STRATEGIC BUSHFIRE STUDY

Monarch's Rise

Precinct 4 & Part of Precinct 1

Newline Road, Raymond Terrace

Prepared for McCloy Project Management Pty Ltd

Bushfire Planning Australia

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BPA Reference: 2165 Monarchs Rise SBS -P4

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Date: 5 November 2024

Disclaimer and Limitation

This report is prepared solely for the McCloy Project Management Pty Ltd (the 'Client') for the specific purposes of only for which it is supplied (the 'Purpose'). This report is not for the benefit of any other person; either directly or indirectly and is strictly limited to the purpose and the facts and matters stated in it and will not be used for any other application.

This report is based on the site conditions surveyed at the time the document was prepared. The assessment of the bushfire threat made in this report is made in good faith based on the information available to Bushfire Planning Australia at the time.

The recommendations contained in this report are considered to be minimum standards and they do not guarantee that a building or assets will not be damaged in a bushfire. In the making of these comments and recommendations it should be understood that the focus of this document is to minimise the threat and impact of a bushfire.

Finally, the implementation of the adopted measures and recommendations within this report will contribute to the amelioration of the potential impact of any bushfire upon the development, but they do not and cannot guarantee that the area will not be affected by bushfire at some time.

Document Status: 2165 - SBS Rezoning

Version	Status	Purpose	Author	Review Date
1	Draft	Draft for Review	Katrina Greville	14 October 2024
2	Draft	Draft for Client Review	Stuart Greville	21 October 2024
3	Final	Final for Submission	Stuart Greville	5 November 2024

Certification

As the author of this Strategic Bushfire Study (SBS), I certify this SBS provides the detailed information required by the NSW Rural Fire Service under Clause 45 of the Rural Fires Regulation 2022 and Appendix 1 of Planning for Bushfire Protection 2019 for the purposes of an application for a bush fire safety authority under section 100B(4) of the Rural Fires Act 1997.

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

Stuart Greville

Accredited Bushfire Practitioner

BPAD-26202

Date: 5 November 2024

In signing the above, I declare the report is true and accurate to the best of my knowledge at the time of issue.

Executive Summary

Bushfire Planning Australia (**BPA**) has been engaged by the McCloy Project Management Pty Ltd (the '**Client'**) to undertake a Strategic Bushfire Study (**SBS**) to support the planning proposal known as Monarch's Rise - Precinct 4 and part of Precinct 1 located at 587 Newline Road, Raymond Terrace (the **'subject site**'); legally known as Part of Lot 2 DP37430 and Part of Lot 32 DP554875. The planning proposal seeks to amend the Port Stephens Local Environmental Plan 2013 (**PSLEP**).

The SBS will address Ministerial Direction 4.3 and the RFS Planning for Bushfire Protection Guidelines 2019 (**PBP 2019**) to support the proposed part rezoning:

1. Align Zone MU1 - Mixed Use with the lot layout envisioned under the Concept Masterplan and DA Approval (DA16-2013-599-1);
2. Extend Zone MU1 - Mixed Use over land zoned C2 – Environmental Conservation (about 2,300m^2) adjoining Newline Road; and
3. Reduce the Minimum Lot Size of Zone MU1 Mixed Use from 400m^2 to 300m^2 to achieve housing diversity in and around the neighbourhood centre and park.

An assessment of the existing bushfire hazard was completed in accordance with Chapter 4 and Appendix 2 of the RFS document Planning for Bushfire Protection 2019 (**PBP 2019**).

The assessment of the landscape, vegetation and topography found the site is subject to a high bushfire hazard immediately to the north and east of the site. The primary hazard is consistent with a *forest* vegetation, namely Hunter Macleay Dry Sclerophyll Forest (**HMDSF**), which transitions from a *forested wetland*. Additionally, *grasslands* that exist immediately to the north and south of the development site will be managed as an inner protection area (**IPA**) whilst *grassland* beyond these areas (i.e. to the south and west) will remain unmanaged and assessed as a bushfire hazard. Approximately a 5-hectare area of pasture separating the northern and southern precincts will be revegetated in accordance with the approved Vegetation Management Plan (**VMP**) prepared by Restore Environmental Consultants in June 2024. The land adjoining the creekline will be rehabilitated consistent with a grassy *forest* formation; specifically a Hunter Macleay Dry Sclerophyll Forest.

The SBS concludes the proposed amendments to the PSLEP 2013 are considered appropriate for the site and the bushfire hazard can be successfully mitigated by applying the requirements of PBP 2019, such as a combination of temporary and permanent Asset Protection Zones.

The following recommendations have been designed to enable future development of the site subsequent to a successful rezoning to maintain an acceptable level of protection from the residual risk of a bushfire that may occur in the existing vegetation:

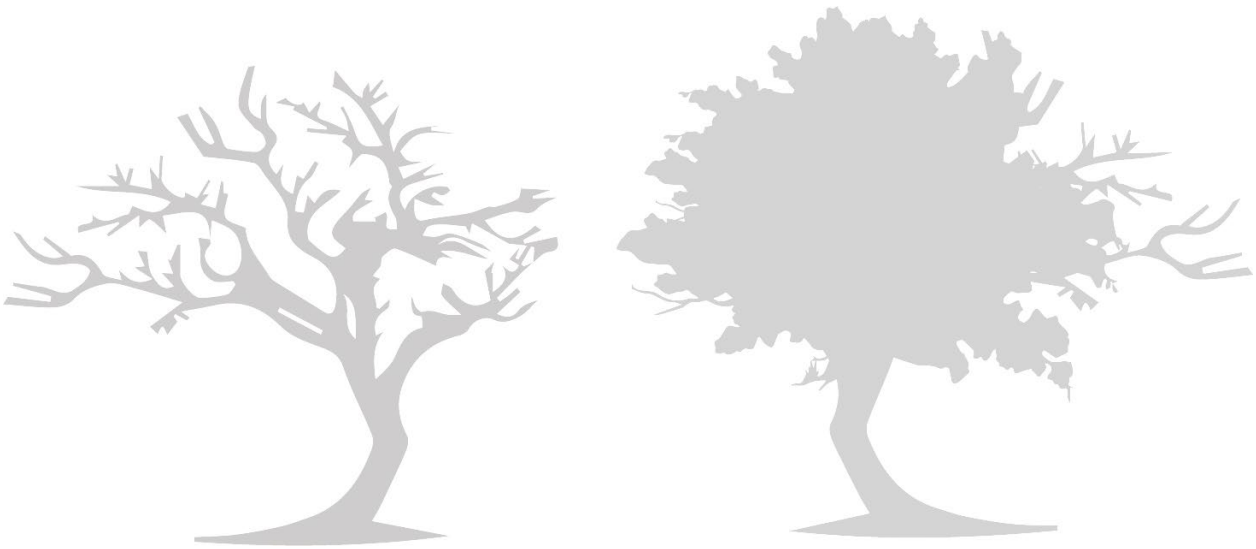
1. The entire site shall be managed as an Inner Protection Area (**IPA**) as outlined within Appendix 4 of PBP 2019 and the RFS document *Standards for asset protection zones*;
2. Access shall satisfy the Performance Criteria outlined in Table 5.3b of PBP 2019;
3. Vegetation within road verges (including swales) to be consistent with a grassland vegetation classification with tree canopy less than 10% at maturity (and considered unmanaged);
4. All future dwellings to be constructed on the proposed lots shall have due regard to the specific considerations given in the National Construction Code: Building Code of Australia (BCA) which makes specific reference to Australian Standard AS3959-2018 Construction of buildings in bushfire prone areas (AS3959-2018) and the NASH Standard Steel Framed Construction in Bushfire Prone Areas;
5. All new lots are to be connected to a reliable water supply network and that suitable fire hydrants are located throughout the development site that are clearly marked and provided

for the purposes of bushfire protection. Fire hydrant spacing, sizing and pressure shall comply with AS2419.1 2005 and section 5.3.3 of PBP 2019; and

6. Consideration should be given to landscaping and fuel loads on site to decrease potential fire hazards on site.

This assessment has been made based on the bushfire hazards observed in and around the site at the time of inspection and production (November 2024) and demonstrates the development has satisfied the aims and objectives of Planning for Bushfire Protection 2019.

Finally, should the above recommendations be implemented, the existing bushfire risk should be suitably mitigated to offer an acceptable level of protection to life and property for those persons and assets occupying the site, but they do not and cannot guarantee that the area will not be affected by bushfire at some time and that property and life damage/loss will not occur.



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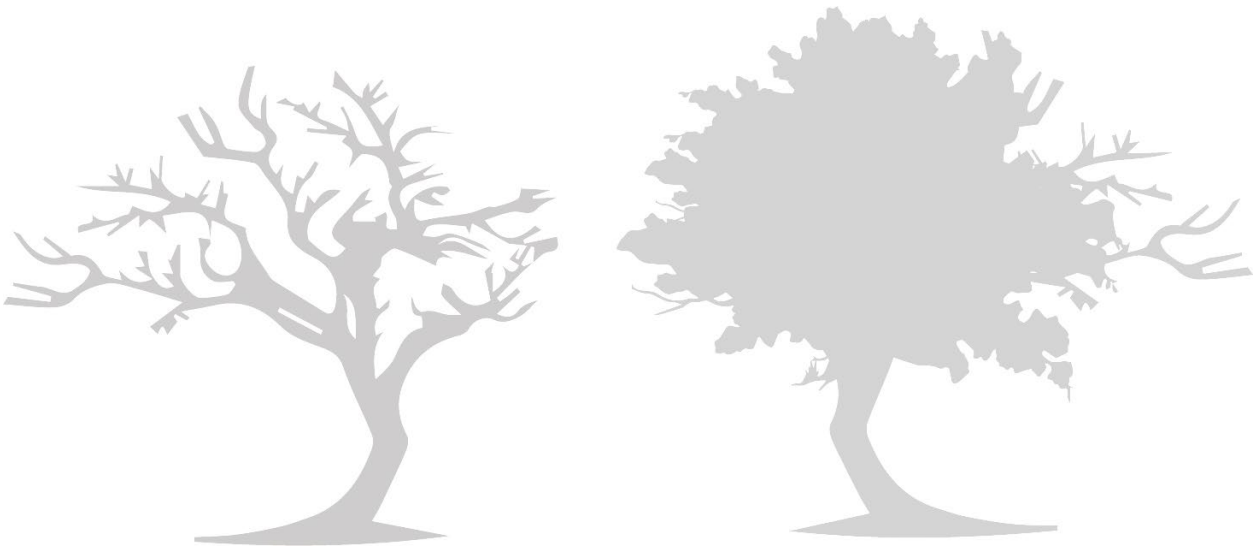

Terms and Abbreviations

Abbreviation	Meaning
APZ	Asset Protection Zone
AS2419-2005	Australian Standard – Fire Hydrant Installations
AS3959-2018	Australian Standard – Construction of Buildings in Bush Fire Prone Areas
BAR	Bushfire Assessment Report
BCA	Building Code of Australia
BC Act	NSW Biodiversity Act 2016
BDAR	Biodiversity Development Assessment Report
BMP	Bush Fire Management Plan
BPA	Bush Fire Prone Area (Also Bushfire Prone Land)
BPL	Bush Fire Prone Land
BPLM	Bush Fire Prone Land Map
BPM	Bush Fire Protection Measures
DoE	Commonwealth Department of the Environment
DPI Water	NSW Department of Primary Industries – Water
EPA Act	NSW Environmental Planning and Assessment Act 1979
EPBC Act	Commonwealth Environment Protection and Biodiversity Conservation Act 1999
FDI	Fire Danger Index
FMP	Fuel Management Plan
ha	hectare
IPA	Inner Protection Area
LEP	Local Environmental Plan
LGA	Local Government Area
LMLEP 2014	Lake Macquarie Local Environmental Plan 2014
NPWS	NSW National Parks and Wildlife Service
OPA	Outer Protection Area
OEH	NSW Office of Environment and Heritage
PBP 2019	Planning for Bushfire Protection 2019
PSC	Port Stephens Council
RF Act	Rural Fires Act 1997
RF Regulation	Rural Fires Regulation
RFS	NSW Rural Fire Service
SBS	Strategic Bushfire Study
VMP	Vegetation Management Plan

1. Introduction

Bushfire Planning Australia (**BPA**) has been engaged by McCloy Project Management Pty Ltd (the '**Client'**) to undertake a Strategic Bushfire Study (**SBS**) to support the planning proposal to amend the Port Stephens Local Environmental Plan 2013 (**PSLEP**). The development site is known as Monarch's Rise and is located at 587 Newline Road, Raymond Terrace (the **'subject site**'); legally known as Part of Lot 2 DP37430 and Part of Lot 32 DP554875.

The SBS applies to Precinct 4 and part of Precinct 1 Monarch's Rise and will address Ministerial Direction 4.3 and the RFS Planning for Bushfire Protection Guidelines 2019 (PBP 2019) to support the proposed part rezoning:

1. Align Zone MU1 - Mixed Use with the lot layout envisioned under the Concept Masterplan and DA Approval (DA16-2013-599-1);
2. Extend Zone MU1 - Mixed Use over land zoned C2 – Environmental Conservation (about 2,300m^2) adjoining Newline Road, which is not Flood Prone; and
3. Reduce the Minimum Lot Size of Zone MU1 Mixed Use from 400m^2 to 300m^2 to achieve housing diversity in and around the neighbourhood centre and park.

The assessment aims to provide a bushfire risk assessment which considers and assesses the bushfire hazard and associated potential bushfire threat relevant to the proposed development on a landscape scale. The assessment outlines the minimum mitigative measures which would be required in accordance with the SBS, provisions of the New South Wales Rural Fire Service (RFS) publication *Planning for Bushfire Protection 2019* (PBP 2019) and the *Rural Fires Regulation 2022*.

1.1. Aims and Objectives

The assessment aims to consider and assess the bushfire hazard and associated potential bushfire threat relevant to the proposed development, and to outline the minimum mitigative measures which would be required in accordance with the provisions of the New South Wales Rural Fire Service (RFS) publication *Planning for Bushfire Protection 2019* (PBP 2019) and the *Rural Fires Regulation 2022.*

This assessment has been undertaken in accordance with clause 44 of the Rural Fires Regulation 2022. This Strategic Bushfire Study also addresses the aims and objectives of PBP 2019, being:

- ❑ Afford buildings and their occupants protection from exposure to a bushfire;
- ❑ Provide for a defendable space to be located around buildings;
- ❑ Provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings;
- ❑ Ensure that appropriate operational access and egress for emergency service personnel and occupants is available;
- ❑ Provide for ongoing management and maintenance of bushfire protection measures (BPMs); and
- ❑ Ensure that utility services are adequate to meet the needs of firefighters.

2. Site Description

Table 1: Site Description

Address	587 Newline Road, Raymond Terrace
Title	Part of Lot 2 DP37430 Part of Lot 32 DP554875
LGA	Port Stephens Council
Subject Site / Study Area	219.48 ha
Development Site	5.43 ha
Land Use Zone	MU1 Mixed Use and C2 Environmental Conservation (**Figure 1**)
Bushfire Prone Land	Vegetation Category 3 and Vegetation Category 1 (**Figure 5**)
Context	The subject site is located on the eastern side of Newline Road within the MU1 land zone spanning across majority of Lot 2 DP37430 and part of Lot 32 DP554875. The subject site is surrounded by the approved Monarchs Rise residential subdivision to the north, east and south. To the west of the site and Newline Road is rural, vegetated land on the residual of Lot 2 DP37430. The site is currently vacant of buildings or dwelling and consists of historically grazed lands.
Topography	Majority of the proposed development site is relatively flat before slopes increase towards the eastern boundary of Lot 32.
Fire History	No (recorded) fire history directly impacting site. FFDI 100

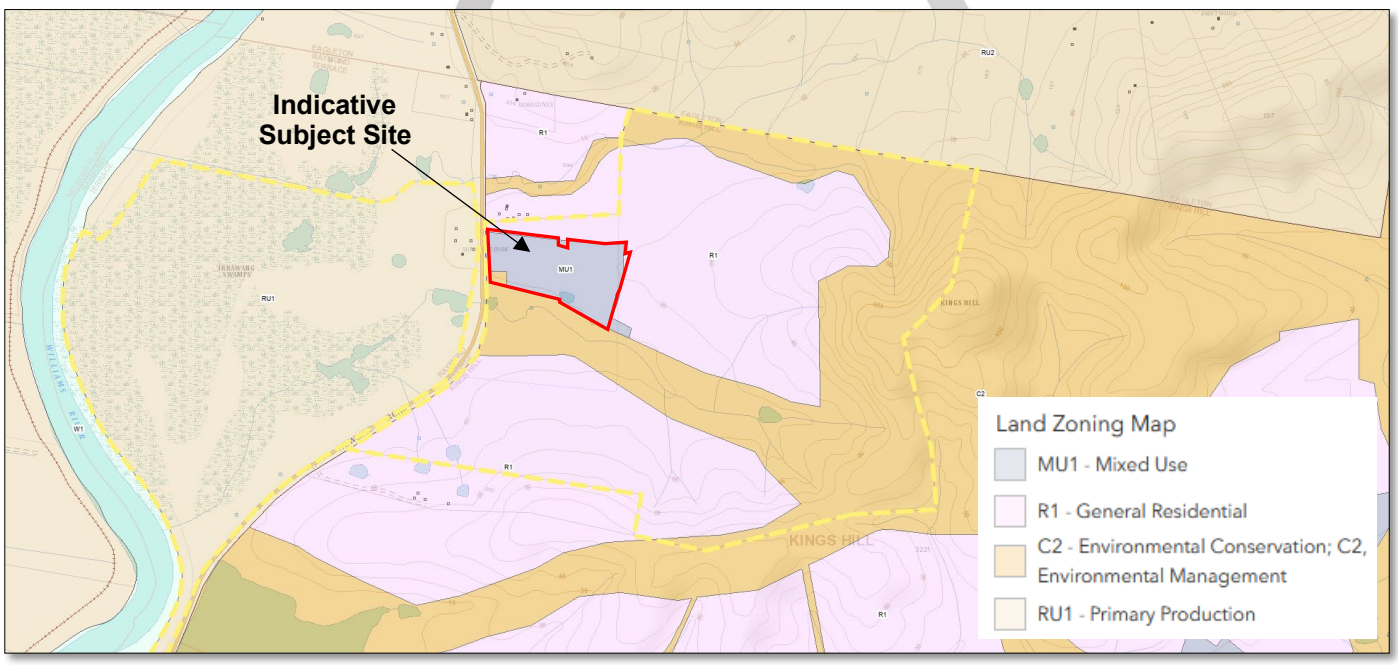

Figure 1: Land Use Zone Map (Port Stephens Local Environment Plan 2013)

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Figure 2

Site Location

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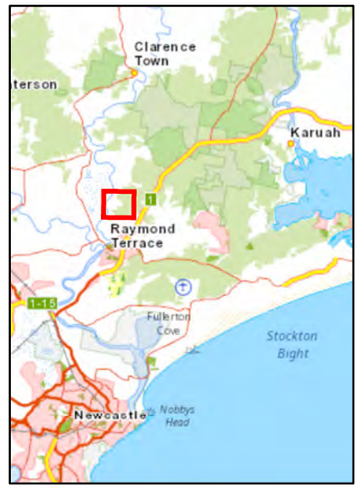

Precinct 4
100m buffer
140m buffer
Proposed lot
Future lot
Approved residential development - Stage 1
Future residential development

SOURCE:
Base Map © Department of Customer Service 2020

N
W E
S

0 100 200 300 400 500
Meters

A3 Scale: 1:10,000

File:2165-KingsHillLot120-Fig1-SiteLocation-241030 Date: 30/10/2024

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2.1. Bushfire Urban Release Area

A portion of the subject site, being Lot 2 DP37430, east of Newline Road, Raymond Terrace, is identified within a Bushfire Planning - Urban Release Area (URA) as indicated on **Figure 3** and **4** by the blue outline. Whilst Lot 32 DP586245 and the remaining portion of Lot 2 DP37430 west of Newline Road, Raymond Terrace is not identified within the Bushfire Planning - Urban Release Area.

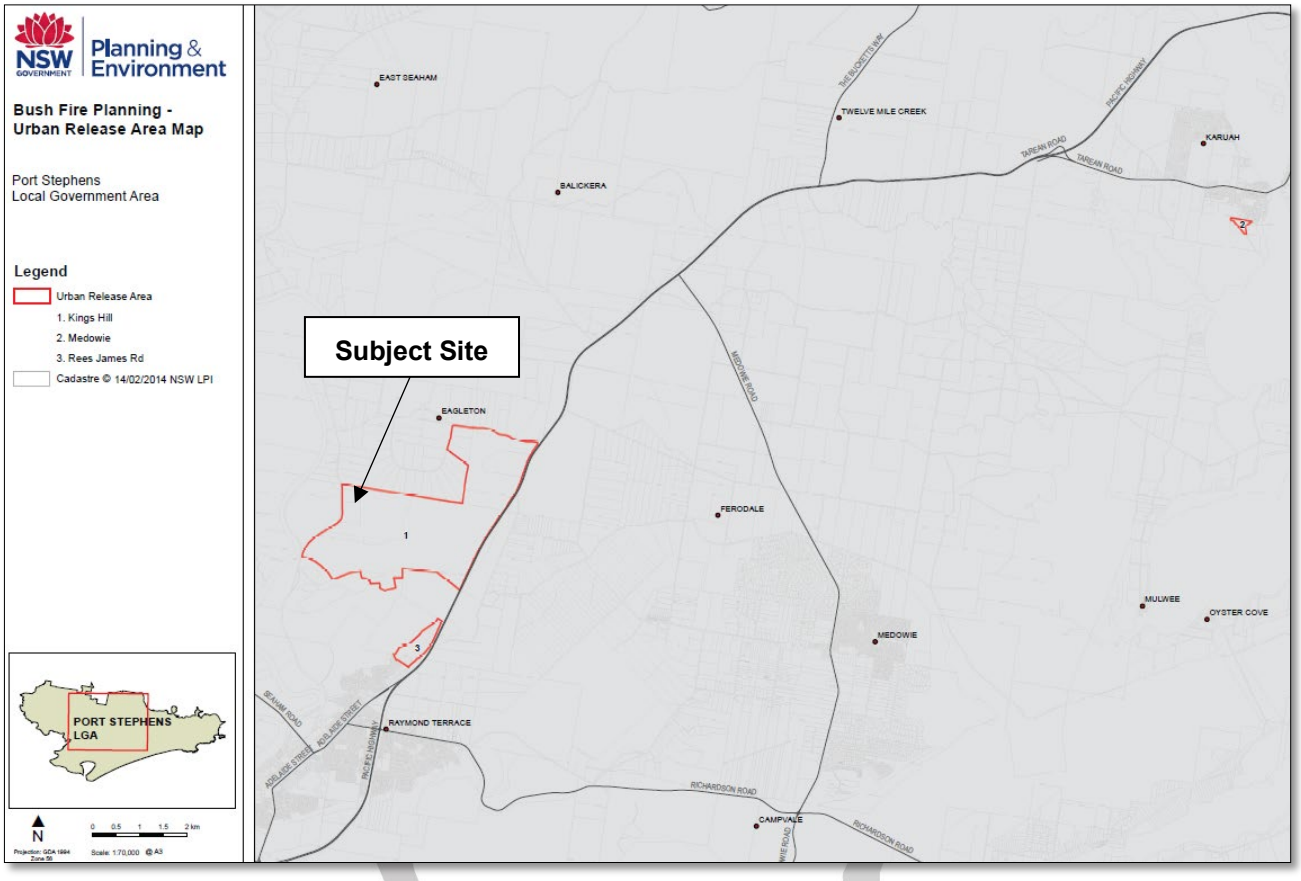


Figure 3: Kings Hill (Port Stephens LGA) Urban Release Area - The Subject Site

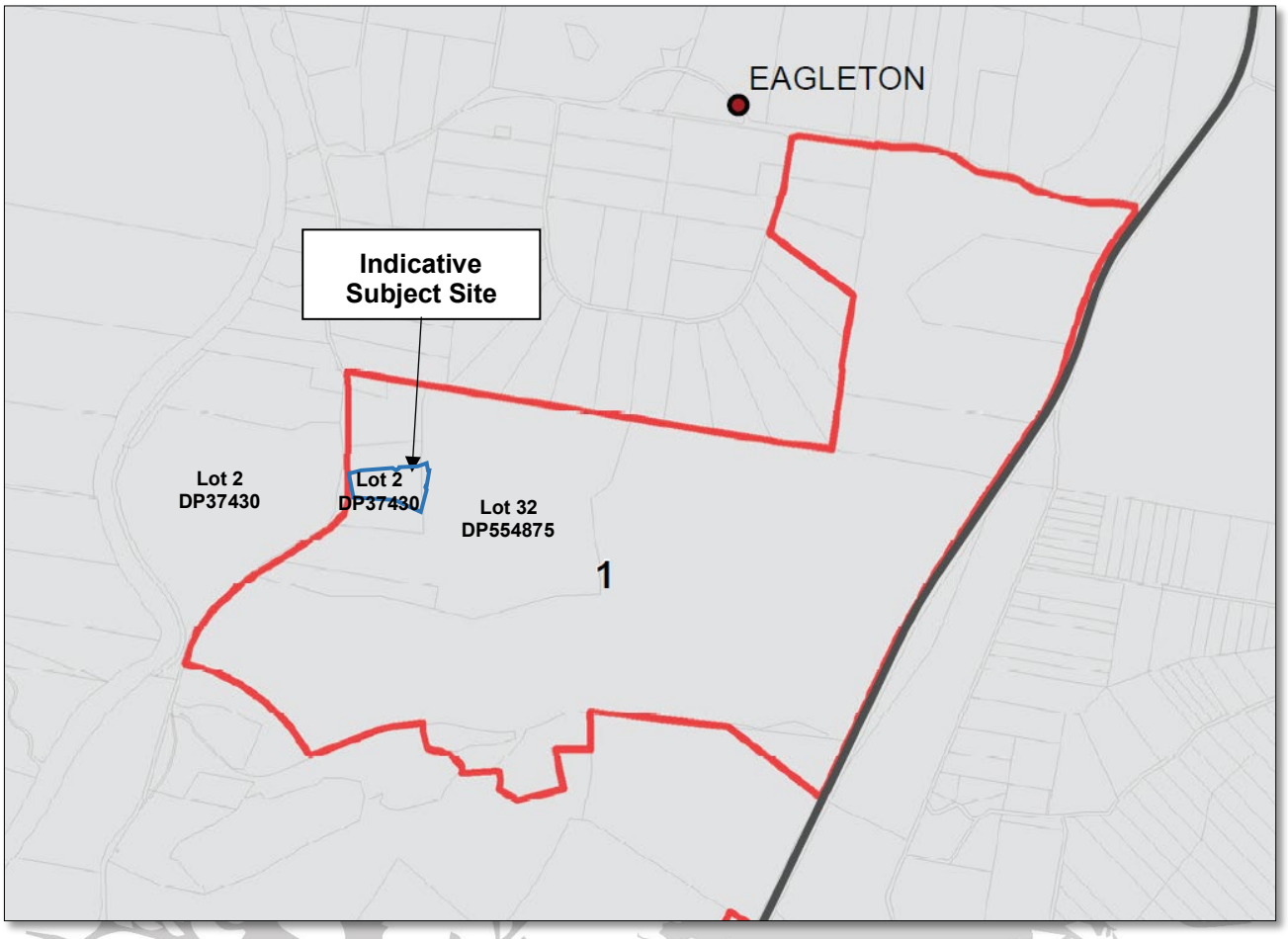


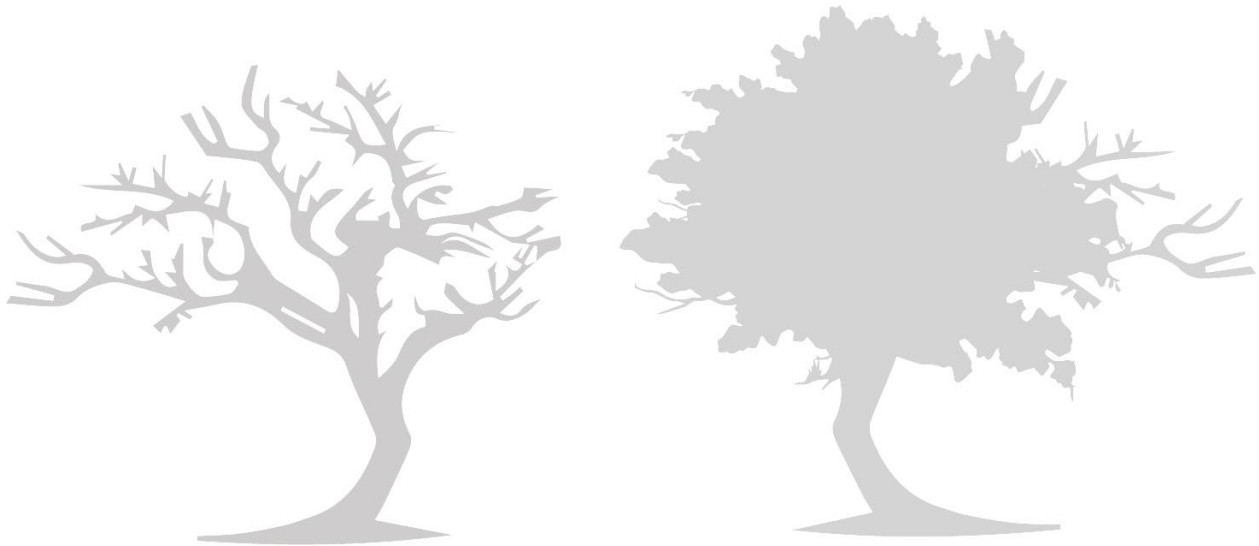
Figure 4: The Subject Site (Blue Line) within the Kings Hill Urban Release Area (Red line)

2.2. Bushfire Prone Land

Bushfire activity is prevalent in landscapes that carry fuel and the two predominant bushfire types are grassland and forest fires. Factors such as topographic characteristics and quantity of fuel loads influence the intensity and spread of fire. The scale of a bushfire hazard is tailored to the characteristics of the hazard, the size and characteristics of the affected population, types of land use exposed to bushfire, predicted development growth pressures and other factors affecting bushfire risk.

Figure 5 demonstrates the entire subject site is mapped as Vegetation Category 2 bushfire prone land with the exception of a narrow corridor of Vegetation Category 1 bushfire prone land located to the east of the site.

The site is surrounded largely by Vegetation Category 2 bushfire prone land in addition to isolated sections of Vegetation Buffer (north) and Vegetation Category 1 (east and south-east) within 140m of the site. Whilst this is considered as part of this assessment, vegetation to the north and east will also be cleared as part of the adjoining approved development (DA16-2013-599-1).



Lot 32
DP536245

Lot 42
DP618892

Newline Road

Lot 32
DP554875

Lot 2
DP37430

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Figure 5

NSW Bush Fire Prone Land

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Precinct 4
100m buffer
140m buffer

Bushfire Prone Land

Vegetation Category 1
Vegetation Category 2
Vegetation Category 3

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2024
NSW Bush Fire Prone Land: NSW Rural Fire Service 2024
Aerial photo: NearMap 06/08/2021

N
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0 25 50 75 100
Meters

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2.3. Proposed Amendment

Monarch's Rise residential development was approved by Port Stephens Council (DA16-2013-599-1) as seen in **Figure 6**. As part of the assessment of approved subdivision, a substantial area (17.61 hectares) of land zoned R2 Residential (shaded dark green in **Figure 6**) was agreed by the Applicant to be retained and will not be developed.

The proposed planning proposal applies to the area of the site known as Precinct 4 (bordered red in **Figure 6**). The planning proposal seeks consent for the proposed part rezoning to:

1. Align Zone MU1 - Mixed Use with the lot layout envisioned under the Concept Masterplan and DA Approval (DA16-2013-599-1) as seen in **Figure 8**;
2. Extend Zone MU1 - Mixed Use over land zoned C2 – Environmental Conservation (about 2,300m^2) adjoining Newline Road, which is not Flood Prone as seen in **Figure 8**; and
3. Reduce the Minimum Lot Size of Zone MU1 Mixed Use from 400m^2 to 300m^2 to achieve housing diversity in and around the neighbourhood centre and park.

A potential subdivision plan is shown in **Figure 7** and contained in **Appendix A.**

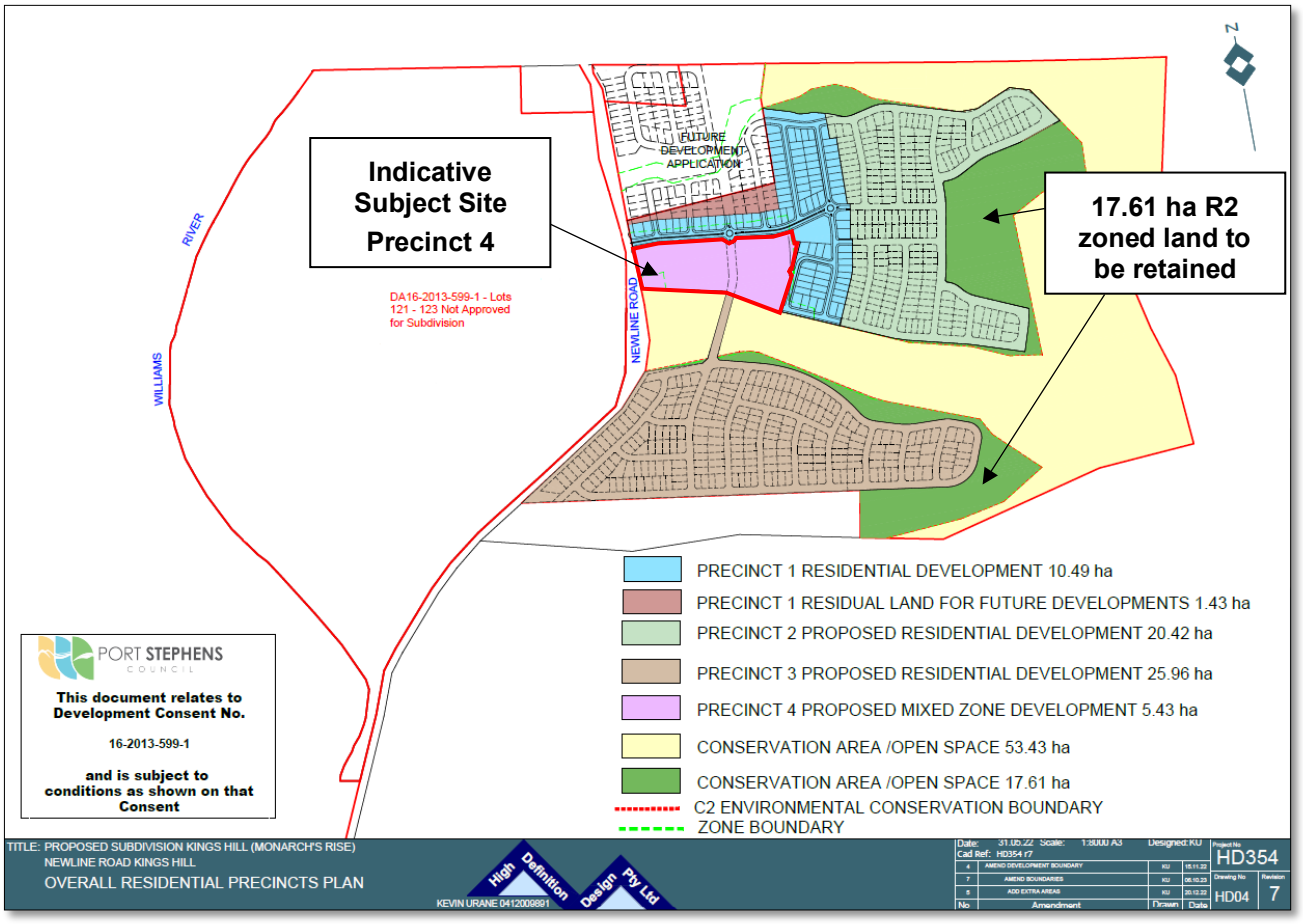


Figure 6: Monarch's Rise Overall Precincts Plan - Precincts 1 to 4

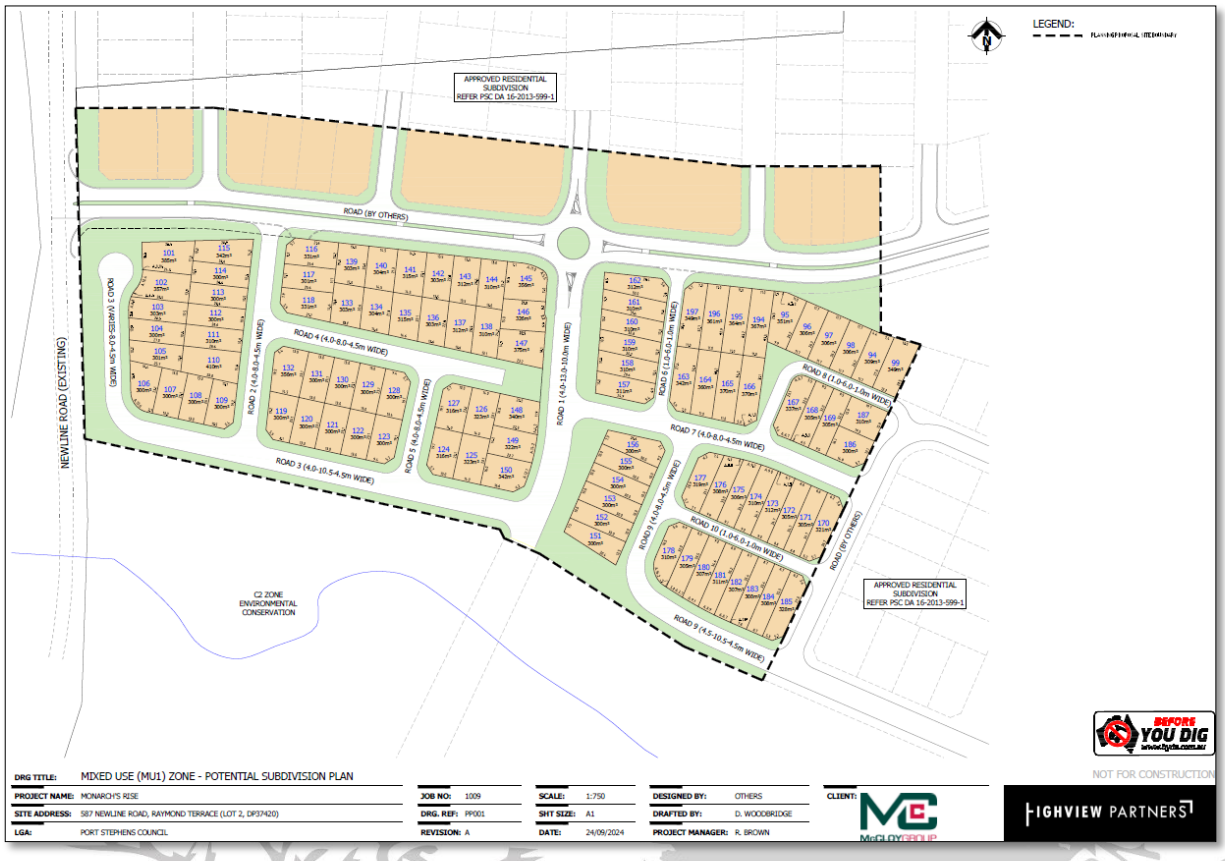


Figure 7: Potential Subdivision Plan - Precinct 4

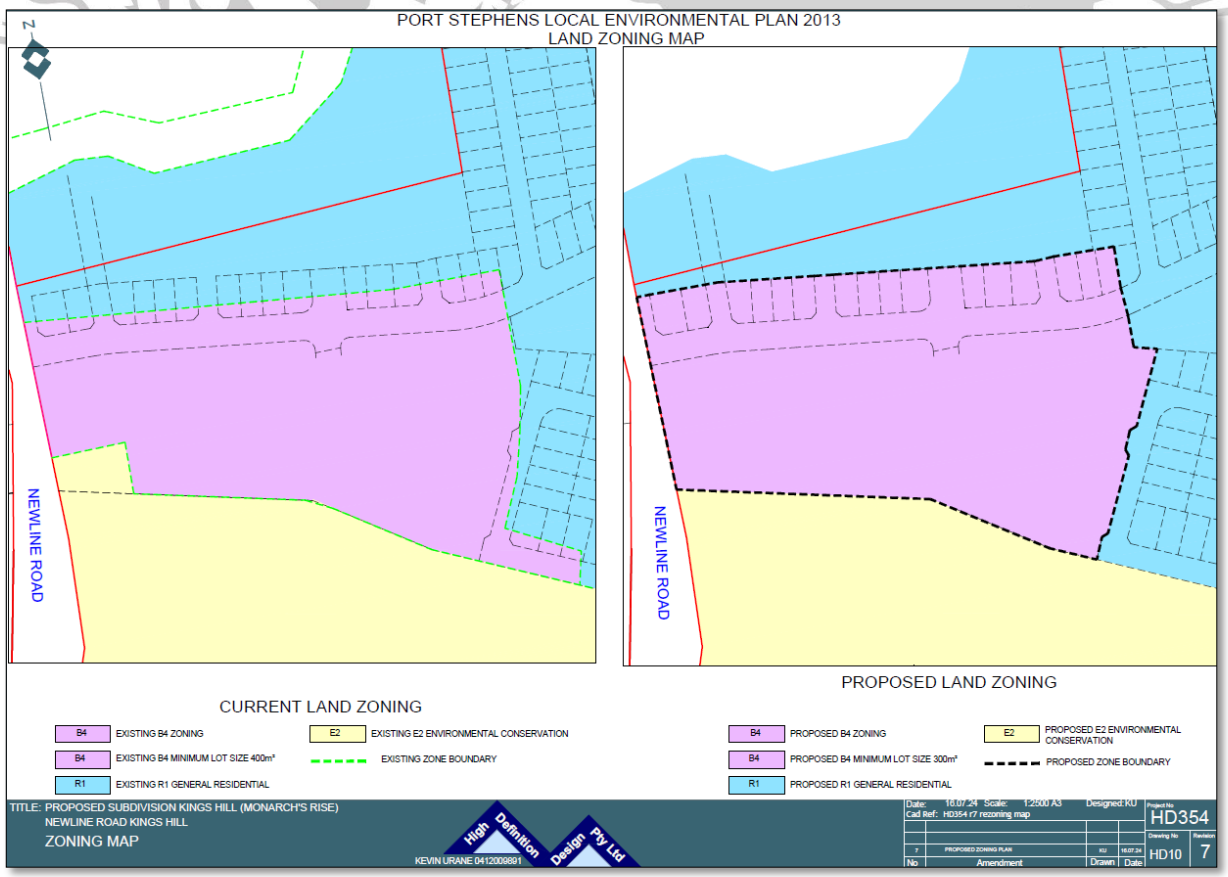


Figure 8: Plan of Proposed Rezoning - Precinct 4

3. Strategic Bushfire Study

3.1. Establishing Risk and Applying Treatment

The Strategic Bushfire Study (SBS) was introduced in NSW by Planning for Bush Fire Protection 2019 (PBP 2019). The SBS follows the principles of strategic planning generally in taking a long-term approach to land use planning and development expectations. The SBS aims to minimise or avoid the impact of natural hazards by taking a risk-based approach to the assessment of strategic planning policies and proposals. The SBS uses a macro-scale assessment, creates a risk profile and seeks treatment strategies to respond to the risk.

There are a number of national level guidance documents which provide helpful guidance in preparing strategic studies for natural hazard resilience. At a high level, the stage is set for consideration for natural hazards in strategic planning by the *Sendai Framework for Disaster Risk Reduction 2015 - 2030* (UNDRR, 2015), *The National Disaster Risk Reduction Framework* (Australian Government Department of Home Affairs, 2018), *Profiling Australia's Vulnerability: The interconnected causes and cascading effects of systemic disaster risk* (Australian Government Department of Home Affairs, 2018) and the *National Strategy for Disaster Resilience* (COAG 2011).

The *Land Use Planning for Disaster Resilient Communities* (the Handbook) published in 2020 by the Australian Institute for Disaster Resilience (AIDR) focuses on reducing disaster risk by improving strategic planning processes. The handbook aims to reduce both vulnerability and exposure of communities to natural hazard scenarios.

By considering natural hazards early and through its processes, land use planning can evaluate and select land use mechanisms to treat disaster risk.

The actions proposed by the Handbook are to understand disaster risk, make accountable decisions, establish governance, ownership and responsibility and ultimately, attract enhanced investment to reduce the risk. Ultimately, the goal is to make decisions which avoid risk. However, accepting that some level of risk is inevitable, the concept of risk tolerance and acceptable risk is highlighted. The Handbook uses a key principle introduced by the Planning Institute of Australia *National Land Use Planning Guidelines for Disaster Resilient Communities* (2015) which is the ALARP principle (As Low As Reasonably Practicable). This revolves around identifying risks that are broadly acceptable, tolerable, or generally intolerable and requires the identification of risk treatment options to move more towards the tolerable or broadly acceptable categories.

The Handbook also highlights the role that land use planning can play in climate change mitigation and adaptation. Future climate change models should be identified and utilised in the process of data gathering and analysis, whilst also acknowledging the uncertainties associated with those models.

The relationship with emergency management principles is highlighted by the Handbook. The integration of risk management and land use planning is recommended. The National Emergency Risk Assessment Guidelines produced by AIDR sets out the following structure for evaluating risk and applying risk treatment (taken from NERAG):

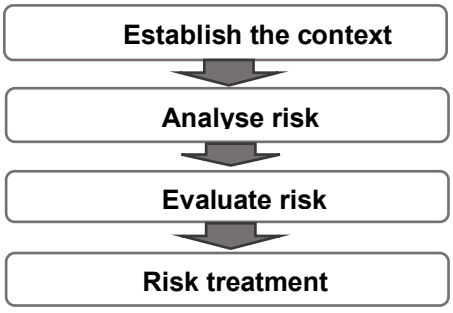


Figure 9: NERAG Risk Assessment Methodology

This process is appropriate for the SBS and will be followed to establish the risk and determine recommended risk treatments.

3.2. Ministerial Directions

Legislatively, planning proposals must follow the Ministerial Directions under Section 9.1(2) of the *Environmental Planning and Assessment Act 1979 (*EP&A Act*)*. Direction 4.3 requires a planning proposal, that is in proximity to land mapped as bushfire prone land, to have regard to PBP 2019, introduce controls that avoid placing inappropriate developments in hazardous areas and ensure that bushfire hazard reduction is not prohibited within the APZ.

A planning proposal must, where development is proposed, comply with the following provisions:

3(a) provide an Asset Protection Zone (APZ) incorporating at a minimum:

i. an Inner Protection Area bounded by a perimeter road or reserve which circumscribes the hazard side of the land intended for development and has a building line consistent with the incorporation of an APZ, within the property, and

ii. an Outer Protection Area managed for hazard reduction and located on the bushland side of the perimeter road,

3(b) for infill development (that is development within an already subdivided area), where an appropriate APZ cannot be achieved, provide for an appropriate performance standard, in consultation with the NSW Rural Fire Service. If the provisions of the planning proposal permit Special Fire Protection Purposes (as defined under section 100B of the Rural Fires Act 1997), the APZ provisions must be complied with,

3(c) contain provisions for two-way access roads which link to perimeter roads and/or to fire trail networks,

3(d) contain provisions for adequate water supply for firefighting purposes,

3(e) minimise the perimeter of the area of land interfacing the hazard which may be developed,

3(f) introduce controls on the placement of combustible materials in the Inner Protection Area.

The SBS will demonstrate the proposed amendments to the PSLEP are minor in nature and will not result in any new development being unable to comply with PBP 2019. Accordingly, the SBS will conclude the land is appropriate for the proposed increased density permissible by reducing the minimum lot size.

3.3. Aim of the Strategic Bushfire Study

In accordance with PBP 2019, the Stategic Bushfire Study (SBS) is a high level assessment that identifies land affected by natural hazards and directs development away from inappropriate and constrained lands. In a bush fire context, strategic planning must ensure that future land uses are in appropriate locations to minimise the risk to life and property from bush fire attack. Services and infrastructure that facilitate effective suppression of bush fires also needs to be provided for at the earliest stages of planning.

The bushfire risk is considered at the macro-scale, looking at fire runs, steep slopes and any areas of isolation. The amount of proposed development interfacing vegetation will also be considered. Firefighting access and evacuation potential must be considered and an assessment of traffic volumes and evacuation routes will be required. The potential for these evacuation routes to be non-trafficable during a bush fire event will be factored into the assessment.

This SBS follows the considerations outlined within Table 4.2.1 of PBP 2019 to identify and analyse the risk profile and apply risk treatment measures.

The aim of the SBS is to meet the following principles:

- ensure land is suitable for development in the context of bush fire risk;
- ensure new development on bush fire prone land will comply with PBP 2019;
- minimise reliance on performance-based solutions;
- provide adequate infrastructure associated with emergency evacuation and firefighting operations; and
- facilitate appropriate ongoing land management practices.

3.4. Bushfire Landscape Assessment

A bushfire landscape assessment considers the likelihood of a bushfire approaching an area, its potential severity and intensity, and the resultant impact on life and property in the context of the broader surrounding landscape.

With regard to proposed site, the bushfire hazard, potential fire behaviour, history of bushfires and fire runs, and operational response was assessed with the outcomes addressed in the following sections.

3.4.1. Vegetation

An assessment of vegetation is important in determining risk as different types of vegetation burn differently across the landscape. This is largely due to location and topography, structure and arrangement and available surface, elevated and canopy fuel loads.

Grasses and heath burn more quickly and erratically with fire consuming a large proportion of the plant matter, as they are influenced by finer fuels, open air, exposed drying conditions and variations in wind speed and direction, whilst forests burn with greater intensity due to substantial amounts of taller, dense and woodier fuels. The amount of plant matter consumed by forest fires also varies due to the availability of fine fuel loads, fuel moisture and localised wind conditions.

It is these traits in vegetation that determine potential radiant heat and flame characteristics which in turn define building setback requirements in accordance with PBP 2019.

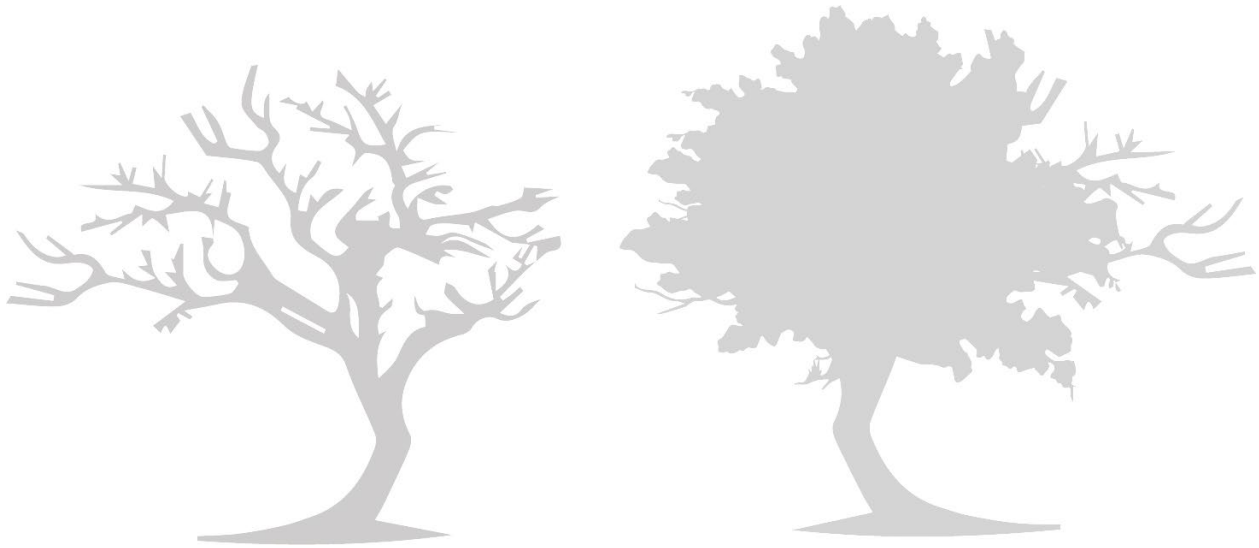
Vegetation within the proposed site areas has been mapped by Department of Planning and Environment 2023 (**Figure 10**). The vegetation communities within the study area have been characterised into structural formations according to David Keith (2004) *Ocean Shores to Desert Dunes* and PBP 2019 to determine likely maximum fuel loads in accordance with the NSW RFS fact sheet *Comprehensive Vegetation Fuel Loads (2019)* (**Table 2**).

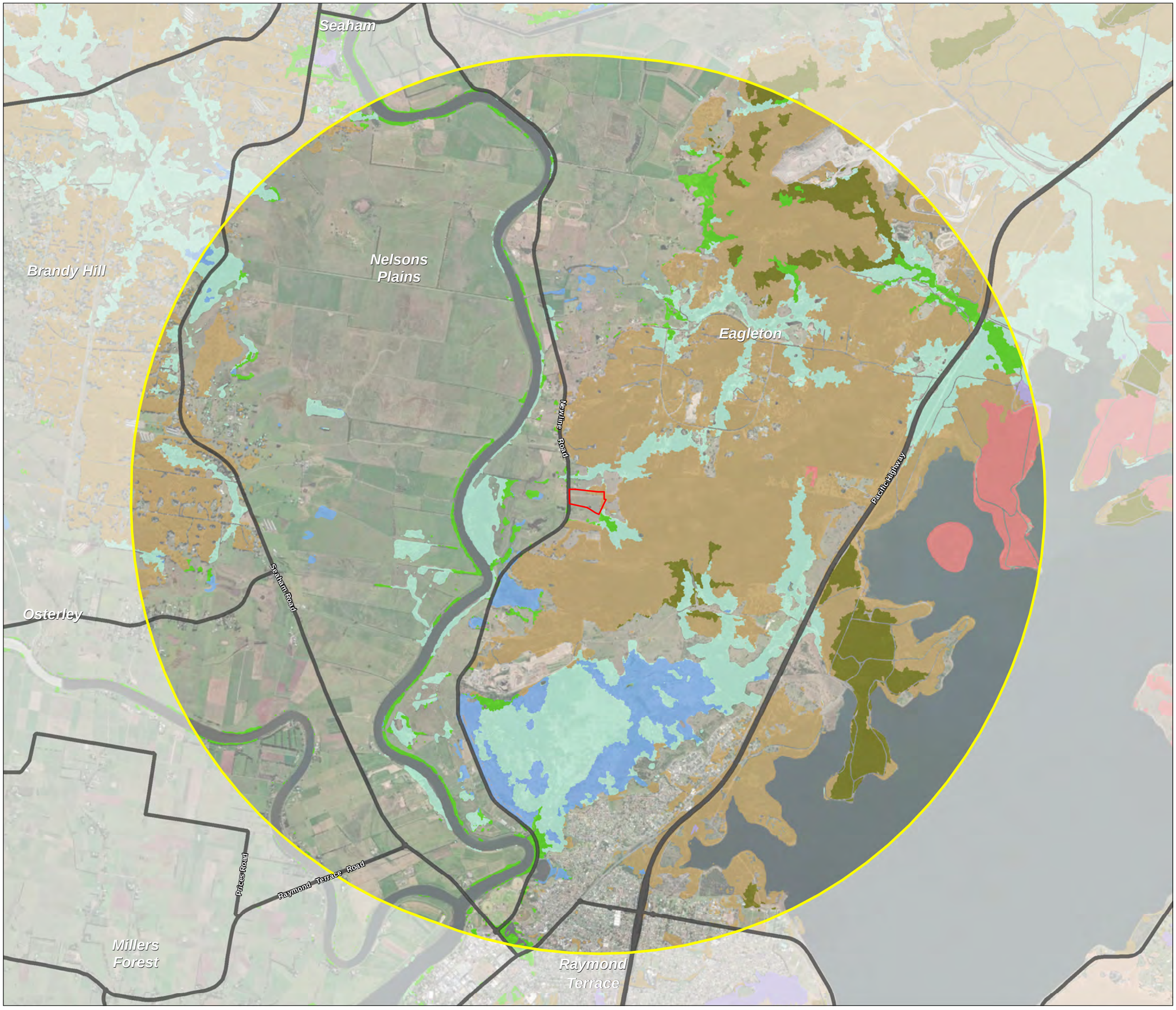
Table 2: Vegetation Communities and Corresponding Structural Formations and Fuel Loads

Vegetation Community	Structural formation (Keith 2004)	Structural formation (PBP 2019)	Overall fuel load (including surface, elevated, bark and canopy) tonnes/ha
Northern Hinterland Wet Sclerophyll Forest	Wet Sclerophyll Forest (Grassy)	Forest	33.1
Coastal Dune Dry Sclerophyll Forest	Dry Sclerophyll Forest (Shrubby)	Forest	31.1
Hunter Macleay Dry Sclerophyll Forest	Dry Sclerophyll Forest (Shrub / Grass)	Forest	24.6
Dry Rainforest	Rainforest	Rainforest	13.2
Coastal Floodplain Wetlands	Forested Wetland (Riverine Forest)	Forested Wetland	15.1
Coastal Freshwater Lagoons	Freshwater Wetland	Freshwater Wetland	4.4
Mangrove Swamps	Excluded	Excluded	N/A

Vegetation within the proposed site area was verified by onsite field investigations in accordance with the site assessment methodologies within Appendix 1 of PBP 2019 (carried out by BPA on 7 October 2021). The site inspection confirmed the majority of the subject site, in addition to land to the north, south and west, is frequently managed and deemed low threat vegetation. Low threat vegetation is not required to be considered for the purposes of PBP.

The primary bushfire hazard is located within 140m to the east and south-east of the site. The vegetation present was identifed as an ecotone of *Forested Wetland,* specifically *Coastal Floodplain Wetlands,* and *Rainforest*. There is also an isolated section of *forest* vegetation, identified as *Hunter Maclaey Dry Sclerophyll Forest*, located outside of the north-eastern corner of the proposed development.





Project: Kings Hill Precinct 4
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Figure 10

NSW State Vegetation Type (5 Km)

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- Precinct 4
- 5Km buffer

Vegetation Class

- Mangrove Swamps
- Coastal Swamp Forests
- Coastal Floodplain Wetlands
- Coastal Freshwater Lagoons
- Dry Rainforests
- Hunter-Macleay Dry Sclerophyll Forests
- Northern Hinterland Wet Sclerophyll Forests
- Coastal Dune Dry Sclerophyll Forests
- Sydney Coastal Dry Sclerophyll Forests

SOURCE:
Aerial photo: Maxar 2023
Vegetation: © State Government of NSW and Department of Planning and Environment 2023

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Kilometers

A3 Scale: 1:40,000

File:2165-KingsHillLot120-Fig3b-Vegetation-SVTM-5Km-241030
Date: 30/10/2024

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3.4.2. Topography

Topography and slope play a significant role in influencing the rate of fire spread and fire behaviour in relation to the potential for canopy involvement.

Research shows that the speed of an advancing bushfire front will double with every 10 degree increase in slope, so that on a 20 degree slope, its speed of advancement is four times greater than on flat ground. This is because the radiation and convection a fire creates preheats the unburned fuel ahead of the fire front causing it to combust at a quicker rate. This is done more effectively upslope than down. Fuel distributed across every layer of the vegetation community, in effect creating a ladder, also contributes to the likelihood of fire transfer to the canopy. This transfer is also more effective on steeper slopes.

Digital Elevation Modelling (DEM) shows us the southern boundary of Precint 4 lies at approximately 5m AHD and rises gradually northwards to approximaately 14m AHD (**Figure 11**).

An assessment of the effective slope (that which sits underneath the bushfire hazardous vegetation) impacting the study area was undertaken using LIDAR point cloud data, DEM (NSW LPI) and results from field investigations carried out in October 2021. An assessment of the slope over a distance of 100m in the hazard direction, as is required within Appendix 1 of PBP 2019, was undertaken. Results revealed slopes within the study area to be mostly flat with a downslope of less than 10 degrees south of the site (**Figure 12**).

In accordance with PBP 2019, development on steeper slopes, where the bushfire threat is downhill and has the potential to increase the rate of spread and intensity of bushfire, requires larger setbacks. Section 4 of this report addresses Asset Protection Zones and building setbacks commensurate with slope surveyed within the study area to achieve radiant heat levels ≤29kW/m^2.

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Figure 11

Digital Elevation Model (5Km)

BUSHFIRE PLANNING AUSTRALIA

Precinct 4

5Km buffer

Elevation (AHD)

High : 177m

Low : 0m

SOURCE:
Aerial photo: Maxar 2023
Surface analysis: Derived from LiDAR - Newcastle, 1 metre Resolution Digital Elevation Model © Department Finance, Services and Innovation 2013

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Kilometers

A3 Scale: 1:40,000

File:2165-KingsHillLot120-Fig4b-DEM-5Km-241030

Date: 30/10/2024

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Seaham
Brandy Hill
Nelsons Plains
Eagleton
Osterley
Millers Forest
Raymond Terrace
Seaham Road
Nelsons Plains Road
Pacific Highway
Prices Road
Raymond Terrace Road

Project: Kings Hill Precinct 4
Job No: 2165

Figure 12

Slope Analysis: LiDAR (5Km)

BUSHFIRE PLANNING AUSTRALIA

Seaham
Brandy Hill
Nelsons Plains
Eagleton
Osterley
Millers Forest
Raymond Terrace
Newline Road
Pacific Highway
Seaham Road
Pitkee Road
Raymond Terrace Road

- Precinct 4
- 5Km buffer

Slope

- 0° - 5°
- 5° - 10°
- 10° - 15°
- 15° - 20°
- >20°

SOURCE:
Aerial photo: Maxar 2023
Surface analysis: Derived from LiDAR - Newcastle, 1 metre Resolution Digital Elevation Model © Department Finance, Services and Innovation 2013

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0 0.5 1 1.5 2
Kilometers

A3 Scale: 1:40,000

File:2165-KingsHillLot120-Fig5b-Slope-LiDAR-5Km-241030
Date: 30/10/2024

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3.4.3. Weather and Climate

The typical/average climate across the Port Stephens LGA is warm subtropical. According to the *Lower Hunter Bush Fire Management Committee Bush Fire Risk Management Plan (2009)* (BFRMP), which includes the Port Stephens LGA, the official bushfire season ordinarily runs from October to March.

Prevailing weather conditions associated with the bushfire season in the Lower Hunter BFMC areas are north-westerly winds accompanied by high daytime temperatures and low relative humidity. There are also frequently dry lightning storms in the western areas occurring during the bushfire season.

The Forest Fire Danger Index (FFDI) given to the Hunter region is 100. The index is calculated from weather station data and is based on representative values of wind speed, temperature, humidity and fuel conditions.

The index represents a 1:50 year fire weather scenario and is applied to methodologies in calculating anticipated bushfire attack levels. It is possible that due to local variations in elevation, slope, and aspect, FFDI values at any point location may reflect values which are higher or lower than 100 resulting in different rates of fire spread across a landscape. **Table 2** provides a brief overview of point location weather data recorded as of 17 October 2024 at Williamtown RAAF (closest AWS with climate statistics to Port Stephens).

Table 3: Climate Statistics Recorded at Williamtown RAAF (BOM Climate Statistics for Australian Locations, as at October 2024)

Weather Station	Williamtown RAAF AWS
Mean maximum temp (degrees)	28.3 (January)
Highest temp (degrees)	45.5 (4 Jan 2020)
Lowest maximum temperature	19.1 (14 February 2009)
Mean number of days ≥ 30 degrees	9.4
Lowest mean rainfall (mm)	60.2 (2008)
Highest mean 3pm relative humidity (%)	62% (February)
Highest mean 3pm windspeed (km/h)	23.5 (November / December)
Maximum wind gust speed (km/h)	137 (December)

Climate change is influencing the frequency and severity of dangerous bushfire conditions in Australia. Fire risk is affected by four main factors, fuel load, fuel dryness, weather and ignition. Understanding the impacts of climate change on bushfires in NSW, relies on how climate change might affect these factors.

- Vegetation (ie fuel) growth will be affected by global increases in greenhouse gas emissions such as carbon dioxide as well as changes to rainfall patterns.
- Climate models have predicted that NSW will experience warmer drier periods of weather, drying vegetation and increasing bushfire risk. The 2019/2020 Black Summer bushfire season was predeeded by three years of increasing drought conditions.
- The risk of fire is increased by low rainfall and humidity and high temperature and wind speeds. There have been significant changes observed in recent decades towards more dangerous bushfire weather conditions for various regions of Australia. Observed changes in southern and eastern Australia include an earlier start to the bushfire season with dangerous weather conditions occurring significantly earlier in spring than they ever used to.

- In relation to fire ignition, there is some indication that climate change could influence the risk of ignitions from dry-lightning storms. Additionally, there has recently been a number of devastating fire events in Australia associated with extreme pyroconvection (including thunderstorm development in a fire plume), with recent research indicating a long-term trend towards increased risk factors associated with pyroconvection in southeast Australia.

According to the BFRMP, temperatures have been increasing in the Port Stephens Region in recent decades. This warming trend is expected to continue, with anticipated considerable rainfall variability across seasons and from year to year. These projected changes include increasing maximum and minimum temperatures, increasing number of hot days, decreasing number of cold nights together with winter rainfall and increasing Autumn and Spring rainfall. Average fire weather and severe fire weather days are projected to increase in Summer and Spring.

In addition to the changing weather conditions, it is anticipated that the potential for wildfire ignition will increase and fuels may also change. There is increased capacity for lightning strikes within the landscape due to potentially more volatile weather conditions, increased ignition potential could lead to more challenging firefighting conditions. Over the longer term, fuels can become drier, areas of forested wetland or forest could become drier with a higher propensity to burn. The increased risk of hotter fires occurring on a more regular basis can also increase the risk of vegetation communities, such as forest, being impacted more frequently by fire and taking hundreds of years to recover (environment.nsw.gov.au).

In planning for a climate change future, the following mechanisms are recommended:

- Required setbacks from bushfire hazardous vegetation commensurate with an FFDI 110;
- Mechanical fuel reduction, where achievable, as opposed to controlled burning;
- Alternative landscaping initiatives and garden design that relies more on non combustible elements and use of succulent and drought resistant plantings; and
- Improved emergency management planning and procedures.

3.4.4. Bushfire Behaviour and Fire History

Information on fire history is a useful factor in understanding fire frequency and bushfire risk. Review of available fire history data within and surrounding the Port Stephens LGA indicates approximately eight to ten (8-10) fires have been recorded over the last 49 years within 5 kilometres of the site.

The closest fire to the subject site was recorded in 2016, within approximately 500m from the sites northern boundary separated by rural residential properties. The largest fire recorded in 2020 occurred approximately 4 kilometres south-east of the site (**Figure 14**).

3.4.4.1. Lower Hunter Bush Fire Risk Management Plan

According to the Bush Fire Risk Management Plan (BFRMP) the Lower Hunter BFRM area has on average 200 bushfires per year, of which 3 on average can be considered to be major fires. The main sources of ignition include:

- Escapes from legal burning off
- Arson; and
- Arcing power lines.

The BFRMP provides a snapshot of the Raymond Terrace assets at risk (indicated as red and orange hatching and icons) as identified within the Lower Hunter BFRMP. This does not include the subject site as seen on **Figure 13**.

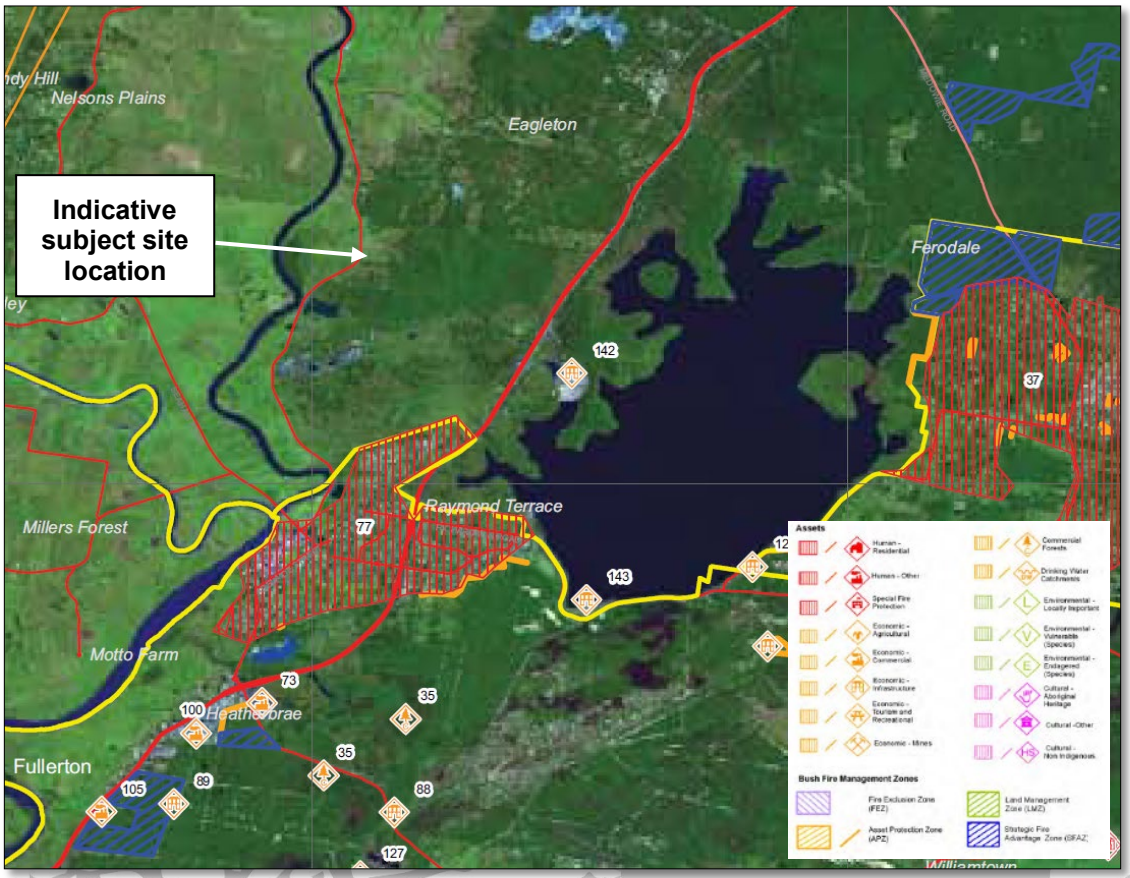

Figure 13: Human Settlement Assets within Lower Hunter BFRMP

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Job No: 2165

Figure 14

NSW State Fire History

BUSHFIRE PLANNING AUSTRALIA

Precinct 4
5Km buffer

Year of Fire

1975
1980
1989
1990
1991
1994
1997
1998
2012
2013
2016
2017
2018
2020
2021
2023

SOURCE:
Aerial photo: Maxar 2023
NSW State Fire History © State Government of NSW and NSW Rural Fire Service 2024

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Kilometers

A3 Scale: 1:40,000

File:2165-KingsHillLot120-Fig2b-FireHistory-241030

Date: 30/10/2024

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3.5. Land Use Assessment

A land use assessment identifies the appropriateness of siting different land uses in particular locations based on risk profiles.

Under the *Rural Fires Act 1997* and PBP 2019 the proposed land uses fall mostly into the category of residential infill. PBP 2019 provides performance criteria for the proposed uses.

Using an FFDI of 100 and the vegetation formations and effective slope described in Section 4.3 of this report, APZ setback requirements were calculated in accordance with Section 5.3 and Table A1.12.2 of PBP 2019. Additional detailed modelling was completed to more accurately assess the required setbacks commensurate with the bushfire risk; noting the existing landscape will be rehabilitated and revegetated as a grassy forest.

3.6. Access and Egress

PBP 2019 requires sufficient access with design objectives that enable safe evacuation away from an area whilst facilitating adequate emergency and operational response. All areas affected by bushfire prone land should have an alternate access or egress option dependant on bushfire risk, density of development, population and the chances of roads being cut-off by fire, smoke and accidents for prolonged periods of time.

Current access/egress within the study area allows distribution of local traffic in and around the township. Minor access roads between the more major transport routes allows for emergency response and traffic flow of the current population in and out of the area.

The proposed development must also ensure there is adequate access/egress. Section 5.3 of PBP 2019 requires a development to provide safe operational access to structures and water supply for emergency services while residents are seeking to evacuate.

All new roads would need to comply with the following requirements, in accordance with Table 5.3b of PBP 2019:

- All roads are two-wheel drive, sealed, all-weather roads;
- A secondary access is provided to the development;
- Traffic management devices do no prohibit access by emergency services vehicles;
- Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees;
- Carriageway width kerb to kerb shall be a minimum of 5.5 metres and have a minimum vertical clearance of 4 metres to overhanging obstructions and tree branches;
- All parking shall be provided outside of the carriageway width;
- Curves of roads shall have a minimum inner radius of 6 metres and crossfall shall not exceed 3 degrees;
- Dead end roads incorporate a minimum 12 metres outer radius turning circle and are clearly sign posted as a dead end;
- 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;
- The capacity of roads/bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes) with bridges/causeways clearly indicating load rating;
- Perimeter roads are two-way with a minimum carriageway width of 8 metres kerb to kerb and non-perimeter roads are minimum 5.5m carriageway width kerb to kerb;

- Where kerb and guttering is provided on perimeter roads, roll top kerbing should be used to the hazard side of the road.

There is no impediment to these standards being achieved. Primary access to the site will occur from Newline Road via a newly constructed 24m wide road connecting to non-perimeter roads throughout the development.

3.7. Emergency Services

With an increase in population comes a growing demand on emergency services and it is prudent that consideration be given to the future impact on firefighter numbers, appliances, infrastructure, training and response time. Currently within a 10-kilometre radius of the study area there are two Rural Fire Brigades, and one Fire and Rescue NSW fire station (**Table 4**).

Their locations are spaced kilometres apart which may impact quick response to bushfire and building fire emergencies and has in previous times often relied upon attendance from out of area brigades to assist with larger bushfire emergencies.

Table 4: Fire Brigades within 10kms of the Study Area

Rural Fire Brigades	Address	Distance to Subject Site
Seaham Rural Fire	12 Torrens Street, Seaham	8.9km or 8 minutes
Raymond Terrace Rural Fire	33 Rees James Road, Raymond Terrace	9.4km or 11 minutes

Fire & Rescue NSW Stations	Address	Distance to Subject Site
Raymond Terrace Fire Station	5 Leisure Way, Raymond Terrace	7.9km or 9 minutes

Whilst there are a number of emergency services located within the area, there is still a requirement for the community to understand their risk and ensure they have a bushfire survival plan that outlines their emergency arrangements and course of action.

Potential growth in population should also prompt the Port Stephens Council and RFS District Office to assess the implications on resource capabilities and the need for extra bushfire management and community advisory roles, stations, firefighting volunteers, equipment and/or increased training opportunities (ie Breathing Apparatus and village training) to cater for future development and capacity.

3.8. Infrastructure

An assessment of the issues associated with infrastructure and utilities considers the life safety issues of fire in proximity to high voltage power lines and natural gas supply lines and the pressures a major bushfire event puts on flow rates of reticulated water systems and telecommunications infrastructure.

Above ground low and high voltage power lines exist in the Port Stephens region. Generally, the energy authority's vegetation management policies and procedures assist with managing fire risks associated with existing vegetation within proximity to powerlines to prevent ignitions.

Any new development as a result of rezoning can site electricity, and communication cables underground so as to both reduce the bushfire risk from sparking power lines and protect the infrastructure supply in a bushfire event.

The extent of the existing water supply is such that an increase in demand should not detrimentally impact water pressure and flow to the study area. Additional static water supply systems can be recommended with new development to lessen dependence on reticulated systems.

In accordance with Section 5.3.3 of PBP, any new development shall provide adequate services of water for the protection of buildings during and after the passage of a bushfire and will locate gas and electricity so as not to contribute to the risk of fire to any building.

- Fire hydrant spacing, sizing, flows and pressure will comply with AS 2419.1-2005. Hydrants will be located outside of parking reserves and road carriageways.
- All sites within proposed developments will be connected to the internal reticulated water supply.
- All electricity services will be located underground.
- Any reticulated or bottled gas should be installed and maintained according to the requirements of the relevant authorities and AS 1596-2014.

3.9. Adjoining Land

Consideration of the implications of a change in land use on adjoining land, including increased pressure on bushfire protection measures, should also be undertaken.

The anticipated impact on adjoining land would be:

- An increase in traffic to the local area and added dependence on reticulated water supply, both of which have been addressed in the sections above; and
- Pressures on landowners and management agencies to more frequently manage bushfire hazardous vegetation on their properties.

4. Bushfire Hazard Assessment

The Bushfire Hazard Assessment is conducted on a more localised scale, assessing vegetation categories out to a distance of 140 metres and slope to a distance of 100m, in accordance with the Site Assessment Methodology within Appendix 1 of PBP. This establishes a more localised risk context for the development and specific bush fire protection measures required for the subdivision of the land to occur.

The bushfire hazard assessment involves quantitative and qualitative assessments of the site. The quantitative assessment includes a detailed site inspection to record and review vegetation communities, slope and aspect both within and surrounding the site. The qualitative assessment will be based on the known bushfire behaviour of the subject land.

A compliance table demonstrating compliance with PBP 2019 is provided in **Appendix B**.

4.1. Vegetation Assessment

Vegetation classification over the site and surrounding area has been carried out as follows:

- Aerial Photograph Interpretation to map the vegetation classification and extent (NearMap historical series);
- Review of NSW State Vegetation Type, NSW Department of Planning and Environment 2023 (**Figure 15**); and
- Site Inspection on 7 October 2021 by Stuart Greville (BPA) (**Plates 1 to 6**).

In accordance with PBP 2019, an assessment of the vegetation over a distance of 100m in all directions from the site was undertaken.

Vegetation that may be considered a bushfire hazard was identified in all directions from the development footprint. The vegetation classification is based on Appendix 1 of PBP 2019; per Keith (2004). The unmanaged fuel loads detailed in the *Comprehensive Vegetation Fuel Loads* published by the RFS in March 2019 have been adopted for the purpose of assessing the bushfire hazard. The findings of the site inspection were compared to the Keith Vegetation Formations mapping provided by the NSW RFS. The inconsistencies between the mapping sources were quantified during the site inspection.

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Figure 15

NSW State Vegetation Type (Class)

BUSHFIRE PLANNING AUSTRALIA

Newline Road

- Precinct 4
- 100m buffer
- 140m buffer

Vegetation Class

- Coastal Floodplain Wetlands
- Coastal Freshwater Lagoons
- Dry Rainforests
- Hunter- Macleay Dry Sclerophyll Forests
- Northern Hinterland Wet Sclerophyll Forests
- Sydney Coastal Dry Sclerophyll Forests
- Not native vegetation

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2024
Vegetation: © State Government of NSW and Department of Planning and Environment 2023
Aerial photo: NearMap 01/08/2021

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Meters

A3 Scale: 1:2,000

File:2165-KingsHillLot120-Fig3a-Vegetation-SVTM-241030 Date: 30/10/2024

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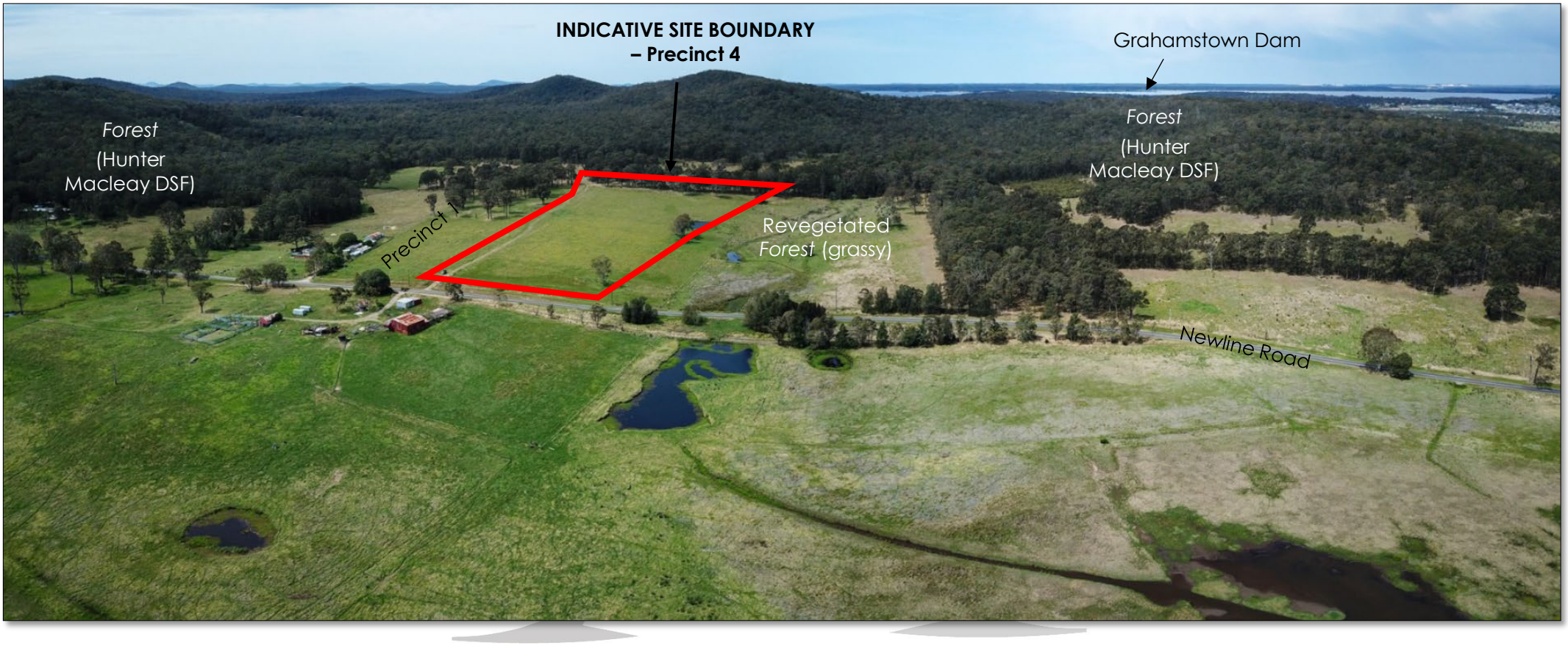

Plate 1: Subject site looking east

Plate 2: Subject site looking north along Newline Road

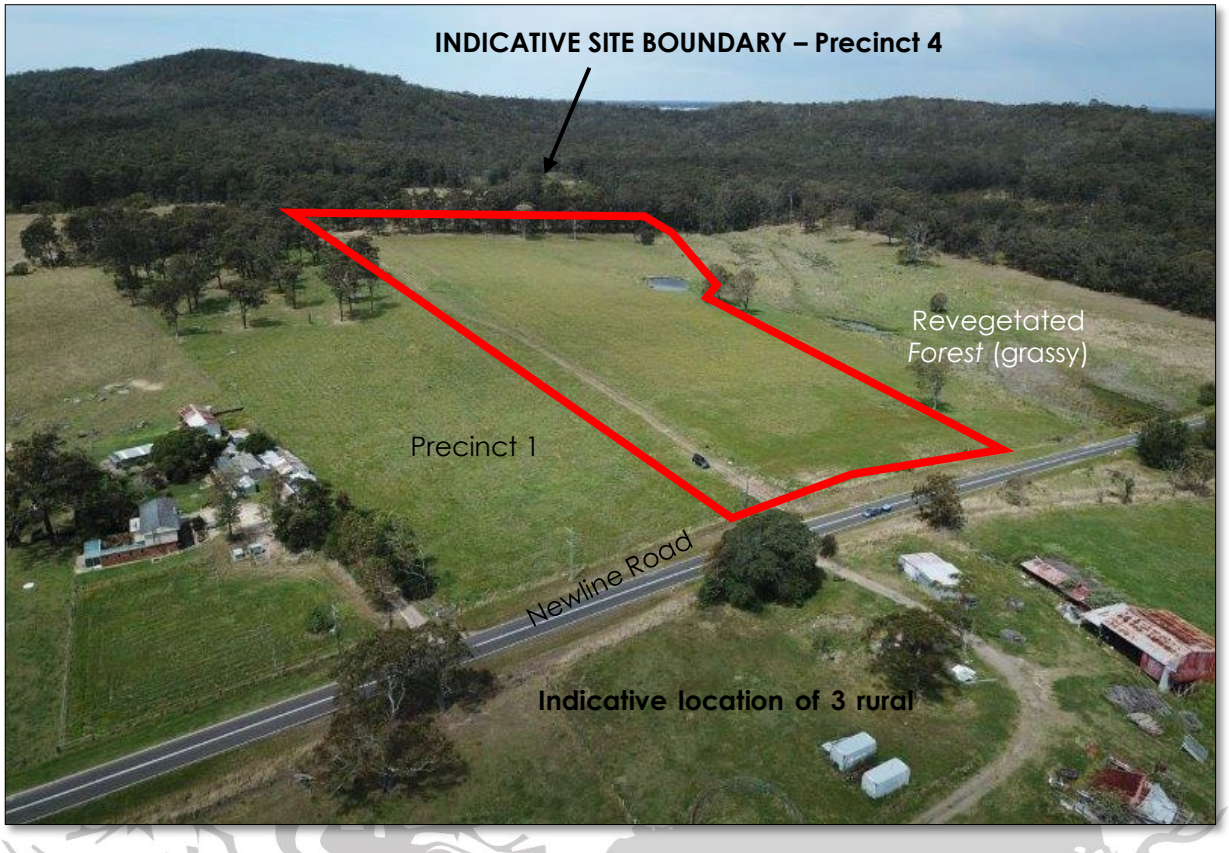

Plate 3: Southeast across rural lots over Newline Road

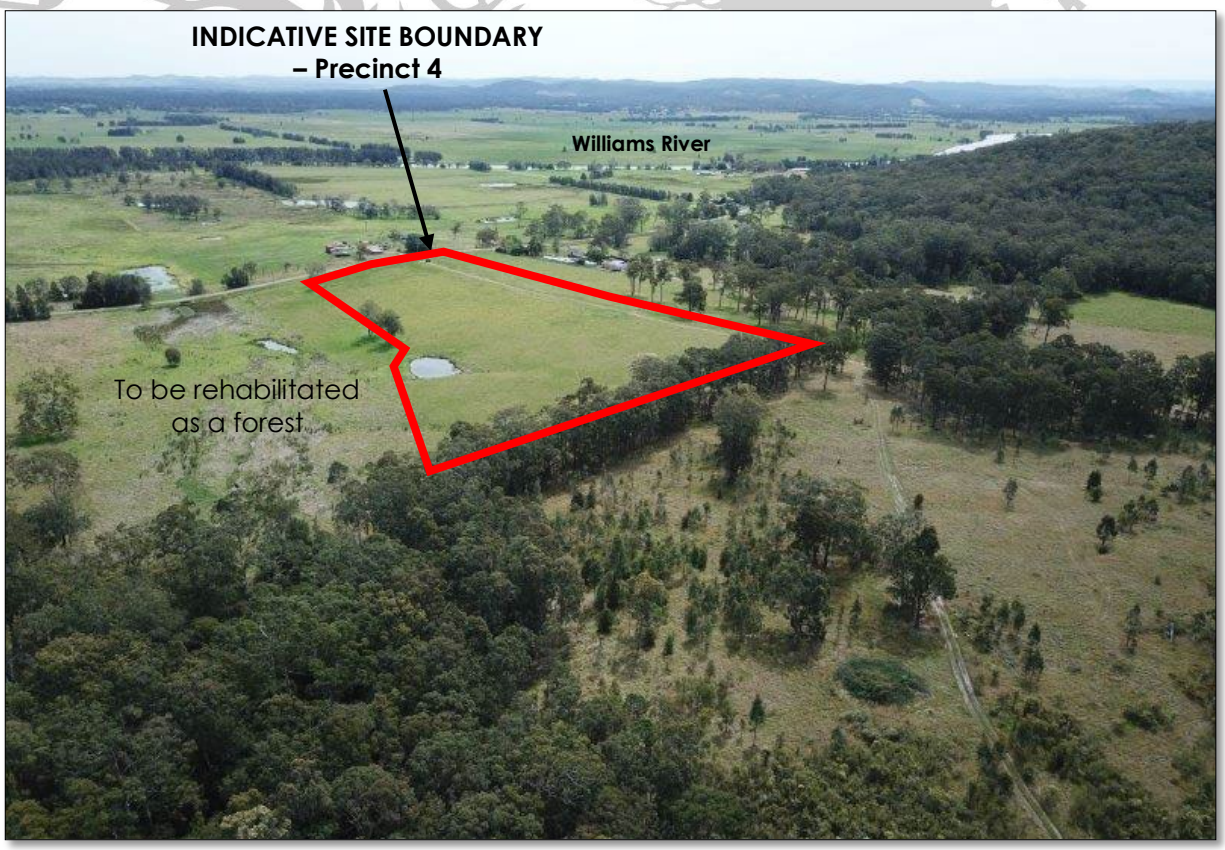

Plate 4: Northwest over an ecotone of dry rainforest and coastal floodplain wetlands

Plate 5: Ecotone of *rainforest* and *forested wetland* south east of the study area

Plate 6: Existing pasture south of site to be rehabilitated as a grassy forest

4.2. Slope Assessment

Assessment of the effective slope impacting the site was undertaken using LiDAR point cloud data including DEM (NSW LPI) and results from field investigations carried out on the 7 October 2021.

An assessment of the slope over a distance of 140m in the hazard direction from the site boundary was undertaken. The effective slope was then calculated under the classified vegetation where there was a fire run greater than 50m. The topography of the site has been evaluated to identify both the average slope and by identifying the maximum slope present. These values help determine the level of gradient which will most significantly influence the fire behaviour of the site.

A series of figures were produced that demonstrate the slope within 140m of the site from the subject site in several formats, including:

- Digital Elevation Model - **Figure 16**; and
- Slope analysis in gradients of 5 degrees - **Figure 17**.

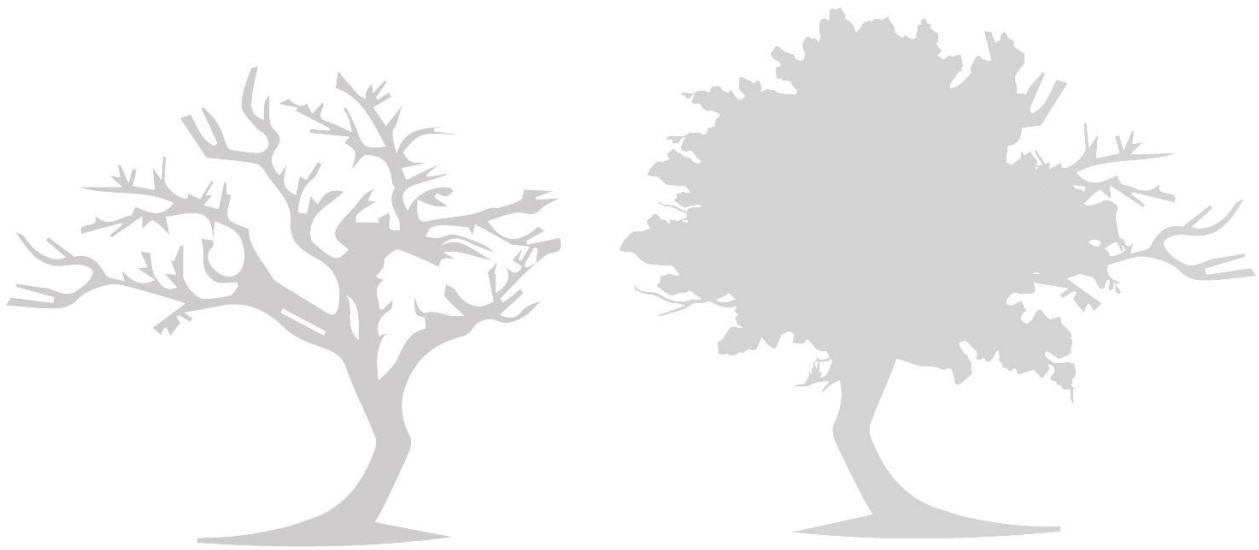

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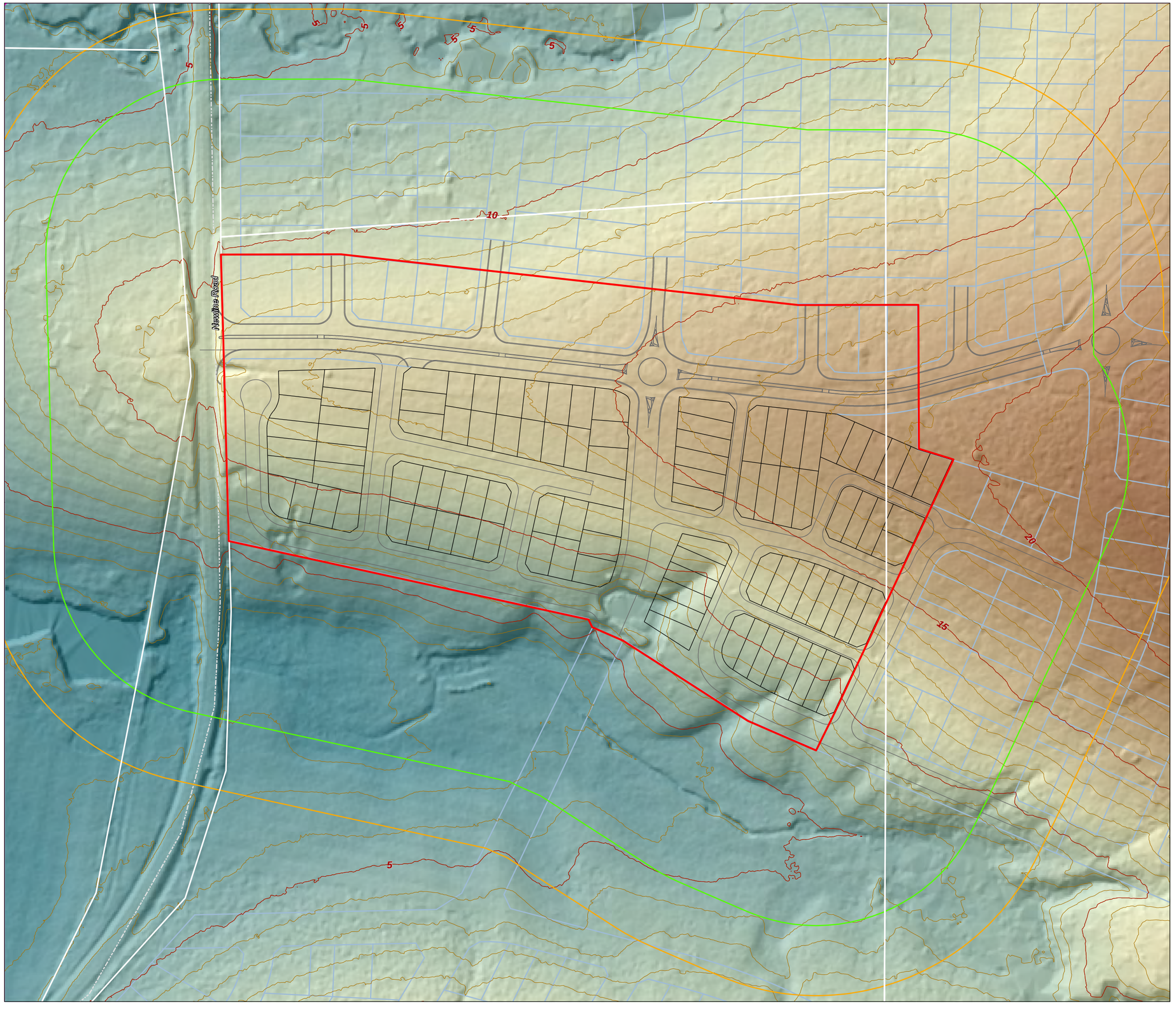
Figure 16

Digital Elevation Model



BUSHFIRE PLANNING AUSTRALIA

- Precinct 4
- 100m buffer
- 140m buffer
- Contour (5m)
- Contour (1m)

Elevation (AHD)
High : 24m
Low : 1m

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2024
Surface analysis: Derived from LiDAR - Newcastle, 1 metre Resolution Digital Elevation Model © Department Finance, Services and Innovation 2013

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0 25 50 75 100
Meters

A3 Scale: 1:2,000

File:2165-KingsHillLot120-Fig4a-DEM-241030 Date: 30/10/2024

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Figure 17

Slope Analysis: LiDAR

BUSHFIRE PLANNING AUSTRALIA

Precinct 4
100m buffer
140m buffer
Contour (5m)
Contour (1m)

Slope

0° - 5°
5° - 10°
10° - 15°
15° - 20°
>20°

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2024
Aerial Photo: Nearmap 06/08/2021
Surface analysis: Derived from LiDAR - Newcastle, 1 metre Resolution Digital Elevation Model © Department Finance, Services and Innovation 2013

N
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0 50 100
Meters

A3 Scale: 1:2,000

File:2165-KingsHillLot120-Fig5a-SlopeLiDAR-241030 Date: 30/10/2024

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4.3. Slope & Vegetation Assessment Results

All vegetation identified within the current Bush Fire Prone Land map was confirmed during the site inspection.

Precinct 4 and part of Precinct 1 is generally in the centre of the subject site and utilises the area of the site that has historically been used for grazing and mostly cleared of mature vegetation. Immediately to the north of the main entry collector road will be managed as an IPA and therefore excluded for the purposes of PBP 2019.

The predominant bushfire hazard affecting Precinct was assessed as a *forest;* Hunter Macleay Dry Sclerophyll Forest (HM DSF*).* The *forest* is identified as the primary bushfire hazard and extends further east and south within and beyond 140m of Precincts 1 - 4. A temporary hazard contained within the residential zone to the east of Precinct 1 is currently heavily vegetated and classified as a forest (HM DSF). All vegetation up to 100m east of Precincts 1 and 4 will be managed as a Temporary APZ.

Vegetation within 140m from the development sites most southern boundary, was confirmed largely as a dry *rainforest* transitioning to the above mentioned *forested wetland*: *Coastal Floodplain Wetland* and continues further to the south-east. The existing vegetation in this gully could be described as an ecotone of the two vegetation formations which have similar available fuel loads. However in accordance with the approved VMP, the land zoned C2 to south of Precinct 4 that has historically been used to graze livestock will be rehabilitated. The VMP details the revegetation commensurate with a grassy forest. Accordingly, the vegetation within the riparian corridor south of Precinct 4 has been assessed as a Hunter Macleay Dry Sclerophyll Forest; comparable to the surrounding remnant vegetation.

Grassland vegetation exists on the western side of Newline Road within and beyond 140m from the development site.

Rural residential properties exist to the west of the development site and are separated by Newline Road. These properties are managed lands and therefore excluded for the purposes of PBP 2019. It will be recommended that all land within 50m of the existing dwellings is managed as an IPA as the existing buildings are unlikely to comply with the construction requirements for buildings in bushfire prone areas.

The results of hazard assessment are detailed in **Table 5** and shown in **Figure 18**.

Table 5: Slope and Vegetation Assessment Results

Transect	Vegetation Description	Vegetation Classification (PBP 2019)	Slope
T1 North	Monarch's Rise approved residential development (DA16-2013-599-1)	Excluded	2.3° Downslope
T2 East	Monarch's Rise approved residential development (DA16-2013-599-1)	Excluded	2.1° Downslope
T3 South-east	Rainforest vegetation south-east of the site within the existing environmental conservation zoned corridor	*Rainforest*	1.3° Downslope
T4 South	Forest vegetation south of the site to be rehabilitated within the existing environmental conservation zoned corridor	*Forest* (Hunter Macleay Dry Sclerophyll Forest)	1.7° Downslope
T5 South	Forest vegetation south of the site to be rehabilitated within the existing environmental conservation zoned corridor	*Forest* (Hunter Macleay Dry Sclerophyll Forest)	2.7° Downslope
T6 West	The most south-western lot within the development to Newline Road, separated by a narrow corridor of vegetation managed as a temporary APZ	Excluded	5.0° Downslope

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Figure 18

Slope & Vegetation Assessment

BUSHFIRE PLANNING AUSTRALIA

- Precinct 4
- 100m buffer
- 140m buffer
- Contour (5m)
- RL
- Downslope transect
- Existing Zone Boundary (PSLEP 2013)
- Temporary APZ (if required)

Vegetation Class

- Grassland
- Coastal Floodplain Wetlands
- Coastal Freshwater Lagoons
- Dry Rainforests
- Hunter-Macleay Dry Sclerophyll Forests
- Rehabilitated Forest (Hunter Macleay DSF)
- Northern Hinterland Wet Sclerophyll Forests
- Sydney Coastal Dry Sclerophyll Forests
- Managed Land (Inner Protection Area)
- Managed Land / Low threat vegetation
- Future Road Crossing

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2024
Aerial Photo: Nearmap 06/08/2021
Vegetation: Bushfire Planning Australia 2024
Zoning: Department of Planning, Industry and Environment 2024
Surface analysis: Derived from LiDAR - Newcastle, 1 metre Resolution Digital Elevation Model © Department Finance, Services and Innovation 2013

N W E S

0 50 100
Meters

A3 Scale: 1:2,000

File:2165-KingsHillLot120-Fig6a-SlopeVeg-241030 Date: 30/10/2024

4.4. Significant Environmental Features

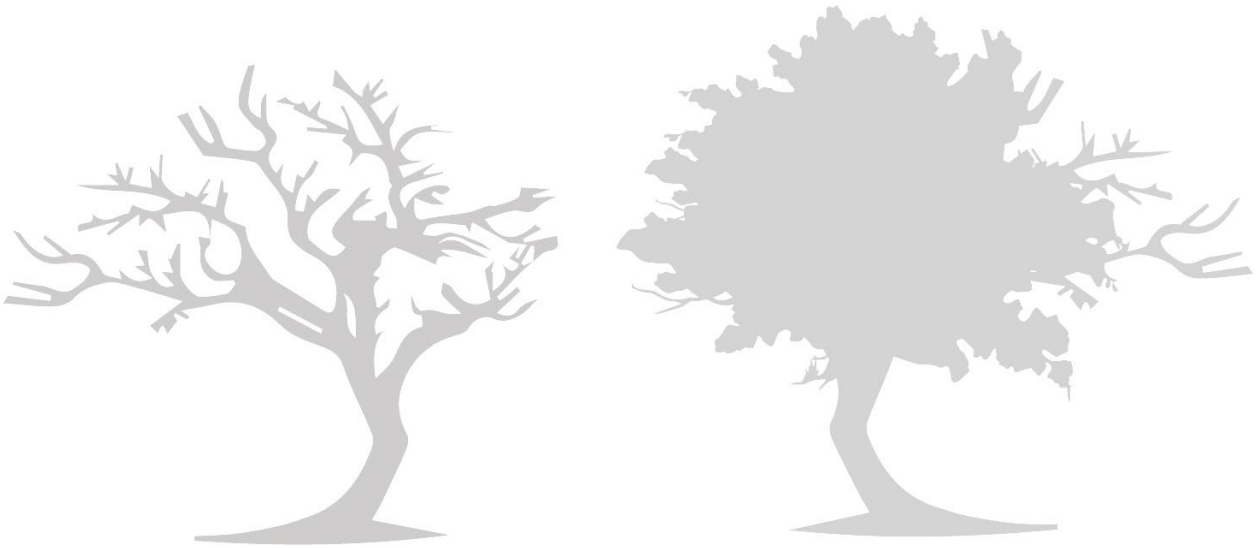
The recommended bushfire protection measures have been designed to avoid any unacceptable impacts on a significant environmental feature. The site is generally devoid of any remnant vegetation.

4.5. Threatened Species, populations or ecological communities

The area of the site to be affected by the proposed development has been identified to minimise impact on any threatened species, population or EEC. All bushfire mitigation measures; including APZs will consider the existing and potential biodiversity values to minimise impact where possible.

4.6. Aboriginal Objects

A search of the AHIMS database within 50m of the development site (results contained in **Appendix B**) revealed there is no Aboriginal sites or places recorded.



5. Bushfire Protection Measures

This report has adopted the methodology to determine the appropriate Bushfire Protection Measures (BPMs) detailed in PBP 2019. The recommended BPMs demonstrate the aims and objectives of PBP 2019 have been satisified; includinig the matters considered by the RFS necessary to protect persons, property and the environment from the danger that may arise from a bushfire.

- APZs
- Access
- Water Supply and Utilities
- Building Construction and Design
- Landscaping
- Emergency Management Arrangements

5.1. Asset Protection Zones

An APZ is an area surrounding a development that is managed to reduce the bushfire hazard to an acceptable level to mitigate the risk to life and property. The required width of the APZ varies with slope and the type of hazard. An APZ can consist of both an inner protection area (IPA) and an outer protection area (OPA).

5.1.1. Determining the Appropriate Setbacks

To achieve compliance with the performance criteria for APZs (Table 5.3a), the Acceptable Solutions outlined in Table A1.12.2 of PBP 2019 may be adopted as a deemed-to-satisify solution.

Alternatively, the appropriate APZ setback may be determined to achieve the Performance Criteria by adopting a performance-based solution. Based on the unique site characteristics identified by the BAR, the intensity of a bushfire event presented as the radiant heat exposure was calculated at several locations throughout the development site using the NBC Bushfire Attack Assessor V4.1. The nominated fuel loads for the respective vegetation classifications as published by the RFS in March 2019 have been used to determine the APZs and the effective slope obtained from the Digital Elevation Model (DEM) for each transect.

As the site lies within the Port Stephens City Council LGA, it is assessed under a FDI rating of 100. The Detailed Method (Method 2) outlined in Australian Standard *AS3959-2018 Construction of buildings in bushfire prone areas* was used to calculate the potential level of radiant heat flux generated at the nominated locations (see transects T1-T6). To ensure the APZs achieve the intent of Section 5.3.1 of PBP 2019, the APZs have been determined to ensure all lots are able to accomomodate a dwelling that will not be exposed to radiant heat levels exceeding 29kW/m^2. The NBC Bushfire Attack Assessor V4.1 report detailing the inputs used is contained in **Appendix C**.

Refer to **Table 6** and **Figure 20** for the recommended APZs.

Table 6: Required and Recommended Asset Protection Zones

Transect	Vegetation Classification (PBP 2019)	Effective Slope	PBP 2019 FDI 100 Table A1.12.2	Recommended APZ (29kW/m^2) Method 2
T1 North	Excluded	2.3° Downslope	N/A	>100m
T2 East	Excluded	2.1° Downslope	N/A	>100m
T3 South-east	*Rainforest*	1.3° Downslope	14m	12m
T4 South	*Forest* (Hunter Macleay Dry Sclerophyll Forest)	1.7° Downslope	29m	17m
T5 South	*Forest* (Hunter Macleay Dry Sclerophyll Forest)	2.7° Downslope	29m	18m
T6 West	Excluded	5.0° Downslope	N/A	>100m

5.2. Landscaping and Vegetation Management

In APZs and IPAs, the design and management of the landscaped areas in the vicinity of buildings have the potential to improve the chances of survival of people and buildings. Reduction of fuel does not require the removal of all vegetation. Trees and plants can provide some bushfire protection from strong winds, intense heat and flying embers (by filtering embers) and changing wind patterns.

Generally landscaping in and around a bushfire hazard should consider the following:

- Priority given to retaining species that have a low flammability;
- Priority given to retaining species which do not drop much litter in the bushfire season and which do not drop litter that persists as ground fuel in the bush fire season;
- Priority given to retaining smooth barked species over stringy bark; and
- Create discontinuous or gaps in the vegetation to slow down or break the progress of fire towards the dwellings.

Landscaping within APZs and IPAs should give due regard to fire retardant plants and ensure that fuel loads do not accumulate as a result of the selected plant varieties.

The principles of landscaping for bushfire protection aim to:

- Prevent flame impingement on dwellings;
- Provide a defendable space for property protection;
- Reduce fire spread;
- Deflect and filter embers;
- Provide shelter from radiant heat; and
- Reduce wind speed.

Avoiding understorey planting and regular trimming of the lower limbs of trees also assists in reducing fire penetration into the canopy. Rainforests species such as Syzygium and figs are preferred to species with high fine fuel and/or oil content. Trees with loose, fibrous or stringy bark should be avoided. These trees can easily ignite and encourage ground fire to spread up to, and then through the crown of trees.

Consideration should be given to vegetation fuel loads present on site with particular attention to APZs. Careful thought must be given to the type and physical location of any proposed site landscaping. Inappropriately selected and positioned vegetation has the potential to 'replace' any previously removed fuel load.

Bearing in mind the desired aesthetic and environment sought by site landscaping, some basic principles have been recommended to help minimise the chance of such works contributing to the potential hazard on site.

Specific requirements for the management of vegetation and landscaping around vulnerable developments and within the APZ the following conditions apply:

- Within 10m of a building, flammable objects such as plants, mulches and fences must not be located close to vulnerable parts of the building such as windows, decks and eaves;
- Trees must not overhang the roofline of the building, touch walls or any other elements of a building;
- Grass should be no more than 100mm in height. All leaves and vegetation debris are to be removed at regular intervals (rake leaves and twigs from grass every week during the fire season);
- Establish lawn substitutes including non-flammable ground covers such as decorative stone or gravel;

- Plants greater than 100m in height at maturity must not be placed directly in front of a window or other glass features;
- Tree canopy separation of 2 metres and overall canopy cover no more than 15% at maturity;
- Preference should be given to smooth barked and evergreen trees;
- Shrubs should not be located under trees;
- Shrubs should not form more than 10% ground cover; and
- Provide a reliable and sufficient water supply and installation of sprinkler systems to create a well-watered landscape.

Whilst it is recognised that fire-retardant plant species are not always the most aesthetically pleasing choice for site landscaping, the need for adequate protection of life and property requires that a suitable balance between visual and safety concerns be considered.

It is reiterated again that it is essential that any landscaped areas and surrounds are subject to ongoing fuel management and reduction to ensure that fine fuels do not build up.

5.3. Access

In the unlikely event of a serious bushfire, it will be essential to ensure that adequate ingress / egress and the provision of defendable space are afforded in the subdivision layout. All dwellings must have direct access to a public road. Section 5.3.2 of PBP 2019 requires a development to provide safe operational access to structures and water supply for emergency services while residents are seeking to evacuate.

Refer to **Appendix A** for the potential subdivision plan indicating possible access arrangements. Access will be provided from Newline Road, via a newly constructed 23m wide road as part of the approved Precinct 1 (DA-16-2013-599-1). The potential subdivision plan indicates a collector road with a 13m wide pavement leading into the site and continuing south to provide a connection to a future stage.

A 10.5m wide perimeter road (Road 3 & 9) connecting to the approved Precinct 1 at the most eastern boundary will act as the APZ against the primary bushfire hazard within the rehabilitated riparian corridor along the southern boundary. The internal non-perimeter roads are able to be designed and constructed with a minimum 8m carriageway and will provide direct access to each lot and future precincts. Several lane ways are shown to provide secondary access to multiple lots. The 6m wide laneways also comply with PBP 2019 and no parking will be permitted on either side of the laneways.

The proposed 8m to 12.5m wide internal local streets (non-perimeter roads) are considered sufficiently wide enough to accommodate parking for light vehicles on both sides of road, outside of the primary vehicle carriageway. It is noted the standard for on-street parking required by Australian Standard *AS2890.5:2020 Parking facilities On-street parking* for roads with a speed limit of 50km/hr or less is to be between 2.0m and 2.3m. It is also noted that a RFS Category 1 Firefighting vehicle is 2.4m wide. Furthermore, applying the option of permitting short constrictions where the width of the access road may be reduced for sections less than 30m, an 8m wide road is considered wide enough to provide a continuous unobstructed carriageway with parking on both sides of the road. The combination of double width driveways along a typical residential local street will prevent a continuous line of parked cars on both sides of the local street.

In summary, the road network outlined in the potential subdivision plan is able to provide safe, all-weather two-way through roads and safe operational access for emergency service personnel and evacuation purposes; complying with the relevant provisions contained in Section 5.3.2 of PBP.

5.4. Services - water, electricity and gas

5.4.1. Water

Fire hydrant spacing, sizing and pressure should comply with AS 2419.1 - 2005. Hydrants are not to be located within any road carriageway.

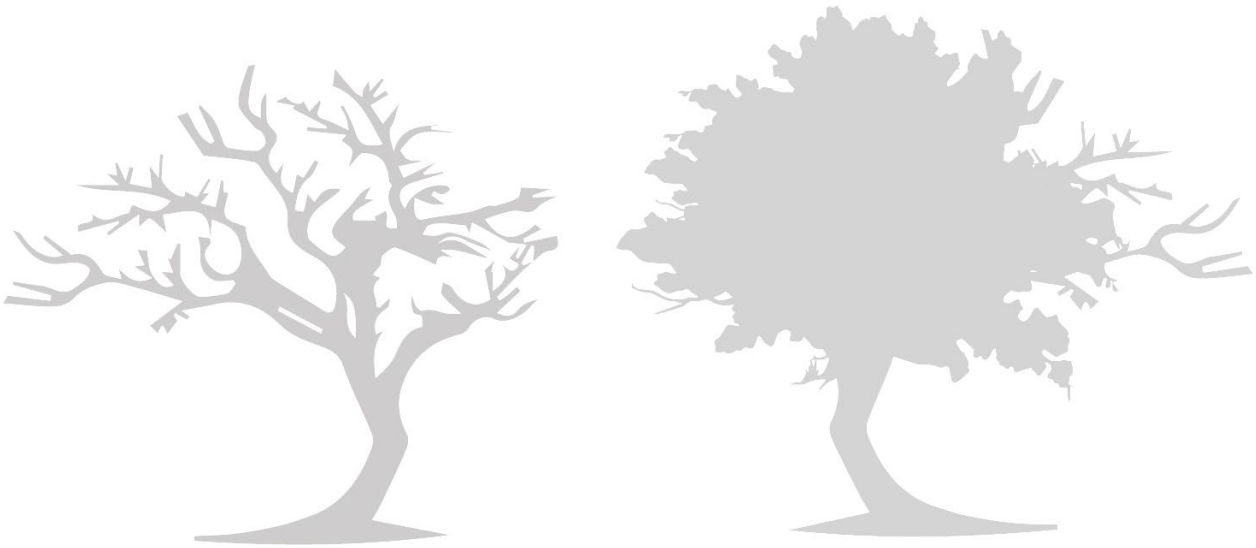
All sites within the proposed development will be connected to the internal reticulated water supply.

5.4.2. Electricity

All electricity services will be located underground.

5.4.3. Gas

Any reticulated or bottled gas should be installed and maintained according to the requirements of the relevant authorities and AS 1596-2002. It is expected that the location of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.



5.5. Construction Standards: Bushfire Attack Level

All buildings must satisfy the Performance Requirements of the National Construction Code: Building Code of Australia (BCA). Part 2.3 of Volume 2 of the BCA applies to dwellings located within designated bushfire areas, which are defined as:

> *Land which has been designated under a power in legislation as being subject, or likely to be subject to, bushfires.*

Accordingly, all forthcoming habitable buildings must satisfy the requirements of Part 3.7.4 of the BCA. The *Deemed-to-Satisfy* (DTS) provision of the BCA can only be achieved if dwellings in bushfire prone areas are constructed in accordance with Australian Standard *AS3959-2018 Construction of buildings in bushfire prone areas*. Alternatively, the DTS provisions can also be achieved if the habitable building is constructed in accordance with the NASH Standard 'Steel Framed Construction in Bushfire Areas'.

Building design and the materials used for construction of future dwellings should be chosen based on the information contained within AS3959-2018, and accordingly the designer/architect should be made aware of this recommendation.

The determinations of the appropriate bushfire attack level (BAL) is based on the maximum potential radiant heat exposure (**Figure 19**). BALs are based upon parameters such as weather modelling, fire-line intensity, flame length calculations, as well as vegetation and fuel load analysis. The determination of the BAL is derived by assessing the:

- Relevant FDI = *100*;
- Flame temperature = *1090K*;
- Slope = *downslope*;
- Vegetation classification = *Forest* and *Rainforest*; and
- Building location.

The BALs for each transect have been calculated and provided in **Table 7**. To demonstrate the BAL ratings, **Figure 20** has been prepared in accordance with the methodology to prepare a BAL Plan outlined in the RFS User Guide for Subdivision of Urban Release Areas on Bush Fire Prone land to represent the BALs required.

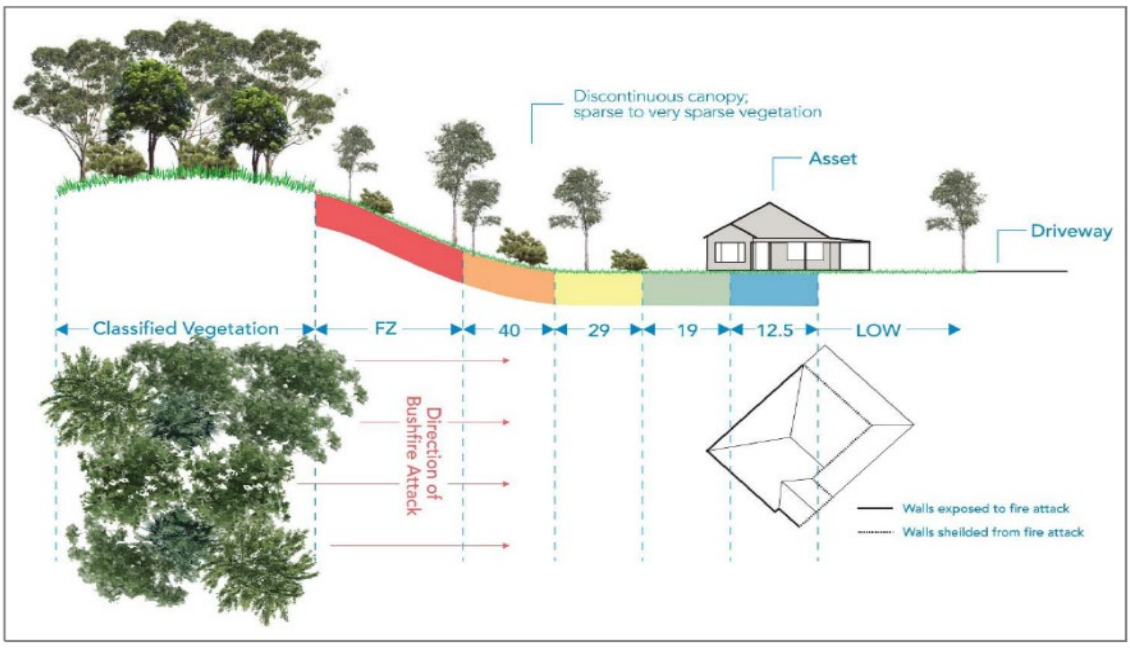


Figure 19: Bushfire Attack Level

Table 7: Required BALs

Transect	Vegetation Classification (PBP 2019)	Slope	APZ (29kW/m^2)	Distance from Hazard	Bushfire Attack Level (BAL)
T1, T2 & T6	Excluded	<5.0° Downslope	**N/A**	>100m	BAL-LOW
T3 South-east	*Rainforest*	1.3° Downslope	**12m**	0m-<10m	BAL-FZ
				10m-<12m	BAL-40
				12m-<17m	BAL-29
				17m-<24m	BAL-19
				24m-<100m	BAL-12.5
T4 South	*Forest* (Hunter Macleay Dry Sclerophyll Forest)	1.7° Downslope	**17m**	0m-<16m	BAL-FZ
				16m-<17m	BAL-40
				17m-<25m	BAL-29
				25m-<35m	BAL-19
				35m-<100m	BAL-12.5
T5 South	*Forest* (Hunter Macleay Dry Sclerophyll Forest)	2.7° Downslope	**18m**	0m-<17m	BAL-FZ
				17m-<18m	BAL-40
				18m-<26m	BAL-29
				26m-<36m	BAL-19
				36m-<100m	BAL-12.5

Project: Kings Hill Precinct 4
Job No: 2165

Figure 20

Subdivision BAL Plan

BUSHFIRE PLANNING AUSTRALIA

- Precinct 4
- 100m Buffer
- 140m Buffer
- Contour (5m)
- Asset Protection Zone (APZ)
- Temporary APZ (if required)
- 29m APZ - Table A1.12.5 PBP 2019

Required Bushfire Attack Levels (AS3959-2018)

- BAL - FZ
- BAL - 40
- BAL - 29
- BAL - 19
- BAL - 12.5

Vegetation Class

- Grassland
- Coastal Floodplain Wetlands
- Dry Rainforests
- Hunter- Macleay Dry Sclerophyll Forests
- Rehabilitated Forest (Hunter Macleay DSF)
- Managed Land (Inner Protection Area)
- Managed Land / Low threat vegetation
- Future Road Crossing

SOURCE:
Cadastral Boundary: NSW Department of Finance, Services and Innovation 2024
Vegetation: Bushfire Planning Australia 2024
Surface analysis: Derived from LiDAR - Newcastle, 1 metre Resolution Digital Elevation Model © Department Finance, Services and Innovation 2013

N W E S

0 50
Meters

A3 Scale: 1:1,500

File:2165-KingsHillLot120-Fig7-BALs-241105 Date: 5/11/2024

5.6. Emergency Services

In the event of an emergency, there is a NSW Rural Fire Brigade located at 33 Rees James Road, Raymond Terrace approximately 6.4km or 7 minutes drive from the site (**Figure 21**). A second NSW Fire & Rescue Station is located at 5 Leisure Way, Raymond Terrace (9kms from site) if required (**Figure 22**).

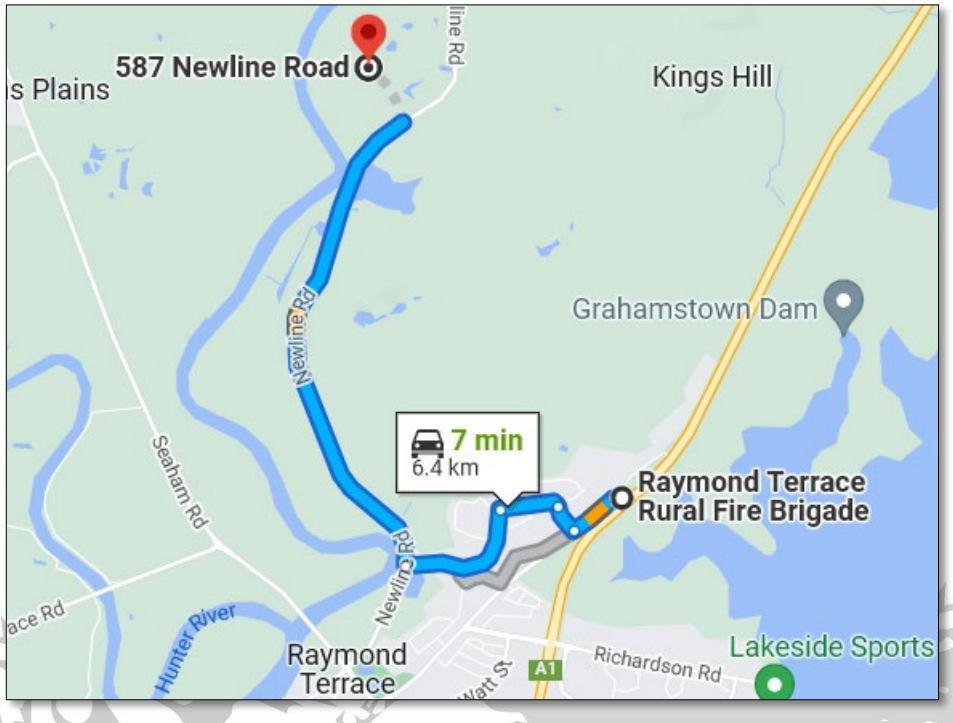


Figure 21: Rural Fire Brigade - Raymond Terrace

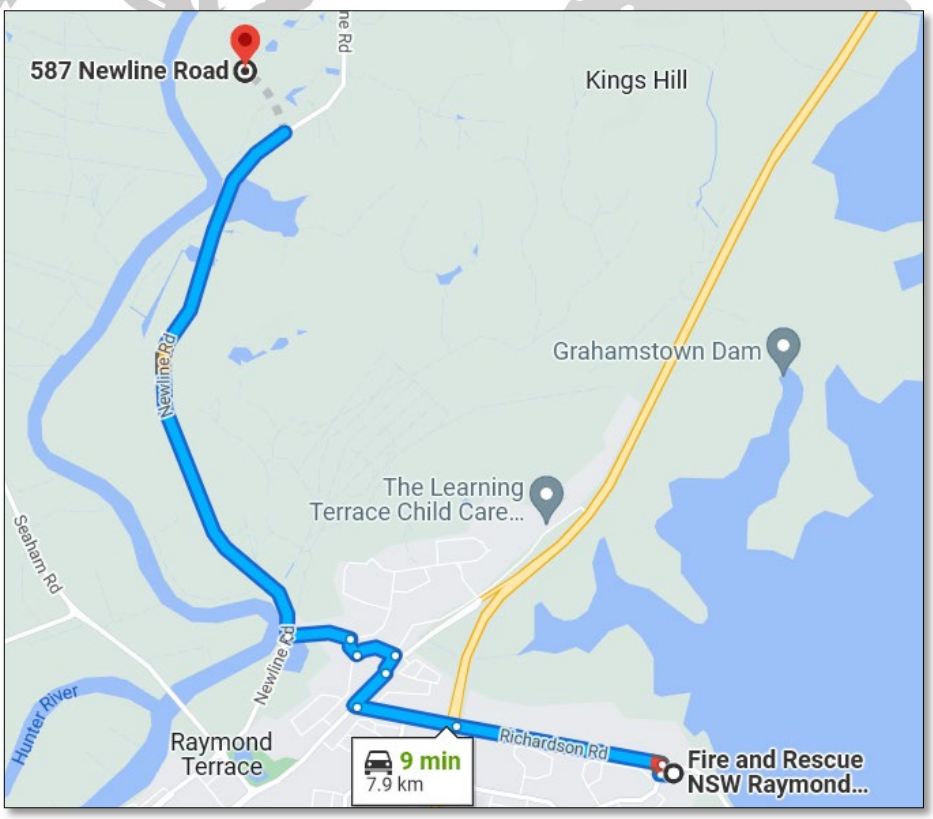


Figure 22: NSW Fire & Rescue - Raymond Terrace

6. Conclusion and Recommendations

Bushfire Planning Australia has been engaged by the McCloy Project Management Pty Ltd to complete a Strategic Bushfire Study to support the planning proposal for Precinct 4 and part of Precinct 1 of Monarch's Rise located at 587 Newline Road, Raymond Terrace; legally known as Part of Lot 2 DP37430 and Part of Lot 32 DP554875. The planning proposal seeks to realign several land use zone boundaries to align with the existing approved subdivision of Precinct 1. Furthermore, the planning proposal may result in an increase in potential density of residential lots as a result of the reduced minimum lot size. Whilst the density within Precinct 4 may increase, the overall yield of Monarch's Rise has been reduced by at least 200 residential lots resulting from the substantial reduction in the development footprint with R2 residential zoned land further east of Precincts 1 and 4. Acknowledging the overall reduction in yield, it remains the overall development has been reduced in both yield and footprint.

This SBS found that the site is currently exposed to a high bushfire hazard to the east and south of the site; beyond future Precincts 2 and 3. The primary hazard is consistent with a *forest* vegetation, namely Hunter Macleay Dry Sclerophyll Forest (DSF), which transitions from a *forested wetland*. However, the closest bushfire hazard is contained to the two (2) isolated sections of the existing pasture directly south of Precinct 4. The land zoned C2 will be rehabilitated and based on the requirements of the approved Vegetation Management Plan, the bushfire hazard has been assessed as a forest.

The BAR concludes that the hazard identified can be successfully mitigated by applying the requirements of PBP 2019, such as Asset Protection Zones. Accordingly, as the bushfire hazard can be sufficiently mitigated, the proposed amendments to PSLEP 2013 can be supported as the development is appropriate in the bushfire hazard context.

In summary, the following recommendations have been designed to enable future residential development to achieve the aims and objectives of PBP 2019:

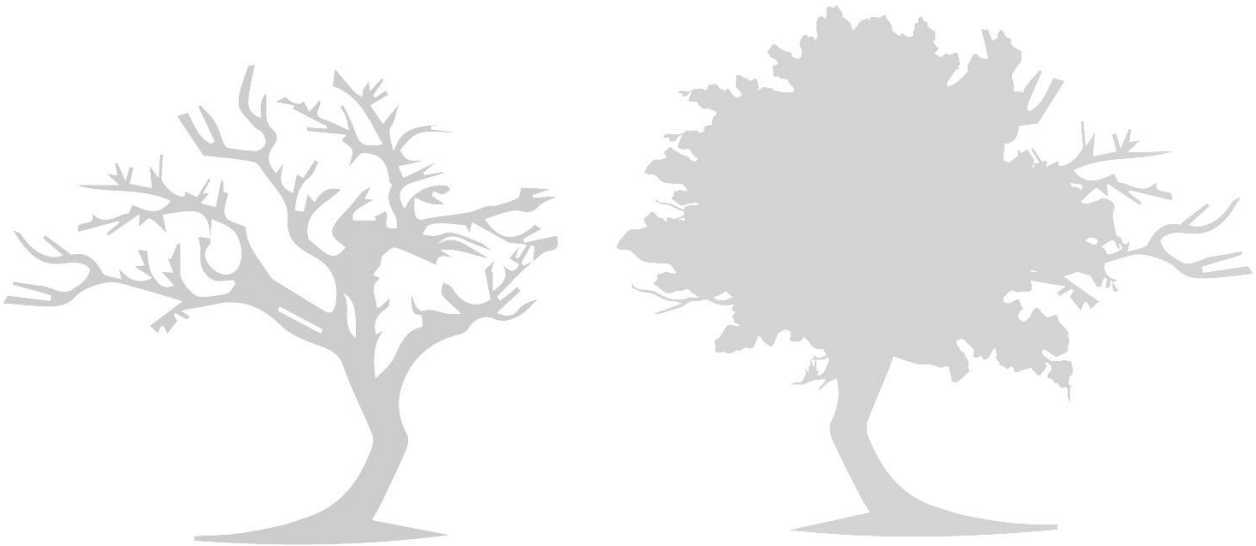
1. The entire site shall be managed as an Inner Protection Area (**IPA**) as outlined within Appendix 4 of PBP 2019 and the RFS document *Standards for asset protection zones*;
2. Access shall satisfy the Performance Criteria outlined in Table 5.3b of PBP 2019;
3. Vegetation within road verges (including swales) to be consistent with a grassland vegetation classification with tree canopy less than 10% at maturity (and considered unmanaged);
4. All future dwellings to be constructed on the proposed lots shall have due regard to the specific considerations given in the National Construction Code: Building Code of Australia (BCA) which makes specific reference to Australian Standard AS3959-2018 Construction of buildings in bushfire prone areas (AS3959-2018) and the NASH Standard Steel Framed Construction in Bushfire Prone Areas;
5. All new lots are to be connected to a reliable water supply network and that suitable fire hydrants are located throughout the development site that are clearly marked and provided for the purposes of bushfire protection. Fire hydrant spacing, sizing and pressure shall comply with AS2419.1 2005 and section 5.3.3 of PBP 2019; and
6. Consideration should be given to landscaping and fuel loads on site to decrease potential fire hazards on site.

Consideration should be given to landscaping and fuel loads on site to decrease potential fire hazards on site. This assessment has been made based on the bushfire hazards observed in and around the site at the time of inspection and production (November 2024) and demonstrates the development has satisfied the aims and objectives of Planning for Bushfire Protection 2019.

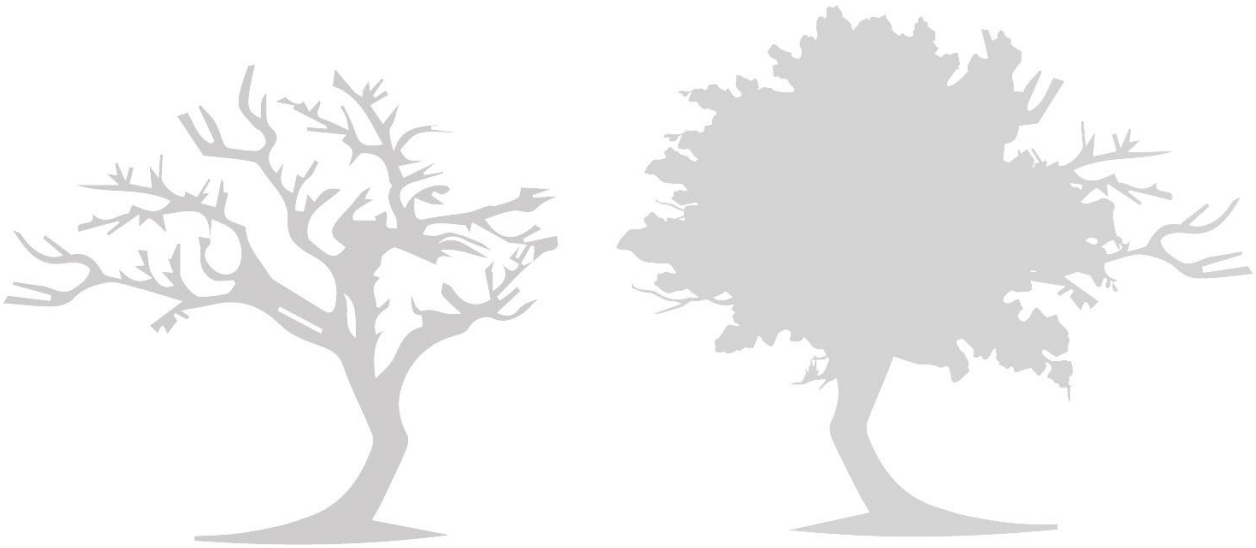
Finally, should the above recommendations be implemented, the existing bushfire risk should be suitably mitigated to offer an acceptable level of protection to life and property for those persons and assets occupying the site, but they do not and cannot guarantee that the area will not be affected by bushfire at some time and that property and life damage/loss will not occur.

7. References

- NSW Rural Fire Service (2005). *Standards for Asset Protection Zones*. NSW Rural Fire Service.
- NSW Rural Fire Service (2019). Planning for Bushfire Protection – A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners.
- Ramsay, GC and Dawkins, D (1993). *Building in Bushfire-prone Areas – Information and Advice*. CSIRO and Standards Australia.
- Rural Fires and Environmental Assessment Legislation Amendment Act 2002.
- Standards Australia (2018). AS 3959 – 2018: Construction of Buildings in Bushfire-prone Areas.



Appendix A: Plan of Proposed Residential Subdivision



LEGEND:

PLANNING PROPOSAL SITE BOUNDARY

APPROVED RESIDENTIAL SUBDIVISION
REFER PSC DA 16-2013-599-1

ROAD (BY OTHERS)

NEWLINE ROAD (EXISTING)

ROAD 3 (VARIES-8.0-4.5m WIDE)

ROAD 2 (4.0-8.0-4.5m WIDE)

ROAD 4 (4.0-8.0-4.5m WIDE)

ROAD 5 (4.0-8.0-4.5m WIDE)

ROAD 1 (4.0-13.0-10.0m WIDE)

ROAD 6 (1.0-6.0-1.0m WIDE)

ROAD 8 (1.0-6.0-1.0m WIDE)

ROAD 7 (4.0-8.0-4.5m WIDE)

ROAD 9 (4.0-8.0-4.5m WIDE)

ROAD 10 (1.0-6.0-1.0m WIDE)

ROAD (BY OTHERS)

ROAD 3 (4.0-10.5-4.5m WIDE)

ROAD 9 (4.5-10.5-4.5m WIDE)

C2 ZONE
ENVIRONMENTAL
CONSERVATION

APPROVED RESIDENTIAL SUBDIVISION
REFER PSC DA 16-2013-599-1

100 mm ON A1 SIZE ORIGINAL

0 50

DRG TITLE:	MIXED USE (MU1) ZONE - POTENTIAL SUBDIVISION PLAN						
PROJECT NAME:	MONARCH'S RISE	**JOB NO:**	1009	**SCALE:**	1:750	**DESIGNED BY:**	OTHERS
SITE ADDRESS:	587 NEWLINE ROAD, RAYMOND TERRACE (LOT 2, DP37420)	**DRG. REF:**	PP001	**SHT SIZE:**	A1	**DRAFTED BY:**	D. WOODBRIDGE
LGA:	PORT STEPHENS COUNCIL	**REVISION:**	A	**DATE:**	24/09/2024	**PROJECT MANAGER:**	R. BROWN

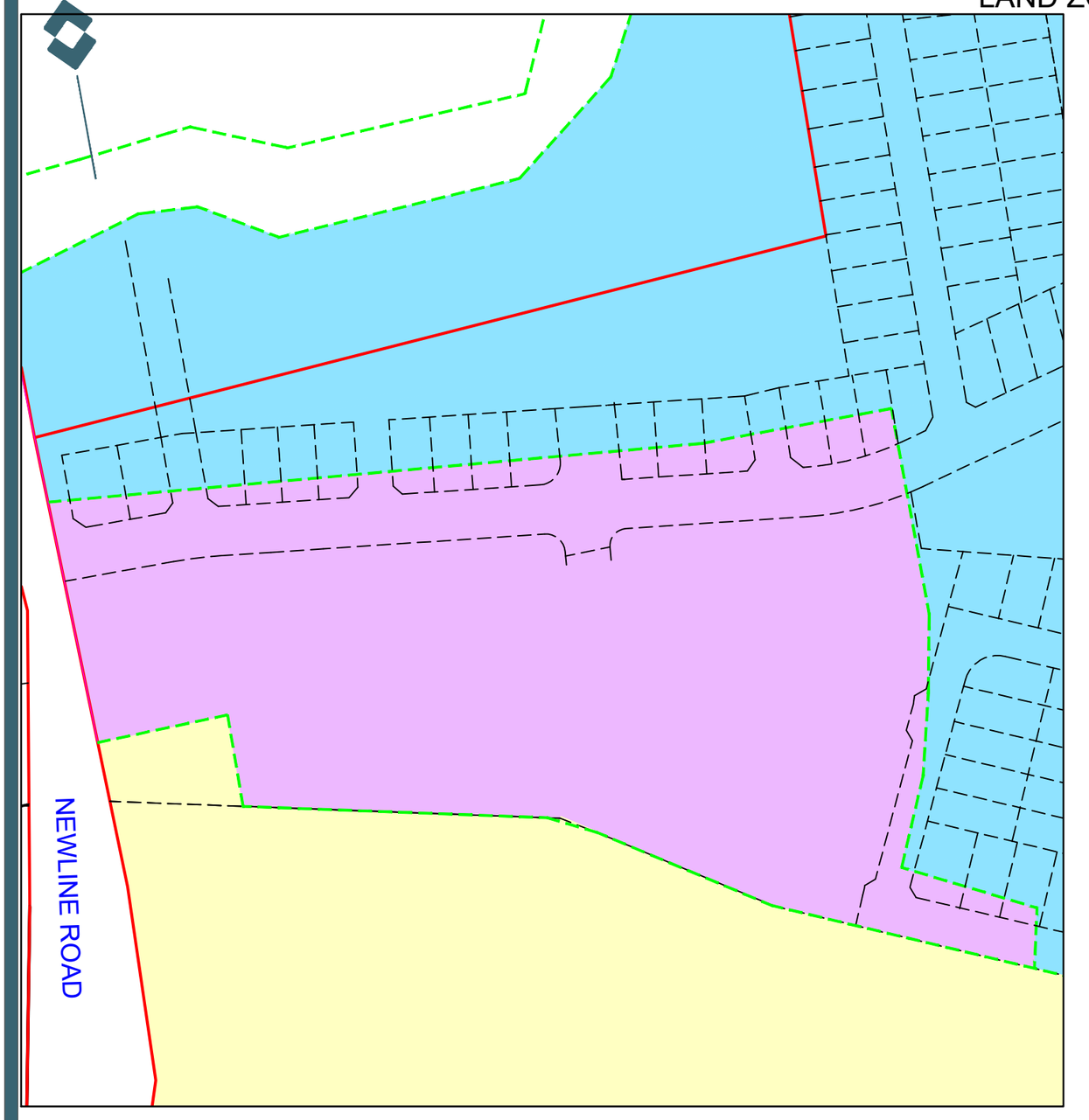
CLIENT: McCLOYGROUP

BEFORE YOU DIG www.byda.com.au

NOT FOR CONSTRUCTION

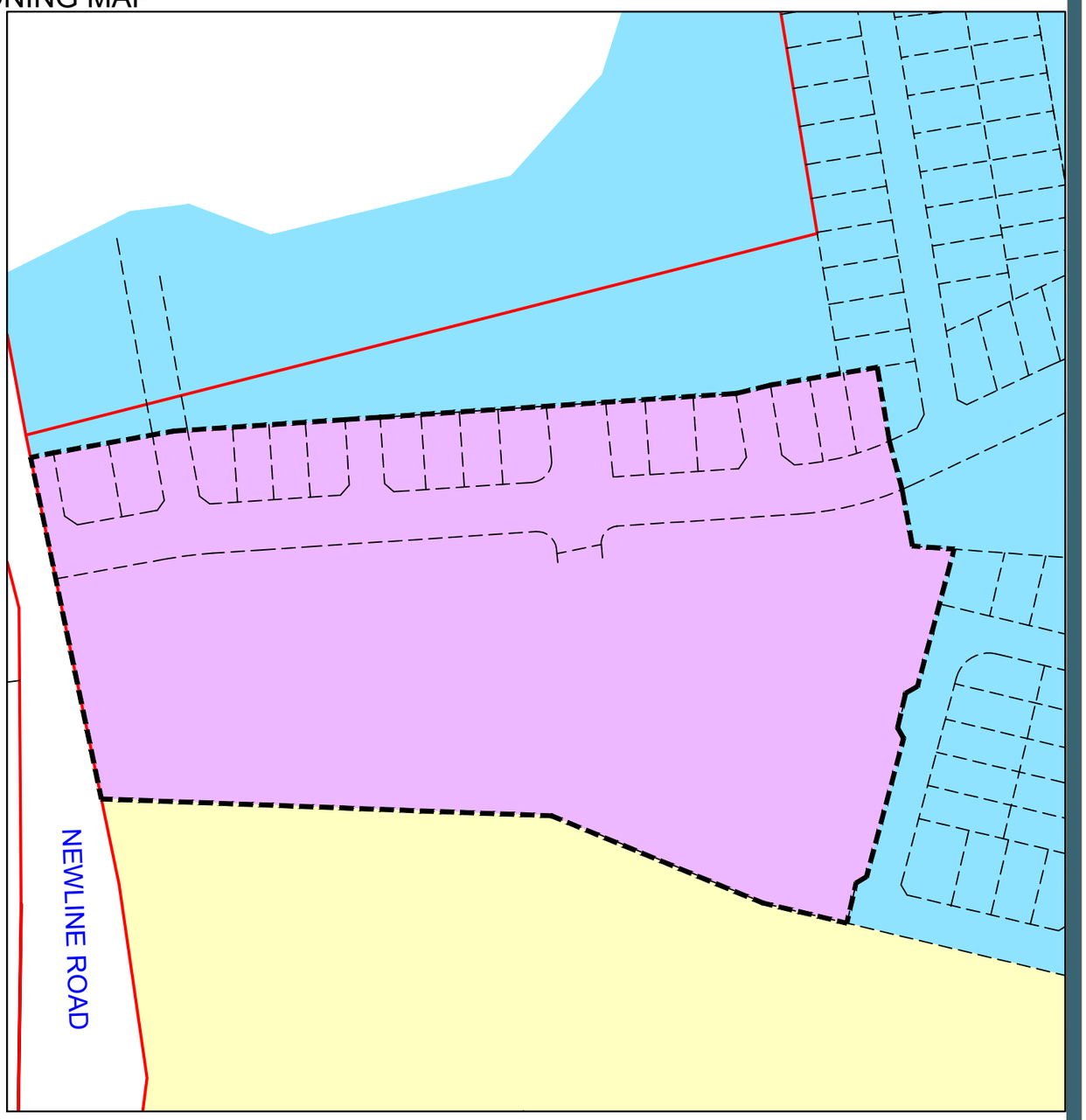
HIGHVIEW PARTNERS

PORT STEPHENS LOCAL ENVIRONMENTAL PLAN 2013
LAND ZONING MAP



CURRENT LAND ZONING

B4	EXISTING B4 ZONING
B4	EXISTING B4 MINIMUM LOT SIZE 400m²
R1	EXISTING R1 GENERAL RESIDENTIAL
E2	EXISTING E2 ENVIRONMENTAL CONSERVATION
	EXISTING ZONE BOUNDARY



PROPOSED LAND ZONING

B4	PROPOSED B4 ZONING
B4	PROPOSED B4 MINIMUM LOT SIZE 300m²
R1	PROPOSED R1 GENERAL RESIDENTIAL
E2	PROPOSED E2 ENVIRONMENTAL CONSERVATION
	PROPOSED ZONE BOUNDARY

TITLE: PROPOSED SUBDIVISION KINGS HILL (MONARCH'S RISE)
NEWLINE ROAD KINGS HILL

ZONING MAP

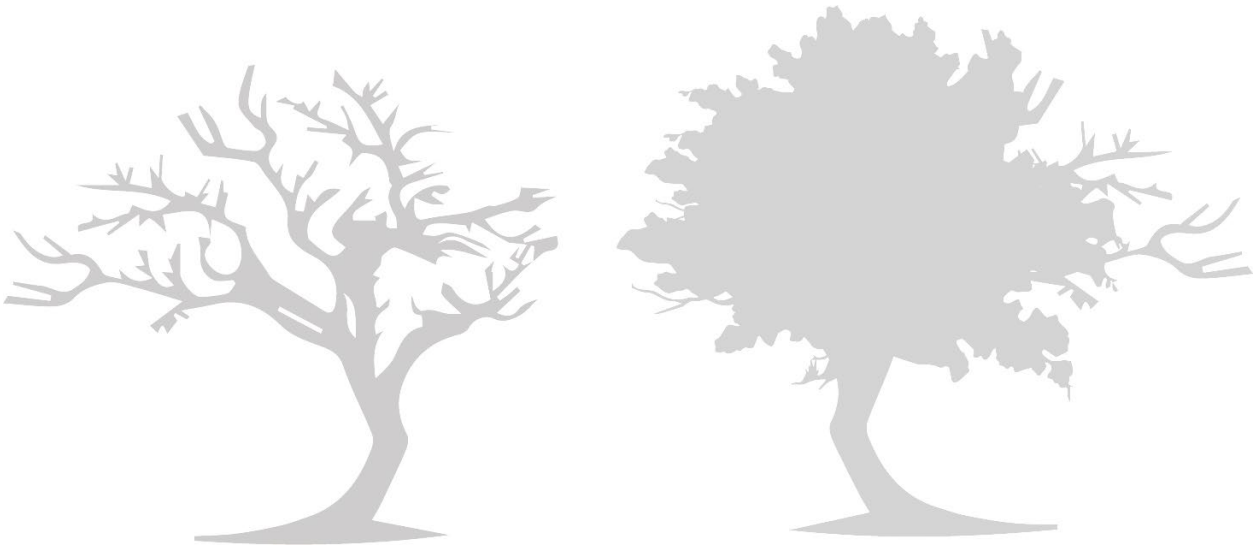
High Definition Design Pty Ltd
KEVIN URANE 0412009891

Date: 16.07.24 Scale: 1:2500 A3 Designed: KU
Cad Ref: HD354 r7 rezoning map

No	Amendment	Drawn	Date
7	PROPOSED ZONING PLAN	KU	16.07.24

Project No HD354
Drawing No HD10
Revision 7

Appendix B: AHIMS Search Results



AHIMS Web Services (AWS)
Search Result

Your Ref/PO Number : 2165 Kings Hill P4

Client Service ID : 941479

Katrina Greville

21 Costata Crescent
Adamstown New South Wales 2289

Attention: Katrina Greville

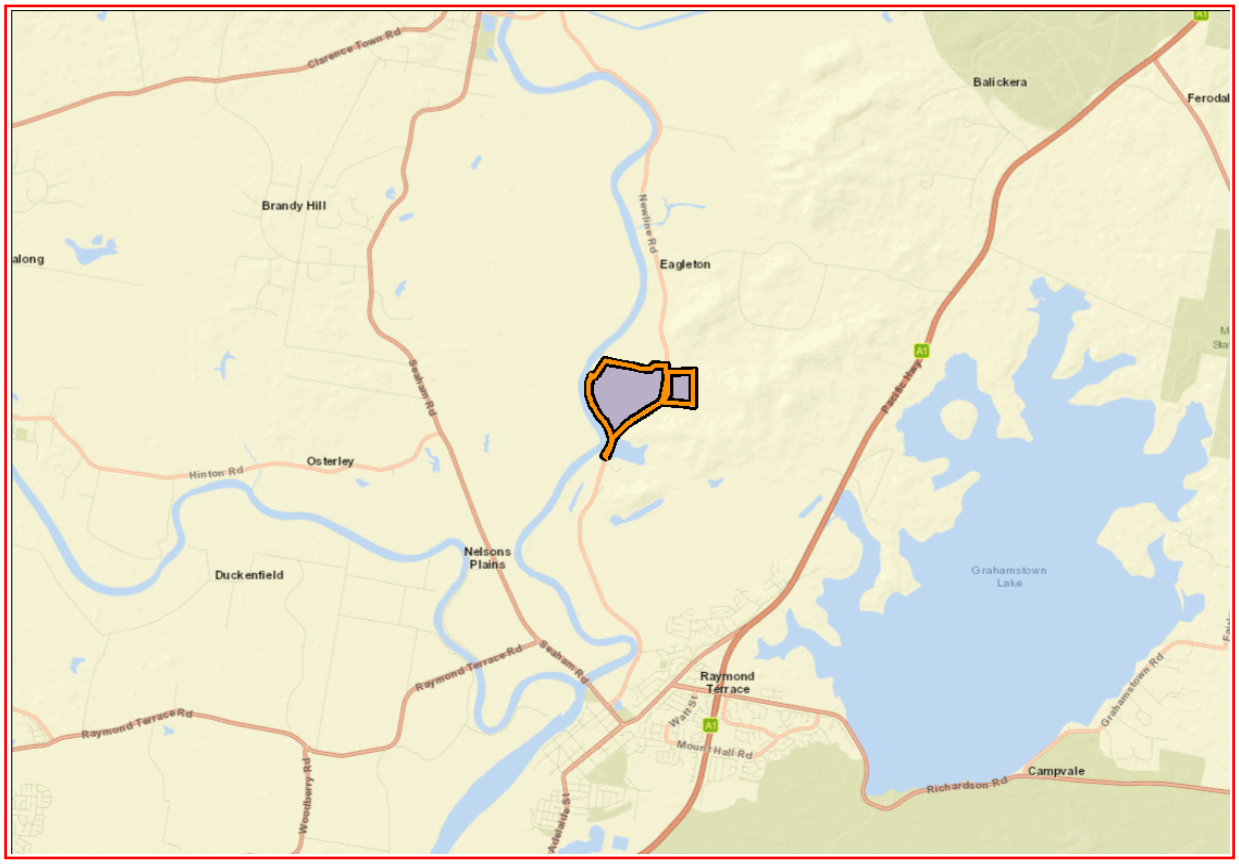
Email: klmukevski@bigpond.com

Date: 18 October 2024

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 2, DP:DP37430, Section : - with a Buffer of 50 meters, conducted by Katrina Greville on 18 October 2024.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of Heritage NSW AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

0	**Aboriginal sites are recorded in or near the above location.**
0	**Aboriginal places have been declared in or near the above location. ***

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the NSW Government Gazette (https://www.legislation.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Heritage NSW upon request

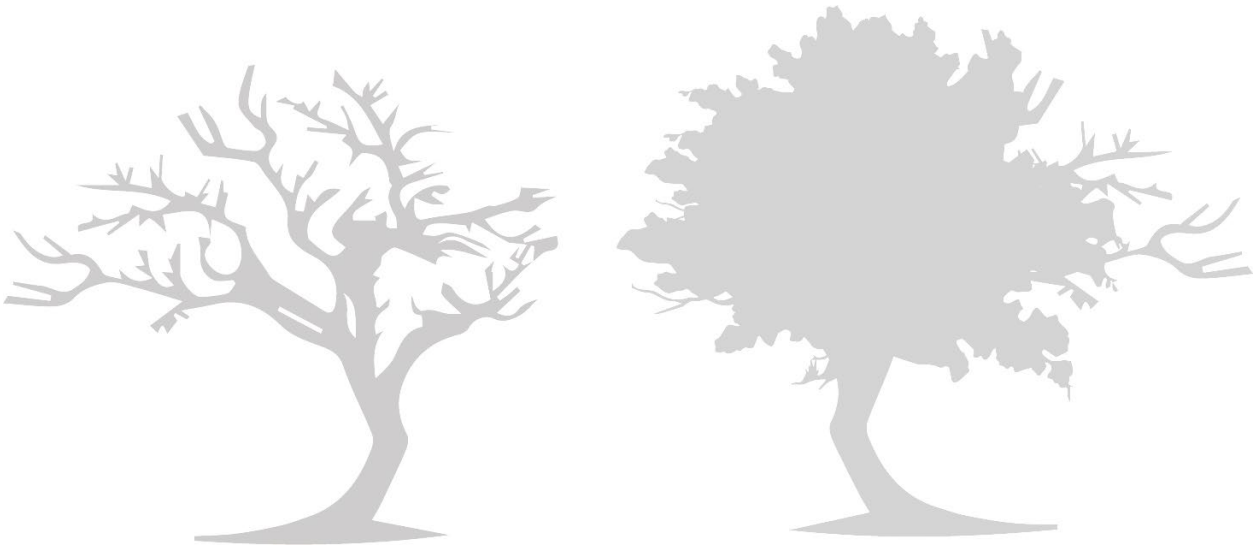
Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Heritage NSW and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

Level 6, 10 Valentine Ave, Parramatta 2150
Locked Bag 5020 Parramatta NSW 2124
Tel: (02) 9585 6345

ABN 34 945 244 274
Email: ahims@environment.nsw.gov.au
Web: www.heritage.nsw.gov.au

Appendix C: NBC Bushfire Attack Assessor V4.1 Report



NBC Bushfire Attack Assessment Report V4.1

AS3959 (2018) Appendix B - Detailed Method 2

Print Date: 18/10/2024 **Assessment Date:** 16/10/2024

Site Street Address: 2165 Monarch's Rise - Newline Road (PP), Kings Hill

Assessor: Stuart Greville; Bushfire Planning Australia

Local Government Area: Port Stephens **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: T3

Vegetation Information

Vegetation Type:	Rainforest		
Vegetation Group:	Forest and Woodland		
Vegetation Slope:	1.3 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	10	**Overall Fuel Load(t/ha):**	13.2
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 29	**Peak Elevation of Receiver(m)**	4.58
Radiant Heat(kW/m2):	27.61	**Flame Angle (degrees):**	65
Flame Length(m):	10.12	**Maximum View Factor:**	0.42
Rate Of Spread (km/h):	1.31	**Inner Protection Area(m):**	12
Transmissivity:	0.864	**Outer Protection Area(m):**	0
Fire Intensity(kW/m):	8952		

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	8	12	17	25	40	6

Run Description:	T4 - revegetated riparian corridor

Vegetation Information

Vegetation Type:	Hunter Macleay DSF		
Vegetation Group:	Dry Sclerophyll Forests (Shrub/Grass)		
Vegetation Slope:	1.7 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	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	17

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 29	**Peak Elevation of Receiver(m)**	6.79
Radiant Heat(kW/m2):	28.75	**Flame Angle (degrees):**	63
Flame Length(m):	15.23	**Maximum View Factor:**	0.444
Rate Of Spread (km/h):	1.89	**Inner Protection Area(m):**	13
Transmissivity:	0.851	**Outer Protection Area(m):**	4
Fire Intensity(kW/m):	24010		

BAL Thresholds

	BAL-40:	**BAL-29:**	**BAL-19:**	**BAL-12.5:**	**10 kw/m2:**	**Elevation of Receiver:**
Asset Protection Zone(m):	13	17	25	35	54	6

Run Description:	T5 - revegetated riparian corridor

Vegetation Information

Vegetation Type:	Hunter Macleay DSF		
Vegetation Group:	Dry Sclerophyll Forests (Shrub/Grass)		
Vegetation Slope:	2.7 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	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	18

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 29	**Peak Elevation of Receiver(m)**	7.18
Radiant Heat(kW/m2):	28.58	**Flame Angle (degrees):**	63
Flame Length(m):	16.11	**Maximum View Factor:**	0.443
Rate Of Spread (km/h):	2.02	**Inner Protection Area(m):**	14
Transmissivity:	0.849	**Outer Protection Area(m):**	4
Fire Intensity(kW/m):	25726		

BAL Thresholds

	BAL-40:	BAL-29:	BAL-19:	BAL-12.5:	10 kw/m2:	Elevation of Receiver:
Asset Protection Zone(m):	14	18	26	36	56	6