



Strategic Bushfire Study

Mooney Mooney & Peat
Island Planning Proposal

Property & Development NSW

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Executive summary

This report is a 'Strategic Bushfire Study' prepared to address the requirements of the NSW Rural Fire Service (RFS) document *Planning for Bush Fire Protection 2019* (NSW RFS 2019) and the *Environmental Planning and Assessment Act 1979* Section 9.1 Ministerial Direction 4.4 – 'Planning for Bush Fire Protection' for the proposal to rezone surplus government land at Mooney Mooney and Peat Island on the Central Coast of NSW. The future uses will include a mix of residential, community, recreation and employment generating land uses.

This study presents the results of a detailed investigation into landscape and site influences on bushfire behaviour and development design. The landscape study was used to map the risk across the subject site to inform the development of the Concept Plan and proposed land zoning and apply site specific bushfire protection measures. The study also assesses the access and evacuation capacity as well as impacts on emergency management.

Research on bushfire hazard (comprising vegetation and topography), fire weather, fire intensity patterns, fire history and ignition sources has allowed an analysis of potential fire scenarios that could impact the subject site. Of most concern is the ability for fire to propagate south along the narrow peninsula through the Popran and Brisbane Waters National Parks to impact the northern portion of the subject site. Fire impact from the west, south and east is limited by the wide expanse of the Hawkesbury River and Mooney Mooney Creek.

Risk profile mapping for the subject site classified the forested and steep sections within the northern areas as 'high' risk and unsuitable for development. Areas of 'medium' risk were assessed as developable providing Asset Protection Zone (APZ) and access and evacuation requirements could be satisfied as specified. Most of the subject site was mapped 'low' risk as it consists of non-hazards areas such as mangroves, open space reserves, roads and managed properties. More vulnerable development types such as tourist accommodation and places of assembly were restricted to the low risk areas.

The proposed rezoning will facilitate new uses and improvements to access, infrastructure and emergency services which will greatly improve the existing level of bushfire emergency management for the Mooney Mooney community and ensure an adequate level of bushfire protection for the new uses.

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 Concept Plan 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.

1 Introduction

1.1 Background

Property and Development NSW commissioned Peterson Bushfire to investigate the bushfire protection requirements associated with rezoning surplus government land at Mooney Mooney and Peat Island for the purpose of a Planning Proposal.

This report is a 'Strategic Bushfire Study' as described by the NSW Rural Fire Service (RFS) document *Planning for Bush Fire Protection 2019* (NSW RFS 2019) and addresses the requirements for assessment of rezoning proposals involving bushfire prone land, namely the *Environmental Planning and Assessment Act 1979* Section 9.1 Ministerial Direction 4.4 – 'Planning for Bush Fire Protection'.

This study is based on a detailed investigation into landscape and site influences on bushfire behaviour and development design. An iterative process occurred identifying development constraints amongst a wider planning team to inform the preparation of a development Concept Plan. This report demonstrates compliance with the relevant bushfire protection legislation and policy.


1.2 Location and description of study area

The land that is subject of the Planning Proposal is shown in Figure 1. The subject site consists of government owned land on either side of the M1 Motorway corridor at Mooney Mooney. The site includes parts of Deerubbun Reserve north to Cabbage Point including Peat Island on the western side of the corridor, and existing residential lands and bushland areas on the eastern side.

Significant tracts of bushland exist on the steep slopes of the northern section of the subject site which are linked to Popran National Park further north. The majority of the site has been cleared and under occupation, dissected by many roads mainly due to the M1 Motorway and Old Pacific Highway interchange. Photographs of the study area are included in Appendix 1.



Legend

 Subject Site



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0 75 150 300
Metres

Figure 1: Land subject to Planning Proposal

Coordinate System: GDA 1994 MGA Zone 56

Imagery: © Nearmap

1.3 Overview of the proposal

The Planning Proposal has been prepared on behalf of Property & Development NSW that seeks amendments to the Gosford Local Environmental Plan 2014 (GLEP 2014) for surplus Government owned land at Peat Island and Mooney Mooney (the Site).

The aim of the Planning Proposal is to facilitate the future redevelopment of the site, for a mix of residential, community, tourism and employment generating land uses.

The Planning Proposal was first submitted to Central Coast Council in November 2016. Gateway Determination was issued by the Department of Planning, Industry and Environment (DPIE) on 10 August 2017 (PP_2017_CCPAS_006_00 (17/06254). The Gateway Determination stated that while the supporting studies were sufficient, a number of conditions are required to be addressed prior to progressing the Planning Proposal further. Since August 2017, Property & Development NSW has undertaken a significant amount of consultation with public authorities and Central Coast Council (Council), including the submission of a revised Planning Proposal to Council in December 2018 for review and comments.

Post the 2018 submission, Property & Development NSW has engaged technical consultants to undertake further environmental investigations to respond to Council's and public authorities feedback.

The indicative Concept Plan has been revised in accordance with the additional technical investigations post 2018 submission. The revised indicative Concept Plan comprehensively evaluated the additional environmental and physical constraints, and responded to site's context, future amenity and connectivity. The revised indicative Concept Plan is shown at Figure 2.

Lot 9 DP 863305 is excluded from the Planning Proposal, given it is under the care, control and management of Central Coast Council and will be retained as RE1 Public Recreation Zone. The indicative Concept Plan identifies a proposed Rural Fire Services (RFS) at this location. This RFS facility does not form part of this Planning Proposal, and is subject to further stakeholder consultation and a separate planning proposal.

The indicative Concept Plan also identifies a proposed location for a Marine Rescue NSW facility. This facility is subject to further stakeholder consultation and a separate proposal.

A land-based marina is shown on the Indicative Concept Plan located on the foreshore of the Hawkesbury River adjacent to Peat Island. It does not form part of the planning proposal and would be subject to a separate future planning proposal if it is to proceed. This would include a detailed environmental assessment of the impacts.

This part of the site is currently zoned partly RE1 Public Recreation and partly SP2 Infrastructure (for the purpose of hospital) under GLEP 2014, and is proposed to be rezoned to RE2 Private Recreational Zone. A car park is proposed to be an Additional Permitted Use under Schedule 1 of GLEP 2014 on a portion of the site as part of the Planning Proposal.

This Strategic Bushfire Study has been prepared based on the revised indicative Concept Plan (Figure 2) and the draft LEP zoning maps.



Figure 2: Concept Plan

1.4 Proposed planning control amendments

The Planning Proposal is seeking to amend the following provisions of the GLEP 2014:

- Amend Clause 2.1 Land Use Zones of the GLEP 2014 to include SP3 Tourist zone listed under Special Purpose Zones. The proposed SP3 Tourist Zone objectives and proposed permissible uses are consistent with the draft SP3 Tourist zone within the draft Consolidated Central Coast Consolidated Local Environmental Plan (CCLEP). Therefore, this Planning Proposal will be consistent with draft CCLEP, subject to gazettal.
- Amend the GLEP 2014 Land Zoning Map applicable to the site, and rezone SP2 Infrastructure and RE1 Public Recreation zones to E2 Environmental Conservation, R1 General Residential, R2 Low Density Residential, RE1 Public Recreation, RE2 Private Recreation, and SP3 Tourist zones.
- Amend the GLEP 2014 Height of Buildings Map to reflect the maximum height of the buildings proposed (8.5m, 12m and 15m) across selected areas of the site as indicated on the proposed Height of Buildings Map.
- Amend the GLEP 2014 Lot Size Map to allow minimum lots size of 150sqm, 220sqm, 300sqm and 450sqm across selected areas of the site as indicated on the proposed Minimum Lot Size Map.
- Amend the GLEP 2014 Additional Permitted Uses Map and amend the GLEP 2014 Schedule 1 Additional permitted uses to include the use of certain land at Mooney Mooney, including:
 - RE2 Private Recreation zoned land, being portion of Lot 11, DP 1157280 and Lot 12, DP 1158746 as identified on the Additional Permitted Uses Map.
 - To include 'car parks' as additional permitted use on this part of the site.
 - R1 General Residential zoned land, being the southern portion of Lot 14, DP1158746 as identified on the Additional Permitted Uses Map.
 - Development for the purposes of emergency services facility is permitted with development consent. The proposed emergency services facility is permissible with consent within the proposed R1 General Residential zone under the draft CCLEP. Therefore, this Planning Proposal will be consistent with draft CCLEP, subject to gazettal.
 - RE1 Public Recreational zoned land, being the southern portion of lot 4 DP239249 as identified on the Additional Permitted Uses Map.
 - Development for the purposes of emergency services facility is permitted with development consent. The proposed emergency services facility is permissible with consent within the proposed RE1 zone under the draft CCLEP. Therefore, this Planning Proposal will be consistent with draft CCLEP, subject to gazettal.

- R1 General Residential zoned land, being the south eastern portion of lot 12, DP1158746 located along Peats Ferry Road, lot 12, DP863305 and the southernmost portion of lot 14DP1158746, as identified on the Additional Permitted Uses Map:
 - Development for the purpose of ‘food and drink premises’ and ‘shops’ are permitted with development consent.
 - The indicative Concept Plan comprises local shops/restaurants and cafes in the form of shop top housing within the Southern Foreshore precinct and the Chapel precinct, which has an area of approximately 200sqm. The proposed shops and food and drinks premises are of a scale that is better suited for this local area. Shops. Restaurants and cafes are prohibited under the R1 zone of the Gosford LEP and the draft CCLEP. Given the proposal no longer includes a service station and a neighbourhood centre, it is proposed to include food and drink premises and local shops to provide sufficient and much needed local retail services for exiting and incoming residents.
- RE1 Public Recreation zoned land, being Lot 11 DP863305 as identified on the Additional Permitted Uses Map.
 - Development for the purpose of electricity generating works is permitted with development consent.

In addition, consistent with the recommendation of the CMP, this Planning Proposal includes the proposed LEP amendment to include Peat Island as an Item of Environmental Heritage (Item - General) under Part 1 - Heritage Items, Schedule 5 of the Gosford LEP.

1.5 Bushfire assessment requirements

The subject site is identified as bushfire prone land as it contains or is within 100 m of stands of bushland that has the potential to sustain a bushfire or contribute to bushfire attack. Figure 3 is an excerpt of the Gosford Bush Fire Prone Land Map relating to the site.

When investigating the capability of bushfire prone land to be rezoned, submissions must have regard to Section 9.1 Direction 4.4 – ‘Planning for Bush Fire Protection’ of the *Environmental Planning and Assessment Act 1979*. The objectives of Direction 4.4 are:

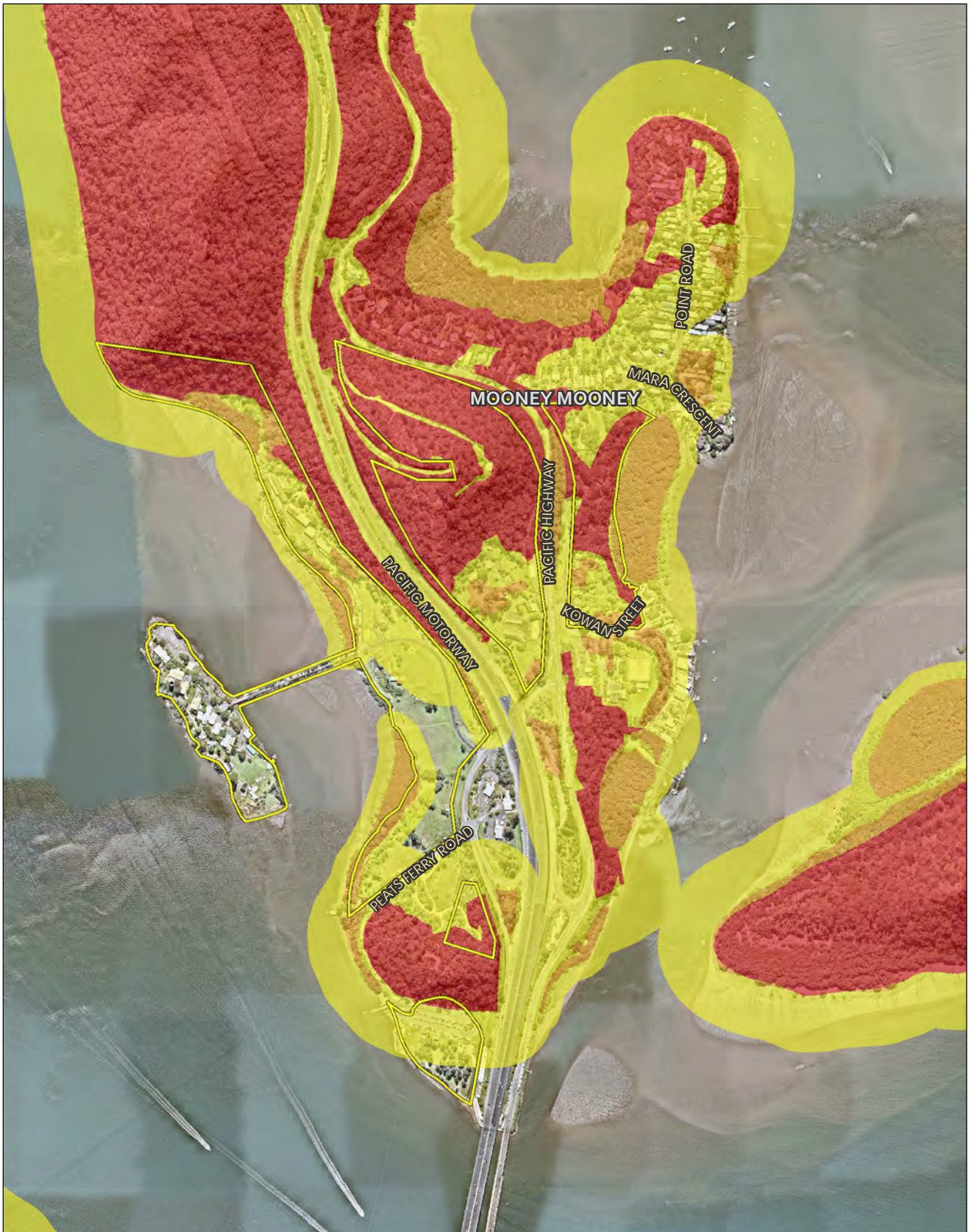
- *To protect life, property and the environment from bushfire hazards, by discouraging the establishment of incompatible land uses in bushfire prone areas; and*
- *To encourage sound management of bushfire prone areas.*

Direction 4.4 instructs councils on the bushfire matters which need to be addressed when drafting and amending Local Environmental Plans (LEP). They are as follows:

- *A draft LEP shall:*

- *have regard to the document Planning for Bush Fire Protection;*
- *introduce controls that avoid placing inappropriate developments in hazardous areas; and*
- *ensure that bushfire hazard reduction is not prohibited within the asset protection zone.*
- *A draft LEP shall, where development is proposed, comply with the following provisions, as appropriate:*
 - *provide an asset protection zone incorporating at a minimum:*
 - *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,*
 - *an Outer Protection Area managed for hazard reduction and located on the bushland side of the perimeter road.*
 - *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 draft LEP permit Special Fire Protection Purposes (as defined under Section 100B of the Rural Fires Act 1997), the APZ provisions must be complied with,*
 - *contain provisions for two-way access roads which links to perimeter roads and/or to fire trail networks,*
 - *contain provisions for adequate water supply for fire-fighting purposes,*
 - *minimise the perimeter of the area of land interfacing the hazard which may be developed,*
 - *introduce controls on the placement of combustible materials in the Inner Protection Area.*

In order to address the above requirements, *Planning for Bush Fire Protection 2019* (referred to as 'PBP' throughout this report) requires the preparation of a Strategic Bushfire Study. The study is to present a landscape assessment of fire behaviour that may impact the site and implications for land use, development scale and layout, access and evacuation, and fire-fighting infrastructure.



Legend

- Subject Site
- Bushfire Prone Land**
- Vegetation Category 1
- Vegetation Category 2
- Vegetation Buffer 100m & 30m



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Figure 3: Bushfire Prone Land

Coordinate System: GDA 1994 MGA Zone 56

Imagery: © Nearmap

2 Assessment process

Table 1 below summarises the process followed to reach the proposed land use and bushfire protection provisions. This study is the result of a detailed investigation into bushfire behaviour and site constraints including research, field reconnaissance, modelling, and consultation with the planning team.

Table 1: Assessment process

Methodology	Task	Considerations
Desk-top review	A brief desk-top review of available mapping was undertaken to guide the field work	Familiarisation of terrain and vegetation communities
Field reconnaissance	Inspection of subject site and surrounding bushfire hazard	The inspection ground-truthed the desk top review and gathered site specific data on slope and vegetation
GIS analysis	Review and analysis of GIS mapping layers relevant to bushfire behaviour	Mapping layers include recent aerial imagery from Nearmap, vegetation mapping from OEH, and topographical data and models provided by the client
Risk profiling	Ranking the subject site based on the outcomes of the GIS analysis	Noting any areas of concern where bushfire or environmental constraints may prevent development
Determination of constraints	Determine requirements of <i>Planning for Bush Fire Protection</i> related to the site and development potential	Primary protection requirements relating to rezoning consist of Asset Protection Zones and access
Site inspection with planning team	A second site viewing with all technical disciplines in attendance occurred to discuss the primary constraints, areas of concerns resulting from GIS analysis, and identify developable areas	The focus of the second site inspection was the bushland areas particularly in the northern part of the site on steep lands and with connectivity to bushfire threat to the north (Popran National Park)
Workshop	A planning workshop was convened to discuss Concept Plan options	Three Concept Plan options were discussed and worked up into one preferred version
Concept Plan review	The preferred Concept Plan was finalised through an iterative process	Final adjustments were made on detailed planning matters
Reporting	Preparation of bushfire report and responding to Council and agency comments	Final report a 'Strategic Bushfire Study' prepared to address EP&A Act s.117 (2) Direction 4.4

3 Bushfire landscape assessment

An analysis of the bushfire landscape, or parameters that give rise to the bushfire threat, provides the foundation for strategic decision-making on appropriate land use patterns. 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.

Figure 4 shows the wider landscape influencing a bushfire approaching the site. The predominant features consist of the narrow peninsula leading south out of Popran National Park to Mooney Mooney Point at the Hawkesbury River. Surrounding the peninsula are the tidal waterways of the Hawkesbury River (west and south) and Mooney Mooney Creek (east). These waterways provide significant separation from the bushland within Muogamarra Nature Reserve to the west and Brisbane Water National Park to the east.

3.1 Vegetation communities

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) in order to assign likely climax fuel loads following the RFS document *Comprehensive Vegetation Fuel Loads* (NSW RFS 2019). The vegetation formations and likely climax fuel loads are shown in Figures 6 and 7 respectively.

Table 2: Vegetation communities and corresponding structural formations and fuel loads

Vegetation community	Structural formation (Keith 2004)	Fuel load (NSW Rural Fire Service 2017)
Scribbly Gum / Red Bloodwood / Old Man Banksia heathy woodland of southern Central Coast	Sydney Coastal Dry Sclerophyll Forest	21.3/27.3 tonnes/hectare
Smooth-barked Apple / Turpentine / Sydney Peppermint heathy woodland on sandstone ridges of the Central Coast		
Rough-barked Apple / Forest Oak / Grey Gum grassy woodland on sandstone ranges of the Sydney Basin	Northern Hinterland Wet Sclerophyll Forest	20/33.1 tonnes/hectare
Mangrove Swamps	Saline Wetlands	Not a bushfire hazard

The predominant pattern of vegetation across the landscape of the peninsula is wet sclerophyll forest at the sheltered toe of the slope adjacent the waterways, grading into heathy, dry sclerophyll forest along much of the steeper and higher parts of the peninsula.

Mangrove forests along the water ways and tidal fringes are not a bushfire hazard and nor are the cleared areas (e.g. reserves, development and roadways etc) which comprise much of the subject site.

The equilibrium fuel load (NSW RFS 2019) is similar between the wet and dry communities, therefore reducing the influence of vegetation type on bushfire behaviour, with exception to the saline wetlands and managed areas which would not carry a bushfire.

Regarding the subject site, bushland exists within and adjacent the northern end, characterised by dry sclerophyll forest in good condition on steep slopes surrounding the water reservoir. The southern end supports a large disturbed remnant of forest in Deerubbun Reserve.

The eastern margins of the subject site support small, patchy and disturbed remnants of forest grading into significant areas of Mangrove Swamps along the water's edge of Mooney Mooney Creek and associated low-lying wetlands (mangroves are not deemed a bushfire hazard by PBP). Similarly, the western foreshore supports fringing Mangrove Swamps and small fragmented patches of scrub along the water's edge, followed by predominantly cleared open space. Peat Island does not support classified vegetation and is not mapped bushfire prone.

Roadside corridors of vegetation in varying conditions are found along most roads and some of these corridors and remnants can be classified as 'low hazard vegetation' due to their width being less than 50 m and/or size less than 1 hectare in size.

3.2 Topography

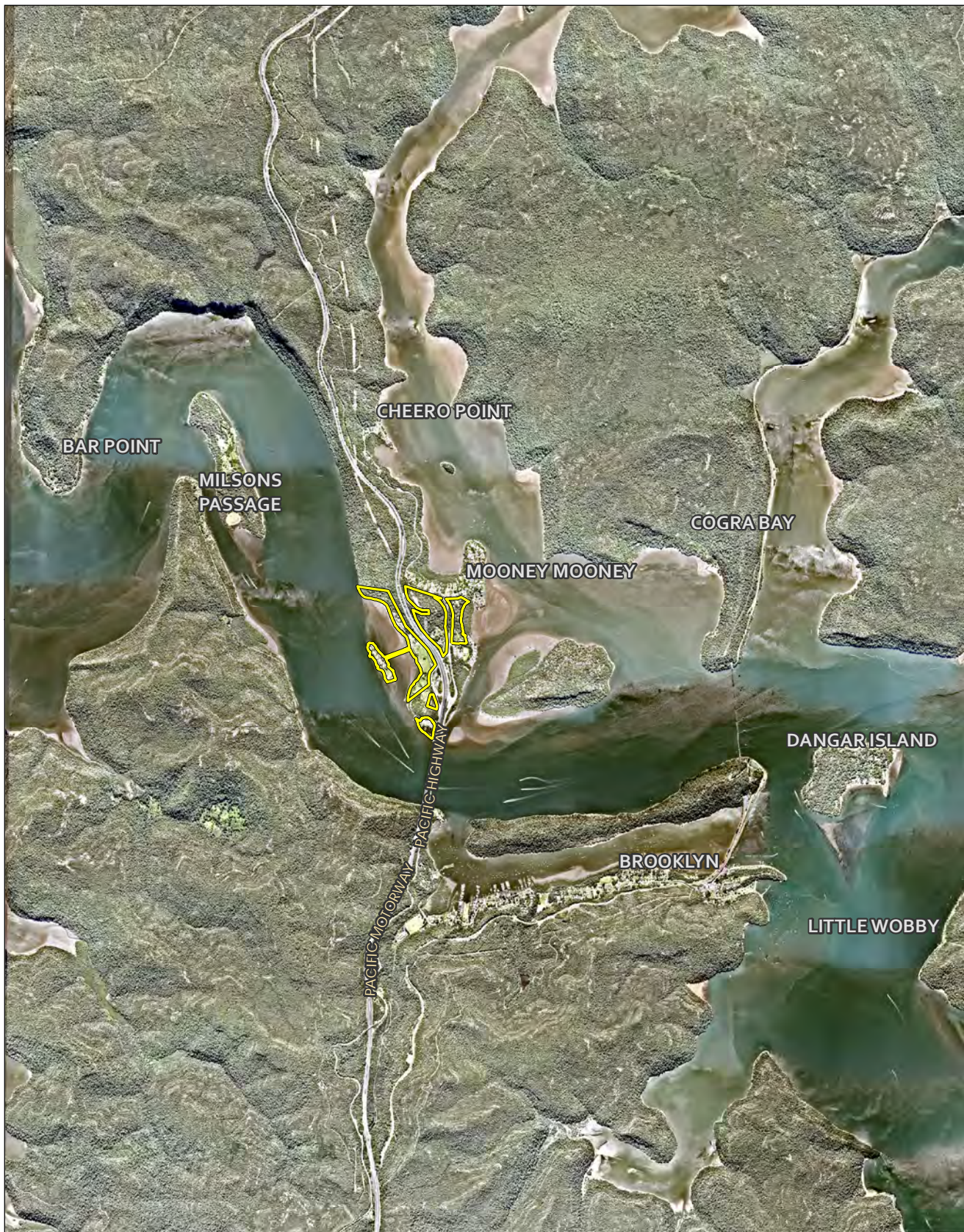
Figure 8 shows the pattern of the terrain across the landscape and in the context of the site. The predominant feature is the steep, central spine of the peninsula flanked by waterways. The southern extent of the ridgeline culminates at the hill with the water reservoir located in the northern end of the site. Deerubbun Reserve at the southern end of the site is also located on a hill. The land in between is relatively flat and flanked by waters and mangrove vegetation.

3.3 Fire weather


As described in the *Gosford Bush Fire Risk Management Plan* (Gosford District Bush Fire Management Committee 2011) the area has a temperate climate with warm to hot summers and cool winters. Rainfall predominantly occurs during the summer.

The bushfire season usually runs from October to March whereby problematic fire weather can occur; a combination of high summer-time temperatures with low humidity and moderate to strong winds from the westerly sector. Dangerous bushfire seasons are most commonly associated with a combination of two or more of the following factors:

- 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).



Legend

 Subject Site



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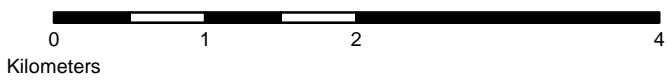


Figure 4: Landscape Context

Coordinate System: GDA 1994 MGA Zone 56
Imagery: © Nearmap



Legend

Subject Site

Vegetation Community

- Grey Mangrove low closed forest
- Red Bloodwood/ Sydney Peppermint/ Podocarpus spinulosus shrubby open forest of the southern Central Coast
- Rough-barked Apple/ Forest Oak/ Grey Gum grassy woodland on sandstone ranges of the Sydney Basin
- Saltmarsh/ Estuarine Complex

- Scribbly Gum/ Red Bloodwood/ Old Man Banksia heathy woodland of southern Central Coast
- Smooth-barked Apple/ Red Bloodwood/ Brown Stringybark/ Hairpin Banksia heathy open forest of coastal lowlands
- Smooth-barked Apple/ Turpentine/ Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast
- Spotted Gum/ Broad-leaved Mahogany/ Grey Gum grass/ shrub open forest on Coastal Lowlands of the Central Coast



Date: 5/10/2020

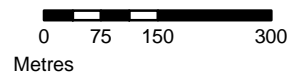


Figure 5: Vegetation Communities

Coordinate System: GDA 1994 MGA Zone 56

Imagery: © Nearmap



Legend

- | | | |
|--|--|--|
|  Subject Site |  Northern Hinterland Wet Sclerophyll Forest |  Sydney Coastal Dry Sclerophyll Forests |
| Vegetation Formation |  Hunter-Macleay Dry Sclerophyll Forests |  Saline Wetlands |
|  Saltmarshes | | |



Date: 5/10/2020

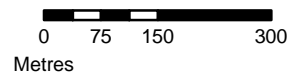








Figure 6: Vegetation Structural Formations

Coordinate System: GDA 1994 MGA Zone 56

Imagery: © Nearmap



Legend

	Subject Site	Equilibrium Fuel Loads		27.3 t/ha	
	hydroarea		24.6 t/ha		33.1 t/ha
			0 t/ha		




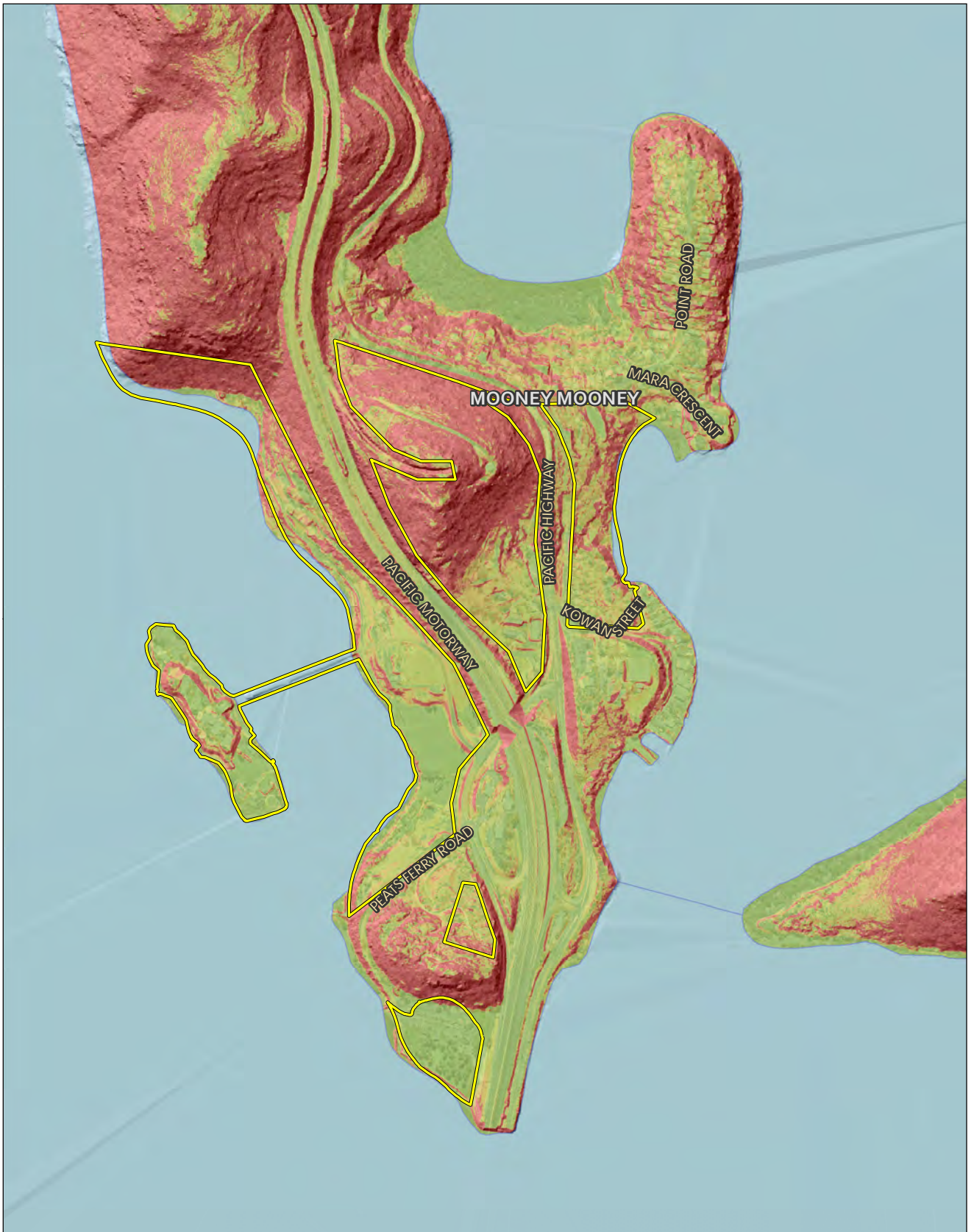
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 Metres

Figure 7: Equilibrium Fuel Loads

Coordinate System: GDA 1994 MGA Zone 56
 Imagery: © Nearmap



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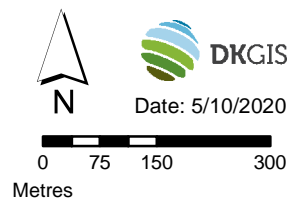
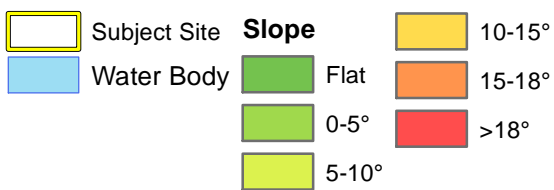


Figure 8: Terrain

Coordinate System: GDA 1994 MGA Zone 56

Imagery: © Nearmap

3.4 Fire intensity analysis

The predicted fire intensity across the area has been modelled using GIS (Figure 9). The map displays the intensity of a fire under the most problematic fire winds from the western sector by providing an understanding of rate of spread, risk to fire-fighters, fire control line feasibility and the relative bushfire risk across the landscape.

The GIS model is based on the fire behaviour formula of McArthur Mk 5 (1962) and utilised inputs of slope, vegetation (fuel load) and aspect as described below:

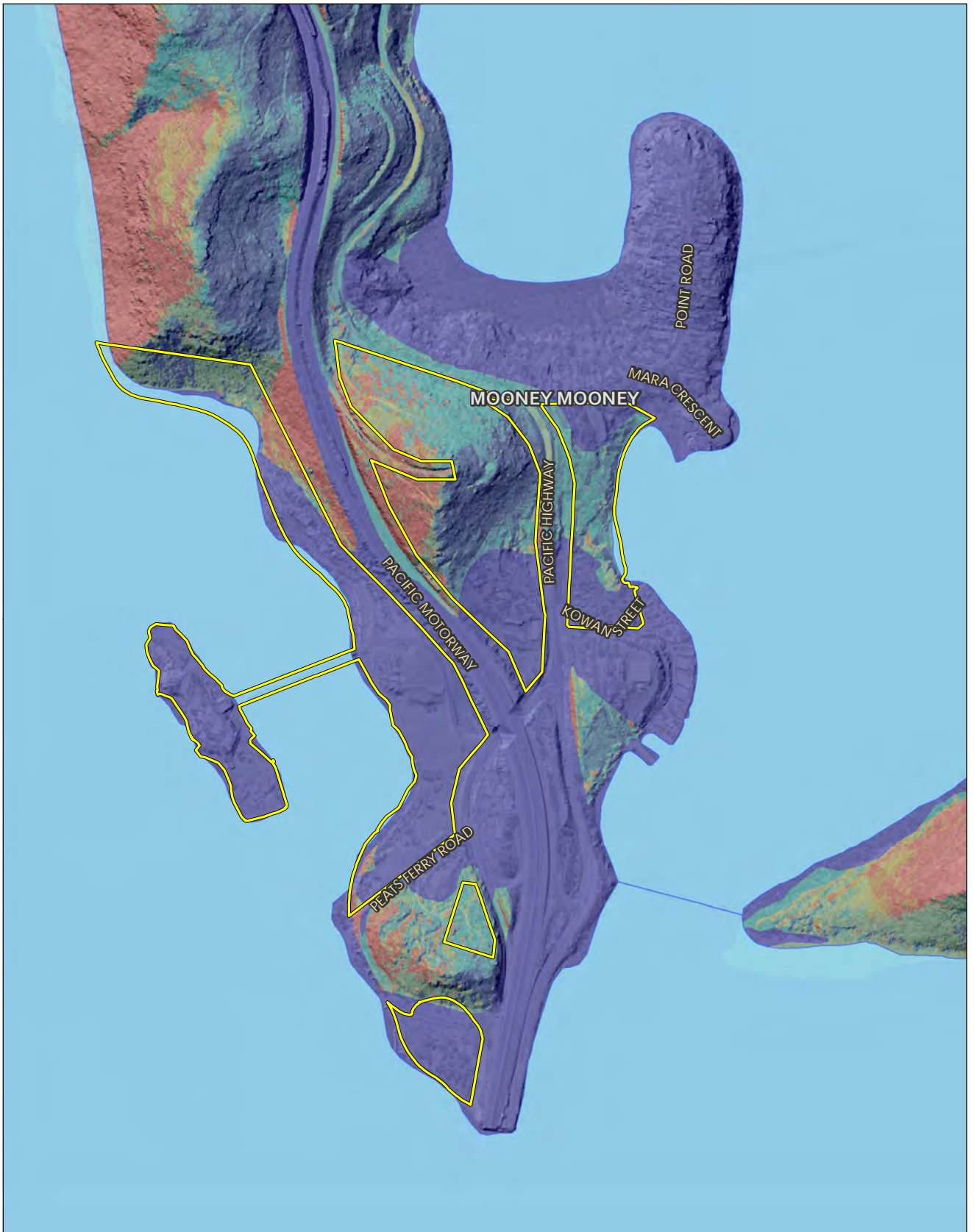
- Slope in degrees (Figure 8);
- Vegetation fuel loads (t/ha) based upon likely climax fuel loads (Figure 7) as specified by the NSW Rural Fire Service document *Comprehensive Vegetation Fuel Loads* (NSW RFS 2019);
- Fire weather represented by a Fire Danger Index (FDI) of 100 (which is a day of 'catastrophic' fire weather on the fire weather warning system). This is the planning (design) level;
- A direction of fire spread under the influence of winds from the western sector when problematic bushfires occurs in the region.

The mapping of areas into varying degrees of intensity does not indicate how often an area will receive potentially damaging fires, however, it provides a useful comparative ranking across the landscape. Mapping intensity assists in understanding the potential behaviour of bushfires and fire pathways. For example, locations with an expanse of higher bushfire intensity running in a west to east direction may represent a potential wildfire path.













The intensity mapping highlights the steep slopes on the western side of the peninsula to the north of the subject site. This pattern indicates a potential fire path leading south along the peninsula whereby a fire could propagate along the steep slopes under the influence of north-westerly winds, flanking uphill towards the ridgeline as it progresses southwards. This pattern continues in the south direction into the subject site affecting the hill with the water reservoir which comprises a significant amount of the northern portion of the subject site. Although separated from the forests of much of the peninsula by the motorway, fire could spread southwards and spot over the motorway to the hill within the site.

Of less significance is an area of higher intensity on the western slopes of Deerubbin Reserve at the southern end of the subject site. The areas of higher intensity are less influential and patchy yet demonstrate that a fire igniting within the reserve could spread uphill under the influence of a westerly wind. A fire in this instance would not spread into the reserve from out of the area due to its isolation from the surrounding bushland.

The most dominating feature of the intensity mapping is most of the subject site and surrounding lands are mapped as the lowest areas of intensity, being the representative of the fuel free areas (e.g. reserves and roads), and non-hazardous vegetation (e.g. mangrove swamps).



Legend

 Subject Site	 15,000 - 30,000	 120,000 - 150,000
 Water Body	 30,000 - 60,000	 150,000 - 180,000
Fire Intensity (kW/m)	 60,000 - 90,000	 180,000 - 250,000
 <math><1,000</math>	 90,000 - 120,000	 >250,000
 1,000 - 15,000		



Date: 5/10/2020



Coordinate System: GDA 1994 MGA Zone 56

Imagery: © Nearmap

Figure 9: Bushfire Intensity

3.5 Fire history

Information on fire history such as temporal and spatial pattern of fire spread is a useful factor in understanding the bushfire risk. The *Gosford Bush Fire Risk Management Plan* (Gosford District Bush Fire Management Committee 2011) does not provide accounts of fire history for the LGA however the documents *Fire Management Strategy Brisbane Water National Park* (Department of Environment and Conservation, 2006a) and *Popran National Park Draft Fire Management Strategy* (Department of Environment and Conservation NSW, 2006b) include fire history mapping showing the last fire to affect the area to be in the season of 1993/1994. That fire affected most of the landscape to the north, spreading along the peninsula and reaching the northern portion of the subject site including the hill surrounding the water reservoir. According to the *Fire Management Strategy Brisbane Water National Park* two landscape fires have affected the peninsula to the north since 1964, which includes the 1993/1994 fire.

The fire history mapping shows that only the forests in the northern portion of the subject site have been affected by fire (since 1964). Fire has been absent from the majority of the subject site including Deerubbun Reserve in the southern portion.

The Gospers Mountain Fire of the 2019/2020 fire season was arrested on the western side of Mangrove Creek at the locality of Spencer just over 8 kms north-west of the site. Although this fire did not directly impact the site, the fire behaviour including spread pattern demonstrates how a fire could emanate from the reserves to the west and travel to the site.

3.6 Ignition sources

The *Gosford Bush Fire Risk Management Plan* (Gosford District Bush Fire Management Committee 2011) notes a list of common ignition sources affecting the LGA. Those that would be synonymous with the area surrounding the subject site are arson associated with car dumping and dry lightning strikes. Setting alight dumped cars is more common around the urbanised areas of the district, however Mooney Mooney is not immune to this problem. Of more of a concern is fires started during lightning strike during spring and summer storms which are not followed by rainfall, as was the case with the Gospers Mountain Fire. Lightning strikes are a natural phenomenon to the north-west of the subject site in the Dharug National Park where there are large deposits of ironstone (Gosford District Bush Fire Management Committee 2011).

Ignition can occur from the road corridors (M1 Motorway and Pacific Highway) which are a feature of the subject site. Fires can ignite from accidental ignitions resulting from cigarette butts or vehicle fires, particularly from trucks heading north bound uphill from sea level towards the top of the ridgeline around the Jolls Bridge area. Ignitions can also occur from arching of overhead high-voltage powerlines cross the area north to south.

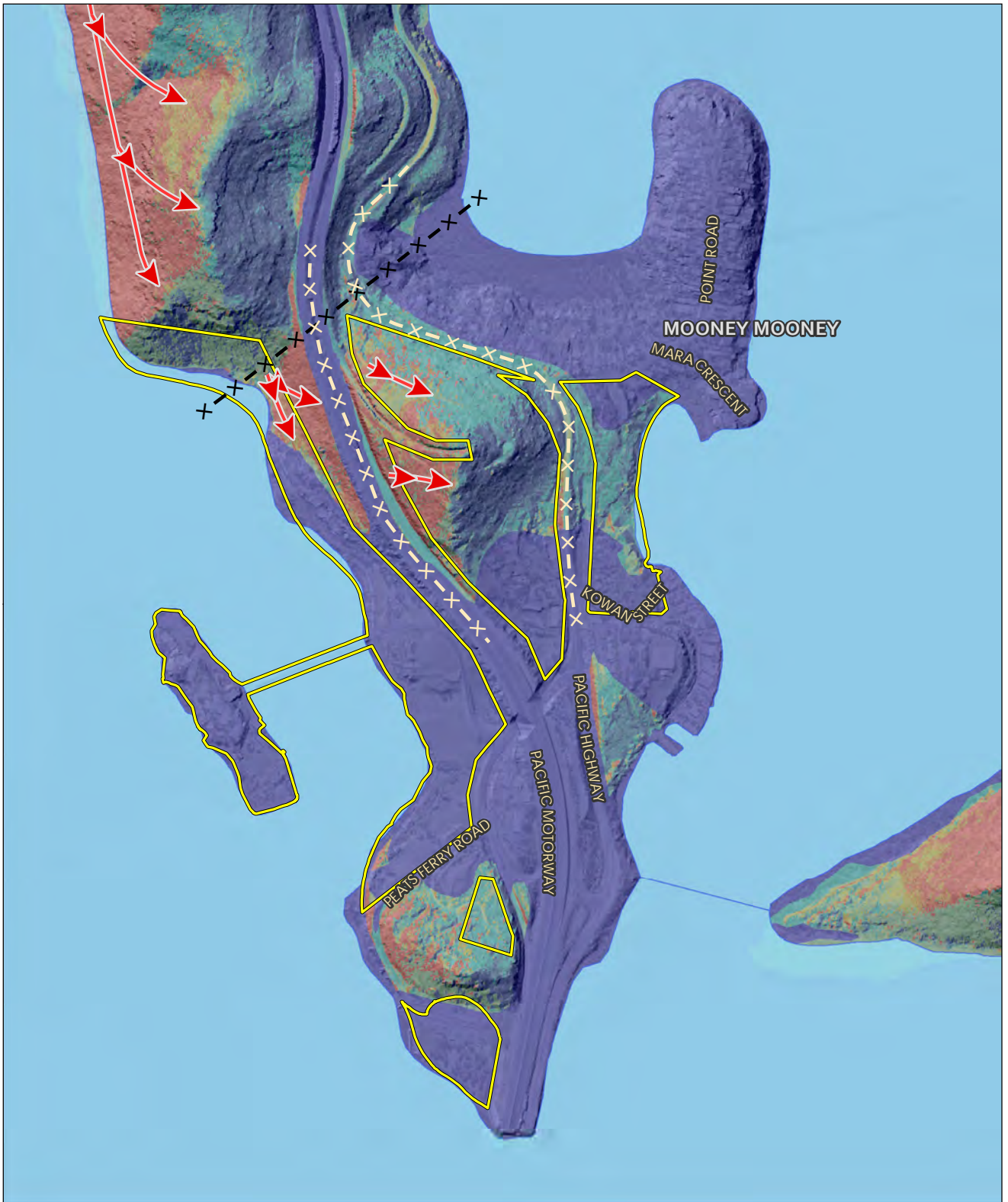
3.7 Potential fire scenarios and control opportunities

Based on the information provided in the preceding sections on hazard, weather, intensity, history and ignition sources, likely fire behaviour and potential fire paths and scenarios can be predicted. As indicated on Figure 10, 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 north-west or human-induced ignition from the road corridors creating the potential for a bushfire to spread south along the peninsula and flank up the steep slopes to impact the northern section of the subject site. A smaller, and less intense fire could occur within Deerubbun Reserve in the southern section of the site, however point-source ignition would need to occur within the reserve which is more unlikely.

Also indicated on Figure 10 are control opportunities that exist throughout the landscape to prevent or limit fire attack from the north. The most notable are the M1 Motorway and Pacific Highway transport corridors. An opportunity also exists across the peninsula between Mooney Bay and the Hawkesbury River whereby the total width of hazard is less than 150 m wide (approximately 70 m either side of the motorway), broken-up by non-hazard areas which include mangrove areas along both waterways, residential properties, the motorway and highway. 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 steep slopes, particularly west of the motorway.

Similarly, an earlier opportunity to control fire spreading south along the peninsular to the subject site is at Cheero Point approximately 1.3 km to the north. Here the total width of hazard is 170 m between the waterways.



Legend

Subject Site	Fire Intensity (kW/m)	90,000 - 120,000
Fire Control	<1,000	120,000 - 150,000
Landscape and Aerial	1,000 - 15,000	150,000 - 180,000
Road Corridor	15,000 - 30,000	180,000 - 250,000
Potential Fire Path	30,000 - 60,000	>250,000
Water Body	60,000 - 90,000	



Date: 5/10/2020



Figure 10: Potential Fire Scenario and Control Opportunities

Coordinate System: GDA 1994 MGA Zone 56

Imagery: © Nearmap

4 Land use assessment

4.1 Risk profiles

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 (Section 3). The subject site has been divided into three broad risk profiles 'high', 'medium' and 'low' based on the same methodology used by NSW Rural Fire Service (BFCC 2008) in developing bushfire risk management plans across NSW.

As detailed in Section 3, considerations for the determination of the risk profiles include fire intensity mapping (a product of vegetation, topography and fire weather), fire history, ignition sources and potential fire attack scenarios and control opportunities. The risk profiles for the subject site are mapped on Figure 11.

Figure 11 shows the areas of high risk to be in the northern portion of the subject site, consisting of the forested, steeply sloping land of the hill with the water reservoir and land bordering Popran National Park between the Hawkesbury River and the motorway.

The areas of medium risk area those that adjoin the high risk areas in the northern portion of the subject site. These areas are not situated amongst high hazards, however, are adjacent high hazards or isolated from a landscape fire (i.e. Deerubbun Reserve). The areas of low risk are the remaining areas which are the gentle sloping and predominantly cleared areas which predominate the central and southern portions of the subject site. These areas comprise of mangroves, residential properties, open space reserves and roads.

As a point of reference, the *Gosford District Bush Fire Risk Management Plan* (Gosford District Bush Fire Management Committee 2011) rated the risk to the Mooney Mooney Precinct as 'High 3A' as a result of a 'likely' likelihood of fire impact and a 'moderate' consequence of impact. Other than community education, no specific bushfire risk treatments such as APZ or prescribed burning are listed in the plan for the Mooney Mooney Precinct.

4.2 Land use recommendations

In collaboration with other land use planning requirements, the risk profiling (Section 4.1 and Figure 11) has been used to plan the proposed land use within the subject site. The proposed land zoning is included as Figure 12.

Most noteworthy is the decision to not introduce development into the high risk areas within the northern portion of the subject site. These are proposed to be zoned E2 – Environmental Conservation and RE1 – Public Recreation. The only development that could occur in these areas would be residential, however the bushfire risk to future residents was considered to be significant and, coupled with the bushfire protection measures such as large Asset Protection Zones on steep slopes, was not viewed as an environmentally acceptable outcome. Therefore residential uses were not proposed in these areas.

Areas mapped as medium risk were deemed acceptable for residential development providing compliant Asset Protection Zone and access provisions could be applied. The medium risk areas feature bushfire hazards on no more than 50% of the area's perimeter, are not located at higher points in the landscape above areas of hazard, and have ready access to the surrounding low risk areas. Medium density residential development is restricted to those areas which are buffered from the higher hazard areas by lower density development and roads. The electricity substation has also been situated within a medium risk area, with significant buffer from the residential areas and high risk areas.

Tourist accommodation (i.e. Peat Island) and areas designated for public use and assembly are confined to areas mapped low risk. These areas do not adjoin significant bushfire hazards and are surrounded by cleared and developed areas easily accessible by the existing road network.

4.3 Asset Protection Zones (APZ)

Using the vegetation and slope data presented in Section 3, APZs have been determined and accommodated within the Concept Plan where required. The APZ layer is shown on Figure 13.

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. The Concept Plan has been designed to accommodate the required APZ dimensions.

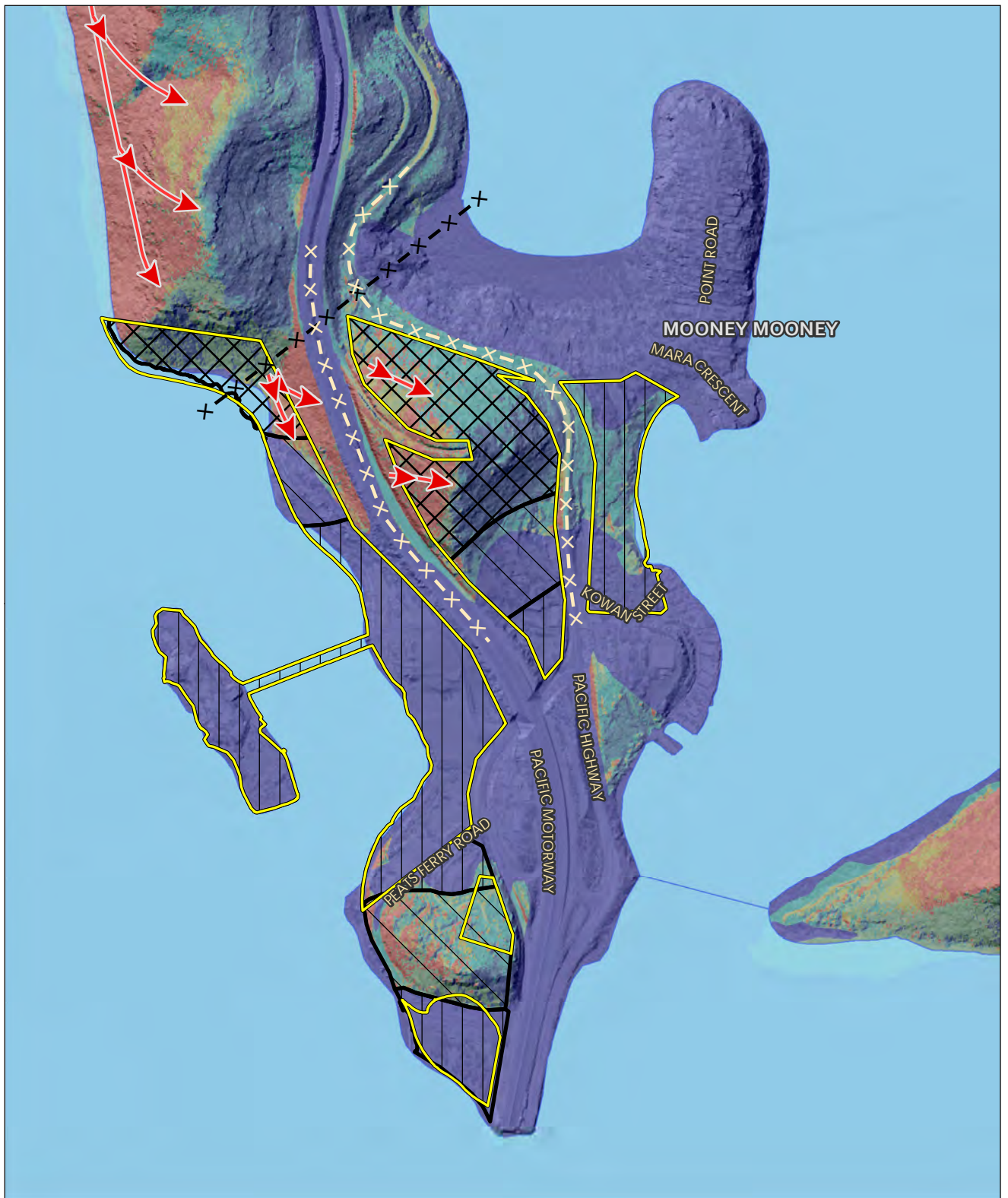
Table 3: APZ determination

Location	Slope ¹	Vegetation ²	PBP APZ ³	Comment
North-east	Downslope 0-5°	Low hazard	14 m	Ecological corridor less than 50 m in width
North-east	Upslope/Flat	Low hazard	11 m	Narrow corridor of roadside vegetation between Highway and service road
North-west	Upslope/Flat	Forest	24 m	Forest corridor alongside M1 wider than 50 m and directly linked to bushland
Central	Upslope/Flat	Forest	24 m	Forest on steep upslopes
M1	Upslope/Flat	Low hazard	11 m	Narrow corridors or roadside vegetation
Electricity substation	Not applicable	Forest	(10 m)	A separate assessment of the substation is provided in Appendix 2

¹ Effective slope assessed over 100 m from edge of developable area where the bushfire hazard occurs.

² Predominant vegetation classification over 140 m from developable area.

³ Asset Protection Zone (APZ) required by Table A1.12.2 of Planning for Bush Fire Protection 2019. Distances in brackets prescribed by other guidelines.



Legend

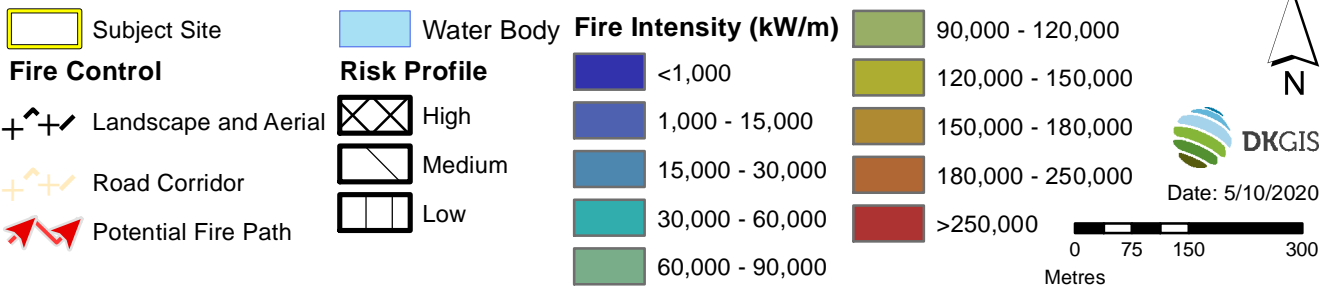


Figure 11: Risk Profiles for Land Use

Coordinate System: GDA 1994 MGA Zone 56

Imagery: © Nearmap

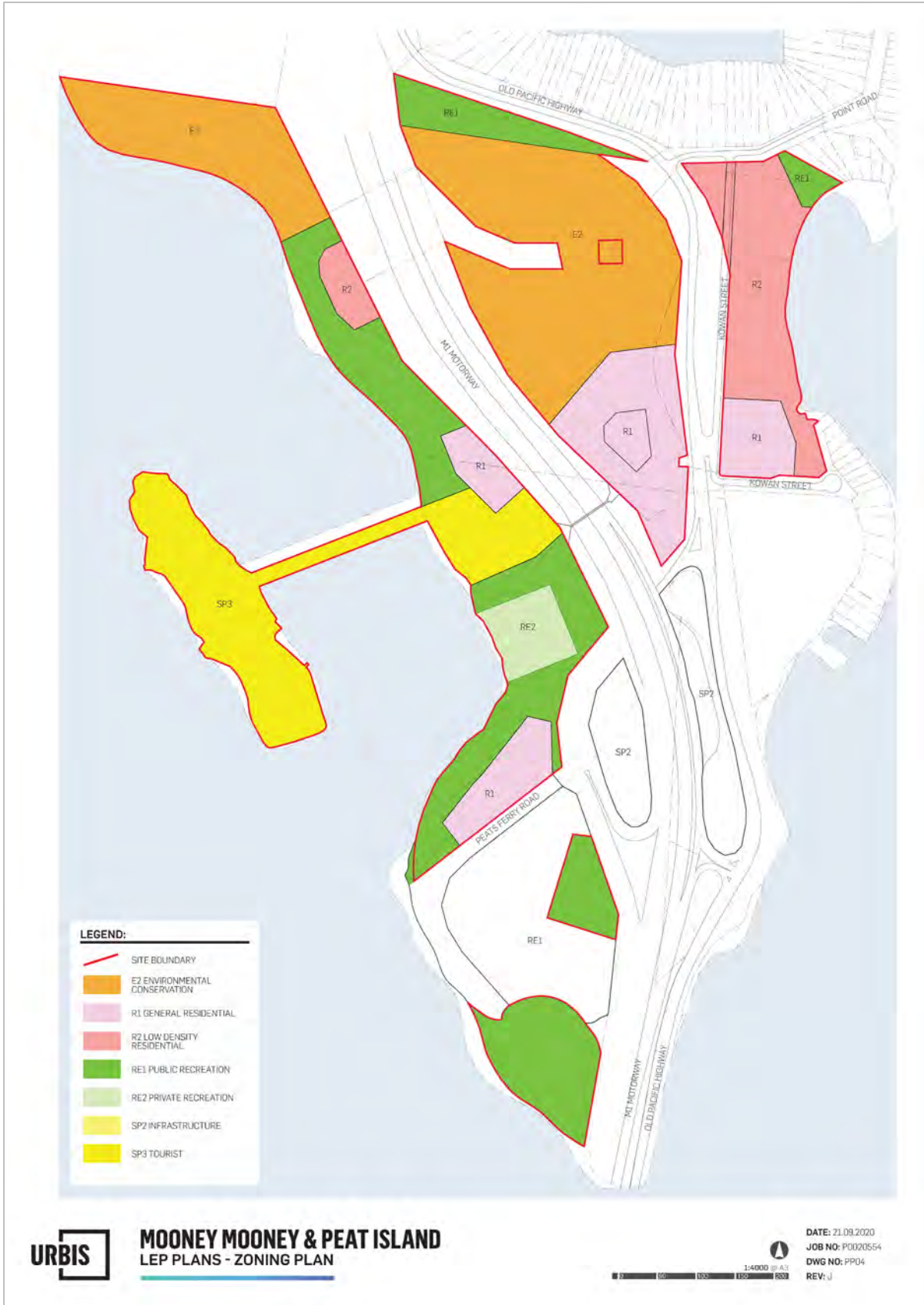








Figure 12: Proposed land zoning



Legend

-  Site Plan
-  Subject Site
- Asset Protection Zone**
-  Asset Protection Zone - 10m
-  Asset Protection Zone - 11m
-  Asset Protection Zone - 14m
-  Asset Protection Zone - 24m



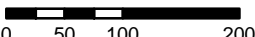
  **DKGIS**
 Date: 12/10/2020

 0 50 100 200
 Metres

Figure 13: Asset Protection Zone

Coordinate System: GDA 1994 MGA Zone 56

Imagery: © Nearmap

4.4 Construction standards 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* (SAI Global 2018). Such an assessment does not occur until 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.

Prior to development, it is recommended that the Gosford Bush Fire Prone Land Map is revised and updated to reflect the more recent bushfire prone land mapping methodology specified by the RFS document *Guide for Bush Fire Prone Land Mapping* (NSW RFS 2015) which will remove many small remnant parcels from the map as well as the mangrove and estuarine areas which should not be identified as bushfire prone vegetation. A map revision will reduce the amount of future bushfire and BAL assessment for development within the subject site.

4.5 Adjoining land uses

The adjoining land owners who have bushfire management responsibility under the *Rural Fires Act 1997* are the National Parks & Wildlife Service (NSW Office of Environment & Heritage) in the management of Popran National Park on the western side of the motorway and Brisbane Water National Park on the eastern side. These two parks present the bushfire threat to the subject site. Both parks have a fire management plan (Department of Environment & Conservation, 2006a and 2006b) which consider the existing community and assets at the subject site. Although both plans should be updated to include future changes in the area, it is not expected that the land manager will be forced to significantly change the existing strategies.

5 Access and emergency services

The subject site currently supports the existing residential community of Mooney Mooney and associated businesses and industries, places of assembly (e.g. Mooney Mooney Club, Mooney Mooney Chapel, Deerubun Reserve and Peat Island) and reserves and waterfront for boating, fishing and recreation. The proposed rezoning will facilitate new uses and improvements to access, infrastructure and emergency services which will greatly improve the existing level of bushfire emergency management and ensure an adequate level of bushfire protection for the new uses.

5.1 Access

PBP requires an access design that enables safe evacuation away from an area whilst facilitating adequate emergency and operational response. All bushfire prone areas should have an alternate access or egress option depending on the bushfire risk, the density of the development, and the chances of the road being severed by fire for a prolonged period. Access into and egress out of the subject site is available in an alternate direction north and south and by alternate roads; M1 Motorway and Pacific Highway. Both roads are major thoroughfares and have the capacity to accommodate the additional residents and users resulting from the rezoning. Figure 14 highlights the existing road network.

It is possible for either road to be severed by the impact of fire as both traverse bushland in the north and south directions once leaving the subject site, however it is highly unlikely for both directions to be severed at once. The north-south spread of wildfire in the region is usually controlled by the wide expanse of the Hawkesbury River which prevents fire occurring simultaneously either side of the Hawkesbury River bridge, unless there have been concurrent ignitions either side.

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 subject site is mapped as low risk and not within 100 m of a bushfire hazard. Figure 14 maps those areas that support a bushfire hazard versus those areas that do not. The low risk areas surround the road interchange and the waterfront open space. For example, Deerubun Reserve is the RFS nominated Neighbourhood Safer Place (NSP) for the existing local residential community of Mooney Mooney to take shelter if their homes are not defensible and egress out of the area is not possible. Future development will greatly improve the shelter in place opportunities for the existing local community.

The level of access for evacuation and emergency response will also be improved by the proposal to modify the existing road layout to accommodate future development within the rezoned areas. The following road changes are proposed:

- An extension of Kowan Street in the north-east of the study area to provide a through road back to the Old Pacific Highway;

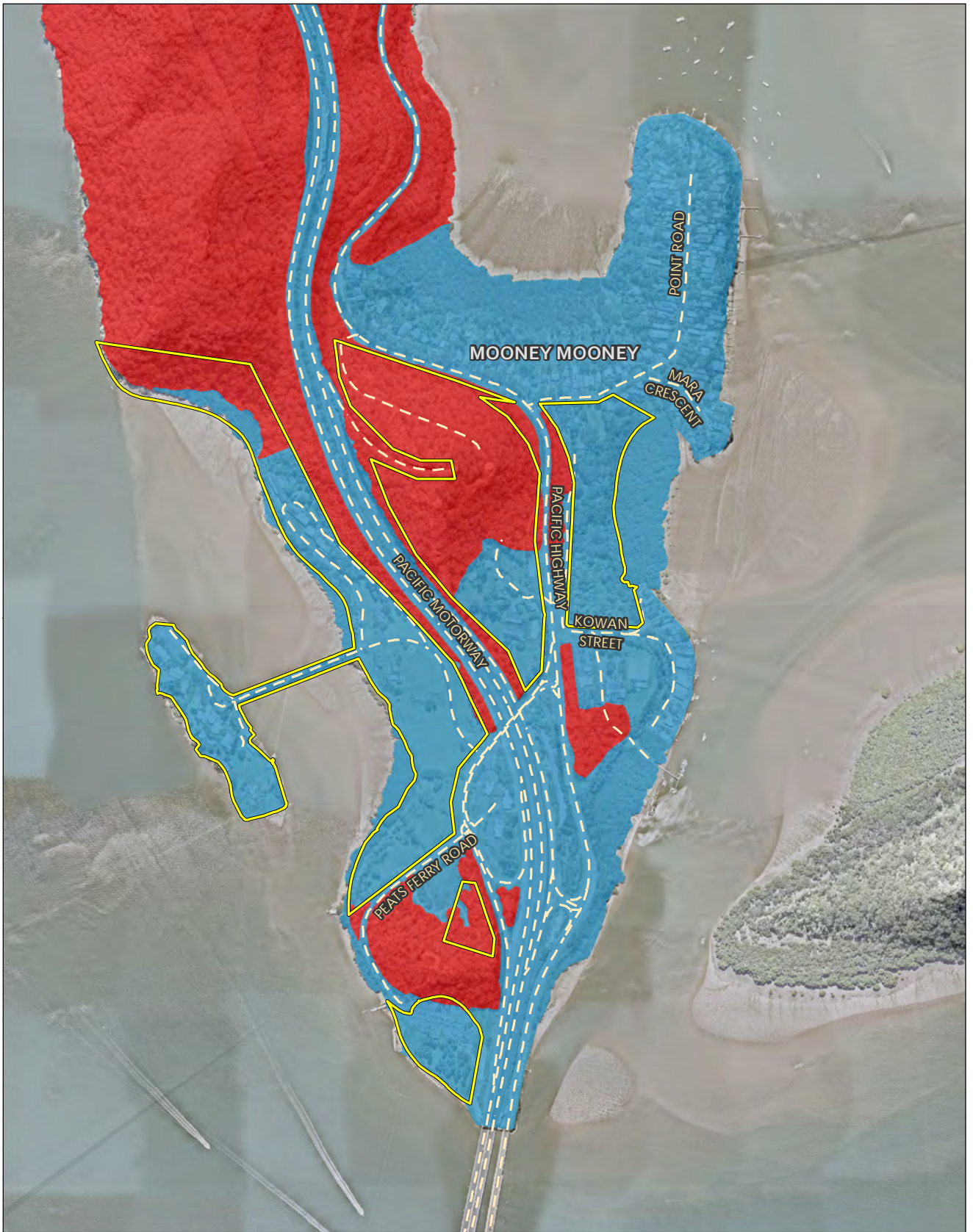
- A reconfiguration of the cul-de-sacs in the central part of the study area. All cul-de-sacs will be less than 200 m from the connecting through road; and
- The construction of a public road along the western foreshore lands. This road will culminate in a cul-de-sac longer than 200 m from the connecting through road, however the road traverses cleared lands with only mangroves and roadside vegetation in proximity. Residents and emergency personnel would not need to traverse bushland.

The proposed layout as shown in the Concept Plan (Figure 2) satisfies PBP objectives in relation to access and egress.





Details such as road dimension and perimeter access are to be addressed in the future stages of planning. *Planning for Bush Fire Protection 2019* requires 5.5 m wide carriageways, increasing to 8 m for perimeter roads, which may also consist of fire trails. It is recommended that a perimeter trail be provided between the residential area of the Chapel Precinct and the proposed E2 zone within the central portion of the site (the location of the perimeter access is shown on the Concept Plan). The steep upslopes at the base of the hill will prevent construction of a public road in this location, and an emergency access road to the rear of lots will allow fire-fighter access whilst residents can evacuate using the internal public road.

5.2 Emergency services

Increasing development in the study area will increase demand on emergency services, fire-fighting infrastructure and operational capability. However, the emergency service capability will be significantly improved for the area. In addition to servicing the additional development to ensure water volumes and hydrant pressures in line with Australian Standard *AS 2419 Fire hydrant installations - System design, installation and commissioning*, the locale will benefit from a new Emergency Services Precinct comprised of the Mooney Mooney Rural Fire Brigade, NSW Ambulance and NSW Roads and Maritime Services (not part of this Planning Proposal). A new Emergency Services Precinct will ensure rapid response via either the M1 Motorway or Pacific Highway and has ready access to Mooney Mooney Creek to the east or under the M1 Motorway to Deerubbun Boat Ramp to the west for boat access.



Legend

-  Roads
-  Subject Site
-  Hazard
-  Non-Hazard



 **DKGIS**
Date: 5/10/2020



Figure 14: Access and Evacuation

Coordinate System: GDA 1994 MGA Zone 56

Imagery: © Nearmap

6 Conclusion

The Concept Plan has been developed via an iterative process involving strategic analysis, constraints assessment and consultative workshops with bushfire protection requirements in mind. The information upon which this Bushfire Strategic Study was founded was used to inform the proposed land use and zoning throughout the subject site.

Risk profiling based on bushfire landscape analysis has, in collaboration with other strategic and site constraints, prevented development within areas mapped as high risk. These areas are the forested and steep lands in the northern portion of the site adjoining National Park and the bushfire threat. Areas mapped as medium risk have development proposed with appropriate bushfire protection provisions such as APZs and adequate access as well as buffering medium density residential development from the hazard interface. The majority of the subject site is mapped low risk and these areas provide ample space and opportunities to shelter in place in the unlikely scenario that the access is severed in both the north and south directions. The Concept Plan will result in an improved situation for the existing Mooney Mooney community in regard to access and emergency management infrastructure, and at a level that will be adequate for the increased density and usage at the site.

As demonstrated by this study, 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 Concept Plan 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.



David Peterson



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Appendix 1 – Site photographs



Photograph 1: View from northern section towards the south showing forest on steep slopes



Photograph 2: Large forest remnant in Deerubbin Reserve



Photograph 3: Forest leading upslope to M1 corridor in the north-west section of subject site



Photograph 4: Exotic roadside vegetation along M1 within central section of subject site



Photograph 5: Narrow foreshore scrub with Peat Island in the background



Photograph 6: Western foreshore showing cleared land with mangrove scrub at the waters edge

Appendix 2 – Substation assessment

22 October 2018

Property NSW
Department of Finance, Services and Innovation
PO Box N408
Grosvenor Place NSW 1220
Attn: Eric Yu

Dear Eric,

RE: Review of substation site for bushfire compliance, Mooney Mooney

Peterson Bushfire was engaged by Property NSW to undertake a preliminary review of a potential site within the Mooney Mooney and Peat Island Planning Proposal area for the construction and operation of an electrical substation. The request was for a brief, preliminary review drawing on previous bushfire assessment work undertaken for the Planning Proposal and knowledge of the bushfire protection requirements for substations.

Peterson Bushfire prepared a Bushfire Assessment Report for the Planning Proposal (dated 29 August 2016) involving an analysis of the bushfire hazard affecting the study area, which encompasses the substation site. The site is situated within Lot 11 DP 863305, located within a proposed public park (refer to Figure 1).



Figure 1: Location of potential substation site.

The site is within the north-eastern quadrant of a disturbed 4 hectare remnant of Dharug Foothills Apple Redgum Forest which is situated on a small hill between the M1 Motorway and existing electrical transmission easement (as shown in Figure 1).

The remnant is isolated from other bushland areas by distances that greatly exceed 100 m. Fire could not spread into the remnant from surrounding areas, therefore the site is not threatened by a landscape-wide fire scenario (as compared to the northern end of the Planning Proposal study area). Fire would have to initiate within the remnant (such as single-source ignition from lightning, arson or spotting from other fires) and propagate within a confined area, effectively limiting the fire development period. The bushfire hazard adjacent the site is not considered excessive such that the risk could not be mitigated using standard procedures.

In conclusion, the bushfire hazard and risk does not preclude the use of the site for an electrical substation. The energy provider will be required to maintain vegetation around the site in accordance with the document 'ISSC3-2016 Guide for the Management of Vegetation in the Vicinity of Electrical Assets' (ISSC3-2016). Compliance with this document will ensure the bushfire hazard and risk is managed to a level acceptable to the industry and the energy provider. Ausgrid's network standard 'NS179 Vegetation Management' (NS 179) refers to ISSC3-2016 for the management of vegetation around substations for bushfire protection. ISSC3-2016 states the requirement for a 10 m wide Asset Protection Zone (APZ) around the boundary fence of a substation to be maintained grass only.

Please don't hesitate to contact the undersigned to seek any clarification.

Yours sincerely,



David Peterson

Director



