

# 77-91 Warnervale Road

## Biodiversity Certification Assessment Report

Minter Ellison

17 August 2022

Final



**Report No. 21169RP2**


The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or commendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

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**Approved by:** Dr David Robertson

**Position:** Director

**Signed:**



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# Glossary

Term / Abbreviation	Definition
Assessment area	Area of land within a 1500 m buffer around the outer boundary of the subject land
APZ	Asset Protection Zone
asl	Above sea level
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method Calculator
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BC Regulation	NSW <i>Biodiversity Conservation Regulation 2017</i>
BCAR	Biodiversity Certification Assessment Report
BOS	Biodiversity Offset Scheme
DA	Development Application
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DBH	Diameter at Breast Height
Development Site Footprint	The area subject to the proposed development, including the construction and operational footprint for the project, as shown in <b>Figure 1</b>
DPIE	Department of Planning, Industry and Environment
EES	Environment, Energy and Science Group
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
EP&A Act	NSW Environmental Planning and Assessment Act 1979
GIS	Geographic Information System
IBRA	Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
NSW	New South Wales
OEH	Former Office of Environment and Heritage
PCT	Plant Community Type
the project	The proposed development at 77-91 Warnervale Road, Warnervale
SAII	Serious and Irreversible Impact
Subject land	The property subject to the BCAR, as shown in <b>Figure 1</b>
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community

# 1. Introduction

Cumberland Ecology was engaged by Minter Ellison, on behalf of Vale Nominee (the 'proponent'), to prepare a Biodiversity Certification Assessment Report (BCAR) for a proposed residential subdivision development on land located at 77-91 Warnervale Road, Warnervale.

The proponent is proposing to undertake a 61-lot residential subdivision that includes the retention of an additional lot as a proposed 50 metre (m) wildlife corridor at the rear of the property (the 'project'). The proponent has opted to apply for standard biodiversity certification under the New South Wales (NSW) *Biodiversity Conservation Act 2016* BC Act to streamline the biodiversity assessment process for the project. The development is planned to be assessed under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) following the completion of the standard biodiversity certification process.

This BCAR has been prepared in accordance with the 2020 version of the Biodiversity Assessment Method (BAM). This BCAR forms part of the documentation to support the application for biodiversity certification under the NSW *Biodiversity Conservation Act 2016* (BC Act).

## 1.1. Purpose

The purpose of this BCAR is to document the findings of an assessment undertaken for the project in accordance with Stage 1 (Biodiversity Assessment) and Stage 2 (Impact Assessment) of the BAM.

Specifically, the objectives of this BCAR are to:

- Identify the landscape features and site context (native vegetation cover) within the subject land and assessment area;
- Assess native vegetation extent, plant community types (PCTs), threatened ecological communities (TECs) and vegetation integrity (site condition) within the subject land;
- Assess habitat suitability for threatened species that can be predicted by habitat surrogates (ecosystem credits) and for threatened species that cannot be predicted by habitat surrogates (species credit species);
- Identify potential prescribed biodiversity impacts on threatened species and communities;
- Describe measures to avoid and minimise impacts on biodiversity values and prescribed biodiversity impacts during project planning;
- Describe impacts to biodiversity values and prescribed biodiversity impacts and the measures to mitigate and manage such impacts;
- Identify the thresholds for the assessment and offsetting of impacts, including:
  - Impact assessment of potential entities of serious and irreversible impacts (SAIL);
  - Impacts for which an offset is required;
  - Impacts for which no further assessment is required;

- Describe the application of the no net loss standard, including the calculation of the offset requirement; and
- Detail the biodiversity certification strategy.

A compliance table showing how this report meets the requirements of BAM is provided in **Appendix A**.

## 1.2. Project Description

### 1.2.1. Location

The project is located at 77-91 Warnervale Road, Warnervale NSW (Lot 72 DP 7091) (the 'subject land'). The subject land currently comprises an existing residential dwelling, a shed, dam, paddocks and treed and grassland vegetation. The subject land is approximately 5.17 ha and is zoned R1: General Residential and RE1: Public Recreation in the northern portion and R2: Low Density Residential in the southern portion under the *Wyong Local Environment Plan 2013*.

A site map and location map have been prepared in accordance with the BAM and are presented in **Figure 1** and **Figure 2**, respectively.

### 1.2.2. Proposed Development

Designs prepared by ADW Johnson (**Figure 3**) show the development consists of the subdivision of the subject land into 61 new residential lots and one residual lot for the proposed wildlife corridor. Additional proposed development works will include:

- Construction of several roads for access to the lots;
- Inclusion of a Bushfire Asset Protection Zone (APZ) along the eastern and southern boundary of the lots; and
- Stormwater infrastructure.

APZs will apply to the residential dwellings as identified in the **Figure 3** for the project, however these are contained within the areas already subject to landscaping, roads or within areas of grassland that require no further modification to function as an APZ and will be contained entirely outside the wildlife corridor of retained native vegetation.

To ensure that an appropriate mechanism is in place to ensure long term protection and conservation of the proposed 50 m wildlife corridor, it is proposed this should be achieved by the proponent dedicating the land to the Council free of cost. However, the proponent understands that Council might be reluctant to accept the dedication of conservation lands. In the alternative the Applicant would seek a Conservation Agreement under Division 12 of the *National Parks and Wildlife Act 1974* to ensure long term protection and conservation of the corridor and based upon the Biodiversity Management Plan outlined in **Section 8.5.9**.

### 1.2.3. Identification of the Development Site Footprint

The preliminary layout of the project is shown in **Figure 3**. The development site footprint comprises approximately 4.37 ha, which comprises the land proposed for biodiversity certification. Approximately 0.80 ha of land occurs outside of the development site footprint and will be retained as a 50 m wide wildlife corridor. These areas comprising the development footprint and retained land are collectively referred to within this BCAR as the subject land.

### 1.2.4. General Description of the Development Site

The subject land currently comprises predominantly scattered trees over previously cleared paddock grasslands in the northern and middle portions of the subject land, with higher abundances of trees towards the north and south and a larger cleared paddock in the centre. A farm dam occurs along the eastern boundary of the subject land in the cleared paddock and an unmapped drainage line runs from the north-western corner through the subject land before discharging into the dam. At the rear of the subject land in the area proposed to be retained as a wildlife corridor, remnant vegetation with a predominantly native understorey occurs that has not been subject to recent grazing or clearing of ground layer or canopy species. This wildlife corridor includes damp patches along the eastern and western boundaries that do not regularly hold water; however, would be inundated during wet periods. The area surrounding the existing residential dwelling and in-ground pool includes planted native and exotic species. The land slopes gently down from the front access at Warnervale Road towards the rear of the subject land.

The subject land is located within the Central Coast Local Government Area (LGA) and is bound by Warnervale Road to the north, Porters Creek Public School to the west (under construction), an AV Jennings residential development site to the south (under construction) and Virginia Road to the east that is currently being upgraded as part of the Porters Creek Public School construction.

The native vegetation of the subject land is part of a large patch of retained vegetation in the locality, with connectivity to the west through a retained 66m wildlife corridor at the rear of Porters Creek Public School to other rural-residential properties, and to south through the AV Jennings site which includes a retained 50 m wildlife corridor adjoining the proposed corridor within the subject land (for a combined retained corridor width of 100 m). The treed vegetation in the front portion of the subject land has connectivity to the north with bushland surrounding Warnervale Oval though it is separated by Warnervale Road, and there is connectivity to the east with a large patch of retained vegetation which is also separated by Virginia Road.

## 1.3. Other Considerations

### 1.3.1. Wyong Development Control Plan

The subject land is located within the Warnervale South Urban Release Area covered by the Development Control Plan 2013 – Development Controls for Wyong Shire (DCP 2013), in an area known as Warnervale Precinct 7A (**Figure 4**). The North Wyong Structure Plan (2012) for the Warnervale Precinct 7A area provides details of the corridor locations which will be created and maintained as part of development under DCP 2013. Areas earmarked for the regeneration of native vegetation that may form future habitat areas and corridors are identified in the *Precinct 7A Conservation Management Plan* (Precinct 7A CMP) prepared by Umwelt (2014).



Alternative parts of the Warnervale South Urban Release Area were set aside for retention and conservation at the rezoning stage. The retained areas have been identified by Umwelt in the Precinct 7A CMP and measured at approximately 306 hectares or approximately 55% of the rezoning area. No native vegetation within the subject land was identified for retention within the Precinct 7A conservation corridors.

The aims of the Wyong DCP are:

- *To identify Council's expectations and requirements for development within the Wyong Shire;*
- *To identify approaches and techniques which promote quality development outcomes in Wyong Shire;*
- *To promote best practice and quality environmental outcomes;*
- *To facilitate the orderly and economic development of land;*
- *To facilitate employment generating development;*
- *To promote the integration of economic, social and ecological sustainability principles into development to encourage vibrant and liveable communities and ensure the future health of the local environment; and*
- *To ensure that land is adequately serviced.*

## **1.4. Information Sources**

### **1.4.1. Databases**

Several databases were utilised during the preparation of this BCAR, including:

- Environment, Energy and Science (EES) BioNet Atlas (EES 2021);
- EES Threatened Biodiversity Data Collection (EES 2021);
- EES BioNet Vegetation Classification database (EES 2021);
- Commonwealth Department of Agriculture, Water and the Environment (DAWE) Species Profile and Threat Database (DAWE 2021); and
- DAWE Directory of Important Wetlands in Australia (DAWE 2021).

### **1.4.2. Literature and Spatial Data**

This BCAR has utilised the results and/or spatial data from the following documents:

- Wyong LGA Vegetation Mapping (Bell and Driscoll 2008);
- Wyong Vegetation Map 2016 v1. Prepared for Wyong Shire Council (Eco Logical Australia (2016); and
- The Natural Vegetation of the Wyong Local Government Area, Central Coast, New South Wales: Vegetation Community Profiles, Unpublished Final Report to Wyong Shire Council (Bell 2002).

The aerial imagery used in this BCAR is sourced from NearMap and is dated 01 August 2021. Additional aerial images available on Google Earth Pro and SixMaps were also consulted.

## 1.5. Authorship and Personnel

This document has been certified by Dr David Robertson (BAM Accredited Assessor No: BAAS17027) as being prepared in accordance with the BAM as at 17 August 2022.

This BCAR and associated field surveys and geographic information systems (GIS) mapping were prepared with the assistance of additional personnel as outlined in **Table 1**.

**Table 1 Personnel involved in preparation of this BCAR**

Name	Tasks	Relevant Qualifications / Training	BAM Accredited Assessor No.
Dr David Robertson	Document review, field surveys	Doctor of Philosophy. Ecology, University of Melbourne, 1986 Bachelor of Science (Honours) in Ecology, University of Melbourne, 1980 BAM Accredited Assessor Training. Muddy Boots, 2017. BAM Renewal Training. August 2021	BAAS17027
Heather Gosper	Document preparation, field survey, BAM calculations	Bachelor of Environmental Science and Management. The University of Newcastle, 2013 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS19028
Katrina Wolf	Document review	Bachelor of Science (Environmental). The University of Sydney, 2007 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS18010
Michael Davis	GIS mapping	Bachelor of Biodiversity and Conservation. Macquarie University, 2016 BAM Accredited Assessor Training. Muddy Boots, 2017	-
Bryan Furchert	Field surveys, PCT analysis	Bachelor of Biodiversity and Conservation. Macquarie University, 2012 Diploma of Conservation and Land Management. TAFE NSW, 2008 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS18095
Rebeca Violante	Field surveys	Diploma of Project Management. Australasia International School, Sydney, 2018.	-

Name	Tasks	Relevant Qualifications / Training	BAM Accredited Assessor No.
		Bachelor of Science (Biology). Universidade Paulista, Brazil, 2015. Bachelor of Communication. Universidade Metodista de São Paulo, Brazil, 2008. BAM Accredited Assessor Training. Muddy Boots, 2019	
Brooke Crismale	Field surveys	Bachelor of Science (Zoology) and Bachelor of Natural Science (Animal Science). Western Sydney University, 2020	-

# 2. Methodology

## 2.1. Review of Existing Data

Existing information on biodiversity values within the subject land and assessment area was reviewed, which includes:

- Species data that is held in the BioNet Atlas;
- Wyong LGA Vegetation Mapping (Bell and Driscoll 2008);
- BioNet Vegetation Classification database;
- Biodiversity Development Assessment Report NSW Department of Education – The New Primary School at Warnervale, 75 Warnervale Road, Warnervale (Kleinfelder 2019);
- Threatened Biodiversity Data Collection (TBDC);
- Warnervale Road, Warnervale Study Area – Ecological Assessment (2017);
- Ecological Assessment – Precinct 7A, Warnervale NSW (Umwelt 2013);
- Conservation Management Plan – Precinct 7A, Warnervale & Hamlyn Terrace NSW (Umwelt 2014); and
- Surveys for Squirrel Glider (*Petaurus norfolcensis*): Warnervale Area (2020).

Anderson Environment and Planning prepared an Ecological Assessment Report (EAR) for the subject land in July 2016, along with two further supporting letters in July 2016 and December 2019 regarding the potential presence of the threatened orchid *Cryptostylis hunteriana* (Leafless Tongue Orchid). These documents were reviewed, and the information incorporated into this assessment, where applicable.

Consultation was undertaken in May 2022 with Mr Greg Chapman, soil expert, to determine the likely soils of the subject land compared to soils reported in typical habitats of Wyong Sun Orchid (*Thelymitra adorata*). Mr Chapman is a senior soil scientist who has been involved in much of the soil mapping in the Sydney Basin Bioregion.

This existing information was considered and included, where appropriate, into survey design, vegetation mapping and reporting.

## 2.2. Landscape Features

Landscape features requiring consideration were initially determined via desktop assessment. Field surveys undertaken on 25 June 2021 sought to verify the following landscape features:

- Rivers, streams and estuaries;
- Important and local wetlands;
- Karsts, caves, crevices, cliffs and areas of geological significance; and
- NSW BioNet Landscapes.

No amendments were required to be made to any of these landscape features following field surveys.

## 2.3. Native Vegetation Survey

### 2.3.1. Vegetation Mapping

Broad scale vegetation mapping exists for the subject land and surrounds, including the mapping prepared by Bell and Driscoll (2008) for the Wyong LGA. Cumberland Ecology conducted vegetation surveys on 25 June 2021 to verify and update (where required) the vegetation mapping. The vegetation within the subject land was ground-truthed to examine and verify the mapping of the condition and extent of the different PCTs. Mapping of PCTs within the subject land was undertaken by random meander surveys through patches of vegetation, noting key characteristics of areas in similar broad condition states such as similar tree cover, shrub cover, ground cover, weediness or combinations of these.

Records of plant community boundaries were made using a hand-held Global Positioning System and mark-up of aerial imagery. The resultant information was synthesised using GIS to create a spatial database that was used to interpret and interpolate the data to produce a vegetation map of the subject land.

### 2.3.2. Plot-based Vegetation Survey and Vegetation Integrity Assessment

A plot-based vegetation survey and vegetation integrity assessment was undertaken concurrently within the subject land and adjoining area in accordance with the BAM (hereafter referred to as 'BAM plots'). These BAM plots were undertaken in accordance with Section 4.2.1 and Section 4.3.2 of the BAM.

A total of five BAM plots were undertaken within the subject land on 25 June 2021, and their locations are shown on **Figure 5**. The BAM plots required the establishment of a 20 x 50 m plot with an internal 20 x 20 m plot. The following data was collected within each of the plots:

- Composition for each growth form group by counting the number of native plant species recorded for each growth form group within the 20 m x 20 m floristic plot;
- Structure of each growth form group as the sum of all the individual projected foliage cover estimates of all native plant species recorded within each growth form group within the 20 m x 20 m floristic plot;
- Cover of 'High Threat Exotic' weed species within the 20 m x 20 m floristic plot;
- Assessment of function attributes within the 20 m x 50 m plot, including:
  - Count of number of large trees;
  - Tree stem size classes, measured as 'diameter at breast height over bark' (DBH);
  - Regeneration based on the presence of living trees with stems <5 cm DBH;
  - The total length in metres of fallen logs over 10 cm in diameter;
  - Assessment of litter cover within five 1 m x 1 m plots evenly spread within each 20 m x 50 m plot; and
  - Number of trees with hollows that are visible from the ground within each 20 m x 50 m plot.

The location of plots sought to capture the environmental variation of the PCT identified within the subject land. **Table 2** summarises the plot requirements based on the size and number of vegetation zones in the subject land. As shown in this table, the minimum number of plots has been completed for all vegetation zones.

**Table 2 BAM plot survey requirements**

Vegetation Zone	PCT	Condition	Subject Land (ha)	Development Site Footprint (ha)	Minimum Number of Plots Required	Number of Plots Completed	Plot Name
1	1619	Good_shrubs -intact	0.96	0.16	1	2	P2, P3
2	1619	Good_shrubs -removed	0.71	0.71	1	1	P1
3	1619	Moderate	0.36	0.36	1	1	P4
4	1619	Low	0.50	0.50	1	1	P5

## 2.4. Threatened Flora Species Survey

### 2.4.1. Habitat Constraints

Desktop assessments and field surveys within the subject land included assessment of habitat constraints and microhabitats for predicted species credit flora species.

### 2.4.2. Targeted Flora Species Survey

Targeted threatened flora surveys were undertaken within the subject land for species credit species that were assessed as candidate species credit species for further assessment (see **Section 5.3**). The locations of the targeted flora species surveys are shown in **Figure 5**.

Species credit species that were assessed as candidate species credit species for further assessment during targeted surveys includes:

- *Acacia bynoeana* (Bynoe’s Wattle);
- *Angophora inopina* (Charmhaven Apple);
- *Asperula asthenes* (Trailing Woodruff);
- *Astrotricha crassifolia* (Thick-leaf Star-hair);
- *Callistemon linearifolius* (Netted Bottle Brush);
- *Corunastylis sp. Charmhaven*;
- *Cryptostylis hunteriana* (Leafless Tongue Orchid);

- *Genoplesium insigne* (Variable Midge Orchid);
- *Grevillea parviflora subsp. parviflora* (Small-flower Grevillea);
- *Melaleuca groveana* (Grove's Paperbark);
- *Rutidosis heterogama* (Heath Wrinklewort);
- *Tetraloche glandulosa*; and
- *Tetraloche juncea* (Black-eyed Susan).

Species credit species determined to not require further assessment due to geographic limitations includes: *Diuris praecox*, *Eucalyptus oblonga* – endangered population, and *Prostanthera askania*.

Further details of the targeted flora survey methodology utilised in the subject land are provided below.

#### 2.4.2.1. Random Meander

Initial targeted threatened flora searches via random meanders were undertaken within all suitable habitat of the subject land for threatened flora species known from the locality by a botanist and ecologist from Cumberland Ecology on the 25 June 2021. A large portion of the subject land is not highly suitable for threatened species, being degraded exotic grassland; nevertheless, these were surveyed as part of the overall survey effort. The random meander transects included surveys of the entire subject land with a particular focus on the areas of potentially suitable habitat for threatened flora species (native woodland) with the greatest potential to support threatened species.

The locations of the random meander survey within the study are shown in **Figure 5**.

Species targeted: *Acacia bynoeana*, *Angophora inopina*, *Melaleuca groveana*, *Rutidosis heterogama*

#### 2.4.2.2. Parallel Field Traverses

Parallel field traverses were undertaken throughout all areas of the subject land for candidate species credit species in accordance with 'Surveying threatened plants and their habitats' (NSW Government 2020) on 18 August 2021, 1 November 2021, 10 November 2021 and 29 December 2021. The entirety of the subject land was traversed on each of the targeted flora survey days. The transect width was established at approximately 10 metres, in accordance with the maximum width for parallel field traverses to identify all species (trees, shrubs, herbs and forbs, etc.) in open vegetation. The location of the parallel field traverses within the subject land are shown in **Figure 5**. Species targeted: *Acacia bynoeana*, *Angophora inopina*, *Asperula asthenes*, *Astrotricha crassifolia*, *Callistemon linearifolius*, *Corunastylis sp. Charmhaven*, *Cryptostylis hunteriana*, *Genoplesium insigne*, *Grevillea parviflora subsp. parviflora*, *Melaleuca groveana*, *Rutidosis heterogama*, *Tetraloche glandulosa*, *Tetraloche juncea*.

### 2.4.2.3. Reference Populations

#### i. *Cryptostylis hunteriana*

Council advised the reference population (location withheld) of *Cryptostylis hunteriana* was flowering the week commencing 27 October 2021 and targeted threatened surveys for this species were subsequently undertaken on 1 November 2021 and 10 November 2021 as described in **Section 2.4.2.2** above.

Following a preliminary review of the BCAR, DPE requested further information about the use of reference populations for several species, including *Acacia bynoeana*, *Corunastylis sp Charmhaven* and *Rutidosis heterogama*. The following response for each of these species was provided to DPE and is included below.

#### ii. *Acacia bynoeana*

*Acacia bynoeana* was surveyed for in June, August, November and December 2021 and the species has a year-round survey period. It is an easily recognisable species and would have been detected if present; particularly given the flowering is anytime from September to March and it is distinguishable from *Acacia trinervata* by the hairy branchlets (species also not detected). A reference population was not required based on the numerous and frequent surveys conducted and the familiarity of the Cumberland Ecology botanists with this species.

This species was also surveyed for by AEP (2016a) and was not found on the subject land. AEP (2016a) stated that the species was not found despite numerous targeted surveys and was so considered unlikely to occur. Similarly, on the school site adjacent to the west of the subject land that contained the same forest type as the subject land, targeted surveys in 2018 by Kleinfelder (2019) did not locate the species.

It is concluded that sufficient information exists to indicate that the species is unlikely to occur on the subject land.

#### iii. *Corunastylis sp. Charmhaven*

*Corunastylis sp. Charmhaven* was surveyed in both November and December 2021 after a period of rainfall when other orchids throughout the site were in flower. No *Corunastylis* or *Genoplesium* species were recorded within the subject land in the multiple targeted surveys; and therefore, the species could not be misidentified. A prior survey of the subject land was conducted by Anderson Environmental and Planning (AEP) in November 2019 for this species and noted anecdotal evidence of species flowering at a reference site at the time of that valid survey.

This species was also previously surveyed for by AEP (2016a) and was not found. AEP (2016a) stated that no sign of this species was found during fieldwork despite targeted surveys during the flowering period, and that no previous records occur on site or in the locality. Similarly, on the school site adjacent to the west of the subject land that contained the same forest type as the subject land, targeted surveys in 2018 by Kleinfelder (2019) did not locate the species.

It is concluded that sufficient information exists to indicate that the species is unlikely to occur on the subject land.



#### iv. *Rutidosia heterogama*

*Rutidosia heterogama* was surveyed for in June, August, November and December 2021 and the species has a year-round survey period. It is also an easily recognisable, perennial species and would have been detected if present. No *Rutidosia* species were detected in the numerous targeted surveys so it could not have been misidentified. A reference population was not required based on the numerous and frequent surveys conducted and the familiarity of the Cumberland Ecology botanists with this species.

This species was also surveyed for by AEP (2016a) and was not found. AEP (2016a) stated that the species was not found despite numerous targeted surveys and was so considered unlikely to occur. Similarly, on the school site adjacent to the west of the subject land that contained the same forest type as the subject land, targeted surveys in 2018 by Kleinfelder (2019) did not locate the species.

It is concluded that sufficient information exists to indicate that the species is unlikely to occur on the subject land.

## 2.5. Threatened Fauna Species Survey

Targeted threatened fauna surveys were undertaken within the subject land for species credit species that were assessed as candidate species credit species for further assessment (see **Section 5.3**). The locations of the targeted fauna species surveys are shown in **Figure 6**.

Species credit species that were assessed as candidate species credit species for further assessment during targeted surveys includes:

- *Burhinus grallarius* (Bush Stone-curlew);
- *Callocephalon fimbriatum* (Gang-gang Cockatoo);
- *Calyptorhynchus lathami* (Glossy Black-Cockatoo);
- *Cercartetus nanus* (Eastern Pygmy Possum);
- *Crinia tinnula* (Wallum Froglet);
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle);
- *Hieraaetus morphnoides* (Little Eagle);
- *Hoplocephalus bitorquatus* (Pale-headed Snake);
- *Litoria aurea* (Green and Golden Bell Frog);
- *Litoria brevipalmata* (Green-thighed Frog);
- *Lophoictinia isura* (Square-tailed Kite);
- *Myotis macropus* (Southern Myotis);
- *Ninox connivens* (Barking Owl);

- *Ninox strenua* (Powerful Owl);
- *Pandion cristatus* (Eastern Osprey);
- *Petauroides volans* (Greater Glider);
- *Petaurus norfolcensis* (Squirrel Glider);
- *Phascogale tapoatafa* (Brush-tailed Phascogale);
- *Phascolarctos cinereus* (Koala);
- *Planigale maculata* (Common Planigale);
- *Tyto novaehollandiae* (Masked Owl); and
- *Uperoleia mahonyi* (Mahoney's Toadlet).

#### **2.5.1.1. Habitat Assessment**

Desktop assessments and field surveys within the subject land included assessment of habitat constraints and microhabitats for predicted species credit fauna species. This included desktop assessment of proximity of the subject land to features such as caves and waterways and field inspection of microhabitats including leaf litter, stick nests, hollowing-bearing trees and waterbodies.

#### **2.5.1.2. Diurnal Bird Survey**

Diurnal bird surveys were conducted in the subject land between 10 and 12 August 2021 using the area search method that involves walking within a 2 ha area and recording all avian species observed or heard. These surveys were conducted at three sites within the subject land for a minimum of 20 minutes per site. (i.e., the entire subject land was surveyed for a minimum of one hour on each survey day). A visual observation of all trees within the site was completed throughout the survey periods and any nests present recorded.

Diurnal bird surveys were conducted again in the subject land for further three days on 17 December 2021 and on 20 and 21 December 2021 using the area search method at three sites within the subject land.

Species targeted: Gang-gang Cockatoo, Glossy Black-Cockatoo, White-bellied Sea-Eagle, Little Eagle, Square-tailed Kite, Eastern Osprey.

#### **2.5.1.3. Nocturnal Spotlighting and Call Playback**

##### **i. August Surveys**

Nocturnal spotlighting and call playback was undertaken via area searches along a pre-determined transect for four consecutive nights between 9 and 12 August 2021 throughout the subject land using high power hand-held torches, focussing on treed areas and areas associated with habitat features. The transect was surveyed for one hour each night. Call playback was undertaken at intervals along the transect using a recording of the Bush-stone Curlew, Barking Owl, Powerful Owl and Masked Owl by spotlighting for ten minutes, playing the call for five minutes, listening for five minutes, and then searching the surrounding habitat for ten minutes. Observations of all nocturnal birds and mammals were recorded.

Species targeted: Bush-stone Curlew, Barking Owl, Powerful Owl, Greater Glider, Squirrel Glider, Koala, Common Planigale, Masked Owl.

## **ii. December Surveys**

A second round of nocturnal spotlighting and call playback was undertaken via area searches along a pre-determined transect for four nights on 16 December 2021 and between 19 and 21 December 2021 throughout the subject land using high power hand-held torches, focussing on treed areas and areas associated with habitat features. The transect was surveyed for an hour each night. Call playback was undertaken at intervals along the transect using a recording of the Squirrel Glider and Koala by spotlighting for ten minutes, playing the call for five minutes, listening for five minutes, and then searching the surrounding habitat for ten minutes. Observations of all nocturnal birds and mammals were recorded

Species targeted: Bush-stone Curlew, Eastern Pygmy-possum, Barking Owl, Greater Glider, Squirrel Glider, Brush-tailed Phascogale, Koala, Common Planigale.

### **2.5.1.4. IR Cameras**

#### **i. Baited IR Cameras**

Three baited arboreal infrared (IR) cameras were set throughout the subject land between 9 and 12 August 2021. A mixture of peanut butter, oats and honey was baited in three of the bait stations and placed in a PVC pipe that had a mesh cap on each end, and then zip-tied to a fixed point facing the IR camera on trees at approximately two metres above ground level. Each camera was set to take three photos in succession when triggered.

Four baited arboreal IR cameras were set throughout the subject land between 16 December 2021 and 18 January 2022 using the same technique as above. The four bait stations were re-baited on 22 December 2021 and on 6 January 2022.

Species targeted: Brush-tailed Phascogale, Eastern Pygmy-possum, Greater Glider, Squirrel Glider,

#### **ii. Honey Baited IR Cameras**

Three baited arboreal infrared IR cameras were set throughout the subject land between 16 and 22 December 2021. A mixture of honey and water was combined the three dripper bottles that were attached to trees facing the IR cameras at approximately two metres above ground level. Each camera was set to take three photos in succession when triggered.

Species targeted: Brush-tailed Phascogale, Eastern Pygmy-possum, Greater Glider, Squirrel Glider,

#### **iii. Nest Boxes**

One arboreal nest box monitored by an IR camera was set within the wildlife corridor in the subject land on 11 August 2021 and baited with raspberry jam. The nest box was attached to a tree approximately two metres above ground level with the entrance facing the IR camera, set to take three photos in succession when triggered. The nest box was rebaited on 20 December 2021 and collected on 18 January 2022.

Three arboreal nest boxes monitored by IR cameras were set within the subject land on 16 December 2021 and baited with raspberry jam. The nest boxes were attached to trees approximately two metres above ground level with the entrance facing the IR cameras, set to take three photos in succession when triggered. The nest boxes were collected on 18 January 2022.

Species targeted: Brush-tailed Phascogale, Eastern Pygmy-possum, Greater Glider, Squirrel Glider,

#### **2.5.1.5. Amphibian Survey**

A first round of amphibian spotlighting and call playback was undertaken for the Wallum Froglet over four consecutive nights between 9 August and 12 August 2021

The Wallum Froglet requires a total of 480 minutes aural-visual survey effort over four days for a 500 m transect of suitable breeding habitat, with a year-round survey period. There had been 45.4 mm of rainfall in July 2021 leading up to the surveys and the conditions were ideal for frog surveys, with a number of frogs calling around the drainage line and dam within the subject land. A transect covering the drainage line and dam was established and surveyed using a recording of the Wallum Froglet and involved searching with a spotlight for ten minutes, playing the call for five minutes, listening for five minutes, and then searching the surrounding habitat for ten minutes with a high-powered spotlight. Within the guideline *NSW Survey Guide for Threatened Frogs* (DPIE 2020), "*Suitable breeding and non-breeding habitat consists of still waterbodies located in acid swamplands (pH<5.5), wallum heaths, open vegetation on sand plains, and flooded areas of swamp forests within the PCTs associated with the species.... Non-breeding habitat is any area of suitable PCT located on the subject land*". It is not considered that any breeding habitat occurs within the subject land and the requirement for survey transects is limited to suitable breeding habitat. Regardless, the species was surveyed for as non-breeding habitat occurs by two ecologists over four nights between 9 – 12 August 2021 for a total of 120 person minutes per night along a transect of approximately 200 metres length for a total of 480 minutes survey in August 2021. The species was again surveyed using aural-visual surveys over four nights on 16 December and between 19 – 21 December 2021, with two ecologists on 16 December 2021 for a total of 120 person minutes and by one ecologist on 19 – 21 December for 180 person minutes along a transect of approximately 200 m length for a total of 300 minutes survey in December 2021, which is consistent with Section 2.9.1 of the guideline which states that "*Where there is insufficient habitat to accommodate a 500 metre transect a pro-rata effort is to be applied with all available habitat being searched.*"

A second round of amphibian surveys were undertaken over four nights on 16 December and between 19 and 21 December 2021 using recordings of the Wallum Froglet, Green and Golden Bell Frog, Green-thighed Frog and Mahoney's Toadlet. There had been 183.8 mm of rainfall in November 2021 leading up to the surveys and the conditions were ideal for frog surveys, with a number of frogs calling around the drainage line and dam within the subject land. Surveys involved establishing a transect through the drainage line, dam, and damp areas; and surveying involved spotlighting for five minutes, playing the call for five minutes, and then searching the surrounding habitat for five minutes with a high-powered spotlight.

The Green and Golden Bell Frog requires a total of 480 minutes of aural-visual survey effort over four days for a 500 m transect of suitable breeding habitat, with a November to March survey period. Within the guideline, "*Suitable breeding and non-breeding shelter habitat consists of any waterbody with emergent aquatic vegetation and without the plague minnow (*Gambusia holbrooki*), although the green and golden bell frog will still*

*occasionally breed in sites with this introduced pest fish.*" Only the dam and drainage line included within the transect meet these criteria. The species was surveyed over four nights on 16 December and between 19 – 21 December 2021, with two ecologists on 16 December 2021 for a total of 120 person minutes and by one ecologist on 19 – 21 December for 180 person minutes along a transect of approximately 200 metres length for a total of 300 minutes survey in December 2021. This survey effort meets the requirements of the guideline for the species.

The Green-thighed Frog requires a total of 240 minutes of aural-visual survey effort over two days for a 500 m transect and two tadpole surveys for areas of suitable breeding habitat, with an October to March survey period. Within the guideline, *"Suitable breeding habitat is any semi-permanent or ephemeral waterbody of >25 square metres in surface area located within native vegetation or immediately adjacent to or within 10 metres of native vegetation."* The dam is not a semi-permanent or ephemeral water body and the drainage line does not include a total waterbody surface area of greater than 25 square metres as only small areas comprise an open water surface despite extensive flooding rainfall in the month leading up to the surveys. Therefore, breeding habitat was not considered to occur within the subject land. Nevertheless, the species was surveyed over four nights on 16 December and between 19 – 21 December 2021, with two ecologists on 16 December 2021 for a total of 120 person minutes and by one ecologist on 19 – 21 December for 180 person minutes along a transect of approximately 200 metres length for a total of 300 minutes survey in December 2021. Visual inspections of any open water area were made during this survey for tadpoles meeting the 10 mins per 50 metres square area and none were recorded.

Species targeted: Wallum Froglet, Green and Golden Bell Frog, Green-thighed Frog, Mahoney's Toadlet

Survey guidelines utilised: NSW Government (DPIE, 2020): NSW Survey Guide for Threatened Frogs - A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method.

#### **2.5.1.6. Reptile Survey**

A reptile survey was undertaken in conjunction with the amphibian survey over four nights on 16 December and between 19 and 21 December 2021 using a combination of nocturnal spotlighting and searching around areas of leaf litter, fallen logs and around the base of trees. The surveys were conducted for one hour on each of the four nights.

Species targeted: Pale-headed Snake

#### **2.5.1.7. SAT Surveys**

Surveys for Koala populations known as the Spot Assessment Technique (SAT) (Phillips & Callaghan, 2011) were conducted throughout the subject land where possible. Survey locations were chosen based on patches of vegetation within the site that contained Koala food trees. Once a central food tree is established, a maximum of two-person minutes was spent searching for faecal pellets (scats) within a one metre radius of the base of the central tree and 29 surrounding trees. Tree trunks were searched for scratch marks, and the canopy was observed for any koalas present. In cases where 30 trees were not present only those available within a 25m radius of the central tree were surveyed. These surveys were completed at three sites throughout the subject land on 12 August 2021.

Survey guidelines utilised: Phillips, S & Callaghan, J (2011): The Spot Assessment Technique: A tool for determining localised levels of habitat use by Koalas (*Phascolarctos cinereus*).

### **2.5.1.8. Elliott Trapping**

#### **i. Arboreal Elliott Trapping**

Arboreal Elliott trapping was undertaken in the subject land between 09 and 12 August 2021 and between 16 and 17 December 2021 and between 19 and 22 December 2021; for a total of eight nights. A total of two trap lines were surveyed within the subject land during both August and December with 20 arboreal Elliott B traps, spread over two transects of 10 traps each.

Within the arboreal trap line, traps were spaced at approximately 10 to 20 m intervals, depending on available habitat. All traps were baited with a mix of peanut butter, honey and oats and were checked each morning within two hours of sunrise. Any captured fauna were then identified and released. Traps were re-set within an hour of sunset the following evening. Arboreal Elliott trapping resulted in a total of 160 trap nights.

Species targeted: Eastern Pygmy-possum, Squirrel Glider, Brush-tailed Phascogale.

#### **ii. Terrestrial Elliott Trapping**

Terrestrial Elliott trapping was undertaken in the subject land between 09 and 12 August 2021 and between 16 and 17 December 2021 and between 19 and 22 December 2021; for a total of eight nights. A total of two trap lines were surveyed within the subject land during both August and December; with 20 Elliott A traps used in August 2021 and 10 Elliott B and 10 Elliott A traps used in December 2021, spread over two transects of 10 traps each.

Within the terrestrial trap line, traps were spaced at approximately 10 to 20 m intervals, depending on available habitat. All traps were baited with a mix of peanut butter, honey and oats and were checked each morning within two hours of sunrise. Any captured fauna were then identified and released. Traps were re-set within an hour of sunset the following evening. Terrestrial Elliott trapping resulted in a total of 160 trap nights.

Species targeted: *Antechinus* sp. (as part of Common Planigale surveys).

### **2.5.1.9. Harp Trapping**

Two harp traps targeting microchiropteran bat species were deployed within the subject land for four nights between 16 and 17 December 2021 and between 19 and 22 December 2022. The traps were set up in a 'flyway' and near the dam each night and checked within two hours of sunrise each morning. The traps were laid down throughout the day and reset each evening.

Species targeted: Southern Myotis

Survey guidelines utilised: NSW Government (OEH 2018): 'Species credit' threatened bats and their habitats, NSW survey guide for the Biodiversity Assessment Method.

### **2.5.1.10. Ultrasonic Call Detection**

Microchiropteran bat calls were recorded using two Song Meter SM2 BAT detectors between 16 and 22 December 2021. These were placed in areas of suitable habitat in the subject land.

Bat calls were sent to Greg Ford of Balance! Environmental for analysis. Call analysis was undertaken using *Anabat Insight* (Version 2.0.2) bat call analysis software.

Species targeted: Southern Myotis.

Survey guidelines utilised: NSW Government (OEH 2018): 'Species credit' threatened bats and their habitats, NSW survey guide for the Biodiversity Assessment Method.

### 2.5.2. Roost Watches

Roost watches were undertaken by observing potential roost hollows for approximately 30 minutes prior to sunset and 30 minutes following sunset. Watches were conducted by two ecologists whom each surveyed a different location each night for three nights between 10 and 12 August 2021, for a total of six locations surveyed during August 2021. Watches were conducted by two ecologists whom each surveyed a different location on 16 December 2021, and one ecologist surveyed a different location on each of the three nights between 19 and 21 December 2021, for a total of five locations surveyed.

Species targeted: Eastern Pygmy-possum, Barking Owl, Powerful Owl, Greater Glider, Squirrel Glider, Brush-tailed Phascogale, Masked Owl, Southern Myotis.

Survey guidelines utilised: Threatened Biodiversity Survey and Assessment: Guidelines for Activities and Developments (DEC (NSW) 2004).

### 2.5.3. Pitfall Trapping

Two pitfall line traps were established within the subject land and surveyed for four consecutive nights between 09 and 12 August 2021. Each trap line consisted of five 20-litre buckets dug in flush with ground level, separated at approximately two metre intervals and connected by a line of wire mesh of approximately 10 metres that spanned the entirety of the trap line. Traps were set at dusk each evening and checked within two hours of sunrise each morning, then closed throughout the day by replacing the bucket lids. Bark and leaf litter were placed at the bottom of each bucket to provide coverage for any fauna entering the trap.

Three pitfall line traps were established within the subject land and surveyed for four nights between 16 and 17 December 2021 and between 19 and 22 December 2021. Each trap line consisted of two 20-litre buckets dug in flush with ground level, separated by approximately 10 metres and connected by a line of wire mesh that spanned the entirety of the trap line. Traps were set at dusk each evening and checked within two hours of sunrise each morning, then closed throughout the day by replacing the bucket lids. Bark and leaf litter were placed at the bottom of each bucket to provide coverage for any fauna entering the trap.

Species targeted: Common Planigale

## 2.6. Weather Conditions

Weather conditions during the field survey were appropriate for detection of all target species credit species. A summary of weather conditions in the wider locality of the subject land (Rainfall: BOM Weather Station 061387 – Gorokan (Goobarabah St), Temperature: BOM Weather Station 061366 – Norah Head AWS) during the field survey is provided in **Table 3**. The following weather observations are made:

- In the week prior to the June 2021 field survey, the average daily temperatures were between 11.8-19.6°C, with a total of 23.2 mm of rainfall falling over the previous seven days.
- In the week prior to the August 2021 field surveys, the average temperatures were between 10.1-18.5°C, with a total of 1.8 mm of rainfall falling over the previous seven days.
- In the week prior to the November 2021 field surveys, the average temperatures were between 15.7-24.5°C, with a total of 2.2 mm of rainfall falling over the previous seven days.
- In the week prior to the December 2021 field surveys, the average temperatures were between 15.7-23.8°C, with a total of 28.4 mm of rainfall falling over the previous seven days.

**Table 3 Weather conditions during field surveys**

Date	Temperature Minimum (°C)	Temperature Maximum (°C)	Rainfall (mm)
25 June 2021	14.4	19.7	0.2
9 August 2021	12.0	19.8	6.4
10 August 2021	10.4	22.9	0.0
11 August 2021	No data	No data	0.0
12 August 2021	No data	No data	0.0
13 August 2021	No data	No data	0.0
18 August 2021	9.4	18.4	0.0
1 November 2021	14.2	24.8	0.0
10 November 2021	17.9	21.1	0.0
16 December 2021	20.3	26.4	0.0
17 December 2021	20.1	27.0	0.0
19 December 2021	21.4	34.5	1.2
20 December 2021	21.2	29.3	0.2
21 December 2021	23.0	28.8	0.0
22 December 2021	22.5	28.1	0.0
29 December 2021	15.3	24.2	6.0



# 3. Landscape Features

## 3.1. Assessment Area

The subject land is approximately 5.17 ha in area and is shown in **Figure 1**. As the project is being assessed as a site-based project, the assessment area comprises the area of land within a 1,500 m buffer around the outer boundary of the subject land. The assessment area is approximately 855.9 ha in area and is shown in **Figure 2**.

## 3.2. Landscape Features

Landscape features identified within the subject land and assessment area are outlined below. The extent of these features within the subject land is shown in **Figure 1** and the extent within the assessment area is shown in **Figure 2**.

### 3.2.1. IBRA Bioregion and IBRA Subregion

The subject land is located within the Sydney Basin IBRA Bioregion and the Wyong IBRA Subregion.

### 3.2.2. Rivers and Streams

No mapped watercourse occurs within the subject land. Watercourses in the assessment area are mapped in **Figure 2** and include the 1<sup>st</sup> to 3<sup>rd</sup> order streams. In accordance with Appendix E of the BAM, riparian corridors of 10 m, 20 m, 30m and 40 m either side of the waterway applies to unmapped/first, second, third and fourth order streams within the assessment area, respectively.

### 3.2.3. Wetlands

One farm dam occurs within the subject land and is mapped as a wetland as per the BAM, as shown in **Figure 2**. However, this is an artificial farm dam created for the existing purpose of the subject land as a rural-residential property. Numerous similar farm dams occur in surrounding properties, and these are not representative of a naturally occurring wetland.

There are no wetlands included in the DAWE Nationally Important Wetlands database in the subject land or assessment area. Porters Creek Wetland is within the assessment area on the western boundary and is listed as a Coastal Wetland under *State Environmental Planning Policy (Resilience and Hazards) 2021* and is considered an important wetland under the BAM. A 50 m buffer zone applies to this important wetland. Neither the wetland or buffer zone occur within the subject land.

### 3.2.4. Habitat Connectivity

No native vegetation within the subject land was identified for retention within the Precinct 7A conservation corridors, nor are there any formal mapped biodiversity corridors occurring.

The subject land contains native vegetation that has connectivity with other retained native vegetation in the surrounding properties; including with Warnervale Oval to the north (connection is separated by Warnervale Road), rural residential properties to the east (connection separated by Virginia Road), to the retained 50 m wildlife corridor of the AV Jennings site directly to the south and to the retained 66 m corridor of the Porters Creek Public School to the south-west. This retained vegetation exists generally as canopy trees with a modified understorey due to land use activities and past clearing; however, regeneration of the ground and shrub layers is evident. The proposed retention of the 50 m wildlife corridor in the south of the subject land will result in a

combined 100 m width corridor when included with the AV Jennings site that links larger areas of retained habitat in an east to west direction.

### **3.2.5. Karsts, Caves, Crevices, Cliffs and Areas of Geological Significance**

No karsts, caves, crevices, cliffs or areas of geological significance have been identified within the subject land or assessment area based on searches of available aerial imagery from NearMap, or topographic data available from SixMaps.

### **3.2.6. Areas of Outstanding Biodiversity Value**

No Areas of Outstanding Biodiversity Value have been mapped within the subject land or assessment area.

### **3.2.7. BioNet NSW Landscapes**

The subject land is located primarily within the Gosford – Cooranbong Coastal Slopes 'BioNet NSW Landscape', with some areas to the southeast mapped within the Sydney – Newcastle Coastal Alluvial Plans BioNet NSW Landscape. The assessment area also comprises a combination of these two landscapes.

### **3.2.8. Soil Hazard Features**

Soil hazard features have not been identified as the project does not comprise a vegetation clearing proposal (i.e. it is a biodiversity certification development proposal).

## **3.3. Native Vegetation Cover**

The native vegetation cover was determined using GIS. To map native vegetation cover within the subject land and assessment area, this assessment utilised the detailed vegetation mapping prepared by Cumberland Ecology in conjunction with the vegetation mapping of the Wyong LGA (Bell and Driscoll 2008). The native vegetation cover within the assessment area is shown in **Figure 2**. It occupies approximately 344.1 ha, which represents 40.2% of the assessment area. Therefore, the native vegetation cover value is assigned to the cover class of >30-70%.

The remaining land within the assessment area comprises cleared land and exotic vegetation. No significant differences between the aerial photographs using in this assessment and the native vegetation cover shown in **Figure 2** have been identified. This BCAR has been assessed as a non-linear project.

# 4. Native Vegetation

## 4.1. Native Vegetation Extent

The subject land was subject to detailed surveys by Cumberland Ecology for the purpose of this BCAR. The native vegetation extent within the subject land was determined through field surveys. The native vegetation extent within the subject land is shown in **Figure 7**. It occupies approximately 2.54 ha, which represents approximately 49.13 % of the subject land. The native vegetation extent in the development site footprint occupies approximately 1.74 ha, which represents approximately 39.82% of the development site footprint. The native vegetation extent within the subject land largely comprises varying conditions of scattered remnant canopy trees over a modified understorey that represent components of an original PCT, along with a small area (approximately 0.02 ha) of planted natives. The area of planted natives has been assessed using the streamlined assessment module for planted native vegetation outlined in Section D.1 of Appendix D of the BAM (see **Section 4.6**). The remaining vegetation within the development site footprint comprises exotic vegetation and cleared areas totalling an area of approximately 2.63 ha, which include the dam and existing dwellings. In accordance with Section 4.1.2 of the BAM, these areas do not require further assessment, unless they provide habitat for threatened species or are proposed for restoration as part of an offset. Therefore, these areas do not require further assessment. No differences between the aerial photographs used in this assessment and the native vegetation extent shown in **Figure 7** have been identified.

## 4.2. Plant Community Types

The vegetation analysis determined that the native vegetation within the subject land aligned with one PCT held within the BioNet Vegetation Classification database. **Table 4** provides a summary of the PCT identified within the subject land. The distribution of this PCTs within the subject land is shown in **Figure 8**. Detailed descriptions of this PCT and the justification for PCT selection is provided in the sections below.

**Table 4 Plant community types within the subject land**

PCT #	PCT	Subject Land (ha)	Development Site Footprint (ha)
1619	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	2.52	1.72

### 4.2.1. PCT 1619

PCT Name: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands

Vegetation Formation: Dry Sclerophyll Forests (Shrubby sub-formation)

Vegetation Class: Sydney Coastal Dry Sclerophyll Forests

Percent Cleared Value: 45%

#### 4.2.1.1. Condition States

The occurrence of PCT 1619 in the subject land includes all of the native vegetation within the subject land and occurs in four broad condition states:

- Good (shrubs intact) condition;
- Good (shrubs removed) condition;
- Moderate condition; and
- Low condition.

Each of these condition states is described below.

##### i. Good (shrubs intact) Condition

This community occurs as a large strip of vegetation along the southern boundary that makes up the area primarily proposed to be retained as the 50 metre wide habitat corridor.

The canopy is dominated by *Eucalyptus capitellata* (Brown Stringybark) and *Corymbia gummifera* (Red Bloodwood), with *Angophora costata* (Smooth-barked Apple) and *Allocasuarina littoralis* (Black She-oak) occurring less commonly.

The native shrub layer includes *Melaleuca nodosa*, *Melaleuca sieberi*, *Phyllanthus hirtellus* (Thyme Spurge), and *Lambertia formosa* (Mountain Devil). Additional, though less prevalent, species include *Pimelea linifolia* subsp. *linifolia*, *Pittosporum undulatum* (Sweet Pittosporum), *Acacia suaveolens* (Sweet Wattle), *Hibbertia empetrifolia* subsp. *empetrifolia*, and *Leptospermum trinervium* (Slender Tea-tree).

The ground layer comprises an abundance of native species, with only a relatively low cover of exotics. The patch is dominated by *Schoenus apogon* (Fluke Bogrush), with *Cyathochaeta diandra*, *Austrostipa pubescens*, *Microlaena stipoides* subsp. *stipoides* and *Ptilothrix deusta* frequently appearing. Exotic species include *Axonopus fissifolius* (Narrow-leaved Carpet Grass), *Andropogon virginicus* (Whiskey Grass), *Hypochoeris radicata* (Catsear), and *Setaria parviflora*.

An example of this community within the subject land is shown in **Photograph 1**.



**Photograph 1 PCT 1619 in good (shrubs intact) condition within the southern portion of the subject land (in the proposed wildlife corridor)**



## **ii. Good (shrubs removed) Condition**

This community occurs as a patch within the north-eastern corner of the subject land. This patch of the PCT in the north is slightly more elevated and drier than the patch in the south, and has undergone a history of grazing as part of the general property rural-residential use.

The canopy is dominated by *Eucalyptus capitellata* (Brown Stringybark) and *Corymbia gummifera* (Red Bloodwood), with *Angophora costata* (Smooth-barked Apple) and *Allocasuarina littoralis* (Black She-oak) occurring less commonly. The native *Glochidion ferdinandi* (Cheese Tree) and the exotic tree *Cinnamomum camphora* (Camphor Laurel) occur within this vegetation condition state.

The native shrub layer is somewhat reduced due to grazing by horses and prior agricultural use. However, it retains a diversity of species that includes *Pimelea linifolia* subsp. *linifolia*, *Pittosporum undulatum* (Sweet Pittosporum), *Acacia suaveolens* (Sweet Wattle), *Hibbertia empetrifolia* subsp. *empetrifolia*, and *Leptospermum trinervium* (Slender Tea-tree).



The ground layer comprises an abundance of native species, with only a relatively low cover of exotics. This includes the natives *Cyathochaeta diandra* and *Microlaena stipoides* subsp. *stipoides* (Weeping Grass), with *Austrostipa pubescens*, *Anisopogon avenaceus* (Oat Speargrass), and *Lepidosperma neesii* also common throughout.

An example of this community within the subject land is shown in **Photograph 2**.

**Photograph 2 PCT 1619 in good (shrubs removed) condition within the northern patch of the development site footprint**



### iii. Moderate Condition

This condition state of the community consists of two patches within the subject land where the canopy is mostly intact, however the shrub layer has been generally removed and the ground layer is degraded through historical and current agricultural use and is now predominantly exotic species; nevertheless, a few natives persist.

The canopy is dominated by mature *Eucalyptus capitellata*, *Corymbia gummifera*, and *Angophora costata*, with several *Glochidion ferdinandi* present.



The shrub layer is sparse and includes only a few scattered *Acacia longifolia* subsp. *longifolia* (Sydney Golden Wattle), *Pimelea linifolia* subsp. *linifolia*, and *Pittosporum undulatum*.

Exotics that dominate the ground layer include *Cenchrus clandestinus* (Kikuyu) and *Axonopus fissifolius*, along with lesser coverage of species such as *Juncus cognatus*, *Paspalum dilatatum* (Paspalum), *Setaria parviflora*, and *Senecio madagascariensis* (Fireweed). Native species include *Cynodon dactylon* (Common Couch) (likely part of the agricultural planted pasture grasses), *Imperata cylindrica* (Blady Grass), *Microlaena stipoides* subsp. *stipoides*, and the fern *Pteridium esculentum* (Bracken).

An example of this community within the subject land is shown in **Photograph 3**.

**Photograph 3** PCT 1619 in moderate condition within the subject land



#### iv. Low Condition

This condition state of the community comprises scattered paddock canopy trees throughout a degraded ground layer resulting from historical and current agricultural use.

The canopy includes mature *Eucalyptus capitellata*, *Corymbia gummifera*, and *Angophora costata*. There is no shrub layer currently remaining. Several *Corymbia maculata* are present in the north-western most patch



indicating a historical transitional area with the Narrabeen Buttonderry Footslopes Community (PCT1590) which commonly intergrades with PCT 1619 in the Warnervale area as described by Bell (Bell 2002).

The ground layer comprises the prevalent exotics *Axonopus fissifolius*, *Cenchrus clandestinus*, and *Lolium perenne* (Perennial Ryegrass), along occurrences of other exotics such as *Juncus cognatus*, *Trifolium repens* (White Clover), *Lotus uliginosus* (Birds-foot Trefoil), and *Bromus catharticus* (Prairie Grass). While there is limited native cover in the ground layer, *Cynodon dactylon*, *Microlaena stipoides* subsp. *stipoides*, *Lythrum hyssopifolia* (Hyssop Loosestrife), *Lobelia purpurascens* (Whiteroot), and *Hydrocotyle laxiflora* (Stinking Pennywort) are examples of the species that appear.

An example of this community within the subject land is shown in **Photograph 4**.

**Photograph 4 PCT 1619 in low condition within the subject land**



#### 4.2.1.2. Justification of PCT Selection

The selection of this PCT involved:

- Vegetation Formation: (Dry Sclerophyll Forests (Shrubby sub-formation));
- IBRA Subregion: Wyong; and



- Upper stratum species: *Angophora costata*, *Eucalyptus capitellata*, *Corymbia gummifera*.

PCTs were filtered in the BioNet Vegetation Classification based on the above selection criteria. PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands was the only PCT that matched all criteria included within the filter. PCT 1619 was then further assessed through a comparison of the diagnostic species with the species occurring within the subject land.

The five BAM plots within the area mapped as PCT 1619 in the subject land contained a total of thirteen (13) key species listed in the description of PCT 1619 in the BioNet Vegetation Classification.

These include the upper stratum species *Angophora costata*, *Eucalyptus capitellata* and *Corymbia gummifera*; the mid stratum species *Allocasuarina littoralis*, *Xanthorrhoea latifolia*, *Acacia myrtifolia*, *Persoonia levis* and *Billardiera scandens*; and the ground stratum species *Aristida vagans*, *Dianella caerulea var. caerulea*, *Lepidosperma laterale*, *Panicum simile* and *Themeda triandra*.

Within the development site footprint, the vegetation is degraded through the modification of the ground layer and absence of a shrub layer. Nevertheless, there are sufficient native species present within the scattered canopy trees and ground layer species, to confidently assign PCT 1619 to the vegetation.

The PCT selection process is shown in **Table 5**.

**Table 5 PCT selection**

Search Criteria	Results that fit the Criteria
1. IBRA Subregion (Wyong), vegetation formation (Dry Sclerophyll Forests (Shrubby sub-formation))	PCTs that fit the criteria: 659, 1083, 1138, 1181, 1183, 1255, 1328, 1618, 1619, 1620, 1621, 1622, 1623, 1624, 1625, 1627, 1628, 1629, 1630, 1631, 1632, 1633, 1634, 1636, 1637, 1638, 1639, 1640, 1642, 1643, 1644, 1645, 1646, 1647, 1650, 1653, 1654, 1655, 1657, 1658, 1666, 1681, 1709, 1711, 1776, 1780, 1783, 1786
2. Characteristic canopy species: <i>Angophora costata</i> , <i>Eucalyptus capitellata</i> , <i>Corymbia gummifera</i>	PCTs that fit all criteria: 1619.
3. Key species comparison between PCT description and recorded plot data to confirm PCT suitability. The following 13 key species were recorded during surveys that matched PCT 1619 key species: <i>Angophora costata</i> , <i>Eucalyptus capitellata</i> , <i>Corymbia gummifera</i> , <i>Allocasuarina littoralis</i> , <i>Xanthorrhoea latifolia</i> , <i>Acacia myrtifolia</i> , <i>Persoonia levis</i> , <i>Billardiera scandens</i> , <i>Aristida vagans</i> , <i>Dianella caerulea var. caerulea</i> , <i>Lepidosperma laterale</i> , <i>Panicum simile</i> and <i>Themeda triandra</i>	PCT 1619 selected as best fit.

#### i. Alignment with Threatened Ecological Communities

Within the BioNet Vegetation Classification, this PCT is not associated with any TECs listed under the BC Act or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

### 4.3. Other Vegetation Types

#### 4.3.1. Planted Natives

This community comprises a few planted native trees, interspersed by exotics, used for landscaping purposes around the main residential dwelling. This includes a couple of large, planted *Banksia integrifolia* (Coast Banksia) a *Callistemon salignus* (Willow Bottlebrush) and a *Callistemon viminalis* (Weeping Bottlebrush).

This community does not meet the requirements to be allocated to a PCT as per Appendix D of the BAM and does not conform to a TEC under the BC Act and/or EPBC Act. It has been assessed against the streamlined assessment module for planted native vegetation as described in **Section 4.6**.

An example of Planted Natives is shown as **Photograph 5**.

**Photograph 5** Planted natives within the subject land





### 4.3.2. Exotics/Cleared

Other vegetation within the site consists of areas dominated by exotic species, comprising both plantings of trees and shrubs, and exotic pasture areas. Trees occurring include *Liquidambar styraciflua* (American Sweetgum), *Fraxinus sp.* and *Jacaranda mimosifolia* (Jacaranda). Shrub species include *Murraya paniculata* (Orange Jessamine). Exotic grass species present include *Axonopus fissifolius*, *Paspalum dilatatum*, *Juncus cognatus*, *Senecio madagascariensis*, and *Cenchrus clandestinus*.

Exotic vegetation does not require allocation to a PCT.

Examples of exotic vegetation are shown as **Photograph 6** and **Photograph 7**.

**Photograph 6 Exotic grassland within the subject land**





**Photograph 7 Exotic planted trees within the subject land**



#### 4.4. Threatened Ecological Communities

None of the vegetation within the subject land has been assessed as conforming to a TEC.

#### 4.5. Vegetation Integrity Assessment

The native vegetation identified within the subject land was assigned to a vegetation zone based on PCTs and broad condition state. Patch sizes were subsequently assigned for each vegetation zone. The extent of vegetation zones within the subject land is shown in **Figure 9**.

Each vegetation zone was assessed using BAM plots (see **Section 2.3.2**) to determine the vegetation integrity score. A summary of BAM plot data utilised within the BAM Calculator (BAM-C) to determine the vegetation integrity score is provided in **Appendix B**.

Vegetation zones, patch sizes and vegetation integrity scores for the subject land are summarised in **Table 6**.

**Table 6 Vegetation integrity of PCTs within the subject land**

Vegetation Zone	PCT #	PCT Name	Condition Name	Subject Land (ha)	Patch Size Class	Vegetation Integrity Score	Hollow-bearing Trees Present?
1	1619	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Good_shrubs - intact	0.96*	>100 ha	53.1 (Composition: 63.1 Structure: 52.1 Function: 45.4)	Yes
2	1619	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Good_shrubs -removed	0.71	>100 ha	52.7 (Composition: 69.1 Structure: 54.3 Function: 38.9)	Yes
3	1619	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Moderate	0.36	>100 ha	32.3 (Composition: 34.3 Structure: 39.9 Function: 24.6)	Yes
4	1619	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Low	0.50	>100 ha	26.0 (Composition: 24.0 Structure: 26.1 Function: 28.3)	Yes

*\*0.80 ha of this area is not within the development site footprint and will not be removed as part of the proposed development.*

## 4.6. Planted Native Vegetation

The decision-making key outlined in Section D.1 of Appendix D of the BAM provides a framework to determine whether the streamlined assessment module for planted native vegetation can be applied to a site.

Planted native vegetation is present in two small patches surrounding the residential dwelling in the middle of the subject land, as described in **Section 4.2.2. Table 7** below details the application of the decision-making key to the planted native vegetation in the subject land. It was determined that subsection 5 applies, as the relevant vegetation has been planted for windbreaks in an agricultural landscape.

**Table 7 Decision-making key to determine the application of the streamlined assessment module for planted native vegetation**

Assessment Criteria	Response/Action
1. Does the planted native vegetation occur within an area that contains a mosaic of planted and remnant native vegetation and which can be reasonably assigned to a PCT known to occur in the same IBRA subregion as the proposal?	ii. No..... Go to 2.
2. Is the planted native vegetation: a. planted for the purpose of environmental rehabilitation or restoration under an existing conservation obligation listed in BAM Section 11.9(2.), and  b. the primary objective was to replace or regenerate a plant community type or a threatened plant species population or its habitat?	ii. No..... Go to 3.
3. Is the planted/translocated native vegetation individuals of a threatened species or other native species planted/translocated for the purpose of providing threatened species habitat under one of the following: a. a species recovery project b. Saving our Species project c. other types of government funded restoration project d. condition of consent for a development approval that required those species to be planted or translocated for the purpose of providing threatened species habitat e. legal obligation as part of a condition or ruling of court. This includes regulatory directed or ordered remedial plantings (e.g. Remediation Order for clearing without consent issued under the BC Act or the Native Vegetation Act) f. ecological rehabilitation to re-establish a PCT or TEC that was, or is carried out under a mine operations plan, or g. approved vegetation management plan (e.g. as required as part of a Controlled Activity Approval for	ii. No..... Go to 4.



Assessment Criteria	Response/Action
works on waterfront land under the NSW Water Management Act 2000)?	
4. Was the planted native vegetation (including individuals of a threatened flora species) undertaken voluntarily for revegetation, environmental rehabilitation or restoration without a legal obligation to secure or provide for management of the native vegetation?	ii. No..... Go to 5.
5. Is the native vegetation (including individuals of a threatened flora species) planted for functional, aesthetic, horticultural or plantation forestry purposes? This includes examples such as: windbreaks in agricultural landscapes, roadside plantings (including street trees, median strips, roadside batters), landscaping in parks, gardens and sport fields/complexes, macadamia plantations or teatree farms?	<p>i. Yes</p> <p>The vegetation has been planted for a garden.</p> <p>Go to D.2 Assessment of planted native vegetation for threatened species habitat (the use of Chapters 4 and 5 of the BAM are not required to be applied).</p>
6. Is the planted native vegetation a species listed as a widely cultivated native species on a list approved by the Secretary of the Department (or an officer authorised by the Secretary)?	This list had not been released at the date of report preparation.
D.2 Assessment of planted Native Vegetation for Threatened Species Habitat.	See <b>Chapter 5</b> for assessment of threatened species habitats.
<p>The assessor must assess the suitability of the planted native vegetation for use by threatened species and record any incidental sightings or evidence (e.g. scats, stick nests) of threatened species credit species (flora and fauna) using, inhabiting or being part of the planted native vegetation.</p>	See <b>Chapter 7</b> and <b>Section 8.4</b> for impact avoidance and minimisation measures.
<p>If there is evidence that threatened species are using the planted native vegetation as habitat, the assessor must apply Section 8.4 of the BAM to mitigate and manage impacts on these species. Species credits are not required to offset the proposed impacts.</p>	
<p>The steps taken to assess threatened species habitat and all reasonable measures proposed to be taken to mitigate or minimise impacts must be set out in the BDAR or BCAR.</p>	

# 5. Threatened Species

## 5.1. Identifying Threatened Species for Assessment

The BAM-C generates a list of threatened species requiring assessment utilising several variables. The following criteria have been utilised to predict the threatened species requiring further assessment in the BAM-C:

- IBRA subregion: Wyong;
- Associated PCTs: 1619;
- Percent native vegetation cover in the assessment area: 40.9%;
- Patch size: >100 ha; and
- Credit type: Ecosystem and/or Species Credit species.

Based on the above variables, the BAM-C generated a list of 32 ecosystem credit species and 44 species credit species. These totals include 13 dual credit species which are considered as ecosystem credit species for their foraging habitat and as species credit species for their breeding habitat. Ecosystem credit species and species credit species are assessed further in **Section 5.2** and **Section 5.3**, respectively. Three (3) additional species credit species were added to the BAM-C list after this BCAR had been submitted to DPE and Council, these are addressed in **Section 5.3.3.1(ii)**.

## 5.2. Ecosystem Credit Species

### 5.2.1. Overview

**Table 8** lists the predicted ecosystem credit species for the vegetation zones within the subject land and whether they have been retained within the assessment following consideration of habitat constraints, geographic limitations, vagrancy and quality of microhabitats. All ecosystem species have been retained in the assessment. The highest sensitivity class of these species is "High Sensitivity to Potential Gain", which has subsequently been utilised by the BAM-C for the calculation of ecosystem credits.

### 5.2.2. Justification for Removal

No ecosystem credit species have been removed from the assessment, therefore no justification is provided.



**Table 8 Ecosystem credit species requiring further assessment**

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Relevant PCT	Relevant Vegetation Zone	Sensitivity to Gain	Retained in Assessment
<i>Ninox connivens</i>	Barking Owl (foraging)	V	-	1619	1, 2, 3, 4	High	Yes
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V	-	1619	1, 2, 3, 4	Moderate	Yes
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (eastern subspecies)	V	-	1619	1, 2, 3, 4	High	Yes
<i>Pseudomys gracilicaudatus</i>	Eastern Chestnut Mouse	V	-	1619	1, 2, 3, 4	High	Yes
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V	-	1619	1, 2, 3, 4	High	Yes
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	1619	1, 2, 3, 4	High	Yes

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Relevant PCT	Relevant Vegetation Zone	Sensitivity to Gain	Retained in Assessment
<i>Pandion cristatus</i>	Eastern Osprey (foraging)	V	-	1619	1, 2, 3, 4	Moderate	Yes
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (foraging)	V	-	1619	1, 2, 3, 4	Moderate	Yes
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo (foraging)	V	-	1619	1, 2, 3, 4	High	Yes
<i>Phoniscus papuensis</i>	Golden-tipped Bat	V	-	1619	1, 2, 3, 4	High	Yes
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	1619	1, 2, 3, 4	High	Yes
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V	-	1619	1, 2, 3, 4	Moderate	Yes
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (foraging)	V	V	1619	1, 2, 3, 4	High	Yes

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Relevant PCT	Relevant Vegetation Zone	Sensitivity to Gain	Retained in Assessment
<i>Phascolarctos cinereus</i>	Koala (foraging)	V	E	1619	1, 2, 3, 4	High	Yes
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat (foraging)	V	-	1619	1, 2, 3, 4	High	Yes
<i>Miniopterus australis</i>	Little Bent-winged Bat (foraging)	V	-	1619	1, 2, 3, 4	High	Yes
<i>Hieraaetus morphnoides</i>	Little Eagle (foraging)	V	-	1619	1, 2, 3, 4	Moderate	Yes
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	1619	1, 2, 3, 4	High	Yes
<i>Tyto novaehollandiae</i>	Masked Owl (foraging)	V	-	1619	1, 2, 3, 4	High	Yes
<i>Grantiella picta</i>	Painted Honeyeater	V	V	1619	1, 2, 3, 4	Moderate	Yes
<i>Ninox strenua</i>	Powerful Owl (foraging)	V	-	1619	1, 2, 3, 4	High	Yes
<i>Petroica boodang</i>	Scarlet Robin	V	-	1619	1, 2, 3, 4	Moderate	Yes

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Relevant PCT	Relevant Vegetation Zone	Sensitivity to Gain	Retained in Assessment
<i>Chthonicola sagittata</i>	Speckled Warbler	V	-	1619	1, 2, 3, 4	High	Yes
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	1619	1, 2, 3, 4	High	Yes
<i>Lophoictinia isura</i>	Square-tailed Kite (foraging)	V	-	1619	1, 2, 3, 4	Moderate	Yes
<i>Lathamus discolor</i>	Swift Parrot (foraging)	E	CE	1619	1, 2, 3, 4	Moderate	Yes
<i>Neophema pulchella</i>	Turquoise Parrot	V	-	1619	1, 2, 3, 4	High	Yes
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	1619	1, 2, 3, 4	Moderate	Yes
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (foraging)	V	-	1619	1, 2, 3, 4	High	Yes
<i>Hirundapus caudacutus</i>	White-throated Needletail	-	V	1619	1, 2, 3, 4	High	Yes
<i>Petaurus australis</i>	Yellow-bellied Glider	V	-	1619	1, 2, 3, 4	High	Yes

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Relevant PCT	Relevant Vegetation Zone	Sensitivity to Gain	Retained in Assessment
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	V	-	1619	1, 2, 3, 4	High	Yes

Key: CE=Critically Endangered, E=Endangered, EP=Endangered Population, V=Vulnerable

### 5.2.3. Presence of Ecosystem Credit Species

A number of ecosystem credit species, including some species credit species that have been located within the subject land, however these occurrences only meet the thresholds for assessment as ecosystem credit species. **Table 9** identifies threatened ecosystem credit species located within the subject land. The dual credit species that have been assessed as ecosystem credit species are addressed in **Section 5.3.3**.

**Table 9 Threatened ecosystem credit species occurrence within the subject land and development site footprint**

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Assessed as Ecosystem or Species Credit Species
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	Ecosystem Credit Species
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V	-	Ecosystem Credit Species
<i>Scoteanax rueppelli</i>	Greater Broad-nosed Bat	V	-	Ecosystem Credit Species

The occurrences of these species are discussed below.

#### 5.2.3.1. Microchiropteran Bats

All microchiropteran bats shown in **Table 9** were detected using ultrasonic call detection surveys undertaken in December 2021 (**Figure 11**). The Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat and Greater Broad-nosed Bat are all ecosystem credit species that have been retained in the assessment of ecosystem credits.

## 5.3. Species Credit Species

### 5.3.1. Overview

**Table 10** lists the flora and fauna species credit species predicted for the vegetation zones within the subject land, and whether they have been retained within the assessment following consideration of habitat constraints, geographic limitations, vagrancy and quality of microhabitats.

Justification is provided below this table for species that have been removed from the assessment in accordance with Steps 1-3 of Section 5.2 of the BAM. All species not removed from consideration (i.e. retained in the assessment) are by default candidate species credit species that require further assessment. Of the assessed predicted species, 35 have been retained for further assessment and nine removed from consideration.

**Table 10 Species credit species requiring further assessment**

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Relevant PCT	Relevant Vegetation Zone	Sensitivity to Gain	Retained in Assessment
<b>Flora</b>							
<i>Acacia bynoeana</i>	Bynoe's Wattle	E	V	1619	1, 2, 3, 4	High	Yes
<i>Angophora inopina</i>	Charmhaven Apple	V	V	1619	1, 2, 3, 4	High	Yes
<i>Asperula asthenes</i>	Trailing Woodruff	V	V	1619	1, 2, 3, 4	High	Yes
<i>Astrotricha crassifolia</i>	Thick-leaf Star-hair	V	V	1619	1, 2, 3, 4	Very High	Yes
<i>Callistemon linearifolius</i>	Netted Bottle Brush	V	-	1619	1, 2, 3, 4	Moderate	Yes
<i>Corunastylis sp. Charmhaven</i>		CE	CE	1619	1, 2, 3, 4	High	Yes
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	V	1619	1, 2, 3, 4	Moderate	Yes
<i>Diuris praecox</i>	Rough Doubletail	C	-	1619	1, 2, 3, 4	High	No
<i>Eucalyptus oblonga - endangered population</i>		EP	-	1619	1, 2, 3, 4	High	No
<i>Genoplesium insigne</i>	Variable Midge Orchid	CE	CE	1619	1, 2, 3, 4	High	Yes
<i>Grevillea parviflora subsp. parviflora</i>	Small-flower Grevillea	V	V	1619	1, 2, 3, 4	High	Yes
<i>Melaleuca groveana</i>	Grove's Paperbark	V	-	1619	1, 2, 3, 4	High	Yes

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Relevant PCT	Relevant Vegetation Zone	Sensitivity to Gain	Retained in Assessment
<i>Prostanthera askania</i>	Tranquility Mintbush	E	E	1619	1, 2, 3, 4	High	No
<i>Rutidosia heterogama</i>	Heath Wrinklewort	V	V	1619	1, 2, 3, 4	High	Yes
<i>Tetraloche glandulosa</i>		V	-	1619	1, 2, 3, 4	High	Yes
<i>Tetraloche juncea</i>	Black-eyed Susan	V	V	1619	1, 2, 3, 4	High	Yes
<b>Fauna</b>							
<i>Burhinus grallarius</i>	Bush Stone-curlew	E	-	1619	1, 2, 3, 4	High	Yes
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (breeding)	V	-	1619	1, 2, 3, 4	High	Yes
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo (breeding)	V	-	1619	1, 2, 3, 4	High	Yes
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	-	1619	1, 2, 3, 4	High	Yes
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	1619	1, 2, 3, 4	Very High	No



Scientific Name	Common Name	BC Act Status	EPBC Act Status	Relevant PCT	Relevant Vegetation Zone	Sensitivity to Gain	Retained in Assessment
<i>Crinia tinnula</i>	Wallum Froglet	V	-	1619	1, 2, 3, 4	Moderate	Yes
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (breeding)	V	-	1619	1, 2, 3, 4	High	Yes
<i>Hieraaetus morphnoides</i>	Little Eagle (breeding)	V	-	1619	1, 2, 3, 4	Moderate	Yes
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	V	-	1619	1, 2, 3, 4	High	Yes
<i>Lathamus discolor</i>	Swift Parrot (breeding)	E	CE	1619	1, 2, 3, 4	Moderate	No
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	1619	1, 2, 3, 4	High	Yes
<i>Litoria brevipalmata</i>	Green-thighed Frog	V	-	1619	1, 2, 3, 4	Moderate	Yes
<i>Lophoictinia isura</i>	Square-tailed Kite (breeding)	V	-	1619	1, 2, 3, 4	Moderate	Yes
<i>Miniopterus australis</i>	Little Bent-winged Bat (breeding)	V	-	1619	1, 2, 3, 4	Very High	No

Scientific Name	Common Name		BC Act Status	EPBC Act Status	Relevant PCT	Relevant Vegetation Zone	Sensitivity to Gain	Retained in Assessment
<i>Miniopterus orianae oceanensis</i>	Large Bat	Bent-winged	V	-	1619	1, 2, 3, 4	Very High	No
<i>Myotis macropus</i>	Southern Myotis		V	-	1619	1, 2, 3, 4	High	Yes
<i>Ninox connivens</i>	Barking (breeding)	Owl	V	-	1619	1, 2, 3, 4	High	Yes
<i>Ninox strenua</i>	Powerful (breeding)	Owl	V	-	1619	1, 2, 3, 4	High	Yes
<i>Pandion cristatus</i>	Eastern (breeding)	Osprey	V	-	1619	1, 2, 3, 4	Moderate	Yes
<i>Petauroides volans</i>	Greater Glider		-	V	1619	1, 2, 3, 4	High	Yes
<i>Petaurus norfolcensis</i>	Squirrel Glider		V	-	1619	1, 2, 3, 4	High	Yes

Scientific Name	Common Name		BC Act Status	EPBC Act Status	Relevant PCT	Relevant Vegetation Zone	Sensitivity to Gain	Retained in Assessment
<i>Petrogale penicillata</i>	Brush-tailed Wallaby	Rock	E	V	1619	1, 2, 3, 4	Very High	No
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale		V	-	1619	1, 2, 3, 4	High	Yes
<i>Phascolarctos cinereus</i>	Koala (breeding)		V	E	1619	1, 2, 3, 4	High	Yes
<i>Planigale maculata</i>	Common Planigale		V	-	1619	1, 2, 3, 4	High	Yes
<i>Pteropus poliocephalus</i>	Grey-headed Flying Fox (breeding)		V	V	1619	1, 2, 3, 4	High	No
<i>Tyto novaehollandiae</i>	Masked (breeding)	Owl	V	-	1619	1, 2, 3, 4	High	Yes
<i>Uperoleia mahonyi</i>	Mahony's Toadlet		E	-	1619	1, 2, 3, 4	High	Yes

Key: CE=Critically Endangered, E=Endangered, EP=Endangered Population, V=Vulnerable

### 5.3.2. Justification for Removal

Under Section 5.2.2 of the BAM, species credit species can be excluded from further assessment, and thereby from targeted surveys, if it is determined that none of the species-specific habitat constraints or geographic constraints are present within the subject land. Furthermore, under Section 5.2.3 of the BAM, a candidate species credit species can be considered unlikely to occur on the subject land (or specific vegetation zones) if after carrying out a field assessment, the assessor determines that the habitat is substantially degraded such that the species is unlikely to utilise the subject land (or specific vegetation zones).

Habitat assessments of the subject land were undertaken as described in **Section 2.4.1.1**. The habitat assessments focussed on habitat features relevant to species credit species predicted to occur. This included determining the presence/absence of the habitat constraints identified for the predicted threatened species and the condition of these habitat constraints and other microhabitats.

Although a number of species credit species had the potential to be removed based on degraded habitat, these species were retained in the assessment and surveyed due to the opportunity to do so while other targeted threatened fauna surveys were being undertaken.

The following threatened flora species were ruled out of consideration as candidate species credit species as the geographic constraints listed in the TBDC did not apply to the subject land. These are:

- *Diuris praecox* - Geographic limitation: Within the Parish boundaries of Newcastle, Kahibah, Wallarah, Tuggerah and Kincumber;
- *Eucalyptus oblonga* – *endangered population* - Geographic limitation: Bateau Bay, Forresters Beach and Tumbi Umbi areas in the Central Coast Council LGA; and
- *Prostanthera askania*: Geographic limitation: south of Wyong River in Central Coast LGA;

The following threatened fauna species were ruled out of consideration as candidate species credit species as the habitat constraints listed in the TBDC did not apply to the subject land. These are:

- Large-eared Pied Bat - Habitat Constraint: Cliffs and within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels;
- Swift Parrot - Habitat Constraint: Mapped areas;
- Little Bent-winged Bat - Habitat Constraint: Cliffs,, within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels;
- Large Bent-winged Bat - Habitat Constraint: Cliffs,, within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels;
- Brush-tailed Rock Wallaby - Habitat Constraint: Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliffines; and
- Grey-headed Flying-fox – Habitat Constraint: Breeding camps.

### 5.3.3. Presence of Candidate Species Credit Species

#### 5.3.3.1. Surveys

Thirty-five (35) predicted threatened species were assessed as candidate species credit species requiring further assessment (i.e. retained in assessment as per **Table 10**). Targeted threatened flora and fauna surveys were undertaken within the subject land as described in **Section 2.4** and **Section 2.5**, respectively. **Table 11** summarises the targeted species, survey dates and survey methods. As shown in this table, 34 species were surveyed within the recommended survey period. One species, *Tetratheca juncea*, was surveyed on 1 November 2021 while the survey period is from September to October. The targeted survey occurred within one day of the survey period at a time that was optimal for plant growth based on rainfall and temperature as shown in **Section 2.6** and it is considered this is appropriate to survey for the species.

#### i. Response to DPE Species Credit Species Comments

Following a first round of consultation, DPE has requested additional information on survey timing for *Genoplesium insigne* and inclusion of *Thelymitra adorata* (Wyong Sun Orchid). The request for information and the response provided has been included below.

DPE Comment: *"Genoplesium insigne surveys should be completed between September to early October and, if not located, the TBDC requires a second survey period in mid-Oct to Nov. Please explain why these surveys are not compliant with the TBDC. If inadequate justification is provided additional surveys may be required."*

This species was surveyed on 1 November 2021 which is consistent with the survey period outlined in the BAM-C and TBDC. Additionally, an initial survey was completed on 18 August 2021, that is within two weeks of the September survey period. 2021 included ideal conditions for orchid growth, as observed throughout the site surveys and the species would have been detected if it were present. No *Genoplesium* species of any kind were recorded within the subject land in the multiple targeted surveys; and therefore, the species could not be misidentified.

This species was also surveyed for by AEP (2019) and was not found during targeted surveys during the flowering period. Similarly, on the school site adjacent to the west of the subject land that contained the same forest type as the subject land, targeted surveys in 2018 by Kleinfelder (2019) did not locate the species.

It is concluded that sufficient information exists to indicate that the species is unlikely to occur on the subject land.

DPE Comment: *"Thelymitra adorata, should be surveyed for in accordance with the TBDC."*

This species is not a candidate species credit species as predicted by the BAM-C and there are no previous records of this species on the subject land (Anderson Environment & Planning 2016) and BioNet records (EES 2022). As per Section 3.1 of the guideline *Surveying Threatened Plants and their Habitats: NSW Survey Guide for the Biodiversity Assessment Method*, species are only required to be considered as a candidate species credit species and subject to targeted threatened surveys if they are one of the species predicted by the BAM-C or there is a previous record of the species on the subject land. Neither of these apply to *Thelymitra adorata* for the subject land.

It is noted:

*"the BAM-C generates a list of threatened species that require targeted survey. The assessor can manually apply any relevant geographic limitations, which are based on information from the Threatened Species Profile website. Additionally, if there are past records of a threatened species on the subject land it must be included in the candidate species list."*

The TBDC lists PCTs that the species can be associated with and one of these is PCT 1619. This is the forest community that occurs on the subject land. However, we have done a detailed analysis of literature about the species habitat, all the existing BioNet records for the species, soils and geology where the species has been previously found. We conclude that the species typically and almost exclusively occurs in other types of forest with more fertile soils and a grassy understorey. This is explained in detail as follows:

To further elucidate the likelihood of occurrence of this species, Cumberland Ecology reviewed the habitat requirements and compared it to the habitats on site. All known BioNet records for the species were acquired and mapped. Descriptions of habitats in BioNet were also compared to geology, soils and other information from the following sites:

*Vegetation Types:* [https://datasets.seed.nsw.gov.au/dataset/vegetation-of-gosford-and-lake-macquarie-1-100-000-vegetation-map-sheet-vis\\_id-23455f9a3](https://datasets.seed.nsw.gov.au/dataset/vegetation-of-gosford-and-lake-macquarie-1-100-000-vegetation-map-sheet-vis_id-23455f9a3)

*Soil Landscapes:* <https://datasets.seed.nsw.gov.au/dataset/soil-landscapes-of-the-gosford-lake-macquarie-1-100000-sheets9ac92>.

*Geology:* <https://datasets.seed.nsw.gov.au/dataset/nsw-seamless-geology>

According to the final determination for this species (NSW Scientific Committee 2008):

- " 6. *The species occurs from 10-40 m a.s.l. in woodland with grassy understorey in well-drained clay loam or shale derived soils. The vegetation type in which the majority of populations occur (including the largest colony) has been described regionally (Bell 2002) as Dooralong Spotted Gum - Ironbark Forest, with an estimated pre-1760 local extent of about 4736 ha, and a local extent of 2215 ha in 2002, a decline of about 53%. Typical composition of the community, in areas where the orchid is known to occur, is an overstorey of Corymbia maculata and Eucalyptus paniculata, with an open to dense shrub layer of Melaleuca nodosa over a grass/herb ground layer. Bell et al. (2005) note that 'This vegetation type is highly fragmented within Wyong Shire ... most is in private ownership. Less than 2200 ha of this vegetation type remains within Wyong Shire (Bell 2002)'. B. Branwhite (in litt.) states that the specific habitat of known sites of this Thelymitra involve a correlation of this vegetation type (or its disturbed remnants) with Patonga Claystone, and that this combination is 'only to be found in a small fraction of the total map unit hectares'.*
- 7. *Some reports suggest that the species may also occur within the margin of two other vegetation types where these adjoin or constitute portions of the remnant vegetation areas in which the orchid has been recorded. Alluvial Redgum Footslopes Forest (Bell 2002) adjoins Dooralong Spotted Gum - Ironbark Forest at one population and may constitute habitat for the species. Alluvial Floodplain Shrub Swamp Forest (Bell 2002) also adjoins Dooralong Spotted Gum - Ironbark Forest at one extant population with a report of a small*

*orchid colony on the margin (B. Branwhite pers. comm.), and one apparently extinct population occurred in vegetation probably assignable to this type near Warnervale."*

According to the approved conservation advice for the Commonwealth Department of Agriculture, Water and Energy (DAWE 2014):

- *"The Wyong sun orchid occurs in areas 10-40 m above sea level, in woodland with grassy understorey, or occasionally derived grassland, in well-drained clay loam or shale derived soils. The vegetation type in which the majority of populations occur has been described as Dooralong Spotted Gum - Ironbark Forest. The typical composition of this habitat is an overstorey of Corymbia maculata and Eucalyptus paniculata, with an open to dense shrub layer of Melaleuca nodosa over a diverse grass/herb ground layer. This type of habitat is highly fragmented within Wyong, and less than 2200 ha remains within the shire. The Wyong sun orchid may also be found within two other habitat types - the Alluvial Redgum Footslopes Forest and Alluvial Floodplain Shrub Swamp Forest – where these habitat types adjoin the habitat in which the species is usually recorded (Bell, 2002)."*

In his recently revised Orchids of Australia, Jones (2020) describes the habitat as *"growing in woodland dominated by spotted gum and ironbarks with groundcover of kangaroo grass in freely draining loam and shale."*

Neither the soil habitats nor the vegetation habitats that the species is typically found in occur on the subject land:

- **Soils:** **Figure 10** shows the known locations for *Thelymitra adorata* versus geology. Cumberland Ecology has mapped all the BioNet records for this orchid species and, although the records appear denatured, they are predominantly on Wyong soil landscapes, or perhaps edge of Wyong landscapes draining off Gorokan soil landscapes. The pattern of occurrences is consistent with the habitat descriptions in the final determination and the approved conservation advice reproduced above. As shown in the figure, the subject site is on Gorokan soil landscape, which has sandy surface soils that are not consistent with the habitat descriptions above. As the site of interest is on Gorokan, from a mapping and TS soil description standpoint, it seems unlikely that the Wyong Sun Orchid would be present on the site.
- **Vegetation:** As set out in **Chapter 4**, none of the typical forest habitat in which the orchid has been found comprises Dooralong Spotted Gum - Ironbark Forest. The typical composition of that vegetation is an overstorey of *Corymbia maculata* and *Eucalyptus paniculata*, with an open to dense shrub layer of *Melaleuca nodosa* over a diverse grass/herb ground layer. The native woodland vegetation on the subject land comprises PCT 1619: Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands. It is not a grassy woodland of the type that has been found to support the *Thelymitra adorata*.

Nevertheless, the survey period is listed in the TBDC as September to October and the species was surveyed for by Cumberland Ecology on 1 November 2021, within a day of the given survey period and on a warm sunny day and this would be considered appropriate for survey of the species. The BioNet database contains 285 records of the species, many of which are recurrent records from the same sites. Of these 7% have been detected within November, indicating that it is possible to detect the species at this time. As 2021 was a wet year with prolific spring flowering of orchids, it is likely to have been detectable if present. The difference of

one day beyond the recommended period is unlikely to have made a material difference to the results of the survey.

AEP (2016) conducted an earlier survey and reported: “No sign of this species during fieldwork, including targeted surveys during the flowering period. No previous records on site or within the locality.” Similarly, on the school site adjacent to the west of the subject land that contained the same forest type as the subject land, targeted surveys in 2018 by Kleinfelder (2019) did not locate the species.

It is concluded that sufficient information exists to indicate that the species is unlikely to occur on the subject land.

## ii. Additional Species Credit Species Following Council Consultation

Following the Council consultation period, the BAM-C was reopened to add in the assumed presence of the Squirrel Glider and calculate the required credit liability for this species. Once reopened, the BAM-C showed that three additional candidate species credit species have been added for consideration (i.e. after this BCAR had been submitted to DPE and Council). These are:

- *Eucalyptus camfieldii* (Camfield’s Stringybark);
- *Rhizanthella slateri* (Eastern Australian Underground Orchid); and
- *Thelymitra adorata* (Wyang Sun Orchid).

*Eucalyptus camfieldii* is listed as vulnerable under both the BC Act and the EPBC Act. This species can be surveyed year-round and is identifiable by epicormic growth or juvenile foliage. This is a conspicuous species that would have been readily identified within the subject land during the multiple targeted threatened flora surveys conducted were it to be present. The habitat for this species is generally ‘shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges’ (DPE 2022). The habitat within the subject land is not consistent with this description and the species and therefore this species has been excluded from consideration based on Section 5.2.3 of the BAM, where a candidate species credit species can be considered unlikely to occur on the subject land (or specific vegetation zones) if after carrying out a field assessment, the assessor determines that the habitat is substantially degraded such that the species is unlikely to utilise the subject land.

*Rhizanthella slateri* is listed as vulnerable under the BC Act and endangered under the EPBC Act. This species can be surveyed between September to November and is identifiable by buds, flowers and/or fruit. In NSW it is currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman’s Ferry area, Agnes Banks and near Nowra (DPE 2022). *Rhizanthella slateri* occurs in a wide range of sclerophyll habitats in coastal NSW. There is no clear link to a particular PCT type, or plant species within it, so vegetation type is only a very broad guide for habitat suitability. However, literature review of the other habitat information indicates that *Rhizanthella slateri*:

- Occurs in shallow to deep loams (Botanic Gardens Trust 2021);
- Occurs in areas of reliable high rainfall ~ 1350 mm or more (Jones 2020);



- Relies on black wallabies, bandicoots and birds like choughs to eat fruits and disperse seeds (Jones 2020); and
- Occurs in areas that generally have deep leaf litter (DoE 2014).

The habitat on within the development site footprint does not have these features based on:

- Soil surveys by the soils expert Greg Chapman (2022) found the subject land does not have loams in the woodland patch in the proposed development site footprint;
- Analysis of rainfall records indicates that the site receives an average of 900 mm rainfall, significantly less than 1350 mm rainfall referred to by Jones (2020). Rainfall records for the nearest weather station indicate that the rainfall is quite variable, not reliable.
- The seed vector animals referred to by Clements (2012), Jones (2020) and OEH (2019, DPE 2022) - black wallabies, bandicoots and choughs - are absent from the subject land based upon surveys for the BCAR, and on surveys of adjacent sites (Kleinfelder 2019).
- BAM plot 1 for the BCAR, completed in the woodland within the proposed development site footprint, shows leaf litter is patchy, with an average cover of 52%. Leaf litter is generally neither deep nor continuous.

Additionally, the subject land has been horse grazed for many years and there are no other records within the literature of these orchids occurring within horse or cattle grazed properties. Finally, the closest records for the species are not close but are approximately 40 km away from the subject land.

Therefore, it is considered unlikely the species would occur and it has been excluded from consideration based on Section 5.2.3 of the BAM, as the habitat is substantially degraded such that the species is unlikely to utilise the subject land.

*Thelymitra adorata* has been addressed as per the response to DPE comment provided in **Section 5.3.3.1(i)** above, and has also been excluded from consideration based on Section 5.2.3 of the BAM.

**Table 11 Threatened flora survey dates and methods**

Scientific Name	Common Name	Survey Period	Dates of Survey within Subject Land	Survey Method
<b>Flora</b>				
<i>Acacia bynoeana</i>	Bynoe's Wattle	Year round	25/06/2021, 18/08/2021, 1/11/2021, 10/11/2021, 29/12/2021	Random meander, plot survey, parallel field traverses
<i>Angophora inopina</i>	Charmhaven Apple	Year round	25/06/2021, 18/08/2021, 1/11/2021, 10/11/2021, 29/12/2021	Random meander, plot survey, parallel field traverses
<i>Asperula asthenes</i>	Trailing Woodruff	Oct - Dec	1/11/2021, 10/11/2021, 29/12/2021	Parallel field traverses

Scientific Name	Common Name	Survey Period	Dates of Survey within Subject Land	Survey Method
<i>Astrotricha crassifolia</i>	Thick-leaf Star-hair	Jul - Dec	18/08/2021, 1/11/2021, 10/11/2021, 29/12/2021	Parallel field traverses
<i>Callistemon linearifolius</i>	Netted Bottle Brush	Oct - Jan	1/11/2021, 10/11/2021, 29/12/2021	Parallel field traverses
<i>Corunastylis sp. Charmhaven</i>		Nov - Apr	1/11/2021, 10/11/2021, 29/12/2021	Parallel field traverses
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	Nov - Jan	1/11/2021, 10/11/2021, 29/12/2021	Parallel field traverses
<i>Genoplesium insigne</i>	Variable Midge Orchid	Sep - Nov	1/11/2021, 10/11/2021	Parallel field traverses
<i>Grevillea parviflora subsp. parviflora</i>	Small-flower Grevillea	Aug - Nov	18/08/2021, 1/11/2021, 10/11/2021	Parallel field traverses
<i>Melaleuca groveana</i>	Grove's Paperbark	Year round	25/06/2021, 18/08/2021, 1/11/2021, 10/11/2021, 29/12/2021	Random meander, plot survey, parallel field traverses
<i>Rutidosia heterogama</i>	Heath Wrinklewort	Year round	25/06/2021, 18/08/2021, 1/11/2021, 10/11/2021, 29/12/2021	Random meander, plot survey, parallel field traverses
<i>Tetradlea glandulosa</i>		Aug - Nov	18/08/2021, 1/11/2021, 10/11/2021	Parallel field traverses
<i>Tetradlea juncea</i>	Black-eyed Susan	Sep - Oct	1/11/2021, 10/11/2021	Parallel field traverses
<b>Fauna</b>				
<i>Burhinus grallarius</i>	Bush Stone-curlew	Year Round	25/06/2021, 9/08/2021 - 13/08/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021	Habitat assessment, nocturnal spotlighting and call-playback
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	Oct - Jan	25/06/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021	Habitat assessment, diurnal bird survey
<i>Calyptorhynchus lathamii</i>	Glossy Black-Cockatoo	Jan - Sep	25/06/2021, 9/08/2021 - 13/08/2021	Habitat assessment, diurnal bird survey
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	Oct - Mar	25/06/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021, 16/12/2021 - 18/01/2021 (IR cameras)	Habitat assessment, nocturnal spotlighting and call-playback, nest box monitoring, IR cameras, roost watches

Scientific Name	Common Name	Survey Period	Dates of Survey within Subject Land	Survey Method
<i>Crinia tinnula</i>	Wallum Froglet	Year Round	25/06/2021, 9/08/2021 - 13/08/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021	Habitat assessment, amphibian survey
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Jul - Dec	25/06/2021, 9/08/2021 - 13/08/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021	Habitat assessment, diurnal bird survey
<i>Hieraaetus morphnoides</i>	Little Eagle	Aug - Oct	25/06/2021, 9/08/2021 - 13/08/2021	Habitat assessment, diurnal bird survey
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	Nov - Mar	25/06/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021	Habitat assessment, reptile survey
<i>Litoria aurea</i>	Green and Golden Bell Frog	Nov - Mar	25/06/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021	Habitat assessment, amphibian survey
<i>Litoria brevipalmata</i>	Green-thighed Frog	Oct - Mar	25/06/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021	Habitat assessment, amphibian survey
<i>Lophoictinia isura</i>	Square-tailed Kite	Sep - Jan	25/06/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021	Habitat assessment, diurnal bird survey
<i>Myotis macropus</i>	Southern Myotis	Oct - Mar	16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021	Habitat assessment, harp trapping, roost watches, ultrasonic call detection
<i>Ninox connivens</i>	Barking Owl	May - Dec	25/06/2021, 09/08/2021 - 13/08/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021	Habitat assessment, nocturnal spotlighting and call-playback, roost watches
<i>Ninox strenua</i>	Powerful Owl	May - Aug	25/06/2021, 09/08/2021 - 13/08/2021	Habitat assessment, nocturnal spotlighting and call-playback, roost watches

Scientific Name	Common Name	Survey Period	Dates of Survey within Subject Land	Survey Method
<i>Pandion cristatus</i>	Eastern Osprey	Apr - Nov	25/06/2021, 09/08/2021 - 13/08/2021	Habitat assessment, diurnal bird survey
<i>Petauroides volans</i>	Greater Glider	Year Round	25/06/2021, 9/08/2021 - 13/08/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021, 16/12/2021 - 18/01/2021 (IR cameras)	Habitat assessment, nocturnal spotlighting and call-playback, IR cameras, Elliott trapping, roost watches
<i>Petaurus norfolcensis</i>	Squirrel Glider	Year Round	25/06/2021, 9/08/2021 - 13/08/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021, 16/12/2021 - 18/01/2021 (IR cameras)	Habitat assessment, nocturnal spotlighting and call-playback, IR cameras, Elliott trapping, roost watches
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Dec - Jun	25/06/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021, 16/12/2021 - 18/01/2021 (IR cameras)	Habitat assessment, nocturnal spotlighting and call-playback, IR cameras, Elliott trapping, roost watches
<i>Phascolarctos cinereus</i>	Koala	Year Round	25/06/2021, 9/08/2021 - 13/08/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021	Habitat assessment, nocturnal spotlighting and call-playback, SAT surveys
<i>Planigale maculata</i>	Common Planigale	Year Round	25/06/2021, 9/08/2021 - 13/08/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021	Habitat assessment, pitfall trapping
<i>Tyto novaehollandiae</i>	Masked Owl	May - Aug	25/06/2021, 9/08/2021 - 13/08/2021	Habitat assessment, nocturnal spotlighting and call-playback, roost watches
<i>Uperoleia mahonyi</i>	Mahony's Toadlet	Oct - Mar	25/06/2021, 16/12/2021 - 17/12/2021, 19/12/2021 - 22/12/2021	Habitat assessment, amphibian survey

### 5.3.3.2. Expert Report

This assessment has not used any expert reports.

### 5.3.3.3. Candidate Species Occurrence

A total flora species list and fauna species list for the study area is provided in **Appendix C** and **Appendix D**, respectively.

A number of dual credit species have been located within the subject land, however these occurrences only meet the thresholds for assessment as ecosystem credit species. Additionally, one flora species credit species, *Callistemon linearifolius* (Netted Bottle Brush) was recorded within the subject land, however its occurrence is restricted to the proposed 50 m wildlife corridor to be retained. One fauna species credit species, the Southern Myotis (*Myotis macropus*) was recorded as a likely occurrence within the subject land based on ultrasonic detection. Although acoustic detection and interpretation of bat call analysis is not always infallible and the Southern Myotis call detection is difficult to distinguish from *Nyctophilus* species, based on the suitability of the habitat and the location of the acoustic detection devices near waterbodies, the species is likely to occur within the subject land and has been assessed as a species credit species.

*Cryptostylis hunteriana* has previously been tentatively identified in the proposed 50 m wildlife corridor by AEP in 2016. The location of these records are shown in **Figure 5**. Subsequent surveys by AEP during the TBDC survey period were conducted by AEP in November 2019 and by Cumberland Ecology in November and December 2021 as described in **Section 2.4**. Neither of these surveys recorded the species, though it is noted that 2019 was a drought year and so the re-survey results for 2019 were also inconclusive. However, in 2021 despite good rainfall during spring, the species was not found. The non-threatened congeneric species *Cryptostylis erecta*, and *Cryptostylis subulata* were found in the north-eastern corner of the subject land and the southern strip of land proposed for conservation. Nevertheless, the 2016 tentative recording of the species is within an area proposed to be avoided and retained for conservation in the long-term as part of the proposed development and therefore the species is not considered further as a species credit species.

The Squirrel Glider has been recorded to the west of the Porters Creek Public School in 2016 (Consulting 2020). Targeted surveys were undertaken in accordance with the TBDC but did not find any Squirrel Gliders. This result is consistent with survey results for other nearby sites since 2016. For example, Kleinfelder (2019) conducted TBDC-compliant surveys for Squirrel Glider in the same forest habitat as the subject land in the site immediately to the west and found no Squirrel Gliders or any other species credit species.

Development to the south, east and west of the subject land have occurred in recent years and these developments have reduced potential connectivity of Squirrel Glider habitats around the subject land. Warnervale Road remains as somewhat of a barrier to glider movement to the north. The proposed conservation area links westward and eastward to other similar habitats that will be retained as conservation areas and which will maintain a corridor of potential habitat for the species in the long term. The proposed conservation area contains the forested areas with the most intact and diverse understorey. It also contains hollow trees. The number of hollows will be augmented by the addition of nest boxes, focussing on nest boxes for Squirrel Glider and microchiropteran bats.

Despite the lack of recent records for Squirrel Glider, to take a precautionary approach and also address Council comments about the species, the Squirrel Glider has been assumed present within the woodland vegetation in the subject land and included as a species credit species within this BCAR.

**Table 12** identifies threatened species credit species located within the subject land.

**Table 12 Threatened species credit species occurrence within the subject land and development site footprint**

Scientific Name	Common Name	BC Act Status	EPBC Status	Act	Assessed as Ecosystem or Species Credit Species
<b>Flora</b>					
<i>Callistemon linearifolius</i>	Netted Bottle Brush	V	-		Species Credit Species
<b>Fauna</b>					
<i>Ninox strenua</i>	Powerful Owl	V	-		Ecosystem Species Credit Species
<i>Miniopterus australis</i>	Little Bent-winged Bat	V	-		Ecosystem Species Credit Species
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	-		Ecosystem Species Credit Species
<i>Myotis macropus</i>	Southern Myotis	V	-		Species Credit Species
<b><i>Petaurus norfolcensis</i></b>	Squirrel Glider	V	-		Species Credit Species

The occurrences of these species are discussed below.

#### 5.3.3.4. *Callistemon linearifolius*

*Callistemon linearifolius* was recorded within the subject land as three individual plants (**Figure 11**). All three individuals were recorded towards the southern boundary of the proposed 50 metre wildlife and were not recorded within the development site footprint. This species is assessed using the count of the species in the TBDC, and as there will be no removal of individuals of this species, it has not been assessed further for direct impacts or species credits calculated. The 30m species polygon for the species encroaches into the development site footprint as shown in **Figure 12**. While no individuals will be removed and no species credit generated, the encroachment may represent an indirect impact is assessed further in **Section 8.3**. A photograph of *Callistemon linearifolius* is shown in **Photograph 8**.



**Photograph 8** *Callistemon linearifolius* within the wildlife corridor



#### **5.3.3.5. Powerful Owl**

The Powerful Owl was recorded within the subject land in August 2021 during targeted threatened species surveys (**Figure 11**). A calling Powerful Owl was heard in the distance to the east of the subject land during spotlighting and call playback surveys. Call playback of a recording of the Powerful Owl call was employed and an individual flew into the subject land after approximately half an hour. The Powerful Owl is likely to use the subject land for foraging purposes, however it is not breeding within the subject land based on the results of the targeted surveys. Accordingly, as this species is a dual credit species and an ecosystem credit species for the foraging component, it has been assessed as an ecosystem credit species only and is not further assessed as a species credit species. A photograph of the Powerful Owl is shown as **Photograph 9**.

**Photograph 9 Powerful Owl within the subject land**



#### **5.3.3.6. Little Bent-winged Bat**

The Little Bent-winged Bat is a dual credit species and the TBDC notes the habitat constraint for the presence of breeding habitat as *"Caves, tunnels, mines, culverts or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature."* The subject land does not include any potential breeding habitat for the Little Bent-winged Bbat and this species has been assessed as an ecosystem credit species only.

#### **5.3.3.7. Large Bent-winged Bat**

The Large Bent-winged Bat is a dual credit species and the TBDC notes the habitat constraint for the presence of breeding habitat as *"Caves, tunnels, mines, culverts or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature."* The subject land does not include any potential breeding habitat for the Large Bent-winged Bat and this species has been assessed as an ecosystem credit species only.



### 5.3.3.8. Southern Myotis

The Southern Myotis was likely recorded within the development site footprint on the two ultrasonic detection devices in December 2021. Within the Balance! Environmental report detailing the results of the ultrasonic call detection survey (**Appendix E**), it was noted that:

*"Eight calls belonged to either Myotis macropus or a Nyctophilus species (N. geoffroyi and N. gouldi may both be present in the study area). Since the detectors were deployed near water bodies, it is highly probable that most these calls were from M. macropus; however, none displayed the species' definitive foraging call characteristics (pulses with a single point of inflection about half-way down the frequency sweep and with variable slope and inter-pulse intervals)."*

Habitat for the Southern Myotis is listed in the TBDC as *"Hollow-bearing trees within 200m of a riparian zone or bridges caves or artificial structures within 200m of riparian zones or waterbodies that include creeks, billabongs, lagoons, dams and other waterbodies on or within 200m of the site"*. Within the document 'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method (OEH, 2018), the habitat for the Southern Myotis is stated as *"The range of PCTs associated with the species (as per the TBDC) within 200 meters of any medium to large permanent creeks, rivers, lakes or other waterways (i.e. with pools/ stretches 3m or wider)"*.

Given the farm dam within the subject land is a waterbody 3m or wider, and that hollow-bearing trees occur within the surrounding woodland, the habitat within the subject land is suitable for the species and it has been assessed as species credit species.

### 5.3.3.9. Squirrel Glider

As described in **Section 5.3.3.3** above, the Squirrel Glider has not been recorded within the subject land despite targeted surveys being conducted for the species. The Squirrel Glider has been assumed present to address Council and DPE comments and is subsequently included as a species credit species within this BCAR.

### 5.3.3.10. Other Microchiropteran Bats

The Balance! Environmental report detailing the results of the ultrasonic call detection survey (**Appendix E**), noted the potential occurrence of the Eastern Cave Bat (*Vespadelus troughtoni*), however it's call could not reliably be assigned to the species. The Eastern Cave Bat is a cave-dwelling species credit species that's habitat constraint within the TBDC is noted as *"Caves, and within 2 km of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within 2 km of old mines, tunnels, old buildings or sheds"*. The subject land does not occur within 2 km of suitable habitat for the species and it is not associated with PCT 1619 within the BAM Calculator. As such, the species has not been reliably determined to occur within the subject land and is not assessed further as a species credit species.

## 5.3.4. Extent of Habitat

### 5.3.4.1. Southern Myotis

The Southern Myotis has been recorded as likely present within the subject land based on the results of targeted surveys. Accordingly, all woodland vegetation zones within 200 m of the farm dam within the subject

land have been included within the species polygon (**Figure 12**). This equates to 1.72 ha of habitat within the development site footprint for the Southern Myotis. This species has a Biodiversity Risk Weighting of 2.

The vegetation zones and areas that comprise the extent of habitat for the Southern Myotis are shown in **Table 13**.

**Table 13 Details of species polygon for the Southern Myotis**

Species Credit Species	Vegetation Zone	Habitat Condition (Vegetation Integrity) Loss	Approximate Area of Habitat Lost (ha)
Southern Myotis	1619_Good_shrubs-intact	53.1	0.16
	1619_Good_shrubs-removed	52.7	0.71
	1619_Moderate	32.3	0.36
	1619_Low	26.0	0.50

#### 5.3.4.2. Squirrel Glider

The Squirrel Glider has been assumed present within the subject land. Accordingly, all woodland vegetation within the subject land has been included within the species polygon (**Figure 12**). This equates to 1.72 ha of habitat within the development site footprint for the Squirrel Glider. This species has a Biodiversity Risk Weighting of 2.

The vegetation zones and areas that comprise the extent of habitat for the Squirrel Glider are shown in **Table 14**.

**Table 14 Details of species polygon for the Squirrel Glider**

Species Credit Species	Vegetation Zone	Habitat Condition (Vegetation Integrity) Loss	Approximate Area of Habitat Lost (ha)
Squirrel Glider	1619_Good_shrubs-intact	53.1	0.16
	1619_Good_shrubs-removed	52.7	0.71
	1619_Moderate	32.3	0.36
	1619_Low	26.0	0.50

# 6. Prescribed Impacts

## 6.1. Prescribed Impacts

Prescribed impacts are identified in Clause 6.1 of the *Biodiversity Conservation Regulation 2017*. Prescribed impacts are those that are additional to the clearing of native vegetation and associated habitat. These include:

- Development on the habitat of threatened species or ecological communities associated with:
  - karst, caves, crevices, cliffs, rock outcrops and other geological features of significance;
  - human-made structures;
  - non-native vegetation;
- Development on areas connecting threatened species habitat, such as movement corridors;
- Development on water quality, water bodies and hydrological processes that sustain threatened species and TECs (including from subsidence or “upsidence” from underground mining);
- Wind turbine strikes on threatened and protected animals; and
- Vehicle strikes on threatened species or on animals that are part of a TEC.

An assessment of the relevance of these prescribed impacts to the project is provided in **Table 15**. The location of prescribed impacts is shown in **Figure 13**.

**Table 15 Relevance of prescribed impacts**

Prescribed Impact	Relevance to the Project
Karst, caves, crevices, cliffs, rock outcrops and other geological features of significance	No karsts, caves, crevices, cliffs or areas of geological significance have been identified within the subject land. Prescribed impact not relevant.
Human-made structures	The residential dwelling and shed within the development site footprint will be demolished as part of the proposed development. These have the potential to be roosting habitat for some microchiropteran bats or bird species. Impacts to human-made structures would occur during the construction phase of the project and result in a long-term impact.
Non-native vegetation	Non-native vegetation occurring within the development site footprint comprises areas of exotic grassland and exotic planted garden species within the Exotics/Cleared vegetation community. This vegetation may provide some low-value habitat for native fauna species, including threatened birds and bats, on occasion. Impacts to non-native vegetation would occur during the construction phase of the project and result in a long-term impact.
Habitat connectivity	The development site footprint contains native vegetation that connects to other retained native vegetation in the surrounding properties. The proposed development will not fragment or break the connectivity but will result in a reduction to the area of the native vegetation patch as a whole.



Prescribed Impact	Relevance to the Project
Waterbodies, water quality and hydrological processes	The eastern farm dam and drainage line within the development site footprint will be filled in as part of the proposed development. The removal of these has the potential to eliminate a water source that the ecosystem credit threatened fauna species may utilise from time to time. It is not considered removal of one farm dam would impact on retained native vegetation occurrence in the surrounding area. Surface runoff from the proposed development will be minor and will be managed through a Stormwater Management Plan. The impacts to the water bodies will occur during the construction phase of the project and will be long-term.
Wind farm developments	Not relevant. The project does not comprise a wind farm development
Vehicle strikes	Vehicle strikes would be limited to potential threatened fauna impacts to ecosystem credit species. Access to the proposed development will be through driveways and several roads to be constructed. Vehicle movement would be at low speed as vehicles enter the development from Warnervale Road. Most threatened species with potential to be impacted are arboreal and would largely be active in the canopy, such that interactions with vehicles on the driveways and roads are unlikely. Most threatened microbat species are active at night, when there would be very limited vehicle traffic. Vehicle strike impacts could also take place during construction but would be very limited as construction would take place during daylight when fauna are unlikely to be active, and construction noise would likely keep fauna away. As such vehicle strike impacts to threatened fauna species are likely to be a very rare occurrence.

# 7. Avoid and Minimise Impacts

This section includes demonstration of efforts to avoid and minimise impacts on biodiversity values identified within the subject land, which includes assessment of direct, indirect and prescribed impacts. The subject land includes the area to be completely cleared for the proposed development (the development footprint).

## 7.1. Avoid and Minimise Direct and Indirect Impacts on Native Vegetation and Habitat

Under the BAM, measures taken to avoid and minimise impacts on biodiversity values from the development need to be documented. As described in previous chapters of this BCAR, the subject land contains native vegetation that was prioritised for retention in the proposed development.

### 7.1.1. Project Location

The development site footprint has been situated within the subject land to allow for the construction and operational requirements of the project while minimising impacts to areas containing biodiversity values. In determining the location of the development site footprint, the project has sought to avoid and minimise direct impacts on native vegetation and habitat by:

- Locating the project within areas currently comprising exotic vegetation and cleared land where possible;
- Locating the project to retain the area of highest quality vegetation within the subject land in the proposed wildlife corridor as shown by the vegetation integrity scores in **Section 4.5**;
- Locating the project to the north to ensure the wildlife corridor maximum width and connectivity is achieved through integration with the 50 m retained corridor of the AV Jennings site to the south and the Porters Creek Public School 66 m corridor to the east, thus ensuring a minimum retained habitat corridor of 100 m width; and
- Locating the project to avoid impacts on the threatened flora species *Callistemon linearifolius*.

An original project layout was proposed the development (**Figure 14**) did not include the retention of the proposed 50 m wildlife corridor. Following identification of the importance of the wildlife corridor area by Cumberland Ecology, the client re-designed the project to retain the area and provide a wildlife corridor consistent with those in the recently approved surrounding developments.

### 7.1.2. Project Design

In determining the design of the development footprint, the project has sought to avoid and minimise direct impacts on native vegetation and habitat by:

- Avoidance of the native vegetation where possible, particularly the entirety of the 50 m wildlife corridor;
- Minimising impacts to native vegetation by placing the development footprint within exotic vegetation and cleared areas where possible;
- Designing the rear road to include part of the proposed APZ and setting back the dwelling pad for these lots to allow the APZ to occur wholly outside of the 50 m wildlife corridor;

- Limiting the construction footprint of earthworks to comprise only the operational footprint area surrounding the project to reduce removal of native vegetation; and
- Minimise impacts to biodiversity through the implementation of a suite of mitigation measures, including weed management, tree protection measures and clearing protocols.

A summary of the avoidance and minimising measures considered for this project is outlined in **Table 16**.

**Table 16 Summary table of options considered for the project to avoid and minimise impacts on biodiversity**

Action	Adopted (Yes/No/In part)	Justification	Timing (if adopted)	Responsibility (if adopted)	Outcome (if adopted)
Incorporation of suitable technologies and design configurations to minimise overall development footprint	Yes	As part of the design process of the project, careful consideration has been given to reducing the footprint to retain the 50 m wildlife corridor and exclude the APZ from this area	During design and approval	Proponent and consultant team	Retention of approximately 0.80 ha of native vegetation within the subject land, including the three individual <i>Callistemon linearifolius</i>
Implementation of a suite of mitigation measures	Yes	To minimise the impacts on biodiversity a suite of mitigation measures will be implemented such as nest box installation, weed management, and tree protection measures.	Pre and post construction and during operation phase	Proponent and consultant team	Minimise impacts on biodiversity
Design amendments to various elements of the project design	Yes	Redesign of the project was undertaken following identification of significance of the wildlife corridor	During design and approval	Proponent and consultant team	Avoid and minimise impacts on native vegetation, retain habitat connectivity and avoid impacts on a threatened flora species
Partial development of the subject land to avoid/minimise impacts on	Yes	Partial development has been incorporated in the retention of the wildlife corridor	During design and approval	Proponent and consultant team	Avoid and minimise impacts on native vegetation, retain habitat connectivity and avoid impacts on a threatened flora species

Action	Adopted (Yes/No/In part)	Justification	Timing (if adopted)	Responsibility (if adopted)	Outcome (if adopted)
biodiversity and achieve greater tree retention					
'Do-nothing' option to avoid all impacts on biodiversity	No	The do-nothing option for the project would maintain current vegetation cover on site but would not enable redevelopment. Under a no-go option, trees would remain. However, the subject land occurs in a rural residential area surrounding by current construction projects, and it would likely be utilised for grazing if it were not developed, which would result in the ongoing degradation of the vegetation on site.	-	-	-
Consideration of alternative sites and layouts within the subject land	Yes	Preliminary options were considered and investigated for the project. The final option selected has consideration to both biodiversity values and the development.	During design and approval	Proponent and consultant team	Retention of approximately 0.80 ha of native vegetation within the subject land, including the three individual <i>Callistemon linearifolius</i>



## 7.2. Avoid and Minimise Prescribed Impacts

### 7.2.1. Human-made Structures

The existing house and large tin shed will be demolished as part of the proposed development. These have the potential to provide roosting habitat for some microchiropteran bat species and birds. The shed was inspected during the field survey and no fauna or roosting sites within the roof were observed, though the house was not able to be internally inspected.

The potential inhabitation of these structures would be limited to ecosystem credit species and non-threatened native species. All species credit species microchiropteran bats identified for the project in **Section 5.3**, except the Southern Myotis, are cave-dwelling species and would not utilise these structures for roosting purposes. It is recommended a pre-clearance survey is undertaken by an experienced ecologist of the structures prior to demolition and any fauna found can be relocated; thus, minimising the impact of removing these structures.

### 7.2.2. Non-native Vegetation

Areas of non-native vegetation within the subject are in the form of low-biodiversity value exotic grasslands and planted exotic garden species.

Although the non-native vegetation may provide some habitat value for native fauna in terms of shelter and foraging resources, these areas are unlikely to be favoured over the adjoining woodland habitats of the subject land and surrounds. The proposed development will remove approximately 2.63 ha of non-native vegetation. The development has prioritised the retention of the native vegetation and has therefore predominantly situated the development in the areas of exotic vegetation. As such, impacts to the areas of non-native vegetation are not able to be avoided as part of the project.

### 7.2.3. Habitat Connectivity

The areas of woodland vegetation in the subject land have connectivity with the treed vegetation in the surrounding properties, though these are separated by Warnervale Road to the north and Virginia Road to the east. No habitat corridor connectivity will be broken or fragmented due to the proposed vegetation removal, there will just be a minor reduction in the area of habitat available. Habitat connectivity to the south, west and east will be retained through the proposed 50 m wildlife corridor and connectivity to the north will occur through the large patch of retained vegetation to the east of the subject land that has connectivity with the north.

When considering the requirements associated with the extent of earthworks, it would not be possible to avoid all impacts native vegetation.

### 7.2.4. Waterbodies, Water Quality and Hydrological Processes

The farm dam and drainage line will be filled in as part of the proposed development. The farm dam is surrounded by predominantly exotic vegetation that does not conform to any native vegetation community. The removal of the dam and drainage line has the potential to eliminate a water source that the ecosystem credit fauna species may utilise from time to time. It is not considered removal of the dam would impact on

native vegetation in the surrounding area through any changes to groundwater. Surface runoff will be minor, though will be appropriately managed through a water management plan.

As such, potential indirect impacts to water quality would primarily be because of sediment inputs during construction and cannot be completely avoided. Erosion and sediment control measures will be implemented during construction following Managing Urban Stormwater: Soils and Construction ("the Blue Book") (Landcom 2004).

### **7.2.5. Vehicle Strikes**

Access to the proposed development will be via driveways and several roads to be constructed. This small-scale road network would limit potential vehicle interaction with fauna that would likely remain within the retained wildlife corridors and surrounding vegetated areas. Vehicles will be entering from Warnervale Road and will be travelling slowly along the short roads and into driveways, minimising the likelihood of vehicle strikes to fauna. There is limited opportunity to re-design the roads to further avoid potential fauna strike impacts.

# 8. Impact Assessment

## 8.1. Direct Impacts

### 8.1.1. Native Vegetation Clearing

One PCT, PCT 1619, present in four condition states will be impacted by the proposed development that also comprises likely habitat for the Southern Myotis and Squirrel Glider. A total of 1.72 ha of this vegetation will be completely cleared within the development site footprint. A further 0.02 ha of planted natives and 2.63 ha of exotics/cleared vegetation will also be removed. The native vegetation to be removed does not conform to any TECs listed under the BC Act or EPBC Act.

The direct impact resulting from the proposed development is the loss of vegetation and associated habitat within the development site footprint. **Table 17** identifies the extent of clearing impacts to vegetation within the subject land and **Table 18** identifies the extent of habitat impacts to the Southern Myotis.

**Table 17 Extent of clearing impacts**

Vegetation Zone	PCT #	PCT Condition Class	Development Site Footprint (ha)	Retained (ha)
1	1619	Good_shrubs-intact	0.16	0.80
2	1619	Good_shrubs-removed	0.71	0.00
3	1619	Moderate	0.36	0.00
4	1619	Low	0.50	0.00
-	-	Planted Natives	0.02	0.00
-	-	Exotics/Cleared	2.63	0.00
<b>Total</b>			<b>4.37*</b>	<b>0.80</b>

\*Total may not exactly add up to sum of individual areas due to rounding

**Table 18 Extent of threatened species impacts within the subject land**

Scientific Name	Common Name	BC Act Status	Area (ha)
<i>Myotis macropus</i>	Southern Myotis	V	1.72
<i>Petaurus norfolcensis</i>	Squirrel Glider	V	1.72

### 8.1.2. Loss of Specific Habitat Features

The main habitat for native fauna in the subject land is in the areas of native vegetation. In addition to native vegetation, specific habitat features identified within the subject land include hollow-bearing trees, stags, a farm dam, drainage line, stick nests, termite nests, *Allocasuarina* trees and *Corymbia gummifera* glider feed trees.

The project will result in the loss of habitat features within the development footprint, comprising 19 hollow-bearing trees, 17 stags, one farm dam, one drainage line, two small stands of *Allocasuarina* trees, two medium-sized stick nests, two termite nests, one timber pile, and ten *Corymbia gummifera* trees with evidence of glider feed scars. These trees occur to the rear of the property and numerous Sugar Gliders (*Petaurus breviceps*) were

recorded during the surveys undertaken by Cumberland Ecology in 2021 and this species would be feeding on these trees. One of the termite nests in a tree was observed to be a Sacred Kingfisher (*Todiramphus sanctus*) nest site.

Within the proposed 50 m wildlife corridor seven hollow-bearing trees, one hollow log, one *Allocasuarina* stand and one stag will be retained.

Overall, the removal of these specific habitat features is considered to have relatively minor implications for native fauna species due to the modified ecological context within which most of the development site occurs, and the high mobility of the species likely to utilise these habitats. The largest impact to native fauna is in the loss of the hollow-bearing trees that were observed to be nesting locations for several pairs of Rainbow Lorikeets (*Trichoglossus moluccanus*) and Australian Wood Ducks (*Chenonetta jubata*) (shown in **Figure 15**). These will be mitigated through the installation of nest boxes within the retained wildlife corridor and appropriate clearing protocols.

## 8.2. Change in Vegetation Integrity Score

Due to the need to remove all vegetation from the development site footprint the future vegetation integrity score for these management zones assumes complete removal of all vegetation. **Table 19** details the change in vegetation integrity score for the vegetation zones and management zones within the development site footprint.

**Table 19** Changes in vegetation integrity score for management zones

Zone	Vegetation Zone Name	Management Zone	BRW	Area (ha)	VI Score		
					Current	Future	Total Change
1	1619_Good_shrubs-intact	Cleared	1.5	0.16	53.1	0.0	-53.1
2	1619_Good_shrubs-removed	Cleared	1.5	0.71	52.7	0.0	-52.7
3	1619_Moderate	Cleared	1.5	0.36	32.3	0.0	-32.3
4	1619_Low	Cleared	1.5	0.50	26.0	0.0	-26.0

BRW = Biodiversity Risk Weighting

VI Score = Vegetation Integrity Score

## 8.3. Indirect Impacts

**Table 20** outlines the indirect impacts to native vegetation and habitat. Due to the existing modified nature of the vegetation within the development site footprint, the indirect impacts of the project are not considered to be significant.

**Table 20 Indirect impacts of the project**

Indirect Impact	Nature	Extent	Duration	Threatened Entities Likely Affected	Consequences
Inadvertent impacts on adjacent habitat or vegetation	Construction activities may result in inadvertent impacts on vegetation surrounding the development site footprint, such as increased sedimentation.	Native vegetation surrounding the development site footprint	Short term (during construction) and potential long term	Ecosystem credit species, <i>Callistemon linearifolius</i>	Reduced condition of the adjoining vegetation
Reduced viability of adjacent habitat due to edge effects	Minor impact as development site footprint is within a rural residential area, with adjacent construction sites, where the habitat is already modified and scattered due to land use. The proposed development would not significantly increase edge effects beyond current conditions.	Native vegetation to the south of the development site footprint	Long-term	Ecosystem credit species	Reduced condition of the adjoining vegetation
Reduced viability of adjacent habitat due to noise, dust or light spill	The construction activities associated with the project are likely to increase the noise, dust and light above current levels within and immediately adjacent the development site footprint.	Native vegetation surrounding the development site footprint	Short term (during construction)	Ecosystem credit species	Short term disruption of fauna habitat usage during construction
Transport of weeds and pathogens from the site to adjacent vegetation	Several exotic weeds are known to occur within the development site footprint and may be inadvertently spread to surrounding vegetation.	Native vegetation surrounding the development site footprint	Potential long-term	Ecosystem credit species, <i>Callistemon linearifolius</i>	Reduced condition of adjoining vegetation



Indirect Impact	Nature	Extent	Duration	Threatened Entities Likely Affected	Consequences
Increased risk of starvation, exposure and loss of shade or shelter	Impact unlikely. The project is unlikely to cause displacement of fauna such that it increases the risk of starvation, exposure and loss of shade or shelter.	-	-	-	-
Loss of breeding habitats	Impact unlikely. The proposed development is unlikely to result in the loss of breeding habitat in adjacent vegetation.				
Trampling of threatened flora species	There is potential for increased human activity resulting from the proposed development to pose a risk to trampling of <i>Callistemon linearifolius</i> .	Proposed wildlife corridor	Potential long term	<i>Callistemon linearifolius</i>	Reduced survival of <i>Callistemon linearifolius</i> in the long term
Inhibition of nitrogen fixation and increased soil salinity	While the proposed development would remove nitrogen fixing species from the disturbance footprint, impacts beyond this on nitrogen fixing species or soil salinity are considered unlikely	-	-	-	-
Fertiliser drift	Impact unlikely, fertiliser use would be limited to landscaping areas during plant establishment and would not be expected to drift	-	-	-	-
Rubbish dumping	Construction activities and occupation of the subject land may result in rubbish dumping within adjoining areas of native vegetation.	Native vegetation surrounding the development site footprint	Potential long term	Ecosystem credit species, <i>Callistemon linearifolius</i>	Reduced condition of the adjoining native vegetation

Indirect Impact	Nature	Extent	Duration	Threatened Entities Likely Affected	Consequences
Wood collection	Impact may occur, though there is limited fallen logs or timber to be collected.	Native vegetation surrounding the development site footprint	Potential long term	Ecosystem credit species	Reduced condition of the adjoining native vegetation
Bush rock removal and disturbance	No bush rock was recorded within the subject land.	-	-	-	-
Increase in predatory species populations	Impact unlikely. The proposed development is considered unlikely to result in an increase in predatory species populations.	-	-	-	-
Increase in pest animal populations	Impact unlikely. The project is considered unlikely to result in an increase in pest animal populations. Domestic cats will be banned in the proposed development.	-	-	-	-
Increased risk of fire	Impact unlikely. The project is unlikely to increase the risk of bushfire.	-	-	-	-
Disturbance to specialist breeding and foraging habitat	The development site footprint contains twenty hollow bearing trees that will require removal, but it not expected to impact on specialist breeding and foraging habitat in adjacent areas	Native vegetation surrounding the development site footprint	Short term (construction)	Ecosystem credit species	Short term disruption of fauna habitat usage during construction.

## 8.4. Prescribed Impacts

The project has been assessed as potentially resulting in five prescribed impacts (see **Section 6.1**). An assessment of these prescribed impacts is provided below in accordance with Section 8.3 of the BAM.

### 8.4.1. Human-made Structures

#### 8.4.1.1. Nature

An existing residential dwelling and large metal shed will be demolished as part of the proposed development.

#### 8.4.1.2. Extent

The development footprint of these areas occupied by the two structures is approximately 0.05 ha.

#### 8.4.1.3. Duration

Impacts to the human-made structures would occur during the construction phase of the project. The removal is a long-term impact.

#### 8.4.1.4. Threatened Entities Affected

Ecosystem credit microchiropteran bat and woodland bird species have the potential to be impacted by the removal of possible roosting habitat.

#### 8.4.1.5. Consequences

The project will result in the removal of these structures that may provide roosting habitat for some threatened species. The impact is unlikely to be significant as preferable woodland habitat will be retained within the subject land and in surrounding properties.

### 8.4.2. Non-native Vegetation

#### 8.4.2.1. Nature

Non-native vegetation is proposed to be cleared for the project. Non-native vegetation includes areas of exotics/cleared land that includes exotic grassland and planted exotic garden species as shown in **Figure 8**.

#### 8.4.2.2. Extent

The proposed development will clear a total of approximately 2.63 ha of non-native vegetation in the form of exotic grassland and planted exotic garden species.

#### 8.4.2.3. Duration

Impacts to non-native vegetation would occur during the construction phase of the project. The removal of the non-native vegetation is a long-term impact.

#### 8.4.2.4. Threatened Entities Affected

The habitat provided by non-native vegetation may provide some foraging habitat for ecosystem credit species, such as microchiropteran bats and birds. However, the non-native vegetation is not considered suitable breeding/nest habitat due to lack of hollows and structural features, other than some minor woody weeds such as scattered shrubs.

#### **8.4.2.5. Consequences**

The project will result in a reduction in non-native vegetation by approximately 2.63 ha. The reduction of this area of habitat is not considered to significantly impact upon the potentially affected threatened entities as other areas of suitable habitat, in the form of both native and non-native vegetation, will remain immediately adjacent to the development site footprint and within the assessment area.

### **8.4.3. Habitat Connectivity**

#### **8.4.3.1. Nature**

The native woody vegetation within the subject land connects to other native treed vegetation within surrounding properties. The area of native vegetation will be reduced marginally. The construction of the residential buildings would be an impediment to the movement of some fauna species.

#### **8.4.3.2. Extent**

Habitat connectivity will be reduced through the removal of 1.72 ha of extant native vegetation. Some connectivity will remain through the retention of vegetation within the proposed wildlife corridor.

#### **8.4.3.3. Duration**

Direct impacts to habitat connectivity would occur during the construction and operational phase of the project. The reduction of habitat connectivity is a long-term impact.

#### **8.4.3.4. Threatened Entities Affected**

The habitat provided by native vegetation may provide foraging habitat for ecosystem credit species, such as the Grey-headed Flying-fox, microchiropteran bats and birds. Some species such as the Grey-headed Flying-fox and threatened owl and eagle species would be able to fly over the proposed buildings and would only be impacted through the direct loss of foraging habitat.

#### **8.4.3.5. Consequences**

The project will result in the direct reduction in extant native vegetation by 1.72 ha. Although the clearing of the subject land will result in a slight reduction of the existing vegetation patch, the reduction of this area of habitat is not considered to significantly impact the movement of mobile fauna species as better-quality habitat is located in the adjacent native vegetation and will be retained in the wildlife corridor. For example, the Grey-headed Flying-fox forages opportunistically, often at distances up to 30 km from camps, and occasionally up to 60-70 km per night, in response to patchy food resources (NSW Scientific Committee 2004). It is considered unlikely that native fauna would be solely reliant on the habitat within the subject land for movement between different areas of habitat.

### **8.4.4. Waterbodies, Water Quality and Hydrological Processes**

#### **8.4.4.1. Nature**

The farm dam that has an area of 0.45 ha and the minor drainage line will be filled in as part of the proposed development.

#### **8.4.4.2. Extent**

The dam and drainage line will be completely filled in; however the numerous farm dams will remain in surrounding properties. The dam is an artificial waterbody that has been constructed in the development site footprint as part of the historical use as a rural residential property. Similar dams exist in most surrounding rural residential properties. As such the extent of impacts of removing this one dam with an approximate area of 0.45 ha would be minor.

#### **8.4.4.3. Duration**

Impacts to waterbodies would be most likely to take place during construction. These will be managed through erosion and sediment control measures to prevent sediment laden run-off from leaving the construction site. Changes to surface run-off will be permanent if the development is constructed.

#### **8.4.4.4. Threatened Entities Affected**

Any changes to waterbodies, water quality and hydrological processes are unlikely to affect threatened entities within the subject land beyond the removal of one farm dam within a mosaic of similar dams retained within the surrounding rural residential properties, that may provide a water source for foraging threatened and native species.

#### **8.4.4.5. Consequences**

The consequences of impacts to waterbodies, water quality and hydrological processes are likely to be minor and would primarily take place during construction. These impacts can be mitigated through implementation of erosion and sediment control measures.

### **8.4.5. Vehicle Strikes**

#### **8.4.5.1. Nature**

Access to the proposed development will be through roads from Warnervale Road, with several roads proposed within the development and individual driveways into each lot. Vehicle movement would be at low speed as vehicles enter and navigate through the short roads and driveways in the development. Most threatened species with potential to be impacted are arboreal and would largely be active in the canopy, such that interactions with vehicles are unlikely. Most threatened bat species are active at night when there would be very limited vehicle traffic. Vehicle strike impacts could also take place during construction but would be very limited as construction would take place during daylight when fauna is unlikely to be active, and construction noise would likely keep fauna away.

#### **8.4.5.2. Extent**

The extent on vehicle strike impacts during construction would primarily be limited to proposed road areas. During operation, impacts would be limited to the roads and driveways within the development site footprint. Vehicles would enter at low speed, such that strike impacts causing mortality would be unlikely.

#### **8.4.5.3. Duration**

Fauna strike impacts could take place both during construction, and during the operational phase of the project.



#### **8.4.5.4. Threatened Entities Affected**

The threatened entities with the potential to be impacted would primarily be ecosystem credit species. Most species are likely to forage in the canopy and as such would rarely be at the level where vehicles are entering the proposed development.

#### **8.4.5.5. Consequences**

Vehicle strike impacts to threatened fauna are likely to be a very rare occurrence. During construction retained vegetation will be fenced-off, and fauna are unlikely to be present due to construction noise. During operation, the likelihood of vehicle strikes would be rare due to the limited space where interactions with fauna could take place and the low speed of vehicles.

### **8.5. Mitigation of Impacts to Native Vegetation and Habitat**

A range of mitigation measures have been developed for the project to mitigate the impacts to native vegetation and habitat that are unable to be avoided. These include a range of measures to be undertaken before, during and after construction to limit the impact of the project. Each mitigation measure is discussed in detail below, and a summary is provided in **Table 21**.

#### **8.5.1. Weed Management**

In order to minimise the spread of weeds throughout the subject land and adjoining areas, appropriate weed control activities will be undertaken prior to vegetation clearing in accordance with the Greater Sydney Management Region and is subject to the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022 (Sydney 2021) under the NSW *Biosecurity Act 2015*.

The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds and high risk activities, as provided in the Appendices of the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022 (Sydney 2021). To comply with the objectives of the Greater Sydney Regional Strategic Weed Management Plan, it is recommended the following measures be implemented as part of weed management for the subject land.

##### **8.5.1.1. Prevention**

Appropriate construction site hygiene measures will be implemented to prevent entry of new weeds to the area such as the cleaning of equipment prior to entering the subject land.

##### **8.5.1.2. Eradication**

Initial weed management will be carried out within the subject land according to best-practice methods under the direction of a suitably qualified bush regenerator. The targeted species will be those listed under Appendices 1 and 2 of the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022 (Sydney 2021). Initial weed treatment will include eliminating woody species and targeting large dominant infestations of exotic herbs. This may be achieved via a combination of manual weed removal and herbicide use. Weed management will focus on the removal of targeted species from within landscaping areas.

Best-practice bush regeneration should undertake measures to avoid adverse impacts to retained vegetation within the subject land, including not over clearing (remove only targeted species), employment of minimal

disturbance techniques to avoid soil and surrounding vegetation disturbance, and replacement of disturbed mulch/leaf-litter.

### **8.5.1.3. Containment**

Follow-up monitoring and maintenance should be undertaken in retained vegetation areas following construction, to contain any re-emergence of weed species.

### **8.5.2. Delineation of Clearing Limits**

The current limits of clearing will be marked either by high visibility tape on trees or metal/wooden pickets, fencing or an equivalent boundary marker that will be installed prior to clearing. To avoid unnecessary or inadvertent vegetation and habitat removal or impacts on fauna, disturbance must be restricted to the delineated area and no stockpiling of equipment, machinery, soil, rock or vegetation will occur beyond this boundary.

### **8.5.3. Pre-clearance Surveys**

To minimise impacts to fauna species during construction, pre-clearance surveys will be conducted in all areas of vegetation that are required to be cleared and within the two structures to be demolished. Pre-clearing surveys will be undertaken within one week of clearing activities by a qualified ecologist.

Habitat features to be identified include:

- Hollow-bearing trees;
- Hollow-bearing logs;
- Termite nests;
- Stags; and
- Nests within tree canopy or shrubs.

Such features have the potential to contain native species. All habitat features will be identified, recorded and flagged with fluorescent marking tape and trees will have an "H" spray painted with marking paint on two sides of the tree.

### **8.5.4. Staging of Clearing**

The clearing of vegetation will be conducted using a two-stage clearing process as follows:

Stage 1: Clearing will commence following the identification of potential habitat features by a qualified ecologist. Hollow-bearing trees marked during pre-clearing will not be cleared during the first stage. However, all vegetation around these trees will be cleared to enable isolation of the feature. Other habitat features, such as hollow-bearing logs, can be removed during Stage 1 only if done under supervision by a qualified ecologist. Identified hollow-bearing trees will be left at a minimum overnight after Stage 1 clearing to allow resident fauna to voluntarily move from the area.

Stage 2: After hollow-bearing trees have been left overnight, the trees will be cleared using the following protocols:

- Trees marked as containing hollows will be shaken by machinery prior to clearing to encourage any animals remaining to leave the hollows and move on;
- Use a bulldozer or excavator to start pushing the tree over. Move the bulldozer over the roots and continue gently pushing the tree over;
- Remove branches with hollows and sections of trunk and set aside for immediate transfer to a storage area for placement within retained vegetation; and
- All hollows will be investigated by an ecologist for the presence of fauna following felling of the tree.

The felled habitat tree will be left overnight to allow any remaining fauna time to leave the hollows and move on. The two-stage clearing process enables fauna a chance to self-relocate upon nightfall, when foraging typically occurs.

Provisions will be made to protect any native fauna during clearing activities by the following means:

- All staff working on the vegetation clearing will be briefed about the possible fauna present and should avoid injuring any present;
- Animals disturbed or dislodged during the clearance but not injured will be assisted to move to adjacent bushland or other specified locations; and
- If animals are injured during the vegetation clearance, appropriate steps will be taken to humanely treat the animal (either taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanised).

Provision of a report following the completion of clearing works will be provided detailing the total number and species of individuals recorded and details of their release/health.

### **8.5.5. Structure Removal Supervision**

There is the potential for microchiropteran bats and birds to roost within the shed and dwelling, therefore it is recommended a suitably qualified ecologist is present to oversee the demolition of these structures and removal of the concrete slabs. A brief letter report will be provided on completion of these works detailing the total number and species of individuals recorded and details of their release/health.

### **8.5.6. Sedimentation Control Measures**

The project may result in erosion and transport of sediments because of soil disturbance during construction. In order to prevent this impact, construction activities will be undertaken in accordance with "The Blue Book" (Landcom 2004).

### **8.5.7. Nest Box Installation**

To mitigate any potential impacts on native fauna associated with the removal of twenty trees containing hollows, a minimum of twenty nest boxes are proposed to be installed as part of the project to offset the removal of hollows at a 1:1 ratio. The nest boxes will be installed in trees to be retained within wildlife corridor.

### **8.5.8. Dam Dewatering**

A suitably qualified ecologist should be present throughout the dam dewatering process to catch and relocate any aquatic or terrestrial species present. All native species will be relocated to a nearby suitable waterbody and any exotic species will be humanely euthanised. The ecologist should also be present while an excavator strips the sediment out of the dam to a depth of approximately 0.5 m to relocate any sub-terranean species. Additional details will be provided in the Construction Environmental Management Plan to be prepared for the project.

A brief letter report will be provided on completion of these works detailing the total number and species of individuals recorded and details of their release/health.

### **8.5.9. Biodiversity Management Plan**

A Biodiversity Management Plan (BMP) will be prepared by a suitably qualified ecologist for the retained native vegetation within the wildlife corridor. The BMP will be implemented for five years and include at a minimum:

- An overview of the existing environment of the BMP area;
- Details of the biodiversity management measures to be implemented;
- Details of the monitoring program to be undertaken;
- Details of the reporting requirements; and
- Details of the performance criteria for the biodiversity management measures.

**Table 21 Summary of mitigation measures**

Mitigation Measure	Proposed Techniques	Timing	Frequency	Responsibility	Risk of Failure	Risk and Consequences of Residual Impacts
Weed management	Appropriate weed control activities will be undertaken in accordance with the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022	Construction	Prior to construction, following vegetation clearing	Contractor	High	Spread of weeds throughout the subject land and surrounding area.
Delineation of clearing limits	Clearing limits marked either by high visibility tape on trees or metal/wooden pickets, fencing or an equivalent boundary marker. Disturbance, including stockpiling, restricted to clearing limits.	Construction	Once	Contractor/ Arborist	High	Unnecessary damage to retained trees in the wildlife corridor or adjacent properties.
Pre-clearance survey	Pre-clearance surveys will be conducted in all areas of vegetation that are required to be cleared. Pre-clearing surveys will be undertaken within one week of clearing. Habitat features will be marked during the pre-clearing survey.	Construction	Once	Project ecologist	Moderate	Increased and unnecessary mortality of native fauna.
Staging of clearing	Vegetation clearing will be conducted using a two-stage clearing process. Animals disturbed or dislodged during the clearance but not injured will be assisted to move to adjacent bushland or other specified locations	Construction	Once	Contractor/ Project ecologist	High	Increased and unnecessary mortality of native fauna.



Mitigation Measure	Proposed Techniques	Timing	Frequency	Responsibility	Risk of Failure	Risk and Consequences of Residual Impacts
	If animals are injured during the vegetation clearance, appropriate steps will be taken to humanely treat the animal (either taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanized)					
Structure Removal Supervision	An ecologist will be present during the demolition of the human-made structures to catch and relocate any species utilising these buildings	Construction	Once	Contractor/ Project ecologist	High	Increased and unnecessary mortality of native fauna.
Sedimentation control	Construction activities will be undertaken in accordance with "The Blue Book" (Landcom 2004). These include implementation of measures detailed in Preliminary Erosion and Sediment Control Plan (Costin and Roe Consulting 2021)	Construction	Throughout construction period	Contractor	High	Sedimentation into adjoining vegetation.
Nest box installation	Installation of twenty nest boxes in retained trees in the wildlife corridor	Prior to vegetation clearing	Once	Project ecologist	Low	Reduction in available fauna habitat.
Dam Dewatering	An ecologist will be present throughout the dam dewatering and during sediment removal to catch and relocate any terrestrial and aquatic species present.	Construction	Once	Contractor/ Project ecologist	High	Increased and unnecessary mortality of native fauna.

Mitigation Measure	Proposed Techniques	Timing	Frequency	Responsibility	Risk of Failure	Consequences of Residual Impacts
Biodiversity Management Plan	Implementation of a five-year BMP to maintain and enhance the quality of the retained native vegetation within the wildlife corridor	Following DA Approval	As required	Ecologist	Low	Reduction in quality of retained native vegetation and fauna habitat.

## 8.6. Mitigation of Prescribed Impacts

The following mitigation measures, described in **Section 8.6**, are relevant to the prescribed impacts relevant to the project:

- Delineation of clearing limits;
- Pre-clearance survey;
- Staging of clearing;
- Structure removal supervision;
- Sedimentation control measures;
- Nest box installation;
- Dam dewatering; and
- BMP.

No additional mitigation measures are proposed for prescribed impacts.

## 8.7. Adaptive Management for Uncertain Impacts

The project is considered unlikely to result in any uncertain impacts that require adaptive management.

## 8.8. Use of Biodiversity Credits to Mitigate or Offset Indirect or Prescribed Impacts

No additional biodiversity credits are required for prescribed impacts.

# 9. Thresholds of Assessment

## 9.1. Introduction

The assessment thresholds that must be considered include the following:

- Impacts on an entity that is at risk of a serious and irreversible impact;
- Impacts for which the assessor is required to determine an offset requirement; and
- Impacts for which the assessor is not required to determine an offset requirement; and
- Impacts that do not require further assessment by the assessor.
- The following sections outline these assessment thresholds and their relevance to the project.

## 9.2. Impacts on Serious and Irreversible Impact Entities

The project is not considered to have any impact on SAll entities, as identified in the Threatened Biodiversity Data Collection.

## 9.3. Impacts that Require an Offset

### 9.3.1. Native Vegetation

In accordance with the BAM, the project requires offsets for the clearing of native vegetation in Vegetation Zones 1 - 4 as the following criteria is met:

- A vegetation zone that has a vegetation integrity score  $\geq 17$  where the PCT is associated with threatened species habitat (as represented by ecosystem credits).

The PCT and vegetation zones requiring offsets is documented in **Table 22**. This area is mapped in **Figure 16**.

For the area covered by the development footprint, all native vegetation will require removal, as such offsetting requirements are calculated on the assumption that the future vegetation integrity score will be zero.

**Table 22 Native vegetation impacts requiring an offset**

Zone	Veg Zone Name	Management Zone	Total Vegetation Integrity Loss	Biodiversity Risk Weighting	Area (ha)	Credits
1	1619_Good_shrubs-intact	Cleared	-53.1	1.5	0.16	3
2	1619_Good_shrubs-removed	Cleared	-52.7	1.5	0.71	14
3	1619_Moderate	Cleared	-32.3	1.5	0.36	4
4	1619_Low	Cleared	-26.0	1.5	0.50	5
<b>Total</b>						<b>26</b>

### 9.3.2. Threatened Species

In accordance with the BAM, the project requires offsets for the clearing of species credit species habitat. The species requiring an offset is documented in **Table 23**, and the areas subject to threatened species offsetting is shown in **Figure 12**.

**Table 23 Threatened species requiring an offset**

Scientific Name	Common Name	Biodiversity Risk Weighting	Vegetation Zone	Area (ha)	Credits
<i>Myotis macropus</i>	Southern Myotis	2	1619_Good_shrubs-intact	0.16	4
			1619_Good_shrubs-removed	0.71	19
			1619_Moderate	0.36	7
			1619_Low	0.50	6
<b>Sub-total</b>					<b>36</b>
<i>Petaurus norfolcensis</i>	Squirrel Glider	2	1619_Good_shrubs-intact	0.16	4
			1619_Good_shrubs-removed	0.71	19
			1619_Moderate	0.36	7
			1619_Low	0.50	6
<b>Sub-total</b>					<b>36</b>

### 9.4. Impacts that do not Require an Offset

In accordance with the BAM, the project does not require offsets for the clearing of native vegetation if the following criteria is met:

- A vegetation zone that has a vegetation integrity score <15 where the PCT is representative of an EEC or CEEC; or
- A vegetation zone that has a vegetation integrity score of <17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits) or is representative of a vulnerable ecological community.

No impacts that do not require an offset include the approximately 0.02 ha of Planted Native Vegetation as shown in **Figure 17** (see **Section 4.6** for details).

### 9.5. Impacts that do not Require Further Assessment

Impacts to areas identified as Exotics/Cleared within the subject land do not require further assessment. This occupies approximately 2.63 ha within the subject land and is shown in **Figure 17**.

## 9.6. Application of the No Net Loss Standard

The BAM sets a standard that will result in no net loss of biodiversity values where the impacts on biodiversity values are avoided, minimised and mitigated, and all residual impacts are offset by retirement of the required number of biodiversity credits.

The ecosystem credit requirement for the project is summarised in **Table 24**, whilst the 'like for like' offsetting options for the ecosystem credits are provided in **Table 25**.

Note that a total of 26 ecosystem credits are required to offset the impacts of the project on native vegetation.

A credit summary report from the BAM-C has been included in **Appendix F**.

**Table 24 Summary of ecosystem credit liability**

Zone	Vegetation Zone Name	Sensitivity to Gain	Area (ha)	Credits Required
1	1619_Good_shrubs-intact	High sensitivity to potential gain	0.16	3
2	1619_Good_shrubs-removed	High sensitivity to potential gain	0.71	14
3	1619_Moderate	High sensitivity to potential gain	0.36	4
4	1619_Low	High sensitivity to potential gain	0.50	5

**Table 25 Like for like offsetting options for PCT 1619**

Class	Containing Hollow-bearing Trees?	In the below IBRA Subregions	Credits
Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787	Yes	Wyong , Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site.	26

The species credit requirement for the project is summarised in **Table 26**, along with the 'like for like' offsetting options.

A credit summary report from the BAMC has been included in **Appendix F**.

**Table 26 Summary of impacts to threatened species requiring an offset**

Scientific Name	Common Name	Credits	Like for Like Options
<i>Myotis macropus</i>	Southern Myotis	36	Southern Myotis in any IBRA region in NSW



Scientific Name	Common Name	Credits	Like for Like Options
<i>Petaurus norfolcensis</i>	Squirrel Glider	36	Squirrel Glider in any IBRA region in NSW

# 10. Conclusion

Cumberland Ecology was engaged by the proponent to prepare a BCAR for the subject land. This BCAR forms part of the documentation to support the application for biodiversity certification under the BC Act. Under the BC Act, all proposals for standard biodiversity certification of land must be assessed using the BAM with the results presented in a BCAR. This BCAR has been prepared in accordance with the 2020 version of the BAM.

To facilitate the project, a total of 4.37 ha of land will be directly impacted of which 1.74 ha comprises native vegetation, including approximately 1.72 ha of PCT 1619 and approximately 0.02 ha of Planted Natives. The remaining area of the development site footprint comprising approximately 2.63 ha to be removed includes exotic grasslands and exotic planted garden species, existing residential structures and a dam. A proposed 50 m wildlife corridor occupying approximately 0.80 ha and including the highest quality vegetation within the subject land, will be retained as part of the project. None of the vegetation within the subject land conforms to any TECs listed under the BC Act or EPBC Act.

One species credit species, the Southern Myotis, was determined as likely to occur within the development site footprint and has been assessed as a species credit species. Although not recorded within the subject land during targeted threatened species surveys, the Squirrel Glider has also been included as an assumed presence species credit species to address Council and DPE comments. *Callistemon linearifolius* occurs as three individuals within the proposed wildlife corridor to be retained, and therefore will not be removed by the project.

The BAM sets a standard that will result in no net loss of biodiversity values where the impacts on biodiversity values are avoided, minimised and mitigated, and all residual impacts are offset by retirement of the required number of biodiversity credits. The project has sought to avoid impacts to biodiversity values, and a suite of mitigation measures will be implemented for the project including weed management, delineation of clearing limits, pre-clearance surveys, staging of clearing, nest box installation, sedimentation control measures, dam dewatering and implementation of biodiversity management plan for the retained wildlife corridor.

Due to the area of PCT 1619 requiring clearing that also comprises likely habitat for the Southern Myotis and Squirrel Glider, and the vegetation integrity scores of the native vegetation within the development site footprint, the biodiversity credit liability of the project has been calculated at 26 ecosystem credits, 36 Southern Myotis species credits, and 36 Squirrel Glider species credits. With the implementation of the proposed mitigation measures and the offsetting described, it is considered that the impacts of this project on biodiversity will be limited and can be appropriately managed.

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# APPENDIX A :

## BAM Compliance Table





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BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
<b>Introduction</b>	Information		
	Introduction to the biodiversity assessment including:		
	identification of development/biodiversity stewardship site footprint, including: operational footprint construction footprint indicating clearing associated with temporary construction facilities and infrastructure		Section 1.2.3
	general description of development/biodiversity stewardship site		Section 1.2.4
	sources of information used in the assessment, including reports and spatial data.		Section 1.4, Section 2.1
	Maps and Data		
	Site Map (as described in Section 4.2)		Figure 1
	Location Map (as described in Section 4.2)		Figure 2
	Digital shape files for all maps and spatial data		To be provided in BOAMs or email
<b>Landscape Features</b>	Information		
	Identification of landscape features at the development/biodiversity stewardship site, including:		
	IBRA bioregions and subregions, NSW landscape region and area (ha)	Subject land area (ha) IBRA bioregions and subregions	Figure 1

BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
		BioNet NSW Landscapes	
	native vegetation extent in the buffer area		Figure 1
	cleared areas	Cleared areas	Figure 2
	evidence to support differences between mapped vegetation extent and aerial imagery		N/A
	rivers and streams classified according to stream order	Rivers, streams and estuaries	Section 3.2.2, Figure 2
	wetlands within, adjacent to and downstream of the site	Wetlands within, adjacent to and downstream of the site	Section 3.2.3. Figure 2
	connectivity features	Connectivity of areas of habitat including areas identified as priority investment areas, flyways for migratory species	Section 3.2.4
	areas of geological significance and soil hazard features	Areas of geological significance and soil hazard features	Section 3.2.5, Section 3.2.8
		Areas of Outstanding Biodiversity Value	Section 3.2.6
	site context components, including: identification of method applied (i.e. linear or site-based) percent native vegetation cover in the landscape (development site and biodiversity stewardship site).	Percent native vegetation cover including: buffer area justification to support differences between aerial imagery used for the assessment and final mapped native vegetation cover.	Section 3.3
	Maps and Data		
	IBRA bioregions and subregions (as described in Paragraphs 4.2.1.3–4.2.1.4)	IBRA bioregions and subregions	Figures 1 and 2

BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
	NSW landscape regions (as described in Paragraph 4.2.1.5)	BioNet NSW landscapes	Figures 1 and 2
	Rivers and streams (as described in Paragraph 4.2.1.6)	Rivers, streams (using Strahler stream ordering) and estuaries	Figures 1 and 2
	Wetlands (as described in Paragraph 4.2.1.7)	Wetlands	Figures 1 and 2
	Connectivity of different areas of habitat (as described in Paragraphs 4.2.1.8–4.2.1.11)	Connectivity	Figure 2
	Areas of geological significance and soil hazard features (as described in Paragraphs 4.2.1.12–4.2.1.15)	Areas of geological significance and soil hazards	Figures 1 and 2
	Native vegetation extent (as described in Subsection 4.3.2)	Native vegetation cover	Figure 2
		Boundary of the subject land.	Figure 1
		Areas of Outstanding Biodiversity Value	Section 3.2.6
<b>Native Vegetation</b>	Information		
	Identify native vegetation extent within the development/biodiversity stewardship site, including cleared areas and evidence to support differences between mapped vegetation extent and aerial imagery.	Native vegetation cover on subject land and justification to support differences between mapped native vegetation cover and aerial imagery.	Section 4.1 and Figure 7
	Describe PCTs within the development/biodiversity stewardship site, including:	PCTs within the subject land, including:	

BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
	vegetation class	vegetation class	Section 4.2
	vegetation type	vegetation type (i.e. PCT names and ID numbers)	Section 4.2
	area (ha) for each vegetation type	area (ha)	Table 6
	species relied upon for identification of vegetation type and relative abundance	species relied upon for identification of vegetation type and relative abundance	Table 5
	justification of evidence used to identify a PCT (as outlined in Paragraph 5.2.1.12)	evidence and justification of decision pathway used in identification of PCT (e.g. vegetation structure and landscape position/geomorphology).	Table 5
	TEC status (as outlined in Paragraphs 5.2.1.14–5.2.1.15)	TEC status	Section 4.4
	estimate of percent cleared value of PCT(as outlined in Paragraph 5.2.1.16)	estimate of percent cleared value of the PCT (available in the BioNet Vegetation Classification)	Section 4.2
	Perform a vegetation integrity assessment of the development/biodiversity stewardship site, including:	Vegetation integrity assessment of the subject land, including:	Section 4.5
	mapping vegetation zones (Subsection 5.3.1)	description of vegetation zones within the subject land with justification for assigning vegetation zones to PCTs area (ha) of each vegetation zone	Section 4.2 and Figure 9
	patch size (development site and biodiversity stewardship site)	patch size for each vegetation zone	Table 6

BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
	assessing vegetation integrity using benchmark data (Subsection 5.3.3)		N/A
	survey effort as described in Subsection 5.3.4 (number of plots)	survey effort	Table 2
	determining the vegetation integrity score (Appendix 6): composition condition score structure condition score function condition score vegetation integrity score.	composition, structure, function and vegetation integrity condition scores.	Section 4.4
		Where use of local data is proposed, identify: source of information for local benchmark data justification of use of local data in preference to database values.	
	Maps and Data		
	Map of native vegetation extent within the development/biodiversity stewardship site (as described in Section 5.1)	Native vegetation extent within the subject land.	Figure 7
	Map of PCTs within the development/biodiversity stewardship site (as described in Section 5.2)	Distribution of PCTs within the subject land.	Figure 8
	Map of plot locations relative to PCTs	Plot locations relative to PCTs including GPS coordinates (GDS zone, eastings, northings and bearings)	Figure 5



BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
	Map of TECs	TECs on the subject land	N/A
	Plot field data (MS Excel format)		To be provided in BOAMs or email
	Plot field data sheets	Plot field data and sheets	To be provided in BOAMs or email
		Vegetation zones	
	Patch size of intact native vegetation (as described in Subsection 5.3.2)	Patch size of intact native vegetation	Table 6
	Table of current vegetation integrity scores for each vegetation zone within the development/biodiversity stewardship site.	Table of vegetation integrity scores for each vegetation zone within the subject land	Table 6
<b>Threatened Species</b>	Information		
	Identify ecosystem credit species associated with PCTs on both the development site and biodiversity stewardship site as outlined in Section 6.2, including:		
	list of species derived	List of predicted ecosystem credit species associated with PCTs on the subject land	Table 8
	justification for exclusion of any ecosystem credit species predicted above.	Justification for exclusion of any ecosystem credit species predicted above	Section 5.2.2
	Identify species credit species on both the development site and the biodiversity stewardship site as outlined in Sections 6.3 to 6.5, including:	Identify species credit species on the subject land, including:	
	list of candidate species	list of candidate species assessed	Table 10

BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
	justification for inclusions and exclusions based on habitat features	justification for inclusions and exclusions of any species credit species predicted above based on habitat features, or vagrancy	Section 5.3.2
	indication of presence based on targeted survey or expert report	indication of presence based on targeted survey or expert report (see below)	Section 5.2.3 and Section 5.3.3
	details of targeted survey technique, effort, timing and weather	details of targeted survey including technique, effort, timing and weather	Chapter 2 and Section 5.3.3
	species polygons	species polygons	Section 5.3.4 and Figure 12
	biodiversity risk weighting for the species	biodiversity risk weighting for the species	Section 5.3.4
		area of suitable habitat or number of individuals counted	Section 5.3.4
	threatened species survey		Chapter 2
	additional requirements for wind farm developments.		N/A
	Where use of local data is proposed:	Where use of local data is proposed:	N/A
	identify relevant species	identify relevant species or population	N/A
	identify aspect of species data		N/A
	identify source of information for local data	identify source of information for local data	N/A
	justify use of local data in preference to database values.	justify use of local data in preference to database values.	N/A
	Where expert reports are used in place of targeted survey:	Where expert reports are used in place of targeted survey:	
	identify the relevant species	identify the relevant species or population	N/A

BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
	justify the use of an expert report	justify the use of an expert report	N/A
	indicate and justify the likelihood of presence of the species and information considered in making this assessment	flag the likely presence of the species or population and the evidence to support this assessment including all information considered	N/A
	estimate the number of individuals or area of habitat (whichever unit of measurement applies to the species/individual) for the development site or biodiversity stewardship site, including a description of how the estimate was made	estimate the number of individuals or area of suitable habitat, including a description of how the estimates were made (e.g. reference populations, past reports)	N/A
	identify the expert and provide evidence of their expert credentials.	identify the expert and provide evidence of their expert credentials.	N/A
		Identify potential prescribed biodiversity impacts on threatened species.	N/A
	<b>Maps and Data</b>		
	Table of habitats or habitat components and their sensitivity classes	Table of habitats or habitat components and their sensitivity classes.	N/A
	Table detailing the list of species credit species and presence status on site as determined by targeted survey, indicating also where presence was assumed and/or where presence was determined by expert report	Table detailing the list of species credit species; presence on subject land as determined by targeted survey, indicating where presence is assumed or by expert report.	Section 5.3.4
		Mapped targeted survey locations including GPS coordinates of survey sites.	Figure 5 and Figure 6

BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
	Species credit species polygons (as described in Paragraph 6.4.1.33)	Species credit species polygons including GPS locations of any individuals counted.	Figure 12
	Table detailing species and habitat feature/component associated with species and its abundance on site (as described in Paragraph 6.4.1.34)	Table detailing species habitat features associated with the species and its location (GPS coordinates) and abundance on the subject land.	Table 22
	Table detailing biodiversity risk weighting for species on site (as described in Section 6.6)	Table detailing biodiversity risk weighting for species credit species on the subject land.	Table 22
		Map location of prescribed biodiversity impacts on the subject land	Figure 13
	For wind farm developments: maps of habitual flight paths for nomadic and migratory species likely to fly over the site and maps of likely habitat for threatened aerial species resident on the site	For wind farm developments, maps of habitual flight paths for nomadic and migratory species likely to fly over the site and maps of likely habitat for threatened aerial species and raptor species resident on site.	N/A
<b>Avoid and Minimise Impacts</b>	Information		
	Demonstration of efforts to avoid and minimise impact on biodiversity values in accordance with Chapter 8.	Demonstration of efforts to avoid or minimise impacts on native vegetation, threatened species habitat and prescribed impacts during project planning including: 1. locating the project –	Chapter 7

BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
		<p>options considered (including maps and why they were not feasible/suitable)</p> <p>analyses associated with alternative options (e.g. routes, locations, sites within the property, constraints)</p> <p>justification for selecting proposed location</p> <p>2. designing the project –</p> <p>temporary and permanent ancillary construction and maintenance facilities required for the proposal</p> <p>options for avoiding these features (e.g. alternative locations, engineering solutions, modes of technology, constraints)</p> <p>justification for selecting proposed location</p> <p>measures taken to minimise impacts</p> <p>long-term management of areas avoided.</p>	
	<p>Assessment of direct and indirect impacts unable to be avoided at the development site in accordance with Sections 9.1 and 9.2. The assessment would include but not be limited to: type, frequency, intensity, duration and consequence of impact.</p>	<p>Determination of the impacts on native vegetation and threatened species habitat including:</p> <p>describing impacts of clearing</p> <p>describing the nature, extent, frequency, duration and timing of indirect and prescribed impacts including during construction and operation phases, on adjacent vegetation</p>	Chapter 8

BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
		calculating the change in VI score and habitat suitability	Section 8.2
		describing impacts that are uncertain and their management/mitigation	Section 8.7
		evaluating consequences of indirect and prescribed impacts	Section 8.3 and Section 8.4
		documenting limitations to data, assumptions and predictions.	N/A
	For major projects: details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (Section 9.4).		N/A
	Maps and Data		
	Table of measures to be implemented before, during and after construction to avoid and minimise the impacts of the project, including action, outcome, timing and responsibility	Table of biodiversity mitigation measures to be implemented before, during and after construction to avoid and minimise the impacts of the project, including action, outcome, timing and responsibility. Unique identifiers (e.g. BIO01) should be included for tracking through management plans and compliance auditing.	Table 15
		Map of alternative locations or sites within the development site that were considered when	Figure 14

BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
		locating and designing the project including constraints to the final selection.	
	Map of final project footprint, including construction and operation	Map of the final development footprint, including demarcation of any prescribed impacts and measures to minimise impacts.	Figure 3
		Showing the areas of biodiversity value on the site map of where impact has been avoided will assist in demonstrating the reasonable measures that the proponent has taken to avoid and minimise impacts.	Figure 17
	Maps demonstrating indirect impact zones where applicable	Map of sites within the subject land likely to be impacted by direct, indirect and prescribed impacts where applicable.	Figure 16
<b>Impact Summary</b>	Information	Identification of impacts:	
	Identification and an assessment of the impacts which are potential serious and irreversible impacts, in accordance with Subsections 10.2.2 for impacts on CEECs and 10.2.3 for threatened species.	<p>on entities at risk of a serious and irreversible impact (SAll), including addressing the assessment criteria in Subsection 10.2.2 (TECs) and 10.2.3 (species) of the BAM</p> <p>All relevant information required by the consent authority to determine whether the proposed impact is serious and irreversible including:</p>	Section 9.2



BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
		<p>clear documentation of the sources of information</p> <p>where confidence in the information provided is low or of questionable reliability</p> <p>how proposed additional measures will contribute to the recovery of the entity</p> <p>where information is not available, for example where impact thresholds for the entity have not been provided.</p>	
	<p>Identification of impacts requiring offset in accordance with Section 10.3.</p>	<p>requiring offsets</p>	<p>Section 9.3</p>
	<p>Identification of impacts not requiring offset in accordance with Paragraph 10.3.2.2.</p>	<p>not requiring offsets</p>	<p>Section 9.4</p>
	<p>Identification of areas not requiring assessment in accordance with Section 10.4.</p>	<p>not requiring further assessment.</p>	<p>Section 9.5</p>
	<p>Maps and Data</p>		
		<p>Mapped locations:</p>	
	<p>Map showing the location of serious and irreversible impacts</p>	<p>that support an entity at risk of a serious and irreversible impact (SAIL)</p>	<p>N/A</p>
	<p>Map of impacts requiring offset</p>	<p>where offsets are required</p>	<p>Figure 16</p>
	<p>Map of impacts not requiring offset</p>	<p>where offsets are not required, and</p>	<p>Figure 17</p>
	<p>Map of areas not requiring assessment</p>	<p>where no further assessment is required.</p>	<p>Figure 17</p>

BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
		Maps illustrating the extent of a TEC or species distribution and any other data used to address the assessment criteria for an entity at risk of an SAIL.	N/A
<b>Impact Summary</b>	Information	The assessor is required to report on:	
	Ecosystem credits and species credits that measure the impact of the development on biodiversity values, including:		
	future vegetation integrity score for each vegetation zone at the development site (Equations 17 and 18 in Appendix 6)		Table 18
	change in vegetation integrity score (Subsection 9.1.3)		Table 18
		the biodiversity risk weighting (BRW) for each ecosystem and species credit requirement generated	Table 21 and Table 22
	number of required ecosystem credits for the impact of development on each vegetation zone at a development site (Subsection 11.2.3)	the number of ecosystem credits for each PCT/TEC	Table 21
	number of required species credits for each threatened species that is impacted on by development (Subsection 11.2.4).	the number of species credits for each species credit species impacted by the proposal	Table 22

BDAR Section	BAM Requirements	Operational Manual Requirements	Assessment of Compliance and Recommendations
	Maps and Data		
	Table of PCTs requiring offset and the number of ecosystem credits required		Table 21
	Table of threatened species requiring offset and the number of species credits required		Table 22
	Submitted proposal in the Credit Calculator	All digital data must be submitted using the Upload Files function in BOAMS: digital shape files for all maps and spatial data completion of all required data fields in BOAMS and the BAM-C. Finalised case in the BAM-C (can be returned to assessor for editing).	To be submitted in BOAMs
<b>Biodiversity Credit Report</b>	Information		
	Credit classes for ecosystem credits and species credits at the development site.	biodiversity credit report from the BAM-C, which defines the number and class of ecosystem and species credits from the proposed impact.	Appendix F
	Maps and Data		
	Table of credit class and matching credit profile		Table 24

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# APPENDIX B :

## BAM Plot Data and Datasheets

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Plot Number	PCT	Area within Development Site Footprint (ha)	Patch Size	Condition Class	Composition - Tree	Composition - Shrub	Composition - Grass	Composition - Forbs	Composition - Ferns	Composition - Other	Structure - Tree	Structure - Shrub	Structure - Grass	Structure - Forbs	Structure - Ferns	Structure - Other	Function – Large Trees	Function – Hollow Trees	Function – Litter Cover	Function – Length Fallen Logs	Function - Tree Stem 5 to 9cm	Function - Tree Stem 10 to 19cm	Function - Tree Stem 20 to 29cm	Function – Tree Stem 30 to 49cm	Function – Tree Stem 50 to 79cm	Function – Tree Regeneration	Function - High Threat Exotic
1	1619	0.71	101	Good_shrubs-removed	5	11	13	9	2	4	45.8	8.9	88.0	1.0	3.1	1.7	0	1	52.0	6.0	0	0	1	1	0	1	1.2
2	1619	0.16	101	Good_shrubs-intact	4	10	13	13	1	5	32.2	8.3	73.7	4.7	0.3	1.0	2	2	25.2	13.0	0	0	1	1	1	1	4.2
3	1619	0.16	101	Good_shrubs-intact	3	12	17	7	0	6	35.3	4.0	85.3	1.0	0.0	1.7	0	1	48.0	0.0	0	0	1	1	0	1	0.2
4	1619	0.36	101	Moderate	4	3	6	4	2	1	40.2	0.6	16.3	0.5	1.0	0.1	1	1	25.0	1.0	0	1	0	1	1	0	77.7
5	1619	0.50	101	Low	3	1	5	4	0	0	25.0	0.1	12.3	0.4	0.0	0.0	1	1	33.0	0.0	0	0	1	1	1	0	70.3



Date: 25/06/2021	Project #: 21169	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: BF	Plot ID: P 1	Start:	32	356337	6320066	
Photos: -	Orientation (°): 180	End:	33	356329	6320022	
Dimensions: □20x20, □10x40	PCT: <u>Dandenong hills? 16/9 local road - grass</u>					Sheet: 1 of 2

Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1 Eucalyptus capitellata	25	8				
2 Pinetia linifolia linifolia	5	200				
3 Allocas. vittorialis	9.5	15				
4 Trachypogon hispidus	0.1	50				
5 Melaleuca sieberi	0.25	1				
6 Lepidosperma	10	2000				W01
7 Hypochaeris radice	6.1	20				
8 Acanthopogon fiss.	1	200				
9 Araucaria suaveolens	2	30				
10 Pterid. escul.	3	100				
11 Xanth. latifol. latifol.	1	20				
12 Dianella caerulea prostr.	0.2	20				
13 Cyathochaeta diandra	20	2000				
14 Lepidosp. lat.	5	300				
15 Themelia triandra	2	200				
16 Micro. stip. stip	20	2000				
17 Composita gumifera	15	5				
18 Phyllanthus hirtellus	0.2	10				
19 Hibbertia empetrifolia empet.	0.3	10				W02
20 Austrostipa pubescens	15	1500				
21 Homandra fil. fil.	0.1	20				
22 Billard scandens	0.1	10				
23 Gloch. ferd.	0.3	10				
24 Anisopyrum renaeum	10	1000				
25 Cryptostylis subulata	0.1	5				
26 Cassytha glabella	0.1	10				
27 Entolasia stricta	5	500				
28 Homandra long.	0.2	10				
29 Bossiaea obcord.	0.2	5				
30 Lindsaea linearis	0.1	30				
31 Lepidosp. trinervium	0.3	3				
32 Dodonaea triquetra	0.1	1				
33 Funzen ambigua	0.25	4				
34 Scaevola ramosissima	0.1	10				
35 Anaph. cost.	0.5	1				
36 Campylolabium latifol.	0.2	2				
37 Parsonsia stram.	0.5	10				
38 Gonocarpus tetragyn.	0.1	2				
39 Poa sieb.	0.1	5				
40 Cinn. lamph.	0.1	1				

Cover (%): 0.1, 0.2, 0.3...etc. up to 1, 2, 3...etc. up to 10, 15, 20, 25...etc. up to 100  
 Abundance (Count): 1, 2, 3... up to 10, 20, 30...up to 100, 200... up to 1,000...etc.  
 GF Group: TG=Tree, SG=Shrub, GG=Grass, FG=Forb, EG=Fern, OG=Other  
 Stratum: C = Canopy, SC = Sub-canopy, S = Shrub, G = Ground

Cover Note: 0.1% = approx 63 cm<sup>2</sup> or circle with 71cm diameter, 0.5% = approx 1.4m<sup>2</sup>, 1% = approx 2m<sup>2</sup>, 5% = approx 4.5m<sup>2</sup>, 25% = approx 10m<sup>2</sup>



Date: 25/06/2021	Project #: 21162	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: DI	Plot ID: P 1	Start:				
Photos:	Orientation (°):	End:				
Dimensions: □20x20, □10x40	PCT: <del>Not taken</del> both - good but grazed. 1619					Sheet: 2 of 2

Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1 Lobelia purpurascens	0.1	20				
2 Centella asiatica	0.1	5				
3 Andropogon virginicus	0.1	2				
4 Setaria parviflora	0.1	3				
5 Richardia humisatva	0.1	10				
6 Aristida vagans	0.5	50				
7 Xanthoxia trident.	0.1	1				
8 Arthochilus prolixus	0.1	1				
9 Echinos	0.1	10				
10 Epaeris pulch.	0.1	1				
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Cover (%): 0.1, 0.2, 0.3...etc. up to 1, 2, 3...etc. up to 10, 15, 20, 25...etc. up to 100  
 Abundance (Count): 1, 2, 3... up to 10, 20, 30...up to 100, 200... up to 1,000...etc.  
 GF Group: TG=Tree, SG=Shrub, GG=Grass, FG=Forb, EG=Fern, OG=Other  
 Stratum: C = Canopy, SC = Sub-canopy, S = Shrub, G = Ground  
 Cover Note: 0.1% = approx 63 cm<sup>2</sup> or circle with 71cm diameter, 0.5% = approx 1.4m<sup>2</sup>, 1% = approx 2m<sup>2</sup>, 5% = approx 4.5m<sup>2</sup>, 25% = approx 10m<sup>2</sup>







Date: 25/06/2021	Project #: 21164	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: B.F.H.G.	Plot ID: P 2	Start:	74	356 227	6319793	
Photos: 326 - 329	Orientation (°): 265	End:	75	356 177	6319794	
Dimensions: □20x20, □10x40	PCT: 1619 canopy but damper					Sheet: 1 of 2

Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1 Euc. capitellata	10	1				
2 Anaph. cost.	12	2				
3 Calymnia gummifera	10	2				
4 Harden violaceo	0.2	10				
5 Hibbertia empetrifol.	0.2	3				
6 Austrostipa pub.	1	100				
7 Schoenus apogon	50	5000				
8 Aristida vagans	1	100				
9 Lomandra longifolia	0.5	20				
10 Banksia marg? collina?	0.25	1				W03
11 Lepido. laterale	1	100				
12 Xanth. lat. lat.	0.25	2				
13 Pinna lpp. lin	1	30				
14 Alb. litt.	0.2	3				
15 Phyll. hirt.	0.1	5				
16 Andropog. virginicus	3	300				
17 Lasonia stram-	0.2	2				
18 Cassytha glab.	0.2	30				
19 Lepyroclia scariosa	1	100				
20 Axonopus fiss.						
21 Gonocarp. micranthus	3	500				
22 Dianella caesul. caesul.	0.2	2				
23 Galinia clark.	5	100				W04
24 Lambertia formosa	0.4	5				
25 Cyathochaeta diandra	5	500				
26 Cyperus polytachyos	2	200				
27 Melaleuca nodosa	5	50				
28 Glycine clare.	0.1	10				
29 Ischaemum purpurascens	0.1	50				
30 Gonocarpus tetragynus	0.4	50				
31 Opac. dipyl.	0.1	10				
32 Eragrost. brownii	2	200				
33 Haemodorum plan.	0.2	3				W05
34 Paspalidium dist.	0.1	10				W06
35 Melaleuca sieberi	0.75	4				
36 Micro stip. stip.	105	500				
37 Acacia long long	0.2	3				
38 <del>Ischaemum</del> Ischaemum australe	0.1	2				
39 Persoonia lewis	0.1	3				
40 Kunzea ambigua	0.25	2				

Cover (%): 0.1, 0.2, 0.3...etc. up to 1, 2, 3...etc. up to 10, 15, 20, 25...etc. up to 100  
 Abundance (Count): 1, 2, 3... up to 10, 20, 30...up to 100, 200... up to 1,000...etc.  
 GF Group: TG=Tree, SG=Shrub, GG=Grass, FG=Forb, EG=Fern, OG=Other  
 Stratum: C = Canopy, SC = Sub-canopy, S = Shrub, G = Ground

Cover Note: 0.1% = approx 63 cm<sup>2</sup> or circle with 71cm diameter, 0.5% = approx 1.4m<sup>2</sup>, 1% = approx 2m<sup>2</sup>, 5% = approx 4.5m<sup>2</sup>, 25% = approx 10m<sup>2</sup>



Date: 25/06/2021	Project #: 21169	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: BF, HG, ---	Plot ID: P 2	Start:				
Photos: ---	Orientation (°): ---	End:				
Dimensions: □20x20, □10x40	PCT: 16/9 -damp					

Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1 Pterid escul.	0.25	10				
2 Drosera spatulata	0.1	5				
3 Cryptostylis subulata	0.1	3				
4 Gamosecta americ.	0.1	10				
5 Goodenia parva	0.1	30				W07
6 Centella asiatica	0.1	20				
7 Hypericum japon.	0.1	10				
8 Paspalum dilat.	0.2	10				
9 Arthrochil proxilus.	0.1	10				
10 Atonopus fiss	1	100				
11 Conpa sumatrensis	0.1	2				
12 Laemannia gracilis	0.1	1				
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**Cover (%)**: 0.1, 0.2, 0.3...etc. up to 1, 2, 3...etc. up to 10, 15, 20, 25...etc. up to 100  
**Abundance (Count)**: 1, 2, 3... up to 10, 20, 30...up to 100, 200... up to 1,000...etc.  
**GF Group**: TG=Tree, SG=Shrub, GG=Grass, FG=Forb, EG=Fern, OG=Other  
**Stratum**: C = Canopy, SC = Sub-canopy, S = Shrub, G = Ground

**Cover Note**: 0.1% = approx 63 cm<sup>2</sup> or circle with 71cm diameter, 0.5% = approx 1.4m<sup>2</sup>, 1% = approx 2m<sup>2</sup>, 5% = approx 4.5m<sup>2</sup>, 25% = approx 10m<sup>2</sup>



Date: 25/06/2021

Personnel: SF, HG

Project #: 21169

Plot ID: P 002



**Large Trees / Stem Classes / Hollows**

DBH <sup>1</sup>	Stem Class Present <sup>2</sup>	Stem Class Count <sup>2,3</sup>	Hollow-bearing Tree Count <sup>4</sup>
80+ cm	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
50-79 cm	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	11	1
30-49 cm	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	111	1
20-29 cm	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	1111	
10-19 cm	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
5-9 cm	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
<5 cm	<input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Are there hollow-bearing trees within the zone? <sup>5</sup>			<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

1. DBH measured at 1.3m above ground.
2. Only living, native, tree species are to be recorded.
3. Exact stem counts must be provided for stems in the following classes: 50-79cm and 80+ cm (or additional classes for a PCT which has a smaller large tree threshold - e.g. heathlands). Include estimates of stem counts of other classes where there is extensive regeneration.
4. Hollow-bearing trees include living and dead native species allocated to the tree and shrub growth form groups. Hollow-bearing trees rooted within the plot with hollows that are visible from the ground must be included.
5. Where there are no hollow-bearing trees within a plot, but they are present within the vegetation zone, a value of 1 is to be entered in the BAMC.

**Logs**

Length of logs <sup>6,7</sup>	(≥10cm diameter, >50cm in length)
Tally	13
Total (m)	13

6. Dead native and exotic species recorded.
7. Logs must be entirely or partially on the ground within the plot, and only the length within the plot is recorded.

**Subplots (1x1m)**

Subplot	Litter Cover (%) <sup>9,10</sup>					Bare Ground Cover (%)					Cryptogram Cover (%)					Rock Cover (%)				
1 x 1m Score <sup>8</sup>	50	15	45	15	1	10	1	15	10	20	2	0	1	0	0	0	0	0	0	0
Average Score	25.2																			

8. Scores must be provided for litter cover. Include scores for other variables where supplementary information is required.
9. Litter includes leaves, seeds, twigs, branchlets and branches (<10cm diameter) from native and exotic species.
10. Must include all plant material detached from a plant and forms part of the litter layer on the ground surface. Material that is not detached is assessed as growth form foliage cover.

**Composition and Structure Summary**

Attribute		Value
Count of Native Richness (Composition)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Native Cover (Structure)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed Cover		

**Additional Notes**

Swamp and wet towards 50m end.



Date: 25/06/2021	Project #: 21169	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: BF, HG	Plot ID: P 3	Start:	76	356300	6319771	
Photos: 330-334	Orientation (°): 359	End:	77	356294	6319807	
Dimensions: □20x20, □10x40	PCT: 1619 - good.					Sheet: 1 of 2

Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1 Euc. capit.	30	10				
2 Anypoph. cost	5	2				
3 Anisopogon avenaceus	1	100				
4 micro stip stip	10	100				
5 Euto strict	5	500				
6 Haemadar. plan.	0.2	3				
7 Pinel. lin. lra	1	30				
8 Phyllanthus hirtellus	1	100				
9 Brunoniella pumil.	0.1	25				
10 Cassytha glab.	0.1	50				
11 <del>Clusia deb.</del>						
12 Austrostipa pubescens	15	1500				
13 Prosera peltata	0.1	2				
14 Lepidosp. neesii	10	1				
15 Allo. litt.	0.25	3				
16 Leptrodia scariosa	1	100				
17 Passasia stran.	0.25	4				
18 Schoenus apogon	1	200				
19 Panicum simile	2	200				
20 Aristida vagans	1	100				
21 Comesperma eric.	0.1	1				
22 Gonocarpus tetragynus	0.2	10				
23 Gahnia clarkii	2	20				
24 Mirbelia rubrifolia	0.3	15				
25 Banksia collina?	0.3	2				W08
26 Gonocarp. micranthus	0.1	5				
27 <del>Euto stricta</del>						
28 Cassytha pub.	0.1	1				
29 Andro virginicus	0.2	10				
30 <del>Phyllo</del> Philothrix duxteri	10	2000				
31 Hibbertia empet empet	0.2	5				
32 <del>Dianella caerulea prod</del>						
33 Cyathochaeta diandra	25	2506				
34 Leptosp. laterale	1	100				
35 Billard. scand.	0.1	3				
36 Melaleuca sieb.	0.25	3				
37 Lamandra multi. multi	0.1	1				
38 Acacia brownii	0.2	1				
39 <del>baux sp</del>	0.1	2				W09
40 <del>farth. lat. lat</del>	1	10				

Cover (%): 0.1, 0.2, 0.3...etc. up to 1, 2, 3...etc. up to 10, 15, 20, 25...etc. up to 100  
 Abundance (Count): 1, 2, 3... up to 10, 20, 30...up to 100, 200... up to 1,000...etc.  
 GF Group: TG=Tree, SG=Shrub, GG=Grass, FG=Forb, EG=Fern, OG=Other  
 Stratum: C = Canopy, SC = Sub-canopy, S = Shrub, G = Ground

Cover Note: 0.1% = approx 63 cm<sup>2</sup> or circle with 71cm diameter, 0.5% = approx 1.4m<sup>2</sup>, 1% = approx 2m<sup>2</sup>, 5% = approx 4.5m<sup>2</sup>, 25% = approx 10m<sup>2</sup>



Date: 25/06/2021	Project #: 21169	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: B.F.H.G.	Plot ID: P 3	Start:				
Photos: _____	Orientation (°): _____	End:				
Dimensions: □20x20, □10x40	PCT: 1619 - good					Sheet: 2 of 2

Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1 Kurzea ambigua	0.2	1				
2 Eragrost. brownii	1	100				
3 Hypoch. rad.	0.1	5				
4 Glycer. claud.	0.1	5				
5 Petroselin. tenuis	0.1	3				
6 Dianella caerulea prod.	0.2	5				
7 Themeda triarctea	0.1	3				
8 Bambusa formos.	0.25	1				
9 Trachypogon incisus	0.1	10				
10 Acaecia long. long.	0.1	2				
11						
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**Cover (%)**: 0.1, 0.2, 0.3...etc. up to 1, 2, 3...etc. up to 10, 15, 20, 25...etc. up to 100  
**Abundance (Count)**: 1, 2, 3... up to 10, 20, 30...up to 100, 200... up to 1,000...etc.  
**GF Group**: TG=Tree, SG=Shrub, GG=Grass, FG=Forb, EG=Fern, OG=Other  
**Stratum**: C = Canopy, SC = Sub-canopy, S = Shrub, G = Ground  
**Cover Note**: 0.1% = approx 63 cm<sup>2</sup> or circle with 71cm diameter, 0.5% = approx 1.4m<sup>2</sup>, 1% = approx 2m<sup>2</sup>, 5% = approx 4.5m<sup>2</sup>, 25% = approx 10m<sup>2</sup>







Date: 25/06/2021	Project #: 21169	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: BF.HG.	Plot ID: P 4	Start:	78	356312	6319867	
Photos: 335 - 338	Orientation (°): 196	End:	79	356287	6319826	
Dimensions: □20x20, □10x40	PCT: 1619-low					Sheet: 1 of 2

Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1 Conchus clavul.	50	5000				
2 Euc. cap. tellur.	15	3				
3 Plantid. escul.	0.75	30				
4 Richard. humis.	0.2	100				
5 Modiola carol.	0.1	5				
6 Carex sumatr.	6.2	30				
7 Tarax. offic.	0.1	10				
8 Senecio mad.	0.5	100				
9 Micro stip. stip.	5	500				
10 Axonopus. fissi	25	2500				
11 Anthoxanthum odorat.	0.1	3				
12 Hypochaeris radicata	0.2	50				
13 Cyperus polystachyos	0.1	10				
14 Sila rhomb.	0.1	20				
15 Juncus cognatus	1	100				
16 Setaria parv.	1	100				
17 Hydrocotyle lax.	0.1	30				
18 Acaeria long long	0.25	3				
19 Echino. desert	0.1	10				
20 Ligustrum sinense	0.1	3				
21 Cinn. camp.	0.1	1				
22 Cynodon dactylon	10	1000				
23 Diarella cae. procl.	0.2	5				
24 Paspalum dilat.	2	200				
25 Plantago lanceolata	0.2	100				
26 Trifolium repens	0.3	300				
27 Cyperus brevifolius	0.1	10				
28 Lindsaea linearis	0.2	40				
29 Imperata cylindrica	1	100				
30 Centella asiatica	0.1	20				
31 Anaph. cost.	10	3				
32 Cymbia gummi.	15	5				
33 Eupat. nigr. stricta	0.1	20				
34 Bromus cern.	0.1	10				
35 Gonocamp. tet.	0.1	1				
36 Pinna lin. lin.	0.2	3				
37 Harder violaceo	0.1	1				
38 Galinula undul.	0.1	5				
39 Bloch. ferch.	0.2	3				
40 Verbena bon.	0.1	1				

Cover (%): 0.1, 0.2, 0.3...etc. up to 1, 2, 3...etc. up to 10, 15, 20, 25...etc. up to 100  
Abundance (Count): 1, 2, 3... up to 10, 20, 30...up to 100, 200... up to 1,000...etc.  
GF Group: TG=Tree, SG=Shrub, GG=Grass, FG=Forb, EG=Fern, OG=Other  
Stratum: C = Canopy, SC = Sub-canopy, S = Shrub, G = Ground  
Ver Note: 0.1% = approx 63 cm<sup>2</sup> or circle with 71cm diameter, 0.5% = approx 1.4m<sup>2</sup>, 1% = approx 2m<sup>2</sup>, 5% = approx 4.5m<sup>2</sup>, 25% = approx 10m<sup>2</sup>



Date: 25/06/2021	Project #: 21169	Location	Waypoint	Easting	Northing	cumberland ecology	
Personnel: BF, HG	Plot ID: P 4	Start:					
Photos: -	Orientation (°):	End:					
Dimensions: <input type="checkbox"/> 20x20, <input type="checkbox"/> 10x40						PCT: 161a - low	Sheet: 2 of 2

Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1 Sporob. afric	0.1	2				
2 Pitto undul.	0.1	1				
3						
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Cover (%): 0.1, 0.2, 0.3...etc. up to 1, 2, 3...etc. up to 10, 15, 20, 25...etc. up to 100  
 Abundance (Count): 1, 2, 3... up to 10, 20, 30...up to 100, 200... up to 1,000...etc.

GF Group: TG=Tree, SG=Shrub, GG=Grass, FG=Forb, EG=Fern, OG=Other  
 Stratum: C = Canopy, SC = Sub-canopy, S = Shrub, G = Ground

Cover Note: 0.1% = approx 63 cm<sup>2</sup> or circle with 71cm diameter, 0.5% = approx 1.4m<sup>2</sup>, 1% = approx 2m<sup>2</sup>, 5% = approx 4.5m<sup>2</sup>, 25% = approx 10m<sup>2</sup>







Date: 25/06/2021	Project #: 21169	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: BF, HG	Plot ID: P 5	Start:	81	356265	6319843	
Photos: 339 - 342	Orientation (°):	End:	80	356290	6319887	
Dimensions: 20x20, 10x40	PCT: 1619-low				Sheet: 1 of 2	

Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1 Anaph. cest.	10	2				
2 Composit. gumm.	5	1				
3 Euc. capitellata	10	2				
4 Aporopus fiss	50	5000				
5 Senecio mach	0.25	20				
6 Cerastium glom.	0.1	10				
7 Cynodon dactylon	10	1000				
8 Lolium perenne	10	1000				
9 Juncus cognatus	1	200				
10 Lotus ulig.	0.2	200				
11 Hypochaeris radic.	0.1	50				
12 Sida rhomb.	0.1	2 10				
13 Lactuca saligna	0.1	20				
14 Conyza sumatrensis	0.1	20				
15 Gamochaeta americana						
16 Richardia humilis	0.1	20				
17 Cyperus brev	0.1	20				
18 Verbena bon.	0.1	2				
19 Cynodon dact.						
20 Bromus cath.	0.2	50				
21 Cerastium glomeratum						
22 Plantago lanc.	0.1	30				
23 Trifolium repens	0.2	100				
24 Cyclosp. lept.	0.1	30				
25 Eragrost. browni	0.1	5				
26 Micro. stip. stip.	2	200				
27 Sporob. afric.	0.1	5				
28 Pimelea lin. lin.	0.1	1				
29 Verbena qualt.	0.1	10				
30 Gamochaeta americana	0.1	30				
31 Anthoxanthum odoratum	0.1	10				
32 Hydrocotyle lax.	0.1	5				
33 Poa annua	0.1	20				
34 Mediola caroliniana	0.1	10				
35 Lythrum hyss.	0.1	1				
36 Medicago minima	0.1	30				
37 Cenchrus clandestinus	20	2000				
38 Cyperus polystach.	0.1	2				
39 Lolita purpurasc.	0.1	1				
40 Otalis cornic.	0.1	3				

Cover (%): 0.1, 0.2, 0.3...etc. up to 1, 2, 3...etc. up to 10, 15, 20, 25...etc. up to 100  
 Abundance (Count): 1, 2, 3... up to 10, 20, 30...up to 100, 200... up to 1,000...etc.  
 GF Group: TG=Tree, SG=Shrub, GG=Grass, FG=Forb, EG=Fern, OG=Other  
 Stratum: C = Canopy, SC = Sub-canopy, S = Shrub, G = Ground

Cover Note: 0.1% = approx 63 cm<sup>2</sup> or circle with 71cm diameter, 0.5% = approx 1.4m<sup>2</sup>, 1% = approx 2m<sup>2</sup>, 5% = approx 4.5m<sup>2</sup>, 25% = approx 10m<sup>2</sup>



Date: 25/06/2021	Project #: 21169	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: B.F. HG	Plot ID: P 5	Start:				
Photos: _____	Orientation (°): _____	End:				
Dimensions: <input type="checkbox"/> 20x20, <input type="checkbox"/> 10x40	PCT: 1619 low					Sheet: 2 of 2

Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1 Paspalid d. St.	0.1	5				
2 Dimella caerulea procl.	0.1	3				
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**Cover (%)**: 0.1, 0.2, 0.3...etc. up to 1, 2, 3...etc. up to 10, 15, 20, 25...etc. up to 100  
**Abundance (Count)**: 1, 2, 3... up to 10, 20, 30...up to 100, 200... up to 1,000...etc.  
**GF Group**: TG=Tree, SG=Shrub, GG=Grass, FG=Forb, EG=Fern, OG=Other  
**Stratum**: C = Canopy, SC = Sub-canopy, S = Shrub, G = Ground  
**Cover Note**: 0.1% = approx 63 cm<sup>2</sup> or circle with 71cm diameter, 0.5% = approx 1.4m<sup>2</sup>, 1% = approx 2m<sup>2</sup>, 5% = approx 4.5m<sup>2</sup>, 25% = approx 10m<sup>2</sup>

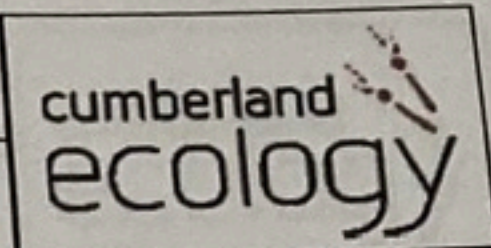


Date: 25/06/2021

Project #: 21169

Personnel: B.F.H.G.

Plot ID: P 005



**Large Trees / Stem Classes / Hollows**

DBH <sup>1</sup>	Stem Class Present <sup>2</sup>	Stem Class Count <sup>2,3</sup>	Hollow-bearing Tree Count <sup>4</sup>
80+ cm	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
50-79 cm	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	1	
30-49 cm	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	11	
20-29 cm	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	11	
10-19 cm	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
5-9 cm	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
<5 cm	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No		
Are there hollow-bearing trees within the zone? <sup>5</sup>			<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

1. DBH measured at 1.3m above ground.
2. Only living, native, tree species are to be recorded.
3. Exact stem counts must be provided for stems in the following classes: 50-79cm and 80+ cm (or additional classes for a PCT which has a smaller large tree threshold - e.g. heathlands). Include estimates of stem counts of other classes where there is extensive regeneration.
4. Hollow-bearing trees include living and dead native species allocated to the tree and shrub growth form groups. Hollow-bearing trees rooted within the plot with hollows that are visible from the ground must be included.
5. Where there are no hollow-bearing trees within a plot, but they are present within the vegetation zone, a value of 1 is to be entered in the BAMC.

**Logs**

Length of logs <sup>6,7</sup>	(≥10cm diameter, >50cm in length)
Tally	0
Total (m)	0

6. Dead native and exotic species recorded.
7. Logs must be entirely or partially on the ground within the plot, and only the length within the plot is recorded.

**Subplots (1x1m)**

Subplot	Litter Cover (%) <sup>9,10</sup>	Bare Ground Cover (%)	Cryptogram Cover (%)	Rock Cover (%)
1 x 1m Score <sup>8</sup>	30 80 10 10 35	0 1 2 0 0	0 0 0 0 0	0 0 0 0 0
Average Score	33			

8. Scores must be provided for litter cover. Include scores for other variables where supplementary information is required.
9. Litter includes leaves, seeds, twigs, branchlets and branches (<10cm diameter) from native and exotic species.
10. Must include all plant material detached from a plant and forms part of the litter layer on the ground surface. Material that is not detached is assessed as growth form foliage cover.

**Composition and Structure Summary**

Attribute		Value
Count of Native Richness (Composition)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Native Cover (Structure)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed Cover		

**Additional Notes**

Paddock used by horses.



Date: 25/06/2021	Project #: 21169	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: BF	Plot ID: P 21169/1	Start:				
Photos:	Orientation (°):	End:				
Dimensions: □20x20, □10x40	PCT: <del>Marantaceae</del> <del>Forb</del> - Addit spp. 1619 - good.				Sheet: 1 of 1	

Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1 Gahnia clark						
2 Gonocarp micranthus						
3 Glycine clark						
4 Alcaea myrs (s)						
5 Ozothamn dios.						
6 Gahnia radula						
7 Acacia long long.						
8 Pultenaea pallescens						
9 Melaleuca nodosum						
10 Sida rhomb.						
11 Dichondra repens						
12 Juncus usill.						
13 Goodenia panic.						
14 Coynia sumatr.						
15 Banksia oblong.						
16 Gonocarp tenu.						
17 Hydratyle bon.						
18 Lambertia form.						
19 Haemodor par.						
20 Rytidosp. tenuifol.						
21 Eragrostis brownii						
22 Digitaria parv.						
23 Gladiolus undul.						
24 Opercularia diphylla						
25 Drosera peltata						
26 Glycine microphylla						
27 Schima apogon						
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Cover (%): 0.1, 0.2, 0.3...etc. up to 1, 2, 3...etc. up to 10, 15, 20, 25...etc. up to 100  
 Abundance (Count): 1, 2, 3... up to 10, 20, 30...up to 100, 200... up to 1,000...etc.  
 GF Group: TG=Tree, SG=Shrub, GG=Grass, FG=Forb, EG=Fern, OG=Other  
 Stratum: C = Canopy, SC = Sub-canopy, S = Shrub, G = Ground

Cover Note: 0.1% = approx 63 cm<sup>2</sup> or circle with 71cm diameter, 0.5% = approx 1.4m<sup>2</sup>, 1% = approx 2m<sup>2</sup>, 5% = approx 4.5m<sup>2</sup>, 25% = approx 10m<sup>2</sup>



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# APPENDIX C :

## Flora List





Scientific Name	Exotic	Common Name	BC Act Status	EPBC Act Status
<i>Acacia brownii</i>		Heath Wattle	Not Listed	Not Listed
<i>Acacia longifolia</i> var. <i>longifolia</i>		Sydney Golden Wattle	Not Listed	Not Listed
<i>Acacia myrtifolia</i>		Red-stemmed Wattle	Not Listed	Not Listed
<i>Acacia suaveolens</i>		Sweet Wattle	Not Listed	Not Listed
<i>Allocasuarina littoralis</i>		Black She-Oak	Not Listed	Not Listed
<i>Andropogon virginicus</i>	*	Whisky Grass	Not Listed	Not Listed
<i>Angophora costata</i>		Sydney Red Gum	Not Listed	Not Listed
<i>Anisopogon avenaceus</i>		Oat Speargrass	Not Listed	Not Listed
<i>Anthoxanthum odoratum</i>	*	Sweet Vernal Grass	Not Listed	Not Listed
<i>Aristida vagans</i>		Threawn Speargrass	Not Listed	Not Listed
<i>Arthrochilus prolixus</i>			Not Listed	Not Listed
<i>Austrostipa pubescens</i>			Not Listed	Not Listed
<i>Axonopus fissifolius</i>	*	Narrow-leaved Carpet Grass	Not Listed	Not Listed
<i>Banksia collina</i>			Not Listed	Not Listed
<i>Banksia oblongifolia</i>		Fern-leaved Banksia	Not Listed	Not Listed
<i>Billardiera scandens</i>		Hairy Apple Berry	Not Listed	Not Listed
<i>Bossiaea obcordata</i>		Spiny Bossiaea	Not Listed	Not Listed
<i>Bromus catharticus</i>	*	Praire Grass	Not Listed	Not Listed
<i>Brunoniella pumilio</i>		Dwarf Blue Trumpet	Not Listed	Not Listed
<i>Callistemon linearifolius</i>		Netted Bottle Brush	Vulnerable	Not Listed
<i>Cassytha glabella</i>			Not Listed	Not Listed
<i>Cassytha pubescens</i>		Downy Dodder-laurel	Not Listed	Not Listed
<i>Cenchrus clandestinus</i>	*	Kikuyu Grass	Not Listed	Not Listed
<i>Centella asiatica</i>		Indian Pennywort	Not Listed	Not Listed
<i>Cerastium glomeratum</i>	*	Mouse-ear Chickweed	Not Listed	Not Listed
<i>Cinnamomum camphora</i>	*	Camphor Laurel	Not Listed	Not Listed
<i>Comesperma ericinum</i>		Pyramid Flower	Not Listed	Not Listed
<i>Conyza sumatrensis</i>	*	Tall fleabane	Not Listed	Not Listed
<i>Corymbia gummifera</i>		Red Bloodwood	Not Listed	Not Listed
<i>Cryptostylis subulata</i>		Large Tongue Orchid	Not Listed	Not Listed
<i>Cyathochaeta diandra</i>			Not Listed	Not Listed
<i>Cyclosporum leptophyllum</i>	*	Slender Celery	Not Listed	Not Listed
<i>Cynodon dactylon</i>		Common Couch	Not Listed	Not Listed



Scientific Name	Exotic	Common Name	BC Act Status	EPBC Act Status
<i>Cyperus brevifolius</i>	*		Not Listed	Not Listed
<i>Cyperus polystachyos</i>			Not Listed	Not Listed
<i>Deyeuxia decipiens</i>		Devious Bent-grass	Not Listed	Not Listed
<i>Dianella caerulea</i> var. <i>caerulea</i>			Not Listed	Not Listed
<i>Dianella caerulea</i> var. <i>producta</i>			Not Listed	Not Listed
<i>Dichondra repens</i>		Kidney Weed	Not Listed	Not Listed
<i>Digitaria parviflora</i>		Small-flowered Finger Grass	Not Listed	Not Listed
<i>Dodonaea triquetra</i>		Large-leaf Hop-bush	Not Listed	Not Listed
<i>Drosera peltata</i>			Not Listed	Not Listed
<i>Drosera spatulata</i>			Not Listed	Not Listed
<i>Echinopogon caespitosus</i>		Bushy Hedgehog-grass	Not Listed	Not Listed
<i>Entolasia stricta</i>		Wiry Panic	Not Listed	Not Listed
<i>Epacris pulchella</i>		Wallum Heath	Not Listed	Not Listed
<i>Eragrostis brownii</i>		Brown's Lovegrass	Not Listed	Not Listed
<i>Eucalyptus capitellata</i>		Brown Stringybark	Not Listed	Not Listed
<i>Gahnia clarkei</i>		Tall Saw-sedge	Not Listed	Not Listed
<i>Gahnia radula</i>			Not Listed	Not Listed
<i>Gamochaeta americana</i>	*	Purple Cudweed	Not Listed	Not Listed
<i>Gladiolus undulatus</i>	*	Wild Gladiolus	Not Listed	Not Listed
<i>Glochidion ferdinandi</i>		Cheese Tree	Not Listed	Not Listed
<i>Glycine clandestina</i>		Twining glycine	Not Listed	Not Listed
<i>Glycine microphylla</i>		Small-leaf Glycine	Not Listed	Not Listed
<i>Gompholobium latifolium</i>		Golden Glory Pea	Not Listed	Not Listed
<i>Gonocarpus micranthus</i>			Not Listed	Not Listed
<i>Gonocarpus tetragynus</i>		Poverty Raspwort	Not Listed	Not Listed
<i>Gonocarpus teucrioides</i>		Germander Raspwort	Not Listed	Not Listed
<i>Goodenia paniculata</i>			Not Listed	Not Listed
<i>Haemodorum planifolium</i>			Not Listed	Not Listed
<i>Hardenbergia violacea</i>		False Sarsaparilla	Not Listed	Not Listed
<i>Hibbertia empetrifolia</i> subsp. <i>empetrifolia</i>			Not Listed	Not Listed
<i>Hydrocotyle bonariensis</i>	*		Not Listed	Not Listed
<i>Hydrocotyle laxiflora</i>		Stinking Pennywort	Not Listed	Not Listed



Scientific Name	Exotic	Common Name	BC Act Status	EPBC Act Status
<i>Hypericum japonicum</i>			Not Listed	Not Listed
<i>Hypochoeris radicata</i>	*	Catsear	Not Listed	Not Listed
<i>Imperata cylindrica</i>		Blady Grass	Not Listed	Not Listed
<i>Ischaemum australe</i>			Not Listed	Not Listed
<i>Juncus cognatus</i>	*		Not Listed	Not Listed
<i>Juncus usitatus</i>			Not Listed	Not Listed
<i>Kunzea ambigua</i>		Tick Bush	Not Listed	Not Listed
<i>Lactuca saligna</i>	*	Willow-leaved Lettuce	Not Listed	Not Listed
<i>Lambertia formosa</i>		Mountain Devil	Not Listed	Not Listed
<i>Laxmannia gracilis</i>		Slender Wire Lily	Not Listed	Not Listed
<i>Lepidosperma laterale</i>		Variable Sword-sedge	Not Listed	Not Listed
<i>Lepidosperma neesii</i>			Not Listed	Not Listed
<i>Leptospermum trinervium</i>		Slender Tea-tree	Not Listed	Not Listed
<i>Lepyrodia scariosa</i>			Not Listed	Not Listed
<i>Ligustrum sinense</i>	*	Small-leaved Privet	Not Listed	Not Listed
<i>Lindsaea linearis</i>		Screw Fern	Not Listed	Not Listed
<i>Lobelia purpurascens</i>		whiteroot	Not Listed	Not Listed
<i>Lolium perenne</i>	*	Perennial Ryegrass	Not Listed	Not Listed
<i>Lomandra filiformis subsp. filiformis</i>			Not Listed	Not Listed
<i>Lomandra longifolia</i>		Spiny-headed Mat-rush	Not Listed	Not Listed
<i>Lomandra multiflora subsp. multiflora</i>		Many-flowered Mat-rush	Not Listed	Not Listed
<i>Lotus uliginosus</i>	*	Birds-foot Trefoil	Not Listed	Not Listed
<i>Lythrum hyssopifolia</i>		Hyssop Loosestrife	Not Listed	Not Listed
<i>Medicago minima</i>	*	Woolly Burr Medic	Not Listed	Not Listed
<i>Melaleuca nodosa</i>			Not Listed	Not Listed
<i>Melaleuca sieberi</i>			Not Listed	Not Listed
<i>Microlaena stipoides var. stipoides</i>		Weeping Grass	Not Listed	Not Listed
<i>Mirbelia rubiifolia</i>		Heathy Mirbelia	Not Listed	Not Listed
<i>Modiola caroliniana</i>	*	Red-flowered Mallow	Not Listed	Not Listed
<i>Opercularia diphylla</i>		Stinkweed	Not Listed	Not Listed
<i>Oxalis corniculata</i>	*	Creeping Oxalis	Not Listed	Not Listed
<i>Ozothamnus diosmifolius</i>		White Dogwood	Not Listed	Not Listed
<i>Panicum simile</i>		Two-colour Panic	Not Listed	Not Listed



Scientific Name	Exotic	Common Name	BC Act Status	EPBC Act Status
<i>Parsonsia straminea</i>		Common Silkpod	Not Listed	Not Listed
<i>Paspalidium distans</i>			Not Listed	Not Listed
<i>Paspalum dilatatum</i>	*	Paspalum	Not Listed	Not Listed
<i>Persoonia levis</i>		Broad-leaved Geebung	Not Listed	Not Listed
<i>Phyllanthus hirtellus</i>		Thyme Spurge	Not Listed	Not Listed
<i>Pimelea linifolia subsp. linifolia</i>			Not Listed	Not Listed
<i>Pittosporum undulatum</i>		Sweet Pittosporum	Not Listed	Not Listed
<i>Plantago lanceolata</i>	*	Lamb's Tongues	Not Listed	Not Listed
<i>Poa annua</i>	*	Winter Grass	Not Listed	Not Listed
<i>Poa sieberiana</i>		Snowgrass	Not Listed	Not Listed
<i>Pteridium esculentum</i>		Bracken	Not Listed	Not Listed
<i>Ptilothrix deusta</i>			Not Listed	Not Listed
<i>Pultenaea paleacea</i>		Chaffy Bush-pea	Not Listed	Not Listed
<i>Richardia humistrata</i>	*		Not Listed	Not Listed
<i>Scaevola ramosissima</i>		Purple Fan-flower	Not Listed	Not Listed
<i>Schoenus apogon</i>		Fluke Bogrush	Not Listed	Not Listed
<i>Senecio madagascariensis</i>	*	Fireweed	Not Listed	Not Listed
<i>Setaria parviflora</i>	*		Not Listed	Not Listed
<i>Sida rhombifolia</i>	*	Paddy's Lucerne	Not Listed	Not Listed
<i>Sporobolus africanus</i>	*	Parramatta Grass	Not Listed	Not Listed
<i>Taraxacum officinale</i>	*	Dandelion	Not Listed	Not Listed
<i>Themeda triandra</i>			Not Listed	Not Listed
<i>Trachymene incisa</i>		Trachymene	Not Listed	Not Listed
<i>Trifolium repens</i>	*	White Clover	Not Listed	Not Listed
<i>Verbena bonariensis</i>	*	Purpletop	Not Listed	Not Listed
<i>Verbena quadrangularis</i>	*		Not Listed	Not Listed
<i>Xanthorrhoea latifolia subsp. latifolia</i>			Not Listed	Not Listed
<i>Xanthosia tridentata</i>		Rock Xanthosia	Not Listed	Not Listed



# APPENDIX D :

## Fauna List





Scientific Name	Exotic	Common Name	BC Act Status	EPBC Act Status	Survey Method
<b>Amphibians</b>					
<i>Crinia signifera</i>		Common Eastern Froglet	Not Listed	Not Listed	Amphibian Survey
<i>Limnodynastes peronii</i>		Striped Marsh Frog	Not Listed	Not Listed	Amphibian Survey
<i>Limnodynastes tasmaniensis</i>		Spotted Marsh Frog	Not Listed	Not Listed	Amphibian Survey
<i>Litoria dentata</i>		Bleating Tree Frog	Not Listed	Not Listed	Amphibian Survey
<i>Litoria fallax</i>		Eastern Dwarf Sedge Frog	Not Listed	Not Listed	Amphibian Survey
<i>Litoria latopalmata</i>		Broad-palmed rocket Frog	Not Listed	Not Listed	Amphibian Survey
<i>Litoria peronii</i>		Peron's Tree Frog	Not Listed	Not Listed	Amphibian Survey
<i>Uperoleia fusca</i>		Dusky Toadlet	Not Listed	Not Listed	Amphibian Survey
<b>Aves</b>					
<i>Alisterus scapularis</i>		Australian King-Parrot	Not Listed	Not Listed	Diurnal Bird Survey
<i>Acridotheres tristis</i>	*	Common Myna	Exotic	Exotic	Diurnal Bird Survey
<i>Anas castanea</i>		Chestnut Teal	Not Listed	Not Listed	Diurnal Bird Survey
<i>Anthochaera carunculata</i>		Red Wattlebird	Not Listed	Not Listed	Diurnal Bird Survey
<i>Cacatua galerita</i>		Sulphur-crested Cockatoo	Not Listed	Not Listed	Diurnal Bird Survey
<i>Caligavis chrysops</i>		Yellow-faced Honeyeater	Not Listed	Not Listed	Diurnal Bird Survey
<i>Chenonetta jubata</i>		Australian Wood Duck	Not Listed	Not Listed	Diurnal Bird Survey
<i>Coracina novaehollandiae</i>		Black-faced Cuckoo-shrike	Not Listed	Not Listed	Diurnal Bird Survey
<i>Corvus coronoides</i>		Australian Raven	Not Listed	Not Listed	Diurnal Bird Survey
<i>Cracticus nigrogularis</i>		Pied Butcherbird	Not Listed	Not Listed	Diurnal Bird Survey
<i>Cracticus torquatus</i>		Grey Butcherbird	Not Listed	Not Listed	Diurnal Bird Survey



Scientific Name	Exotic	Common Name	BC Act Status	EPBC Act Status	Survey Method
<i>Dacelo novaeguineae</i>		Laughing Kookaburra	Not Listed	Not Listed	Diurnal Bird Survey
<i>Eolophus roseicapilla</i>		Galah	Not Listed	Not Listed	Diurnal Bird Survey
<i>Eurystomus orientalis</i>		Dollarbird	Not Listed	Not Listed	Diurnal Bird Survey
<i>Geopelia humeralis</i>		Bar-shouldered Dove	Not Listed	Not Listed	Diurnal Bird Survey
<i>Grallina cyanoleuca</i>		Magpie-lark	Not Listed	Not Listed	Diurnal Bird Survey
<i>Gymnorhina tibicen</i>		Australian Magpie	Not Listed	Not Listed	Diurnal Bird Survey
<i>Lichenostomus penicillatus</i>		White-plumed Honeyeater	Not Listed	Not Listed	Diurnal Bird Survey
<i>Malurus cyaneus</i>		Superb Fairywren	Not Listed	Not Listed	Diurnal Bird Survey
<i>Manorina melanocephala</i>		Noisy Miner	Not Listed	Not Listed	Diurnal Bird Survey
<i>Meliphaga lewinii</i>		Lewin's Honeyeater	Not Listed	Not Listed	Diurnal Bird Survey
<i>Ninox strenua</i>		Powerful Owl	Vulnerable	Not Listed	Nocturnal Spotlighting and Call Playback
<i>Ocyphaps lophotes</i>		Crested Pigeon	Not Listed	Not Listed	Diurnal Bird Survey
<i>Pachycephala pectoralis</i>		Golden Whistler	Not Listed	Not Listed	Diurnal Bird Survey
<i>Pardalotus punctatus</i>		Spotted Pardalote	Not Listed	Not Listed	Diurnal Bird Survey
<i>Philemon corniculatus</i>		Noisy Friarbird	Not Listed	Not Listed	Diurnal Bird Survey
<i>Platycercus eximius</i>		Eastern Rosella	Not Listed	Not Listed	Diurnal Bird Survey
<i>Ptilonorhynchus violaceus</i>		Satin Bowerbird	Not Listed	Not Listed	Diurnal Bird Survey
<i>Rhipidura albiscapa</i>		Grey Fantail	Not Listed	Not Listed	Diurnal Bird Survey
<i>Rhipidura leucophrys</i>		Willie Wagtail	Not Listed	Not Listed	Diurnal Bird Survey



Scientific Name	Exotic	Common Name	BC Act Status	EPBC Act Status	Survey Method
<i>Strepera graculina</i>		Pied Currawong	Not Listed	Not Listed	Diurnal Bird Survey
<i>Threskiornis spinicollis</i>		Straw-necked Ibis	Not Listed	Not Listed	Diurnal Bird Survey
<i>Todiramphus sanctus</i>		Sacred Kingfisher	Not Listed	Not Listed	Diurnal Bird Survey
<i>Trichoglossus moluccanus</i>		Rainbow Lorikeet	Not Listed	Not Listed	Diurnal Bird Survey
<i>Vanellus miles</i>		Masked Lapwing	Not Listed	Not Listed	Diurnal Bird Survey
<b>Mammals</b>					
<i>Antechinus stuartii</i>		Brown Antechinus	Not Listed	Not Listed	Terrestrial Elliott Trapping
<i>Chalinolobus gouldii</i>		Gould's Wattled Bat	Not Listed	Not Listed	Ultrasonic Call Detection
<i>Chalinolobus morio</i>		Chocolate Wattled Bat	Not Listed	Not Listed	Ultrasonic Call Detection
<i>Falsistrellus tasmaniensis</i>		Eastern False Pipistrelle	Not Listed	Not Listed	Ultrasonic Call Detection
<i>Micronomus norfolkensis</i>		Eastern Coastal Free-tailed Bat	Vulnerable	Not Listed	Ultrasonic Call Detection
<i>Miniopterus australis</i>		Little Bent-winged Bat	Vulnerable	Not Listed	Ultrasonic Call Detection
<i>Miniopterus orianae oceanensis</i>		Large Bent-winged Bat	Not Listed	Not Listed	Ultrasonic Call Detection
<i>Myotis macropus</i>		Southern Myotis	Vulnerable	Not Listed	Ultrasonic Call Detection
<i>Ozimops ridei</i>		Ride's Free-tailed Bat	Not Listed	Not Listed	Ultrasonic Call Detection
<i>Petaurus breviceps</i>		Sugar Glider	Not Listed	Not Listed	Arboreal Elliott Trapping
<i>Pseudocheirus peregrinus</i>		Common Possum Ringtail	Not Listed	Not Listed	Nocturnal Spotlighting and Call Playback
<i>Rattus sp.</i>		Rat sp.	Not Listed	Not Listed	Nocturnal Spotlighting and Call Playback



Scientific Name	Exotic	Common Name	BC Act Status	EPBC Act Status	Survey Method
<i>Scoteanax ruepellii</i>		Greater Broad-nosed Bat	Vulnerable	Not Listed	Ultrasonic Call Detection
<i>Scotorepens orion</i>		Eastern Broad-nosed Bat	Not Listed	Not Listed	Ultrasonic Call Detection
<i>Trichosurus vulpecula</i>		Common Brushtail Possum	Not Listed	Not Listed	Nocturnal Spotlighting and Call Playback
<i>Vespadelus pumilus</i>		Eastern Forest Bat	Not Listed	Not Listed	Ultrasonic Call Detection



# APPENDIX E :

## Bat Data Report







## Microbat Call Identification Report

<b>Prepared for (“Client”):</b>	Cumberland Ecology
<b>Survey location/project name:</b>	Unknown location, Sydney region
<b>Survey dates:</b>	16-20 December 2021
<b>Client project reference:</b>	
<b>Job no.:</b>	CE-2202
<b>Report date:</b>	3 March 2022

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## Methods

### Data received & post processing

Balance! Environmental received 1321 full-spectrum bat-call sequence files (WAV files) recorded on two Song Meter SM2 detectors (Wildlife Acoustics, Maynard MA, USA). The detectors were deployed at two separate sites (“Dam” and “Drainage Line”) between 16<sup>th</sup> and 20<sup>th</sup> December 2021.

### Call analysis and species identification

Data were analysed using *Anabat Insight* (Version 2.0.2; Titley Scientific, Brisbane). All WAV files were initially scanned with a generic noise filter to separate files containing only non-bat background noise from those with potentially identifiable bat calls. Files that passed the noise filter (*i.e.*, contained bat calls) were then processed through a Decision Tree analysis to group calls with similar pulse characteristics (e.g., characteristic frequency, slope, duration) and apply tentative group labels. Each group was then reviewed manually to verify and correct species labels.

Species confirmation was achieved by comparing call spectrograms and derived metrics with those of regionally relevant reference calls and published call descriptions (e.g., Pennay *et al.* 2004). The likelihood of species’ occurrence in the study area was also confirmed by referring to the Australasian Bat Society’s *BatMap* application (<https://www.ausbats.org.au/batmap.html>) and other relevant published material (e.g., Churchill 2008; van Dyck *et al.* 2013).

### Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003), available on-line at <http://www.ausbats.org.au/>.

Species nomenclature follows Armstrong *et al.* (2020).

## Results & Discussion

The noise filter excluded 52 WAV files from further analysis. The other 1269 files contained 1287 identifiable bat calls, representing at least 12 species

Some 84% (1077) of the calls were positively attributed to 10 distinct species (see **Table 1**), with just one species (*Chalinolobus gouldii*) contributing 833 of those calls. The other 210 calls could not be reliably identified and were assigned to several multi-species groups (see bottom section of **Table 1**). Over half (128) of these “unresolved” calls belonged to species that were otherwise positively identified from more definitive calls; however, three unresolved call groups represented at least three and perhaps as many as five additional species.

Eight calls belonged to either *Myotis macropus* or a *Nyctophilus* species (*N. geoffroyi* and *N. gouldi* may both be present in the study area). Since the detectors were deployed near water bodies, it is highly probable that most these calls were from *M. macropus*; however, none displayed the species’ definitive foraging call characteristics (pulses with a single point of inflection about half-way down the frequency sweep and with variable slope and inter-pulse intervals).



Twenty calls belonged to *Vespadelus vulturnus* and/or *V. troughtoni*, and another 54 came from either of those species or *Chalinolobus morio*. The two *Vespadelus* spp. are difficult to differentiate, as both produce calls with distinctive hook-shaped pulse-bodies with up-swept tails in the same frequency range (~48-52 kHz). *C. morio* calls occupy the same frequency range but can usually be distinguished by their diagonal pulse-bodies with down-sweeping tails.

Sample call spectrograms of each species are shown in **Appendix 1**.

**Table 1** Bat species recorded during the survey of 16-20 December 2021.

Number of calls recorded per species on each detector

Unit:	SM2-2	SM2-3	Species Total
Location:	Drainage line	Dam	
<b>Positively identified calls</b>			
<i>Chalinolobus gouldii</i>	779	54	833
<i>Chalinolobus morio</i>	28	87	115
<i>Falsistrellus tasmaniensis</i>	7	1	8
<i>Scoteanax rueppellii</i>	24	4	28
<i>Scotorepens orion</i>	2	2	4
<i>Vespadelus pumilus</i>	7	2	9
<i>Miniopterus australis</i>	19	4	23
<i>Miniopterus orianae</i>	6		6
<i>Micronomus norfolkensis</i>	10	15	25
<i>Ozimops ridei</i>	12	14	26
<b>Unresolved calls</b>			
<i>C. gouldii</i> / <i>O. ridei</i>	39	9	48
<i>C. morio</i> / <i>Vespadelus</i> sp.	16	38	54
<i>M. norfolkensis</i> / <i>O. ridei</i>	1	2	3
<i>Nyctophilus</i> sp. / <i>Myotis macropus</i>	7	1	8
<i>F. tasmaniensis</i> / <i>S. orion</i>	28	3	31
<i>S. orion</i> / <i>S. rueppellii</i>	32	3	35
<i>S. rueppellii</i> / <i>O. ridei</i>	2	2	4
<i>V. pumilus</i> / <i>M. australis</i>	3	4	7
<i>Vespadelus vulturnus</i> / <i>V. troughtoni</i>	19	1	20
Site Total	1041	246	1287

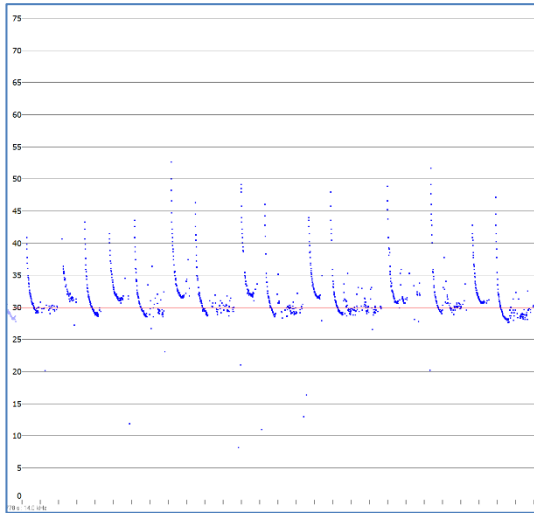


## References

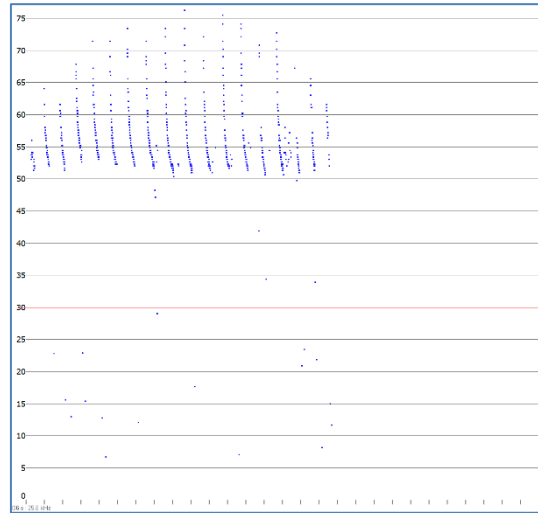
- Armstrong, K.N., Reardon, T.B., and Jackson, S.M. (2020). A current taxonomic list of Australian Chiroptera. *Australasian Bat Society*. Version 2020-06-09.  
URL: <http://ausbats.org.au/species-list/4593775065>
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- Reardon, T. (2003). Standards in bat detector based surveys. *Australasian Bat Society Newsletter* 20, 41-43.
- van Dyck, S., Gynther, I. and Baker, A. (ed.) (2013). *Field Companion to the Mammals of Australia*. New Holland; Sydney.



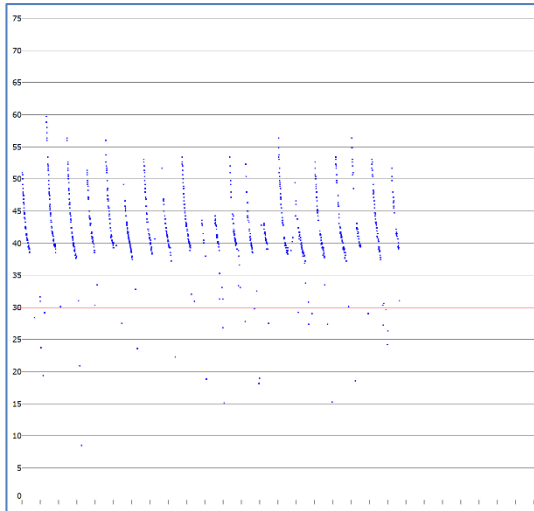
**Appendix 1** Representative sonograms of calls recorded 16-20 December 2021.  
 X-axis (time)=10 msec per tick; time between pulses removed



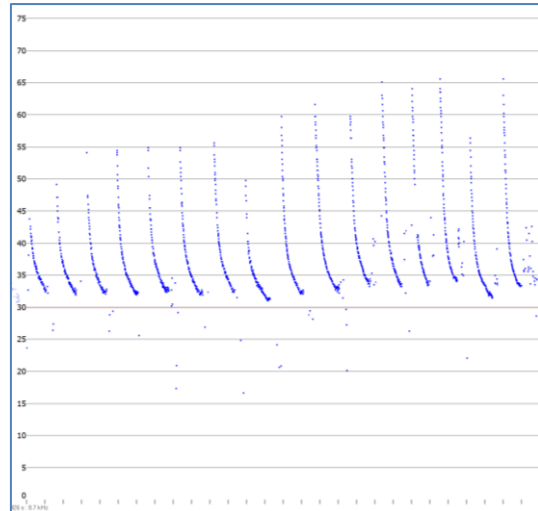
*Chalinolobus gouldii*



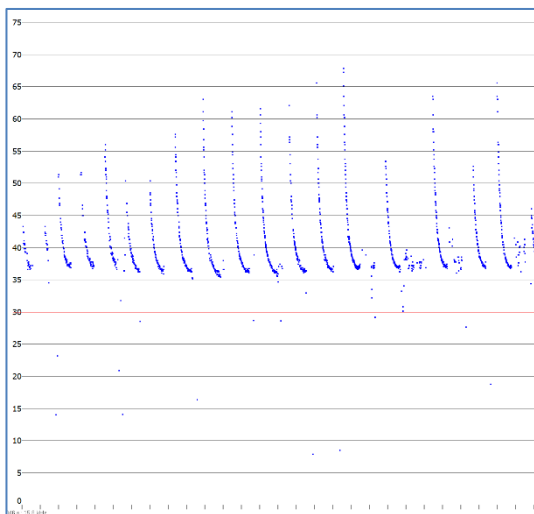
*Chalinolobus morio*



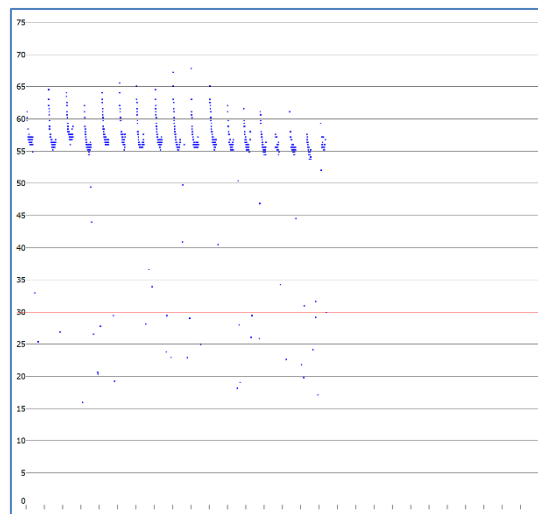
*Falsistrellus tasmaniensis*



*Scoteanax rueppellii*

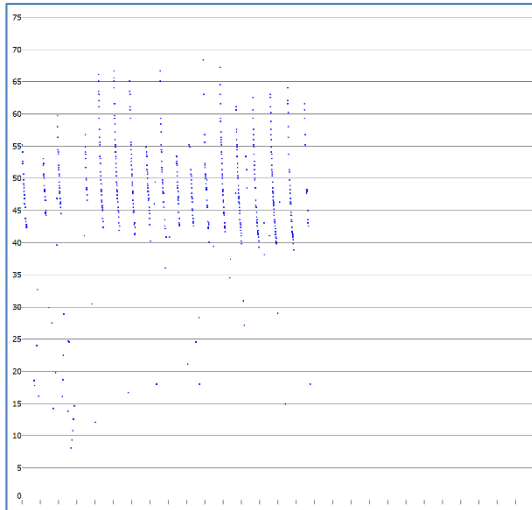


*Scotorepens orion*

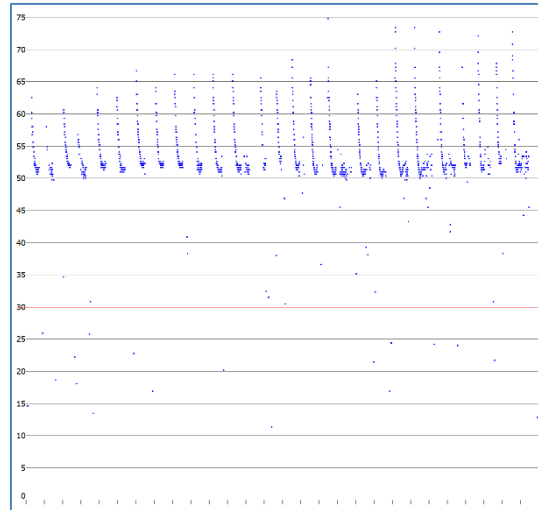


*Vespadelus pumilus*

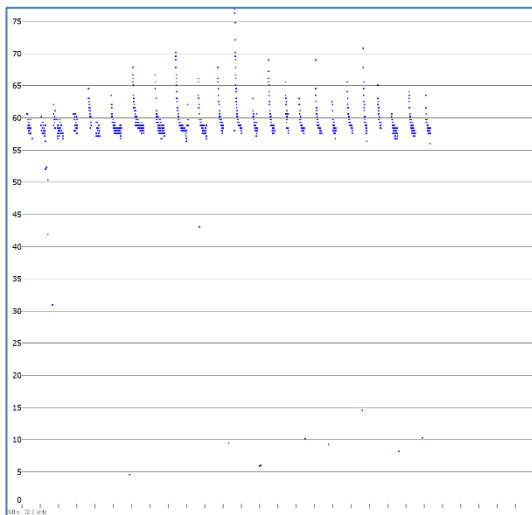




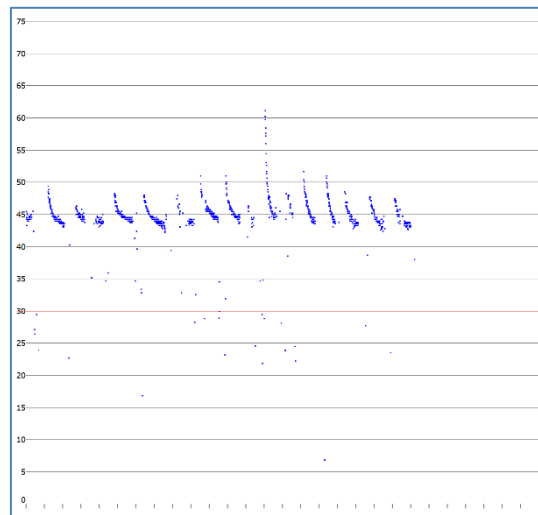
*Nyctophilus sp. / Myotis macropus*



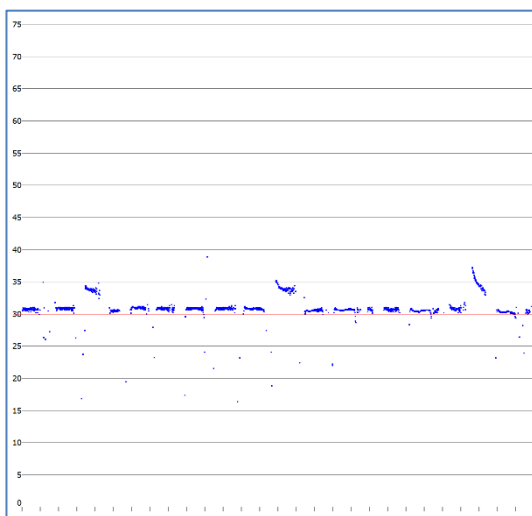
*Vespadelus vulturnus / V. troungtoni*



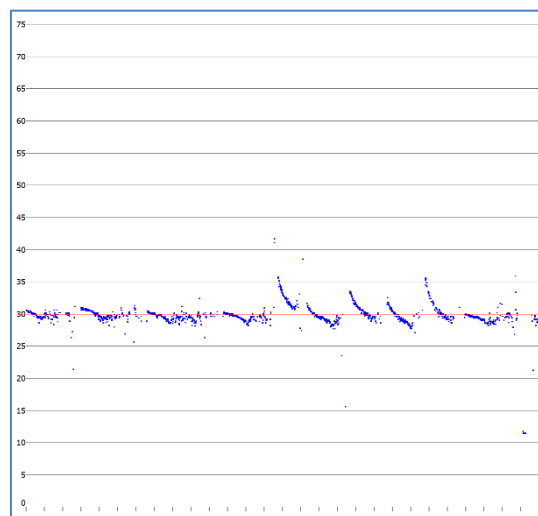
*Miniopterus australis*



*Miniopterus orianae*



*Micronomus norfolkensis*



*Ozimops ridei*



# APPENDIX F :

## BAM Credit Report





## Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00030874/BAAS17027/22/00030875	77-91 Warnervale Road	16/06/2022
Assessor Name	Report Created	BAM Data version *
David Robertson	17/08/2022	54
Assessor Number	BAM Case Status	Date Finalised
BAAS17027	Finalised	17/08/2022
Assessment Revision	Assessment Type	
1	Biocertification	

\* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

## Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAI	Ecosystem credits
<b>Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands</b>												
1	1619_Good_shrubs-intact	Not a TEC	53.1	53.1	0.16	PCT Cleared - 45%	High Sensitivity to Gain			1.50		3



2	1619_Good_shrubs-removed	Not a TEC	52.7	52.7	0.71	PCT Cleared - 45%	High Sensitivity to Gain			1.50		14
3	1619_moderate	Not a TEC	32.3	32.3	0.36	PCT Cleared - 45%	High Sensitivity to Gain			1.50		4
4	1619_low	Not a TEC	26	26.0	0.5	PCT Cleared - 45%	High Sensitivity to Gain			1.50		5
										<b>Subtotal</b>		<b>26</b>
										<b>Total</b>		<b>26</b>

## Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAI	Species credits	
<b><i>Myotis macropus / Southern Myotis ( Fauna )</i></b>										
1619_moderate		32.3	32.3	0.36		Vulnerable	Not Listed	False	6	
1619_low		26.0	26.0	0.5		Vulnerable	Not Listed	False	7	
1619_Good_shrubs-intact		53.1	53.1	0.16		Vulnerable	Not Listed	False	4	
1619_Good_shrubs-removed		52.7	52.7	0.71		Vulnerable	Not Listed	False	19	
									<b>Subtotal</b>	<b>36</b>



<i>Petaurus norfolcensis / Squirrel Glider ( Fauna )</i>									
1619_Good_shr ubs-intact	53.1	53.1	0.16			Vulnerable	Not Listed	False	4
1619_Good_shr ubs-removed	52.7	52.7	0.71			Vulnerable	Not Listed	False	19
1619_moderate	32.3	32.3	0.36			Vulnerable	Not Listed	False	6
1619_low	26.0	26.0	0.5			Vulnerable	Not Listed	False	7
								<b>Subtotal</b>	<b>36</b>





# BAM Biodiversity Credit Report (Like for like)

## Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00030874/BAAS17027/22/00030875	77-91 Warnervale Road	16/06/2022
Assessor Name	Assessor Number	BAM Data version *
David Robertson	BAAS17027	54
Proponent Names	Report Created	BAM Case Status
	17/08/2022	Finalised
Assessment Revision	Assessment Type	Date Finalised
1	Biocertification	17/08/2022

\* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

## Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
<b>Nil</b>		
Species		
<b>Nil</b>		

## Additional Information for Approval

PCT Outside Ibra Added





# BAM Biodiversity Credit Report (Like for like)

None added

## PCTs With Customized Benchmarks

PCT
No Changes

## Predicted Threatened Species Not On Site

Name
No Changes

## Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Not a TEC	1.7	26	0	26

1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region



## BAM Biodiversity Credit Report (Like for like)

	<p>Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787</p>	<p>Sydney Coastal Dry Sclerophyll Forests &lt;50%</p>	<p>1619_Good_shr ubs-intact</p>	<p>Yes</p>		<p>3 Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</p>
	<p>Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787</p>	<p>Sydney Coastal Dry Sclerophyll Forests &lt;50%</p>	<p>1619_Good_shr ubs-removed</p>	<p>Yes</p>		<p>14 Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</p>



## BAM Biodiversity Credit Report (Like for like)

	<p>Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787</p>	<p>Sydney Coastal Dry Sclerophyll Forests &lt;50%</p>	<p>1619_moderate</p>	<p>Yes</p>		<p>4 Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</p>
	<p>Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787</p>	<p>Sydney Coastal Dry Sclerophyll Forests &lt;50%</p>	<p>1619_low</p>	<p>Yes</p>		<p>5 Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</p>



## BAM Biodiversity Credit Report (Like for like)

### Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
<b>Myotis macropus</b> / Southern Myotis	<b>1619_moderate, 1619_low, 1619_Good_shrubs-intact, 1619_Good_shrubs-removed</b>	1.7	36.00
<b>Petaurus norfolcensis</b> / Squirrel Glider	<b>1619_Good_shrubs-intact, 1619_Good_shrubs-removed, 1619_moderate, 1619_low</b>	1.7	36.00

### Credit Retirement Options

Like-for-like credit retirement options

<b>Myotis macropus</b> / Southern Myotis	Spp	IBRA subregion
	<b>Myotis macropus</b> / Southern Myotis	Any in NSW
<b>Petaurus norfolcensis</b> / Squirrel Glider	Spp	IBRA subregion
	<b>Petaurus norfolcensis</b> / Squirrel Glider	Any in NSW



## Proposal Details

<b>Assessment Id</b>	Proposal Name	BAM data last updated *
00030874/BAAS17027/22/00030875	77-91 Warnervale Road	16/06/2022
Assessor Name	Assessor Number	BAM Data version *
David Robertson	BAAS17027	54
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1	Biocertification	17/08/2022

\* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

## Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
<b>Nil</b>		
Species		
<b>Nil</b>		

## Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks



# BAM Biodiversity Credit Report (Variations)

PCT

No Changes

Predicted Threatened Species Not On Site

Name

No Changes

## Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Not a TEC	1.7	26	0	26.00

**1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands**

### Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787	Sydney Coastal Dry Sclerophyll Forests <50%	1619_Good _shrubs- intact	Yes	3	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.



## BAM Biodiversity Credit Report (Variations)

	<p>Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787</p>	<p>Sydney Coastal Dry Sclerophyll Forests &lt;50%</p>	<p>1619_Good _shrubs- removed</p>	<p>Yes</p>	<p>14</p>	<p>Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</p>
	<p>Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787</p>	<p>Sydney Coastal Dry Sclerophyll Forests &lt;50%</p>	<p>1619_mod erate</p>	<p>Yes</p>	<p>4</p>	<p>Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.</p>



## BAM Biodiversity Credit Report (Variations)

Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787	Sydney Coastal Dry Sclerophyll Forests <50%	1619_low	Yes		5 Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
<b>Variation options</b>					
Formation	Trading group	Zone	HBT	Credits	IBRA region
Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1619_Good_shrubs-intact	Yes (including artificial)	3	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1619_Good_shrubs-removed	Yes (including artificial)	14	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1619_moderate	Yes (including artificial)	4	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.



# BAM Biodiversity Credit Report (Variations)

	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1619_low	Yes (including artificial)	5	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
--	---	--------------------------------	----------	----------------------------	---	--

## Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
<b>Myotis macropus</b> / Southern Myotis	<b>1619_moderate, 1619_low, 1619_Good_shrubs-intact, 1619_Good_shrubs-removed</b>	1.7	36.00
<b>Petaurus norfolcensis</b> / Squirrel Glider	<b>1619_Good_shrubs-intact, 1619_Good_shrubs-removed, 1619_moderate, 1619_low</b>	1.7	36.00

## Credit Retirement Options Like-for-like options

<b>Myotis macropus</b> / Southern Myotis	Spp	IBRA region
	<b>Myotis macropus</b> /Southern Myotis	Any in NSW
	<b>Variation options</b>	
Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region



## BAM Biodiversity Credit Report (Variations)

	Fauna	Vulnerable	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
<b>Petaurus norfolcensis/ Squirrel Glider</b>	Spp	IBRA region	
	<b>Petaurus norfolcensis/Squirrel Glider</b>	Any in NSW	
	<b>Variation options</b>		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.



# FIGURES







Figure 1. Site map

0 50 m





Figure 2. Location map



190766-MP-001 E



Responsible Consultant: ADW Johnson Pty Ltd  
 Project Manager: ADW Johnson Pty Ltd  
 Design Manager: ADW Johnson Pty Ltd  
 Surveyor: ADW Johnson Pty Ltd  
 Drafting: ADW Johnson Pty Ltd  
 Environmental: ADW Johnson Pty Ltd  
 Planning: ADW Johnson Pty Ltd  
 Engineering: ADW Johnson Pty Ltd  
 Quantity Surveying: ADW Johnson Pty Ltd  
 Construction Management: ADW Johnson Pty Ltd  
 Project Management: ADW Johnson Pty Ltd  
 Civil Engineering: ADW Johnson Pty Ltd  
 Structural Engineering: ADW Johnson Pty Ltd  
 Mechanical Engineering: ADW Johnson Pty Ltd  
 Electrical Engineering: ADW Johnson Pty Ltd  
 Fire Engineering: ADW Johnson Pty Ltd  
 Traffic Engineering: ADW Johnson Pty Ltd  
 Landscape Architecture: ADW Johnson Pty Ltd  
 Urban Design: ADW Johnson Pty Ltd  
 Sustainability: ADW Johnson Pty Ltd  
 Social Impact: ADW Johnson Pty Ltd  
 Surveying: ADW Johnson Pty Ltd  
 Validation: ADW Johnson Pty Ltd  
 Urban Design: ADW Johnson Pty Ltd

Figure 3. Concept Masterplan

Image Source: ADW Johnson (2021)

I:\...121169\Figures\RP2\20220516\Figure 3. Concept Masterplan



## 2.0 SUBDIVISION DESIGN AND ENVIRONMENTAL CONSIDERATIONS

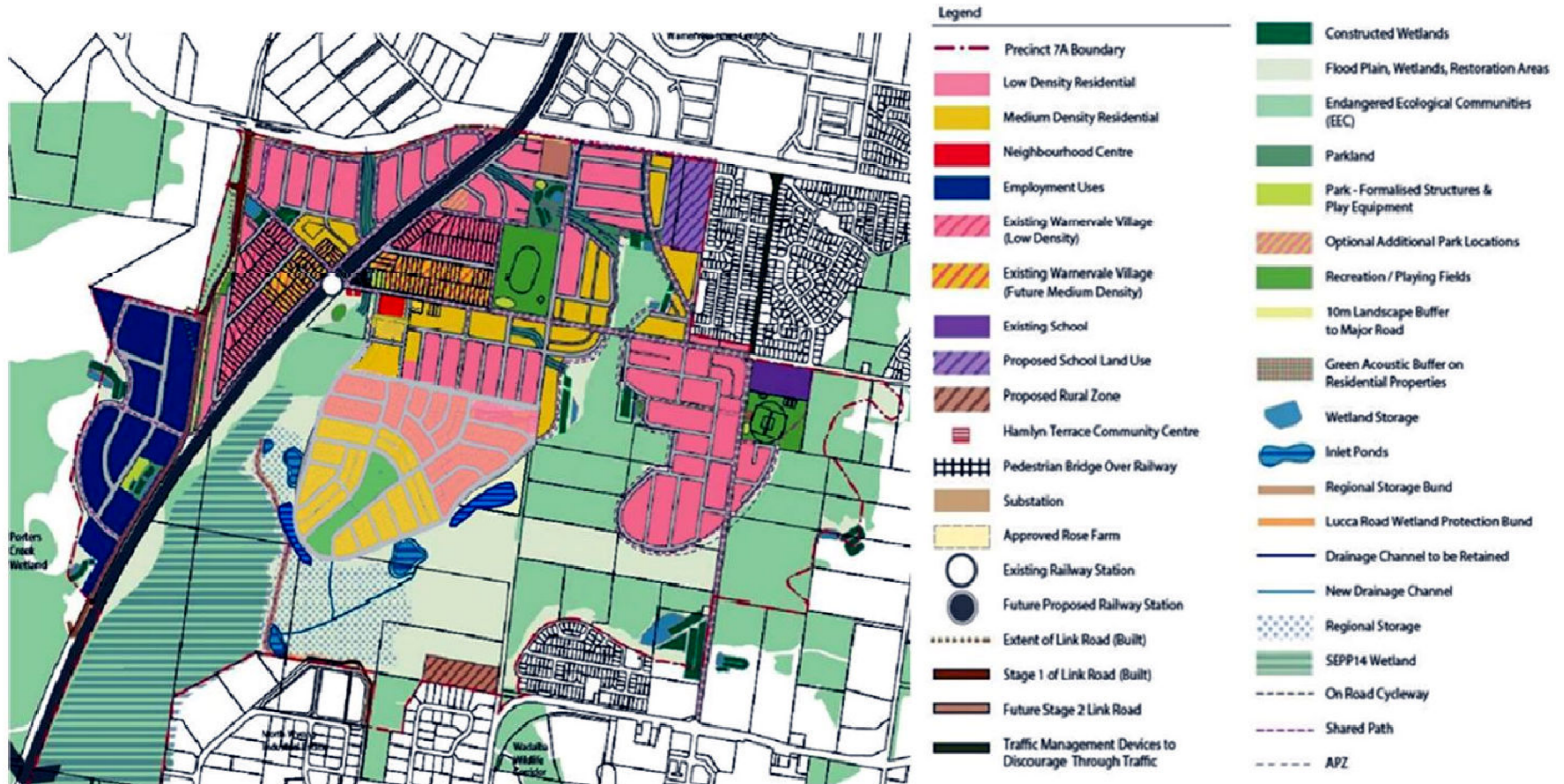


Figure 2 Indicative Structure Plan – Precinct 7A

Figure 4. Warnervale Precinct 7A





- Legend**
- Subject Land
  - Development Site Footprint
  - BAM Plot
  - Parallel Field Traverses
  - Random Meander Surveys
  - ▲ Probable *Cryptostylis hunteriana* record (AEP 2016)

**Plant Community Types**

- Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands

Coordinate System: MGA Zone 56 (GDA 94) ↑

Image Source: Image © Nearmap (2021)  
 Dated: 01/08/2021  
 Data Source: Sixmaps Clip and Ship Spatial Services  
 NSW Department of Finance and Services  
 AEP 2016



**Figure 5. Flora surveys**

0  50 m





Coordinate System: MGA Zone 56 (GDA 94)

**Legend**

- Subject Land
- Development Site Footprint

**Plant Community Types**

- Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands

**Fauna Survey**

- Amphibian Transect
- Nocturnal Spotlighting and Call Playback Transect - August
- Nocturnal Spotlighting and Call Playback Transect - December
- Pitfall Trap Line - August
- Pitfall Trap Line - December

Image Source:  
Image © Nearmap (2021)  
Dated: 01/08/2021  
Data Source:  
Sixmaps Clip and Ship  
Spatial Services  
NSW Department of  
Finance and Services



**Figure 6. Fauna surveys**

0 50 m





**Legend**

- Subject Land
- Development Site Footprint
- Native Vegetation
- Exotic Vegetation/Cleared Land

Coordinate System: MGA Zone 56 (GDA 94)



Image Source:  
Image © Nearmap (2021)  
Dated: 01/08/2021  
Data Source:  
Sixmaps Clip and Ship  
Spatial Services  
NSW Department of  
Finance and Services



**Figure 7. Native vegetation extent**

0  50 m





**Legend**

- Subject Land
- Development Site Footprint

**Plant Community Types**

- Smooth-barked Apple - Red
- Bloodwood - Brown Stringybark -
- Hairpin Banksia heathy open forest of coastal lowlands

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:  
Image © Nearmap (2021)  
Dated: 01/08/2021  
Data Source:  
Sixmaps Clip and Ship  
Spatial Services  
NSW Department of  
Finance and Services



**Figure 8. Plant community types**

0 50 m





**Legend**

- Subject Land
- Development Site Footprint

**Vegetation Zone**

- 1. PCT1619\_Good\_shrubs-intact
- 2. PCT1619\_Good\_shrubs-removed
- 3. PCT 1619\_Moderate
- 4. PCT 1619\_Low

Coordinate System: MGA Zone 56 (GDA 94)



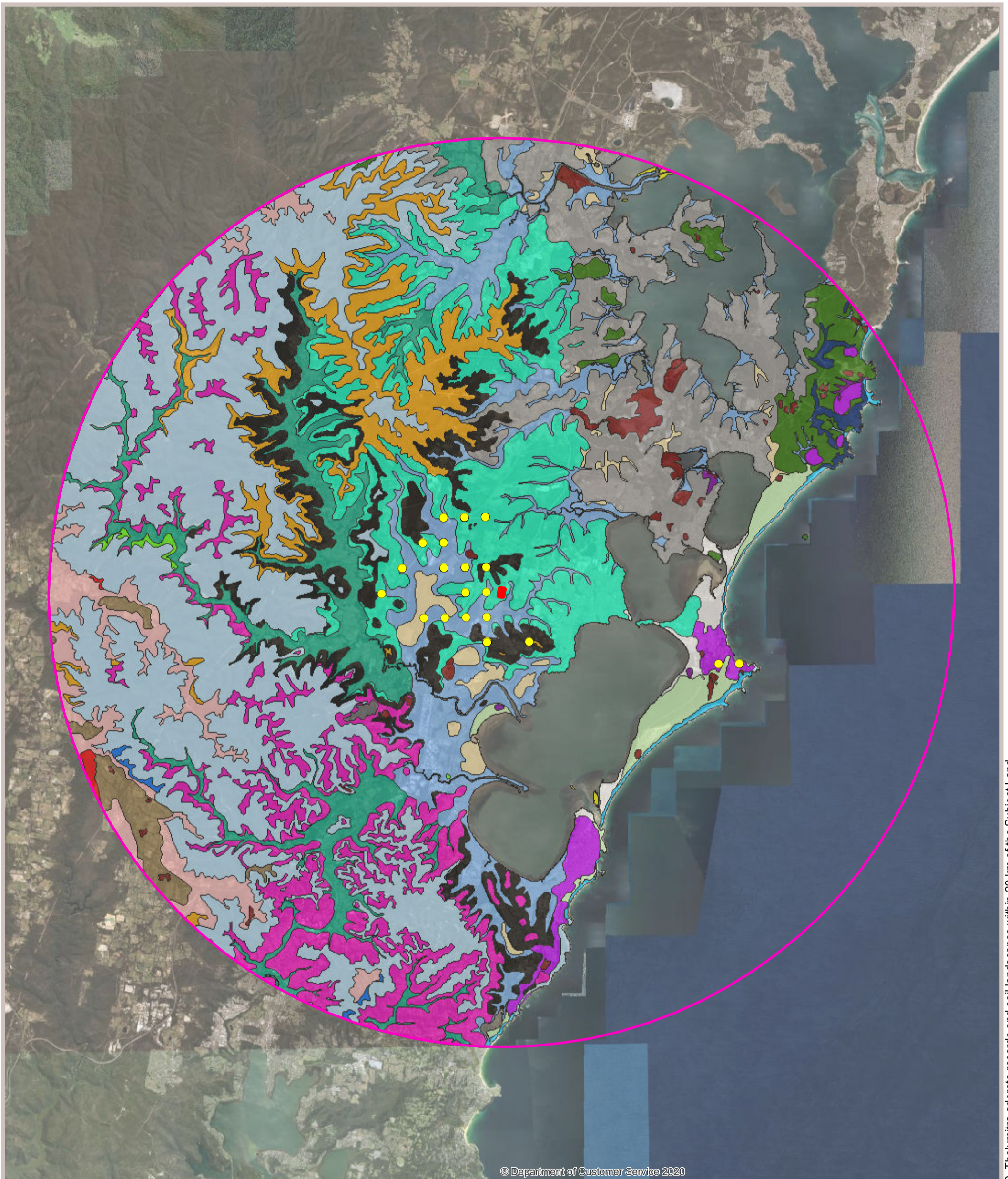
Image Source:  
Image © Nearmap (2021)  
Dated: 01/08/2021  
Data Source:  
Sixmaps Clip and Ship  
Spatial Services  
NSW Department of  
Finance and Services



**Figure 9. Vegetation zones**

0  50 m





© Department of Customer Service 2020

**Legend**

	Subject Land	<b>Soil Landscape</b>		Erina/Woodburys Bridge		Mangrove Creek		Tuggerah	
	Locality (20 km)		Awaba		Gorokan		Narrabeen		Watagan
<b>Thelymitra adorata Record</b>			Awaba variant a		Gymea		Norah Head		Woodburys Bridge
	2021-2022		Belmont Swamp		Hawkesbury		Somersby		Woy Woy
	1980-2020		Disturbed Terrain		Lambert		Sydney Town		Wyong
			Doyalson		Mandalong		Tacoma Swamp		Yarramalong
			Erina						

Coordinate System: MGA Zone 56 (GDA 94)  
 Data Source:  
 Soil Landscapes of the  
 Gosford-Lake Macquarie  
 1:100,000 Sheets  
 © State Government of  
 NSW and Department of Planning,  
 Industry and Environment 1993  
 NSW BioNet Species  
 Sightings Data Collection  
 Dated: 05/02/2022  
 © State Government of NSW  
 and Department of Planning,  
 Industry and Environment 2010



**Figure 10. Thelymitra adorata records and soil landscapes within 20 km of the Subject Land**

0 1,750 3,500 5,250 7,000 m





**Legend**

- Subject Land
- Development Site Footprint
- Threatened Flora Species**
- Callistemon linearifolius

- Threatened Fauna Species**
- Eastern False Pipistrelle, Greater Broad-nosed Bat, Little Bent-winged Bat, Eastern Coastal Free-tailed Bat, and Southern Myotis
- Eastern False Pipistrelle, Greater Broad-nosed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Eastern Coastal Free-tailed Bat, and Southern Myotis

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:  
Image © Nearmap (2021)  
Dated: 01/08/2021  
Data Source:  
Sixmaps Clip and Ship  
Spatial Services  
NSW Department of  
Finance and Services



**Figure 11. Location of threatened species**

0 50 m





**Legend**

- Subject Land
- Development Site Footprint
- Species Polygon**
- Callistemon linearifolius
- Southern Myotis
- Squirrel Glider
- Threatened Flora Species**
- Callistemon linearifolius

Coordinate System: MGA Zone 56 (GDA 94)

Image Source:  
Image © Nearmap (2021)  
Dated: 01/08/2021  
Data Source:  
Sixmaps Clip and Ship  
Spatial Services  
NSW Department of  
Finance and Services




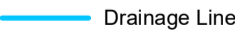





**Figure 12. Species polygons**

0 50 m





**Legend**

- |  |                            |   |   |                                |
|--|----------------------------|---|---|--------------------------------|
|  | Subject Land               | <b>Prescribed Impact</b>  |  | Drainage Line                  |
|  | Development Site Footprint |  |   | Dam                            |
|  |                            |  |   | Human Made Structures          |
|  |                            |  |   | Exotic Vegetation/Cleared Land |
|  |                            |  |   | Habitat Connectivity           |

Coordinate System: MGA Zone 56 (GDA 94) 

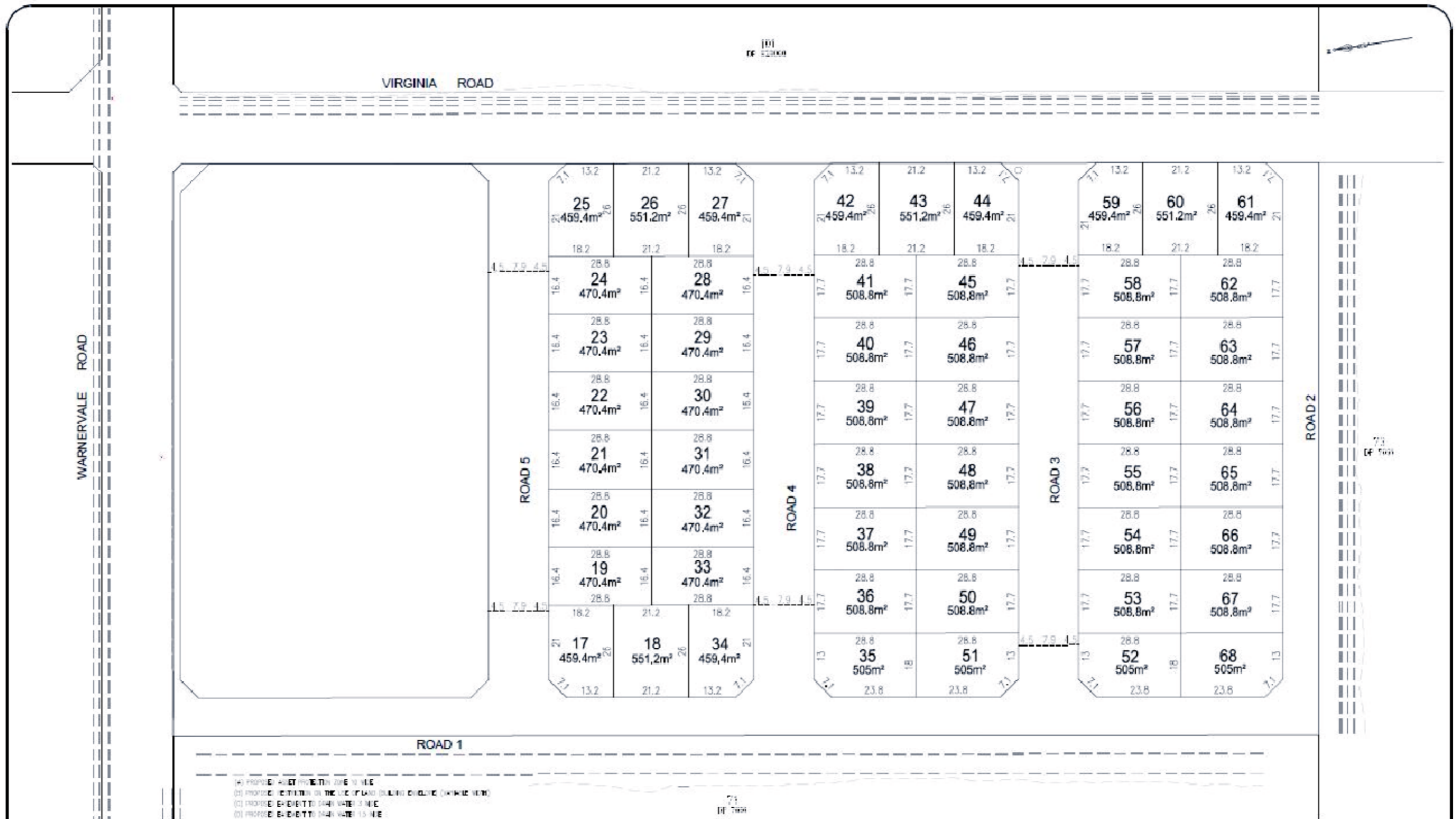
Image Source:  
Image © Nearmap (2021)  
Dated: 01/08/2021  
Data Source:  
Sixmaps Clip and Ship  
Spatial Services  
NSW Department of  
Finance and Services



**Figure 13. Extent of prescribed impacts**

0  50 m





- (A) PROPOSED ASSET PROTECTION ZONE 10 MIE
- (B) PROPOSED PROTECTION ON THE LIC OF LAND (DURING CONSTRUCTION) (SHOULD BE MAINTAINED)
- (C) PROPOSED EASEMENT TO DRAIN WATER 15 MIE
- (D) PROPOSED EASEMENT TO DRAIN WATER 15 MIE
- (E) PROPOSED EASEMENT FOR WATER MAIN 15 MIE
- (F) EASEMENT FOR WATER MAIN 15 MIE (FOR 100mm) - TO BE MAINTAINED
- (G) EASEMENT FOR POWER TRANSMISSION LINE 10 MIE & VEHICLE (FOR 100mm)
- (H) PROPOSED ASSET PROTECTION ZONE 15 MIE
- (I) PROPOSED PROTECTION AS TO USE OF MIE - NO PROTECTION TO BE CONSTRUCTED IN ANTICIPATION
- (J) PROPOSED EASEMENT TO DRAIN WATER 15 MIE & VEHICLE
- (K) PROPOSED EASEMENT TO DRAIN WATER MAIN 15 MIE

**PRELIMINARY ONLY**  
NOT FOR CONSTRUCTION

THESE PLANS MUST BE  
PRINTED IN COLOUR



INSTRUCTION NUMBER: 14/271	---	---	---
FILE ID: 95401	---	---	---
SURVEYED: LH	---	---	---
DRAWN: DW	---	---	---
CHECKED: CE	---	---	---
DATUM: AD	---	---	---
CONTOUR INTERVAL: 0.2	---	---	---

NO.	DESCRIPTION	DRAWN	DATE
A	ISSUED FOR QA	---	18/01/2018

**pcb**  
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P.O. Box 728  
NEWCASTLE 2060  
Ph (02) 4929 3622  
Fax (02) 4928 2214

90 LAMES STREET  
EAST MAITLAND 2220  
Ph (02) 4924 2026  
Fax (02) 4924 2027

**SURVEYORS TOWN PLANNERS  
CIVIL ENGINEERS PROJECT MANAGERS**

PLAN: SURVEY PLAN

CLIENT: WALMIRA PTY LTD

Horizontal Scale 1:500 (A1)  
1:1000 (A2)

No. OF SHEETS  
14  
SHEET No.  
**4**

File Date: 18/01/2018 9:41 AM File Name: 14\_271 - Development Plan (P 101662)

Figure 14. Prior Development Layout

Image Source: PCB (2018)





**Legend**

Subject Land

Development Site Footprint

**Hollow-bearing Tree (DBH)**

- 20 cm
- 30 cm
- 35 cm
- 40 cm
- 45 cm
- 50 cm
- 55 cm
- 60 cm
- 70 cm
- 80+ cm

Image Source:  
Image © Nearmap (2022)  
Dated: 03/04/2022

Data Source:  
Anderson Environmental  
& Planning

Coordinate System: MGA Zone 56 (GDA 94)



Figure 15. Hollow-bearing trees within the subject land





**Legend**

- Subject Land
- Development Site Footprint

**Species Polygon**

- Southern Myotis, Squirrel Glider

**Vegetation Zone**

- 1. PCT1619\_Good\_shrubs-
- 2. PCT1619\_Good\_shrubs-
- 3. PCT 1619\_Moderate
- 4. PCT 1619\_Low

Coordinate System: MGA Zone 56 (GDA 94)



Image Source:  
Image © Nearmap (2021)  
Dated: 01/08/2021  
Data Source:  
Sixmaps Clip and Ship  
Spatial Services  
NSW Department of  
Finance and Services



**Figure 16. Impacts requiring an offset**

0 50 m





**Legend**

- Subject Land
- Development Site Footprint
- Retained Vegetation**
- PCT 1619\_Good\_shrubs-intact
- Impacts that do not require an offset**
- Planted Native Vegetation
- Impacts that do not require further assessment**
- Exotic Vegetation/Cleared

Coordinate System: MGA Zone 56 (GDA 94)



Image Source:  
Image © Nearmap (2021)  
Dated: 01/08/2021  
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**Figure 17. Impacts that do not require an offset or further assessment and retained vegetation**

0  50 m