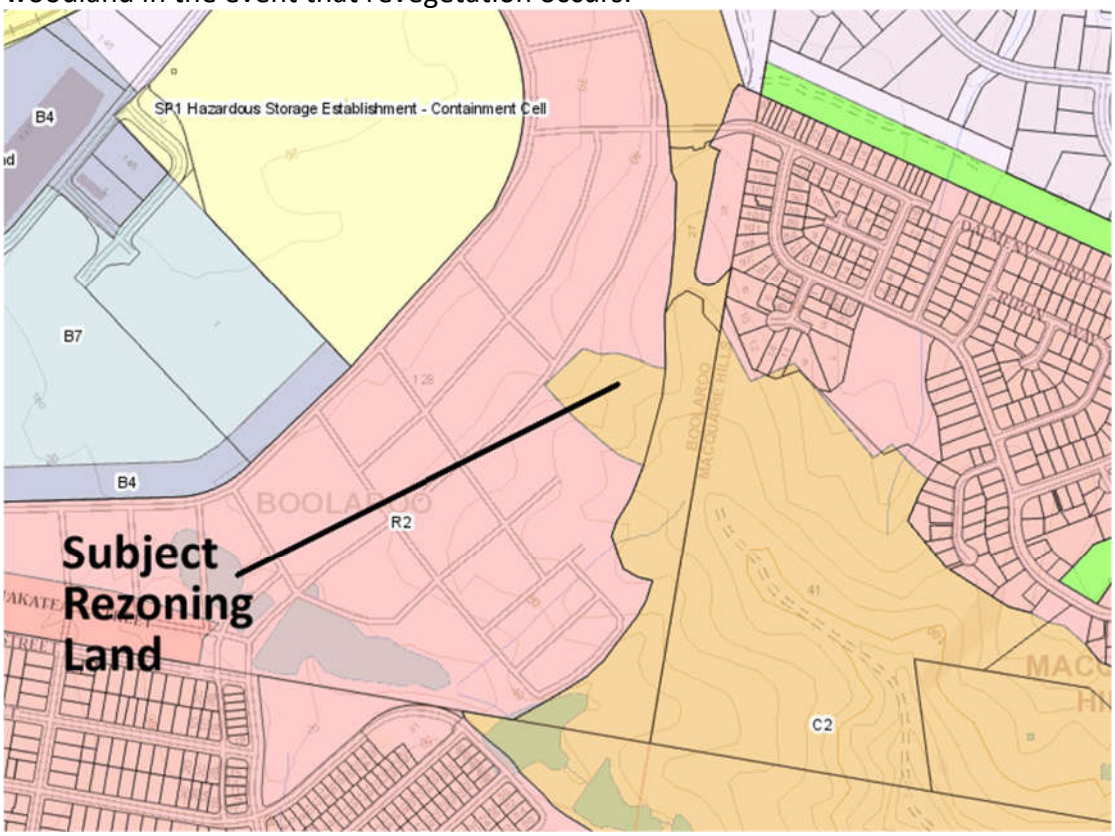

FIGURE 4 – CURRENT ZONING MAP

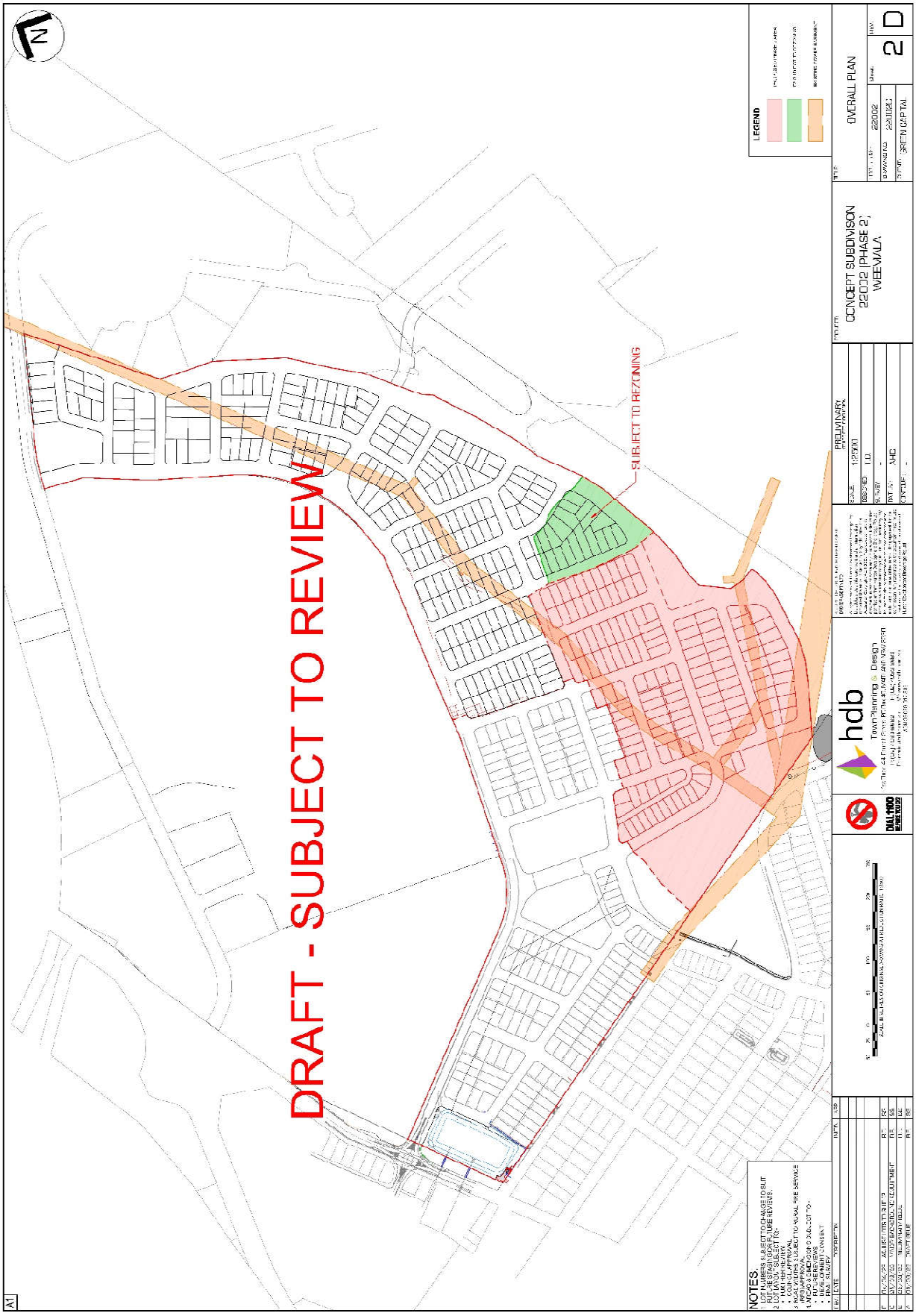

FIGURE 5 – DRAFT POTENTIAL LOT LAYOUT FOR REZONED LAND

4.0 LANDSCAPING MAINTENANCE

Future residential development shall have asset protection zones and landscaping maintenance imposed on the development as part of the development approval in accordance with Planning for Bush Fire Protection (2019) Appendix 4 or legislation current at time of approval.

5.0 BUSHFIRE PROTECTION MEASURES

Bushfire protection measures described in Planning for Bush Fire Protection 2019 aim to minimise the risks from bushfire and ensure that the aims and objectives of Planning for Bush Fire Protection 2019 are met. The following key bushfire protection measures have been addressed in this assessment:

- Asset Protection Zones (APZs)
- Water supplies
- Infrastructure (including access road provisions and other services)
- Landscape management and garden design principles.

In addition to the above a Bushfire Strategic Study has been completed in section 8.0.

6.0 BUSHFIRE STRATEGIC STUDY

Planning for Bush Fire Protection 2019 table 4.2.1 has been used to complete a Bushfire Strategic Study for the proposed rezoning.

6.1 BUSHFIRE LANDSCAPE ASSESSMENT

The bushfire landscape assessment considers the likelihood of a bushfire, its potential severity and intensity and the potential impact on life and property in the context of the broader surrounding landscape.

Bushfire Hazard

The subject site is located within a wider area of Bush Fire Prone Land (Figure 3) which extends to the north and east of the site. A large conflagration could occur to the northwest and west of the site however the nearest forest is located 1.5 kilometres from the site, with a river and significant development located between the subject site and the bushland. An arm of bushland will be retained, over 140 metres south of the subject site, within the adjacent subdivision development. The primary threat to the subject land is the eastern forest located 140 metres to the east where a high intensity forest fire could occur.

Vegetation

Vegetation within the subject site includes clusters of unmanaged grassland with large expanses of exposed mineral earth. A small number of taller shrubs and scattered trees are located east of the site however the dominant vegetation structure is currently grassland.

The eastern vegetation is located adjacent to existing approved residential development to the northeast with access to fight fire. The vegetation between the eastern forest and the subject land includes an expanse of grassland and C2 zoned land that presently offers limited bushfire threat, however it has been conservatively assessed as woodland in the event that revegetation occurs in the future. The assessment of woodland was made following discussions of conservative vegetation structure regeneration with New South Wales Rural Fire Service officer Garth Bladwell.

The forest located 140 metres east of the subject site is approximately 24.86 hectares in size. This classification of forest is identified within the NSW vegetation formations version 3.0 mapping as Hunter-Macleay Dry Sclerophyll Forest with this representing a significant redundancy in fuel load from Planning for Bush Fire Protection (2019) generic forest fuel loads.

Grass fire threat is the primary risk to the subject site at present, with the vegetation potentially able to regenerate to woodland.

It is noted a walkway is planned to be constructed within the land located east of the site, based on Lake Macquarie City Council Munibung Hill Management Plan.

Topography

There is a steep upslope from the subject site, with the eastern land forming a ridge and more gradual slope. Slopes have been summarised using a strategic 5-degree increment slope region illustrated in Figure 6 Topography Analysis. The topography analysis is focused on effective slope within the bushland. 10-metre slope contours are also provided to illustrate that the site is largely located below the line of the vegetation.

Weather

Planning for Bush Fire Protection 2019 identifies the Hunter Region to have a Forest Fire Danger Index (FFDI) Classification of 100. Douglas et al. (2014) defines forest fire dangers using Extreme Value Analysis in Determining Annual Probability of Exceedance for Bushfire Protection Design. Fire weather projections for the Hunter region based on Williamtown weather data are detailed below.

Extreme Value Analysis – year event	**FFDI**
1 in 50-year event	106
1 in 100-year event	116

The proximity to the lake and river will result in a reduced FFDI.

FIGURE 6 – TOPOGRAPHY ANALYSIS

Potential Fire Behaviour

High fire intensities could occur in the eastern vegetation with fast moving grassfire being the primary threat at present. With regeneration to woodland the fire would be slower moving due to the tree canopy reducing wind spread, however it will result in higher intensity fire with longer flames.

Potential high intensity fire runs into the site are limited to the eastern forest located a distance away, however lofted ember attack could occur from the vegetation kilometres west of the site. Future vegetation will have the potential to burn at higher intensities, however the management of walking trails and the rerouted electrical transmission lines will represent permanent fire breaks. The site benefits from a perimeter road that will provide potential fire control lines, which will help mitigate the landscape-wide fire risk. The proposed perimeter road access will support fire suppression activities.

Given the infrequent burning to the east, the site is at risk of higher intensity bushfire in most years, however a senescence state has occurred within the bushland. Any prescribed burning may offer benefit for 5 to 7 years, however after that period fuel loads may increase to exceed current fuel loads.

The Angophora Reserve to the north of the site offers limited potential for sustained canopy fire and fire intensity in its current form, with ongoing management expected via a vegetation management plan.

Planning for Bush Fire Protection (2019) acceptable solutions for bushfire protection measures are deemed conservative for the adjacent vegetation and is deemed a reasonable level of community level of safety in describing the landscape fire behaviour potential.

Wildfire History

The adjacent vegetation is identified as long unburnt, with no prescribed burn or larger mapped fire having occurred in recent years. The nearest wildfire occurred in 2002 being the Killingworth Fire, which burnt to within 2.95 kilometres of the subject site.

The Central Coast Bush Fire Risk Management Plan identifies there are on average 843 bush and grass fire incidents per year, of which 6 to 8 on average per year can be considered to be major fires.

The main sources of ignition in the Central Coast Bush Fire Management Committee area are:

- Illegal burning activity
- Escapes from legal burning
- Arson & Incendiarism
- Ignition of abandoned/stolen motor vehicles
- Lightning
- Arching electrical power lines

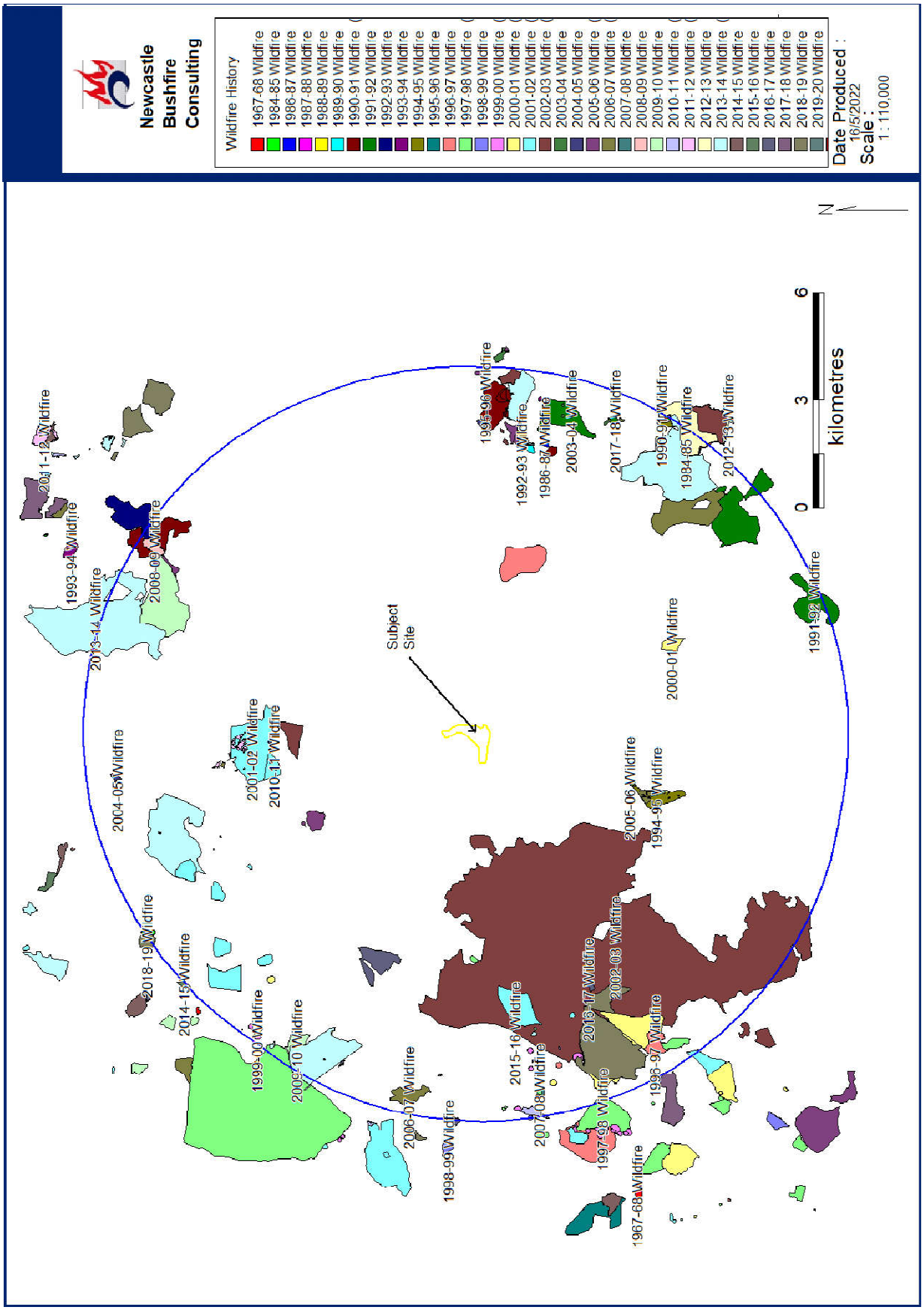

FIGURE 7 – WILDFIRE HISTORY

6.2 LAND USE ASSESSMENT

Residential development and perimeter roads of the proposed development will provide a more resilient design, improved public road access and reduced interface to the bushland than the existing approved residential subdivision.

The site will interconnect into a recently approved residential subdivision which complies with Planning for Bush Fire Protection (2019). To the south and to the northeast of the adjacent subdivision are existing residential subdivisions designed in accordance with Planning for Bush Fire Protection (2006). Commercial development extends north of the site.

The proposed rezoning to residential is in sympathy with the surrounding development and will reduce the risk profile of the western adjacent subdivision.

Land Use Zones and Permitted Uses
The proposed rezoning is to Zone R2 Low Density Residential.

1. Objectives of zone
- To provide for the housing needs of the community within a low-density residential environment.
- To enable other land uses that provide facilities or services to meet the day-to-day needs of residents.
- To encourage development that is sympathetic to the scenic, aesthetic and cultural heritage qualities of the built and natural environment.

2. Permitted without consent
Home-based childcare; Home occupations.

3. Permitted with consent
Bed and breakfast accommodation; Boarding houses; Boat sheds; Building identification signs; Business identification signs; Centre-based childcare facilities; Community facilities; Dual occupancies; Dwelling houses; Emergency services facilities; Environmental facilities; Environmental protection works; Exhibition homes; Exhibition villages; Flood mitigation works; Group homes; Health consulting rooms; Home businesses; Home industries; Hostels; Kiosks; Neighbourhood shops; Oyster aquaculture; Places of public worship; Pond-based aquaculture; Recreation areas; Respite day care centres; Roads; Secondary dwellings; Semi-detached dwellings; Seniors housing; Sewage reticulation systems; Sewage treatment plants; Shop top housing; Tank-based aquaculture; Water recreation structures; Water recycling facilities; Water supply systems.

4. Prohibited
Any other development not specified in item 2 or 3.

Due to the size and shapes of the proposed allotments, the expected land use will be for residential dwelling development. Any special fire protection purpose development will need to comply with the minimum requirements of Planning for Bush Fire Protection (2019).

Asset Protection Zones and Siting
The subject site is located downhill from the eastern bushland with a slight upslope from the site extending east.

Planning for Bush Fire Protection (2019) asset protection zones defined in table A1.12.2 can be achieved without any easements located off site.

Potential fire behaviour for 1 in 50-year and 1 in 100 fire weather event with consideration of woodland is summarised below:

	FDI 100	**FDI 106**	**FDI 116**
Planning for Bush Fire Protection 2019 Woodland Minimum distance (< 29 kw/m2)	12 metres	13 metres	14 metres

The above distances will be encompassed within the perimeter road reserve. The 17-metre wide rerouted 33kv overhead transmission lines will offer further significant setback to future dwellings from the bushland.

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.

Planning for Bush Fire Protection (2019) acceptable solutions for minimum setbacks can be achieved within the subdivision, as can conservative fire weather modelling of minimum setbacks based on radiant heat exposures of less than 29 kw/m2.

6.3 ACCESS AND EGRESS

The existing adjacent approved subdivision is predominantly accessed by Fotheringham Road with interconnection to the public road to the north and west. The key access routes are to the north and west. The proposed rezoning will allow the extension of the perimeter road along the eastern boundary of the site, rather than surround part of the site with cul-de-sac heads provided off Stidoplph Close and Moon Close.

Figure 5 draft layout plan illustrates a draft design for future residential subdivision. The development offers full compliance with the acceptable solutions of Planning for

Bush Fire Protection (2019) Table 5.3b. The site interfaces an existing subdivision approved under current legislation and will be an extension of that legislation.

Approved residential subdivisions extend north and west of the subject site, with a reduction in the potential for the public road to become isolated as the road extends away from the bushland. There are no pinch points surrounded by bushland where the primary access roads in the adjacent subdivision connect into the primary road network.

Due to the size of the adjacent subdivision, Planning for Bush Fire Protection (2019) Table 5.3b has been applied to roads located only on bushfire prone land and the primary access roads through the subdivision. The public road network of the adjacent subdivision is illustrated in Figure 8 Road Network of Adjacent Subdivision.

The proposed public road network is deemed adequate to handle increased volumes of traffic in the event of a bushfire emergency.

ACCESS (GENERAL REQUIREMENTS)	
Firefighting vehicles are provided with safe, all-weather access to structures.	Property access roads are two-wheel drive, all-weather roads; Perimeter roads are provided for residential subdivisions of three or more allotments; Subdivisions of three or more allotments have more than one access in and out of the development; Traffic management devices are constructed to not prohibit access by emergency service vehicles; Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient; All roads are through-roads; Dead end roads are not recommended, but if unavoidable, are not more than 200 metres in length, incorporate a minimum 12-metre outer radius turning circle, and are clearly sign posted as a dead end; Where kerb and guttering is provided on perimeter roads, roll top kerbing should be used to the hazard side of the road; Where access/egress can only be achieved through forest, woodland and heath vegetation, secondary access shall be provided to an alternate point on the existing public road system; and One-way only public access roads are no less than 3.5 metres wide and have designated parking bays with hydrants located outside of these areas to ensure accessibility to reticulated water for fire suppression.

Compliance: The development can offer full compliance.	
The capacity of access roads is adequate for firefighting vehicles.	The capacity of perimeter and non-perimeter road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges/causeways are to clearly indicate load rating.
Compliance: The development can offer full compliance.	
There is appropriate access to water supply.	Hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression; Hydrants are provided in accordance with the relevant clauses of AS2419.1 (2005) - Fire hydrant Installations - System design, installation and commissioning; and There is suitable access for a Category 1 fire appliance to within 4 metres of the static water supply where no reticulated supply is available.
Compliance: The development can offer full compliance.	
PERIMETER ROADS	
Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating, as well as providing a safe operational environment for emergency service personnel during firefighting and emergency management on the interface.	Are two-way sealed roads; Minimum 8-metre carriageway width kerb to kerb; Parking is provided outside of the carriageway width; Hydrants are located clear of parking areas; Are through-roads, and these are linked to the internal road system at an interval of no greater than 500 metres; Curves of roads have a minimum inner radius of 6 metres; The maximum grade road is 15 degrees and average grade of not more than 10 degrees; The road crossfall does not exceed 3 degrees; and A minimum vertical clearance of 4 metres to any overhanging obstructions, including tree branches, is provided.
Compliance: The proposed development will extend and connect into the existing perimeter road.	

NON-PERIMETER ROADS	
Access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating.	Minimum 5.5-metre carriageway width kerb to kerb; Parking is provided outside of the carriageway width; Hydrants are located clear of parking areas; Roads are through-roads and are linked to the internal road system at an interval of no greater than 500 metres; Curves of roads have a minimum inner radius of 6 metres; The road crossfall does not exceed 3 degrees; and A minimum vertical clearance of 4 metres to any overhanging obstructions, including tree branches, is provided.
Compliance: The development can offer full compliance.	

6.4 EMERGENCY SERVICES

The proposed development increases dwellings density on Bush Fire Prone Land, however it offers full compliance with Planning for Bush Fire Protection (2019), including defendable space. The development reduces the firefighting interface of the existing adjacent subdivision.

There are two RFS brigades within 5 kilometres and 10 minutes travel time of the Site:
- Fire and Rescue NSW Cardiff Fire Station, 18 Taylor St, Cardiff NSW 2285
- Fire and Rescue NSW Teralba Fire Station, 54 William St, Teralba NSW 2284.

The 20 additional residential properties are a small number in the surrounding two residential subdivisions that exceed 100 properties. The 20 additional properties are not expected to lead to a requirement for additional fire stations or brigades.

There are no expected limitations on the ability of emergency services to carry out fire suppression in a bushfire emergency.

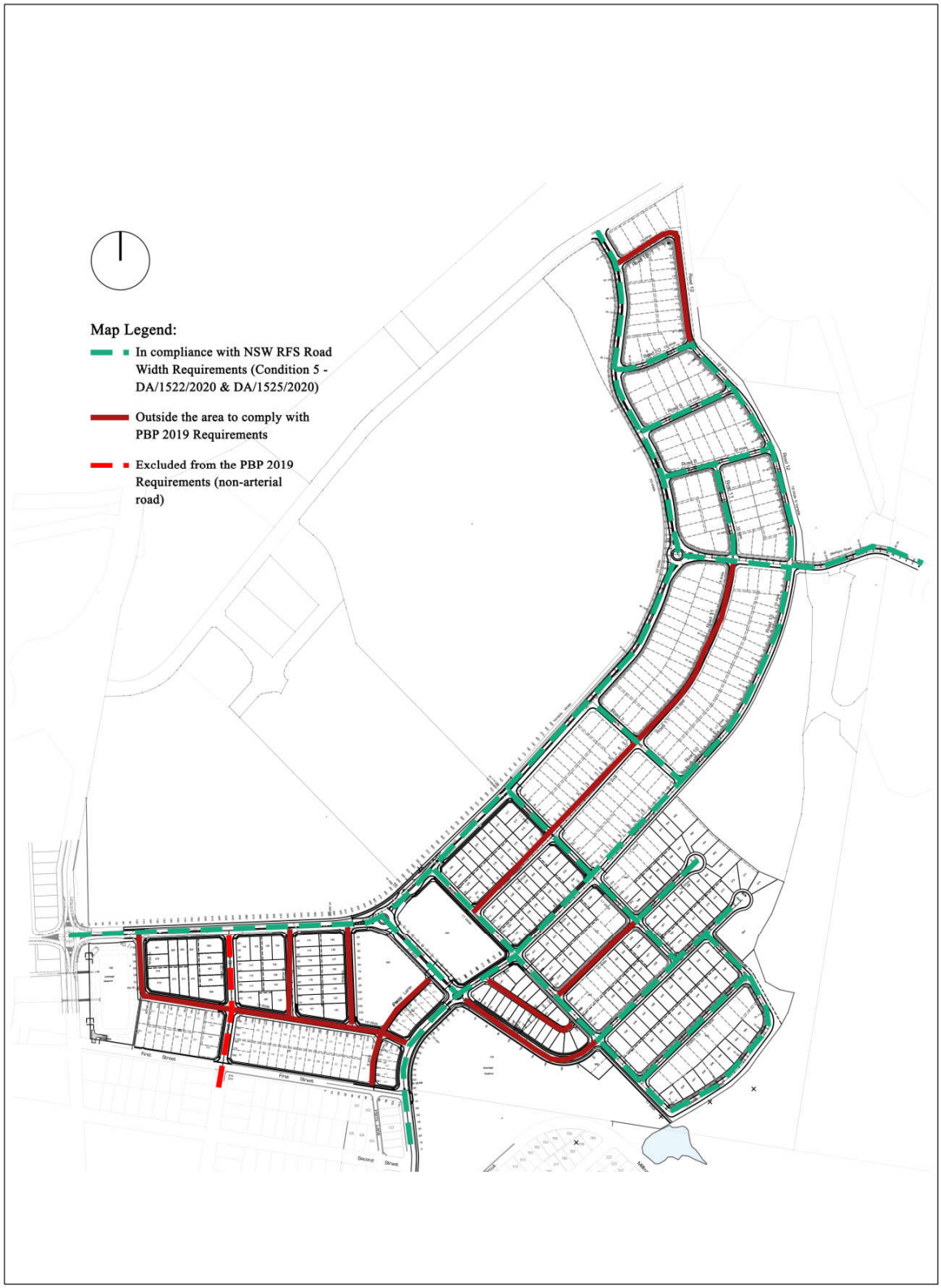

FIGURE 8 – PRIMARY ROAD NETWORK OF ADJACENT APPROVED SUBDIVISION

6.5 INFRASTRUCTURE

The reticulated water supply will extend from the adjacent residential subdivision and will be designed in accordance with AS2419.1. The rezoning of the subject site will allow a more strategic firefighting water supply design by the hydraulic engineer; water pressure and hydrant spacing with which to be complied.

The perimeter road surrounding the site and the adjacent approved subdivision will improve fire appliance access to hydrants.

The electrical transmission supply for the proposed adjacent subdivision and within the development, will be located underground. The applicant has initiated efforts to reroute overhead 33Kv transmission lines to the east of the site. The current transmission lines zig zag through the development, whereas the proposed rerouting would improve access for management and would represent a fire break from trees if revegetation occurs.

There has not been a decision on whether there will be a gas supply connected to the development. The compliance for any gas services (reticulated or bottled gas) shall comply with Planning for Bush Fire Protection (2019) Section 5.3.4.

6.6 ADJOINING LAND

Future development will not be reliant on any off-site bushfire mitigation measures. Asset protection zones are achieved entirely within the subject site and perimeter road.

All buildings and future uses will be designed to be resilient to the appropriate bushfire attack level, with the proposed development benefitting future residential development and improving firefighting access.

The bushfire protection measures for the development will be achieved through compliant planning and design.

The Central Coast Bushfire Management Committee identifies the subject and surrounding land to be a low risk, unlikely to be affected by fire with a moderate consequence. It is noted the bushfire management plan identifies the land to be commercial, with human settlement being a better description of the future land use.

7.0 CONCLUSION

Based upon an assessment of the plans and information received for the proposal, the proposed rezoning for the subject site is deemed to comply with the acceptable solutions. The rezoning and future residential subdivision will lead to a better bushfire outcome, by benefitting the existing approved residential subdivision, through the installation of a perimeter road around the entire subdivision and a reduction in residential development interfacing a bushland hazard. The proposed development offers compliance with the intent of Planning for Bush Fire Protection 2019 and has considered future fire weather and increased bushfire attack.

8.0 APPENDIX 1.0 – ASSET PROTECTION ZONES SUMMARY

Below is a summary of asset protection zones (APZ) outlined in Planning for Bush Fire Protection 2019 Appendix 4 and the NSW RFS's Standards for Asset Protection Zones. The property owner(s) should obtain these two documents and familiarise themselves with their content.

Generally
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 IPA. Refer to the plans for locations of APZ and distances from assets.

IPA
The IPA 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. Shrubs must be located away from a building's glazing and vent openings.
2. Avoid planting around entryways if the vegetation is flammable.
3. A maximum 20% of the IPA may contain shrubs.
4. A minimum 1.5 metre separation of shrubby vegetation from the building shall be maintained.
5. Shrubs must not have a connection with the tree canopy layer; remove/trim shrubs or underprune trees.
6. Ensure turf is suitably mown and/or grasslands are continually slashed to restrict to maximum 100 millimetres high.

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

1. Trees are allowed in the IPA however they should not touch or overhang buildings. No tree should be within 2 metres of the roofline.
2. Underprune branches between the shrub layer and the canopy layer.
3. Ensure branches do not overhang buildings.
4. Ensure all trees in the IPA within 3 metres of buildings do not provide a serious fire threat.
5. Trees should have lower limbs removed up to a height of 2 metres above the ground.

OPA
The 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. Reduce or trim large stands of shrubs.

B. Trees:

1. Existing trees can be retained.
2. Ensure a separation is available between shrubs and tree canopy.
3. Reduce tree canopy so there is no interlocking canopy.

9.0 APPENDIX 2.0 – AS 3959 2018 METHOD 2 DETAILED FIRE MODEL

NBC Bushfire Attack Assessment Report V4.1

AS3959 (2018) Appendix B - Detailed Method 2

Print Date: 30/05/2022 **Assessment Date:** 15/05/2022

Site Street Address:	Weemala Strategic Bushfire Study, Boolaroo		
Assessor:	Phillip Couch; Newcastle Bushfire Consulting		
Local Government Area:	Lake Macquarie	**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:	Eastern Woodland FDI 100		
Vegetation Information			
Vegetation Type:	Grassy and Semi-Arid Woodland (including Mallee)		
Vegetation Group:	Forest and Woodland		
Vegetation Slope:	0 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	10.5	**Overall Fuel Load(t/ha):**	20.2
Vegetation Height(m):	2	Only Applicable to Shrub/Scrub and Vesta	
Site Information			
Site Slope:	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m):	Default	**APZ/Separation(m):**	12
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			
Level of Construction:	BAL 40	**Peak Elevation of Receiver(m):**	4.73
Radiant Heat(kW/m2):	29.01	**Flame Angle (degrees):**	63
Flame Length(m):	10.61	**Maximum View Factor:**	0.441
Rate Of Spread (km/h):	1.26	**Inner Protection Area(m):**	12
Transmissivity:	0.865	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	13150		

Note: the above setbacks are based on table A1.12.2 with NSW RFS expected to have rounded the radiant heat flux down to achieve BAL-29.

Run Description:	Eastern Woodland FDI 106		
Vegetation Information			
Vegetation Type:	Grassy and Semi-Arid Woodland (including Mallee)		
Vegetation Group:	Forest and Woodland		
Vegetation Slope:	0 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	10.5	**Overall Fuel Load(t/ha):**	20.2
Vegetation Height(m):	2	Only Applicable to Shrub/Scrub and Vesta	
Site Information			
Site Slope:	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m):	Default	**APZ/Separation(m):**	13
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):**	4.99
Radiant Heat(kW/m2):	27.87	**Flame Angle (degrees):**	64
Flame Length(m):	11.11	**Maximum View Factor:**	0.425
Rate Of Spread (km/h):	1.34	**Inner Protection Area(m):**	13
Transmissivity:	0.862	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	13939		

Run Description:	Eastern Woodland FDI 116		
Vegetation Information			
Vegetation Type:	Grassy and Semi-Arid Woodland (including Mallee)		
Vegetation Group:	Forest and Woodland		
Vegetation Slope:	0 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	10.5	**Overall Fuel Load(t/ha):**	20.2
Vegetation Height(m):	2	Only Applicable to Shrub/Scrub and Vesta	
Site Information			
Site Slope:	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m):	Default	**APZ/Separation(m):**	14
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:**	116
Program Outputs			
Level of Construction:	BAL 29	**Peak Elevation of Receiver(m):**	5.36
Radiant Heat(kW/m2):	27.67	**Flame Angle (degrees):**	64
Flame Length(m):	11.92	**Maximum View Factor:**	0.424
Rate Of Spread (km/h):	1.46	**Inner Protection Area(m):**	14
Transmissivity:	0.859	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	15254		

10.0 REFERENCES AND DISCLAIMER

References

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

Douglas G. He Y. Yang X. and Morris E.C. (2014) Use of Extreme Value Analysis in Determining Annual Probability of Exceedance for Bushfire Protection Design. Proceedings of the 11th International Association of Fire Science, Christchurch, New Zealand.

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.

This bushfire assessment is limited to the subject land only and does not provide comment on the suitability of existing approved development surrounding the site.