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STRATEGIC BUSHFIRE STUDY

for

LAKE MUNMORAH REZONING

(Lot 642 of DP1027231 & Lot 100 DP1044282)

November 2021

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EXECUTIVE SUMMARY

This Strategic Bushfire Study considers the proposed rezoning of the Darkinjung Local Aboriginal Land Council site located in Lake Munmorah and Crangan Bay.

The *Planning for Bush Fire Protection 2019* (PBP) statutory guideline introduces a range of strategic planning considerations which are intended to be addressed through the strategic principles and assessment requirements of PBP via the preparation of a Strategic Bush Fire Study. In terms of satisfaction of these principles concerning the proposed rezoning, the following is noted:

'ensuring land is suitable for development in the context of bush fire risk'

The proposed rezoning does not present any substantial strategic issues on balance with the risk profile of the landscape. Whilst hazard and risk are not avoided, the risk is capable of being satisfactorily mitigated. This includes the ability to evacuate which is a core facet of minimising risk to life in bush fire prone areas.

'ensuring new development on BFPL will comply with PBP'

This strategic bush fire study identifies the proposed rezoning is capable of satisfying the statutory bush fire protection measures outlined by PBP. Further detail in relation to this would be required to be submitted as part of future subdivision applications to NSW RFS for integrated development.

'minimising reliance on performance-based solutions'

Whilst this study cannot fully determine the potential for performance-based solutions as this is dependant upon a final subdivision settlement pattern, it is noted the proposed rezoning is capable of satisfying the acceptable outcomes as per PBP, as required.

'providing adequate infrastructure associated with emergency evacuation and firefighting operations'

The study considers the strategic aspects of firefighting capability, relevant to the proposed rezoning. This includes how the proposal supports firefighting ability and enables suppression efforts to occur. From a strategic perspective, the proposed development does not involve any identifiable challenges or impediments, but rather seeks to establish a formalised road network that connects with informal fire trails, easement and access tracks to facilitate land management and support suppression, if required.

'***facilitating appropriate ongoing land management practices'***

The proposed rezoning is unlikely to introduce any variation to existing or agreed land management practices for the Darkinjung Local Aboriginal Land Council beyond that which would otherwise be required if the land remained in its current zoning.

Having regard to the strategic principles for the exclusion of inappropriate development contained in Part 4 of PBP, this study does not identify elements of the proposed rezoning that would deem it to be considered inappropriate development pursuant to Part 4 of PBP.

This study demonstrates the proposal to rezone the subject site satisfies EP&A Act s.9.1 Direction 4.4 – 'Planning for Bush Fire Protection' and *Planning for Bush Fire Protection 2019*. The proposal is not considered incompatible with the surrounding environment and bushfire risk. With sound bushfire management, the proposal can coexist within the bushland setting. The Strategic Bushfire Study addresses all bushfire protection related matters required for consideration at the pre-gateway stage, and therefore can proceed through to the next stage of the rezoning process.

CONTENTS

TABLES

APPENDIX

DOCUMENT TRACKING

Project Location	405-415 Pacific Highway, Lake Munmorah & 425 Pacific Highway, Crangan Bay
Date	12/11/21
Prepared by	Kristan Dowdle
Reviewed by	Ashley Dowdle
Approved by	Kristan Dowdle
Status	FINAL
Version	2

1.0 INTRODUCTION

Clarke Dowdle & Associates has been engaged by the Darkinjung Local Aboriginal Land Council (DLALC) to conduct a Strategic Bushfire Study (the Study) on the property located at 405-415 Pacific Highway, Lake Munmorah and portions of 425 Pacific Highway, Crangan Bay (subject site).

This Study has been prepared to inform and assist with the consideration of a Planning Proposal for lands situated within the Central Coast Council (CCC) Local Government Area (LGA). The objectives of the Planning Proposal are to amend the Local Environmental Plan (LEP).

The subject land is mapped as vegetation buffer on the bush fire prone land (BFPL) maps (Figure 3) and therefore under the Ministerial Direction 4.4 (Planning for Bushfire Protection) issued under Section 9.1 of the *Environmental Planning and Assessment Act 1979*, where a Planning Proposal includes or is in close proximity to BFPL, the relevant planning authority must consult with the Commissioner of the NSW Rural Fire Service (RFS) following receipt of a gateway determination.

The gateway determination issued by the Department of Planning, Industry and Environment (DPIE) for this Planning Proposal, therefore, requires consultation with the RFS. The assessment detailed in this Study seeks to outline how the Planning Proposal can adhere to the requirements of *Planning for Bushfire Protection* (PBP) (RFS 2019) and is to accompany a Gateway Review application, following feedback received from DPIE on the earlier Gateway application.

1.1 Assumptions and Limitations

The following assumptions and exclusions apply to this study:

- It focuses on the assessment of the proposed rezoning from a strategic land use planning perspective. It is not a detailed bush fire hazard assessment or management plan. It is expected such detail will be prepared and submitted for assessment at the subdivision stage;
- It is based on available data provided by the Department, as well as additional publicly-available information. It is assumed the evidence source utilised to inform this study are accurate can be reasonably relied upon for the purposes of its application;
- It is noted this study provides commentary on the interface between bush fire protection measures and the land use planning system;
- This study does not constitute a risk assessment; and
- It has been undertaken using a high-level approach, noting additional investigation and scrutiny of available information from a field-based perspective could be undertaken to enhance accuracy.

2.0 OBJECTIVES AND SCOPE OF THE ASSESSMENT

PBP (RFS, 2019) outlines broad principles and assessment considerations for strategic planning. It also specifies that bushfire protection measures need to be considered at the strategic planning stage to provide an opportunity to assess the suitability of future land uses within the broader bushfire hazard setting, to ensure that future land uses can meet the objectives of PBP. As such, this Study seeks to address the requirements for a strategic bushfire study, as listed in Table 4.2.1 of PBP, and are listed in Table 1 below.

Table 1: Strategic Bushfire Study Requirements

ISSUE	DETAIL	ASSESSMENT CONSIDERATIONS
Bush fire landscape assessment	A bush fire landscape assessment considers the likelihood of a bush fire, its potential severity and intensity and the potential impact on life and property in the context of the broader surrounding landscape.	• The bush fire hazard in the surrounding area, including: ➢ Vegetation ➢ Topography ➢ Weather • The potential fire behaviour that might be generated based on the above; • Any history of bush fire in the area; • Potential fire runs into the site and the intensity of such fire runs; and • The difficulty in accessing and suppressing a fire, the continuity of bush fire hazards or the fragmentation of landscape fuels and the complexity of the associated terrain
Land use assessment	The land use assessment will identify the most appropriate locations within the masterplan area or site layout for the proposed land uses.	• The risk profile of different areas of the development layout based on the above landscape study; • The proposed land use zones and permitted uses; • The most appropriate siting of different land uses based on risk profiles within the site (i.e., not locating development on ridge tops, SFPP development to be located in lower risk areas of the site); and • The impact of the siting of these uses on APZ provision.
Access and egress	A study of the existing and proposed road networks both within and external to the masterplan area or site layout.	• The capacity for the proposed road network to deal with evacuating residents and responding emergency services, based on the existing and proposed community profile; • The location of key access routes and direction of travel; and • The potential for development to be isolated in the event of a bush fire.
Emergency services	An assessment of the future impact of new development on emergency services.	• Consideration of the increase in demand for emergency services responding to a bush fire emergency including the need for new stations/brigades; and • Impact on the ability of emergency services to carry out fire suppression in a bush fire emergency.
Infrastructure	An assessment of the issues associated with infrastructure and utilities.	• The ability of the reticulated water system to deal with a major bush fire event in terms of pressures, flows, and spacing of hydrants; and • Life safety issues associated with fire and proximity to high voltage power lines, natural gas supply lines etc.
Adjoining land	The impact of new development on adjoining landowners and their ability to undertake bush fire management	• Consideration of the implications of a change in land use on adjoining land including increased pressure on BPMs through the implementation of Bush Fire Management Plans.

To address the items listed in Table 1 the following methodology was employed for the Study;

PROPOSAL REVIEW

- Review of the proposed rezoning documentation (i.e., maps, specialist reports etc)

DESK-TOP REVIEW

- A desk-top review of available mapping to determine the extent/scale/locale of fieldwork

SITE INSPECTION

- Inspection of the subject site and surrounding bushfire hazard/s
- The inspection was for verification and/or otherwise of the desk-top review and gathered site-specific data on slope and vegetation

DESKTOP ANALYSIS

- Review and analysis of GIS mapping layers relevant to bushfire behaviour
- Mapping layers include recent aerial imagery from Nearmap, Fire history from NPWS, vegetation mapping from OEH, topographical data and proposed layout provided by the client

REPORTING

- Determine requirements *of Planning for Bush Fire Protection* related to the subject site and development potential;
- Determine protection requirements relating to rezoning consisting of Asset Protection Zones and access
- Determine any areas of concern where bushfire or environmental constraints may prevent the development
- Final report a 'Strategic Bushfire Study' prepared to address EP&A Act s.117 (2) Direction 4.4

3.0 LEGISLATION

The NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for the state, providing a framework for the overall environmental planning and assessment of development proposals. Various legislation and instruments are integrated with the EP&A Act, including the *Rural Fires Act 1997* (RF Act).

When investigating the capability of bushfire prone land to be rezoned for residential purposes, councils must have regard to s.9.1 (2) Direction 4.4 – 'Planning for Bushfire Protection' of the EP&A Act. The objectives of Direction 4.4 are;

a) to protect life, property and the environment from bush fire hazards, by discouraging the establishment of incompatible land uses in bush fire-prone areas, and

b) to encourage sound management of bush fire prone areas.

Direction 4.4 instructs councils on the bushfire matters which need to be addressed when drafting LEPs. This includes:

- Consultation with the Commissioner of the NSW RFS, and take into account any comments so made;
- Draft LEPs shall have regard to PBP; and
- Compliance with numerous bushfire protection provisions where development is proposed.

After the rezoning stage, future subdivision and the construction of buildings will also require assessment against PBP. These assessments are based on the final development applications for these proposals.

4.0 SITE IDENTIFICATION AND DESCRIPTION

4.1 Site Identification and Location

The subject site is currently known as 405-415 Pacific Highway, Lake Munmorah and portions of 425 Pacific Highway, Crangan Bay (Lot 642 of DP1027231 and portions of Lot 100 DP1044282). The land is within the Local Government Area (LGA) of Central Coast Council (Fire Danger Index-100).

The subject site is approximately 60 hectares in size and bounded by bushland to the north, north-west. north-east and east. To the south is the Pacific Highway and to the west are the grounds of St Brendan's Catholic Church and School. The subject site is accessed via the Pacific Highway to the south and Chain Valley Bay Road to the east.

The subject site is currently zoned under the Wyong Local Environmental Plan (LEP) as containing E3-Environmental Management and E2-Environmental Conservation (See Figure 1)

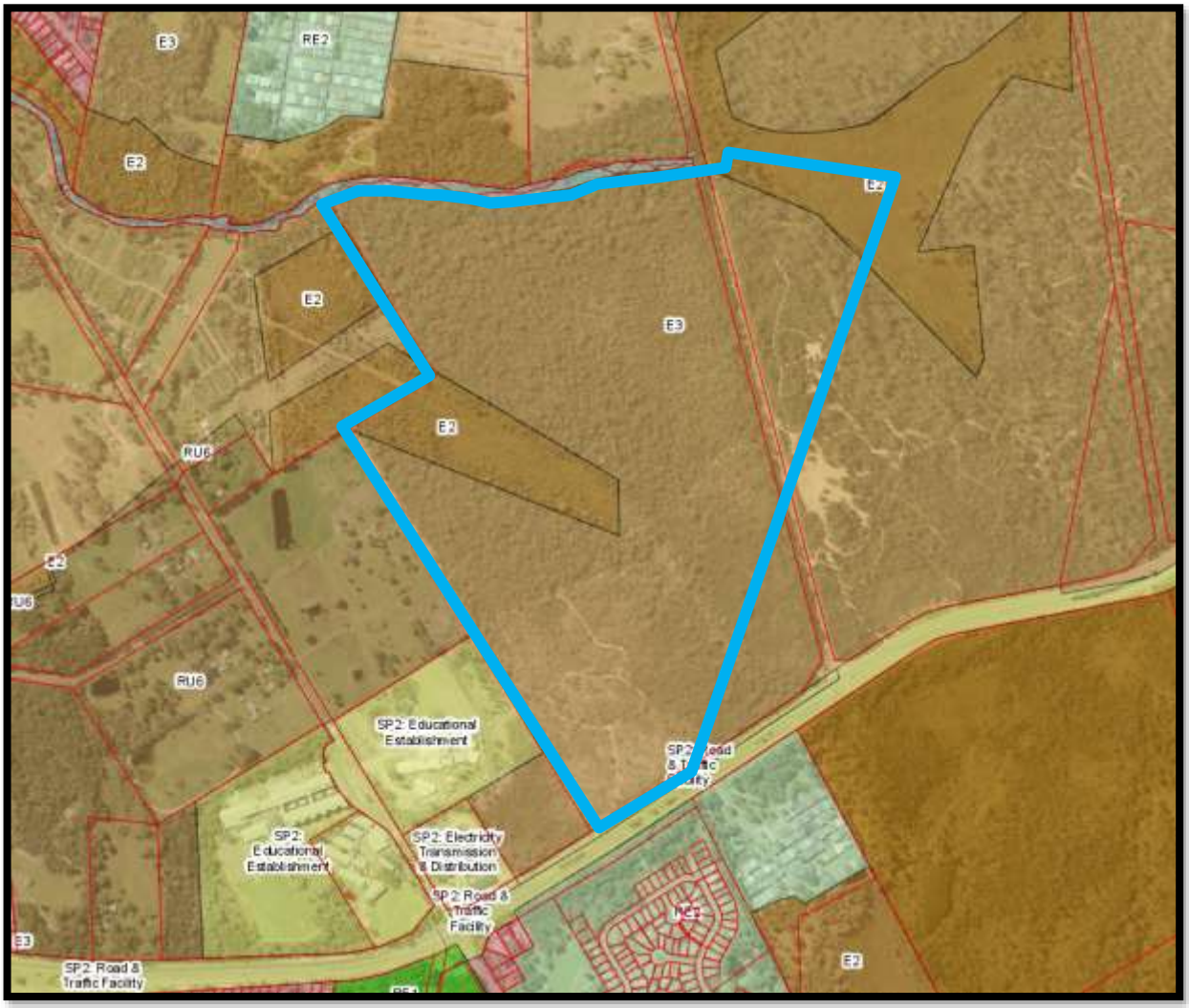


Figure 1: Current Lane Zoning (subject site bordered in blue(approximate only))
Source: EPlanning Spatial Viewer

4.2 Bushfire Prone Mapping

The land is mapped by Central Coast Council as being bushfire prone. The subject site has been mapped as containing Category 1 (red) vegetation throughout and therefore the planning requirements of PBP are applicable.

Figure 2: Aerial Photograph of the site and locality

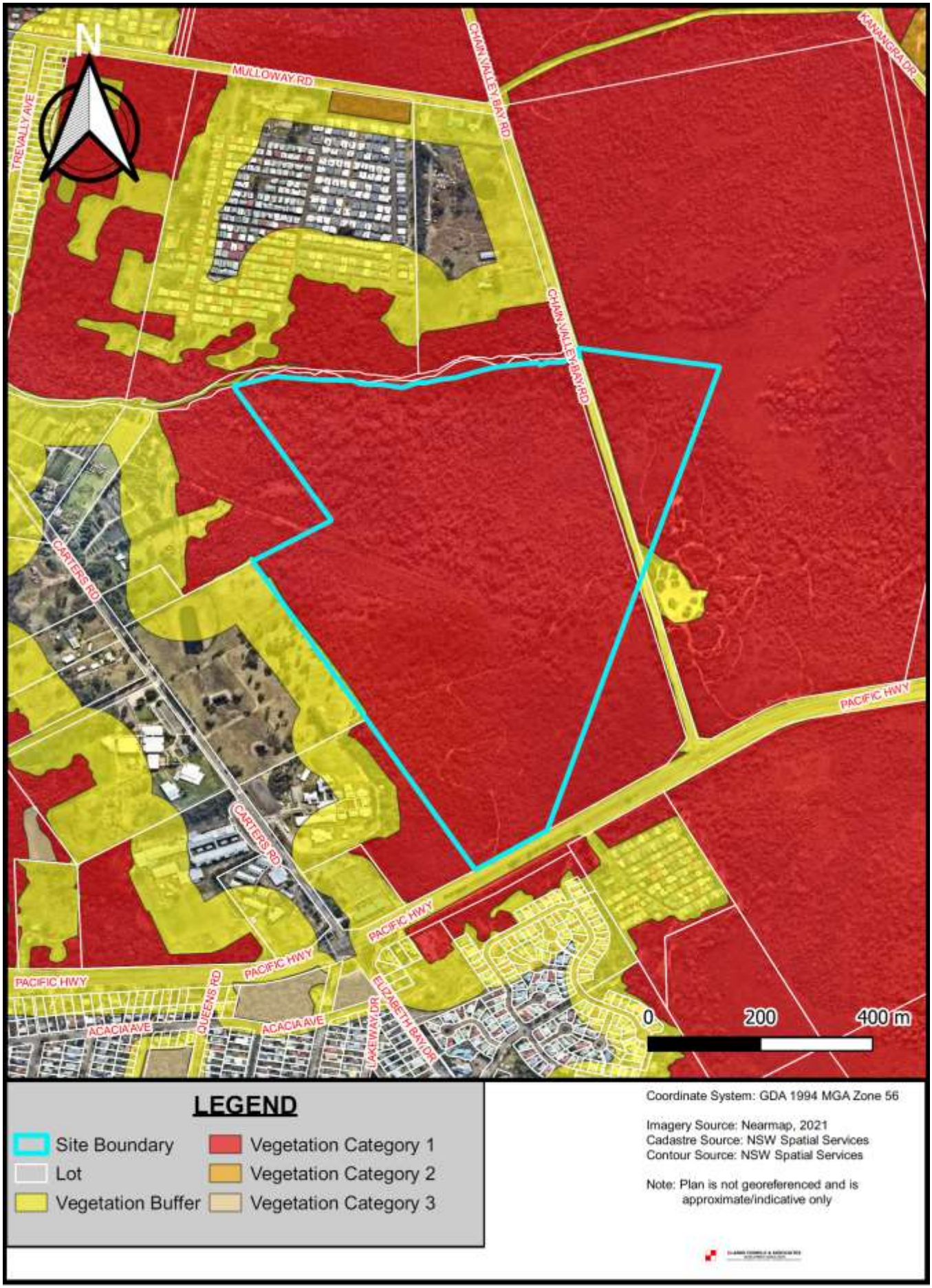


Figure 3: Bushfire Prone Mapping

4.2 Proposal

The proposed rezoning relates to the rezoning of the current allotments to allow for a mixture of general and medium-density housing (refer to Figure 1). The proposed rezoning will form;

- R1 - General Residential
- R3 - Medium Density Residential
- RE1 - Public Recreation
- E2 - Environmental Conservation

The proposed E2 zoned areas will be retained and no dwellings will occur on these lands. As a result of the vegetation retention within the E2 areas, appropriate Bushfire Protection Measures (i.e., Asset Protection Zones) will be required.

It is noted that lot yield and final layouts are subject to modification during the final subdivision design and planning.

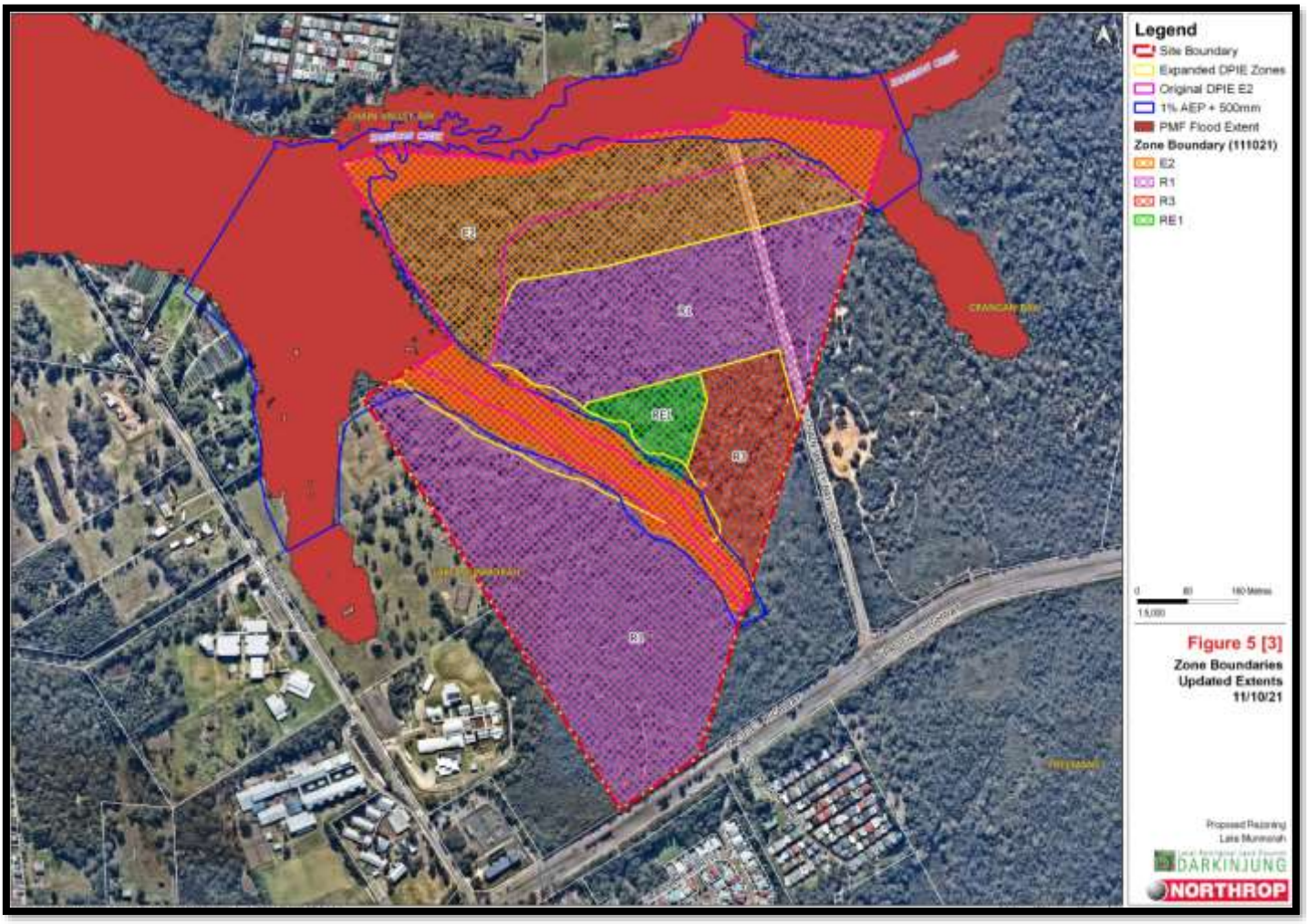


Figure 4: Proposed Rezoning Layout

5.0 BUSH FIRE LANDSCAPE ASSESSMENT

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

The parameters to be analysed are discussed in the following subsections and consist of bushfire hazard (comprising vegetation and topography), fire weather, fire intensity patterns, fire history and ignition sources.

5.1 Surrounding Vegetation

The predominant vegetation communities known to occur throughout the area are listed in Table 2 below and mapped on Figure 5. The communities have been categorised into vegetation structural formations according to Keith (2004) and then converted under Appendix 1 in PBP.

The vegetation mapping and formations presented in Figures 5 and 6 are sourced by Greater Hunter Native Vegetation Mapping v4.0.

Table 2: Vegetation communities and corresponding structural formations

VEGETATION COMMUNITY	STRUCTURAL FORMATION (KEITH, 2004)	PBP CLASSIFICATION
Scribbly Gum/ Red Bloodwood/ Angophora inopina heathy woodland	Sydney Coastal Dry Sclerophyll Forests	Forest
Smooth-barked Apple/ Red Bloodwood/ Scribbly Gum grass/ shrub woodland	Sydney Coastal Dry Sclerophyll Forests	Forest
Smooth-barked Apple/ Red Mahogany/ Swamp Mahogany/ Melaleuca sieberi heathy swamp	Coastal Swamp Forests	Forest
Smooth-barked Apple/ Swamp Mahogany/ Red Mahogany/ Cabbage Palm open forest	Sydney Coastal Dry Sclerophyll Forests	Forest
Broom Bush/ Allocasuarina gymnanthera heathy woodland	Sydney Montane Heaths	Tall Heath

The predominant pattern of vegetation across the landscape is typical with the landscape being a low-lying coastal area with the predominant vegetation being dry sclerophyll forest.

There is also a mixture of heath and Coastal Swamp Forest in low lying areas within the drainage/riparian corridor which runs through the subject site and will be retained as part of the rezoning application. Further, comments in relation to the structure and classification will be made in Section 6.2 of this report.

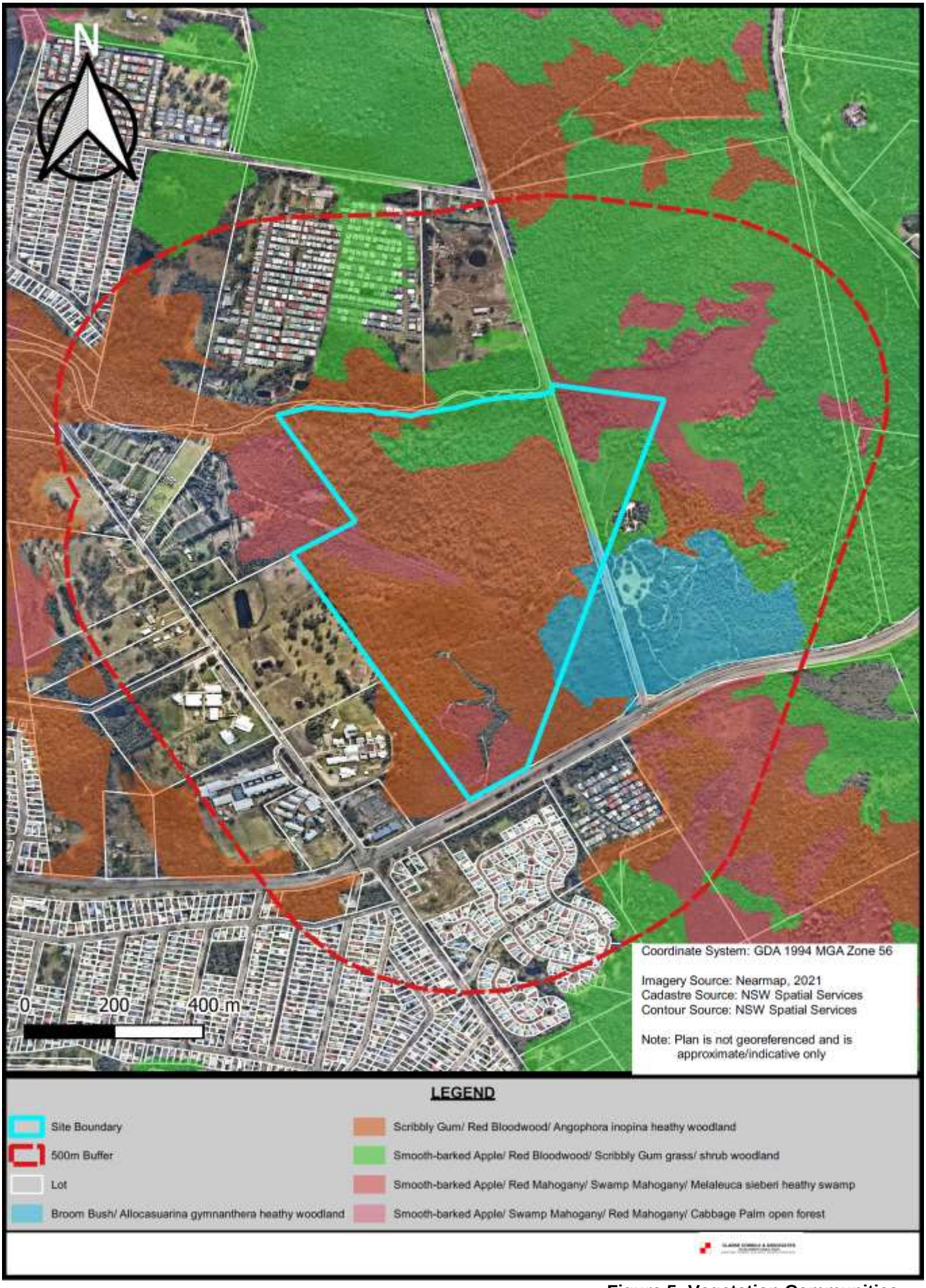


Figure 5: Vegetation Communities

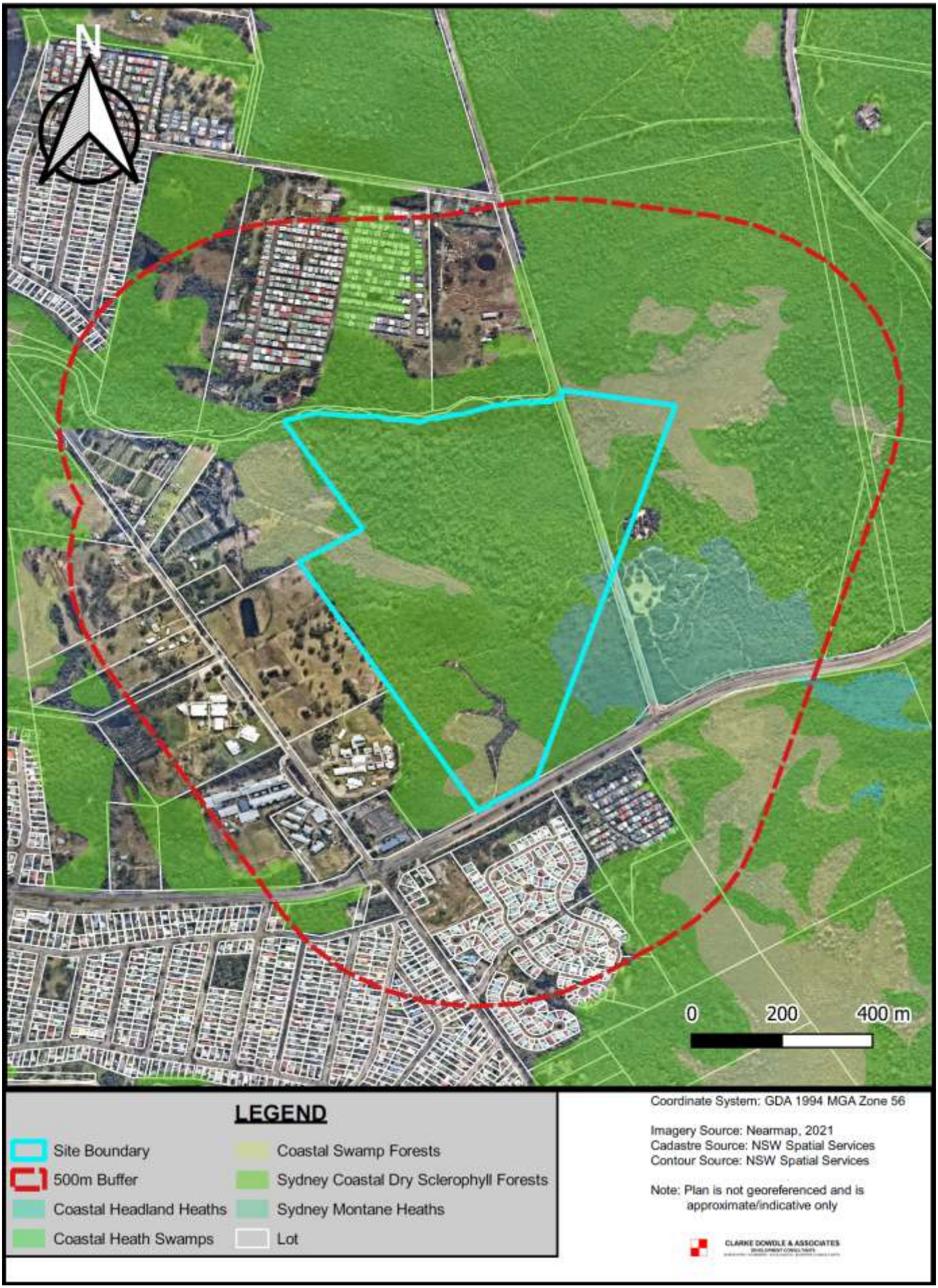


Figure 6: Structural Formations

5.2 Topography

Figure 7 shows the topography across the landscape within and beyond 200m of the subject site boundaries. The topographic mapping was sourced by NSW Spatial Services (1m contours). This data has a stated accuracy of 0.3m (95% Confidence Interval) vertical and 0.8m (95% Confidence Interval) horizontal.

The site and surrounds are relatively flat with a fall evident to the north-west and north to/along existing drainage lines.

The subject site is surrounded by upslope influenced land to the east and south-east; cross slope/flat land to the west; and a downslope influence to the north-west and north towards existing drainage lines located adjoining and within the subject site.

5.3 Fire weather

As described in the *Central Coast Bush Fire Risk Management Plan 2020-2025* (Central Coast Bush Fire Management Committee) the area is cool temperate with predominately summer rainfall. The coastal strip is dominated by local coastal weather patterns (predominant coastal winds) and the western areas can be slightly warmer, drier and less humid, often influenced by wider wind systems.

The bush fire season generally runs from August to March whereby problematic fire weather can occur. Prevailing weather conditions associated with the bush fire season in the Central Coast BFMC area are associated with coastal conditions, and more generally north-westerly winds accompanied by high daytime temperatures and low relative humidity. There are also occasional dry lightning storms occurring during the bush fire season.

The main sources of ignition in the Central Coast BFMC area are:

- Illegal burning activity
- Escapes from legal burning
- Arson & Incendiarism
- Ignition of abandoned/stolen motor vehicles
- Lightning
- Arching electrical power lines
- Occurrence of an extended drought period;
- Lower than average rainfall through winter and spring;
- Persistent north-west winds; and
- Spring/summer thunderstorm activity (‘dry’ lightning strikes).

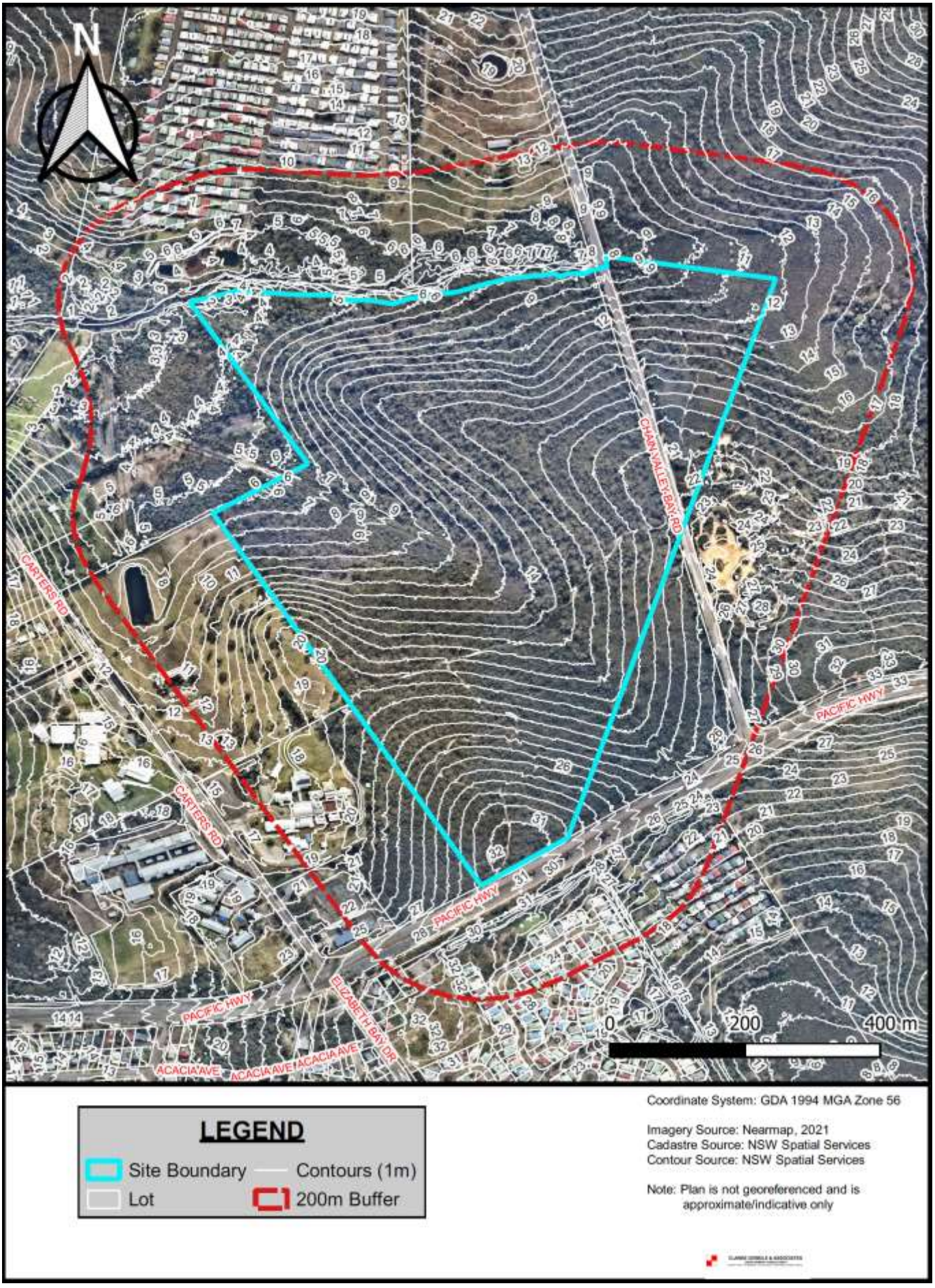


Figure 7: Topographic mapping

5.3 Fire History

The Central Coast BFMC area has on average 843 bush and grass fire incidents per year, of which 6 to 8 on average per year can be considered to be major fires. The main sources of ignition in the Central Coast BFMC area are:

- Illegal burning activity
- Escapes from legal burning
- Arson & Incendiarism
- Ignition of abandoned/stolen motor vehicles
- Lightning
- Arching electrical power lines
- Occurrence of an extended drought period;
- Lower than average rainfall through winter and spring;
- Persistent north-west winds; and
- Spring/summer thunderstorm activity ('dry' lightning strikes).

A review of the fire history mapping from NPWS highlights several fires including wildfires and prescribed burns that have occurred within a 1km radius of the subject site. The major fires to impact the site are the Carters Road fire (1987-88) which was a prescribed burn and the Rutleys Road Fire (2013-14) which was an uncontrolled fire. The Rutleys Road Fire burnt through the entire site and the surrounds which in total was a 2872 Hectare fire.

5.4 Likely Fire Behaviour

Utilising the information provided in the preceding sections on hazard, weather, history and ignition sources, likely fire behaviour and potential fire paths and scenarios can be predicted. As indicated in Figure 9, the problematic fire scenario is the combination of undesirable fire weather (i.e., hot and dry north-westerly westerly winds during late spring and summer) with ignition from dry lightning strikes to the west/north-west or human-induced ignition from the road corridors/arson creating the potential for a bushfire to spread from the west/north-west through the narrow corridor to impact the northern section of the subject site. This pathway is similar to the fire behaviour of the Rutleys Road Fire. It is further noted that fires from the north-west would allow for potential fire movement through the proposed E2 areas within the site, including the riparian corridor.

Another potential fire pathway, is from the vegetation existing to the east of Chain Valley Bay Road. This large area is located to the north-east and east of the site and would require easterly winds in order to be directed towards the subject site of which are not typical with large scale fire events. It is highlighted that these lands are also owned by the Darkinjung Local Aboriginal Land Council and have the potential for being part of future planning proposals for residential purposes which would result in the subsequent removal of the bushfire hazard.

Further possible fire pathways exist to the south-east that would require south-easterly winds in order to be directed towards the subject site of which are not typical with large scale fire events.

Also indicated in Figure 9 are there are limited control opportunities that exist in the surrounding areas, specifically to the north-west. No public roads are adjoining the vegetation and although some fire trails exist, the ability for fire suppression is limited. Aerial bombing would be required to create the control line. Control line establishment on the ground by manual removal of vegetation would be challenging due to limited access.

There is an opportunity for fire-fighting works from Pacific Highway to the south-east and Chain Valley Bay Road to the east. As stated, these aspects would not pose the greatest risk to the subject site.

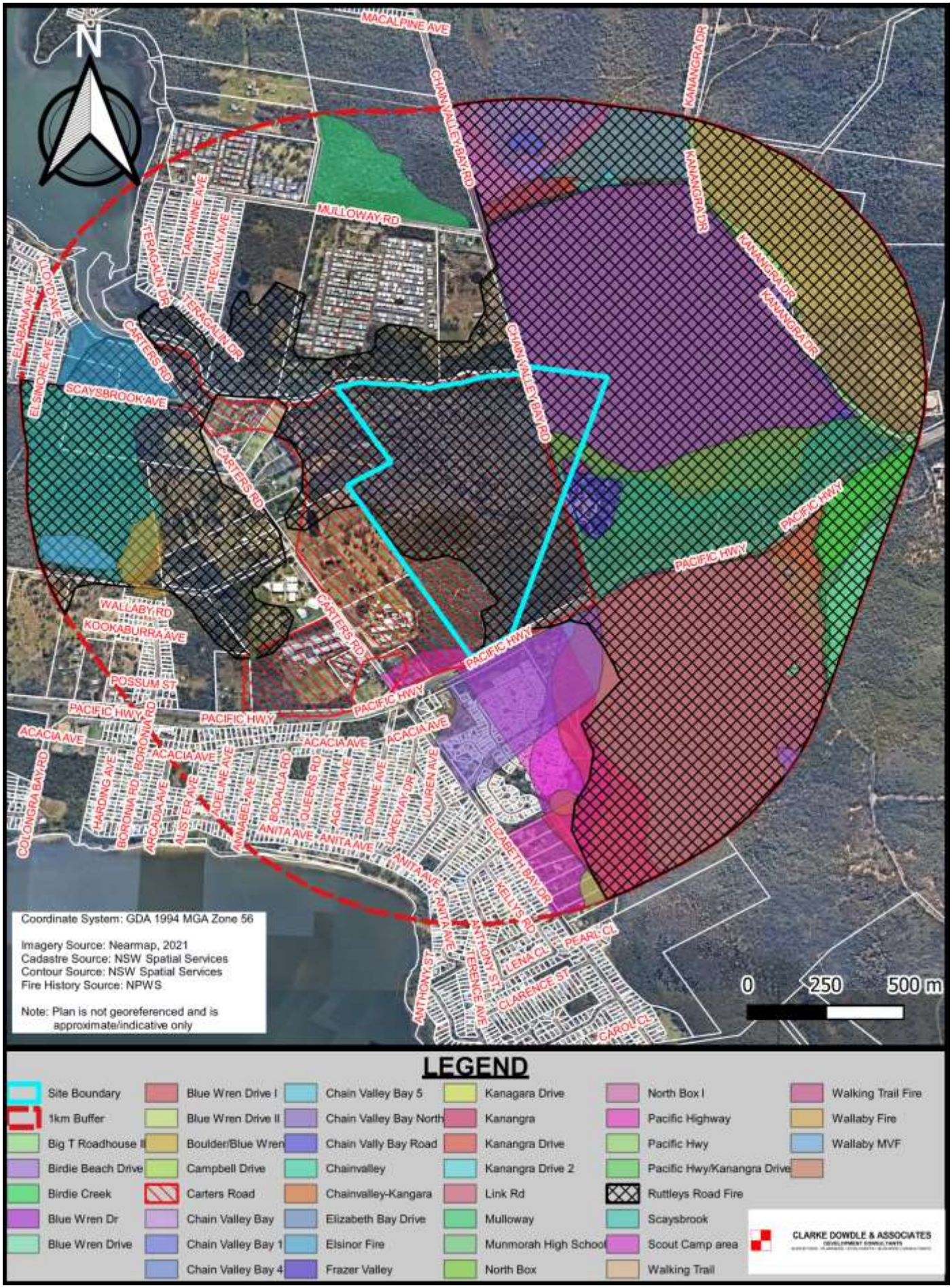


Figure 8: Fire History

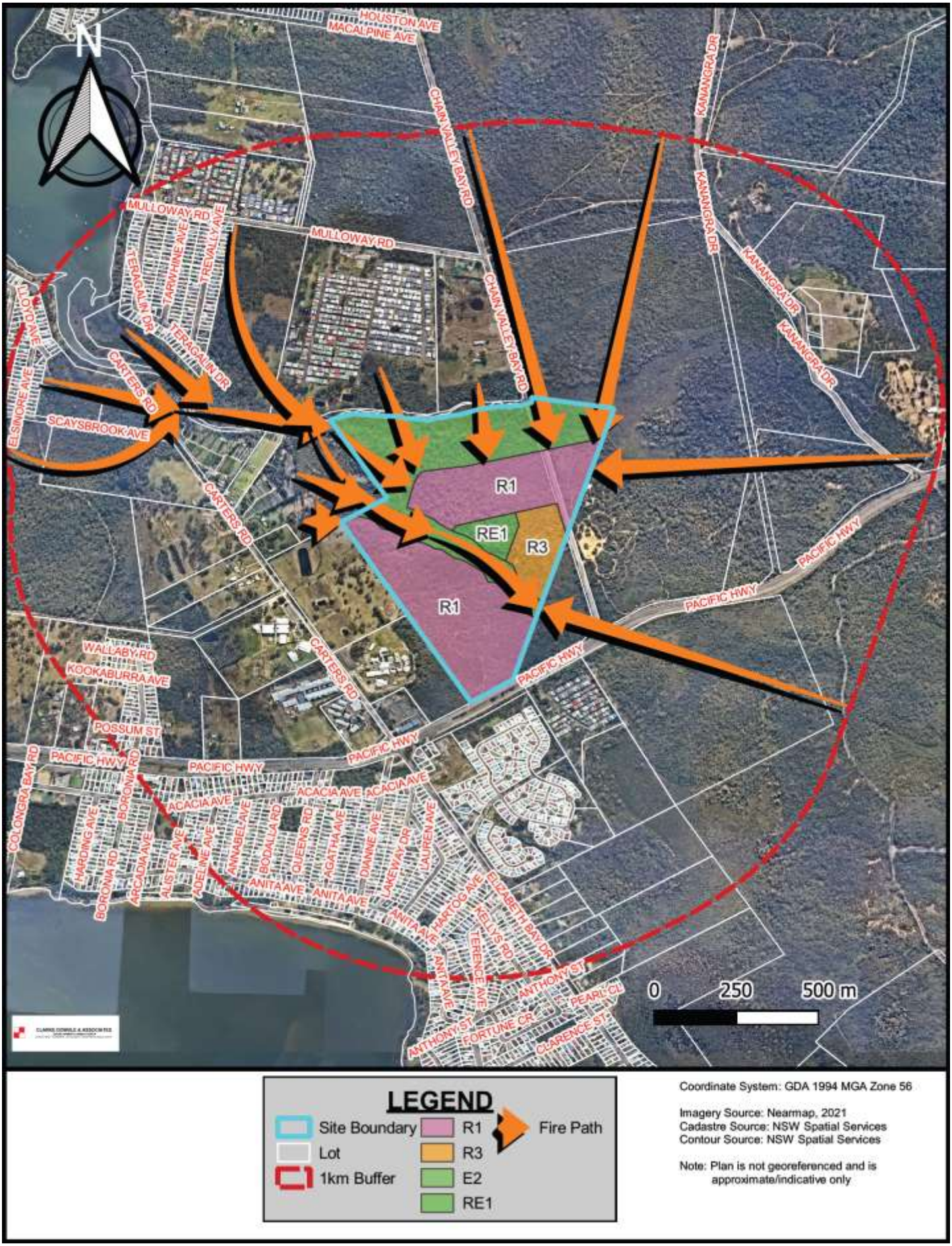


Figure 9: Potential Fire Pathways

6.0 LAND USE ASSESSMENT

6.1 The Risk Profile

Risk is the function of likelihood and consequence, where the consequence is a factor of exposure and vulnerability.

In terms of event likelihood, the risk of a bushfire igniting, spreading and causing damage to future development at the subject site has been assessed following the outcomes of the preceding **Bushfire Landscape Assessment**. The Central BFRMP also identifies that deliberate ignition is observed, largely as a result of the interface of the urban population with a hazard. This translates to an *almost certain probability of higher fire danger* (relevant to historic observed conditions of the Greater Sydney fire weather region), *likely probability of ignition*, and the probability of resulting bush fire occurring is *possible*.

From a risk consequence perspective, the proposed rezoning immediately adjoins vegetation to the west, north-west, north and east. Furthermore, the proposed E2 zoned areas will retain the existing vegetation and provide a bushfire threat to any future works. Thus, exposure to potential flame contact, radiant heat and ember attack is potentially present, unless otherwise mitigated via strategic and/or site-based bush fire protection measures.

Having regard to *vulnerability*, the rezoning environmental to Urban alters the nature of the land use, the following land use risk profile has been identified in the Study:

- The requirement and ability of the site to accommodate Asset Protection Zones wholly with the subject site;
- The ability for any future works to incorporate perimeter roads into the design;
- The study site does not contain any significant cumulative risks;
- The feasibility of complementary and consistent risk management through the landscape and building design, and community programs for any future works.

6.2 Asset Protection Zones

Appendix 1 of PBP provides a methodology for determining the Asset Protection Zone (APZ) required for any given proposed development. APZ's describe the distance between the proposed development (the asset) and the hazard (the bushland) and vary according to topography and vegetation type. PBP states that the primary purpose of an APZ is to ensure that a progressive reduction of bushfire fuels occurs between the bushfire hazard and any habitable structures within the development.

Using the vegetation and slope data presented in Section 5 of this report, APZs have been determined and accommodated within the subject site. The required APZ distances are presented in Table 3 whilst Figure 12 provides the APZ layer on the proposed rezoning plan.

Areas that will require an APZ at an interface with a bushfire hazard that will not already be provided by roads or open space are listed in Table 3 below.

Table 3: Asset Protection Zones

Aspect	Vegetation[1] within 140m of development	Effective Slope of Land	APZ Required
North	Forest	0-5° Down Slope	29m
North-West	Forest	0-5° Down Slope	29m
West	Grassland	0-5° Down Slope	12m
South-West	Forest	0-5° Down Slope	29m
South	Managed Lands	-	-
South-east	Forest	Flat/Up Slope	24m
East	Forest	Flat/Up Slope	24m
North-east	Forest	0-5° Down Slope	29m
E2 Corridor	Tall Heath/Remnant[4]	0-5° Down Slope	18m

Notes for Table 1:

- (1) Refer to Keith (2004) and Appendix 1 in *PBP*
- (2) Refer to A1.12.1 in PBP for Residential Subdivision Development
- (3) Refer to Table A1.12.5 in *PBP*
- (4) See Comments Below

It is noted that the E2 riparian corridor that runs through the subject site contains vegetation that is characterised by a Coastal Heath Swamp with sparse paperbarks. The sparseness of the trees is evident in the aerial photography and photos 1-4 highlighting drone imagery of the vegetation. The vegetation does not contain a continuous upper canopy fuel layer and does not meet with the description of a Forest (Swamp Forest-Forested Wetland).

It is noted that under the mapping undertaken by Bell, 2019, this low lying has been mapped as containing vegetation known as *Munmorah Impeded Sand Sedgeland* (See Figure 10) which meets with the Keith (2004) definition of a '*Freshwater Wetland'*. Due to the sparse paperbarks existing within this area, the Freshwater Wetland classification does align with the site conditions and potential fuel loads present.

PBP states that heath (short) is described as;

'Shrubby vegetation less than 2 metres in height. Often more open in canopy. Principal plant species include banksias, spider flowers, wattles, legumes, eucalypts, tea trees, paperbarks, she oaks, grass trees, cord rushes and sedges. Grasses are scarce. Not found in arid and semi arid locations.'

The above classification provides an accurate description of the vegetation; however, some trees are >2m in height. As a result, and to provide a conservative approach to this study, the vegetation will be assessed a Tall Heath.

It further noted, that the corridor ranges from >100m in width to the west and reduces in width to <50m on the eastern most portions. The narrow width provides a short fire run and potentially could be assessed as Remnant Hazard in accordance with Section A1.11 of PBP. However, Tall Heath will be used as a conservative approach as it provides greater fuel loads than a Remnant Hazard.

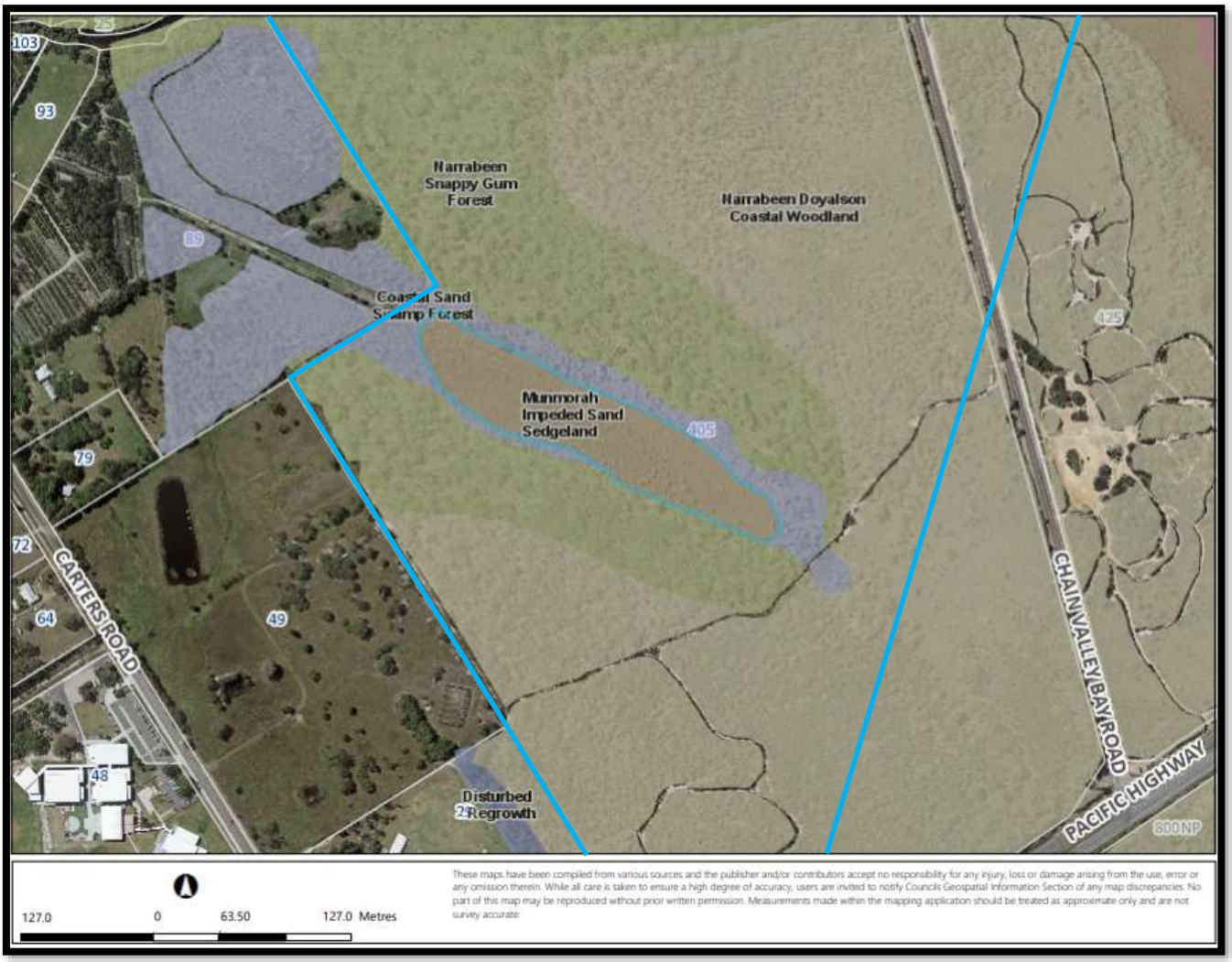
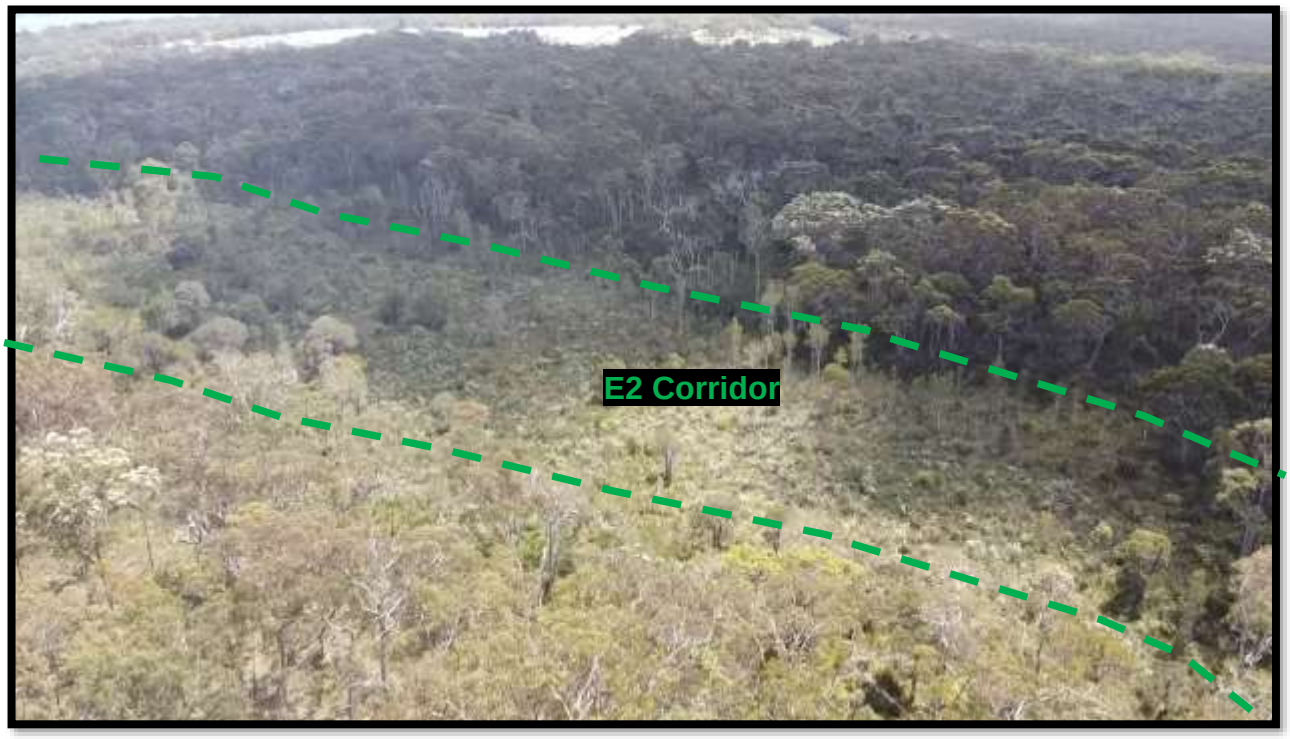
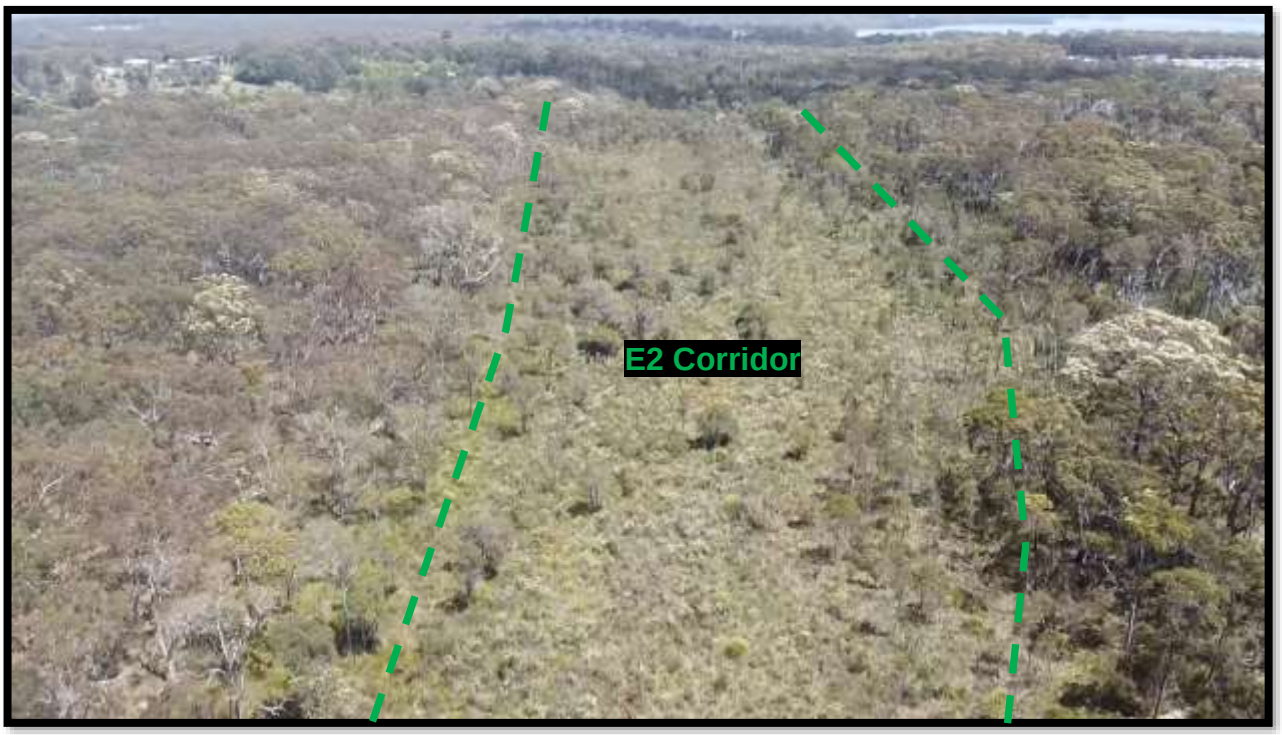


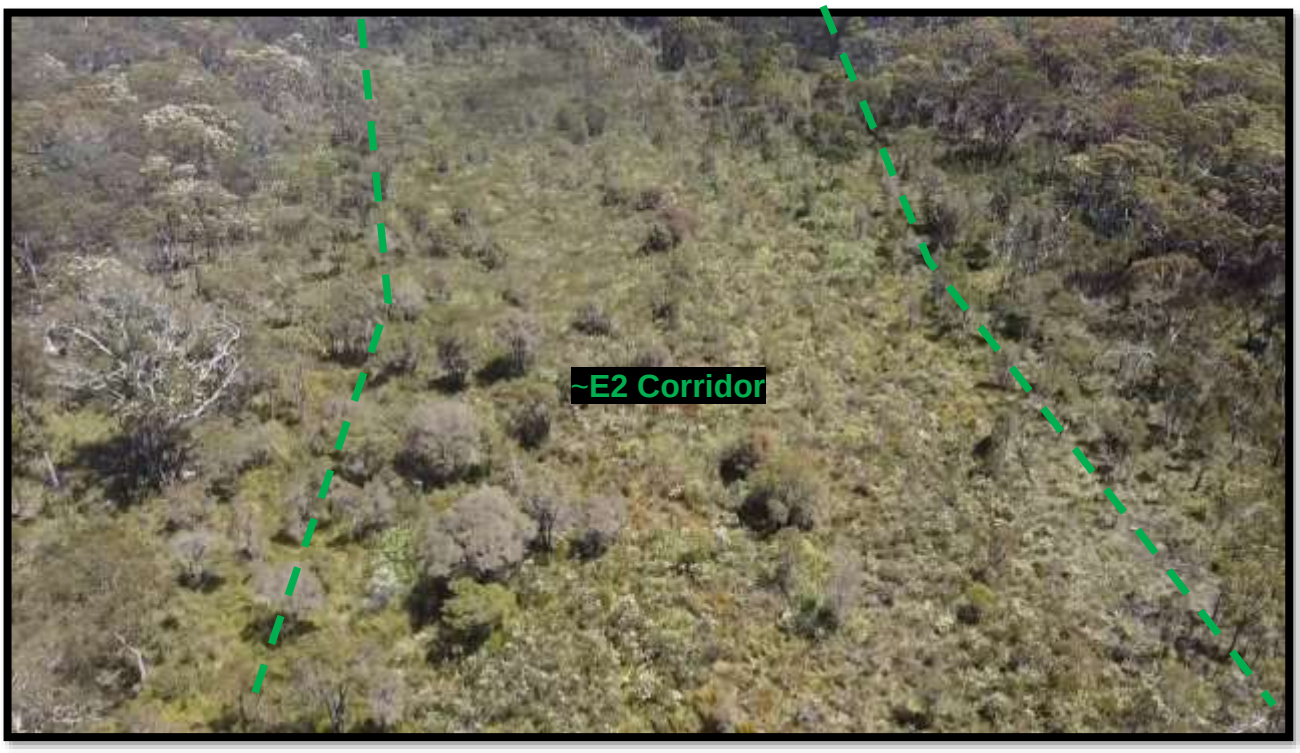
Figure 10: E2 Corridor Vegetation Mapping (site bordered in blue)
Source: Central Coast Council, 2021 (Bell, 2019)



Photograph 1-Looking North



Photograph 2-Looking North-west



Photograph 3--Looking North-west

Photograph 4--Looking North-west

6.3 Construction Requirements for Future Buildings

Buildings proposed within bushfire prone land are required to be assessed to ascertain the Bushfire Attack Level (BAL) in order to design and construct the building in compliance with the corresponding suite of construction specifications listed within Australian Standard *AS 3959- 2018 Construction of buildings in bushfire prone areas*. Such an assessment does not occur until the development application stage.

Based on the minimum APZ dimensions listed in Table 3, those buildings closest to the hazard will have a maximum rating of BAL-29. The rating reduces to BAL-19, BAL-12.5 and BAL-LOW (no requirements) the further a building is located from a hazard.

The following figure 11 as sourced from Table A1.7A in PBP provides a background of potential bushfire impacts associated with the corresponding BAL ratings.

Heat flux exposure	Description	AS 3959 construction level
N/A	Minimal attack from radiant heat and flame due to the distance of the building from the vegetation, although some attack by burning debris is possible. There is insufficient threat to warrant specific construction requirements.	BAL-LOW
≤12.5	Attack by burning debris is significant with radiant heat (not greater than 12.5kW/m^2). Radiant heat is unlikely to threaten building elements (such as unscreened glass). Specific construction requirements for ember protection and accumulation of debris are warranted.	BAL-12.5
>12.5 ≤19	Attack by burning debris is significant with radiant heat flux (not greater than 19kW/m^2) threatening some building elements (such as screened glass). Specific construction requirements for embers and radiant heat are warranted.	BAL-19
>19 ≤29	Attack by burning debris is significant and radiant heat flux (not greater than 29kW/m^2) threatens building integrity. Specific construction requirements for ember and higher levels of radiant heat are warranted. Some flame contact is possible.	BAL-29
>29 ≤40	Radiant heat flux and potential flame contact could threaten building integrity.	BAL-40
>40	Significant radiant heat and significantly higher likelihood of flame contact from the fire front will threaten building integrity and result in significant risk to residents.	BAL-FZ

Figure 11: BAL ratings
Source: PBP

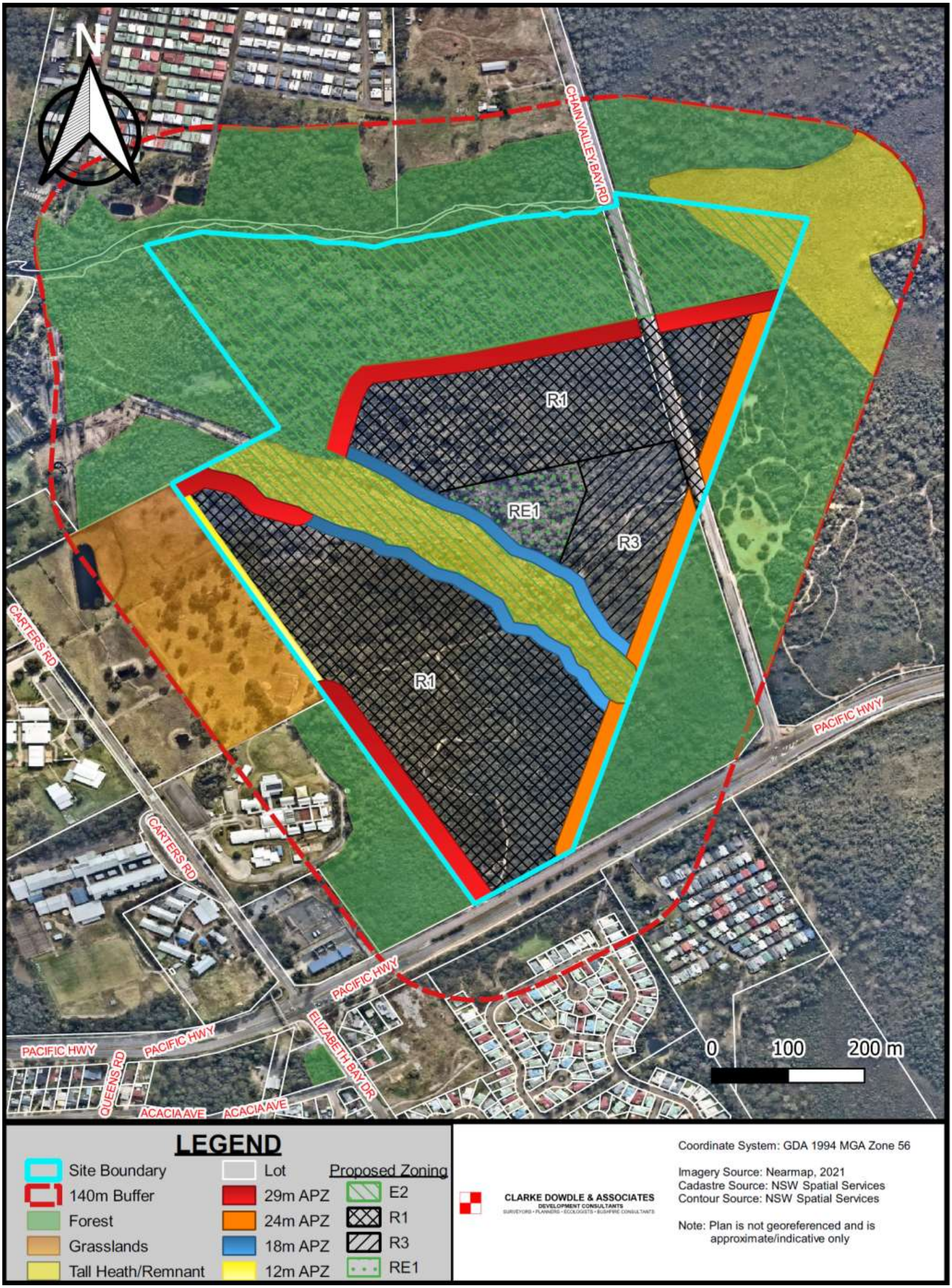


Figure 12: APZ Site Plan

7.0 ACCESS AND EGRESS

Access into and egress out of the subject site is available both via Pacific Highway to the south and Chain Valley Bay Road to the east. Both roads are major thoroughfares and have the capacity to accommodate the additional residents and users resulting from the rezoning.

It is possible for either road to be severed by the impact of fire as both traverse bushland to the east on Chain Valley Bay Road and the south-east on the Pacific Highway, however, it is highly unlikely for both directions to be severed at once. This is due to the likely fire scenarios and previous fire history as listed in Section 5 of this report. Furthermore as detailed in Figure 13, the Planning Proposal will facilitate a new road ink between Chain Valley Bay Road and Carters Road (and schools), which will improve accessibility, and potentially evacuation, for the subject site and others.

In the unlikely event that access in both directions and on both roads be impassable, shelter in place can occur within the subject site. Much of the site, once developed, will not be within 100m of a bushfire hazard. With regards to the future subdivision stages within the subject site, any application will need to address and comply with the access requirements under PBP (see Appendix A) and achieve:

- a road design that facilitates the safe access and egress for residents and emergency service personnel, including multiple access/egress options for each area;
- a road design with adequate capacity to facilitate a satisfactory emergency evacuation

A Traffic Impact Assessment was undertaken by Intersect Traffic (April 2020) to assess increased traffic flows and potential impacts on the existing road infrastructure. The planning proposal currently includes the full width upgrading of Chain Valley Bay Road along the site frontage and the construction of (4) four new public roads accessing the residential subdivision off Chain Valley Bay at two proposed four way cross-intersections (See Figure 13).

Based on the planning proposal the Traffic Impact Assessment concluded;

- Having carried out this preliminary traffic impact assessment for the proposed planning proposal for a residential development Lot 642 in DP 1027231 - 405 – 415 Pacific Highway, Lake Munmorah, Lot 100 in DP 1044282 – 425 Pacific Highway, Crangan Bay and Lot 644 in DP 1027231 – 2 Kanangra Drive, Crangan Bay it is recommended that the proposal can be supported from a traffic impact perspective.
- Subject to the upgrading of the Pacific Highway / Chain Valley Bay Road intersection to a signalised intersection it will not adversely impact on the local and state road network and complies with all relevant Central Coast Council, Austroads, and NSW Roads and Maritime Services (RMS) requirements.

As detailed, the Traffic Impact Assessment concluded that the existing road network is suitable for the proposed rezoning application with the upgrading Pacific Highway / Chain Valley Bay Road intersection.

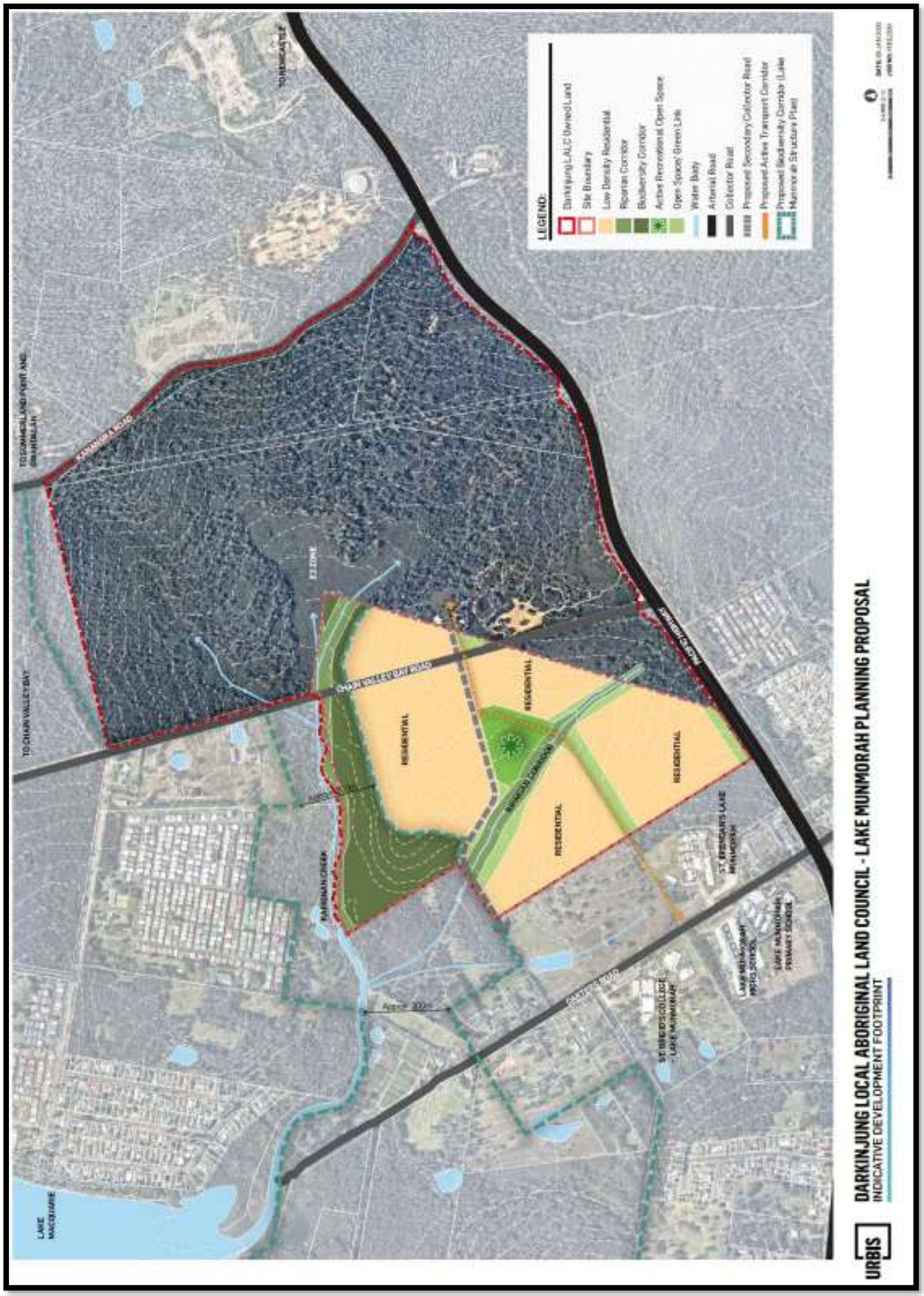


Figure 13: Indicative Development and Access plan

8.0 EMERGENCY SERVICES

Any urban development inherently increases the local resident population, which in turn increases demand or reliance on local emergency services, at least to an extent. As detailed in the Traffic Impact Assessment the proposed rezoning would allow for up to 470 new dwellings.

Concerning the existing emergency infrastructure, the following RFS stations are located nearby;

- Lake Munmorah RFS (~3km to the south-west);
- Mannering Park RFS (~10km to the north-west);
- Gwandalan & Summerland Point RFS (~7km to the north-east)

Additional NSW Fire and Rescue resources stationed at Doyalson would also attend any emergency and is located approximately 12km west. The proximity of emergency services to the precinct is considered adequate, provided emergency management and planning fosters a 'leave early' approach.

In addition, any future development within the subject site will require compliance with PBP for access and also water including ensuring water volumes and hydrant pressures comply with Australian Standard *AS 2419 Fire hydrant installations - System design, installation and commissioning*, and will of benefit to the local emergency services for the site and also the adjoining lands.

The combined land use, access and egress and infrastructure responses of the proposed rezoning to bush fire hazard and risk, analysed by this study, seek to limit the potential exposure of persons and property to unacceptable or intolerable bush fire risk. It does this by adopting measures in a combination approach, utilising a suite of bushfire protection measures that satisfy the strategic principles of PBP, which also minimises the potential demand on emergency services in the event of bush fire.

8.1 Neighbourhood Safer Places (NSPs)

There are three existing NSPs in close proximity to the subject land, which are situated in three different directions from the subject land:

- Lake Munmorah Foreshore (Open Space), 2.4km south, located at 86-88 Anita Avenue, Lake Munmorah
- Joshua Porter Reserve (Open Space), 5.6 km north-west, located Joshua Porter Reserve, 52 Lloyd Ave, Chain Valley Bay
- Chain Valley Bay (North) Foreshore (Open Space), 2.5 km north, located at End of Mulloway Road, Chain Valley Bay

9.0 INFRASTRUCTURE

9.1 Water

Any future subdivision upon the subject site is required to comply with PBP. This will include fire hydrant spacing, sizing and pressures that should comply with AS 2419.1 – 2005. Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles. Fire hydrants should not be located within any road carriageway. All above ground water and gas service pipes external to the building are to be metal, including and up to any taps.

Appendix A identifies the acceptable solution requirements of Section 5.3.4 of PBP, while Table 65 identifies the requirements for lots that may require a static water supply (i.e., if >70 m from hydrant points) which may be applicable for the proposed R3 zoned areas.

The PBP acceptable solution requirements for water is achievable.

9.2 Electricity and gas

Any future subdivision upon the site is required to comply with PBP. This will include either underground electricity supply to the subject land or if the electrical transmission line to the subject land is above ground, no part of a tree is to be closer than 0.5 m to the powerline conductors.

Reticulated or bottled gas on the lot is to be installed and maintained in accordance with Australian Standard AS/NZS 1596 'The storage and handling of LP Gas' (Standards Australia 2014) and the requirements of relevant authorities (metal piping must be used).

Details for compliance with PBP are provided in Appendix A.

10.0 ADJOINING LAND

Future development should not be reliant on any off-site bushfire mitigation measures. All buildings and land uses should be designed to be resilient to bushfire attack in circumstances where no additional fuel management occurs outside of the subject land.

The proposed land uses are not likely to impact on the ability for bushfire management activities to be undertaken on adjoining land. Given the adherence to PBP and other land use planning requirements, the proposed land uses should not increase bushfire management needs for retained and/or adjoining bushfire prone vegetation.

11.0 CONCLUSION

Clarke Dowdle & Associates has been engaged by the Darkinjung Local Aboriginal Land Council (DLALC) to conduct a Strategic Bushfire Study (the Study) on the property located at 405-415 Pacific Highway, Lake Munmorah and portions of 425 Pacific Highway, Crangan Bay. The assessment was performed in November 2021 and was conducted in accordance with the procedures and methods recommended in the NSW Rural Fire Service published document '*Planning for Bushfire Protection, 2019'* (PBP).

This strategic bushfire study has assessed the bushfire risk to the Planning Proposal, the appropriateness of the proposed land uses and the ability for appropriate bushfire protection measures to be provided. It has been found that the Planning Proposal meets the aim and objectives of PBP and can achieve required APZs and other bushfire mitigation measures and does not impose additional mitigation actions on adjoining land. At the detailed design phase, lot design / APZ provision, infrastructure, access and construction plans are required to meet the specifications outlined in PBP 2019. However, the assessment of the Planning Proposal in this Strategic Bushfire Study identifies that the orderly provision of bushfire protection measures to achieve the deemed to satisfy standards prescribed within PBP is achievable.

In conclusion, the proposal to rezone the subject site satisfies EP&A Act s.9.2 Direction 4.4 – 'Planning for Bush Fire Protection' and Planning for Bush Fire Protection 2019. The proposal is not considered incompatible with the surrounding environment and bushfire risk. With sound bushfire management, the proposal can coexist within the bushland setting.

The determining authorities and Rural Fire Service may suggest further or additional measures to be implemented in the planning and construction on the subject site.

We would be pleased to provide further information on any aspects of this report.

For and on behalf of

Clarke Dowdle and Associates

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Grad Dip. Design in Bushfire Prone Areas
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Bushfire Consultant

Disclaimer
PBP States;
Due to a range of limitations, the measures contained in this document do not guarantee that loss of life, injury and/or property damage will not occur during a bush fire event.

AS 3959-2018 states;
It should be borne in mind that the measures contained in this standard cannot guarantee that the building will survive a bushfire event on every occasion. This is substantially due to the unpredictable nature and behaviour of fire and extreme weather conditions.

This report provides the required information to assist Local Council and the Rural Fire Service in determining compliance in accordance with PBP and AS 3959-2018 and as stated above, this report does not guarantee that the proposal will withstand bushfire attack on every occasion.

REFERENCES

- Bell (2019), *A Revised Interim Vegetation Classification of the Central Coast Local Government Area*
- Central Coast Bush Fire Management Committee (2020). *Bush Fire Risk Management Plan 2020-2025*. Approved by NSW Bush Fire Coordinating Committee.
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- NSW Rural Fire Service and Department of Planning (2019), *Planning for Bushfire Protection, A guide for Councils, Planners, Fire Authorities and Developers*. NSW Rural Fire Service.
- Schauble, J. (2004). *The Australian Bushfire Safety Guide*. Harper Collins Publishers, Sydney, Australia.
- Sivertsen, D., Roff, A., Somerville, M., Thonell, J., and Denholm, B. 2011. *Hunter Native Vegetation Mapping. Geodatabase Guide (Version 4.0),* Internal Report for the Office of Environment and Heritage, Department of Premier and Cabinet, Sydney, Australia.
- Standards Australia, (2018), AS3959 Construction of Buildings in Bushfire-prone Areas. Standards Australia International

APPENDIX A PBP PERFORMANCE CRITERIA COMPLIANCE

The following tables outline the performance requirements and acceptable solutions provided in Section 4.2 of PBP for any future subdivision's compliance.

Asset Protection Zones

Intent of measures: *to provide sufficient space and maintain reduced fuel loads to ensure radiant heat levels at the buildings are below critical limits and prevent direct flame contact.*

	PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS
ASSET PROTECTION ZONES	potential building footprints must not be exposed to radiant heat levels exceeding 29 kW/m² on each proposed lot.	APZs are provided in accordance with Tables A1.12.2 and A1.12.3 based on the FFDI.
	APZs are managed and maintained to prevent the spread of a fire towards the building.	APZs are managed in accordance with the requirements of Appendix 4.
	the APZs is provided in perpetuity.	APZs are wholly within the boundaries of the development site
	APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised.	APZs are located on lands with a slope less than 18 degrees.
LANDSCAPING	landscaping is designed and managed to minimise flame contact and radiant heat to buildings, and the potential for wind-driven embers to cause ignitions.	landscaping is in accordance with Appendix 4; and fencing is constructed in accordance with section 7.6.

Access

Intent of measures: *to provide safe operational access to structures and water supply for emergency services, while residents are seeking to evacuate from an area.*

	PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS
ACCESS	firefighting vehicles are provided with safe, all-weather access to structures.	• property access roads are two-wheel drive, all-weather roads; • perimeter roads are provided for residential subdivisions of three or more allotments; • subdivisions of three or more allotments have more than one access in and out of the development; • traffic management devices are constructed to not prohibit access by emergency services vehicles; • maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient; • all roads are through roads; • dead end roads are not recommended, but if unavoidable, are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end; • where kerb and guttering is provided on perimeter roads, roll top kerbing should be used to the hazard side of the road; • where access/egress can only be achieved through forest, woodland and heath vegetation, secondary access shall be provided to an alternate point on the existing public road system; and • one way only public access roads are no less than 3.5 metres wide and have designated parking bays with hydrants located outside of these areas to ensure accessibility to reticulated water for fire suppression.
	the capacity of access roads is adequate for firefighting vehicles	the capacity of perimeter and non-perimeter road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges/causeways are to clearly indicate load rating.
	there is appropriate access to water supply.	• hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression; • hydrants are provided in accordance with the relevant clauses of AS 2419.1:2005 - *Fire hydrant installations System design, installation and commissioning*; and • there is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available.
PERIMETER ROAD	access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating as well as providing a safe operational environment for emergency service personnel during firefighting and emergency management on the interface.	• are two-way sealed roads; • minimum 8m carriageway width kerb to kerb; • parking is provided outside of the carriageway width; • hydrants are located clear of parking areas; • are through roads, and these are linked to the internal road system at an interval of no greater than 500m; • curves of roads have a minimum inner radius of 6m; • the maximum grade road is 15 degrees and average grade of not more than 10 degrees; • the road crossfall does not exceed 3 degrees; and • a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.

NON-PERIMETER ROAD	access roads are designed to allow safe access and egress for firefighting vehicles while residents are evacuating.	• minimum 5.5m carriageway width kerb to kerb; • parking is provided outside of the carriageway width; • hydrants are located clear of parking areas; • roads are through roads, and these are linked to the internal road system at an interval of no greater than 500m; • curves of roads have a minimum inner radius of 6m; • the road crossfall does not exceed 3 degrees; and • a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.
PROPERTY ACCESS	firefighting vehicles can access the dwelling and exit the property safely	• There are no specific access requirements in an urban area where an unobstructed path (no greater than 70m) is provided between the most distant external part of the proposed dwelling and the nearest part of the public access road (where the road speed limit is not greater than 70kph) that supports the operational use of emergency firefighting vehicles. In circumstances where this cannot occur, the following requirements apply: • minimum 4m carriageway width; • in forest, woodland and heath situations, rural property access roads have passing bays every 200m that are 20m long by 2m wide, making a minimum trafficable width of 6m at the passing bay; • a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches; • provide a suitable turning area in accordance with Appendix 3; • curves have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress; • the minimum distance between inner and outer curves is 6m; • the crossfall is not more than 10 degrees; • maximum grades for sealed roads do not exceed 15 degrees and not more than 10 degrees for unsealed roads; and • a development comprising more than three dwellings has access by dedication of a road and not by right of way.

Services-Water, electricity and gas

***Intent of measures**: to provide adequate services of water for the protection of buildings during and after the passage of a bush fire, and to locate gas and electricity so as not to contribute to the risk of fire to a building.*

	PERFORMANCE CRITERIA	ACCEPTABLE SOLUTIONS
WATER SUPPLY	adequate water supplies is provided for firefighting purposes.	• reticulated water is to be provided to the development where available; • a static water and hydrant supply is provided for non-reticulated developments or where reticulated water supply cannot be guaranteed; and • static water supplies shall comply with Table 5.3d.
	• water supplies are located at regular intervals; and • the water supply is accessible and reliable for firefighting operations.	• fire hydrant, spacing, design and sizing complies with the relevant clauses of Australian Standard AS 2419.1:2005; • hydrants are not located within any road carriageway; and • reticulated water supply to urban subdivisions uses a ring main system for areas with perimeter roads.
	flows and pressure are appropriate	• fire hydrant flows and pressures comply with the relevant clauses of AS 2419.1:2005.
	the integrity of the water supply is maintained.	• all above-ground water service pipes are metal, including and up to any taps; and • above-ground water storage tanks shall be of concrete or metal

ELECTRICAL SERVICES	location of electricity services limits the possibility of ignition of surrounding bush land or the fabric of buildings.	• where practicable, electrical transmission lines are underground;
		• where overhead, electrical transmission lines are proposed as follows:
		  ○ lines are installed with short pole spacing of 30m, unless crossing gullies, gorges or riparian areas; and
		  ○ no part of a tree is closer to a power line than the distance set out in ISSC3 *Guideline for Managing Vegetation Near Power Lines*.

GAS SERVICES	location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.	• reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 **-** *The storage and handling of LP Gas*, the requirements of relevant authorities, and metal piping is used; • all fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side; • connections to and from gas cylinders are metal; • polymer-sheathed flexible gas supply lines are not used; and • above-ground gas service pipes are metal, including and up to any outlets.