



SMALL RESERVES BUSH FIRE MANAGEMENT PLAN

Boronia Park Hill Top

Yerrinbool Reserve

Berrima Reserves (Berrima River, River Bend, Berrima and Apple Street Reserves)

Medway Reserve

Leaver Park Bundanoon

Prepared for : Wingecarribee Shire Council August 2013



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Abbreviations

ABBREVIATION	DESCRIPTION
APZ	Asset Protection Zone
BEAC	Bushfire Environmental Assessment Code
BFMC	Bush Fire Management Committee
BFRMP	Bush Fire Risk Management Plan
EEC	Endangered Ecological Community
ELA	Eco Logical Australia
FDI	Fire Danger Index
FI	Fire Intensity
KTP	Key Threatening Process
LMZ	Land Management Zone
OEH	Office of Environment and Heritage
SFAZ	Strategic Fire Advantage Zone
WLEP	Wingecarribee Local Environment Plan
WSC	Wingecarribee Shire Council

1 Introduction and background

This Bushfire Management Plan (the Plan) was prepared for Wingecarribee Shire Council (WSC) under contract by Eco Logical Australia Pty Ltd (ELA). The Plan describes the objectives, strategies and works program for bushfire management years 2013 to 2018 within the following Reserves (collectively referred to as 'the Reserves' in this Plan):

- Berrima Reserves
 - Apple Street Reserve
 - Berrima Reserve
 - Berrima River Reserve
 - River Bend Reserve
- Boronia Park, Hilltop
- Leaver Park, Bundanoon
- Medway Reserve, Medway
- Yerrinbool Reserve, Yerrinbool

It also provides the framework for bushfire management beyond 2018 and is accompanied by two poster style plans.

1.1 Planning framework

1.1.1 *Rural Fires Act 1997 (RF Act) and Rural Fires Regulation 2008 (RF Reg)*

The *Rural Fires Act 1997* (RF Act) provides for:

- (i) the prevention, mitigation and suppression of bushfires in rural fire districts;
- (ii) co-ordination of bushfire mitigation and suppression across all of NSW;
- (iii) the protection of people from injury, death and property from damage arising from fires; and
- (iv) the protection of the environment.

Under Section 63 (1) (a) of the *RF Act*, 'local authorities' such as Wingecarribee Shire Council have a duty to take all practicable and notified steps (if any) to prevent fire occurring on land under their care and control and to minimise the risk of a fire spreading on or from their land.

The *RF Act* also requires local authorities to direct owners or occupiers of private land to undertake bush fire hazard reduction works where these are identified as being required. However, as with the majority of Councils across the state, Wingecarribee Shire Council has entered into an arrangement where this work is undertaken by the NSW Rural Fire Service and Fire and Rescue NSW.

Section 50 of the *RF Act* establishes the requirement for Bush Fire Management Committees (BFMCs) in each Local Government Area that contains some portion of a rural fire district. Part 3 of the *Rural Fires Regulation 2008* (RF Reg) outlines the constitution, membership and functions of a BFMC including the requirements for Local Government participation.

1.1.2 Southern Highlands Bush Fire Risk Management Plan

A Bush Fire Risk Management Plan (BFRMP) describes the level of bush fire risk across an area. The BFRMP identifies assets within the community at risk from bush fire, assesses the level of risk to those assets and establishes treatment options to deal with the risk and the agency or the entity responsible for carrying out those treatments.

Southern Highlands Bush Fire Risk Management Plan (SHBFRMP) currently identifies some bushfire mitigation actions which are within the Reserves. These have been reviewed in the context of this planning process and included in the individual Reserve Plans where they contribute to the objectives of each reserve and the aims of the Bushfire Management Plan.

The WBFRMP is currently under review and will incorporate Wollondilly LGA. The review is due for completion towards the end of 2013.

1.1.3 Wingecaribee Local Environment Plan 2010 (WLEP)

The Wingecaribee Local Environment Plan 2010 (WLEP) has been developed under Division 5 of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act). The WLEP provides environmental planning provisions for land in Wingecaribee Shire in accordance with the relevant standard environmental planning instrument under section 33A of the EP&A Act.

The LEP zoning of the Reserves is shown below in **Table 1**.

In the absence of specific reserve Plans of Management, the zoning is used as a surrogate for management intent for each reserve.

Table 1: LEP zoning of the reserves

	Zone	Zone Name	Zone Objectives
Berrima Reserves: Apple Street Reserve	RE1	Public Recreation	<p>To enable land to be used for public open space or recreational purposes.</p> <p>To provide a range of recreational settings and activities and compatible land uses.</p> <p>To protect and enhance the natural environment for recreational purposes.</p> <p>To enable ancillary development that will encourage the enjoyment of land zoned for open space.</p>
	R5	Large Lot Residential	<p>To provide residential housing in a rural setting while preserving, and minimising impacts on, environmentally sensitive locations and scenic quality.</p> <p>To ensure that large residential lots do not hinder the proper and orderly development of urban areas in the future.</p> <p>To ensure that development in the area does not unreasonably increase the demand for public services or public facilities.</p> <p>To minimise conflict between land uses within this zone and land uses within adjoining zones.</p> <p>To provide a restricted range of opportunities for employment development and community facilities and services that do not unreasonably or significantly detract from:</p> <p>(a) the primary residential function, character and amenity of the neighbourhood, and</p> <p>(b) the quality of the natural and built environments.</p>
Berrima Reserves: Berrima Reserve	E3	Environmental Management	<p>To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values.</p> <p>To provide for a limited range of development that does not have an adverse effect on those values.</p> <p>To encourage the retention of the remaining evidence of significant historic and social values expressed in existing landscape and land use patterns.</p> <p>To minimise the proliferation of buildings and other structures in these sensitive landscape areas.</p> <p>To provide for a restricted range of development and land use activities that provide for rural settlement, sustainable agriculture, other types of economic and employment development, recreation and community amenity in identified drinking water catchment areas.</p> <p>To protect significant agricultural resources (soil, water and vegetation) in recognition of their value to Wingecarribee's longer-term economic sustainability.</p>
Berrima Reserves: Berrima River Reserve	E2	Environmental Conservation	<p>To protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values.</p> <p>To prevent development that could destroy, damage or otherwise have an adverse effect on those values.</p>

	Zone	Zone Name	Zone Objectives
Berrima Reserves: River Bend Reserve	E2	Environmental Conservation	Detailed above
Boronia Park, Hilltop	RE1	Public Recreation	Detailed above
Leaver Park, Bundanoon	RU2	Rural Landscape	<p>To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.</p> <p>To maintain the rural landscape character of the land.</p> <p>To provide for a range of compatible land uses, including extensive agriculture.</p> <p>To provide opportunities for employment-generating development that is compatible with, and adds value to, local agricultural production through food and beverage processing and that integrates with tourism.</p>
Medway Reserve, Medway	E2	Environmental Conservation	Detailed above
	R2	Low Density Residential	<p>To provide for the housing needs of the community within a low density residential environment.</p> <p>To enable other land uses that provide facilities or services to meet the day to day needs of residents.</p>
Yerrinbool Reserve, Yerrinbool	E2	Environmental Conservation	Detailed above

1.1.4 Local Government Act 1993 (LG Act)

The boundaries of the Reserves in the Plan include Crown Land, which is largely under the care and control of Wingecarribee Shire Council and also includes some adjacent unformed road reserves. The exception to this is Berrima Reserve, which is under the care and control of a community trust. Under Division 1 of the *Local Government Act 1993* (LG Act), this public land is usually classified as either community or operational land.

1.2 Objectives

The aim of this Bushfire Management Plan is to provide the best possible life, property and environmental protection within the broader management objectives of the Reserves.

The general objectives of the Plan are:

- Protection of life and property within and adjoining the Reserves; and the
- Conservation of biodiversity, landscapes, visual amenity and water quality.

The specific objectives are to:

- Provide bushfire management zones for development of bushfire strategy and programs;
- Reduce bushfire ignitions;
- Minimise the spread of bushfires in the Reserves and the potential impact of these on assets;
- Provide appropriate fire regimes and hazard reduction activities to avoid detrimental impacts on species, communities, populations and culturally significant assets;
- Provide management that is consistent with the Southern Highlands Bush Fire Risk Management Plan;
- Provide a 5 year operational works program.

1.3 Limitations of the Plan

Design of mitigation measures around existing development is often complicated and constrained. Unlike new development which must meet current best practice bushfire protection, existing development is typically unable to meet such standards. It is also typically not possible to reduce the risk to that achieved by new development through substantial modification of adjoining bushland areas such as with wide Asset Protection Zones (APZ). This is because the remnant bushland often has significant environmental constraints, such as steep lands with possible geotechnical problems, threatened species, endangered ecological communities and other environmental considerations.

A risk-based approach has therefore been used in this Plan so that the bushfire risk is reduced to the lowest level possible under the biophysical and socio-economic constraints of the locality.

1.4 Residual risk

Residual risk is defined as the bushfire risk that remains after the implementation of bushfire risk reduction measures. It is acknowledged that despite the bushfire protection measures within this Plan, bushfire risk to life and property will remain and bushfires will continue to threaten life and property to some extent. It is simply not possible, without major environmental and/or financial impact, to provide complete protection for life and property located in bush fire prone areas. Research shows that the most effective bushfire protection measures for life and property occurs on and immediately abutting a

building; this Plan does not address these locations as they typically occur beyond the Reserves' boundaries on private property.

2 Bushfire hazard analysis

This chapter describes the bushfire risks to the Reserves through GIS and a field based analysis of the bushfire hazard, and a review of assets at risk.

2.1 Fire intensity analysis

Analysis of the predicted Fire Intensity (FI) for the Reserves has been modelled using GIS. Among other uses, the mapped output allows spatial ranking of the landscape according to FI under the most problematic fire winds from the north to south-west sector. The FI model can also be used to better understand the bushfire risk profile of the Reserves in combination with other risk assessment tools such as proximity to refuges, fire catchments, bushfire frequency/likelihood, ignition potential, suppression capacity and impact/damage potential.

The FI map enables fire fighters and fire planners to glean FI which influences rate of spread, risk to fire fighters or visitors, fire control line feasibility and the relative bushfire risk across the landscape. The FI map is based on peak fuel loads predicted in *Planning for Bushfire Protection* (NSW RFS 2006a).

The FI model has the following inputs:

- Slope (in degrees)
- Vegetation classified into groups and predicted fuel loads (t/ha) based upon maximum fuel loads
- 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 represents worst case scenario
- A direction of fire spread under the FDI 100 as follows:
 - *north to south-west* aspect recognised as uphill fire run
 - *south-west to south-east* aspects recognised as a traversing fire run i.e. level, and
 - *north to south-east* recognised as downhill fire run

GIS rules utilised the slope, vegetation and aspect inputs (described above) and fire behaviour formula of McArthur Mk 5 (1962).

The fire intensity map output is shown in the accompanying poster plans. It shows that if wildfire occurs under an FDI 100 there are few areas within the Reserves where the fire will be at an intensity that is controllable by firefighters (i.e. <4,000 kW/m). The map may also be used as a surrogate to bushfire risk (NB: it assumes winds from the north to south-west sector) with the higher fire intensity localities representing areas where fire control may be more difficult or dangerous. It is emphasised, however, that most of the Reserves have the potential to carry fire in any year at intensity well beyond the controllability of fire-fighters. The fire intensity analysis map is included on the accompanying poster style plans.

2.1.1 Vegetation formation

Vegetation formations were assessed according to Keith (2004). The majority of vegetation falls under the dry sclerophyll forest (shrubby subformation) classification with some wet sclerophyll forest also present.

Table 2: Vegetation formations within the Reserves using Keith (2004)

Vegetation Type	Keith Vegetation Formation
Bundanoon Sandstone Woodland	Dry Sclerophyll Forest (Shrubby Subformation)
Hawkesbury Sandstone Woodland	Dry Sclerophyll Forest (Shrubby Subformation)
Mittagong Sandstone Woodland	Dry Sclerophyll Forest (Shrubby Subformation)
Nattai Sandstone Gully Forest	Wet Sclerophyll Forest (Shrubby Subformation)
Wingecarribee Woodland	Dry Sclerophyll Forest (Shrubby Subformation)
Southern Highlands Shale Woodland (EEC)	Dry Sclerophyll Forest (Shrubby Subformation)

The vegetation classifications used reflect the fire regime applied by neighbouring landholders where a bushfire management plan is in place to ensure consistent management across the landscape.

2.1.2 Slope

Slope was assessed across the site using a 10 m digital elevation model.

2.2 Climate change

Changes in global climate have the potential to significantly impact bushfire behaviour in Australia. Currently the effect of climate change on bushfire risk is not fully understood and in particular, predicting the impacts of climate change in specific regions or at the individual site level is very complex and difficult.

Some of the most thorough and current research on the issue comes from a CSIRO publication in collaboration with the Bushfire Cooperative Research Centre and Australian Bureau of Meteorology Hennessy *et al.* (2005). This paper uses statistical modelling and landscape simulation to provide a number of predictions, some of which are relevant to this study, including:

- Changes to bushfire behaviour over the next 50 years are likely to be greatest inland, and relatively less significant along the coast;
- An increase of between 1 to 6 days per year of Very High or Extreme Forest Fire Danger Index days in Sydney by 2050; and
- The window available for prescribed burning in Sydney may shift and narrow by 2 to 3 weeks.

It is not clear what the effects of climate change will bring for the Reserves specifically, however as indicated in the second point above, an increase in the number of days when extreme fire behaviour could occur may significantly increase the risk of bushfire damage of the Reserves (through intensity and extent of wildfire) and pose a greater risk to adjoining property through a greater risk of higher

intensity bushfire attack. With an assumption of increased wildfire risk this plan takes a conservative approach to prescribed burning.

2.3 Assets at risk

Bushfire, bushfire management, and bushfire suppression activities all have the potential to adversely impact the built and environmental assets in and around the Reserves. Damage or destruction of these assets may have major economic, social, and environmental consequences.

2.3.1 Human settlement assets

Bushfire attacks built assets through flame contact, wind, radiant heat, smoke and burning debris (or ember attack). Evidence indicates ember attack is responsible for most bushfire related house fires.

Burning debris can cause spotting well beyond the fire ground and ignite buildings beyond those adjoining the Reserve. Radiant heat can impair fire fighting operations, the health of residents and damage or destroy buildings.

Flames restrict fire fighting operations, provide piloted ignition to building elements and threaten the health of residents and their capacity to evacuate the area. Smoke may affect the health of nearby residents, especially the elderly and those with or susceptible to respiratory disorders.

Bushfire protection planning should aim to prevent flame contact, reduce radiant heat to below the ignition thresholds for various elements of a building, minimise the potential for embers to cause ignition, and reduce the effects of smoke on residents and fire fighters.

There are few assets within the Reserve boundaries with most risk exposure to assets being related to those assets located on or adjacent to the Reserve boundaries.

Table 3: Built assets within and adjoining the Reserves

Reserve		Assets within Reserve	Assets Adjoining Reserve
Berrima Reserves	Apple Street	Berrima RFS Station	Residential area to the south (approx. 40 houses) Individual houses to the north Scout camp to the west
	Berrima Reserve	None	Residential houses (3) East of Sutton Street
	Berrima River Reserve	Stream gauge assets	Individual houses to the west, on Bowen St
	River Bend Reserve	None	Individual houses (3) on Berrima Drive
Boronia Park	Hilltop	Soccer and Tennis club buildings	Residential areas to the south, north and west Sewer pump station to the north
Leaver Park	Bundanoon	None	Sandstone Quarry to the north Individual houses to the south
Medway Reserve	Medway	None	Water supply infrastructure for Medway Dam to the south Residential area of Medway to the north east
Yerrinbool Reserve	Yerrinbool	None	Houses on Cascade Ave, Cascade Cres, Alpine Rd, Simla Rd, Sierra St. and Appenine Rd Baha'i Centre.

2.3.2 Environmental assets

Table 4 and **5** detail the threatened fauna and flora species which have been recorded within 2km of the Reserves and need to be considered in any fire mitigation or management decision making process.

Section 5 of this Plan details management actions for these species.

Table 4: Threatened fauna species recorded within 2km of the Reserves (Source: Bionet. June 2013 & Birdlife Australia Atlas of Australian Birds)

Scientific	Common Name	NSW Status	Comm Status	Apple Street	Berrima Reserve	Berrima River Reserve	River Bend Reserve	Boronia Park	Leaver Park	Medway Reserve	Yerrin-bool
<i>Anthochaera phrygia</i>	Regent Honeyeater	Endangered						✓			
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	Vulnerable						✓	✓		
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	Vulnerable		✓	✓	✓	✓		✓		
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	Vulnerable							✓		
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Vulnerable						✓			
<i>Daphoenositta chrysoptera</i>	Varied Sittella	Vulnerable		✓	✓	✓	✓		✓		
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	Vulnerable	Endangered						✓		✓
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	Vulnerable									✓
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	Vulnerable						✓	✓		
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	Vulnerable						✓	✓		
<i>Mixophyes balbus</i>	Stuttering Frog	Endangered	Vulnerable						✓		
<i>Myotis macropus</i>	Southern Myotis	Vulnerable									✓
<i>Ninox strenua</i>	Powerful Owl	Vulnerable							✓		
<i>Petroica boodang</i>	Scarlet Robin	Vulnerable					✓	✓	✓		✓
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper	Vulnerable					✓				
<i>Petroica phoenicea</i>	Flame Robin	Vulnerable							✓		
<i>Phascolarctos cinereus</i>	Koala	Vulnerable					✓	✓		✓	
<i>Pseudophryne australis</i>	Red-crowned Toadlet	Vulnerable									✓

Scientific	Common Name	NSW Status	Comm Status	Apple Street	Berrima Reserve	Berrima River Reserve	River Bend Reserve	Boronia Park	Leaver Park	Medway Reserve	Yerrinbool
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Vulnerable							✓		
<i>Tyto tenebricosa</i>	Sooty Owl	Vulnerable									

Table 5: Threatened flora species recorded within 2km of the Reserves (Source: Bionet. June 2013)

Scientific	Common Name	NSW Status	Comm Status	Apple Street	Berrima Reserve	Berrima River Reserve	River Bend Reserve	Boronia Park	Leaver Park	Medway Reserve	Yerrinbool
<i>Acacia bynoeana</i>	Bynoe's Wattle	Endangered	Vulnerable		✓	✓	✓	✓	✓		
<i>Acacia flocktoniae</i>	Flockton Wattle	Vulnerable									✓
<i>Eucalyptus aggregata</i>	Black Gum	Vulnerable			✓	✓	✓				
<i>Eucalyptus macarthurii</i>	Camden Woollybutt	Vulnerable		✓	✓	✓	✓		✓		
<i>Kunzea cabbagei</i>	Cabbage Kunzea	Vulnerable	✓	✓		✓			✓		
<i>Leucochrysum albicans</i> <i>var. tricolor</i>	Hoary Sunray	Vulnerable	Endangered	✓					✓		
<i>Leucopogon exolasius</i>	Woronora Beard-heath	Vulnerable			✓		✓				✓
<i>Persoonia acerosa</i>	Needle Geebung	Vulnerable					✓				
<i>Persoonia glaucescens</i>	Mittagong Geebung	Endangered	Vulnerable	✓	✓	✓	✓	✓			
<i>Persoonia hirsuta</i>	Hairy Geebung	Endangered					✓			✓	
<i>Phyllota humifusa</i>	Dwarf Phyllota	Vulnerable							✓		
<i>Pomaderris sericea</i>	Silky Pomaderris	Endangered	Vulnerable	✓	✓	✓	✓				
<i>Zieria murphyi</i>	Velvet Zieria	Vulnerable						✓			

2.4 Key Threatening Processes

In March 2000, the NSW Scientific Committee, established through the *Threatened Species Conservation (TSC Act) 1995*, made a final determination to support a proposal to list “*High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition*” as a Key Threatening Process (KTP) on Schedule 3 of the Act. This KPT is an important consideration in all fire-prone habitats in New South Wales, although the likelihood of occurrence of high frequency fire is currently greatest in coastal and tablelands habitats and where bushland joins urban areas.

The NSW Scientific Committee (2001) recognised that in the Southern Highlands Shale Woodlands community the number of species and the above-ground composition of species will change with time since fire, and may also change in response to changes in fire frequency.

Bushfire regimes, bushfire suppression and bushfire management activities also have the potential to exacerbate weed problems. Weed invasion is a threatening process affecting the Southern Highlands Shale Woodlands community. Weed species typically respond well to the exposed, nutrient rich, and competition-free conditions following fire. Bushfire management activities may allow these and other weeds to penetrate new areas and increase the density of existing infestations. As such, appropriate vegetation management before and after fire is required to mitigate this risk. This is discussed later in Section 5.4.

2.5 Culturally significant assets

River Bend Reserve at Berrima is included on the NSW Heritage Register as part of the Berrima Internment Group, being the location of a First World War Prisoner of War camp. It was here that the Germans interned at the Berrima gaol built a large complex of huts and other items such as watercraft, boatsheds, mooring posts, jetties and bridges to facilitate their daytime activities while in detention. Evidence of the huts that remain on site covered by the Bushfire Management plan includes numerous stone rubble platforms and retaining walls on which huts would have been constructed (NSW OEH 2011).

Individual indigenous heritage sites were assessed (AHIMS, May 2013), however they are not identified in this plan. However management strategies that are to be applied if indigenous heritage sites should be identified are provided in Table 22.

The Reserves do not have comprehensively surveyed Indigenous cultural heritage site data and as the dense vegetation may conceal artefacts this plan has adopted a precautionary approach and contains measures and guiding principles to protect unknown aboriginal sites within the Reserves. These measures are detailed within Indigenous heritage, Section 5.6.2 of this report.

2.6 Recreational use and facilities

The types of use, characteristics of users and the administration of the activities are important considerations for the management of bushfire risk to the participants of these recreational uses within the Reserves.

Table 6 below details the recreational uses within each of the Reserves which have been considered in this Plan.

Table 6: Recreational use of the Reserves

Reserve	Recreational Uses
Berrima Reserves: Apple Street	None formally provided
Berrima Reserves: Berrima Reserve	Berrima Sports
Berrima Reserves: Berrima River Reserve	Walking tracks, fishing
Berrima Reserves: River Bend Reserve	Walking tracks and adjoining scout camp
Boronia Park, Hilltop	Soccer fields, Tennis courts
Leaver Park, Bundanoon	None formally provided
Medway Reserve, Medway	None formally provided
Yerrinbool Reserve, Yerrinbool	None formally provided

3 Bushfire risk analysis

The analysis provided throughout this Section and summarised in **Table 7 - Table 10** assesses the risks of bushfire to people, property (infrastructure, assets and private property), environmental assets, and cultural assets. The methodology adopted is that given in AS/NZS 31000:2009 '*Risk management – principles and guidelines*' whereby a risk classification scheme is developed through qualitative scales of likelihood and of consequence.

This assessment adopts a definition of likelihood based on likelihood of occurrence over the currency of the plan. The scale of likelihood is shown below and is based on AS/NZS ISO 31000. Values have been allocated to the likelihood descriptors on a scale of 1 to 5 with 1 being extremely rare (extremely unlikely) and 5 being almost certain, as outlined in **Table 7** below.

Table 7: Likelihood description

Likelihood Descriptor	Description
Almost certain (5)	The event is expected to occur in most circumstances during the currency of the plan
Likely (4)	The event will probably occur in most circumstances during the currency of the plan
Possibly (3)	The event might occur at some time over the currency of the plan
Unlikely (2)	The event could occur at some time over the currency of the plan
Rare (1)	The event may occur only in exceptional circumstances

The scale of consequence is shown below. Values have been allocated to the consequence descriptors on a scale of 1 to 5 as outlined in **Table 8** below.

Table 8: Consequence description

Consequence Descriptor	Description
Catastrophic (5)	Death, huge financial loss, irreversible widespread environmental damage
Major (4)	Extensive injury, major financial loss, irreversible local environmental damage
High (3)	Medical treatment, high financial loss, Long-term environmental damage
Medium (2)	First aid, medium financial loss, Short-term environmental damage
Low (1)	No injuries, low financial loss, minor environmental impact

Rating codes and the level of risk have then been calculated by multiplying likelihood levels and consequence levels with the rating determined as per the scale outlined in **Table 9** below.

Table 9: Risk rating

Level of risk	Risk rating
0 - 4	Insignificant
5 - 9	Minor
10 - 14	Moderate
15 - 19	Major
20 - 25	Extreme

Table 10 below provides an analysis of the risk factors. The risk assessments presented in Appendix 1 indicate that, over the currency of the Plan, threats to life, property, heritage and environmental attributes of the Reserves have a moderate to major risk and will require appropriate risk management.

Table 10: Analysis of risk factors

Risk Factor	Analysis of the risk factor
1. The likelihood of human and natural fire ignitions, as influenced by time, space and demographics.	<p>Natural ignitions within the Reserves may occur.</p> <p>Human induced ignitions are known to be relatively more frequent at the urban / bushland interface and the accessibility of the Reserves makes ignitions more likely.</p> <p>Ignition caused by fires elsewhere in the landscape may occur.</p>
2. The potential spread and severity of a bushfire, as determined by surrounding land uses, fuel, topography and weather conditions.	<p>The Reserves are located on the juxtaposition of residential development and large conservation areas.</p> <p>Where the Reserves adjoin conservation areas these are managed under Fire Management Strategies however the continuity of bushfire prone vegetation in association with widespread moderately steep slopes may result in uncontrollable fire intensities under winds from any direction. Where steep slopes occur in the Reserves this may result in rapid rates of spread and at times difficult fire control.</p> <p>The Reserves may be exposed to strong north-westerly and southerly winds. Given the continuity of vegetation, wind and slope will be the primary determinant of the direction of fire spread.</p>
3. The proximity of assets vulnerable to bushfire and likely bushfire paths.	<p>Residential dwellings and associated structures directly adjoin parts of some Reserves. The majority of these assets have some set back from the Reserve boundaries although some would not meet contemporary standards. Most yards are reasonably managed in a fuel reduced state, however a detailed assessment of this has not occurred and it is certain that some improvement to properties could occur.</p> <p>Historic sites (WWI internment hut sites within Berrima River Bend Reserve) exposed to bushfire attack.</p> <p>The Southern Highlands Shale Woodland (EEC) covers part of the site at Medway Reserve. Inappropriate fire regimes may threaten this and other vegetation types in the reserves.</p>
4. The vulnerability of assets, or their capacity to cope with, and recover from bushfire.	<p>Few of the surrounding residential dwellings have been constructed in accordance with Planning for Bushfire Protection 2001 or 2006 and AS 3959 - <i>Construction of Buildings in Bushfire Prone Areas</i>. These older buildings are more vulnerable to bushfire attack than buildings constructed since 2001.</p> <p>The WWI sites are considered to be fire resistant (as it is a site rather than building remnants) however they remain vulnerable to bushfire mitigation actions (i.e. earthmoving equipment).</p> <p>Fire may impact threatened species and communities.</p> <p>Fire events may exacerbate weed invasion.</p>

4 Bushfire risk management

Bushfire risk management aims to reduce both the likelihood and consequences of bushfires. Broad strategies to achieve this aim are summarised in **Table 11** and detailed in the following subsections.

Implementation of these strategies helps minimise the risk to natural assets within the Reserves and built assets within and adjoining the Reserves. However as no development in a bush fire prone area can be guaranteed to be entirely safe from bushfires, providing an acceptable level of protection and a tolerable residual risk, is to some extent a compromise between the level of threat, inconvenience, dangers, ability or practicality of implementation and costs (financial and environmental) involved in providing the protection.

Typically the best outcomes are achieved where neighbouring properties and Reserve managers co-operate to provide bushfire protection measures.

Table 11: Bushfire risk reduction strategies and actions

Strategy	Actions
Avoid the risk	Building and development controls and prohibiting certain developments near hazards
Reduce the hazard	Reduce the level of fuel available to burn in a bushfire Manual clearing of bushfire fuels and provision of asset protection zones
Reduce unplanned ignition	Local bushfire education and extension programs Communications regarding Total Fire Ban days and burn permits
Reduce vulnerability	Establishment and maintenance of Asset Protection Zones for the protection of built assets in and around the Reserve Development and implementation of cooperative and complementary fire management strategies with neighbours and adjoining residences
Understand and accept residual risk	Manage with early detection and fire suppression operations Maintenance of existing access routes to facilitate suppression of fires

4.1 Fire management zones

Fire management zones are based on the location of assets, surrounding land managers bushfire mitigation measures, topography, land use, potential bushfire hazard and risk (Section 4 above). Fire management zones are separated into the following categories based on the *Bushfire Environmental Assessment Code* (BEAC) (NSW RFS 2006) and WBFRMP:

- Asset Protection Zone (APZ)
- Land Management Zone (LMZ)
- Strategic Fire Advantage Zone (SFAZ)

Zones have been identified and mapped across the Reserves to provide a planning framework upon which the protection of life, property and the environment can be improved. A description of each of these zones is provided in **Table 12** and details of the zones applied in this plan are provided in **Table 13**.

Table 12: Description of bushfire management zones

Zone	Objective	Description	Fuel management strategies
Asset Protection Zone (APZ)	Aims to protect human life, property and highly valued public assets and values.	It is an area immediately surrounding a development managed to reduce the bushfire hazard to an acceptable level. APZs exist within other zones around specific built assets.	The width of the APZ will vary with slope and building construction standard. Fine fuel in ground and shrub layers are not to exceed 4 tonnes/ha. Fuel managed by slashing, selective shrub clearing, trail construction or burning.
Strategic Fire Advantage Zone (SFAZ)	To provide for strategic containment of wildfires which will reduce the speed and intensity of bushfires, and reduce the potential for spot fire development. They are also used to provide safe access for bushfire operations and to assist with implementing fire management activities.	Usually adjacent to infrastructure (e.g. management trails, roads, walking tracks and cleared boundaries) for the purpose of adding depth to the effectiveness of these features. They can also be located in strategic areas to reduce the spread of wildfire and aid suppression e.g. near known ignition points and narrow vegetated corridors.	Fine fuel in ground and shrub layers should not exceed 8-12 tonnes/ha. Maximum 8 tonnes/ha of fine fuels in ground and shrub layers is commonly used as a level for which the fire intensity expected will not impact on any adjacent developments or assets. Fuel management by slashing, selective shrub clearing, trail construction or prescribed burning.
Land Management Zone (LMZ)	To manage bushfires to meet land management objectives where Asset Protection or Strategic Fire Advantage Zones are not appropriate or necessary.	Areas that are primarily managed for conservation, aesthetic, or water catchment purposes.	Undertake prescribed (ecological) burning programs primarily for biodiversity conservation purposes, however the spatial pattern of burning should also provide some fire control advantage where possible

Table 13: Zones

Reserve	Zone	Fire Management Objectives
Berrima Reserves: Apple Street	Asset Protection Zone	To protect adjacent houses to the north and south, and RFS building
	Strategic Fire Advantage Zone	To mitigate wildfire movement and compliment the life and property protection within the adjoining APZ
Berrima Reserves: Berrima Reserve	Land Management Zone	To maintain fire regimes predominantly within biodiversity thresholds using mid-long range fire intervals
Berrima Reserves: Berrima River Reserve	Asset Protection Zone	To protect houses to the west
	Land Management Zone	To maintain fire regimes predominantly within biodiversity thresholds using mid-long range fire intervals To burn this zone to create a mosaic of fire ages across the landscape that helps mitigate wildfire movement and provide a diversity of fire age classes in vegetation communities
Berrima Reserves: River Bend Reserve	Land Management Zone	To maintain fire regimes predominantly within biodiversity thresholds using mid-long range fire intervals To protect cultural sites
	Strategic Fire Advantage Zone	To strengthen the measures in place within the Apple St Reserve to mitigate wildfire movement
Boronia Park, Hilltop	Asset Protection Zone	To protect houses which border the Park
	Strategic Fire Advantage Zone	To mitigate wildfire movement and compliment the life and property protection within the adjoining APZ
Leaver Park, Bundanoon	Land Management Zone	Maintain fire regimes using mid to long-range fire intervals
Medway Reserve, Medway	Asset Protection Zone	To protect built assets (Medway Hall)
	Strategic Fire Advantage Zone	To reduce intensity of fire impacting on adjacent houses
	Land Management Zone	To maintain fire regimes predominantly within biodiversity thresholds using mid-long range fire intervals To conserve the Endangered Ecological Community
Yerrinbool Reserve, Yerrinbool	Asset Protection Zone	To protect built assets
	Strategic Fire Advantage Zone	To burn this zone to create a mosaic of fire ages across the landscape that helps mitigate wildfire movement and provide a diversity of fire age classes in vegetation communities To maintain fire regimes using short to medium fire intervals

4.2 Asset protection zones

The threat from flame contact and radiant heat to property, assets and thereby persons in and adjacent to the Reserves can be significantly reduced by the establishment and maintenance of Asset Protection Zones at the locations displayed and detailed in **Table 14**. Asset Protection Zone (APZ) dimensions have been determined with consideration of;

- Existing APZ's
- Specifications in the WBFRMP
- The Bush Fire Environmental Assessment Code (NSW RFS 2006b)
- A field based assessment of pre-existing conditions (i.e. existing fire breaks, adjacent assets);
- The existing residential setback; and
- The bushfire threat and risk to the assets.

Table 14: Asset Protection Zones

Reserve	APZ Name	Area (m2)	Width of APZ
Boronia Park	Boronia Ave/Stanley St	12,340	10-20m
	Stanley St South	490	6m
	Wilson Drive	1,190	20m
	Harold St (Sewer Pump Station)	2,880	20m
	Harold St	970	20m
	Wilson Drive (Battleaxe)	1,400	20m
Yerrinbool Reserve	Cascade Cres & Baha'i School	4,320	20m
	Unformed Andes St	2,715	20m
	Appenine Rd	1,350	20m
Berrima River Reserve	Bowen St APZ	3,250	20m
Berrima River Bend Reserve	Carribee Close	1,360	20m
	Berrima Drive	5,590	20m
Apple Street Reserve	North	5,900	20m
	South	8,950	20m
	RFS Station	750	10m
Medway Reserve	Medway Hall	1,810	20m

4.2.1 Vegetation / fuel management prescription within Asset Protection Zones

The following guidelines are for APZ maintenance within the Reserves, they also provide guidelines that should be encouraged on adjoining private property.

- Any existing larger trees (at least 200 mm in diameter measured at chest height) can remain within the APZ provided that;
 - No part of their crown occurs within 5 m of any building (significant habitat trees can remain 2 m out from the building line);
 - Canopies are discontinuous, i.e., canopies are separated by at least 2 m;
 - They are smoothed barked species or, if rough barked, are maintained free of hanging bark and other ladder fuels;
 - Low branches holding fine fuel (i.e. leaves and twigs of <6mm in diameter) are pruned to 2 m from the ground;
- Trees are to be hand-removed leaving stumps cut at ground level and where accessible, stumps are to be 'ground' to just below soil level. Stumps of all species that have the capability of resprouting are to be treated with an appropriate herbicide immediately after the cut is made;
- Smaller trees (i.e. less than 200 mm in diameter), shrubs, fallen trees and tree-limbs and stumps are to be removed and continuously suppressed;
- All shrubs and tree saplings are to be removed off-site or mulched, but all native grasses within the Reserves are to remain in-situ wherever possible; and
- Minimal ground fuel is to be maintained to include either mown grass or bare ground or less than 3 tonnes per hectare of fine fuel (i.e. material <6 mm in diameter).

4.3 Access and fire trails

In a bushfire planning context, roads and trails perform a variety of functions, they can:

- Facilitate evacuation
- Provide access for fire crews for direct fire attack
- Function as control lines for prescribed burning
- Function as control lines for back-burning
- In NSW, fire trails are classified using a vehicle carrying capacity and strategic importance classification as specified in the NSW Bushfire Co-ordinating Committee policy (BFCC 2007). The vehicle carrying capacity classification is based on the details shown in **Table 15** and the strategic importance classification is detailed in

Table 16, below.

Table 15: Fire vehicle specifications

Trail & Vehicle Classification	Weight	Ground Clearance	Width	Height	Turning Circle
Category 1	15,000kg	310mm	2800mm	4000mm	22m Diameter
Category 7	7,000kg	215mm	2600mm	3200mm	17m Diameter
Category 9	3,700kg	220mm	2200mm	2600mm	16m Diameter

Table 16: Fire trails strategic importance classification

Category	Description
Essential	<p>This is a fire trail without which fire response and suppression in an area would be severely compromised. All reasonable efforts must be made to ensure that this trail is trafficable to the agreed vehicle carrying capacity at all times. Sudden problems such as tree falls and land slips should be rectified as soon as identified. This trail should be checked on occasions throughout each year, and particularly before the commencement of bush fire season.</p> <p>Physical barriers to vehicle access must not be deliberately installed, unless they are readily breached by fire fighters. That is, a locked gate with key access for fire fighters would be acceptable; fixed bollards, felled trees, piles of rock and the like would not be acceptable, as the obstruction cannot be removed by a fire fighting crew without additional machinery.</p>
Important	<p>This is a fire trail that is required for fire management. If this trail was unusable due to temporary circumstances, other trails could be used to contain a fire, albeit with some loss of fire management efficiency. This trail should be trafficable to the agreed vehicle carrying capacity at all times. This trail should be checked before the commencement of the local bush fire season.</p>
Dormant	<p>This is a track or trail that has been used at some time in the past, but where there is no requirement for it to be constantly maintained in a trafficable state.</p>

This Plan does not recommend the establishment of any additional access tracks, however it is recommended that the existing tracks and access points are continued to be maintained and identifies some areas for improvement of access availability.

5 Protection of environment and cultural sites

The Plan has identified operational guidelines to reduce impacts on the environment which are to be followed when carrying out the activities identified in the Plan. These guidelines are based upon the NSW Rural Fire Service Standards for Asset Protection Zones and the Bushfire Environmental Assessment Code for NSW (2006). These operational guidelines are detailed in the following subsections.

5.1 Notes on Bushfire Environmental Assessment Code and the threatened species hazard reduction list

The Bushfire Environmental Assessment Code (BEAC) provides a streamlined environmental assessment process for use by issuing authorities and certifying authorities in determining bush fire hazard reduction certificates. It does not provide guidelines for landscape level fire management planning. Accordingly, where the BEAC specifies conditions relating to a particular species, they are noted here for consideration when implementing works, however there are also additional provisions in the safeguards detailed below be adopted as part of the Plan.

5.2 Fuel / vegetation reduction operations

During the establishment and maintenance of APZs within the Reserve, the following tree and vegetation clearing and management operations are recommended to protect soils, landscape features, and conservation values:

- The use of hand held tools and machinery are the most satisfactory equipment for hazard reduction operations.
- Use of slashing machinery is acceptable in certain circumstances;
- Threatened flora species or endangered ecological communities under the TSC Act (1995) must not be removed or damaged. In order to minimise the risk of damage to these species or communities, surrounding vegetation is to be removed by hand only;
- The use of bulldozers or other track type machinery is only permissible in limited circumstances;
- Cut vegetative material (with the exception of noxious and environmental weeds) and ground fuel, leaves, bark, twigs, grass tussocks etc. may be mulched and spread to help prevent weed invasion and soil erosion;
- Removal by hand is permissible on all slopes while mowing and slashing will not be undertaken on slopes greater than 18 degrees.

5.3 Fire regimes for biodiversity conservation

An objective of this Bushfire Management Plan is to *‘Provide appropriate fire regimes and hazard reduction activities to avoid detrimental impacts on species, communities, populations and culturally significant assets’*. Management of fire is therefore guided by the following general biodiversity conservation principles:

- Groups of plant and animal species respond similarly to fire according to characteristics of their life history
- Depending on the attributes of individual species, variation in components of the fire regime may facilitate local species extinctions (Keith 1996)
- It is not necessary to individually specify fire regimes for the conservation of every species and an overview of the requirements for broad groups of species can be applied. Requirements for most plant species can be summarised on the basis of a small number of groups
- Flora are commonly categorised into three broad groups based on their response to fire (Naveh 1975):
 - 'Obligate seed regenerators' generally regenerate only by seed
 - 'Obligate re-sprouters' generally regenerate solely by re-sprouting
 - 'Facultative re-sprouters' regenerate by seed and re-sprouting
- Plant and animal communities are inextricably linked. Plants form an important component of habitat for animals
- A diversity of fire regimes may be needed to maintain biodiversity. This means that over time, there is a place for fires of high, moderate and low intensity, frequency and size. Extinctions may be likely when fire regimes of relatively fixed intensity, frequency and extent prevail without variation
- Much of the vegetation within the Reserves is highly adapted to fire.

Table 17 provides fire regime guidelines for the major groups of vegetation within the Reserves applied in this Plan. As a variable fire regime within these guidelines is required to avoid a decline in biodiversity it is important to vary the fire frequency, intensity, season and pattern of burn within the guidelines for each vegetation group identified in **Table 17**.

Table 17: Fire regime guidelines for conservation of biodiversity (after NPWS 2004)

Community	A decline in biodiversity is predicted if there are...		
Dry sclerophyll forests:			
Hawkesbury Sandstone Woodland Bundanoon Sandstone Woodland Mittagong Sandstone Woodland Wingecarribee Woodland Southern Highlands Shale Woodland (EEC)	3 consecutive fires, with each of the fires less than 7 years apart	no fire for more than 30 years	successive fires that totally scorch or consume the tree canopy successive fires that do not consume more than 8-10 t/ha of surface fuel
Wet sclerophyll forest:			
Nattai Sandstone Gully Forest	more than one fire every 25 years	no fire for 60 years	successive fires that totally scorch or consume the tree canopy

5.4 Threatened species management

5.4.1 Threatened fauna safeguards

The major effects of fire on animals are through changes to their habitat and the availability of food, shelter and breeding sites (Williams & Gill 1995). Thus, the effect of fire regimes on the habitat requirements of animals is significant.

Although further research is required, it appears necessary to ensure a diversity of age classes in appropriate vegetation types for the maintenance of animal species (Williams & Gill 1995). Whilst

endeavouring to provide this, care must be taken to avoid unnecessary, severe impact on animals when implementing these guidelines. Burning a large proportion of available habitat; burning during breeding seasons; or burning prior to the dispersal of young, may have a long-term detrimental effect on isolated animal populations. The availability of nectar flow from flowering plants is another important consideration for both vertebrate and invertebrate species. It is desirable that any individual fire, or the combination of fires within a short period of time, should not completely burn the local extent of a vegetation community or habitat type.

Specific safeguards for threatened fauna species are provided in **Table 19** are also on the poster plans.

5.4.2 Threatened flora safeguards

Where the fire regime requirements of an individual threatened species are known, and particularly where requirements differ from the regime to be applied to the surrounding vegetation, site-specific fire management strategies may be required. The Bushfire Environmental Assessment Code (BEAC) provides some guidance on threatened flora safeguards as detailed in the Threatened Species hazard reduction list.

Table 18: Threatened fauna considerations

Scientific name	Common Name	Species specific conditions relating to the use of fire and mechanical hazard reduction from BEAC	Additional Safeguards (from Table 19) to be put in place
<i>Anthochaera phrygia</i>	Regent Honeyeater		1, 2, 3, 4, 6, 7 & 8
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo		1, 8, 11, 12, & 13
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	No burning of allocasuarina thickets	1, 8, 11, 12, & 13
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	No slashing, trittering or tree removal	1, 6, 7, 8, 9, 10, 11, 12 & 13
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	No burning around known roost sites No slashing, trittering or tree removal around known roosting sites	1, 2, 4, 6, 7, 8, 10 & 14
<i>Daphoenositta chrysoptera</i>	Varied Sittella		1, 2, 3, 4, 6, 7 & 8
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll		1, 2, 3, 4, 6, 7, 8, 13 & 14
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	No burning adjacent to streams No slashing, trittering or tree removal	1, 2, 3, 4, 6, 7 & 8
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	No fire around known roost sites	1, 6, 7, 8, 9, 10, 11, 12 & 13
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	No slashing, trittering or tree removal	1, 6, 7, 8, 9, 10, 11, 12 & 13
<i>Mixophyes balbus</i>	Stuttering Frog	No burning within 100 metres of streams No slashing, trittering or tree removal	1, 2, 3, 4, 6, 7 & 8
<i>Myotis macropus</i>	Southern Myotis	No fire around known roost sites No removal of trees	1, 6, 7, 8, 9, 10, 11, 12 & 13
<i>Ninox strenua</i>	Powerful Owl	No burning around known nesting sites at any time No slashing, trittering or tree removal of or around known nesting sites	1, 11 & 12

Scientific name	Common Name	Species specific conditions relating to the use of fire and mechanical hazard reduction from BEAC	Additional Safeguards (from Table 19) to be put in place
<i>Petroica boodang</i>	Scarlet Robin		1, 2, 3, 4, 6, 7 & 8
<i>Petroica phoenicea</i>	Flame Robin		1, 2, 3, 4, 6, 7 & 8
<i>Phascolarctos cinereus</i>	Koala		1, 2, 3, 4, 6, 7, 8, 9, 13 & 14
<i>Pseudophryne australis</i>	Red-crowned Toadlet	No burning adjacent to streams, and no burning in and around ephemeral drainage lines at the headwaters of creek No slashing, trittering or tree removal	1, 2, 3, 4, 6, 7 & 8
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	Avoid known roost sites	1, 2, 4, 6, 7, 8, 10 & 14
<i>Tyto tenebricosa</i>	Sooty Owl	No burning around known nesting sites at any time No slashing, trittering or tree removal	1, 11 & 12

(* applied from other *Myotis* species)

Table 19: Fire management safeguards (practices to avoid) for threatened fauna

Safeguard option	Where possible, in locations of known populations and/or core habitat:
Safeguard 1	Avoid fire regimes beyond fire interval thresholds of the native vegetation communities making up the species habitat.
Safeguard 2	Avoid burning more than 30% of the local habitat of the species in any year
Safeguard 3	Avoid size of each burn patch being >50% of the smaller home range of the species
Safeguard 4	Avoid actual area burned being >75% of the total area within a burn perimeter
Safeguard 5	Avoid burning a small total area where post-fire herbivore overgrazing is a concern
Safeguard 6	Avoid lighting up more than 50% of the burn perimeter and allow fire to spread in a single direction. Avoid situations resulting in converging fire lines with no escape routes.
Safeguard 7	Avoid burning in breeding season. If a number of species with different breeding seasons occur in the burn area, avoid the breeding season of the most fire sensitive species.
Safeguard 8	Avoid high intensity fire by minimising the size of wildfires, ignition times during mid-day, ignition during higher fire danger periods and if possible suppressing wildfires prior to it affecting the population. Prescribed burning may be appropriate to reduce nearby fuel loads in the direction from which wildfire is expected.
Safeguard 9	Avoid scorching the over-storey canopy during prescribed burning
Safeguard 10	Avoid placing infrastructure (e.g. temporary utilities, re-routing trails, etc.) within habitat or near nesting and roosting sites
Safeguard 11	Avoid felling hollow-bearing trees during mop-up and control line construction
Safeguard 12	Avoid burning known den trees and roost sites during prescribed burning
Safeguard 13	Avoid felling feed trees during mop-up and control line construction
Safeguard 14	Avoid predation by, or competition with, feral animals (in areas where they occur) by implementing appropriate feral animal control measures in conjunction with the prescribed burning

Table 20: Threatened flora and fire management safeguards

Scientific	Common Name	Species specific conditions relating to the use of fire and mechanical hazard reduction from BEAC Berrima Reserve	
<i>Acacia bynoeana</i>	Bynoe's Wattle	No fire more than once every 7 years	No slashing, trittering or tree removal
<i>Acacia flocktoniae</i>	Flockton Wattle	No fire more than once every 7 years	No slashing, trittering or tree removal
<i>Eucalyptus aggregata</i>	Black Gum	No BEAC requirements therefore the surrounding vegetation regime to be applied	
<i>Eucalyptus macarthurii</i>	Camden Woollybutt	No BEAC requirements therefore the surrounding vegetation regime to be applied	
<i>Kunzea cabbagei</i>	Cabbage Kunzea	No fire more than once every 7 years	No slashing, trittering or tree removal
<i>Leucochrysum albicans</i> var. <i>tricolor</i>	Hoary Sunray	No BEAC requirements therefore the surrounding vegetation regime to be applied	
<i>Leucopogon exolasius</i>	Woronora Beard-heath	No BEAC requirements therefore the surrounding vegetation regime to be applied	
<i>Persoonia acerosa</i>	Needle Geebung	No fire more than once every 13 years No burning mid-winter	No slashing, trittering or tree removal
<i>Persoonia glaucescens</i>	Mittagong Geebung	No BEAC requirements therefore the surrounding vegetation regime to be applied	
<i>Persoonia hirsuta</i>	Hairy Geebung	No BEAC requirements therefore the surrounding vegetation regime to be applied	
<i>Phyllota humifusa</i>	Dwarf Phyllota	No fire more than once every 7 years	No slashing, trittering or tree removal
<i>Pomaderris sericea</i>	Silky Pomaderris	No fire	No slashing, trittering or tree removal
<i>Zieria murphyi</i>	Velvet Zieria	No fire more than once every 10 years	No slashing more frequently than every 10 years, and no trittering or tree removal

5.5 Weed management

Where fuel/vegetation reduction and access maintenance works occur it is recommended that all vehicles and machinery likely to disturb the soil are to be cleaned prior to, during and after these activities to reduce the spread of weeds.

As bushfires may exacerbate weed infestations, it is recommended that weed control occurs within 6 months of any bushfire. **Table 21** outlines safeguards to reduce the spread of weeds during fire management activities.

Table 21: Safeguards when carrying out fire management activities in sites containing exotic plant species

Potential impact	Safeguards (or ameliorative measures) to mitigate the impact
Exotic seeds introduced on machinery and boots during fire management activities	<ul style="list-style-type: none"> Wash down all vehicles and machinery likely to disturb the soil prior to, during and after APZ maintenance, prescribed burning or trail maintenance activities. Vehicles and machinery regularly used in wildfire suppression should be thoroughly cleaned on a regular basis. Carry out weed management following the fire management activities.
Weed distribution and abundance increased as a result of fire management activities	<ul style="list-style-type: none"> Carry out weed control following the fire management activities. Avoid movement through weed infested areas. Wash down all vehicles and machinery that are likely to disturb the soil during prescribed burning or trail maintenance activities.
Environmental conditions that favour the expansion of exotic species are created by fire regimes	<ul style="list-style-type: none"> Minimise size of burn areas by slashing or other (non-fire) fuel reduction. Delay burning if burning at the proposed time will exceed fire interval threshold. Whenever possible, avoid scorching the overstorey canopy during prescribed burning.

5.6 Protection of cultural sites

5.6.1 Historic heritage

The Berrima Internment historic site at River Bend Reserve includes evidence of the WWI huts; these are numerous stone rubble platforms and retaining walls on which huts would have been constructed (NSW OEH 2011) and as such are not vulnerable to bushfire itself. They may however be damaged by heavy machinery and accordingly an exclusion area for heavy machinery is included in the Bushfire Management Plan.

5.6.2 Indigenous heritage

Table 22 details management strategies to mitigate bushfire threat to known, or any other newly discovered, indigenous cultural sites.

Table 22: Management strategies for fire related threats to Indigenous sites

Site types	Threats	Management Strategies
Scarred and/or carved trees	Destruction by fire or damage to bark layers. Threat may originate from wildfire and prescribed burns.	<ul style="list-style-type: none"> Avoid prescribed burning in known locations. Where prescribed burning is unavoidable, fuel should be cleared around identified trees prior to burn. Loose leaf litter and low ground cover is to be manually cleared by raking for 10 m around the tree. Incident Controllers and Incident Management Teams are to be informed of known locations. The use of earthmoving equipment around known sites is to be avoided or closely scrutinised. Known sites are to be examined as soon as possible after the passage of the fire and embers and smoulder to be immediately extinguished.
Art Grinding grooves Rock engravings	Smoke damage and exfoliation of rock layers	<ul style="list-style-type: none"> Clear vegetation from around the art so the potential for flame contact during wildfire is reduced. However avoid removal of vegetation that may provide protection from weathering and security. Avoid prescribed burning in known locations. Where prescribed burning is unavoidable, fuel should be cleared from in, on, and around all identified sites. Fuel clearing must not damage the site. Incident Controllers and Incident Management Teams are to be informed of known locations. The use of earthmoving equipment around known sites is to be avoided or closely scrutinised. Bushfire fighting foam should not be used within 20 m of art sites. If windy the distance should be extended to 50 m.
Middens Artefacts Deposits	Damage through inappropriate or unplanned fire suppression activities e.g. construction of containment lines via earthmoving equipment. Accelerated erosion.	<ul style="list-style-type: none"> The earth around known sites is to remain intact. Any surface impact adjacent to a site must be returned to its previous state. Incident Controllers and Incident Management Teams are to be informed of known locations. The use of earthmoving equipment, vehicles and heavy equipment must not be used on or within these sites unless a path exists that will not damage sites.

6 Fire management actions for the Reserves

Table 23 to **Table 30** detail the recommended actions for WSC to undertake over the next 5 years. These measures have been derived from the policy and legislative obligations, from research and risk assessment and stakeholder consultation.

The actions works are designed to strategically reduce the bushfire risk to life, property and the environment. However, even if perfectly implemented the actions will not eliminate the bushfire risk and effective preparedness, response and recovery to bushfire will always be essential. All strategies and actions are interconnected to build an effective bushfire management outcome; if one is not completed it may significantly reduce the effectiveness of others, some of which may be critical.

Table 23: Summary of fire management actions – Berrima Reserves: Apple St

	Fire Interval	Indicative Prescribed burn year	Comments
SFAZ	Maintain fire regimes using mid-range fire intervals Avoid successive fires at intervals less than 7 years Avoid fire exclusion for period greater than 15 years	2014 - 2020	Area is burnt within the plan timeframe. Note that there was an attempted burn in eastern section in 2012
APZ	Maintain 20m APZ around RFS station, and houses on northern and southern boundaries at location shown in poster plan, to standard specified in Section 4.2.1 (note that tree density can be retained and the understorey is to be managed appropriately)		
Access	Ensure fire trail at location shown in poster plan is maintained at Category 1 standard as detailed in Section 4.3 of this plan		

Table 24: Summary of fire management actions – Berrima Reserves: Berrima Reserve

	Fire Interval	Indicative Prescribed burn year	Comments
LMZ	Maintain fire regimes using mid-long range fire intervals Avoid successive fires at intervals less than 10 years Avoid fire exclusion for period greater than 30 years	2014 - 2020	Area is long unburnt and can be burnt within life of plan to maintain biodiversity thresholds. Will exceed upper biodiversity threshold in the life of this plan if not burnt.

Table 25: Summary of fire management actions – Berrima Reserves: Berrima River Reserve

	Fire Interval	Indicative Prescribed burn year	Comments
LMZ	Maintain fire regimes using mid to long-range fire intervals Avoid successive fires at intervals less than 10 years Avoid fire exclusion for a period greater than 30 years	2014 - 2020 except <ul style="list-style-type: none"> • area in SE burnt in 2012 which cannot be burnt within the life of this plan • area in west burnt in 2006, which becomes eligible for burning in 2016 	This area has a history of mosaic burning, and this zoning allows for a continuation of this burn pattern.
APZ	Maintain Bowen St APZ at location shown in poster plan, to standard specified in Section 4.2.1		
Access	Ensure fire trails at locations shown in poster plan are maintained according to Section 4.3 of this plan		
Recreational Use	Fishing		

Table 26: Summary of fire management actions – Berrima Reserves: River Bend Reserve

	Fire Interval	Indicative Prescribed burn year	Comments
LMZ	Maintain fire regimes using mid-long range fire intervals Avoid successive fires at intervals less than 10 years Avoid fire exclusion for period greater than 30 years	2015 - 2020	Lower biodiversity threshold will be reached within the life of this plan
SFAZ	Maintain fire regimes using mid-range fire intervals Avoid successive fires at intervals less than 7 years Avoid fire exclusion for period greater than 15 years	2014 - 2020	Priority for burning should be given to the two SFAZ areas
APZ	Establish and maintain APZ's for properties at end of Berrima Drive and Carribee Close, at locations shown in poster plan, to standard specified in Section 4.2.1 of this plan		
Heritage	Exclude heavy machinery from historic WWI precinct as shown on accompanying poster plan.		
Access	Ensure fire trail at location shown in poster plan is maintained in accordance with Section 4.3 of this plan. Installation of gates at access points to control unauthorised access.		
Recreational Use	Develop protocol for walking track closure on days of Extreme Fire Danger Rating and above, including notification at track heads which are outside of the Reserve (also consider Scout camp on adjoining land)		

Table 27: Summary of fire management actions – Medway Reserve

	Fire Interval	Indicative Prescribed burn year	Comments
LMZ	Maintain fire regimes using mid to long-range fire intervals Avoid successive fires at intervals less than 10 years Avoid fire exclusion for period greater than 30 years	2014 - 2020	Area is long unburnt and can be burnt within life of plan to maintain biodiversity thresholds. This allows for burning to take place in conjunction with neighbouring land managers within the life of this plan.
SFAZ	Maintain fire regimes using short range fire intervals Avoid successive fires at intervals less than 7 years Avoid fire exclusion for period greater than 12 years	2017-2020 for areas burnt in 2010 2014 - 2020 for remainder	Medway Hall and south of Medway Drive burnt in 2010, Eligible for burning again in 2017.
APZ	Maintain Medway Hall APZ at location shown in poster plan, to standard specified in Section 4.2.1		

Access	Ensure fire trails at locations shown in poster plan are maintained in accordance with Section 4.3 of this plan Investigate fire vehicle access to Medway Dam access road, and ensure that fire fighter access is possible through currently locked gates. The availability of access for fire vehicles through locked security gate is currently uncertain and not formalised. Protocols for access should be established and communicated to RFS.
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Table 28: Summary of fire management actions – Boronia Park Hilltop

	Fire Interval	Indicative Prescribed burn year	Comments
SFAZ 1	Maintain fire regimes using short range fire intervals Avoid successive fires at intervals less than 7 years Avoid fire exclusion for periods greater than 10 years	2014 - 2018	
SFAZ 2	Maintain fire regimes using short range fire intervals For Hawkesbury Sandstone Woodland: Avoid successive fires at intervals less than 7 years Avoid fire exclusion for periods greater than 12 years For Wet Sclerophyll Forest: Avoid successive fires at intervals less than 25 years Avoid fire exclusion for periods greater than 40 years	2014 - 2018	<u>Burning Priority Areas</u> Reserve to be burned within thresholds Where possible burn zones in different years to create mosaic In deciding zones to burn give priority to zones in the following order: 1,2,3,4.
SFAZ 3	Maintain fire regimes using short range fire intervals Avoid successive fires at intervals less than 7 years Avoid fire exclusion for periods greater than 12 years	2015 - 2019	This allows for burning to take place in conjunction with neighbouring land managers.
SFAZ 4	Maintain fire regimes using mid-range fire intervals Avoid successive fires at intervals less than 7 years Avoid fire exclusion for periods greater than 15 years	2014 - 2018	
APZ	Maintain APZ's for properties on Harold St , Wilson Drive, Boronia Ave, Stanley St, at locations shown in poster plan, to standard specified in Section 4.2.1 of this plan		
Access	Ensure fire trails at locations shown in poster plan are maintained in accordance with Section 4.3 of this plan		
Evacuation	Prepare Evacuation Plan for soccer fields. This must consider peak numbers, fire danger rating, time to evacuate, notification system and fires nearby.		

Table 29: Summary of fire management actions – Yerrinbool Reserve

	Fire Interval	Indicative Prescribed burn year	Comments
SFAZ	Maintain fire regimes using mid-range fire intervals For Hawkesbury Sandstone Woodland: Avoid successive fires at intervals less than 7 years Avoid fire exclusion for periods greater than 15 years For Wet Sclerophyll Forest: Avoid successive fires at intervals less than 25 years Avoid fire exclusion for periods greater than 60 years	2014 – 2020 except area in SW burnt in 2012	Burn currently approved by RFS for 2014
APZ	Establish and maintain APZ's at Cascade Cres extending to behind the Baha'i school, unformed Andes St, and property at Government Road end of Appenine Road at location shown in poster plan, to standard specified in Section 4.2.1		

Table 30: Summary of fire management actions – Leaver Park, Bundanoon

	Fire Interval	Indicative Prescribed burn year	Comments
LMZ	Maintain fire regimes using mid to long-range fire intervals Avoid successive fires at intervals less than 10 years Avoid fire exclusion for periods greater than 30 years	2014	Last burnt in 1982/83. It will exceed the upper biodiversity threshold in the life of this plan if not burnt.

7 Environmental assessments and permit requirements

The environmental assessment for the proposed works within the APZs may be obtained using the Bush Fire Environmental Assessment Code (BFEAC) (RFS 2006b) and the Hazard Reduction Certificate process. As a Public Authority, Council may prepare and certify its own Hazard Reduction Certificates for APZ works on land under its care and control.

The environmental assessment for any future proposed works within the Southern Highlands Shale Woodland EEC or within any of the Land Management Zones will need to be undertaken in the form of a Flora and Fauna Assessment. This may result in a Review of Environmental Factors including 7 part tests of significance where required.

8 Monitoring, review and evaluation

All strategies and plans must have mechanisms that show that progress is being made in successfully completing the prescribed actions. It is also necessary to determine the effectiveness of the plan and efficiency of individual or collective actions.

8.1 Monitoring and evaluation

Monitoring for management purposes should therefore be carried out to ensure that the actions listed in **Table 23** to **Table 30** are being carried out and the objectives are being achieved.

8.2 Review of the plan

A complete evaluation, review and updating of the plan should occur after five years. The review should;

- Consider whether the plan has achieved the objectives set out in Section 1.1;
- Re-assess the strategies and environmental safeguards in light of current research and management best practice; and
- Re-assess the strategies taking into account the legislative changes, financial constraints, social philosophies, improvements in bushfire protection and suppression, and changes in vegetation.

Annual reviews of the plan may be done when preparing annual work programs. Small changes to the actions and strategies may occur within the plan without formally discussing the changes with stakeholders. Matters that require a more significant variation should be discussed with any affected stakeholders.

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Appendix 1: Bushfire risk assessments

Table 31: Bushfire Risk Assessment – Berrima Reserves: Apple St

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
<i>Key considerations</i> <ul style="list-style-type: none"> Reserve is located NW of township area immediately adjacent to group of approximately 50 houses to the south-east Scout camp access traverses through the reserve Rural Fire Service station located in the reserve Private properties are accessed directly through the Reserve The Reserve is small, but proximal to large extent of forested area within the landscape Vegetation community is well represented in protected area within region No known cultural heritage sites 				
<i>Life</i>				
Populated area where the combination of threat and vulnerability expose a community to a significant likelihood of fatalities and major injuries.	5	3	15	Major
Less likely to be fatalities or major injuries due to the presence of attributes which afford some protection.	4	1	4	Insignificant
Loss of life or major injury highly unlikely. Medical/hospital treatment may be required.	3	2	6	Minor
Minor injuries only - first aid treatment. No major injuries or fatalities likely.	2	2	4	Insignificant
No injuries or fatalities likely.	1	4	4	Insignificant
<i>Property (infrastructure, assets and private property)</i>				
Extensive and widespread loss of property. Major impact across a large part of the community and region. Long term external assistance required to recover.	5	2	10	Moderate
Localised damage to property. Short-term external assistance required to recover.	4	3	12	Moderate
Short-term damage to individual assets. No external assistance required to recover.	3	3	9	Minor
Inconsequential or no damage to property. Little or no disruptions to the community.	1	4	4	Insignificant

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
<i>Environment</i>				
Local extinctions of native species.	4	1	4	Insignificant
Irreversible damage to the environment.	4	1	4	Insignificant
Long-term damage to the environment over a landscape scale.	4	2	8	Minor
Short-term, localised damage to the environment.	2	3	6	Minor
Minor environmental impact.	1	5	5	Minor
<i>Cultural Sites</i>				
Loss and/or irreversible damage to sites or objects of national, state or regional significance.	5	1	5	Minor
Extensive damage to sites or objects of national, state, regional or local significance requiring major external assistance.	4	1	4	Insignificant
Short-term damage to individual objects. Short term external assistance required to repair.	3	1	3	Insignificant
Short-term, localised damage to a small number of sites, objects and the cultural landscape.	2	2	4	Insignificant
Minor impact on sites or items which are repairable with little to no external assistance.	1	3	3	Insignificant

Table 32: Bushfire Risk Assessment – Berrima Reserves: Berrima Reserve

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
<i>Key considerations</i> <ul style="list-style-type: none"> Managed lands to the west Public access to the Reserve is unrestricted Fishing is a popular recreational use The large sportsground cleared area facilitates access The Reserve is small, but proximal to large extent of forested area within the landscape Vegetation community is well represented in protected area within region No known cultural heritage sites 				
<i>Life</i>				
Populated area where the combination of threat and vulnerability expose a community to a significant likelihood of fatalities and major injuries.	5	2	10	Moderate
Less likely to be fatalities or major injuries due to the presence of attributes which afford some protection.	4	2	8	Minor
Loss of life or major injury highly unlikely. Medical/hospital treatment may be required.	3	2	6	Minor
Minor injuries only - first aid treatment. No major injuries or fatalities likely.	2	2	4	Insignificant
No injuries or fatalities likely.	1	4	4	Insignificant
<i>Property (infrastructure, assets and private property)</i>				
Extensive and widespread loss of property. Major impact across a large part of the community and region. Long term external assistance required to recover.	5	2	10	Moderate
Localised damage to property. Short-term external assistance required to recover.	4	2	8	Minor
Short-term damage to individual assets. No external assistance required to recover.	3	3	9	Minor
Inconsequential or no damage to property. Little or no disruptions to the community.	1	4	4	Insignificant
<i>Environment</i>				
Local extinctions of native species.	4	1	4	Insignificant
Irreversible damage to the environment.	4	2	8	Minor
Long-term damage to the environment over a landscape scale.	4	2	8	Minor

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
Short-term, localised damage to the environment.	2	3	6	Minor
Minor environmental impact.	1	5	5	Minor
<i>Cultural Sites</i>				
Loss and/or irreversible damage to sites or objects of national, state or regional significance.	5	1	5	Minor
Extensive damage to sites or objects of national, state, regional or local significance requiring major external assistance.	4	1	4	Insignificant
Short-term damage to individual objects. Short term external assistance required to repair.	3	1	3	Insignificant
Short-term, localised damage to a small number of sites, objects and the cultural landscape.	2	2	4	Insignificant
Minor impact on sites or items which are repairable with little to no external assistance.	1	3	3	Insignificant

Table 33: Bushfire Risk Assessment – Berrima Reserves: Berrima River Reserve

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
<i>Key considerations</i>				
<ul style="list-style-type: none"> Existing fire trail Access restricted by locked gates Few properties on boundary, and those are on the NW side Reserve is SE of the township (i.e on the low threat side) Water gauging assets within the Reserve Recreational walking tracks utilised within Reserve Vegetation community is well represented in protected area within region No known cultural heritage sites 				
<i>Life</i>				
Populated area where the combination of threat and vulnerability expose a community to a significant likelihood of fatalities and major injuries.	5	2	10	Moderate
Less likely to be fatalities or major injuries due to the presence of attributes which afford some protection.	4	2	8	Moderate
Loss of life or major injury highly unlikely. Medical/hospital treatment may be required.	3	2	6	Minor
Minor injuries only - first aid treatment. No major injuries or fatalities likely.	2	2	4	Insignificant
No injuries or fatalities likely.	1	4	4	Insignificant
<i>Property (infrastructure, assets and private property)</i>				
Extensive and widespread loss of property. Major impact across a large part of the community and region. Long term external assistance required to recover.	5	2	10	Moderate
Localised damage to property. Short-term external assistance required to recover.	4	3	12	Moderate
Short-term damage to individual assets. No external assistance required to recover.	3	3	9	Minor
Inconsequential or no damage to property. Little or no disruptions to the community.	1	4	4	Insignificant
<i>Environment</i>				
Local extinctions of native species.	4	2	8	Minor
Irreversible damage to the environment.	4	2	8	Minor
Long-term damage to the environment over a landscape scale.	4	3	12	Moderate

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
Short-term, localised damage to the environment.	2	3	6	Minor
Minor environmental impact.	1	5	5	Minor
<i>Cultural Sites</i>				
Loss and/or irreversible damage to sites or objects of national, state or regional significance.	5	1	5	Minor
Extensive damage to sites or objects of national, state, regional or local significance requiring major external assistance.	4	1	4	Insignificant
Short-term damage to individual objects. Short term external assistance required to repair.	3	1	3	Insignificant
Short-term, localised damage to a small number of sites, objects and the cultural landscape.	2	2	4	Insignificant
Minor impact on sites or items which are repairable with little to no external assistance.	1	3	3	Insignificant

Table 34: Bushfire Risk Assessment – Berrima Reserves: River Bend Reserve

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
<i>Key considerations</i>				
<ul style="list-style-type: none"> • Good emergency access road network • Public access to the Reserve is unrestricted • Walking track network facilitates public recreational access • Small number of dwellings on boundary • WWI cultural sites • Vegetation community is represented in protected area within region 				
<i>Life</i>				
Populated area where the combination of threat and vulnerability expose a community to a significant likelihood of fatalities and major injuries.	5	2	10	Moderate
Less likely to be fatalities or major injuries due to the presence of attributes which afford some protection.	4	1	4	Insignificant
Loss of life or major injury highly unlikely. Medical/hospital treatment may be required.	3	2	6	Minor
Minor injuries only - first aid treatment. No major injuries or fatalities likely.	2	2	4	Insignificant
No injuries or fatalities likely.	1	4	4	Insignificant
<i>Property (infrastructure, assets and private property)</i>				
Extensive and widespread loss of property. Major impact across a large part of the community and region. Long term external assistance required to recover.	5	2	10	Moderate
Localised damage to property. Short-term external assistance required to recover.	4	3	12	Moderate
Short-term damage to individual assets. No external assistance required to recover.	3	3	9	Minor
Inconsequential or no damage to property. Little or no disruptions to the community.	1	4	4	Insignificant
<i>Environment</i>				
Local extinctions of native species.	4	2	8	Minor
Irreversible damage to the environment.	4	2	8	Minor
Long-term damage to the environment over a landscape scale.	4	3	12	Moderate
Short-term, localised damage to the environment.	2	3	6	Minor

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
Minor environmental impact.	1	5	5	Minor
<i>Cultural Sites</i>				
Loss and/or irreversible damage to sites or objects of national, state or regional significance.	5	1	5	Minor
Extensive damage to sites or objects of national, state, regional or local significance requiring major external assistance.	4	1	4	Insignificant
Short-term damage to individual objects. Short term external assistance required to repair.	3	1	3	Insignificant
Short-term, localised damage to a small number of sites, objects and the cultural landscape.	2	2	4	Insignificant
Minor impact on sites or items which are repairable with little to no external assistance.	1	3	3	Insignificant

Table 35: Bushfire Risk Assessment – Medway Reserve

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
<i>Key considerations</i> <ul style="list-style-type: none"> Colliery to the north-west, Medway township to the North, Medway Hall within Reserve, water supply infrastructure immediately to the South Good emergency access road network to northern portion Access to southern portion is restricted by locked gates (applies to both public and emergency services) Single road access into Medway village Water supply linked to colliery Forms part of forested landscape with adjoining lands Endangered Ecological Community in southern portion 				
<i>Life</i>				
Populated area where the combination of threat and vulnerability expose a community to a significant likelihood of fatalities and major injuries.	5	3	15	Major
Less likely to be fatalities or major injuries due to the presence of attributes which afford some protection.	4	1	4	Insignificant
Loss of life or major injury highly unlikely. Medical/hospital treatment may be required.	3	2	6	Minor
Minor injuries only - first aid treatment. No major injuries or fatalities likely.	2	2	4	Insignificant
No injuries or fatalities likely.	1	4	4	Insignificant
<i>Property (infrastructure, assets and private property)</i>				
Extensive and widespread loss of property. Major impact across a large part of the community and region. Long term external assistance required to recover.	5	2	10	Moderate
Localised damage to property. Short-term external assistance required to recover.	4	3	12	Moderate
Short-term damage to individual assets. No external assistance required to recover.	3	3	9	Minor
Inconsequential or no damage to property. Little or no disruptions to the community.	1	4	4	Insignificant
<i>Environment</i>				
Local extinctions of native species.	4	3	12	Moderate
Irreversible damage to the environment.	4	2	8	Minor
Long-term damage to the environment over a landscape scale.	4	3	12	Moderate
Short-term, localised damage to the environment.	2	3	6	Minor

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
Minor environmental impact.	1	5	5	Minor
<i>Cultural Sites</i>				
Loss and/or irreversible damage to sites or objects of national, state or regional significance.	5	1	5	Minor
Extensive damage to sites or objects of national, state, regional or local significance requiring major external assistance.	4	1	4	Insignificant
Short-term damage to individual objects. Short term external assistance required to repair.	3	1	3	Insignificant
Short-term, localised damage to a small number of sites, objects and the cultural landscape.	2	2	4	Insignificant
Minor impact on sites or items which are repairable with little to no external assistance.	1	3	3	Insignificant

Table 36: Bushfire Risk Assessment – Boronia Park, Hilltop

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
<i>Key considerations</i> <ul style="list-style-type: none"> Residential area to the western, south-western and north-western boundaries Public infrastructure (sewer pumping station) adjacent Established APZ along Boronia Avenue/Stanley St Established fire trail network Soccer and tennis facilities within Reserve Adjacent to protected area (Bargo River SCA) Vegetation community is well represented in protected area within region 				
<i>Life</i>				
Populated area where the combination of threat and vulnerability expose a community to a significant likelihood of fatalities and major injuries.	5	3	15	Major
Less likely to be fatalities or major injuries due to the presence of attributes which afford some protection.	4	1	4	Insignificant
Loss of life or major injury highly unlikely. Medical/hospital treatment may be required.	3	2	6	Minor
Minor injuries only - first aid treatment. No major injuries or fatalities likely.	2	2	4	Insignificant
No injuries or fatalities likely.	1	4	4	Insignificant
<i>Property (infrastructure, assets and private property)</i>				
Extensive and widespread loss of property. Major impact across a large part of the community and region. Long term external assistance required to recover.	5	2	10	Moderate
Localised damage to property. Short-term external assistance required to recover.	4	3	12	Moderate
Short-term damage to individual assets. No external assistance required to recover.	3	3	9	Minor
Inconsequential or no damage to property. Little or no disruptions to the community.	1	4	4	Insignificant
<i>Environment</i>				
Local extinctions of native species.	4	2	8	Minor
Irreversible damage to the environment.	4	2	8	Minor
Long-term damage to the environment over a landscape scale.	4	3	12	Moderate
Short-term, localised damage to the environment.	2	3	6	Minor

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
Minor environmental impact.	1	5	5	Minor
<i>Cultural Sites</i>				
Loss and/or irreversible damage to sites or objects of national, state or regional significance.	5	1	5	Minor
Extensive damage to sites or objects of national, state, regional or local significance requiring major external assistance.	4	1	4	Insignificant
Short-term damage to individual objects. Short term external assistance required to repair.	3	1	3	Insignificant
Short-term, localised damage to a small number of sites, objects and the cultural landscape.	2	2	4	Insignificant
Minor impact on sites or items which are repairable with little to no external assistance.	1	3	3	Insignificant

Table 37: Bushfire Risk Assessment – Yerrinbool Reserve

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
<i>Key considerations</i>				
<ul style="list-style-type: none"> Residential area to the east Located in landscape between township and adjacent protected area (Bargo River SCA) and township No access within the Reserve SW Yerrinbool access is single road (Cascade Cres) which passes adjacent to Reserve No known cultural heritage sites 				
<i>Life</i>				
Populated area where the combination of threat and vulnerability expose a community to a significant likelihood of fatalities and major injuries.	5	3	15	Major
Less likely to be fatalities or major injuries due to the presence of attributes which afford some protection.	4	1	4	Insignificant
Loss of life or major injury highly unlikely. Medical/hospital treatment may be required.	3	2	6	Minor
Minor injuries only - first aid treatment. No major injuries or fatalities likely.	2	2	4	Insignificant
No injuries or fatalities likely.	1	4	4	Insignificant
<i>Property (infrastructure, assets and private property)</i>				
Extensive and widespread loss of property. Major impact across a large part of the community and region. Long term external assistance required to recover.	5	3	15	Major
Localised damage to property. Short-term external assistance required to recover.	4	3	12	Moderate
Short-term damage to individual assets. No external assistance required to recover.	3	3	9	Minor
Inconsequential or no damage to property. Little or no disruptions to the community.	1	4	4	Insignificant
<i>Environment</i>				
Local extinctions of native species.	4	2	8	Minor
Irreversible damage to the environment.	4	2	8	Minor
Long-term damage to the environment over a landscape scale.	4	2	8	Minor
Short-term, localised damage to the environment.	2	3	6	Minor

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
Minor environmental impact.	1	5	5	Minor
<i>Cultural Sites</i>				
Loss and/or irreversible damage to sites or objects of national, state or regional significance.	5	1	5	Minor
Extensive damage to sites or objects of national, state, regional or local significance requiring major external assistance.	4	1	4	Insignificant
Short-term damage to individual objects. Short term external assistance required to repair.	3	1	3	Insignificant
Short-term, localised damage to a small number of sites, objects and the cultural landscape.	2	2	4	Insignificant
Minor impact on sites or items which are repairable with little to no external assistance.	1	3	3	Insignificant

Table 38: Bushfire Risk Assessment – Leaver Park, Bundanoon

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
<i>Key considerations</i>				
<ul style="list-style-type: none"> Quarry to the north Numerous threatened species Located in landscape adjacent to protected area (Morton NP) Single road through the Reserve SW Yerrinbool access is single road (Cascade Cres) which passes adjacent to Reserve No known cultural heritage sites 				
<i>Life</i>				
Populated area where the combination of threat and vulnerability expose a community to a significant likelihood of fatalities and major injuries.	5	2	10	Moderate
Less likely to be fatalities or major injuries due to the presence of attributes which afford some protection.	4	1	4	Insignificant
Loss of life or major injury highly unlikely. Medical/hospital treatment may be required.	3	2	6	Minor
Minor injuries only - first aid treatment. No major injuries or fatalities likely.	2	2	4	Insignificant
No injuries or fatalities likely.	1	4	4	Insignificant
<i>Property (infrastructure, assets and private property)</i>				
Extensive and widespread loss of property. Major impact across a large part of the community and region. Long term external assistance required to recover.	5	2	10	Moderate
Localised damage to property. Short-term external assistance required to recover.	4	3	12	Moderate
Short-term damage to individual assets. No external assistance required to recover.	3	3	9	Minor
Inconsequential or no damage to property. Little or no disruptions to the community.	1	4	4	Insignificant
<i>Environment</i>				
Local extinctions of native species.	4	2	8	Minor
Irreversible damage to the environment.	4	2	8	Minor
Long-term damage to the environment over a landscape scale.	4	3	12	Moderate
Short-term, localised damage to the environment.	2	3	6	Minor

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
Minor environmental impact.	1	5	5	Minor
<i>Cultural Sites</i>				
Loss and/or irreversible damage to sites or objects of national, state or regional significance.	5	1	5	Minor
Extensive damage to sites or objects of national, state, regional or local significance requiring major external assistance.	4	1	4	Insignificant
Short-term damage to individual objects. Short term external assistance required to repair.	3	1	3	Insignificant
Short-term, localised damage to a small number of sites, objects and the cultural landscape.	2	2	4	Insignificant
Minor impact on sites or items which are repairable with little to no external assistance.	1	3	3	Insignificant

Appendix 1: Tenure map

The lands included in this Bushfire Management Plan are a mix of tenures administered, under a variety of mechanisms, by Wingecarribee Shire Council. Tenure of the lands, to the best available information, is shown in Figures 1 – 8, below.

Apple Street Reserve - Reserves Tenure



- Reserve Boundary
- Crown (To be confirmed)
- Crown Land
- Crown Land, under Care, Control and Management of Wingecarribee Shire Council
- Crown Road
- Wingecarribee Shire Council

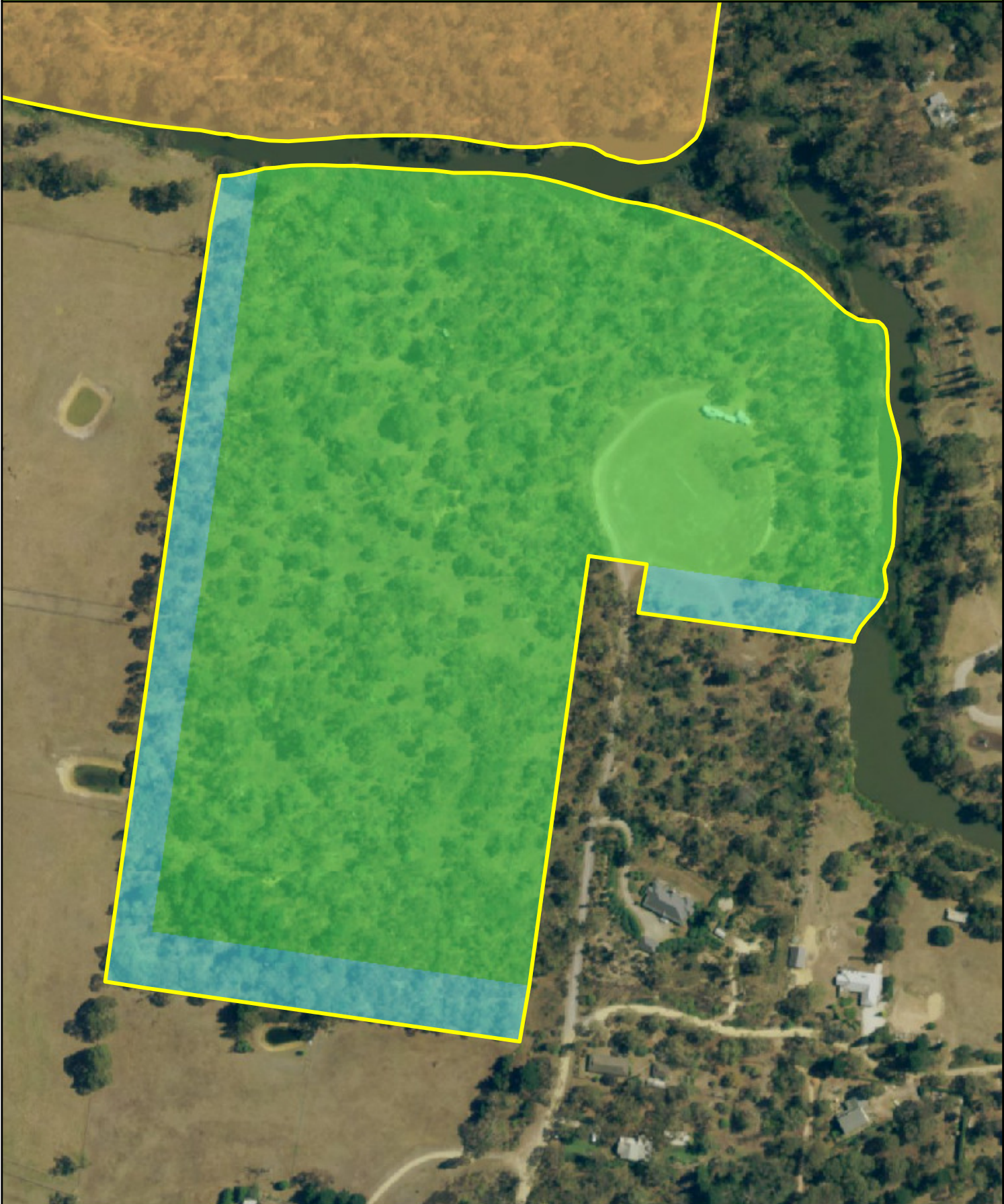
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



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Datum/Projection:
GDA 1994 MGA Zone 56

Data Sources:
Wingecarribee Shire Council

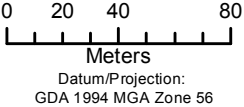
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Berrima Reserve - Reserves Tenure



-  Reserve Boundary
-  Crown (To be confirmed)
-  Crown Land
-  Crown Land, under Care, Control and Management of Wingecarribee Shire Council
-  Crown Road
-  Wingecarribee Shire Council

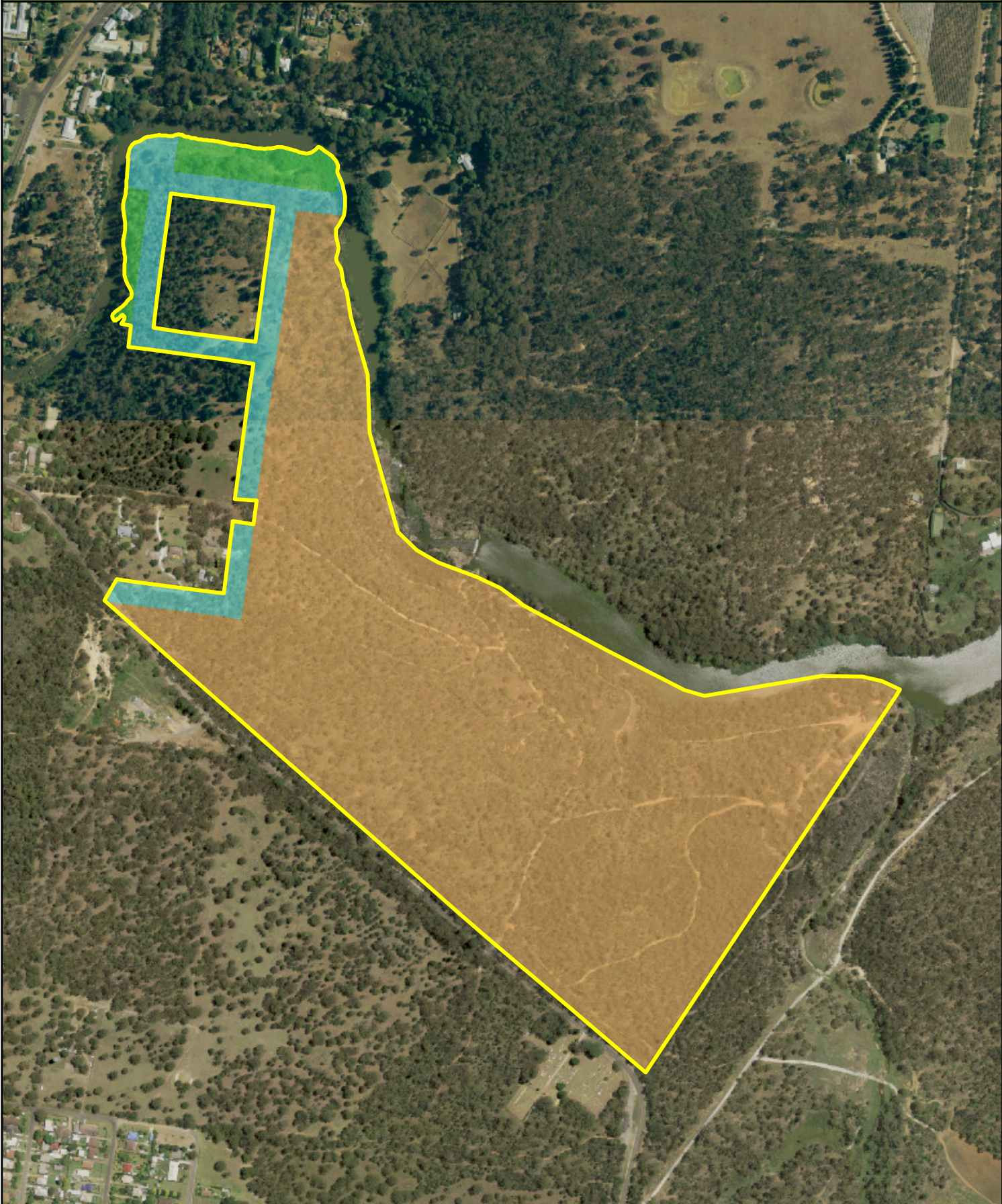
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Data Sources:
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Berrima River Reserve - Reserves Tenure



- Reserve Boundary
- Crown (To be confirmed)
- Crown Land
- Crown Land, under Care, Control and Management of Wingecarribee Shire Council
- Crown Road
- Wingecarribee Shire Council

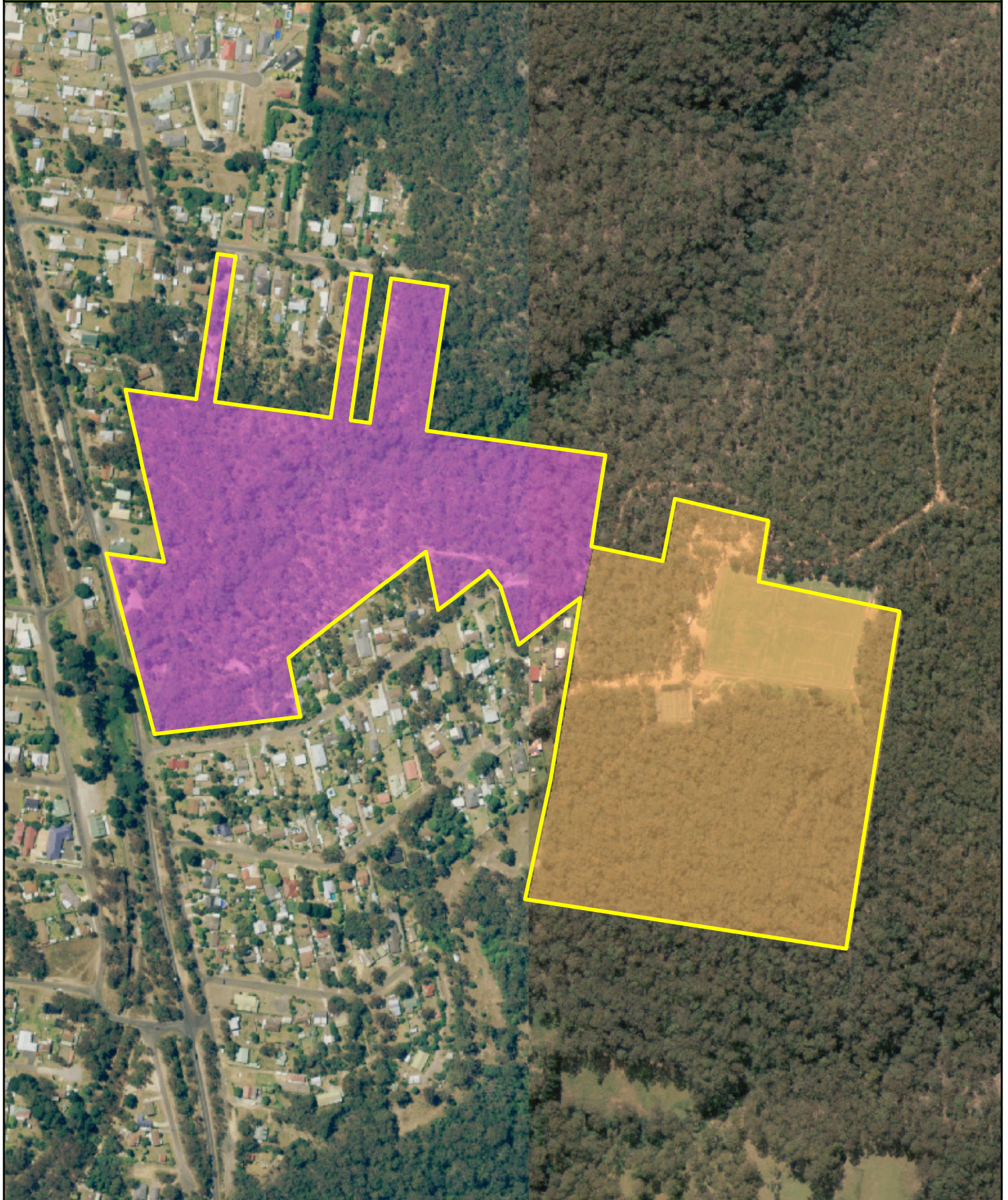
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Meters
Datum/Projection:
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Data Sources:
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Boronia Park - Reserves Tenure



- Reserve Boundary
- Crown (To be confirmed)
- Crown Land
- Crown Land, under Care, Control and Management of Wingecarribee Shire Council
- Crown Road
- Wingecarribee Shire Council

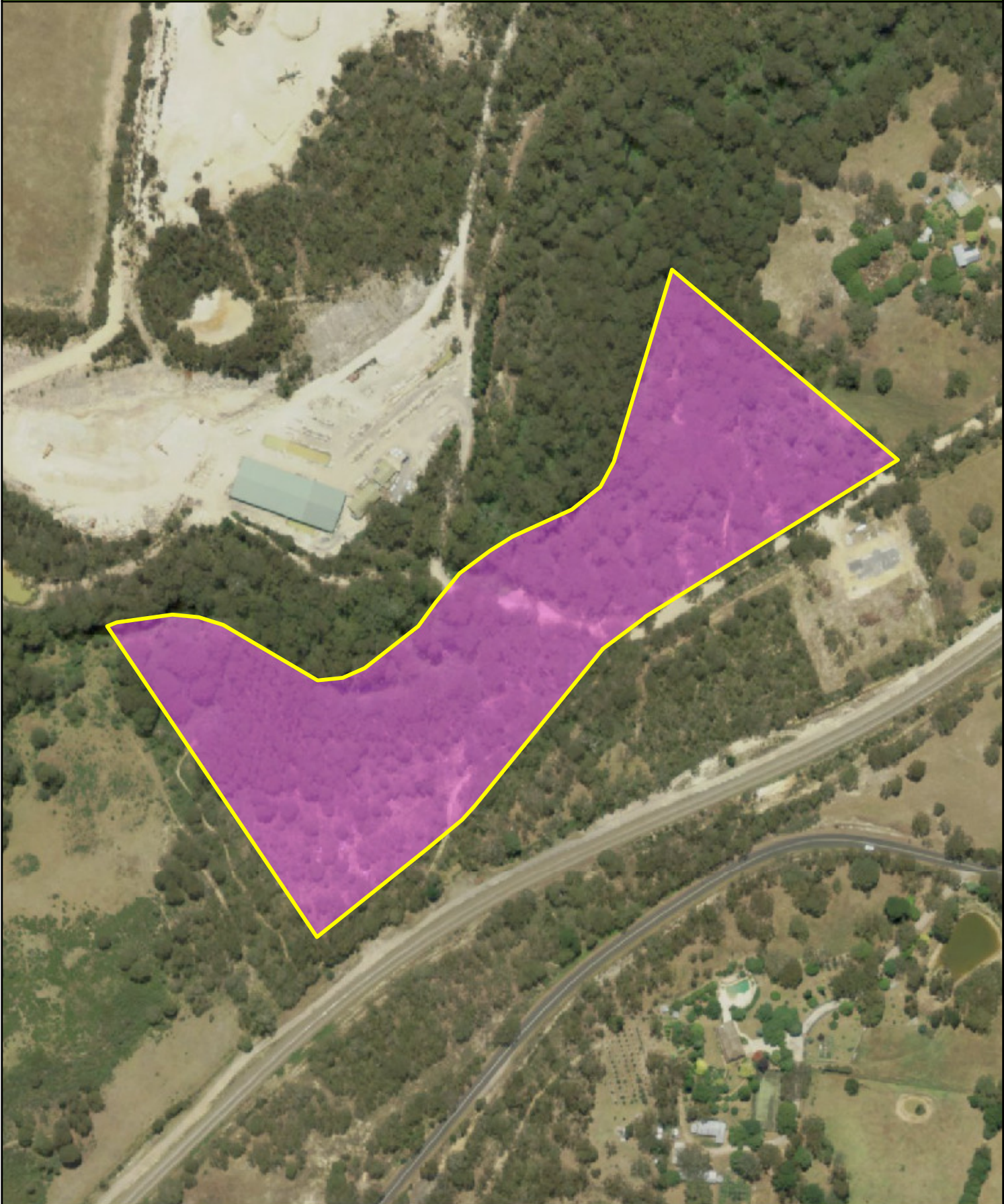
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Leaver Park - Reserves Tenure



- Reserve Boundary
- Crown (To be confirmed)
- Crown Land
- Crown Land, under Care, Control and Management of Wingecarribee Shire Council
- Crown Road
- Wingecarribee Shire Council

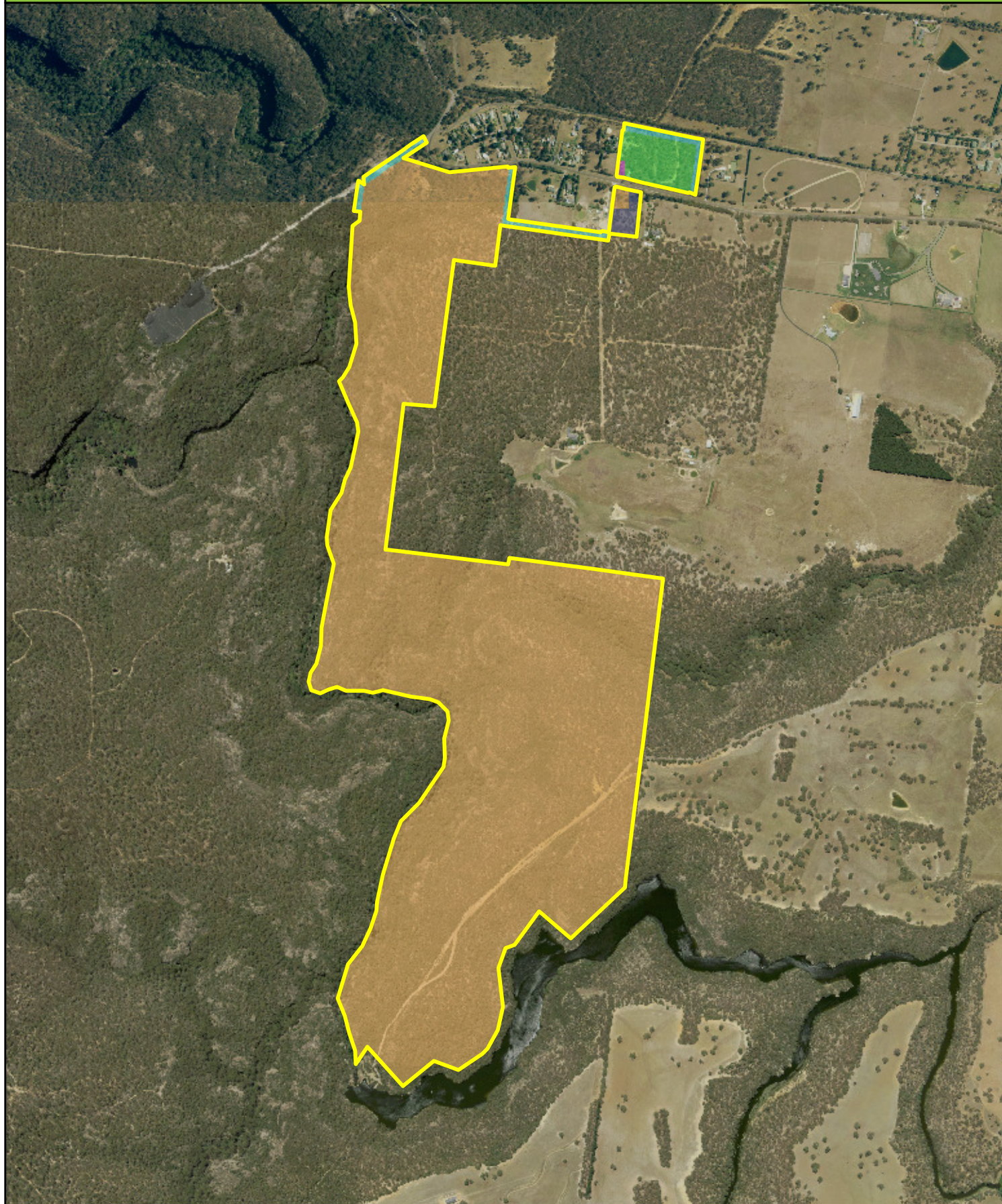
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Medway Reserve - Reserves Tenure



- Reserve Boundary
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- Crown Land
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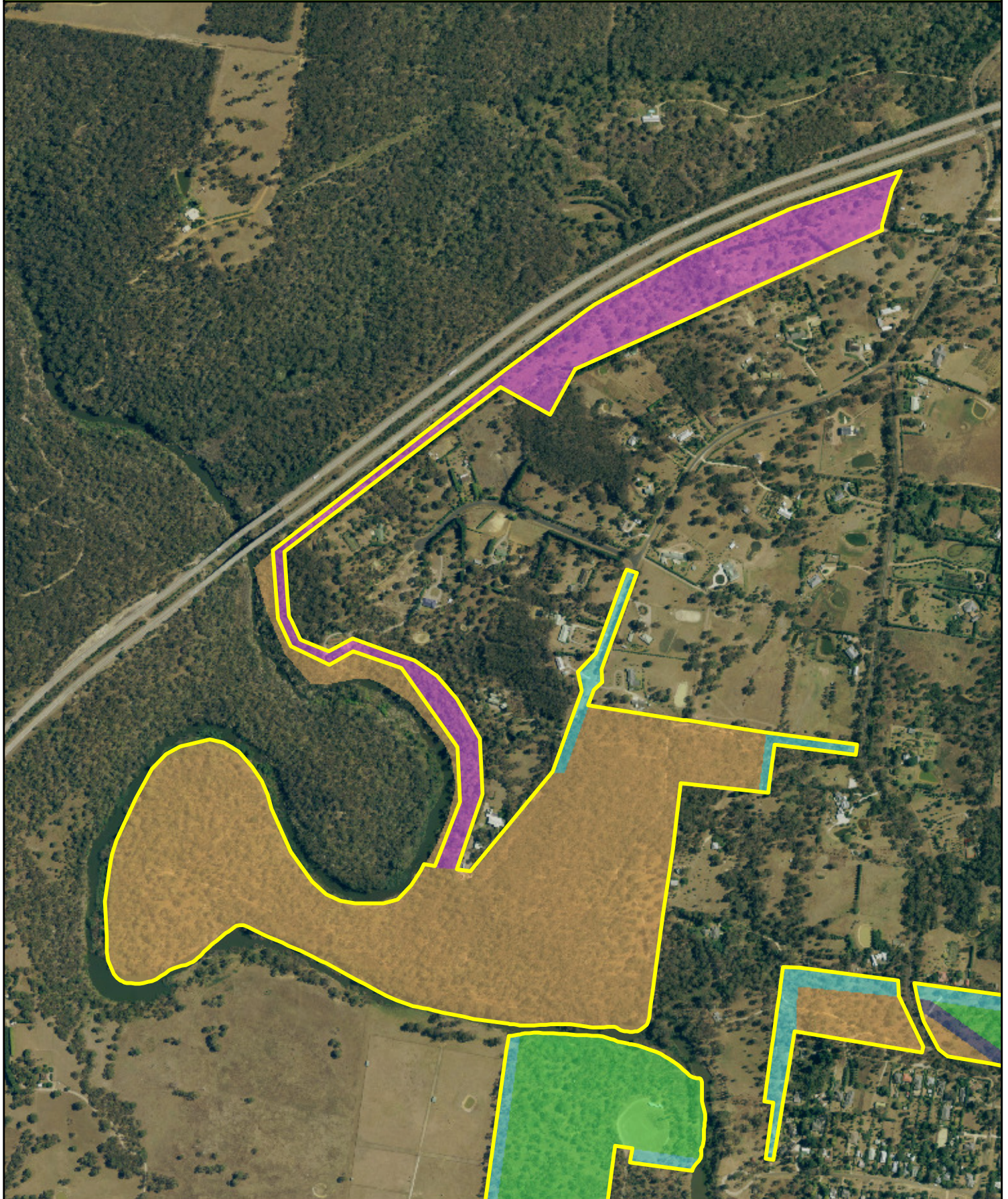
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Data Sources:
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River Bend Reserve - Reserves Tenure



- Reserve Boundary
- Crown (To be confirmed)
- Crown Land
- Crown Land, under Care, Control and Management of Wingecarribee Shire Council
- Crown Road
- Wingecarribee Shire Council

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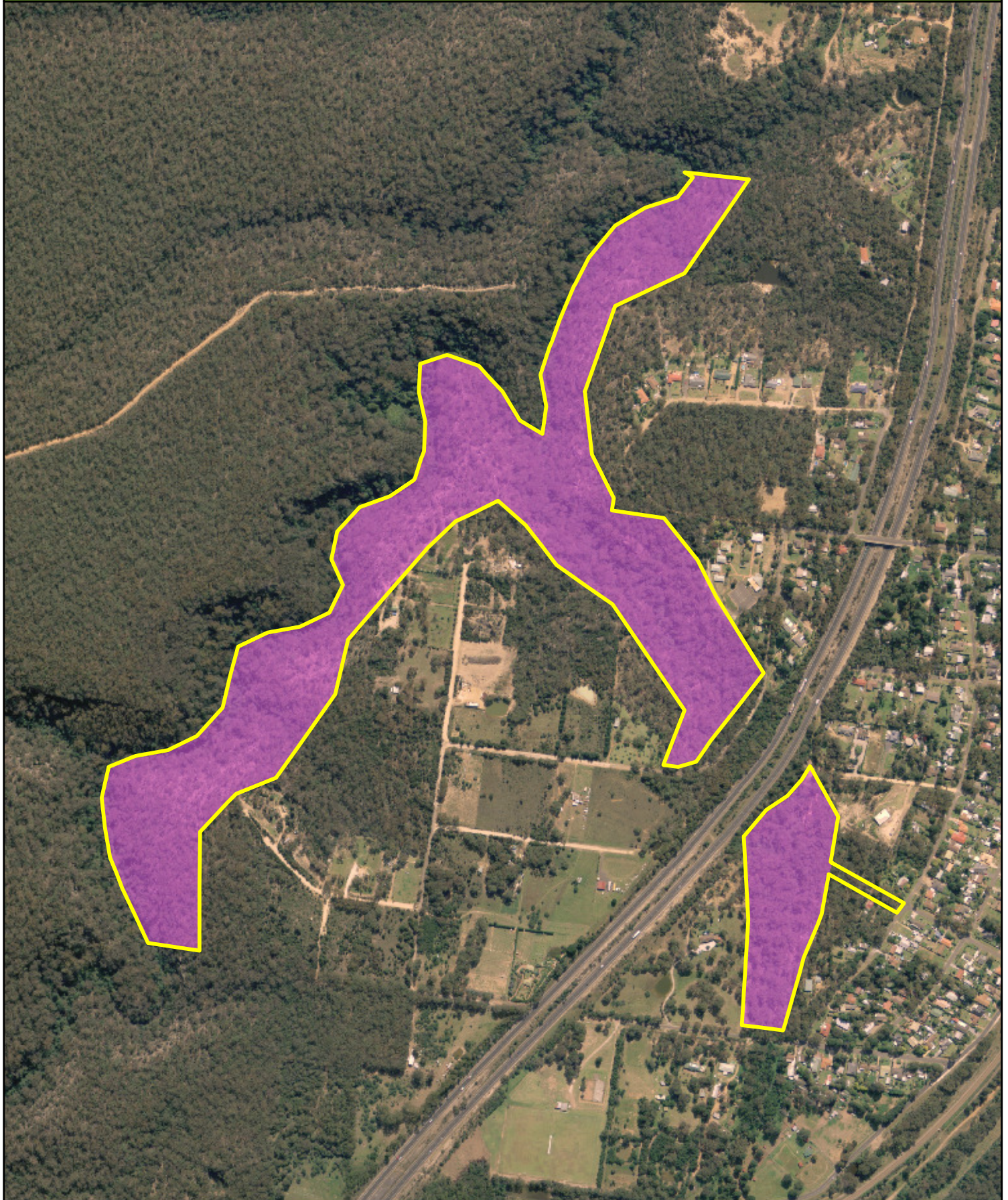
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Datum/Projection:
GDA 1994 MGA Zone 56

Data Sources:
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Yerrinbool Reserve - Reserves Tenure



- Reserve Boundary
- Crown (To be confirmed)
- Crown Land
- Crown Land, under Care, Control and Management of Wingecarribee Shire Council
- Crown Road
- Wingecarribee Shire Council

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Meters

Datum/Projection:
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Data Sources:
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Appendix 2: Community consultation

As a part of the Wingecarribee Small Reserves Bushfire Management Plan project, a community consultation process was undertaken.

This community consultation process aimed to obtain public input and feedback on analysis, alternatives and decisions. Council undertook to keep the public informed, listen and acknowledge concerns and aspirations, and provide feedback on how public input has influenced decisions. This approach is consistent with the 'consult' approach under the International Association for Public Participation (IAP2) spectrum.

This approach builds knowledge, understanding, support and capacity. This is important as fire management strategies are more likely to be implemented successfully if they are owned and supported by the community.

This community consultation process comprised the following:

- Community meetings
 - Berrima, Monday 13th May
 - Yerrinbool, Tuesday 14th May
- The community meetings were open invitation events communicated by
 - Written invitations sent by mail to adjacent residents and key stakeholders
 - Media release and notification in Council Notices in local media
 - Notification on Council website
- Surveys posted out to neighbours of Leaver Park
- Notification of the public exhibition period of the draft plan was made in the local Southern Highlands News and on the council website. The public exhibition phase occurred between Wednesday 10 July to Wednesday 31 July 2013. The draft documents and accompanying posters were made available at Moss Vale, Bowral and Mittagong libraries, the civic centre, the Fire Control Centre in Mittagong and at the Bundanoon, Berrima, Hill Top and Yerrinbool volunteer rural fire brigade buildings.

Summary of Outcomes from Community Consultation

Community meetings

The community meetings were structured as an information session presented by Eco Logical Australia followed by question and answer session, with questions encouraged throughout the information session. The meetings were very well attended, with 35 attendees at Berrima and 47 attendees at Yerrinbool. The sessions ran for approximately 1.5 hours of presentation, followed by the opportunity to discuss specific issues or seek further information from the presenters or Council representatives informally afterwards. The issues presented below were raised in both the formal and informal consultation processes.

The community information sessions were presented by Rod Rose and Julie Holden from Eco Logical Australia, with Karen Guymer and Ian Perkins representing Wingecarribee Shire Council.

The information session provided background on bushfire science and behaviour, displayed and interpreted preliminary bushfire behaviour modelling for the Reserves, introduced bushfire risk mitigation measures likely to be included in the plan and provided guidance for attendees on actions they can take to mitigate bushfire risk in their individual situations.

General themes in the community input were a perceived reduction in hazard reduction burning taking place in the Reserves compared to previous burning activities and that as the reserves make up a small portion of the landscape, management of the surrounding lands (i.e. National parks, colliery) is critical to the success of bushfire mitigation measures put in place within the Reserves.

Specific issues raised are detailed below. Note these have been summarised and categorised into topics, rather than providing a list of individual comments. Also note that some of these are beyond the scope of issues which will be resolved by this plan; they are however reported here to ensure a full record of issues identified is communicated to Council.

- Single road access to SW Yerrinbool and Medway and concerns about the impact on this on the ability for fire response personnel to access the areas in the event of a fire and concerns about community evacuation capacity should the roads be blocked
- Concerns about standards of fire coverage at Medway as there is no longer a RFS brigade
- Community awareness at Medway, particularly considering a large proportion of new residents with little awareness of bushfire as a threat have moved into the area (note that this should be discussed with RFS)
- Low levels of community participation in RFS brigades (raised by numerous contributors at Yerrinbool meeting)
- Water supply at Medway and availability for fire fighting response due to reliance on colliery
- Concerns about Colliery stockpile and bushfire risk posed by it to Medway residents
- A number of concerns were raised regarding management of fire trails
 - Perception that some fire trails are poorly maintained (resolved during session with clarification by Council on what are and are not fire trails)
 - Use of fire trails by dirt bikes and 4WD
 - Link between access and ignition likelihood
- Conflicts between tree protection requirements and tree removal for bushfire mitigation, raised at both Berrima and Yerrinbool sessions
- Difficulty in negotiating with public land managers for bushfire mitigation works to be completed where they are neighbours (National Parks).

These issues raised by the community were utilised as one of the resources to inform the recommendations of the actions for each of the Reserves in this Bushfire Management Plan.

Public Exhibition Phase

Submissions received after the public exhibition phase were used to inform a review the Plan recommendations. During this review the following changes were made to incorporate feedback received.

- Boundary of the planning area at Boronia Park and River Bend Reserve were amended
- Additional APZ's were included at Yerrinbool Reserve, Boronia Park and Medway River Bend reserve
- Zoning of Medway River Bend Reserve was amended to introduce a Strategic Fire Advantage Zone east of the access trail and in lands added to the Plan to the NW
- Fire trail route at Boronia Park was amended

- Fire history for Berrima River and River Bend Reserves were updated and recommendations re-validated
- Additional threatened species considerations were incorporated
- Vegetation mapping/classification at Yerrinbool was reconfirmed

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