

MANDALONG MOD 10: ADDITION OF LW34

Biodiversity Development Assessment Report



149823
3
24 October 2021

REPORT

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
0	Internal Review	Dr Hayden Beck	Mark Aitkens	Mark Aitkens	6 August 2021
1	Final	Dr Hayden Beck	Mark Aitkens	Mark Aitkens	19 August 2021
2	Final (minor amendments)	Dr Hayden Beck	Mark Aitkens	Mark Aitkens	1 October 2021
3	Final following BCD feedback	Dr Hayden Beck	Mark Aitkens	Mark Aitkens	24 October 2021

This Biodiversity Development Assessment Report has been certified by the following accredited assessor:

Dr Hayden Beck (Accredited BAM Assessor – BAAS19000)



24 October 2021

This report was prepared by RPS within the terms of RPS' engagement with its client and in direct response to a scope of services. This report is supplied for the sole and specific purpose for use by RPS' client. The report does not account for any changes relating the subject matter of the report, or any legislative or regulatory changes that have occurred since the report was produced and that may affect the report. RPS does not accept any responsibility or liability for loss whatsoever to any third party caused by, related to or arising out of any use or reliance on the report.

Prepared by:

RPS

Dr Hayden Beck
Senior Ecologist

Unit 2A, 45 Fitzroy Street
Carrington NSW 2294

T +61 2 4940 4200
E hayden.beck@rpsgroup.com.au

Prepared for:

Centennial Mandalong

James Wearne
Group Manager Approvals/Environment

100 Miller Road
Fassifern NSW 2283

T +61 2 4935 8944
E james.wearne@centennialcoal.com.au

Contents

STAGE 1 Biodiversity assessment	1
1 INTRODUCTION TO STAGE 1 – BIODIVERSITY ASSESSMENT	2
1.1 Project Area particulars.....	3
1.2 The Project.....	3
1.3 Sources of Information.....	3
1.4 Staff Qualifications and authorship.....	4
2 LANDSCAPE FEATURES	7
2.1 IBRA Bioregions and subregions.....	7
2.2 NSW Landscape regions.....	7
2.3 Area.....	7
2.4 Native vegetation.....	7
2.5 Cleared Areas.....	7
2.6 Rivers and Streams.....	7
2.7 Wetlands.....	8
2.8 Connectivity Features.....	8
2.9 Areas of Geological Significance and Soil Hazard Features.....	8
2.10 Areas of Outstanding Biodiversity Value.....	8
2.11 Project Area Context Components.....	8
2.11.1 Method of BAM assessment.....	8
2.11.2 Percentage of Native Vegetation Cover.....	8
3 NATIVE VEGETATION	13
3.1 Native Plant Species.....	13
3.2 High Threat Weeds.....	13
3.3 Plant Community Types (PCTs).....	13
3.3.1 Method of assessing PCTs.....	13
3.3.2 PCTs identified within the Project Area.....	15
3.3.3 Zone allocation.....	15
3.3.4 Patch size.....	24
3.3.5 Vegetation integrity score.....	24
4 THREATENED SPECIES	25
4.1 Fauna habitat assessment.....	25
4.2 Ecosystem credit species assessment.....	25
4.2.1 Species excluded from assessment.....	27
4.3 Species Credit Species.....	27
4.3.1 Exclusions based on habitat.....	34
4.3.2 Candidate species requiring confirmation of presence or absence.....	34
4.4 Potential prescribed biodiversity Impacts.....	57
4.4.1 Occurrences of karst, caves, crevices and cliffs.....	57
4.4.2 Occurrences of rock.....	57
4.4.3 Hydrological processes that sustain and interact with the rivers, streams and wetlands.....	57
Stage 2 Impact assessment	58
5 INTRODUCTION TO STAGE 2 – IMPACT ASSESSMENT	59
5.1 Avoiding and Minimising Impacts on Native Vegetation and Habitat.....	59
5.2 Avoiding and Minimising Prescribed Biodiversity Impacts.....	59
5.2.1 Impacts of development on the habitat of threatened species associated with karst, caves, crevices and cliffs.....	59
5.2.2 Impacts of development on the habitat of threatened species associated with rocks.....	60

5.2.3	Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities.....	60
5.2.4	Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC	61
6	IMPACTS UNABLE TO BE AVOIDED.....	64
6.1	Direct Impacts	64
6.1.1	Impacts to Native Vegetation.....	64
6.1.2	Loss of species credit species habitat or individuals	65
6.2	Indirect Impacts.....	67
6.3	Prescribed Impacts	67
6.3.1	Karst, caves, crevices, cliffs and other geological features of significance	67
6.3.2	Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities.....	67
6.4	Mitigation and Management of Impacts	68
6.4.1	Adaptive Management Strategy	68
7	SERIOUS AND IRREVERSIBLE IMPACTS (SAII).....	69
8	REQUIREMENT TO OFFSET.....	72
8.1	Impacts requiring an offset.....	72
8.1.1	Ecosystem credits.....	72
8.1.2	Areas not requiring assessment	72
8.2	Species credits	73
9	CONCLUSION	77
9.1	Need for Offsetting	77
9.2	Offsetting Measures	77
9.3	Offsetting Strategy	78
9.4	Adaptive Management for Uncertain Impacts.....	78
10	REFERENCES.....	80

Tables

Table 2-1	Soil Landscape Units	8
Table 3-1	Definitions of vegetation zones	14
Table 3-2	PCTs and zones present within the Project Area	15
Table 3-3	Zone 1: PCT 1528 Jackwood – Lilly Pilly – Sassafras riparian warm temperate rainforest of the Central Coast	17
Table 3-4	Zone 2: PCT 1556 Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast.....	18
Table 3-5	Zone 3: PCT 1568 Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast (Moderate)	19
Table 3-6	Zone 4: PCT 1573 Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment (Moderate)	20
Table 3-7	Zone 5: PCT 1588 Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	22
Table 3-8	Zone 6: Disturbed/cleared land.....	23
Table 3-9	Vegetation integrity score for the vegetation zones	24
Table 5-1	Assessment of impacts of vehicle strike on threatened fauna.....	61
Table 6-1	Impacts to native vegetation	64
Table 6-2	Impacts to Species Credit Species	65

REPORT

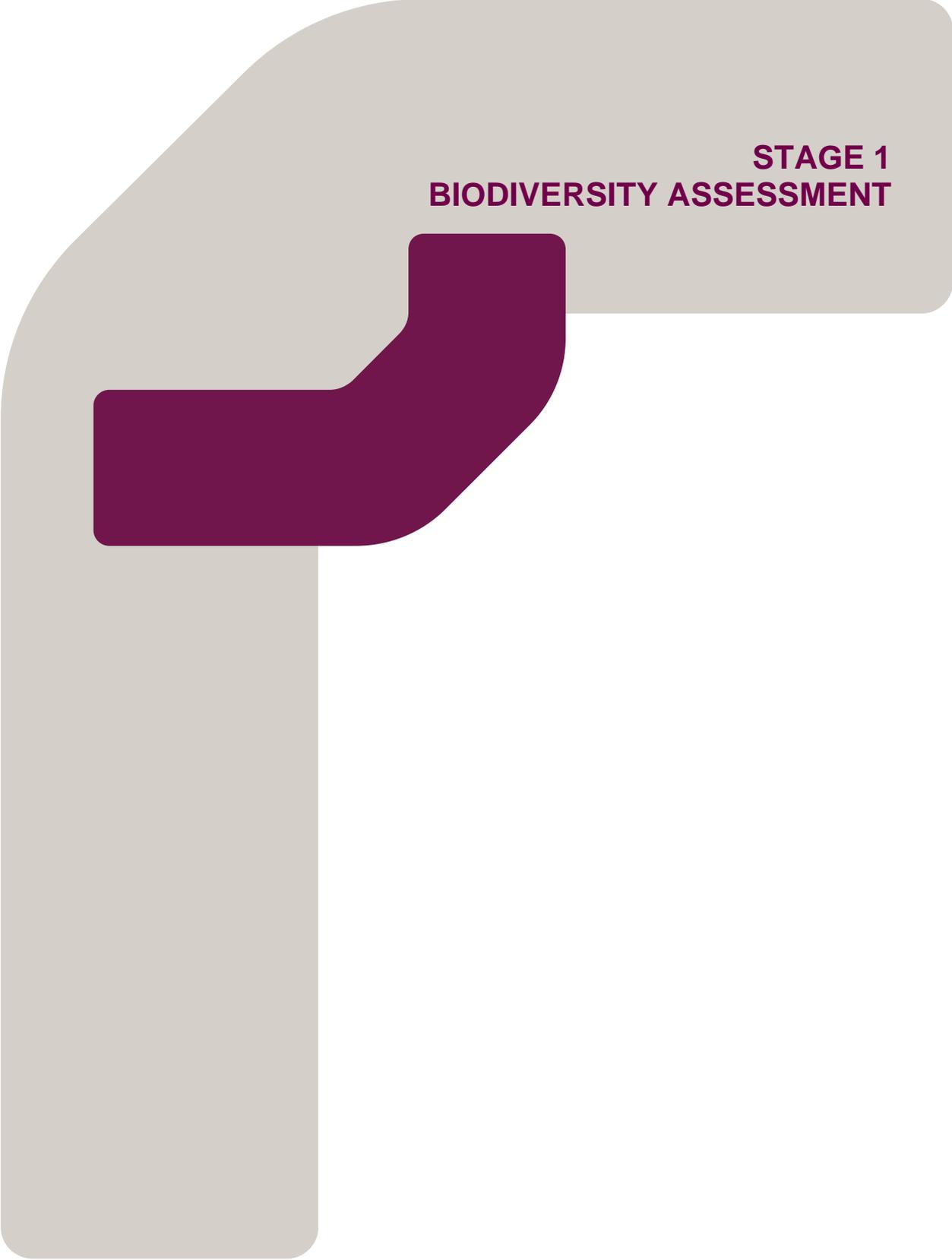
Table 8-1	Ecosystem credit liability	72
Table 8-2	Species credit liability	73

Figures

Figure 1-1	Location map	5
Figure 1-2	Project Area map	6
Figure 2-1	Landscape context	9
Figure 2-2	Native vegetation within the Assessment Area	10
Figure 2-3	Areas of geological significance	11
Figure 2-4	Soil Landscape Units	12
Figure 3-1	Vegetation zones	16
Figure 4-1	Species polygon: <i>Callocephalon fimbriatum</i> [Gang-gang Cockatoo (Breeding)]	42
Figure 4-2	Species polygon: <i>Cercartetus nanus</i> (Eastern Pygmy-possum); <i>Hoplocephalus bitorquatus</i> (Pale-headed Snake); <i>Pteropus poliocephalus</i> [Grey-headed Flying-fox (Breeding)]; <i>Rhizanthella slateri</i> (Eastern Australian Underground Orchid)	43
Figure 4-3	Species Polygon: <i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	44
Figure 4-4	Species Polygon: <i>Cryptostylis hunteriana</i> (Leafless Tongue Orchid); <i>Lophoictinia isura</i> [Square-tailed Kite (Breeding)]; <i>Petaurus norfolcensis</i> (Squirrel Glider); <i>Phascogale tapoatafa</i> (Brush-tailed Phascogale)	45
Figure 4-5	Species Polygon: <i>Haliaeetus leucogaster</i> (White-bellied Sea-Eagle)	46
Figure 4-6	Species polygon: <i>Hoplocephalus stephensii</i> (Stephens' Banded Snake); <i>Mixophyes balbus</i> (Stuttering Frog); <i>Mixophyes iteratus</i> (Giant Barred Frog)	47
Figure 4-7	Species polygon: <i>Litoria aurea</i> (Green and Gold Bell Frog)	48
Figure 4-8	Species polygon: <i>Litoria brevipalmata</i> (Green-thighed Frog)	49
Figure 4-9	Species polygon: <i>Litoria littlejohni</i> (Littlejohn's Tree Frog); <i>Tetratheca juncea</i> (Black-eyed Susan)	50
Figure 4-10	Species polygon: <i>Miniopterus australis</i> [Little Bent-winged Bat (Breeding)]; <i>Miniopterus orianae oceanensis</i> [Large Bent-winged Bat (Breeding)]	51
Figure 4-11	Species polygon: <i>Myotis macropus</i> (Southern Myotis)	52
Figure 4-12	<i>Ninox connivens</i> [Barking Owl (Breeding)]	53
Figure 4-13	Species polygon: <i>Ninox strenua</i> [Powerful Owl (Breeding)]; <i>Tyto novaehollandiae</i> [Masked Owl (Breeding)]	54
Figure 4-14	Species polygon: <i>Rhodamnia rubescens</i> (Scrub Turpentine)	55
Figure 4-15	Species polygon: <i>Tyto tenebricosa</i> [Sooty Owl (Breeding)]	56
Figure 7-1	Threatened species at risk of an SAIL within the Project Area	71
Figure 8-1	Impacts requiring offset	75
Figure 8-2	Areas not requiring assessment	76

Appendices

Appendix A Biodiversity Inventory Report
Appendix B Current VI Scores
Appendix C Biodiversity Credit Report
Appendix D Offset Trading Groups
Appendix E BCD Correspondence



**STAGE 1
BIODIVERSITY ASSESSMENT**

1 INTRODUCTION TO STAGE 1 – BIODIVERSITY ASSESSMENT

RPS Australia East Pty Ltd (RPS) has been engaged by Centennial Mandalong (the proponent) to undertake a Biodiversity Development Assessment Report (BDAR) to assess the addition of Longwall (LW) 34 as part of Modification 10 (MOD 10) to the approved State significant development 5144 (SSD-5144) (herein referred to as the 'Project').

Mandalong Mine (Mandalong) is an existing underground coal mine near Morisset, approximately 35 kilometres (km) south-west of Newcastle, predominantly in the Lake Macquarie local government area (LGA) (**Figure 1-1**). Mandalong is operated by Centennial Mandalong Pty Limited (Centennial Mandalong).

Centennial Mandalong has approval to extract run-of-mine (ROM) coal from the West Wallarah and Wallarah-Great Northern seams using a combination of longwall and continuous mining methods. Mandalong operates under the approved SSD-5144, which was granted on 12 October 2015 by the NSW Planning Assessment Commission under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

As identified in Mandalong's Mining Operations Plan (MOP) (Centennial Coal 2018), the progression of underground mining is regularly reviewed dependent on ongoing monitoring and geological conditions. Centennial Mandalong recently encountered poor geological conditions within the Mandalong Southern Extension Area, including a fault zone and igneous sill.

In response to these conditions and in order to maintain coal production, improve mining conditions and improve the financial viability of Mandalong, amendments to the approved mine plan were sought as part of a modification to SSD-5144 (herein referred to as MOD 9). As part of MOD 9, Centennial Mandalong sought approval to amend the approved mine plan, including the reorientation of LW30-LW33.

Since the approval of MOD 9 in April 2021, Centennial Mandalong has continued to review the progression of underground mining within the Mandalong Southern Extension Area. As a result of these investigations, the decision has been made to shorten LW30 and remove LW33 from the mine plan. The shortening of LW30 and removal of LW33 are estimated to result in the sterilisation of approximately 0.4 million tonnes (Mt) and 1.6 Mt of coal, respectively. Consequently, Centennial Mandalong has explored options to optimise the mine plan to access additional coal resources.

Centennial Mandalong is seeking to modify SSD-5144, pursuant to Section 4.55(2) of the EP&A Act, to change Mandalong's approved mine plan to include LW34 (herein referred to as MOD 10 or the proposed modification). The addition of LW34 will maximise resource extraction within the West Wallarah Seam and Mandalong's development consent boundary and improve the continuity of coal extraction and employment at Mandalong. Two updates to Appendix 8 of SSD-5144 are also proposed.

Application of the Biodiversity Assessment Methodology (BAM) is mandatory (State of NSW 2020) for SSD projects and associated modifications. This BDAR is based on the application of the BAM, as required under the *Biodiversity Conservation Act 2016* (BC Act). This BDAR addresses Stage 1 (Biodiversity Assessment) and Stage 2 (Impact Assessment) of the BAM.

The following terms are used in this document:

- **Project** – Modification to Mandalong Mine SSD-5144 for the addition of LW34;
- **Predicted Impact Area** – Areas where ponding associated with subsidence is modelled to occur;
- **Project Area** – Land within the angle-of-draw (i.e. angle between the goaf and the point on the ground surface to which subsidence is expected to occur; AOD);
- **Potential Impact Area** – Land predicted to be impacted by ponding associated with the Project;
- **Assessment Area** – Land within a 1500 m buffer from the outer extent of the Project Area; and
- **Local Area or locality** – Land within 10 km of the Project Area.

In addition to this BDAR, the attached Biodiversity Inventory Report (BIR; **Appendix A**) describes the biodiversity values of the Project Area as a basis for assessing the Project impacts on threatened biodiversity listed under the BC Act. The BIR supports the BDAR through providing comprehensive details of the survey method, efforts and results, and so is referred to throughout this BDAR. The BIR also addresses

the assessment requirements of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and relevant State Environmental Planning Policies (SEPPs).

1.1 Project Area particulars

Locality:	Mandalong, NSW
LGA:	Lake Macquarie City Council (LMCC) and Central Coast Council (CCC)
Lot/DP:	Lot 114 DP755238; Lot 2 DP805044; Lot 145 DP755238; Lot 115 DP755238
Project Area:	Footprint of the Project Area is approximately 52.17 ha. The location of the Project Area is shown in Figure 1-2 .
Boundaries:	The Project Area is predominantly surrounded by vegetated lands in all directions on private land and State Forest.
Zoning:	Under the provisions of the LMCC and CCC Local Environment Plans (LEPs), the Project Area is zoned as E2 Environmental Conservation and E3 Environmental Management and RU3 Forestry. Other land uses within the broader Assessment Area are RU1 Primary Production, RE1 Public Recreation and RU2 Rural Landscape.
Current Land Use:	Bushland makes up most of the Project Area. Other land uses are tributaries of Morans, Mannering and Buttonderry creeks; local roads (including Toepfers Road and Kiar Ridge Road); private dwellings, ancillary buildings, fences and driveways; and Aboriginal cultural and historic heritage sites.
Topography:	Project Area is dominated by undulating coastal hills ranging from up to 210 m Above Sea Level (ASL) down to Morans Creek at approximately 64 m ASL. The land contains numerous watercourses, many of which are ephemeral, low order tributaries. The topography within the Project Area has been altered by local roads, earthworks associated with private properties and past state forestry activities.

1.2 The Project

Centennial Mandalong is seeking approval to add an additional longwall (LW34). The previously approved and proposed mine plans for the western longwalls in the Mandalong Southern Extension Area are shown in **Figure 1-2**.

LW34 will align with adjacent panels by maintaining the existing panel width of 200 m and all other mining geometry aspects will remain unchanged. Secondary extraction of coal as part of the proposed modification will extend beyond the previously assessed and approved footprint for secondary extraction. No changes to the development consent boundary are required.

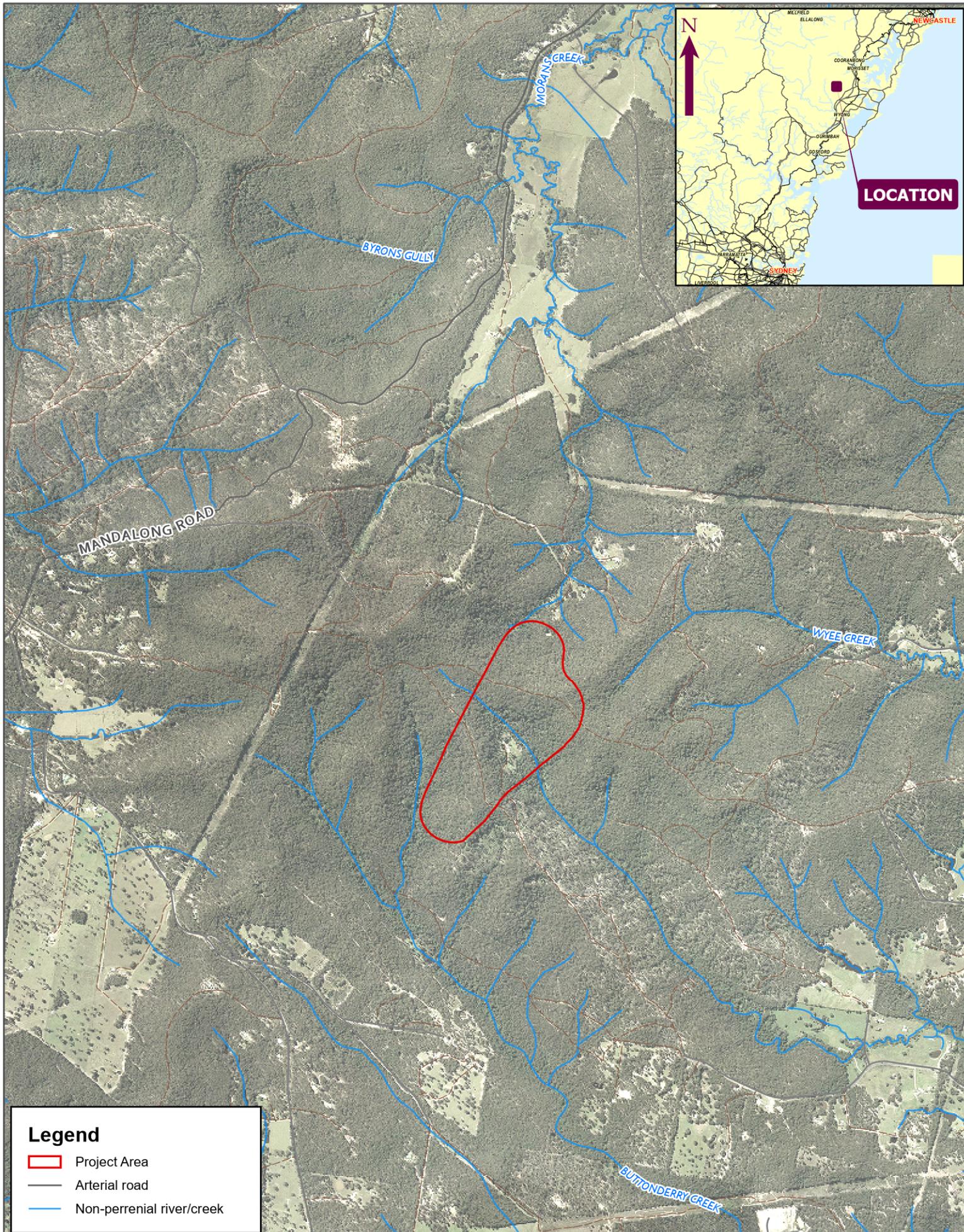
1.3 Sources of Information

- Proposal layers and concept designs provided by Centennial Mandalong Pty Ltd;
- Department of Agriculture, Water and Environment (DAWE) Australian Government's Species Profiles and Threats (SPRAT) database (<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>) (DAWE 2021a);
- DAWEs EPBC Act Protected Matters Search Tool (<http://www.environment.gov.au/epbc/protected-matters-search-tool>; Accessed June 2021; DAWE 2021b);
- Department of Planning, Industry and Environment (DPIE) Threatened Species Profiles (<http://www.environment.nsw.gov.au/threatenedspeciesapp/>; Accessed June 2021);
- Interim Biogeographical Regionalisation for Australia (IBRA) and IBRA sub-regions (<http://www.environment.gov.au/land/nrs/science/ibra>);
- DPIEs profiles of threatened species, populations and ecological communities;

- DPIEs BioNet database;
- DPIEs VIS Mapping (<http://www.environment.nsw.gov.au/research/VISmap.htm>);
- NSW Biodiversity Values Map (<https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap>; Accessed June 2021); and
- State of NSW and OEH (2018). Biodiversity Assessment Method Operational Manual – Stage 1;
- State of NSW and DPIE (2019). Biodiversity Assessment Method Operational Manual – Stage 2; and
- State of NSW (2020). Biodiversity Assessment Method.

1.4 Staff Qualifications and authorship

The BDAR report was written by Dr Hayden Beck and reviewed by Mark Aitkens. Fieldwork was undertaken by Dan Creevey, Hayden Beck, Tara Boreham, John Hembra and Rhys Corrigan. Academic qualifications and professional experience of RPS staff involved in the documentation are provided in **Appendix A**.



Legend

- Project Area
- Arterial road
- Non-perennial river/creek

**FIGURE 1-1
LOCATION MAP**

VERSION: **A**
 DATE EXPORTED: **19/08/2021 10:58 AM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.

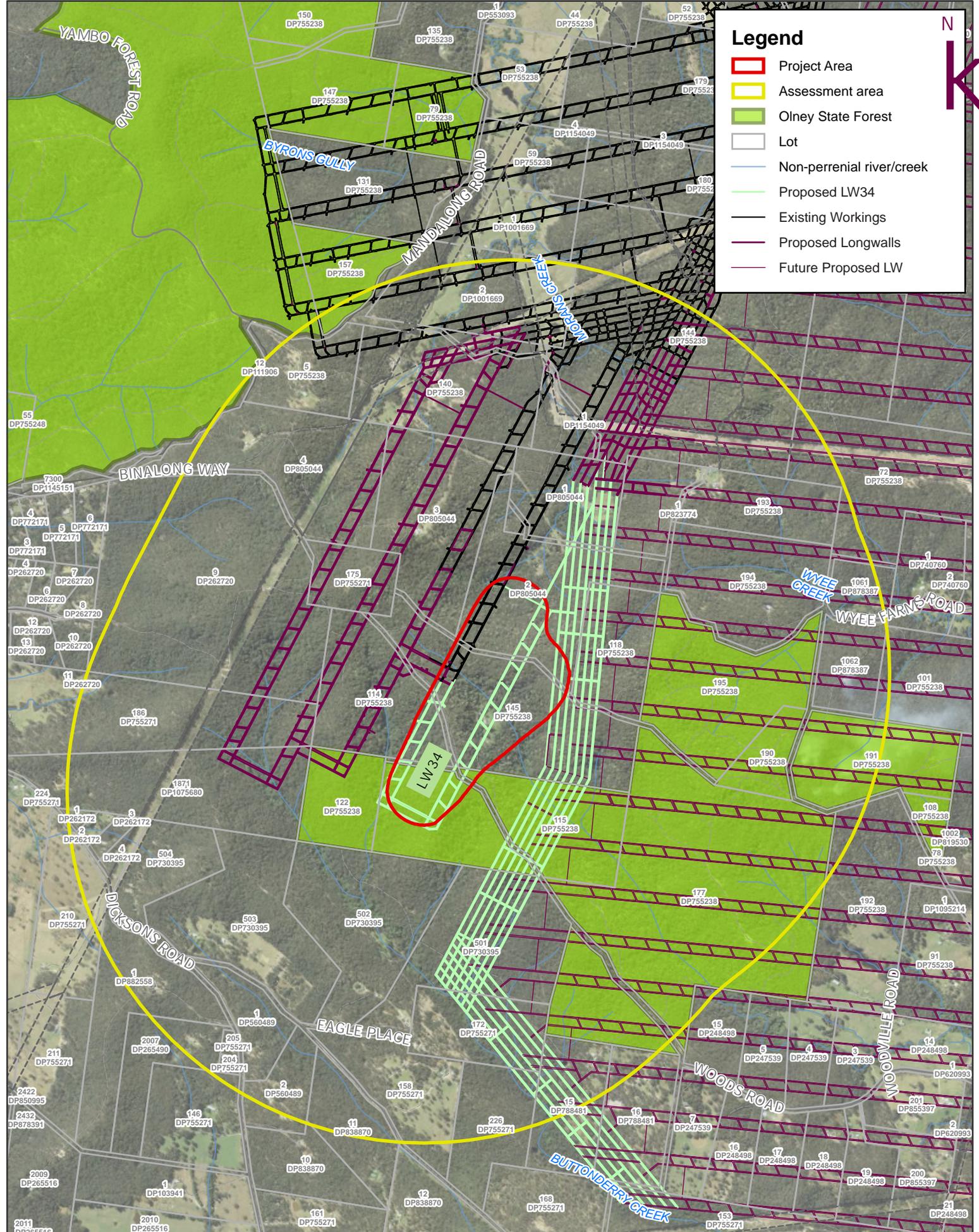


SCALE 1:25,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: **Centennial**
 PROJECT: **149823**
 PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a planning or advisory opinion. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other purpose or purpose, past or present. The plan is prepared solely on the basis of information of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be liable (or negligent or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party purchasing land or relying on this plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party before the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.
 3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. any reliance on this plan with any local authority against the recommendation of RPS Australia East Pty Ltd;
 6. the accuracy, reliability, suitability or completeness of the approximations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.





Legend

- Project Area
- Assessment area
- Olney State Forest
- Lot
- Non-perennial river/creek
- Proposed LW34
- Existing Workings
- Proposed Longwalls
- Future Proposed LW

**FIGURE 1-2
PROJECT AREA**

VERSION:
B
DATE EXPORTED:
25/08/2021 11:00 AM
TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong

DATA SOURCES
Centennial, RPS, © Department of Finance, Services & Innovation 2018



SCALE 1:22,500 AT A4 SIZE
SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
PROJ: 149823
PURPOSE: BDAR

IMPORTANT NOTE
1. This plan was prepared for the sole purposes of the claim for the specific purposes of production of a photographic cover plan. This plan is solely intended for the purposes and does not apply directly or indirectly and will not be used for any other independent purpose, use or matter. The plan is provided without the responsibility of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
2. RPS Australia East Pty Ltd will not be liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to a Third Party's reliance on, use of or reliance on the plan.
3. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreliable.
4. Any inaccuracies or other faults with information or data sourced from a Third Party.
5. RPS Australia East Pty Ltd making no surface indicators that are incorrect or inaccurate.
6. The Client or any Third Party not relying on information in this plan where recommended by RPS Australia East Pty Ltd.
7. RPS Australia East Pty Ltd with any local authority requires the recommendation of RPS Australia East Pty Ltd.
8. The accuracy, reliability, suitability or completeness of any representations or statements made or referred to by RPS Australia East Pty Ltd in this plan.



2 LANDSCAPE FEATURES

2.1 IBRA Bioregions and subregions

The Project Area is located within the NSW Sydney Interim Biogeographic Regionalisation for Australia (IBRA) region and Wyong IBRA Subregion (**Figure 2-1**).

2.2 NSW Landscape regions

The dominant Mitchell Landscape present is Gosford-Cooranbong Coastal Slopes Mitchell Landscape, with an incursion of Watagan Rise Mitchell Landscape occurring toward the middle of the Project Area (**Figure 2-1**). Further descriptions of these landscapes are provided in **Appendix A**.

2.3 Area

The Project Area footprint (i.e. AOD) is approximately 52.17 ha. Subsidence predictions indicate that there is potential for direct impact (via ponding) to approximately 0.00047 ha of native vegetation.

2.4 Native vegetation

Approximately 1136.63 ha of vegetation occurs within the 1500 m Buffer (~93.46%), according to Lake Macquarie Vegetation Mapping (Bell and Driscoll 2015). Native vegetation within this Assessment Area is shown in **Figure 2-2**.

Vegetation mapping and inspection of recent aerial photography indicates a limited amount of vegetation clearing within the locality, resulting in a continuous native vegetation patch size of over 1.5M ha, which extends into large tracts of bushland to the south and west. This vegetation is largely intact and incorporates the Watagans National Park; as well as Olney and Watagan State Forests.

2.5 Cleared Areas

Native vegetation clearing within the Assessment Area has occurred for transport, agriculture (e.g. poultry farms, horse stables and livestock), past forestry activity, industrial development, low-density residential housing, a landscaping supply depot and powerline easements. Approximately 6.54% (79.52 of 1216.15 ha) of the Assessment Area is cleared. Clearing within the Project Area has been due to:

- Public roads;
- Unsealed access tracks;
- Rubbish depot;
- Clearing by past forestry;
- Livestock farming;
- Rural housing; and
- Transmission line easements.

2.6 Rivers and Streams

First order tributaries of Morans Creek, Buttonderry Creek and Mannering Creek are located within the Project Area. Morans Creek discharges into Lake Macquarie, Mannering Creek discharges into Lake Mannering, whilst Buttonderry Creek discharges into Tuggerah Lake. Lake Macquarie and Tuggerah Lake are approximately 10 km to the northeast and southeast of the Project Area, respectively. Lake Mannering is approximately 8 km to the east of the Project Area. The ephemeral nature of Morans, Mannering and Buttonderry Creeks within the Project Area is reflected in small flows during dry periods and cease to flow during drought periods (Umwelt 2020). There is no Key Fish Habitat mapped within the Project Area (DPI 2021).

2.7 Wetlands

There are no wetlands within the Project Area. The nearest wetlands fringe Lake Mannering, which is located approximately 8 km east of the Project Area.

2.8 Connectivity Features

The Project Area provides a variety of internal habitat linkages along creeks, gullies and ridgelines, and as such is mapped primarily as a corridor of remnant native vegetation or within the Lake Macquarie Native Vegetation and Corridors Map (LMCC 2015). Apart from small patches of bushland cleared for private properties and easements within the Project Area, much of the vegetation present is recognised as corridors that contribute significantly to movement and viability of flora and fauna in the locality.

Inspection of state vegetation mapping and recent aerial photography indicates a limited amount of vegetation clearing within the locality, resulting in a very large and continuous native vegetation that extends to the Watagan Mountains and further into the Great Dividing Range (estimated to be > 1.5M ha).

The M1 Motorway and Central Coast/ Newcastle Line rail corridor present a potential barrier for fauna moving east toward Lake Macquarie.

2.9 Areas of Geological Significance and Soil Hazard Features

There are several sandstone crevices and cliffs within the Project Area, primarily associated with the Watagan Rise Mitchell Landscape (as depicted by the Watagan Soil Landscape; detailed below). Locations of these geological units and topographic data are shown in **Figure 2-1**. Formational geology for the Project Area is also provided in **Figure 2-3**.

Watagan and Mandalong Soil landscapes are in the Project Area. These soil units are prone to erosion. Soil types within the Project Area are described in **Table 2-1** and indicated in **Figure 2-4**.

Table 2-1 Soil Landscape Units

Soil Landscape	Formative Process	Composition	Hazards
Mandalong (ml)	Colluvial	Magnesian – Natric, Brown, Kurosol	Mass movement hazards, steep slopes, erosion hazards and foundation hazards. Soils have low wet-bearing strength, can be acidic, sodic and have low fertility.
Watagan (wn)	Colluvial	Dark Brown Loam, Yellowish brown sandy clay loam, sandstone colluvium	Mass movement hazard, steep slopes, soil erosion hazard, foundation hazard, occasional rock outcrop, seasonal waterlogging (localised).

2.10 Areas of Outstanding Biodiversity Value

No areas of outstanding Biodiversity Value are known to occur within the Project Area.

2.11 Project Area Context Components

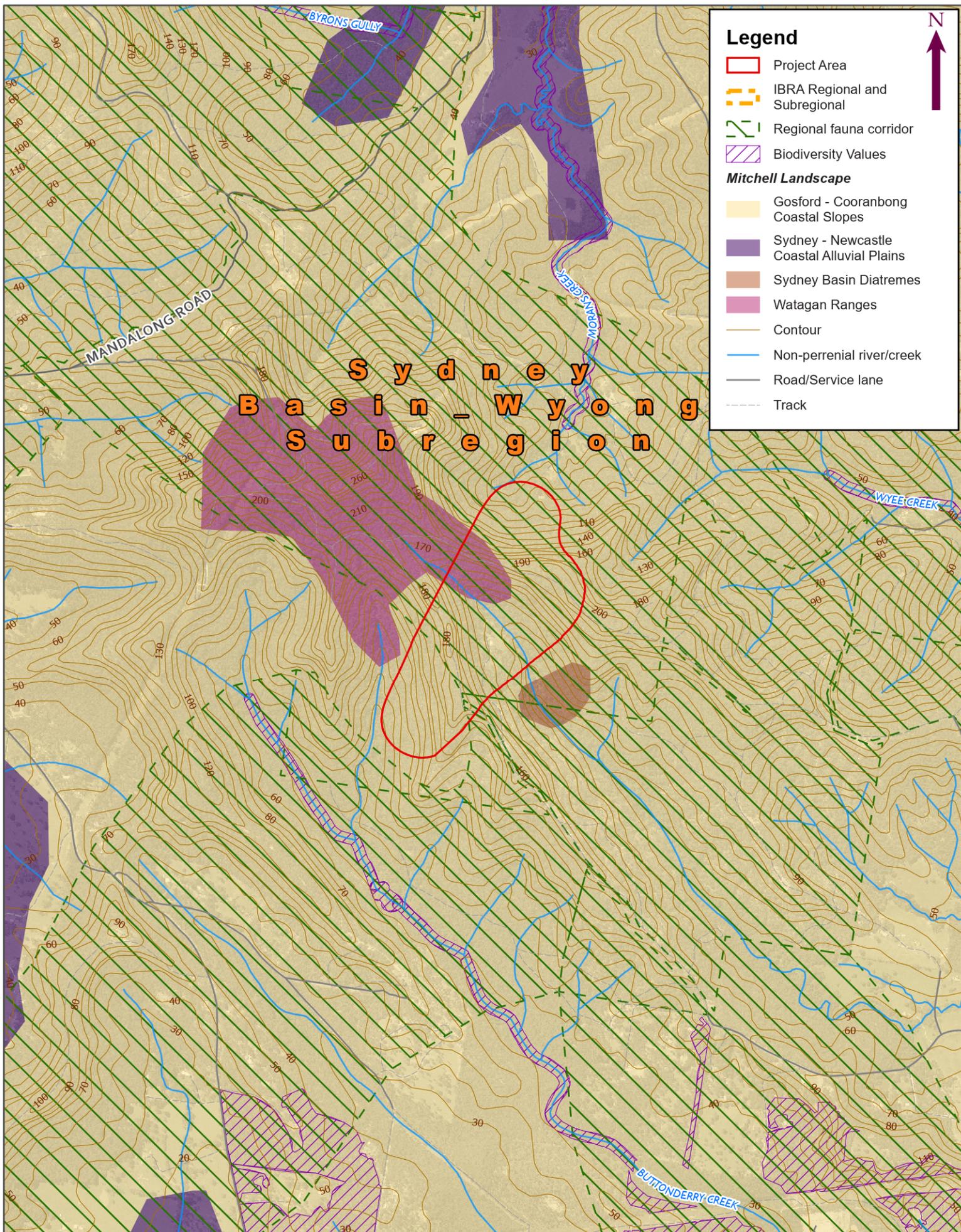
2.11.1 Method of BAM assessment

A Development Assessment Case for a Major Development was applied within the BAM calculator (BAM-C).

2.11.2 Percentage of Native Vegetation Cover

The overall vegetation cover within the Assessment Area was determined using aerial photographs and Lake Macquarie Vegetation Community Mapping by Bell and Driscoll (2015).

Native vegetation cover within the Assessment Area was calculated to be approximately 93.46% (**Figure 2-2**).



**FIGURE 2-1
LANDSCAPE CONTEXT**

VERSION: **A**

DATE EXPORTED: **19/08/2021 11:00 AM**

TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
Centennial, RPS,



SCALE 1:20,000 AT A4 SIZE
SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: **Centennial**

PROJECT: **149823**

PURPOSE: **BDAR**

IMPORTANT NOTE
1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a planning assessment. This plan is advisory in nature and does not apply directly or indirectly and will not be used for any other purpose or purpose for which the plan is prepared without the consent of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
2. RPS Australia East Pty Ltd will not be held responsible or liable for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
a. a Third Party publishing, displaying, copying or relying on this plan;
b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party before the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
c. any inaccuracies or other faults with information or data sourced from a Third Party.
3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
5. the Client or any Third Party with any local authority against the recommendation of RPS Australia East Pty Ltd;
6. the accuracy, reliability, suitability or completeness of the approximations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.





**FIGURE 2-2
NATIVE VEGETATION MAPPING IN THE
ASSESSMENT AREA**

VERSION: **A**

DATE EXPORTED: **19/08/2021 11:02 AM**

TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
Centennial, RPS,



SCALE 1:24,000 AT A4 SIZE
SPATIAL REFERENCE: GDA 1994 MGA Zone 56

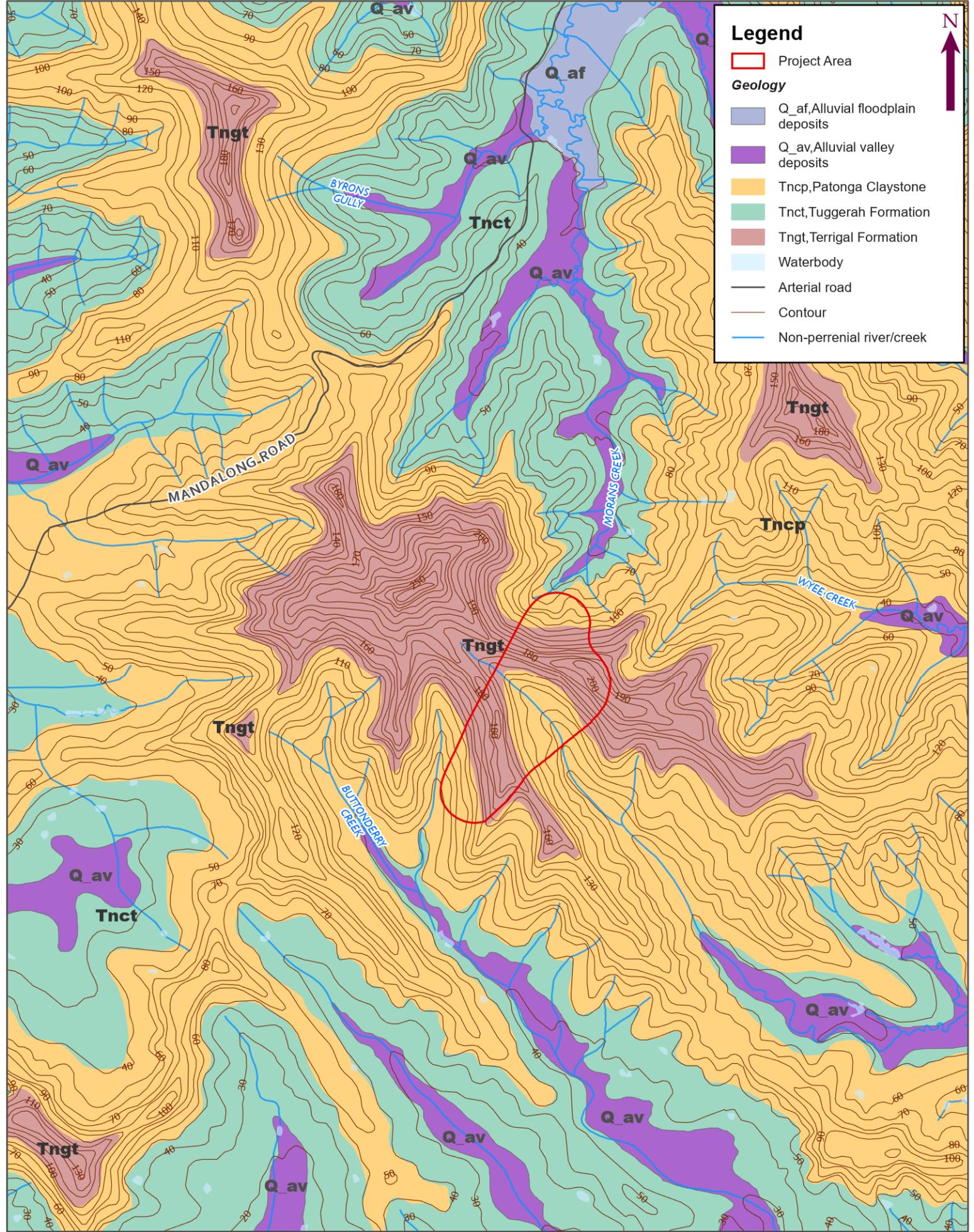
CLIENT: **Centennial**

PROJECT: **149823**

PURPOSE: **BDAR**

IMPORTANT NOTE
1. This plan was prepared for the sole purposes of the client for the specific purpose of producing a photographic monitoring plan. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other purpose, in whole or in part. The plan is prepared without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
2. RPS Australia East Pty Ltd will not be liable (or negligent or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
a. a Third Party publishing, disseminating or relying on this plan;
b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unauthorised;
c. any inaccuracies or other faults with information or data sourced from a Third Party.
3. RPS Australia East Pty Ltd relies on surface indicators that are incorrect or inaccurate;
4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
5. the Client or any Third Party with any local authority against the recommendation of RPS Australia East Pty Ltd;
6. the accuracy, reliability, suitability or completeness of the approximations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.





**FIGURE 2-3
AREAS OF GEOLOGICAL SIGNIFICANCE**

VERSION: **A**
 DATE EXPORTED: **19/08/2021 11:04 AM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



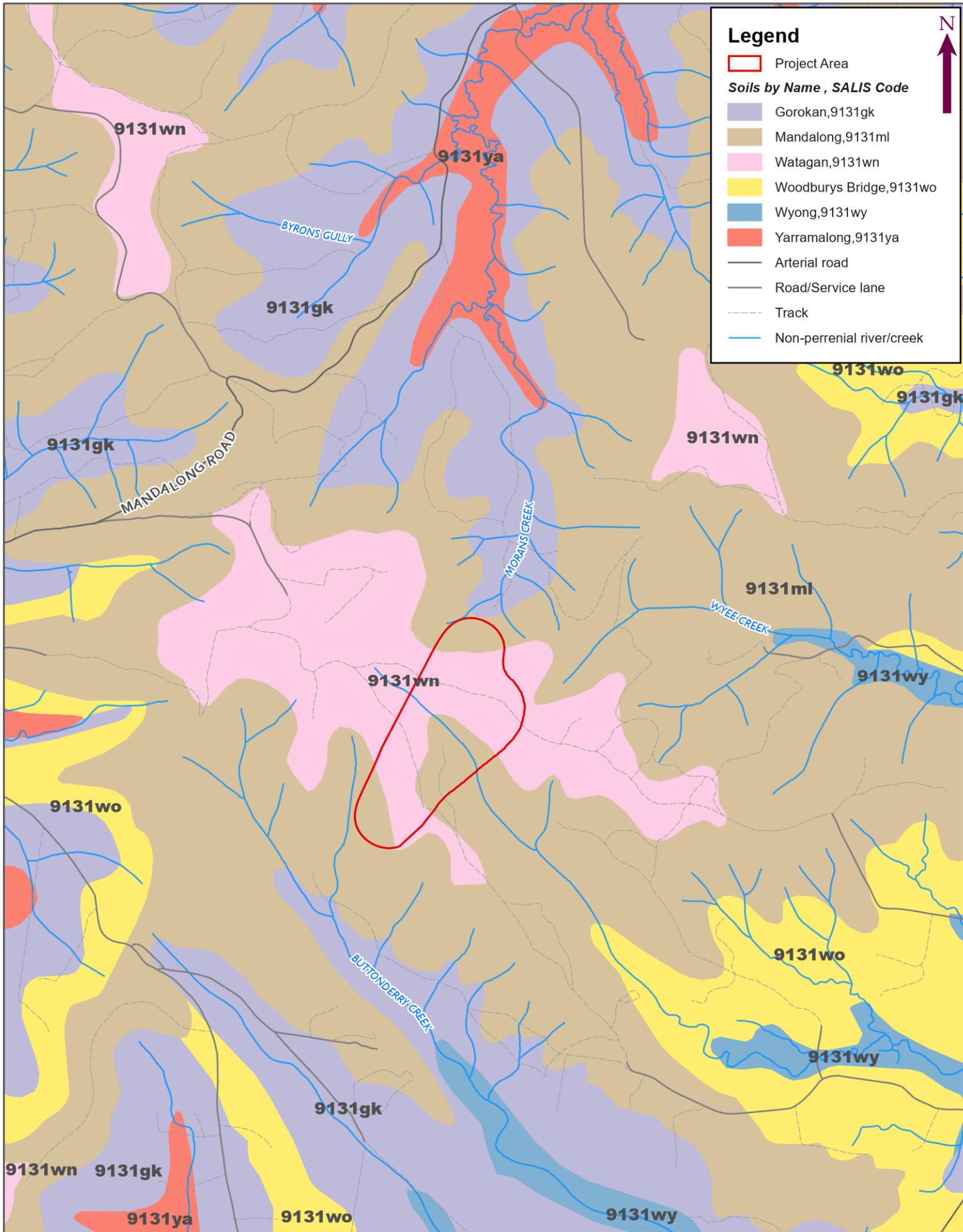
SCALE 1:24,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: **Centennial**
 PROJECT: **149823**
 PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a preliminary assessment. This plan is advisory in nature and does not apply directly or indirectly and will not be used for any other purpose or purpose and for which the plan is prepared without the consent of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be held responsible or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. the use of this plan for any purpose other than that for which it was prepared;
 b. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.
 3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate.
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. the accuracy, reliability, suitability or completeness of the approximations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.

RPS
 RPS Australia East Pty Ltd
 RPS Australia East Pty Ltd
 RPS Australia East Pty Ltd





Legend

- Project Area
- Soils by Name , SALIS Code**
- Gorokan,9131gk
- Mandalong,9131ml
- Watagan,9131wn
- Woodburys Bridge,9131wo
- Wyong,9131wy
- Yarramalong,9131ya
- Arterial road
- Road/Service lane
- Track
- Non-perrenial river/creek

**FIGURE 2-4
SOIL LANDSCAPE UNITS**

VERSION: **A**
 DATE EXPORTED: **19/08/2021 11:06 AM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE 1:24,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: **Centennial**
 PROJECT: **149823**
 PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of producing a photographic overlay job. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other residential, business, or other matter. The plan is provided without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be liable (or negligent or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. the Client or any Third Party publishing, using or relying on this plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or any Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unauthorised;
 c. any inaccuracies or other faults with information or data sourced from a Third Party;
 3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. judgement of this plan with any local authority or the recommendation of RPS Australia East Pty Ltd;
 6. the accuracy, reliability, suitability or completeness of any approximations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.



3 NATIVE VEGETATION

3.1 Native Plant Species

In total, 263 flora species were detected within the BAM plots; 233 native and 30 exotic species. The following threatened species was detected within the Project Area:

- *Rhodamnia rubescens* (Scrub Turpentine; BC Act: Critically Endangered; EPBC Act: Critically Endangered).

For a full list of flora species recorded during the study see the BIR (**Appendix A**).

3.2 High Threat Weeds

Six high threat weeds were found within the Project Area:

- *Ageratina Adenophora* (Crofton Weed);
- *Alternanthera philoxeroides* (Alligator Weed);
- *Bidens Pilosa* (Cobbler's Peg);
- *Cyperus eragrostis* (Umbrella Sedge);
- *Paspalum dilatatum*; and
- *Lantana camara* (Lantana).

Duties for management of these weeds under the *Biosecurity Act* (2015) are provided in the BIR (**Appendix A**).

3.3 Plant Community Types (PCTs)

Below is a summary of the vegetation communities assigned on the Project Area. For further information, including survey methods, photographs and datasheets, please refer to the BIR (**Appendix A**).

3.3.1 Method of assessing PCTs

3.3.1.1 Review of Existing Information

The Lake Macquarie Vegetation Community Mapping (Bell and Driscoll 2015) was used as the basis for a preliminary analysis of vegetation patterns within the Project Area. Mapping by Bell and Driscoll (2015) was updated following re-interpretation of mapped vegetation boundaries using the latest aerial photography (e.g. Google™ 2021) prior to survey stratification. Plant Community Types (PCTs) were assigned to Bell and Driscoll (2015) using a conversion table prepared by Bell (2016a). Updates also included the assigning of notional condition classes. PCTs were preliminarily assigned to areas of relatively homogenous land cover (i.e. vegetation zones). Additional revisions were performed following the completion of Rapid Data Points (RDPs) during field surveys (i.e. revision of zone boundaries and condition classes). PCT extent was calculated using ArcGIS™ to determine the number of BAM plots required and to stratify other survey methods.

3.3.1.2 Floristic survey

Prior to allocating the BAM plot location and replication requirements, RDPs were collected across the Project Area to ground-truth the Bell and Driscoll (2015) vegetation mapping. At each RDP point, species composition in the vicinity (i.e. 20 m radius) was recorded, focusing on the dominant species in each stratum (e.g. canopy, mid, shrub and ground layer) this process assists in aligning the vegetation with the PCTs and delineating the extent of the PCTs. Following confirmation of the PCT extent, GIS was used to determine required survey effort. Mapping by Bell and Driscoll (2015) was generally consistent with the RDPs, with the need to slightly shift the boundaries of this vegetation mapping following ground-truthing.

REPORT

A total of 17 flora plots were carried out in accordance with the BAM to assess the composition, structure and function components of vegetation integrity (**Appendix A**). The locations of these BAM plots were selected on site to avoid ecotones and disturbed areas that were readily distinguishable from the broad condition state of the vegetation zone.

The following attributes were measured in each plot:

- One standard 20 x 20 m plot, to assess the composition and structure attributes, including trees, shrubs, grasses, forbs, ferns and other growth forms;
- One standard 20 x 50 m plot (1000 m²) to assess the function attributes: number of large trees (i.e. > 50 cm DBH), stem size class, tree regeneration, length of fallen logs, high threat exotic vegetation cover and hollow-bearing trees; and
- Five 1 m² sub-plots to assess average litter cover for the plots.

The vegetation condition of each PCT was classified as good, moderate, derived, poor or disturbed/cleared based on the definitions provided in **Table 3-1**. Vegetation condition was then used to delineate vegetation zones, and subsequently stratify sampling, as required by the BAM (State of NSW 2020).

Where the number of BAM plots undertaken exceeded the required minimum number of BAM plots required based on the area of each zone, all BAM plots were entered into the BAM-C.

Table 3-1 Definitions of vegetation zones

Vegetation Condition Class	Definition
Good	Vegetation community generally resembles pre-European levels of condition, structure and overall integrity. Vegetation is resilient to weed invasion due to dominance of native species within the ground, shrub and canopy layers.
Moderate	Native canopy present. The understorey is dominated by natives (>50 % native cover). Vegetation condition is below benchmark value but above that defined for poor condition.
Derived	Native vegetation in a structurally modified state, exemplified by an unnatural dominance of species in a non-characteristic strata combined with the absence of characteristic species in the dominant strata (e.g. native grasslands derived from grassy woodlands, native shrublands derived from dry sclerophyll forests).
Poor	Native canopy largely absent. Understorey dominated by exotic species (i.e. > 50% exotic cover). Native shrub layer has largely been replaced by weeds.
Disturbed/ cleared	<p>These areas have:</p> <ul style="list-style-type: none">• a vegetation integrity score <15 where the PCT is representative of an endangered or critically endangered ecological community, or• a vegetation zone has a vegetation integrity score <17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community, or• a vegetation zone has a vegetation integrity score <20 where the PCT is not representative of a TEC or associated with threatened species habitat. <p>Based on the vegetation integrity score for this vegetation group, assessment of native vegetation is not required beyond Section 5.4 of the BAM (State of NSW 2020).</p>

3.3.2 PCTs identified within the Project Area

Five Plant Community Types (PCTs) were identified within the Project Area:

- PCT 1528 Jackwood – Lilly Pilly – Sassafras riparian warm temperate rainforest of the Central Coast;
- PCT 1556 Tallowwood – Smooth-barked Apple – Blackbutt grass tall open forest of the Central and lower North Coast;
- PCT 1568 Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast;
- PCT 1573 Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment; and
- PCT 1588 Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast.

3.3.3 Zone allocation

The condition of native vegetation for most of the Project Area was moderate to good quality, generally impacted by edge effects associated with adjacent power easements and nearby rural properties (**Table 3-2**). There are also some highly disturbed areas, largely lacking native vegetation associated with land clearing for rural dwellings, agriculture and roads, which were not considered native vegetation as defined by BAM (State of NSW 2020). As such, this resulted in six vegetation zones across the Project Area (**Figure 3-1**).

Table 3-2 PCTs and zones present within the Project Area

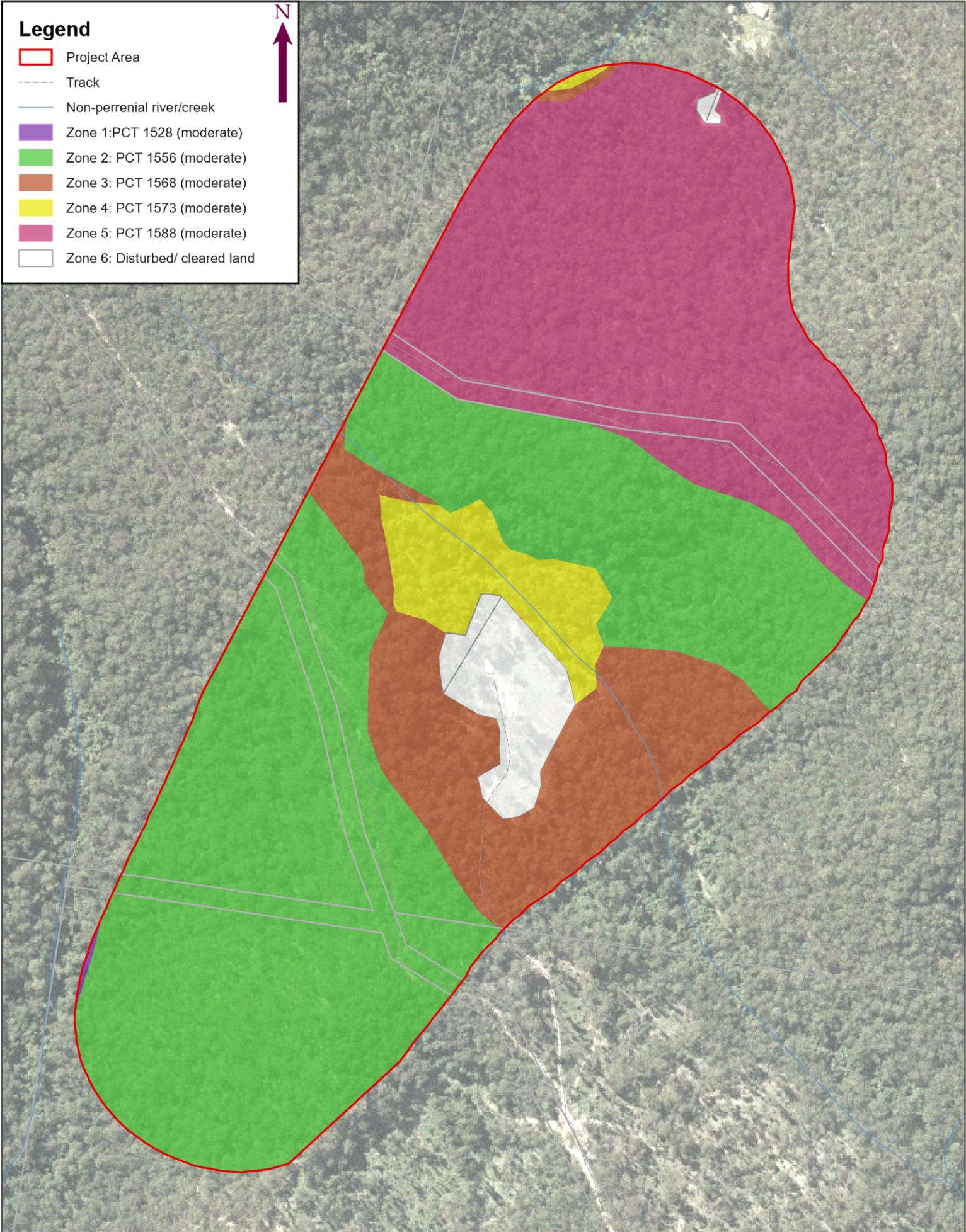
Zone	PCT	Condition	Total area (ha) ²	Potential ponding impact (ha)	No. plots undertaken	No. plots required
1	1528	Moderate	0.04	0	1	1
2	1556	Moderate	25.10	0.000083	5	4
3	1568	Moderate	7.20	0.00031	4	3
4	1573	Moderate	2.48	0.000078	2	2
5	1588	Moderate	15.44	0	3	3
6	Disturbed/cleared	Non-native	1.92	0.00022	2	1

1. The area of native vegetation to be impacted and hence offset is 0.00047 ha. As this value is too small for the BAM-C to recognise, it has been rounded up in BAM-C to the nearest accepted number (i.e. 0.01 ha). 2. Misalignment of listed Project Area size (e.g. **Section 2.3**) and total areas of zones in this table is due to rounding.

A map of the six zones is provided in **Figure 3-1**. A description of each of these zones, and justification for PCT selection, is provided in **Table 3-3** to **Table 3-8**. Further information regarding these vegetation communities, including photographs, is found in the BIR (**Appendix A**).

Legend

- Project Area
- Track
- Non-perennial river/creek
- Zone 1: PCT 1528 (moderate)
- Zone 2: PCT 1556 (moderate)
- Zone 3: PCT 1568 (moderate)
- Zone 4: PCT 1573 (moderate)
- Zone 5: PCT 1588 (moderate)
- Zone 6: Disturbed/ cleared land



**FIGURE 3-1
VEGETATION ZONES**

VERSION: **A**
 DATE EXPORTED: **10/08/2021 2:42 PM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE 1:5,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: **Centennial**

PROJECT: **149823**

PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of producing a photographic overlay plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other regulatory purpose, use or release. The plan is prepared without the assumption of a duty of care to any other person (other than the Client) ("Third Party") and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.
 3. RPS Australia East Pty Ltd relaying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. RPS Australia East Pty Ltd, its employees or any local authority regarding the recommendations of RPS Australia East Pty Ltd;
 6. the accuracy, reliability, suitability or completeness of any representations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.

3. RPS Australia East Pty Ltd relaying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. RPS Australia East Pty Ltd, its employees or any local authority regarding the recommendations of RPS Australia East Pty Ltd;
 6. the accuracy, reliability, suitability or completeness of any representations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.



Table 3-3 Zone 1: PCT 1528 Jackwood – Lilly Pilly – Sassafras riparian warm temperate rainforest of the Central Coast

Jackwood – Lilly Pilly – Sassafras riparian warm temperate rainforest of the Central Coast		
Vegetation Formation	Rainforest	
Vegetation class	Northern Warm Temperate Rainforest	
Vegetation Type	PCT ID	1528
	Common Community Name	Jackwood – Lilly Pilly – Sassafras riparian warm temperate rainforest of the Central Coast
Description	Closed forests with a diverse canopy characterised by <i>Acmena smithii</i> ; <i>Cryptocarya glaucescens</i> and <i>Doryphora sassafras</i> .	
Condition	Moderate/ Good	
Approximate extent within the Project Area	~0.04 ha	
BAM Plot no.	LW 34-3	
Species relied upon for PCT identification	Species Name	Mean relative abundance (400 m² BAM Plot)
	<i>Cryptocarya glaucescens</i>	15.00
	<i>Ficus coronata</i>	0.20
	<i>Alphitonia excelsa</i>	8.00
	<i>Archontophoenix cunninghamiana</i>	15.00
	<i>Alectryon subcinereus</i>	0.30
	<i>Wilkiea huegeliana</i>	2.00
	<i>Pittosporum multiflorum</i>	2.00
	<i>Morinda jasminoides</i>	0.30
	<i>Cissus antarctica</i>	5.00
	<i>Lastreopsis microsora</i>	0.07
	<i>Hypolepis muelleri</i>	0.27
	<i>Gymnostachys anceps</i>	0.10
<i>Oplismenus imbecillis</i>	0.20	
Other consistent diagnostic features	Floodplains; valley floors; sheltered riparian sites of the Central Coast; mainly on sandstones; at elevations below 50 m.	
Justification of evidence used to identify the PCT	<p>This vegetation community is in sheltered riparian areas on the valley floor within the Central Coast, with alluvial soils consistent with this PCT. The elevation in the location of this zone is low (~60 m asl), at the back of the coastal floodplain. Vegetation was consistent with a rainforest growth formation, depicted by a high-density canopy and lower density understory. The vegetation aligns closest to MU1a under Bell (2016b), which has been allocated to PCT 1528 by Bell (2016a). Many of the diagnostic species listed in the BioNet Vegetation Classification System (DPIE 2021C) were present adjacent or inside plots, as indicated above.</p> <p>Floristic analysis of dominant canopy/mid stratum species within this zone were entered into the BioNet Vegetation Classification (DPIE 2021b; filtered for Wyong Sub-region): <i>Archontophoenix cunninghamiana</i>; <i>Eucalyptus microcorys</i>; <i>Ficus coronata</i>; <i>Cryptocarya glaucescens</i>; <i>Backhousia myrtifolia</i> and <i>Alphitonia excelsa</i>. The top matches were PCTs 1528; 616; 905; 1522 and 1526. PCT 1528 had the highest match of the search criteria (4 key species were diagnostic) with landscape/geographical position and soil/geological nature consistent. As a comparison, dry rainforests PCT 616 was ruled out as it was not a dry rainforest (i.e. not in a rain-shadow or other area of low rainfall). PCT 905 was ruled out as it typically occurs on clay soils enriched from clay (soils were alluvial sands primarily), whilst <i>Ceratopetalum apetalum</i> and <i>Livistonia australis</i> (key diagnostic species for PCT 905) were lacking. While, PCT 1522 had some diagnostic species that were present (albeit outside</p>	

plot), however failed to explain the majority of dominant canopy present (only matched 2 dominant species).

The confidence in PCT selection was 80%.

TEC Status	This PCT corresponds with BC Act-listed Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions TEC.
Estimate of percentage cleared	32%
Notes	No predicted ponding expected in this area.

Table 3-4 Zone 2: PCT 1556 Tallowood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast

Tallowood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast		
Vegetation Formation	Wet Sclerophyll Forest (Grassy sub-formation)	
Vegetation class	Northern Hinterland Wet Sclerophyll Forest	
Vegetation Type	PCT ID	1556
	Common Community Name	Tallowood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
Description	Open forests with a canopy dominated by <i>Eucalyptus microcorys</i> . The mid-storey consists of an open shrub layer and the ground layer is dominated by grasses with various ferns; and forbs.	
Condition	Moderate	
Approximate extent within the Project Area	~25.10 ha	
BAM Plot no.	LW34-8; LW34-9; LW34-10; LW34-11; LW34-12	
Species relied upon for PCT identification	Species Name	Mean relative abundance (400 m² BAM Plot)
	<i>Eucalyptus microcorys</i>	10.60
	<i>Eucalyptus pilularis</i>	15.00
	<i>Allocasuarina torulosa</i>	8.20
	<i>Persoonia linearis</i>	0.40
	<i>Imperata cylindrica</i>	0.16
	<i>Entolasia stricta</i>	0.10
	<i>Themeda triandra</i>	0.34
	<i>Dianella caerulea</i>	0.34
	<i>Lomandra longifolia</i>	2.28
	<i>Lepidosperma laterale</i>	0.10
	<i>Lobelia purpurascens</i>	0.20
Other consistent diagnostic features	Upper slopes & valleys in dissected terrain; coastal flats and rises; ranges of the lower North Coast at mid to lower elevations.	
Justification of evidence used to identify the PCT	<p>This vegetation community is in the upper slopes and valleys in the ranges of the Central Coast, located at mid to lower elevations above rainforests located at the valley floor. As such, the landscape/ geographic position was consistent with PCT 1556.</p> <p>The vegetation aligns closest to MU9I under Bell (2016b), which has been allocated to PCT 1556 by Bell (2016a). Many of the diagnostic species listed in the BioNet Vegetation Classification System (DPIE 2021C) were present, as indicated above.</p>	

Floristic analysis of dominant canopy species within this zone were entered into the BioNet Vegetation Classification (DPIE 2021b; filtered for Wyong Sub-region and Wet Sclerophyll Forest Grassy formation): *Eucalyptus microcorys*; *Eucalyptus pilularis*; *Allocasuarina torulosa*; *Syncarpia glomulifera*; and *Angophora costata* (observed nearby plots). The top matching PCTs were: PCTs 1556; 1564; 1579; 684; and 695. The vegetation was consistent floristically with PCT 1556 (all but *Syncarpia glomulifera* matched), whilst the landscape/geographical position and soil/geological nature were also consistent with this PCT. PCT 1564 was ruled out due to largely a lack of *Angophora floribunda*, whilst there were not numerous shrubs and climbers, which typifies this PCT. PCTs 1579 and 684 were a close match, but lacked *Eucalyptus microcorys*, which was a dominant canopy species in the zone (it occurred in four of the five plots). PCTs 695 was also not suitable due to a lack of *Lophostemon confertus* (Brush Box).

The confidence in PCT selection was 80%.

TEC Status	Although this PCT can correspond with BC Act-listed River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions TEC, vegetation within the Project Area was inconsistent with this TEC since it was not positioned on a river flat of the coastal floodplain. That is, river flats are typically level landforms that occur below 20 m ASL (DECC 2007b), whilst the lowest point of the Project Area is approximately 60 m ASL with typically steep terrain. This PCT does not correspond to any EPBC Act-listed TEC.
Estimate of percentage cleared	41%
Notes	None

Table 3-5 Zone 3: PCT 1568 Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast (Moderate)

Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast		
Vegetation Formation	Wet Sclerophyll Forest (Shrubby sub-formation)	
Vegetation class	Northern Coast Wet Sclerophyll Forest	
Vegetation Type	PCT ID	1568
	Common Community Name	Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast
Description	All open forests to open forests with a canopy dominated by <i>Syncarpia glomulifera</i> and <i>Eucalyptus pilularis</i> . The mid-storey is semi-mesic and includes diverse small trees and shrubs along with climbers. The ground layer is dominated by ferns.	
Condition	Moderate	
Approximate extent within the Project Area	~7.20 ha	
BAM Plot no.	LW 34-6; LW 34-13; PR144986 Plot 12; PR144986 Plot 19	
Species relied upon for PCT identification	Species Name	Mean relative abundance (400 m² BAM Plot)
	<i>Eucalyptus pilularis</i>	6.00
	<i>Eucalyptus saligna</i>	1.50
	<i>Cryptocarya microneura</i>	0.13
	<i>Synoum glandulosum</i>	23.33
	<i>Pittosporum revolutum</i>	0.35
	<i>Dianella caerulea</i>	0.03
	<i>Doodia aspera</i>	0.05
	<i>Gymnostachys anceps</i>	0.10

	<i>Dianella caerulea</i>	0.50
	<i>Wilkiea huegeliana</i>	0.20
Other consistent diagnostic features	Sandstones ranges of the Central Coast at elevations below 450 m.	
Justification of evidence used to identify the PCT	<p>Landscape and geological position of vegetation was consistent with PCT 1568 given it was located on sandstones ranges of the Central Coast at elevations below 450 m. Located toward the gully floor on typically alluvial sediments, coinciding with the occurrence of <i>Eucalyptus saligna</i>. The vegetation aligns closest to MU5 under Bell (2016b), which has been allocated to PCT 1568 by Bell (2016a). Many of the diagnostic species listed in the BioNet Vegetation Classification System (DPIE 2020C) were present adjacent or inside plots, as indicated above.</p> <p>Floristic analysis of dominant canopy/mid story species within this zone were entered into the BioNet Vegetation Classification (DPIE 2021b; filtered for Wyong Sub-region and Wet Sclerophyll Forest Shrubby formation): <i>Eucalyptus pilularis</i>; <i>Eucalyptus saligna</i>; <i>Eucalyptus propinqua</i>; <i>Syncarpia glomulifera</i>; <i>Archontophoenix cunninghamiana</i>; <i>Corymbia maculata</i>; and <i>Synoum glandulosum</i>. The top matching PCTs were: PCTs 1568; 1915; 684; 1245 and 694. PCT 1568 were the best fit given the landscape position (Central Coast below 450 m), Sandstone geology (typically alluvial sand), whilst had the most matching diagnostic species in the floristic assessment. PCTs 694 and 1245 were not suitable as they are located in Illawarra not Central Coast. PCT 684 has several diagnostic species lacking in the vegetation zone (i.e. Flooded Gum and Brush Box). PCT 684 occurs on hillslopes are Mandalong Valley but <i>Eucalyptus acemenoides</i> and <i>Angophora floribunda</i> were lacking, whilst PCT 684 does not support <i>Eucalyptus saligna</i>. PCT 1915 is typified by <i>Eucalyptus botryoides</i>, <i>Angophora floribunda</i>, <i>Angophora costata</i> and <i>Livistonia australis</i>, which were lacking from this zone, so was unsuitable.</p> <p>The confidence in PCT selection was 90%.</p>	
TEC Status	Not Listed	
Estimate of percentage cleared	40%	
Notes	None	

Table 3-6 Zone 4: PCT 1573 Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment (Moderate)

Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment		
Vegetation Formation	Wet Sclerophyll Forest (Shrubby sub-formation)	
Vegetation class	Northern Coast Wet Sclerophyll Forest	
Vegetation Type	PCT ID	1573
	Common Community Name	Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment
Description	Open forests to tall open forests consisting of a eucalypt canopy over a small tree layer of mesic species. The lower mid-storey consists mainly of vines; with sparse shrubs. The under-storey is ferny; with only sparse grasses and forbs. Occurs on steep near coastal ranges of the lower North coast and Northern Tablelands escarpment between 150 and 900 m elevation; predominately on mid to lower slopes.	
Condition	Moderate/ Good	
Approximate extent within the Project Area	~2.48 ha	
BAM Plot no.	LW34-7; PR144986 Plot 20	
Species relied upon for PCT identification	Species Name	Mean relative abundance (400 m² BAM Plot)
	<i>Acmena smithii</i>	0.05

REPORT

<i>Cryptocarya glaucescens</i>	20.00
<i>Eupomatia laurina</i>	12.50
<i>Schizomeria ovata</i>	2.50
<i>Synoum glandulosum</i>	1.25
<i>Adiantum formosum</i>	0.50
<i>Cissus antarctica</i>	1.00
<i>Oplismenus imbecillis</i>	2.60

Other consistent diagnostic features

Occurred on lower slopes of coastal ranges, just below the 150 to 900 m elevation criteria (~120-130 m ASL).

Justification of evidence used to identify the PCT

Located on footslopes of the Central Coast at elevations broadly consistent with this PCT description. The vegetation aligns closest to MU1 under Bell (2016b), which has been allocated to PCT 1573 by Bell (2016a). Many of the diagnostic species listed in the BioNet Vegetation Classification System (DPIE 2020C) were present adjacent or inside plots, as indicated above.

Floristic analysis of dominant canopy/mid story species within this zone were entered into the BioNet Vegetation Classification (DPIE 2021b; filtered for Wyong Sub-region and Wet Sclerophyll Forest Shrubby formation): *Eucalyptus saligna* (located nearby plots); *Syncarpia glomulifera*; *Synoum glandulosum*; *Eupomatia laurina*; *Cryptocarya glaucescens*; *Cryptocarya microneura*; *Alphitonia excelsa*; *Acmena smithii* and *Clerodendrum tomentosum*. The top matching PCTs were: PCTs 1245; 1915; 1568; 1573; and 747. PCT 1573 was the best fit given the landscape position (Central coastal foothills), highly mesic nature of the zone, whilst had 5 of the 10 matching diagnostic species in the floristic assessment. PCT 1245 was discounted since it is located in Illawarra not Central Coast. PCT 684 has several diagnostic species lacking in the vegetation zone (i.e. Flooded Gum and Brush Box). PCT 1915 is typified by *Eucalyptus botryoides*, *Angophora floribunda*, *Angophora costata* and *Livistonia australis*, which were lacking from this zone. PCT 1568 was similar (had 5 of 10 of the species searched) but *Eucalyptus pilularis* was lacking from the vegetation zone, which is a key diagnostic species of PCT 1568. It was also typically located up the catchment from PCT 1568, which occurs more toward the lower foot slopes and floodplains.

The confidence in PCT selection was 80%.

TEC Status

Not Listed

Estimate of percentage cleared

NA

Notes

None

Table 3-7 Zone 5: PCT 1588 Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast

Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast		
Vegetation Formation	Dry Sclerophyll Forest (Shrub/grass sub-formation)	
Vegetation class	Hunter-Macleay Dry Sclerophyll Forest	
Vegetation Type	PCT ID	1588
	Common Community Name	Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast
Condition	Moderate	
Description	Open forests characterised by <i>Eucalyptus paniculata</i> . The understorey is typically shrubby with sparse climbers. The ground layer is characteristically grassy with various graminoids and forbs.	
Approximate extent within the Project Area	~15.44 ha	
BAM Plot no.	LW 34-2; LW 34-4; LW 34-14	
Species relied upon for PCT identification	Species Name	Relative abundance (400 m² BAM Plot)
	<i>Breynia oblongifolia</i>	0.07
	<i>Dianella caerulea</i>	0.4
	<i>Pandorea pandorana</i>	0.03
	<i>Themeda triandra</i>	0.07
	<i>Dianella caerulea</i>	1.25
Other consistent diagnostic features	Low rises; upper slopes; coastal lowlands of the Central Coast mainly on sandstones.	
Justification of evidence used to identify the PCT	<p>Located on upper slopes of Central Coast on sandstones range. vegetation aligns closest to MU15 Coastal Foothills Spotted Gum Ironbark Forest under Bell (2016b), which has been allocated to PCT 1588 by Bell (2016a). Specifically, vegetation best aligned with MU 15 due to dominance of <i>Allocasuarina torulosa</i>, <i>Corymbia maculata</i> and <i>Eucalyptus fergusonii</i>, which occurred within each plot. <i>Eucalyptus pilularis</i> was also present, however the occurrence of this species did not fit any other MU given the presence of the three commonly occurring tree species just mentioned. Moreover, many of the diagnostic species listed in the BioNet Vegetation Classification System (DPIE 2020c) were present, as indicated above. As noted by Bell (2016a), best fit is PCT 1216 Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin Bioregion, but that has been decommissioned.</p> <p>There was subtle variance in the floristic composition of this zone according to slight changes in aspect and ecotonal influences from ground water, leading to a mosaic of canopy species across the area. The zone had some characteristics of PCT 1556 (e.g. <i>Eucalyptus microcorys</i> and <i>Eucalyptus pilularis</i>), however the dominance of <i>Corymbia maculata</i> and various Ironbark species throughout the zone (mostly <i>Eucalyptus siderophloia</i>) suggested that a Spotted Gum - Ironbark Forest was a more suitable classification. Floristic analysis of dominant canopy/mid story/ ground cover species within this zone were entered into the BioNet Vegetation Classification (DPIE 2021b; filtered for Wyong Sub-region and Dry Sclerophyll Forest Shrub/grass sub-formation): <i>Corymbia maculata</i>; <i>Eucalyptus fergusonii</i>; <i>Eucalyptus pilularis</i>; <i>Eucalyptus siderophloia</i>; <i>Allocasuarina torulosa</i>; <i>Breynia oblongifolia</i>; <i>Lomandra longifolia</i>; and <i>Themeda triandra</i>. Of the Spotted Gum Ironbark vegetation communities, PCTs 1590; 1602 and 1588 were the best matches given others in the top 5 were from Clarence or Macleay Valley. PCT 1588 was considered the best of these three since <i>Eucalyptus umbra</i> and <i>Eucalyptus paniculata</i> occurs (but not detected in plots), whilst the landscape position was a match given it is located on the coastal lowland of the Central Coast on sandstone geology. PCT 1590 was deemed unsuitable since <i>Eucalyptus fibrosa</i> was lacking</p>	

(not observed across the entire zone). PCT 1602 was unsuitable due to a lack of *Eucalyptus crebra* (not observed across the entire zone).

The confidence in PCT selection was 70%.

TEC Status	<p>This PCT can correspond with BC Act-listed Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion TEC. However, this TEC extends north from Port Stephens, and hence this vegetation is not classified as this TEC. The Project Area is also above the coastal floodplain.</p> <p>This community is also not consistent with Lower Hunter Spotted Gum Ironbark Forest as <i>Corymbia maculata</i> dominates in association with <i>Eucalyptus umbra</i>, <i>E. siderophloia</i> and <i>Allocasuarina torulosa</i> (as per NSW Threatened Species Scientific Committee 2019). Further, nowhere is there a patch comprising Spotted Gum and Red Ironbark as co-dominant species.</p>
Estimate of percentage cleared	56%
Notes	No predicted ponding expected in this area.

Table 3-8 Zone 6: Disturbed/cleared land

Disturbed/ cleared land					
Vegetation Formation	None				
Vegetation class	None				
Vegetation Type	<table border="1"> <tr> <td>PCT ID</td> <td>None</td> </tr> <tr> <td>Common Community Name</td> <td>None</td> </tr> </table>	PCT ID	None	Common Community Name	None
PCT ID	None				
Common Community Name	None				
Condition	Disturbed/ Cleared Land				
Approximate extent within the Project Area	~1.92 ha				
BAM Plot no.	LW34-1; LW 34-5				
Other consistent diagnostic features	<p>This zone consists of:</p> <ul style="list-style-type: none"> cleared, gravel tracks (i.e. Kiar Ridge Road and Toepfers Road), as well as property access tracks; and cleared associated with private dwellings and associated Asset Protection Zones (APZs). 				
Justification of evidence used to identify the PCT	<p>Not native vegetation so does not constitute a PCT. Heavily transformed vegetation zone due to historic clearing and is now dominated by exotics, including dominance of <i>Bouteloua dactyloides</i> (Buffalo Grass). Weeds were also common to these areas, which included <i>Alternanthera philoxeroides</i>, <i>Axonopus compressus</i>, <i>Cyperus eragrostis</i>, <i>Hypochaeris radicata</i>, <i>Lysimachia arvensis</i>, <i>Modiola caroliniana</i>, <i>Nasturtium officinale</i>, <i>Richardia humistrata</i>, <i>Trifolium repens</i>, <i>Setaria sphacelata</i>, <i>Sida rhombifolia</i>, <i>Stellaria media</i> and <i>Taraxacum officinale</i>. Some native forbs and grasses were present but only in small occurrences, including <i>Cynodon dactylon</i>, <i>Dichondra repens</i>, <i>Geranium</i> spp., <i>Hibiscus heterophyllus</i> subsp. <i>heterophyllus</i>, <i>Hydrocotyle tripartite</i>, <i>Lobelia pratioides</i>, <i>Oplismenus imbecillis</i>, <i>Plectranthus parviflorus</i>, <i>Stephania japonica</i> and <i>Viola betonicifolia</i>.</p>				
TEC Status	None				
Estimate of percentage cleared	NA				
Notes	None				

3.3.4 Patch size

Patch sizes were assigned to vegetation zones within the Project Area using ArcGIS™ to select boundaries depicted in the existing mapping for the Project Area by Bell and Driscoll (2015), with reference to RDPs (strategically located across the Project Area) and aerial imagery.

In accordance with the BAM, patch size area was assigned to each vegetation zone as a class, being < 5ha, 5–24 ha, 25–100 ha or ≥ 100 ha. The patch size for all six zones was > 100 ha.

3.3.5 Vegetation integrity score

The vegetation integrity score for each vegetation zone is presented in **Table 3-9**. Note that only vegetation zones 2, 3 and 4 are predicted to be impacted by ponding. As such, these are the vegetation communities focused on when determining the offset liability for the Project.

Table 3-9 Vegetation integrity score for the vegetation zones

Zone	PCT	Condition	Composition	Structure	Function	Vegetation Integrity Score
1	1528	Moderate	89.7	49	63.6	65.4
2	1556	Moderate	84.8	58	97.4	78.2
3	1568	Moderate	86.8	86	65.5	78.8
4	1573	Moderate	89.8	68	74.7	76.9
5	1588	Moderate	90.6	55	65.1	68.7
6	-	Disturbed/ cleared	26.3	3.5	21	12.4

4 THREATENED SPECIES

4.1 Fauna habitat assessment

The habitat assessment aims to inform the assessment of ecosystem credit species predicted to occur within the Project Area and to assist in developing a list of Candidate species requiring further assessment (in accordance with Section 6.2 of the BAM and Section 6.4 of BAM respectively). A habitat-based fauna assessment was undertaken by identifying the following fauna habitat features:

- Habitat trees (including large hollow-bearing trees);
- Flowering shrubs and feed tree species, including winter flowering species;
- Sandstone rocky outcrops, including rock crevices/ caves and cliffs; and
- First order tributaries of Morans Creek, Mannering Creek and Buttonderry Creek.

The results of this fauna habitat assessment are further detailed in the BIR (**Appendix A**).

4.2 Ecosystem credit species assessment

Ecosystem credit species assigned by the BAM-C as being associated with the PCTs present within the Project Area are presented in **Table 4-1**. Although focus of the BAM-C final calculation was placed on vegetation zones to be impacted by ponding, the full suite of associated Ecosystem Credit Species across the Project Area was applied to inform assessment of indirect impacts.

Table 4-1 Ecosystem Credit Species

Ecosystem credit species	Vegetation type(s)	Sensitivity to gain class	BC Act listing	EPBC Act listing
<i>Anthochaera phrygia</i> Regent Honeyeater (Foraging)	PCT 1556	High Sensitivity to Potential Gain	Critically Endangered	Critically Endangered
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo (Foraging)	PCT 1556 PCT 1568 PCT 1573	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo (Foraging)	PCT 1556 PCT 1568 PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Chthonicola sagittata</i> Speckled Warbler	PCT 1588	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Climacteris picumnus victoriae</i> Brown Treecreeper (eastern subspecies)	PCT 1588	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Daphoenositta chrysoptera</i> Varied Sittella	PCT 1556 PCT 1568 PCT 1573 PCT 1588	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Dasyurus maculatus</i> Spotted-tailed Quoll	PCT 1528 PCT 1556 PCT 1568 PCT 1573 PCT 1588	High Sensitivity to Potential Gain	Vulnerable	Endangered
<i>Falsistrellus tasmaniensis</i> Eastern False Pipistrelle	PCT 1556 PCT 1568 PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Glossopsitta pusilla</i> Little Lorikeet	PCT 1556 PCT 1568	High Sensitivity to Potential Gain	Vulnerable	Not Listed

REPORT

Ecosystem credit species	Vegetation type(s)	Sensitivity to gain class	BC Act listing	EPBC Act listing
	PCT 1573 PCT 1588			
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle (Foraging)	PCT 1556 PCT 1568 PCT 1588	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Hirundapus caudacutus</i> White-throated Needletail	PCT 1528 PCT 1556 PCT 1568 PCT 1573 PCT 1588	High	Not Listed	Vulnerable
<i>Lathamus discolor</i> Swift Parrot (Foraging)	PCT 1556 PCT 1568	Moderate Sensitivity to Potential Gain	Endangered	Critically Endangered
<i>Lophoictinia isura</i> Square-tailed Kite (Foraging)	PCT 1556 PCT 1568	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Micronomus norfolkensis</i> Eastern Coastal Free-tailed Bat	PCT 1556 PCT 1568 PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Miniopterus australis</i> Little Bent-winged Bat (Foraging)	PCT 1556 PCT 1568 PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat (Foraging)	PCT 1556 PCT 1568 PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Neophema pulchella</i> Turquoise Parrot	PCT 1556 PCT 1568	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Ninox connivens</i> Barking Owl (Foraging)	PCT 1528 PCT 1556 PCT 1568 PCT 1573 PCT 1588	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Ninox strenua</i> Powerful Owl (Foraging)	PCT 1556 PCT 1568 PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Petaurus australis</i> Yellow-bellied Glider	PCT 1556 PCT 1568 PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Petroica boodang</i> Scarlet Robin	PCT 1556	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Phascolarctos cinereus</i> Koala (Foraging)	PCT 1556 PCT 1568 PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Vulnerable
<i>Phoniscus papuensis</i> Golden-tipped Bat	PCT 1556 PCT 1568 PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Pseudomys gracilicaudatus</i> Eastern Chestnut Mouse	PCT 1556 PCT 1568 PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	PCT 1556 PCT 1568	High Sensitivity to Potential Gain	Vulnerable	Vulnerable

Ecosystem credit species	Vegetation type(s)	Sensitivity to gain class	BC Act listing	EPBC Act listing
(Foraging)	PCT 1573			
<i>Ptilinopus magnificus</i> Wompoo Fruit-Dove	PCT 1528 PCT 1568 PCT 1573	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Ptilinopus regina</i> Rose-crowned Fruit-Dove	PCT 1528 PCT 1568 PCT 1573	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Ptilinopus superbus</i> Superb Fruit-Dove	PCT 1528 PCT 1568 PCT 1573	Moderate Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Saccolaimus flaviventris</i> Yellow-bellied Sheath-tail-bat	PCT 1556 PCT 1568 PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat	PCT 1556 PCT 1568 PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Thylogale stigmatica</i> Red-legged Pademelon	PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Tyto novaehollandiae</i> Masked Owl (Foraging)	PCT 1556 PCT 1568 PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed
<i>Tyto tenebricosa</i> Sooty Owl (Foraging)	PCT 1573	High Sensitivity to Potential Gain	Vulnerable	Not Listed

4.2.1 Species excluded from assessment

No ecosystem credit species were excluded from assessment based on habitat constraints or geographic limitations.

4.3 Species Credit Species

The species credit species predicted by the BAM-C to occur within the Project Area are presented in **Table 4-2**.

Tetradlea juncea (Black-eyed Susan) was added as a species credit species due to its potential to occur within the Project Area (**Appendix A**). This species may occur within open forest/woodland below 200m elevation, preferring cooler southerly aspects. As such, PCT 1556 was considered potential habitat for this species.

A *Tyto tenebricosa* (Sooty Owl) was detected by call during the surveys. As such, it was included as a Species Credit Species. Although no PCTs were present that this species aligns with in BioNet (DPIE 2020b), it can occupy rainforest and most eucalypt forest. As such, it is considered possible to occur within PCTs 1528 and 1556. Although they are not predicted to be impacted by ponding, species associated only with PCT 1588 was also included here (as indicated by a footnote in **Table 4-2**), due to potential for indirect impacts associated with the Project. This encompassed only *Litoria aurea* (Green and Golden Bell Frog). Nevertheless, it is considered that the survey efforts were still sufficient to survey for this species, which was not detected (**Appendix A**).

Table 4-2 Candidate species credit species requiring assessment

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on Project Area	Included or excluded	Reason for inclusion or exclusion
<i>Anthochaera phrygia</i> Regent Honeyeater (Breeding)	Critically Endangered	Critically Endangered	<ul style="list-style-type: none"> As per mapped areas 	High Sensitivity to Potential Gain	No	Excluded	Not in mapped areas for breeding
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo (Breeding)	Vulnerable	Not Listed	<ul style="list-style-type: none"> Hollow bearing trees Eucalypt tree species with hollows greater than 9cm diameter 	High Sensitivity to Potential Gain	Yes	Included	Habitat components assumed present
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo (Breeding)	Vulnerable	Not Listed	<ul style="list-style-type: none"> Hollow bearing trees Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground 	High Sensitivity to Potential Gain	Yes	Included	Habitat components assumed present
<i>Cercartetus nanus</i> Eastern Pygmy-possum	Vulnerable	Not Listed	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	Vulnerable	Vulnerable	<ul style="list-style-type: none"> Cliffs Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels 	Very High Sensitivity to Potential Gain	Yes	Included	Rocky outcrops/ crevices within 2km
<i>Corybas dowlingii</i> Red Helmet Orchid	Endangered	Not Listed	-	Moderate Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Cryptostylis hunteriana</i> Leafless Tongue Orchid	Vulnerable	Vulnerable	-	Moderate Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Cynanchum elegans</i> White-flowered Wax Plant ¹	Endangered	Endangered	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Diuris praecox</i> Rough Doubletail	Vulnerable	Vulnerable	<ul style="list-style-type: none"> Within the Parish boundaries of Newcastle, Kahibah, 	Moderate Sensitivity to Potential Gain	No	Excluded	Project Area outside parish boundaries of Newcastle, Kahibah,

REPORT

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on Project Area	Included or excluded	Reason for inclusion or exclusion
			Wallarah, Tuggerah and Kincumber				Wallarah, Tuggerah and Kincumber
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle (Breeding)	Vulnerable	Not Listed	<ul style="list-style-type: none"> Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines 	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Hoplocephalus bitorquatus</i> Pale-headed Snake	Vulnerable	Not Listed	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Hoplocephalus stephensii</i> Stephens' Banded Snake	Vulnerable	Not Listed	<ul style="list-style-type: none"> Hollow bearing trees or within 500m of this habitat Within 500m of arboreal vine tangles, fallen/standing dead timber including logs or within 500m of this habitat 	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Lathamus discolor</i> Swift Parrot (Breeding)	Endangered	Critically Endangered	<ul style="list-style-type: none"> As per mapped areas 	Moderate Sensitivity to Potential Gain	No	Excluded	Not in mapped areas for breeding
<i>Litoria aurea</i> Green and Golden Bell Frog ¹	Endangered	Vulnerable	<ul style="list-style-type: none"> Semi-permanent/ephemeral wet areas Within 1km of wet areas/Swamps Within 1km of swamp/Waterbodies Within 1km of waterbody 	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Litoria brevipalmata</i> Green-thighed Frog	Vulnerable	Not Listed	-	Moderate Sensitivity to Potential Gain	Yes	Included	Habitat components present

REPORT

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on Project Area	Included or excluded	Reason for inclusion or exclusion
<i>Litoria littlejohni</i> Littlejohn's Tree Frog	Vulnerable	Vulnerable	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Lophoictinia isura</i> Square-tailed Kite (Breeding)	Vulnerable	Not Listed	<ul style="list-style-type: none"> Nest trees 	Moderate Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Macropus parma</i> Parma Wallaby	Vulnerable	Not Listed	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Melaleuca biconvexa</i> Biconvex Paperbark	Vulnerable	Vulnerable	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Melaleuca groveana</i> Grove's Paperbark	Vulnerable	Not Listed	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Miniopterus australis</i> Little Bent-winged Bat (Breeding)	Vulnerable	Not Listed	<ul style="list-style-type: none"> Caves Cave, tunnel, mine, culvert 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 	Very High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat (Breeding)	Vulnerable	Not Listed	<ul style="list-style-type: none"> Caves Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with 	Very High Sensitivity to Potential Gain	Yes	Included	Habitat components present

REPORT

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on Project Area	Included or excluded	Reason for inclusion or exclusion
			<ul style="list-style-type: none"> microhabitat code 'IC – in cave' • Observation type code 'E nest-roost' • with numbers of individuals >500 • or from the scientific literature 				
<i>Mixophyes balbus</i> Stuttering Frog	Endangered	Vulnerable	-	Very High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Mixophyes iteratus</i> Giant Barred Frog	Endangered	Endangered	<ul style="list-style-type: none"> • Land within 50m of semi permanent and permanent drainages 	Moderate Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Myotis macropus</i> Southern Myotis	Vulnerable	Not Listed	<ul style="list-style-type: none"> • Hollow bearing trees • Within 200 m of riparian zone • Bridges, caves or artificial structures within 200 m of riparian zone • This include rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200m of the site 	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Ninox connivens</i> Barking Owl (Breeding)	Vulnerable	Not Listed	<ul style="list-style-type: none"> • Hollow bearing trees • Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground 	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Ninox strenua</i> Powerful Owl (Breeding)	Vulnerable	Not Listed	<ul style="list-style-type: none"> • Hollow bearing trees • Living or dead trees with hollow greater than 20cm diameter 	High Sensitivity to Potential Gain	Yes	Included	Habitat components present

REPORT

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on Project Area	Included or excluded	Reason for inclusion or exclusion
<i>Petauroides volans</i> Greater Glider	Not Listed	Vulnerable	<ul style="list-style-type: none"> Hollow bearing trees 	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Petaurus norfolcensis</i> Squirrel Glider	Vulnerable	Not Listed	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Petrogale penicillata</i> Brush-tailed Rock-wallaby	Endangered	Vulnerable	<ul style="list-style-type: none"> Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliffines 	Very High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Phascogale tapoatafa</i> Brush-tailed Phascogale	Vulnerable	Vulnerable	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Phascolarctos cinereus</i> Koala (Breeding)	Vulnerable	Vulnerable	<ul style="list-style-type: none"> Areas identified via survey as important habitat 	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Planigale maculata</i> Common Planigale	Vulnerable	Not Listed	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Potorous tridactylus</i> Long-nosed Potoroo	Vulnerable	Vulnerable	<ul style="list-style-type: none"> Dense shrub layer or alternatively high canopy cover exceeding 70% (i.e. to capture populations inhabiting wet sclerophyll and rainforest) 	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox (Breeding)	Vulnerable	Vulnerable	<ul style="list-style-type: none"> Breeding camps 	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Rhizanthella slateri</i> Eastern Australian Underground Orchid	Vulnerable	Endangered	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Rhodamnia rubescens</i> Scrub Turpentine	Critically Endangered	Not Listed	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Rhodomyrtus psidioides</i> Native Guava	Critically Endangered	Not Listed	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present

REPORT

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on Project Area	Included or excluded	Reason for inclusion or exclusion
<i>Tetratheca juncea</i> Black-eyed Susan ²	Vulnerable	Vulnerable	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Turnix maculosus</i> Red-backed Button-quail	Vulnerable	Not Listed	-	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Tyto novaehollandiae</i> Masked Owl (Breeding)	Vulnerable	Not Listed	<ul style="list-style-type: none"> • Hollow bearing trees • Living or dead trees with hollows greater than 20cm diameter 	High Sensitivity to Potential Gain	Yes	Included	Habitat components present
<i>Tyto tenebricosa</i> Sooty Owl (Breeding) ³	Vulnerable	Not Listed	<ul style="list-style-type: none"> • Caves • Caves or clifflines/ledges • Hollow bearing trees • Living or dead trees with hollows greater than 20cm diameter 	Very High Sensitivity to Potential Gain	Yes	Included	Habitat components present

1. Species is associated only with PCT 1588, so it is not expected to be directly impacted by ponding-associated with the Project.

4.3.1 Exclusions based on habitat

The following species were excluded from assessment due to an absence of habitat components within the Project Area:

- *Anthochaera phrygia* (Regent Honeyeater; Breeding Habitat) - Not mapped in Regent Honeyeater 'Important Habitat Mapping';
- *Diuris praecox* (Rough Doubletail) - Project Area is outside parish boundaries of Newcastle, Kahibah, Wallarah, Tuggerah and Kincumber; and
- *Lathamus discolor* (Swift Parrot; Breeding Habitat) - Not mapped in Swift Parrot 'Important Habitat Mapping'.

4.3.2 Candidate species requiring confirmation of presence or absence

Species listed in **Table 4-3** are considered to have habitats present within the Project Area, which may be impacted by ponding associated with the Project. Specifically, this includes Zones 2, 3 and 4, where ponding is predicted. Results from surveys are summarised in **Table 4-3**. Rules for Species Polygon construction and references to relevant figures of Species Polygons are also provided in **Table 4-3**. Further details of the survey methodologies, locations and results for these surveys are provided in the BIR (**Appendix A**).

Table 4-3 Summary of species credit species surveyed within the Project Area

Species credit species	Biodiversity risk weighting	Survey Timing	Assumed to occur/ survey/ expert report	Habitat constraints measured	Unit	Detected in Project Area?	Detected in Predicted Impact Area?	Species polygon	Figure
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo (Breeding)	2	October to January	Assumed to occur	Suitable nesting habitat recorded: All hollow-bearing trees with >20 cm diameter entry recorded within 100 m of creeks (i.e. where ponding-related impacts are predicted).	Area	No	No	Species Polygon: 100 m buffer off all hollow-bearing trees with ≥10 cm diameter entry on or within 100m of the Project Area in associated PCTs. Associated PCTs to define polygon: 1556; 1568 and 1573. Total Area: 21.72 ha	4-1
<i>Calyptorhynchus lathamii</i> Glossy Black-Cockatoo (Breeding)	2	April to August	Survey	Suitable nesting habitat recorded: All hollow-bearing trees with >20 cm diameter entry recorded within 100 m of creeks (i.e. where ponding-related impacts are predicted).	Area	Yes – foraging only but not breeding	No	None: Species not recorded during targeted surveys.	None
<i>Cercartetus nanus</i> Eastern Pygmy-possum	2	October to March	Assumed to occur	-	Area	No	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1556; 1568 and 1573. Total Area: 34.78 ha	4-2
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	3	November to January	Assumed to occur	Suitable roosting habitat recorded: All caves within 100 m of creeks (i.e. where ponding-related impacts are predicted).	Area	No ²	No	Species Polygon: 50 m radius buffer off marked-up caves in associated PCTs on or within 100 m of the Project Area in associated PCTs. Associated PCTs to define polygon: 1556; 1568 and 1573. Total Area: 7.96 ha	4-3

REPORT

Species credit species	Biodiversity risk weighting	Survey Timing	Assumed to occur/ survey/ expert report	Habitat constraints measured	Unit	Detected in Project Area?	Detected in Predicted Impact Area?	Species polygon	Figure
<i>Corybas dowlingii</i> Red Helmet Orchid	2	June to July	Survey	-	Area	No	No	None: Species not recorded during targeted surveys.	None
<i>Cryptostylis hunteriana</i> Leafless Tongue Orchid	1.5	November to January	Assumed to occur	-	Area	No	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1556 and 1568. Total Area: 32.30 ha	4-4
<i>Cynanchum elegans</i> White-flowered Wax Plant	2	All months	Surveyed	-	Area	No	No	None: Species not recorded during targeted surveys.	None
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle (Breeding)	2	July to December	Assumed to occur	-	Area	No ²	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1556; 1568 and 1588. Total Area: 47.74 ha	4-5
<i>Hoplocephalus bitorquatus</i> Pale-headed Snake	2	November to March	Assumed to occur	-	Area	No	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1556; 1568 and 1573. Total Area: 34.82 ha	4-2
<i>Hoplocephalus stephensii</i> Stephens' Banded Snake	2	October to March	Assumed to occur	-	Area	No	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1528; 1556; 1568 and 1573. Total Area: 34.82 ha	4-6
<i>Litoria aurea</i> Green and Gold Bell Frog ¹	2	November to March	Assumed to occur	-	Area	No	No	Species Polygon: All of associated PCTs.	4-7

REPORT

Species credit species	Biodiversity risk weighting	Survey Timing	Assumed to occur/ survey/ expert report	Habitat constraints measured	Unit	Detected in Project Area?	Detected in Predicted Impact Area?	Species polygon	Figure
								Associated PCTs to define polygon: 1588. Total Area: 15.44 ha	
<i>Litoria brevipalmata</i> Green-thighed Frog	1.5	October to March	Assumed to occur	-	Area	No	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1528; 1556; 1568 and 1588. Total Area: 47.78 ha	4-8
<i>Litoria littlejohni</i> Littlejohn's Tree Frog	2	July to November	Assumed to occur	-	Area	No	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1568. Total Area: 7.20 ha	4-9
<i>Lophoictinia isura</i> Square-tailed Kite (Breeding)	1.5	September to January	Assumed to occur	-	Area	No	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1556 and 1568. Total Area: 32.30 ha	4-4
<i>Macropus parma</i> Parma Wallaby	2	All months	Surveyed	-	Area	No	No	None: Species not recorded during targeted surveys.	None
<i>Melaleuca biconvexa</i> Biconvex Paperbark	2	All months	Surveyed	-	Area	No	No	None: Species not recorded during targeted surveys.	None
<i>Melaleuca groveana</i> Grove's Paperbark	2	All months	Surveyed	-	Area	No	No	None: Species not recorded during targeted surveys.	None
<i>Miniopterus australis</i> Little Bent-winged Bat	3	December to February	Assumed to occur	Suitable roosting habitat recorded: All caves within 100 m of creeks (i.e. where ponding-related impacts are predicted).	Area	No ²	No	Species Polygon: 100 m radius buffer off marked-up caves in associated PCTs on or within 100 m of the	4-10

REPORT

Species credit species	Biodiversity risk weighting	Survey Timing	Assumed to occur/ survey/ expert report	Habitat constraints measured	Unit	Detected in Project Area?	Detected in Predicted Impact Area?	Species polygon	Figure
(Breeding)								Project Area in associated PCTs. Associated PCTs to define polygon: 1556; 1568 and 1573. Total Area: 17.62 ha	
<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat (Breeding)	3	December to February	Assumed to occur	Suitable roosting habitat recorded: All caves within 100 m of creeks (i.e. where ponding-related impacts are predicted).	Area	No	No	Species Polygon: 100 m radius buffer off marked-up caves in associated PCTs on or within 100 m of the Project Area in associated PCTs. Associated PCTs to define polygon: 1556; 1568 and 1573. Total Area: 17.62 ha	4-10
<i>Mixophyes balbus</i> Stuttering Frog	3	September to March	Assumed to occur	-	Area	No	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1528; 1556; 1568 and 1573. Total Area: 34.82 ha	4-6
<i>Mixophyes iteratus</i> Giant Barred Frog	2	October to March	Assumed to occur	-	Area	No	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1528; 1556; 1568 and 1573. Total Area: 34.82 ha	4-6
<i>Myotis macropus</i> Southern Myotis	2	October to March	Assumed to occur	Suitable roosting habitat recorded: All caves and hollow-bearing trees within 200 m of creeks (i.e. where ponding-related impacts are predicted).	Area	No ²	No	Species Polygon: 200 m radius buffer off pools/stretches 3 m or wider on or within 200 m of Project Area in associated PCTs.	4-11

REPORT

Species credit species	Biodiversity risk weighting	Survey Timing	Assumed to occur/ survey/ expert report	Habitat constraints measured	Unit	Detected in Project Area?	Detected in Predicted Impact Area?	Species polygon	Figure
								Associated PCTs to define polygon: 1556; 1568 and 1573. Total Area: 37.05 ha	
<i>Ninox connivens</i> Barking Owl (Breeding)	2	May to December	Assumed to occur	Suitable nesting habitat recorded: All hollow-bearing trees with >20 cm diameter entry recorded within 100 m of creeks (i.e. where ponding-related impacts are predicted).	Area	No	No	Species Polygon: 100 m buffer off all hollow-bearing trees with ≥20 cm diameter entry on or within 100 m of the Project Area in associated PCTs. Associated PCTs to define polygon: 1528; 1556; 1568; 1573 and 1588. Total Area: 19.10 ha	4-12
<i>Ninox strenua</i> Powerful Owl (Breeding)	2	May to August	Assumed to occur	Suitable nesting habitat recorded: All hollow-bearing trees with >20 cm diameter entry recorded within 100 m of creeks (i.e. where ponding-related impacts are predicted).	Area	No	No	Species Polygon: 100 m buffer off all hollow-bearing trees with ≥20 cm diameter entry on or within 100 m of the Project Area in associated PCTs. Associated PCTs to define polygon: 1556; 1568 and 1573. Total Area: 18.30 ha	4-13
<i>Petauroides volans</i> Greater Glider	2	All months	Surveyed	-	Area	No ²	No	None: Species not recorded during targeted surveys.	None
<i>Petaurus norfolcensis</i> Squirrel Glider	2	All months	Assumed to occur	-	Area	No ²	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1556 and 1568. Total Area: 32.30 ha	4-4

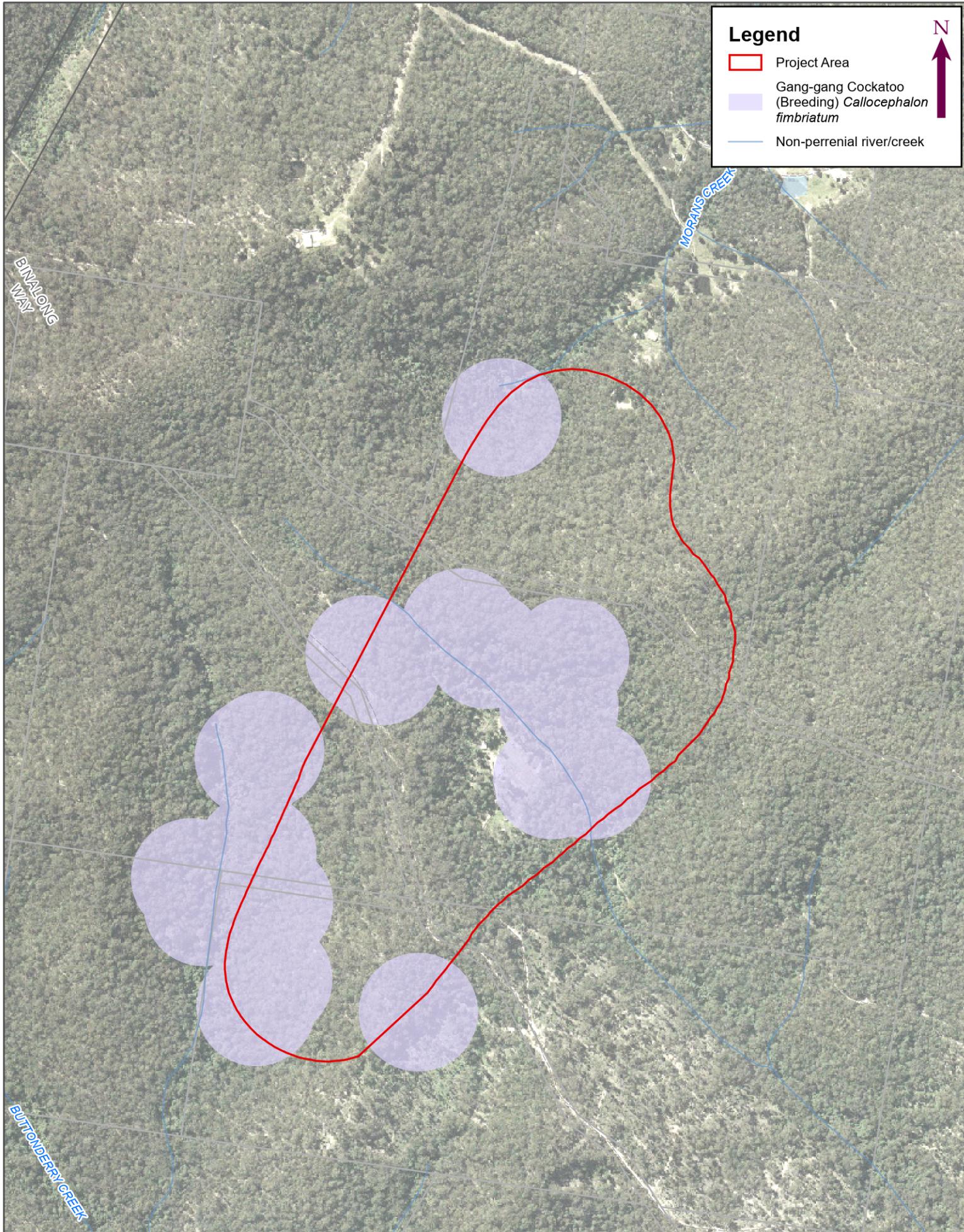
REPORT

Species credit species	Biodiversity risk weighting	Survey Timing	Assumed to occur/ survey/ expert report	Habitat constraints measured	Unit	Detected in Project Area?	Detected in Predicted Impact Area?	Species polygon	Figure
<i>Petrogale penicillata</i> Brush-tailed Rock-wallaby	3	All months	Surveyed	-	Area	No	No	None: Species not recorded during targeted surveys.	None
<i>Phascogale tapoatafa</i> Brush-tailed Phascogale	2	December to June	Assumed to occur	-	Area	No	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1556 and 1568. Total Area: 32.30 ha	4-4
<i>Phascolarctos cinereus</i> Koala	2	All months	Assumed to occur	-	Area	No	No	None: Species not recorded during targeted surveys.	None
<i>Planigale maculata</i> Common Planigale	2	All months	Surveyed	-	Area	No	No	None: Species not recorded during targeted surveys.	None
<i>Potorous tridactylus</i> Long-nosed Potoroo	2	All months	Surveyed	-	Area	No	No	None: Species not recorded during targeted surveys.	None
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox (Breeding)	2	October to December	Surveyed	-	Area	No ²	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1556; 1568 and 1573. Total Area: 34.78 ha	4-2
<i>Rhizanthella slateri</i> Eastern Australian Underground Orchid	3	September to November	Assumed to occur	-	Area	No	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1556; 1568 and 1573. Total Area: 34.78 ha	4-2

REPORT

Species credit species	Biodiversity risk weighting	Survey Timing	Assumed to occur/ survey/ expert report	Habitat constraints measured	Unit	Detected in Project Area?	Detected in Predicted Impact Area?	Species polygon	Figure
<i>Rhodamnia rubescens</i> Scrub Turpentine	3	All months	Surveyed	-	Count	Yes	Yes	Species Polygon: 30 m buffer off recorded individuals. Total Area: 1.46 ha	4-14
<i>Rhodomyrtus psidioides</i> Native Guava	3	All months	Surveyed	-	Area	No	No	None: Species not recorded during targeted surveys.	None
<i>Tetradlea juncea</i> Black-eyed Susan	2	September to November	Assumed to occur	-	Area	No	No	Species Polygon: All of associated PCTs. Associated PCTs to define polygon: 1568. Total Area: 7.20 ha	4-9
<i>Turnix maculosus</i> Red-backed Button-quail	2	All months	Surveyed	-	Area	No	No	None: Species not recorded during targeted surveys.	None
<i>Tyto novaehollandiae</i> Masked Owl (Breeding)	2	May to August	Assumed to occur	Suitable nesting habitat recorded: All hollow-bearing trees with >20 cm diameter entry recorded within 100 m of creeks (i.e. where ponding-related impacts are predicted).	Area	Yes – foraging only but not breeding	No	Species Polygon: 100 m buffer off all hollow-bearing trees with ≥20 cm diameter entry on or within 100 m of the Project Area in associated PCTs. Associated PCTs to define polygon: 1556; 1568 and 1573. Total Area: 18.30 ha	4-13
<i>Tyto tenebricosa</i> Sooty Owl (Breeding)	2	April to August	Assumed to occur	Suitable nesting habitat recorded: All caves and hollow-bearing trees within 100m of creeks (i.e. where ponding-related impacts are predicted).	Area	No ²	No	Species Polygon: 100 m buffer off all hollow-bearing trees with ≥20 cm diameter entry and caves. Associated PCTs to define polygon: 1573. Total Area: 13.52 ha	4-15

1. This species is not part of final Candidate species list as associated with PCT 1588 (Zone 5), which is not subject to ponding impacts. 2. Located nearby Project Area – foraging detected only.



Legend

- Project Area
- Gang-gang Cockatoo (Breeding) *Callocephalon fimbriatum*
- Non-perennial river/creek

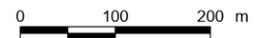


FIGURE 4-1
THREATENED SPECIES - CALLOCEPHALON FIMBRIATUM
GANG-GANG COCKATOO (BREEDING)

VERSION: **A**
 DATE EXPORTED: **3/08/2021 8:25 AM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE: 1:8,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial

PROJECT: 149823

PURPOSE: BDAR

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic coverage plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose without the prior written consent of the client. The plan is provided without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be held liable (negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out of date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.
 3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. RPS Australia East Pty Ltd with any local authority regarding the recommendations of RPS Australia East Pty Ltd;
 6. the accuracy, reliability, usability or completeness of any recommendations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.



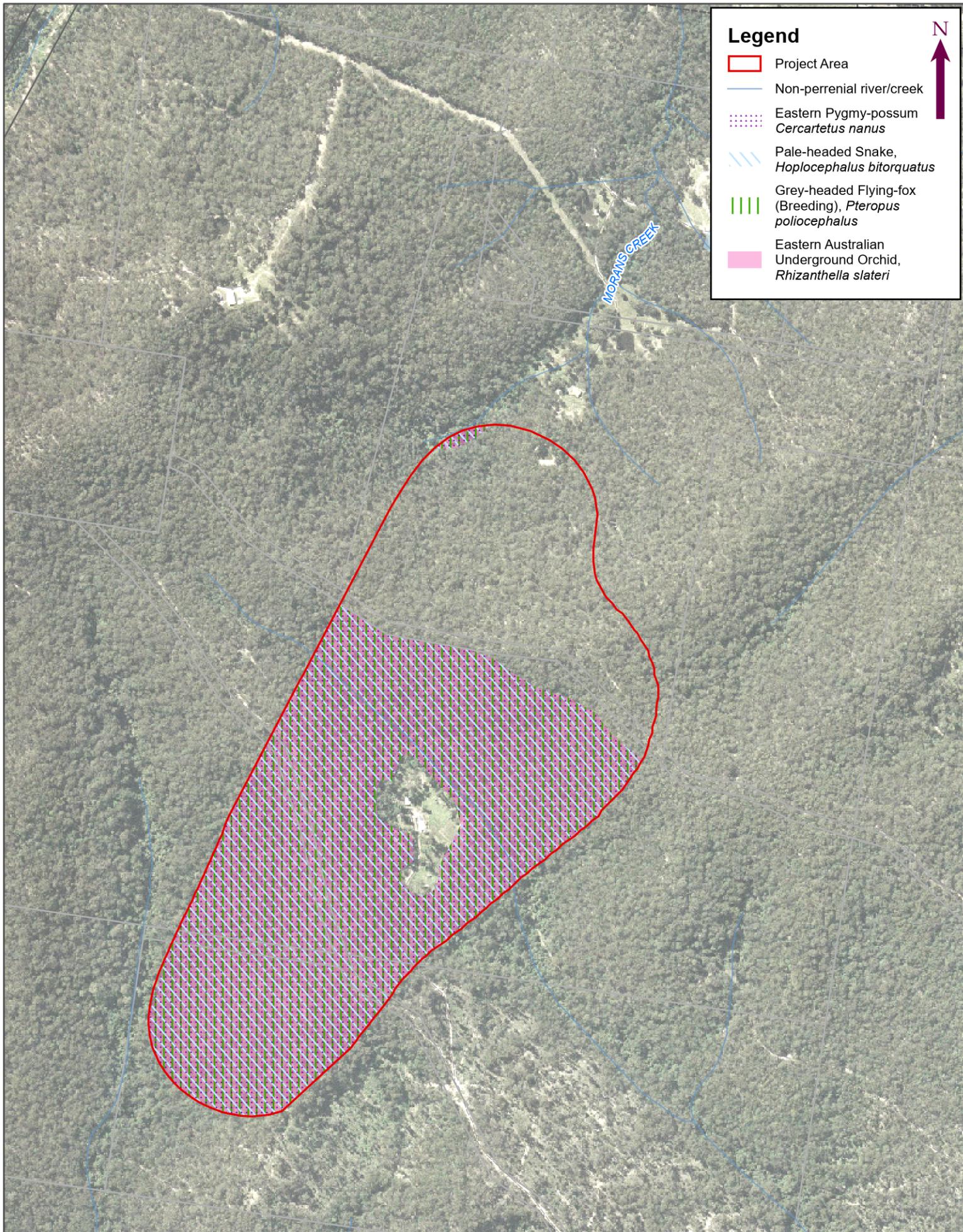
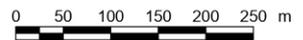


FIGURE 4-2
 THREATENED SPECIES - CERCARTETUS NANUS
 EASTERN PYGMY-POSSUM, HOPLOCEPHALUS BITORQUATUS
 PALE-HEADED SNAKE, PTEROPUS POLIOCEPHALUS
 GREY-HEADED FLYING-FOX (BREEDING) AND RHIZANTHELLA SLATERI
 EASTERN AUSTRALIAN UNDERGROUND ORCHID

VERSION: **A**
 DATE EXPORTED: **3/08/2021 9:53 AM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE 1:8,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

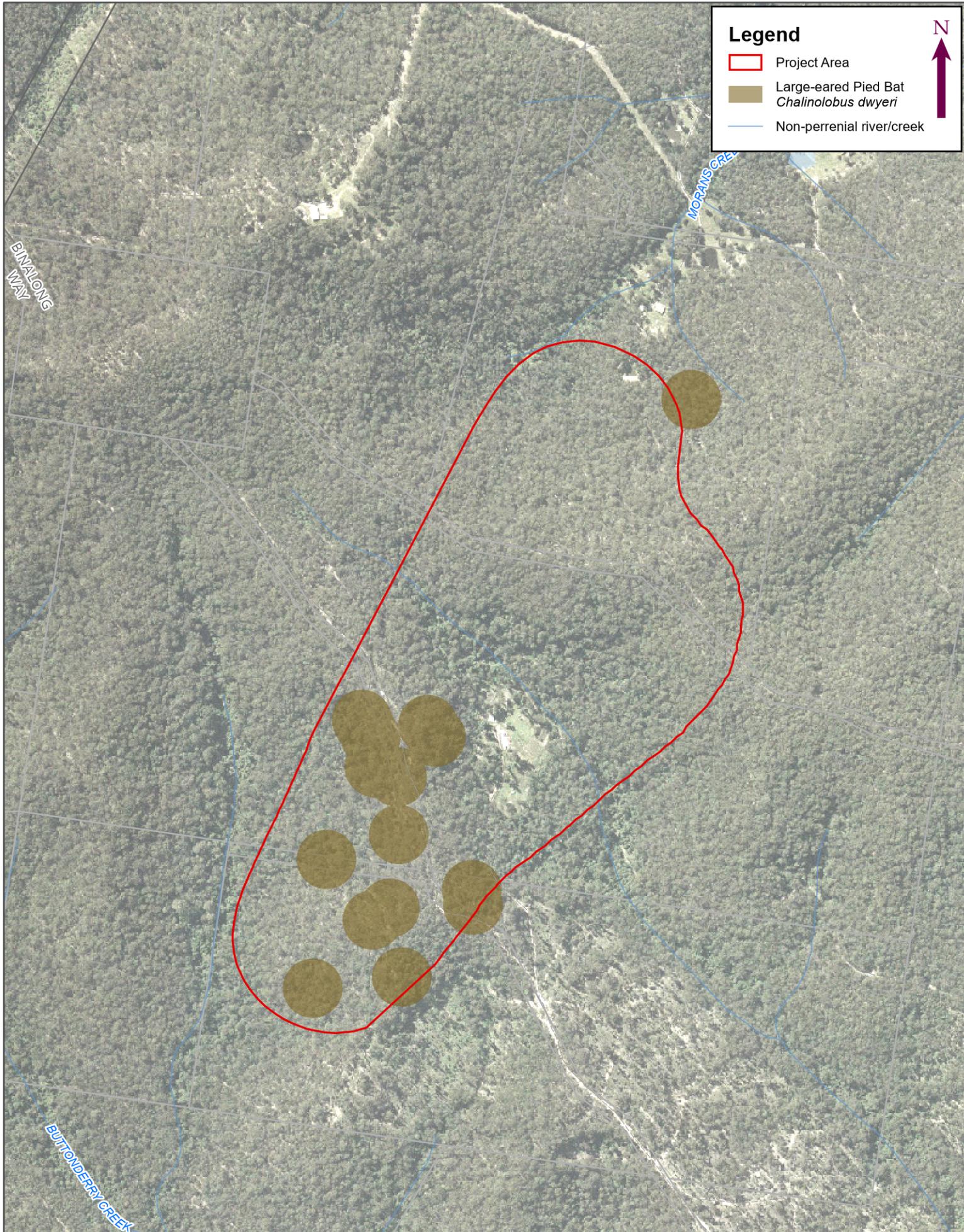
CLIENT: **Centennial**

PROJECT: **149823**

PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overlay plan. This plan is solely limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose without the prior written consent of the client. The plan is provided without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.
 3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. RPS Australia East Pty Ltd with any local authority regarding the recommendations of RPS Australia East Pty Ltd;
 6. the accuracy, reliability, validity or completeness of any applications or estimates made or referred to by RPS Australia East Pty Ltd in this plan.





Legend

- Project Area
- Large-eared Pied Bat *Chalinolobus dwyeri*
- Non-perennial river/creek



FIGURE 4-3
THREATENED SPECIES - CHALINOLOBUS DWYERI
LARGE-EARED PIED BAT

VERSION: **A**
 DATE EXPORTED: **3/08/2021 10:02 AM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.

SCALE 1:8,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: **Centennial**

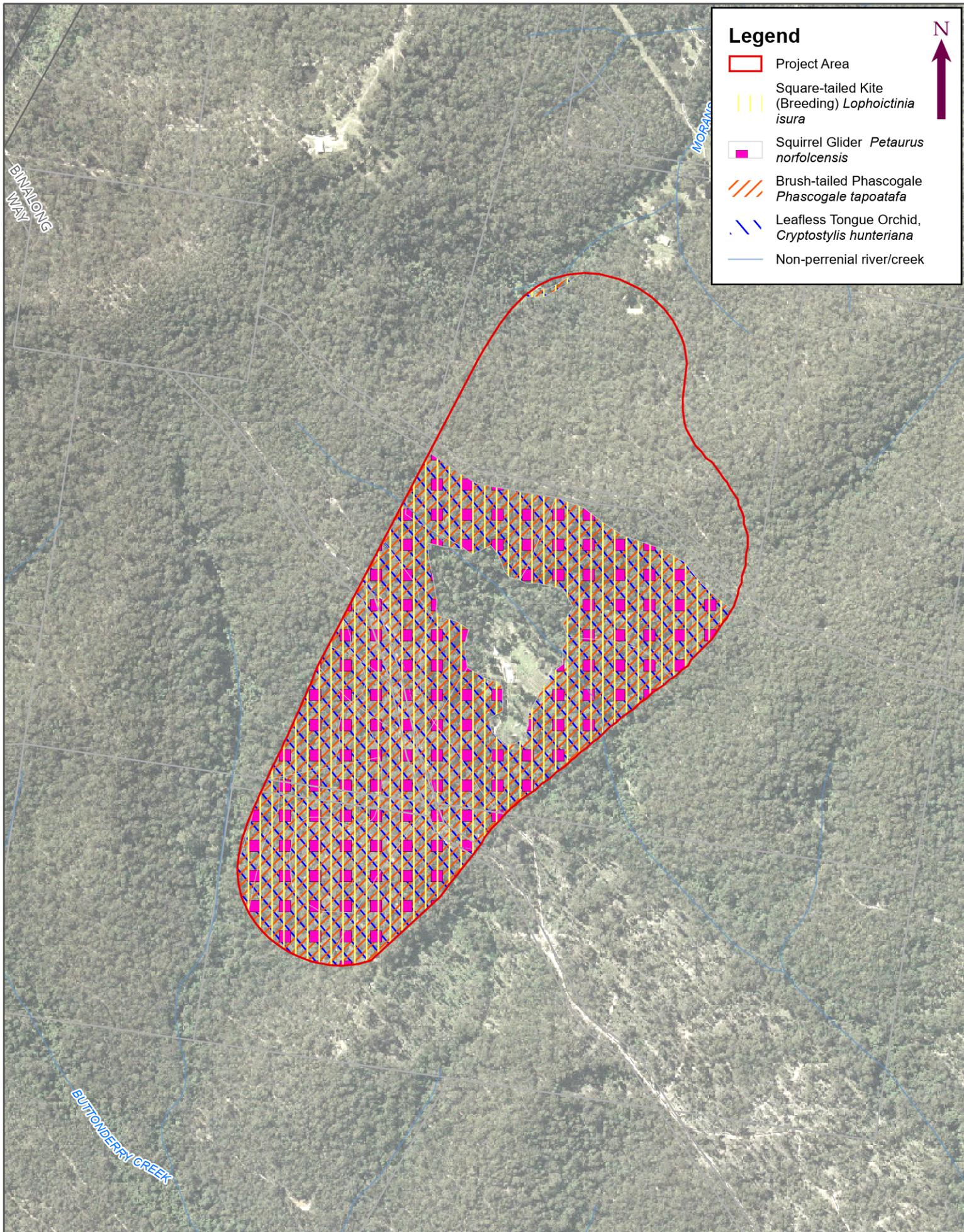
PROJECT: **149823**

PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overview plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose, in particular, but not limited to, the plan is provided without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be liable (in negligence or otherwise) for any direct or indirect loss, damages, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on this plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.

d. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 e. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 f. engagement of this plan with any local authority regarding the recommendations of RPS Australia East Pty Ltd;
 g. the accuracy, reliability, validity or completeness of any observations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.





Legend

- Project Area
- Square-tailed Kite (Breeding) *Lophoictinia isura*
- Squirrel Glider *Petaurus norfolcensis*
- Brush-tailed Phascogale *Phascogale tapoatafa*
- Leafless Tongue Orchid, *Cryptostylis hunteriana*
- Non-perennial river/creek

FIGURE 4-4
 THREATENED SPECIES - CRYPTOSTYLIS HUNTERIANA
 LEAFLESS TONGUE ORCHID, LOPHOICTINIA ISURA
 SQUARE-TAILED KITE (BREEDING), PETAURUS NORFOLCENSIS
 SQUIRREL GLIDER AND PHASCOGALE TAPOATAFA
 BRUSH-TAILED PHASCOGALE

VERSION: **A**
 DATE EXPORTED: **3/08/2021 10:30 AM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE 1:8,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

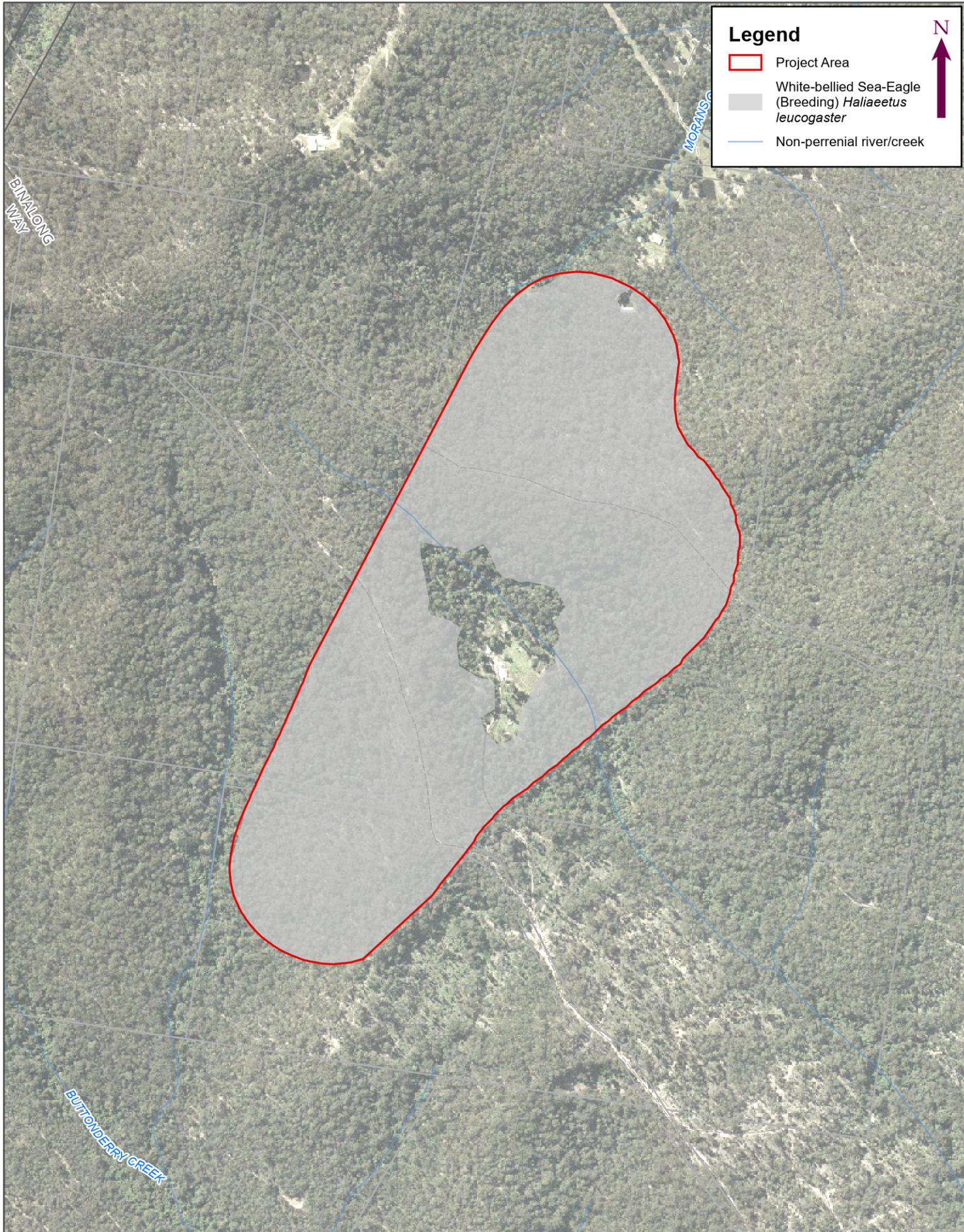
CLIENT: Centennial

PROJECT: 149823

PURPOSE: BDAR

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overview plan. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other purpose without the prior written consent of the client. The plan is provided without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be held liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.
 3. RPS Australia East Pty Ltd relaying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. engagement of Third Party with any local authority against the recommendation of RPS Australia East Pty Ltd;
 6. the accuracy, reliability, suitability or completeness of any recommendations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.

RPS



Legend

- Project Area
- White-bellied Sea-Eagle (Breeding) *Haliaeetus leucogaster*
- Non-perennial river/creek



**FIGURE 4-5
THREATENED SPECIES - HALIAEETUS
LEUCOGASTER
WHITE-BELLIED SEA-EAGLE (BREEDING)**

VERSION: **A**
 DATE EXPORTED: **3/08/2021 10:54 AM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE 1:8,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

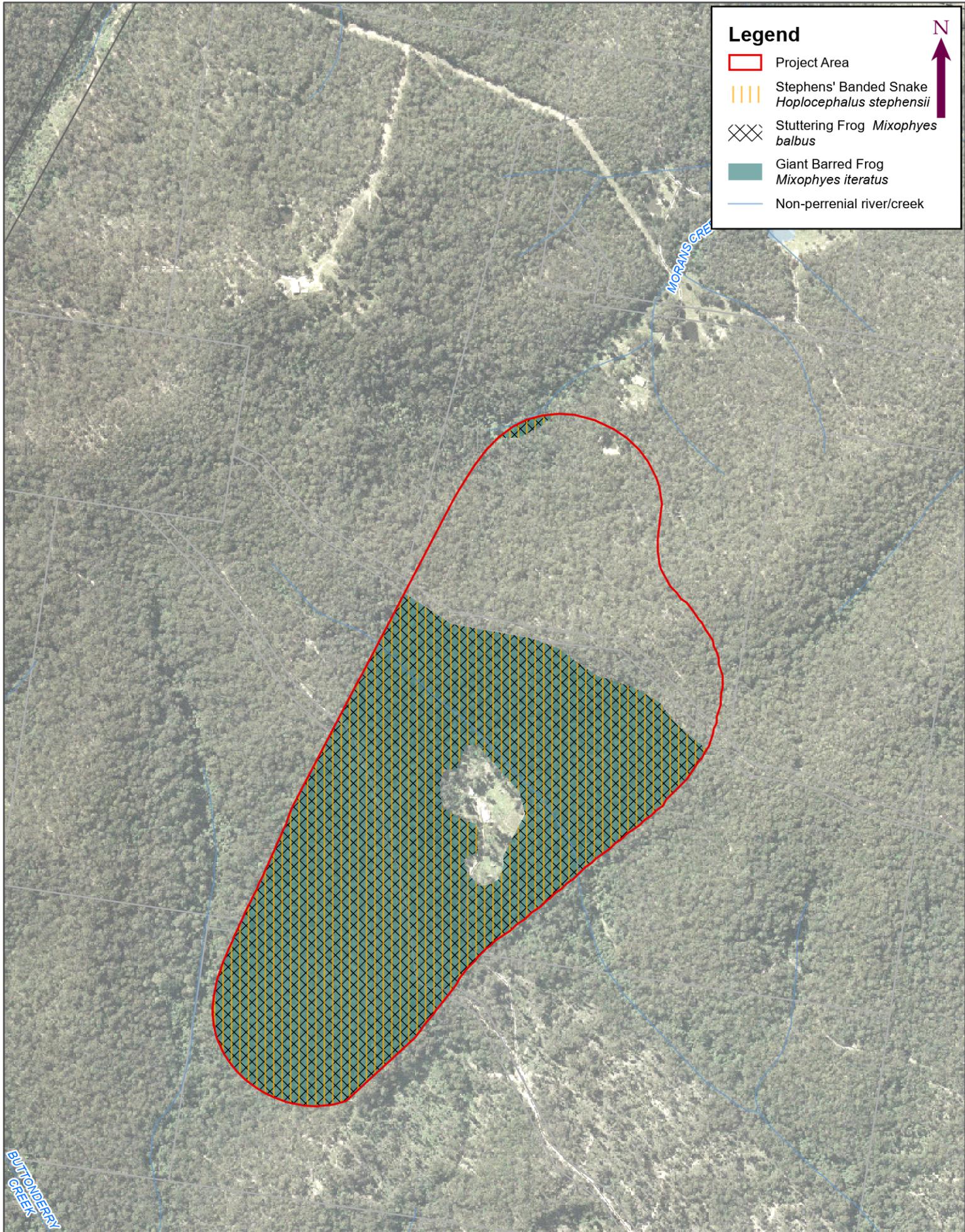
CLIENT: **Centennial**
 PROJECT: **149823**
 PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overview plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose, in particular, but not limited to, the planning, construction, or operation of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be held liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out of date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.

d. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 e. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 f. RPS Australia East Pty Ltd with any local authority regarding the recommendations of RPS Australia East Pty Ltd;
 g. the accuracy, reliability, validity or completeness of any representations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.





Legend

- Project Area
- Stephens' Banded Snake *Hoplocephalus stephensii*
- Stuttering Frog *Mixophyes balbus*
- Giant Barred Frog *Mixophyes iteratus*
- Non-perennial river/creek

FIGURE 4-6
 THREATENED SPECIES - HOPLOCEPHALUS STEPHENSII
 STEPHENS' BANDED SNAKE, MIXOPHYES BALBUS
 STUTTERING FROG AND MIXOPHYES ITERATUS
 GIANT BARRED FROG

VERSION: **A**
 DATE EXPORTED: **3/08/2021 11:14 AM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE 1:8,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

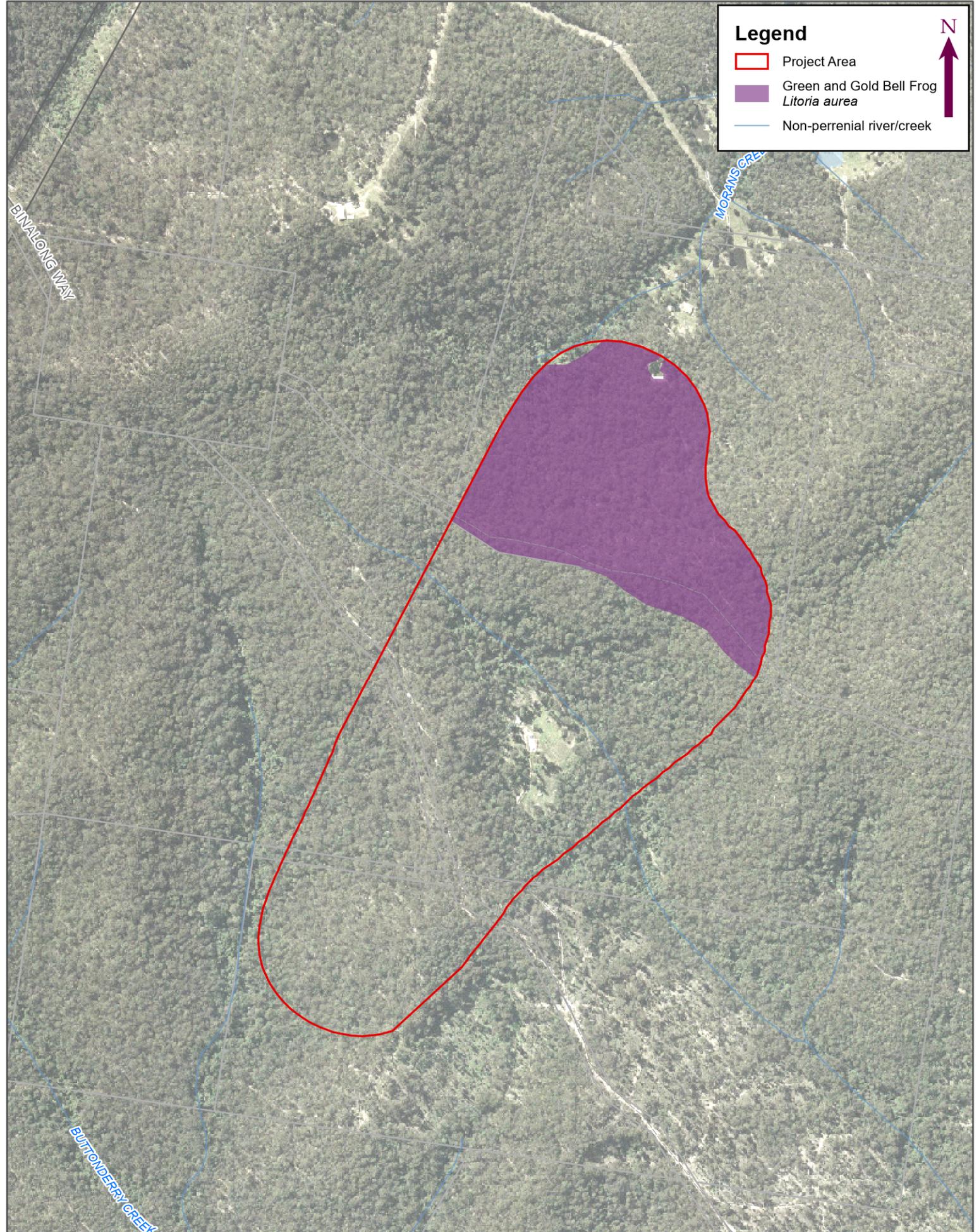
CLIENT: **Centennial**

PROJECT: **149823**

PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overview plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose or purposes, past or present. The plan is intended solely for the satisfaction of a duty of care to any other person (other than the Client) ("Third Party") and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.
 3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. RPS Australia East Pty Ltd with any local authority regarding the recommendations of RPS Australia East Pty Ltd;
 6. the accuracy, reliability, suitability or completeness of any representations or statements made or referred to by RPS Australia East Pty Ltd in this plan.





Legend

- Project Area
- Green and Gold Bell Frog
Litoria aurea
- Non-perennial river/creek

N
↑

FIGURE 4-7
THREATENED SPECIES - LITORIA AUREA
GREEN AND GOLD BELL FROG

VERSION: **A**
 DATE EXPORTED: **3/08/2021 11:41 AM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.

0 50 100 150 200 250 m

SCALE 1:8,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: **Centennial**
 PROJECT: **149823**
 PURPOSE: **BDAR**

IMPORTANT NOTE

1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overview plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose without the prior written consent of the client. The plan is provided without the responsibility or a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out of date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.

3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. RPS Australia East Pty Ltd, in any local authority regarding the recommendation of RPS Australia East Pty Ltd;
 6. the accuracy, reliability, suitability or completeness of any recommendations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.

RPS

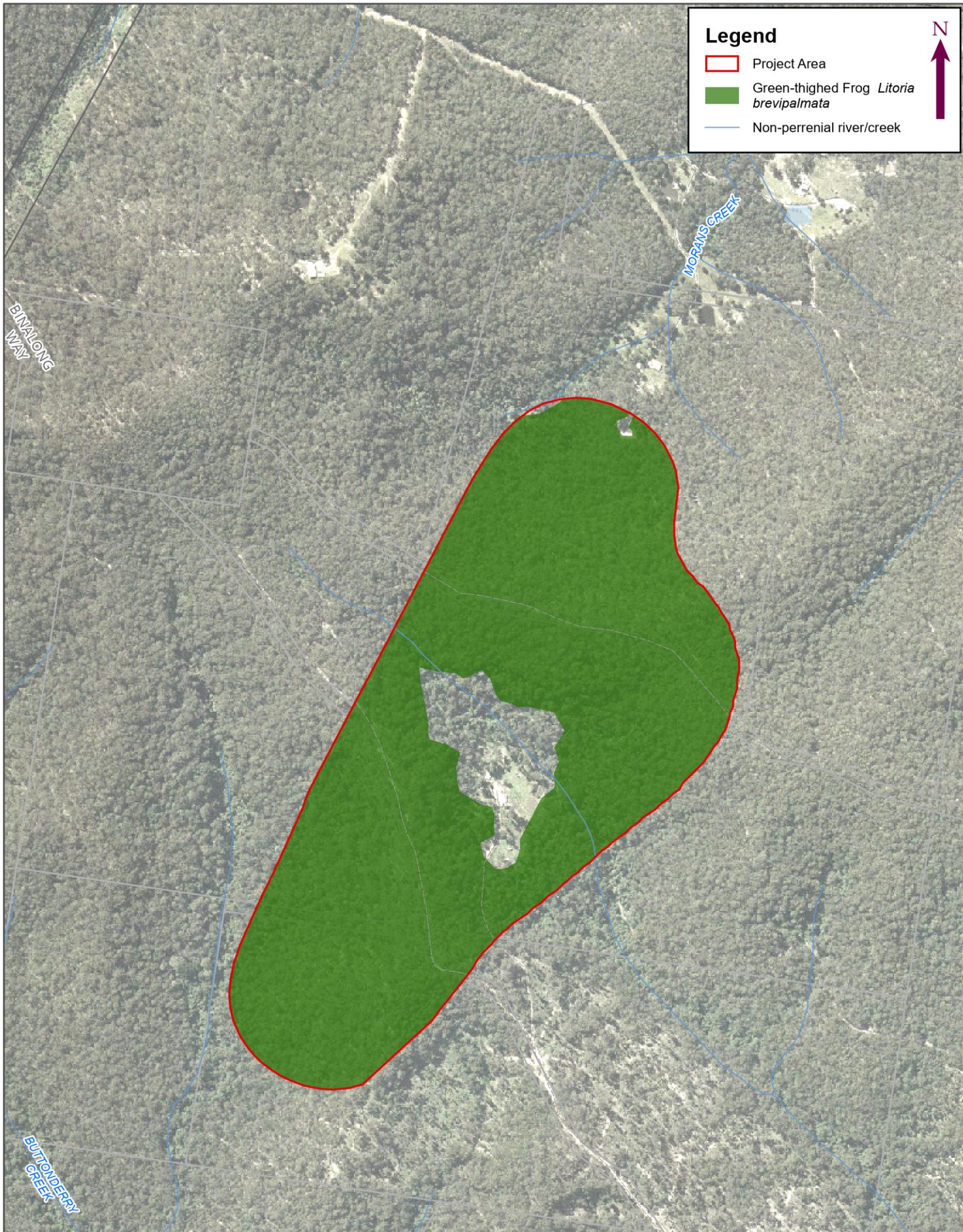


FIGURE 4-8
THREATENED SPECIES - LITORIA BREVIPALMATA
GREEN-THIGHED FROG

VERSION: **A**
 DATE EXPORTED: **3/08/2021 11:54 AM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE: **1:8,000 AT A4 SIZE**
 SPATIAL REFERENCE: **GDA 1994 MGA Zone 56**

CLIENT: **Centennial**
 PROJECT: **149823**
 PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overlay plan. This plan is solely limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose, in whole or in part. The plan is prepared without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.
 3. RPS Australia East Pty Ltd relaying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. Reliance of this plan by any local authority against the recommendations of RPS Australia East Pty Ltd;
 6. the accuracy, integrity, reliability or completeness of any representations or statements made or referred to by RPS Australia East Pty Ltd in this plan.



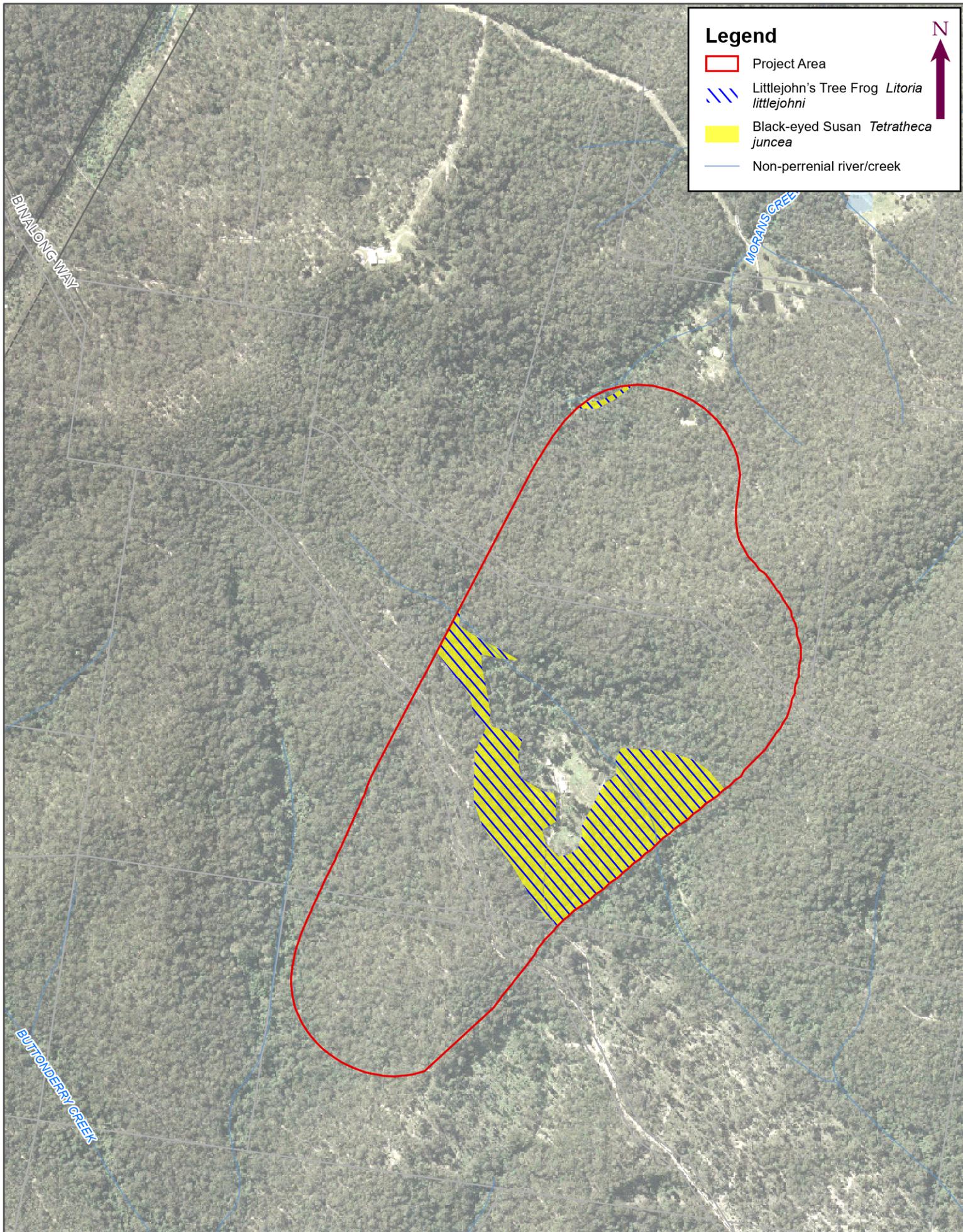


FIGURE 4-9
THREATENED SPECIES - LITORIA LITTLEJOHNI
LITTLEJOHN'S TREE FROG AND TETRATHECA JUNCEA
BLACK-EYED SUSAN

VERSION: **A**
 DATE EXPORTED: **3/08/2021 12:06 PM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.

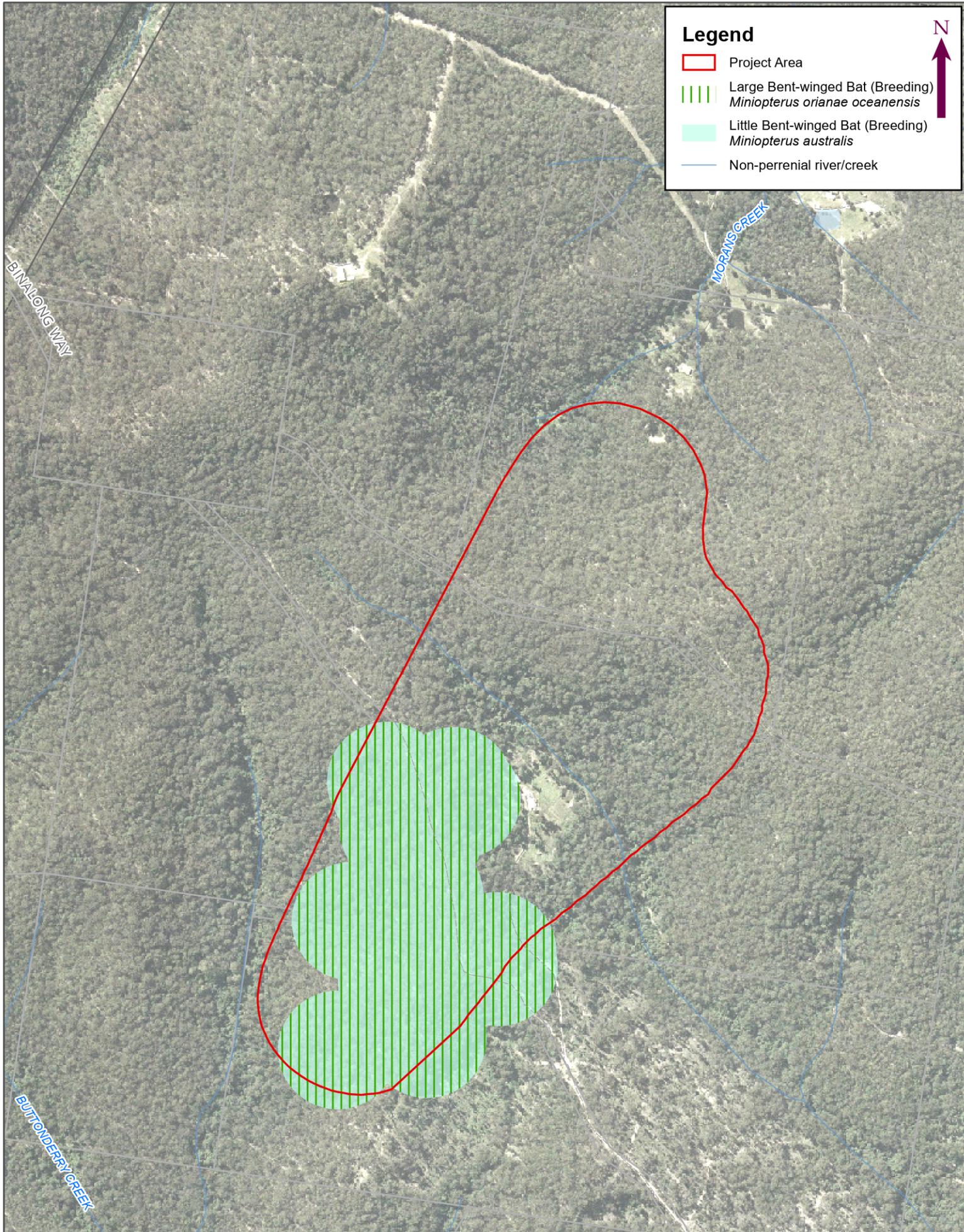


SCALE 1:8,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: **Centennial**
 PROJECT: **149823**
 PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overlay plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose without the express written consent of the client. The plan is prepared without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. Third Party publishing, using or relying on this plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or Third Party where the information is incorrect, incomplete, inaccurate, out of date or unreasonable;
 c. Third Party inaccuracies or other faults with information or data sourced from a Third Party.
 3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 4. The Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd.
 5. RPS Australia East Pty Ltd with any local authority regarding the recommendation of RPS Australia East Pty Ltd.
 6. The accuracy, reliability, suitability or completeness of any recommendations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.





Legend

- Project Area
- Large Bent-winged Bat (Breeding)
Miniopterus orianae oceanensis
- Little Bent-winged Bat (Breeding)
Miniopterus australis
- Non-perennial river/creek

FIGURE 4-10
THREATENED SPECIES - MINIOPTERUS AUSTRALIS
LITTLE BENT-WINGED BAT (BREEDING) AND
MINIOPTERUS ORIANAE OCEANENSIS
LARGE BENT-WINGED BAT (BREEDING)

VERSION: **A**
 DATE EXPORTED: **3/08/2021 12:20 PM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong
 DATA SOURCES
 Centennial, RPS.

0 50 100 150 200 250 m

SCALE 1:8,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
 PROJECT: 149823
 PURPOSE: BDAR

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overview plan. This plan is not intended to be used for any other purpose and does not apply directly or indirectly and will not be used for any other purpose, in whole or in part. The plan is provided subject to the disclaimer of liability of care to any other person (other than the Client) ("Third Party") and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be held liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or Third Party where the information is incorrect, incomplete, inaccurate, out of date or unreasonable;
 c. Any inaccuracies or other faults with information or data sourced from a Third Party.

3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 4. The Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. RPS Australia East Pty Ltd, in conjunction with any local authority regarding the recommendations of RPS Australia East Pty Ltd;
 6. The accuracy, reliability, validity or completeness of any representations or statements made or referred to by RPS Australia East Pty Ltd in this plan.



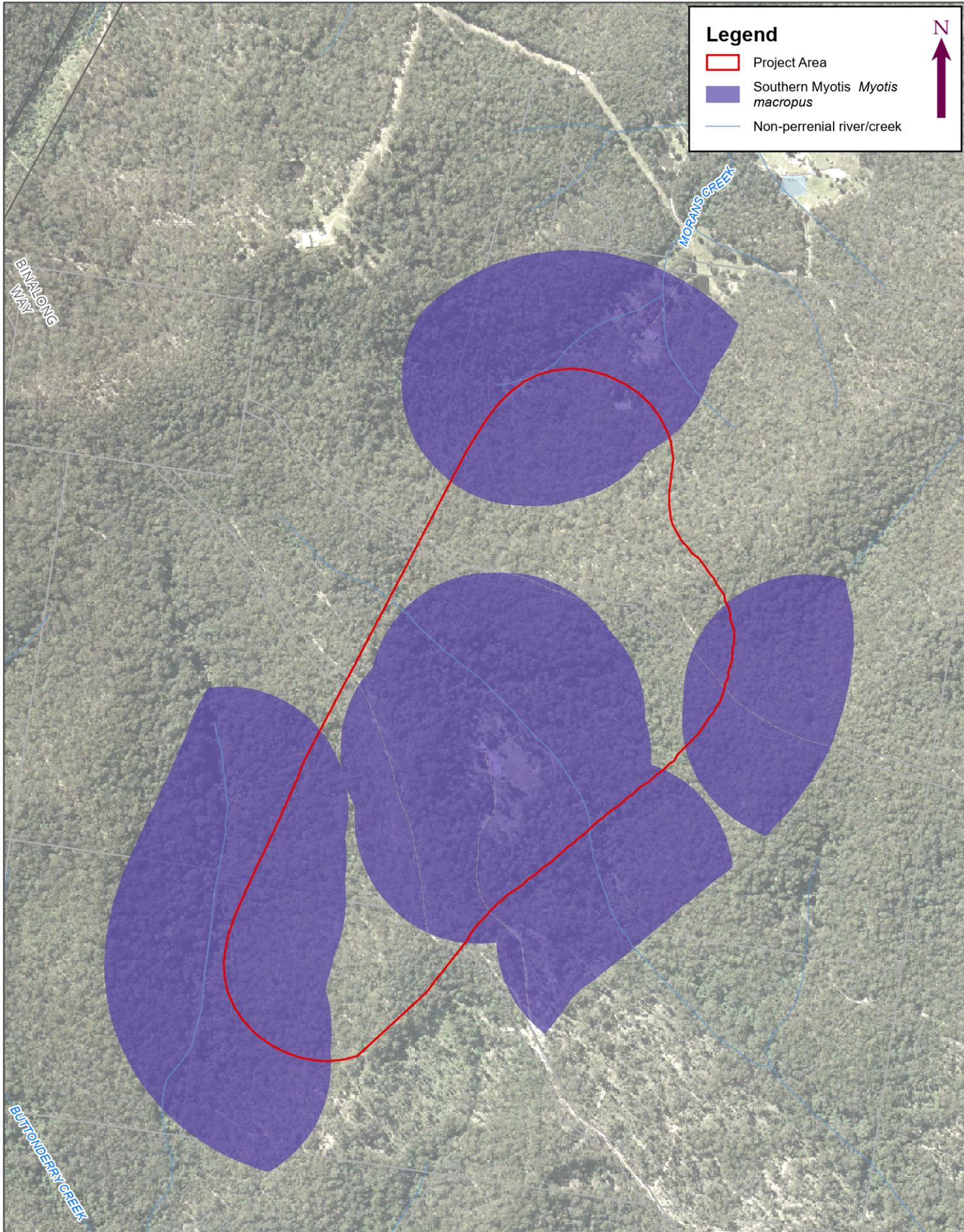


FIGURE 4-11
THREATENED SPECIES - MYOTIS MACROPUS
SOUTHERN MYOTIS

VERSION: **A**
 DATE EXPORTED: **3/08/2021 1:15 PM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE: **1:8,000 AT A4 SIZE**
 SPATIAL REFERENCE: **GDA 1994 MGA Zone 56**

CLIENT: **Centennial**

PROJECT: **149823**

PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic coverage plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose, including, but not limited to, the plan is presented without the assumption of a duty of care to any other person (other than the Client) ("Third Party") and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be held liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.
 3. RPS Australia East Pty Ltd relaying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd.
 5. RPS Australia East Pty Ltd, in any local authority regarding the recommendation of RPS Australia East Pty Ltd.
 6. the accuracy, reliability, validity or completeness of any representations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.



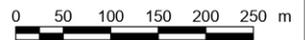


FIGURE 4-12
THREATENED SPECIES - NINOX CONNIVENS
BARKING OWL (BREEDING)

VERSION: **A**
 DATE EXPORTED: **3/08/2021 1:22 PM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE 1:8,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: **Centennial**

PROJECT: **149823**

PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overview plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose without the prior written consent of the Client. The plan is provided without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be held liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. This Third Party publishing using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
 c. Any inaccuracies or other faults with information or data sourced from a Third Party.
 3. RPS Australia East Pty Ltd relaying on surface indicators that are incorrect or inaccurate;
 4. The Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. Reliance of this plan with any local authority regarding the recommendations of RPS Australia East Pty Ltd;
 6. The accuracy, reliability, validity or completeness of any representations or statements made or referred to by RPS Australia East Pty Ltd in this plan.



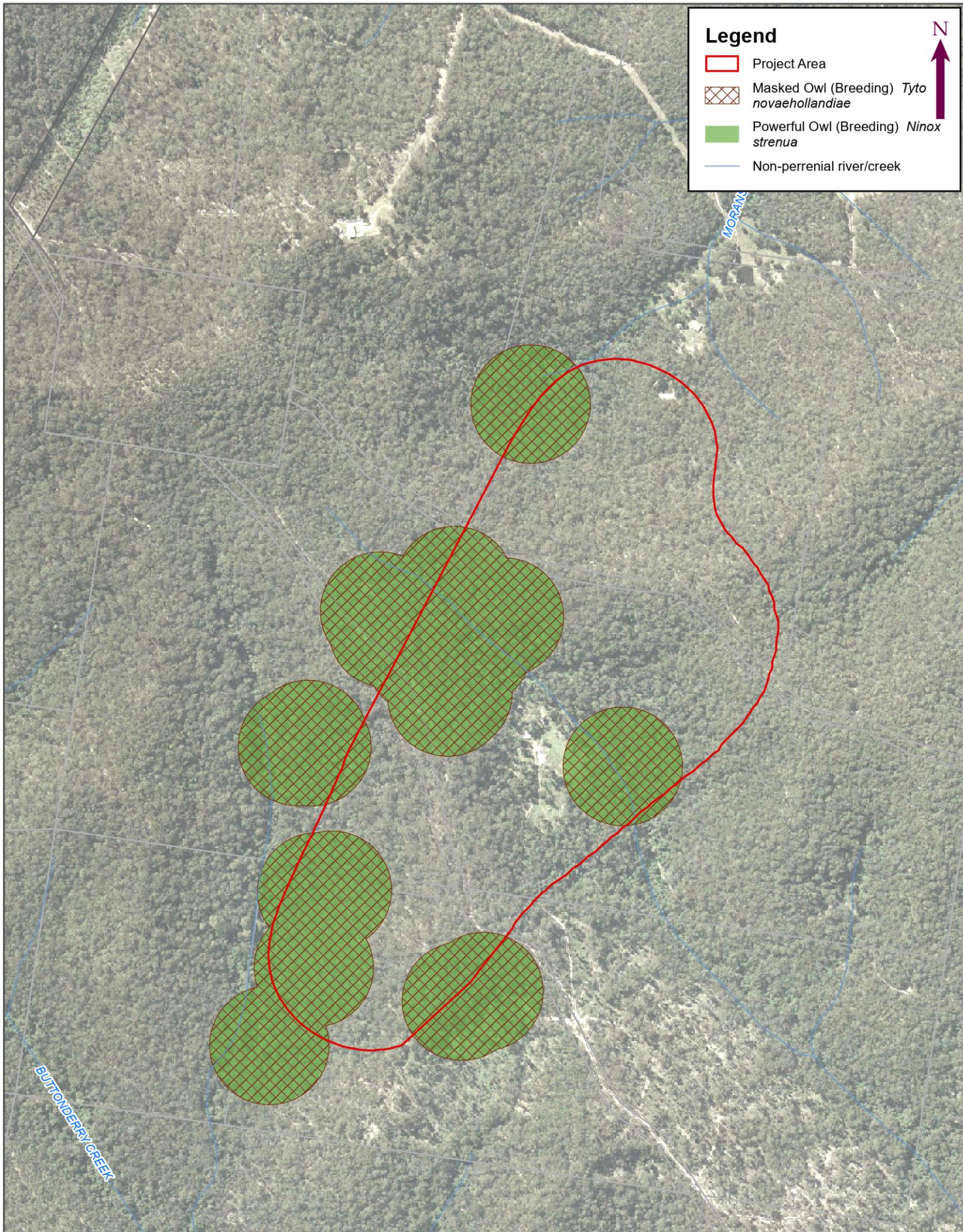


FIGURE 4-13
THREATENED SPECIES - NINOX STRENUA
POWERFUL OWL (BREEDING) AND TYTO
NOVAEHOLLANDIAE
MASKED OWL (BREEDING)

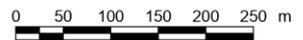
VERSION: **A**

DATE EXPORTED: **3/08/2021 1:30 PM**

TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE **1:8,000** AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: **Centennial**

PROJECT: **149823**

PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overlay plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose or project, past or future. The plan is provided subject to the acceptance of a duty of care to any other person (other than the Client) ("Third Party") and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be liable (or negligent or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out of date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.
 3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. RPS Australia East Pty Ltd with any local authority regarding the recommendations of RPS Australia East Pty Ltd;
 6. the accuracy, reliability, validity or completeness of any representations or statements made or referred to by RPS Australia East Pty Ltd in this plan.



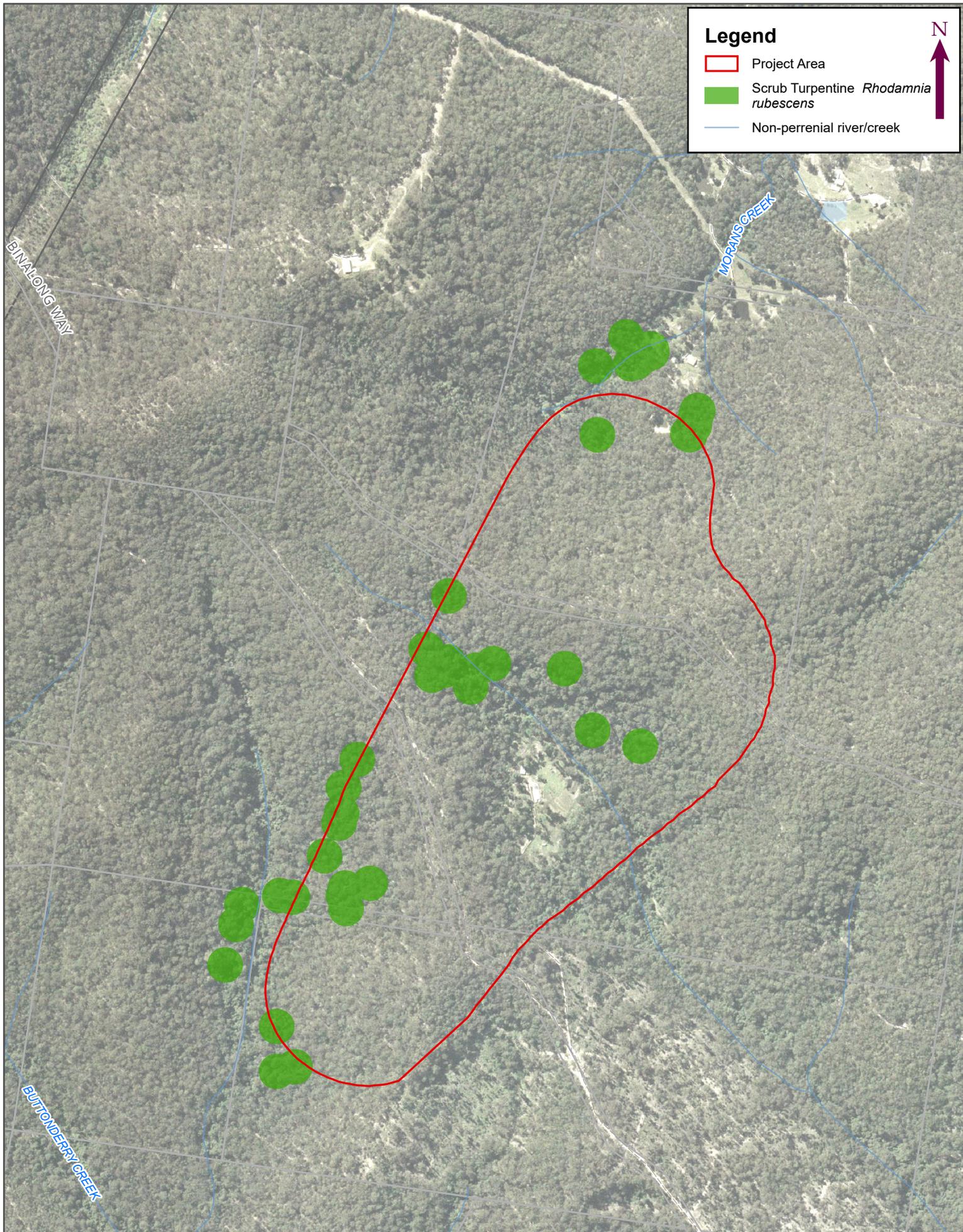
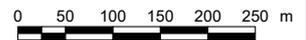


FIGURE 4-14
THREATENED SPECIES - RHODAMNIA
RUBESCENS
SCRUB TURPENTINE

VERSION: **B**
 DATE EXPORTED: **24/08/2021 8:44 AM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.

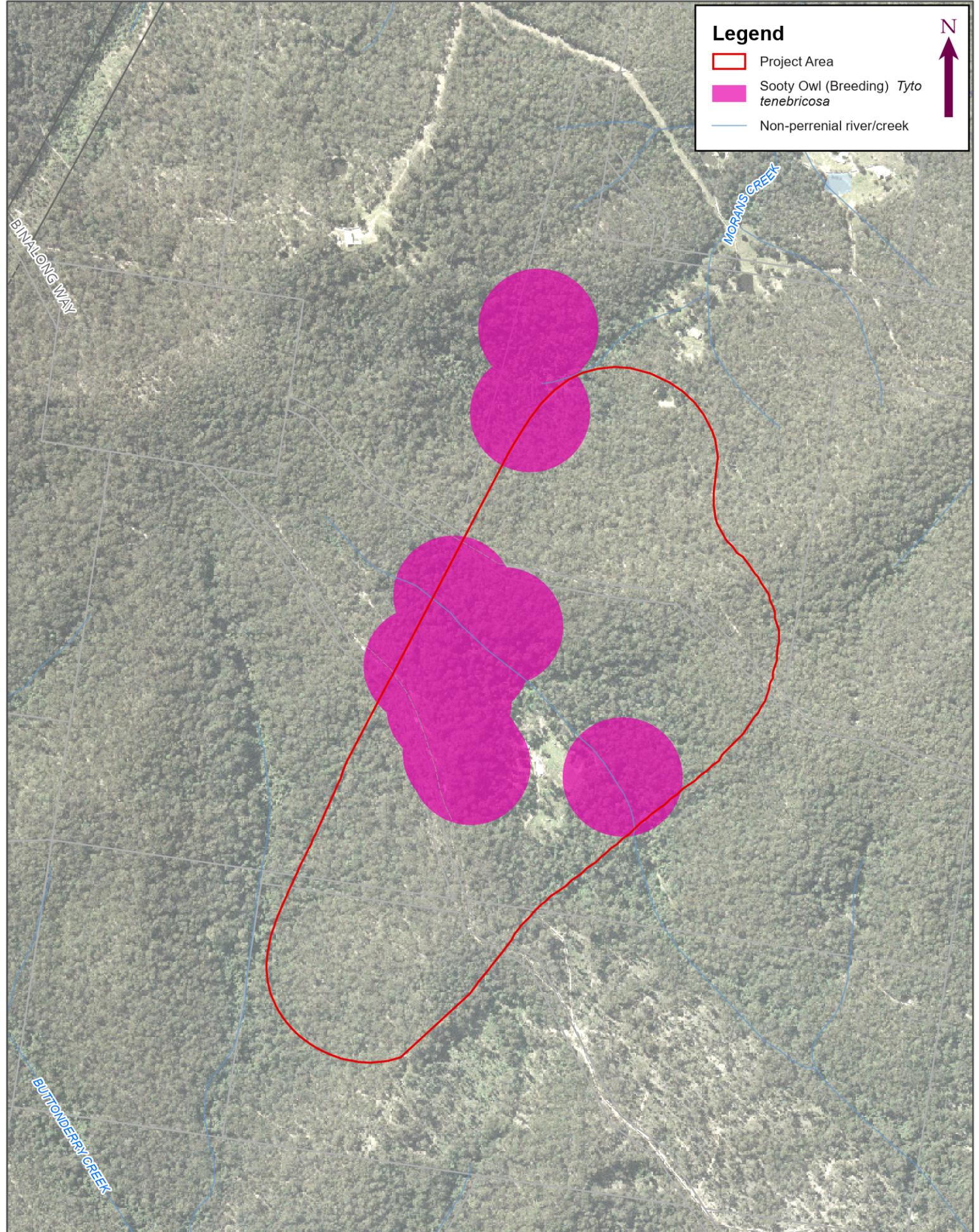


SCALE 1:8,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
 PROJECT: 149823
 PURPOSE: BDAR

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overview plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other legislative purpose, use or matter. This plan is prepared without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. the Client or any Third Party relying on or using or relying on this plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out of date or unreliable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party;
 d. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 e. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 f. RPS Australia East Pty Ltd, or any local authority against the recommendation of the accuracy, reliability, suitability or completeness of any representations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.

RPS



Legend

- Project Area
- Sooty Owl (Breeding) *Tyto tenebricosa*
- Non-perennial river/creek



FIGURE 4-15
THREATENED SPECIES - TYTO TENEBRICOSA
SOOTY OWL (BREEDING)

VERSION: **A**
 DATE EXPORTED: **3/08/2021 1:48 PM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE 1:8,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: **Centennial**
 PROJECT: **149823**
 PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overview plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose, including, but not limited to, the plan is provided without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.

3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. engagement of this plan with any local authority regarding the recommendations of RPS Australia East Pty Ltd;
 6. the accuracy, timeliness, reliability or completeness of any communications or estimates made or referred to by RPS Australia East Pty Ltd in this plan.



4.4 Potential prescribed biodiversity Impacts

Prescribed impacts are the impacts on biodiversity values which are not related to, or are in addition to, native vegetation clearing and habitat loss (Section 6.7 of the BAM). Based on the Candidate species listed in **Table 4-3**, potential prescribed biodiversity impacts on threatened species identified within the Project Area are:

- Occurrences of karst, caves, crevices and cliffs;
- Occurrences of rock; and
- Hydrological processes that sustain and interact with the rivers, streams and wetlands.

The occurrence of these potential prescribed impacts is detailed in **Sections 4.4.1 to 4.4.3** below.

4.4.1 Occurrences of karst, caves, crevices and cliffs

There are several sandstone crevices and cliffs within the Project Area. During caves surveys, 19 sandstone caves were recorded. Locations of these geological features are detailed further in **Appendix A**.

Cave-dwelling microbats may occupy these rocky outcrops and or cliffs, which may include *Chalinolobus dwyeri* (Large-eared Pied Bat), *Miniopterus australis* (Little Bent-winged Bat), *Miniopterus orianae oceanensis* (Large Bent-winged Bat) and *Myotis macropus* (Southern Myotis). Not however, that Anabat surveys within the Project Area failed to detect these species, however *Chalinolobus dwyeri* (Large-eared Pied Bat) and *Miniopterus australis* (Little Bent-winged Bat) were recorded nearby (approximately 500 m north of the Project Area). Nevertheless, survey effort failed to meet guideline survey requirements (four nights effort), breeding habitat was assumed to be present in the Project Area.

Caves within the Project Area may also provide potential breeding habitat of *Tyto tenebriocosa* (Sooty Owl). However, no nesting material was observed during cave surveys that may suggest past breeding of this species in the Project Area.

4.4.2 Occurrences of rock

Toward the ridges throughout the Project Area, there are occurrences of sandstone rocks and isolated rocky outcrops exposed on some steep hill slopes. *Hoplocephalus stephensii* (Stephens' Banded Snake) may shelter under rock slabs or within rock crevices within the Project Area during the day, amongst other sheltering options including loose bark and tree trunks, amongst vines or hollow trunks limbs. Nevertheless, species was not recorded during spotlight surveys.

4.4.3 Hydrological processes that sustain and interact with the rivers, streams and wetlands

The Project Area is in the headwaters of Morans, Mannering and Buttonderry Creeks. These tributaries discharge into Lake Macquarie, Lake Mannering and Tuggerah Lake, respectively (**Figure 1-1**). Threatened frogs that may associate with hydrological processes in these tributaries, and hence potentially associated with this sensitive receiver are *Litoria aurea* (Green and Golden Bell Frog), *Litoria brevipalmata* (Green-thighed Frog), *Litoria littlejohni* (Littlejohn's Tree Frog), *Mixophyes balbus* (Stuttering Frog) and or *Mixophyes iteratus* (Giant Barred Frog). Threatened plants may occur within the ephemeral extents of these drainage lines, with varying degrees of dependence on groundwater. These species may include *Rhizanthella slateri* (Eastern Australian Underground Orchid), *Cryptostylis hunteriana* (Leafless Tongue Orchid), *Rhodamnia rubescens* (Scrub Turpentine) and *Tetratheca juncea* (Black-eyed Susan). Note however that *Rhodamnia rubescens* (Scrub Turpentine) was the only threatened plant observed, with presence assumed for the other above species since survey was not conducted during the prescribed survey period.



**STAGE 2
IMPACT ASSESSMENT**

5 INTRODUCTION TO STAGE 2 – IMPACT ASSESSMENT

5.1 Avoiding and Minimising Impacts on Native Vegetation and Habitat

Clearing of native vegetation will not be required by the Project. Moreover, extraction will use existing surface infrastructure at approved facilities [e.g. Mandalong Mine Access Site (MMAS) and Mandalong South Surface Site (MSSS)], and as such, no vegetation needs to be cleared to install additional surface infrastructure as part of the Project.

The following steps were also undertaken to reduce impacts associated with MOD 10:

- LW33 (as part of MOD 9) will no longer be extracted. The potential impacts on biodiversity associated with this longwall (including *R. rubescens* recorded in the vicinity) would be avoided;
- An original version of MOD 10 included the extension of LW30-33. By avoiding this extension, potential impacts to biodiversity in this area was avoided; and
- The original version of MOD 10 and addition of LW34 (MOD 10; Project) initially extended into Lot 502 DP730395. This land parcel was inaccessible for survey. To avoid uncertain impacts on biodiversity values on that property, LW34 was shortened to avoid potential impacts on this property.

5.2 Avoiding and Minimising Prescribed Biodiversity Impacts

5.2.1 Impacts of development on the habitat of threatened species associated with karst, caves, crevices and cliffs

The Project may impact upon habitat for cave, crevice and or cliff habitat associated threatened species due to structural damage or noise/vibration associated with mining in the Project Area. These findings were presented within the Subsidence Prediction Report for the Project by DgS (2021); which state:

- 'Cracks ranging from 30 mm to 70 mm width may occur in relatively flat terrain where shallow or exposed rock exists (i.e. along creek beds);
- 'Cracking is unlikely to occur where deep soil or alluvium profiles exist, as the strain will be more uniformly distributed and absorbed';
- 'The predicted subsidence and associated tilt and strains could result in minor cracking along the existing rock faces or rock outcrops and talus boulders on steep slopes'; and
- 'The release of sandstone boulders down slope is 'possible' due to the presence of several cliff lines > 5 m high'.

However, it should be noted that the expression of above predictions have some level of uncertainty due to the unique geological nature of the Mandalong area. DgS (2021) state that the occurrence of cracking is strongly influenced by near surface lithology and differential subsidence effects and should not be ruled out above the steep slopes in the Mandalong South Area. For instance, surface cracking has been rare above the Mandalong LW1 to 24a, and it was likely to be due to the presence of thinly bedded, near surface strata of the Tuggerah and Patonga Claystone Formations that tend to 'shear' into thinner beams during subsidence development instead of generating fresh vertical cracks (DgS 2020). The above potential impacts are expected to be pertaining to the Project Area only, with DgS (2021) predicting 'no impacts to surface features are predicted due to far-field movements caused by LW34'.

Given the limited and minor extent of cracking and the low chance for dislodgement of rock structures by the predicted subsidence, it is not expected that the Project would have a more than negligible impact on habitat of threatened species associated with caves, crevices and or cliff habitat.

5.2.2 Impacts of development on the habitat of threatened species associated with rocks

The Project may impact upon habitat for rock-associated threatened species due to subsidence related cracking and or release of sandstone boulders downslope, particularly in steep terrain. However, so far surface cracking has been rare above steep slopes and ridges above Mandalong LW1 to 24a after subsidence of up to 1.2 m. According to DGS (2020), minor cracking of rock structures is expected in steep terrain; surface cracks ranging from 150 mm to 320 mm width are predicted to occur on the slopes above LW30-33 (including the proposed extension areas; DGS 2020). Moreover, it is considered very unlikely that boulders will be dislodged and released downslope because of subsidence.

These findings were presented within the Subsidence Prediction Report for the Project by DGS (2021), which states:

- 'The predicted subsidence and associated tilt and strains could result in minor cracking along the existing rock faces or rock outcrops and talus boulders on steep slopes'; and
- 'The release of sandstone boulders down slope is 'possible' due to the presence of several cliff lines > 5 m high'.'

Given the limited and minor extent of cracking and the low chance for dislodgement of rock structures by the predicted subsidence, it is not expected that the Project would have a more than negligible impact on habitat of threatened species associated with rocks.

5.2.3 Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

The Project may impact upon behaviour of ephemeral surface waters in the Morans, Mannering and Buttonderry Creek catchments through subsidence resulting from underground mining. Potential landform changes that may impact flows within these tributaries are catchment boundaries, watercourse stability/water quality, remnant ponding and flooding regimes.

To date, the potential impacts of the Mandalong Southern Extension Project on flooding have been minimised by the iterative process Centennial Mandalong has undertaken over time to develop mine designs that minimise potential impacts on surface waters, including catchment areas, watercourse impacts, flood regimes, regional infrastructure and annual flows.

A Flood Impact Assessment (FIA) for the Project was undertaken by Umwelt (2021) and concluded that:

- 'MOD 10 will not materially change the watercourse stability impacts for Morans Creek and Buttonderry Creek identified for the approved SSD-5144 MOD 9';
- When compared with the remnant ponding (ponding that occurs after prolonged rainfall and/or flooding) for the approved landform indicates:
 - 'Remnant ponding is typically confined to existing flow paths';
 - 'Negligible change in remnant ponding along Morans Creek';
 - 'Minor increased in remnant ponding along Buttonderry Creek';
- 'Compared to the approved scenario, a slight increase in total remnant ponding area of 0.01 ha is predicted (i.e. less than 1%)'; and
- 'MOD 10 will not materially change the flood regime impacts (depth, extent, velocity, duration or hazard) for Morans Creek and Buttonderry Creek identified for the approved SSD-5144 MOD 9'.

Based on Mandalong Mine's impact experience to-date, the proposed subsidence beneath the watercourses and Groundwater Dependent Ecosystems (GDEs) areas above the proposed mining layout is unlikely to cause significant, long-term impacts due to the presence of strain-absorbing alluvium and low levels of surface cracking experienced to-date (DGS 2021).

5.2.4 Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC

Being an underground mine (connected underground to the MMAS), the Project is not expected to considerably modify the threats vehicles pose to threatened species. That is, vehicle movements pertaining to extraction are underground. However, the Project will require ongoing surface monitoring activities requiring vehicular access for environmental and geotechnical surveys. Risk of vehicle strike to fauna when travelling off public roads will be reduced by pertaining to the speed limit.

The risk of vehicle strike from these activities on relevant threatened species is assessed in **Table 5-1**. It was concluded that the risk of vehicle strike associated with Project would be unlikely/negligible.

Table 5-1 Assessment of impacts of vehicle strike on threatened fauna

Species	Likelihood of strike	Predicted impacts
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo	Low – species generally flies near canopy	Unlikely to be struck by vehicles
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo	Low – species generally flies near canopy	Unlikely to be struck by vehicles
<i>Cercartetus nanus</i> Eastern Pygmy-possum	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	Low – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
<i>Chthonicola sagittata</i> Speckled Warbler	Moderate – species forages diurnally potentially along access tracks. .	Potential to be struck by vehicles, however low frequency of vehicle passage and speed limits (<40 km/hr on private roads) should lead to a negligible increase in risk of strike associated with the Project.
<i>Climacteris picumnus victoriae</i> Brown Treecreeper (eastern subspecies)	Moderate – species forages diurnally potentially along access tracks. .	Potential to be struck by vehicles, however low frequency of vehicle passage and speed limits (<40 km/hr on private roads) should lead to a negligible increase in risk of strike associated with the Project.
<i>Daphoenositta chrysoptera</i> Varied Sittella	Moderate – species forages diurnally potentially along access tracks. .	Potential to be struck by vehicles, however low frequency of vehicle passage and speed limits (<40 km/hr on private roads) should lead to a negligible increase in risk of strike associated with the Project.
<i>Dasyurus maculatus</i> Spotted-tailed Quoll	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Falsistrellus tasmaniensis</i> Eastern False Pipistrelle	Low – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
<i>Glossopsitta pusilla</i> Little Lorikeet	Low – species generally flies near canopy	Unlikely to be struck by vehicles
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle	Low – species generally flies near canopy	Unlikely to be struck by vehicles
<i>Hoplocephalus bitorquatus</i> Pale-headed Snake	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Hoplocephalus stephensii</i> Stephens' Banded Snake	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles

REPORT

Species	Likelihood of strike	Predicted impacts
<i>Litoria aurea</i> Green and Golden Bell Frog	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Litoria brevipalmata</i> Green-thighed Frog	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Litoria littlejohni</i> Littlejohn's Tree Frog	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Lophoictinia isura</i> Square-tailed Kite	Low – species generally flies near canopy	Unlikely to be struck by vehicles
<i>Macropus parma</i> Parma Wallaby	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Micronomus norfolkensis</i> Eastern Coastal Free-tailed Bat	Low – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
<i>Miniopterus australis</i> Little Bent-winged Bat	Low – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat	Low – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
<i>Mixophyes balbus</i> Stuttering Frog	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Mixophyes iteratus</i> Giant Barred Frog	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Myotis macropus</i> Southern Myotis	Low – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
<i>Neophema pulchella</i> Turquoise Parrot	Low – species generally flies near canopy	Unlikely to be struck by vehicles
<i>Ninox connivens</i> Barking Owl	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Ninox strenua</i> Powerful Owl	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Tyto tenebriocosa</i> Sooty Owl	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Petaurus australis</i> Yellow-bellied Glider	Low – species is nocturnal and requires vegetation to glide between trees and is unlikely to be moving across the path of a vehicle.	Unlikely to be struck by vehicles
<i>Petroica boodang</i> Scarlet Robin	Moderate – species forages diurnally potentially along access tracks. .	Potential to be struck by vehicles, however low frequency of vehicle passage and speed limits (<40 km/hr on private roads) should lead to a negligible increase in risk of strike associated with the Project.
<i>Phascolarctos cinereus</i> Koala	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Petaurus norfolcensis</i> Squirrel Glider	Low – species is nocturnal and requires vegetation to glide between trees and is unlikely to be moving across the path of a vehicle.	Unlikely to be struck by vehicles

REPORT

Species	Likelihood of strike	Predicted impacts
<i>Phoniscus papuensis</i> Golden-tipped Bat	Low – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
<i>Pseudomys gracilicaudatus</i> Eastern Chestnut Mouse	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Planigale maculata</i> Common Planigale	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Potorous tridactylus</i> Long-nosed Potoroo	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	Low – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
<i>Ptilinopus magnificus</i> Wompoo Fruit-Dove	Low – species typically associates with rainforest and similar closed forests. Most of the access tracks are located along ridge tops and away from these heavily vegetated areas.	Unlikely to be struck by vehicles
<i>Ptilinopus regina</i> Rose-crowned Fruit-Dove	Low – species typically associates with rainforest and similar closed forests. Most of the access tracks are located along ridge tops and away from these heavily vegetated areas.	Unlikely to be struck by vehicles
<i>Ptilinopus superbis</i> Superb Fruit-Dove	Low – species typically associates with rainforest and similar closed forests. Most of the access tracks are located along ridge tops and away from these heavily vegetated areas.	Unlikely to be struck by vehicles
<i>Saccolaimus flaviventris</i> Yellow-bellied Sheath-tail-bat	Low – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
<i>Scoteanax rueppellii</i> Greater Broad-nosed Bat	Low – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
<i>Turnix maculosus</i> Red-backed Button-quail	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles
<i>Tyto novaehollandiae</i> Masked Owl	Low – species forages at night, when vehicular movements associated with the Project will be highly irregular.	Unlikely to be struck by vehicles

6 IMPACTS UNABLE TO BE AVOIDED

6.1 Direct Impacts

The Project uses existing surface infrastructure so avoids clearance of native vegetation.

6.1.1 Impacts to Native Vegetation

There will be no clearing of native vegetation by the Project. However, based on modelled remnant ponding by Umwelt (2021), there is potential for a very minor impact to native vegetation due to an increase in remnant ponding (i.e. ponding that occurs after prolonged rainfall and/or flooding) arising from subsidence associated with MOD 10. Modelling undertaken by Umwelt (2021) suggests an increased ponding of < 10 m² that is confined to existing flow paths. This change is <1% of existing conditions. They conclude that negligible change in remnant ponding is expected along Morans Creek and only minor increases expected along Buttonderry Creek.

The modelled extent of increased remnant ponding on PCTs 1556, 1568 and 1573 is detailed in **Table 6-1**.

Table 6-1 Impacts to native vegetation

PCT	Area (ha)	Area rounded up to minimum BAM-C input (ha)
PCT 1556 Tallowood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast (Moderate)	0.000083	0.01
PCT 1568 Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast (Moderate)	0.00031	0.01
PCT 1573 Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment (Moderate)	0.000078	0.01
Total impact to native vegetation	0.00047	0.01

Note: the area of native vegetation to be impacted is 0.00047 ha. As this value is too small for the BAM-C to recognise, it has been rounded up in the BAM-C to the nearest accepted number (i.e. 0.01 ha). This matter was raised with BCD on 9 August 2021 (see **Appendix E**), with no response received to date.

It is important to note that Umwelt (2021) attribute much of this change in remnant ponding to the data used in the model (i.e. use of different LiDAR datasets in the modelling). As such, Umwelt (2021) conclude that the MOD 10 remnant ponding is essentially unchanged relative to the approved SSD-5144 MOD 9. Hence, the expression of ponding impacts associated with MOD 10 on biodiversity values are considered unlikely and calls for an Adaptive Management Approach implemented through a Trigger, Action, Response Plan (TARP), as part of the Extraction Plan BMP, to respond to impacts in the case that they do occur.

At the request of the BCD, the precautionary principle was applied and that the nominal 0.01 ha of vegetation was considered to be directly impacted is considered to be fully cleared.

6.1.2 Loss of species credit species habitat or individuals

A negligible increase in remnant ponding is predicted (see **Section 6.1.1**). It is assumed this ponding would lead to the following impacts on Candidate species (i.e. species credit species) that were either found as present or are assumed to be present (**Table 6-2**).

Table 6-2 Impacts to Species Credit Species

Species	Associated zone	Area (ha) ¹	Area rounded up to minimum BAM-C input (ha)
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000282	
	4: PCT 1573_Moderate	0.000078	
<i>Cercartetus nanus</i> Eastern Pygmy-possum	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000313	
	4: PCT 1573_Moderate	0.000078	
<i>Cryptostylis hunteriana</i> Leafless Tongue Orchid	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000313	
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000313	
<i>Hoplocephalus bitorquatus</i> Pale-headed Snake	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000313	
	4: PCT 1573_Moderate	0.000078	
<i>Hoplocephalus stephensii</i> Stephens' Banded Snake	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000313	
	4: PCT 1573_Moderate	0.000078	
<i>Litoria brevipalmata</i> Green-thighed Frog	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000313	
<i>Litoria littlejohni</i> Littlejohn's Tree Frog	3: PCT 1568_Moderate	0.000313	0.01
<i>Lophoictinia isura</i> Square-tailed Kite	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000313	
<i>Mixophyes balbus</i> Stuttering Frog	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000313	
	4: PCT 1573_Moderate	0.000078	
<i>Mixophyes iteratus</i> Giant Barred Frog	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000313	
	4: PCT 1573_Moderate	0.000078	
<i>Myotis macropus</i> Southern Myotis	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000313	
	4: PCT 1573_Moderate	0.000078	
<i>Ninox connivens</i> Barking Owl	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000282	
<i>Ninox strenua</i> Powerful Owl	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000282	
<i>Petaurus norfolcensis</i> Squirrel Glider	2: PCT 1556_Moderate	0.000083	0.01
	3: PCT 1568_Moderate	0.000313	
<i>Phascogale tapoatafa</i>	2: PCT 1556_Moderate	0.000083	0.01

REPORT

Species	Associated zone	Area (ha) ¹	Area rounded up to minimum BAM-C input (ha)
Brush-tailed Phascogale	3: PCT 1568_Moderate	0.000313	
<i>Pteropus poliocephalus</i>	2: PCT 1556_Moderate	0.000083	0.01
Grey-headed Flying-fox	3: PCT 1568_Moderate	0.000313	
	4: PCT 1573_Moderate	0.000078	
<i>Rhizanthella slateri</i>	2: PCT 1556_Moderate	0.000083	0.01
Eastern Australian Underground Orchid	3: PCT 1568_Moderate	0.000313	
	4: PCT 1573_Moderate	0.000078	
<i>Tetratheca juncea</i>	3: PCT 1568_Moderate	0.000313	0.01
Black-eyed Susan			
<i>Tyto novaehollandiae</i>	2: PCT 1556_Moderate	0.000083	0.01
Masked Owl	3: PCT 1568_Moderate	0.000282	
<i>Tyto tenebriocosa</i>	3: PCT 1568_Moderate	0.000282	0.01
Sooty Owl			

1. The area to be impacted is $\sim < 0.001$ ha. As this value is too small for the BAM-C to recognise, it has been rounded up to the nearest accepted number (i.e. 0.01 ha).

Note that the area of impact (if to occur) is well below the BAM-C minimum input of 0.01 ha. This matter was raised with BCD on 9 August 2021 (see **Appendix E**), with no response received to date.

6.2 Indirect Impacts

It is not expected that the Project will contribute to the indirect impacts listed in Section 8.2 of BAM; however, hydrological changes are considered to be the most applicable.

Hydrological changes to Morans Creek and Buttonderry Creek due to subsidence from underground mining have potential to influence riparian-associated vegetation and habitat downstream. However, it is not expected that MOD 10 will materially change the watercourse stability impacts for Morans Creek and Buttonderry Creek from those identified for the approved SSD 5144 MOD 9 (Umwelt 2021). Moreover, the potential for change to remnant ponding and or storage of surface runoff is considered negligible for MOD 10 (i.e. a slight increase in remnant ponding; Umwelt 2021). Therefore, downstream ecological impacts due to MOD 10 are expected to be negligible.

6.3 Prescribed Impacts

The prescribed impacts identified as relevant to the Project are potential impacts to karst, caves, crevices, cliffs and other geological features, and impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities. Other potential prescribed impacts (e.g. impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC) were minimised and or avoided (as per **Section 5.2**). The residual potential prescribed impacts are outlined further in **Sections 6.3.1** and **6.3.2**.

6.3.1 Karst, caves, crevices, cliffs and other geological features of significance

Underground mining has the potential to disturb microbats or cave-associated owls associated with structural changes to rock-habitat features resulting from subsidence. The Project specific risks of this impact and efforts to avoid and minimise these impacts are outlined in **Section 5.2.1**.

Bat roosts may be disturbed indirectly through noise/vibration associated with underground mining and/or through structural changes to cave/ cliff/ crevice habitat. As the Project involves extraction beneath sandstone formations may support threatened microbat or owl roosts, there is potential for this activity to impact these species if roosts are present.

Cave-associated species that may associate with sandstone structures within the Project Area, as associated with the PCTs within the Project Area, are:

- *Chalinolobus dwyeri* (Large-eared Pied Bat);
- *Miniopterus australis* (Little Bent-winged Bat);
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat); and
- *Tyto tenebriocosa* (Sooty Owl).

The extent and nature of this potential impact is difficult to predict due to the potentially dispersed and temporal nature of maternity roosts of threatened cave-associated bats, and uncertainty about the location and extent of impacts to caves/ crevices and cliffs associated with the Project. As such, an Adaptive Management Strategy will be adopted to monitor for changes in bat occupancy/activity due to extraction, should roost sites for threatened microbats and or Sooty Owl be detected. This strategy is presented in **Section 6.4.1.1**.

6.3.2 Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

Underground mining has the potential to disturb TEC's, and riparian-associated threatened flora through altering the ground water regime and remnant ponding extent. As detailed in **Section 5.2.1**, the Project is expected to have negligible impact on the hydrology of Morans and Buttonderry Creek within the Project Area. The only impact identified is the potential increase of <0.001 ha of remnant ponding within Buttonderry

Creek. Due to the ephemeral nature of this waterway, the translatable impact on threatened entities (i.e. TEC's and threatened frogs and plants) is expected to be negligible.

Nevertheless, as there is still some uncertainty of how impacts to ground and surface water associated with subsidence may express, an Adaptive Management Strategy will be adopted to monitor and respond to potential impacts to relevant plant communities and threatened flora is presented in **Section 6.4.1**.

6.4 Mitigation and Management of Impacts

6.4.1 Adaptive Management Strategy

6.4.1.1 Prescribed impact: karst, caves, crevices, cliffs and other geological features of significance

The Project is unlikely to have a measurable impact upon cave-associated bats (see **Section 6.3.1**). However, a monitoring program is recommended to evaluate the impacts of subsidence on cave structures for microbat roosting, if threatened microbats are found to be roosting in the Project Area.

If threatened microbats are found roosting in the Project Area [e.g. *Miniopterus australis* (Little Bent-winged Bat); *Chalinolobus dwyeri* (Large-eared Pied Bat)], monitoring is to incorporate an appropriate baseline period and is to end after the full effects of subsidence are realised. Impacts on caves may be associated with vibration (noise) and or physical disturbance.

If an impact may be attributed to MOD 10, it is expected that a decrease in microbat activity [e.g. *Miniopterus australis* (Little Bent-winged Bat); *Chalinolobus dwyeri* (Large-eared Pied Bat)], species richness and/or body condition (body condition index), or a shift in age structure (as indicated by Canine length) would be detected within the impact area, but not within roosts at control sites. This monitoring work would be undertaken as part of the Biodiversity Monitoring Program (BMP) for the LW34 Extraction Plan.

Surveys are also required to establish whether breeding activity of *Tyto tenebriocosa* (Sooty Owl) is associated with caves within the Project Area. Although no signs of breeding material consistent with this species were observed within caves surveyed, surveys are required to confirm this result during breeding season. If present activity is found associated with caves in the Project Area, monitoring should be incorporated over an appropriate baseline period and is to end after the full effects of subsidence are realised. This monitoring work would be undertaken as part of the BMP for the LW 34 Extraction Plan.

6.4.1.2 Prescribed impact: Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

To ensure the potential impacts of the Project pertain to those identified by Umwelt (2021), where ponding may be increased by mine-related subsidence (see **Section 6.2**), a monitoring program will be undertaken to detect impacts associated with subsidence (if they occur).

A monitoring program as part of the Extraction Plan will be undertaken to determine if plant communities and or threatened flora are impacted by the Project and be based on the principles of a Before-After-Control-Impact (BACI) design. This BACI design will involve collecting data at monitoring sites where impacts are expected and corresponding control/reference sites before and after mining (as per Underwood 1991). If an impact may be attributed to the Project, it is expected that a positive or negative ecological response would be detected in plant communities and or threatened plants within the potential impact area, but not within relevant controls.

Baseline data for this monitoring program has been collected as part of this BDAR (i.e. BAM plots, locations of threatened plants and microbat activity levels). Moreover, existing controls have been established for other monitoring programs for Mandalong, including relevant PCTs. These control sites are in the Olney State Forest, unaffected by mining.

Given that the BAM Calculator has a minimum area of 0.01 ha for an impact, it is suggested here that the need to offset impacts is triggered when remnant ponding following extraction of LW34 exceeds 0.01 ha (i.e. the minimum area input within the BAM Calculator). In this case, ecosystem and species credits should be honoured, as calculated in this BDAR which applied this minimum BAM-C area value.

7 SERIOUS AND IRREVERSIBLE IMPACTS (SAII)

The only SAII species found was *Rhodamnia rubescens* (Scrub Turpentine). However, this species was located outside the predicted impact area (i.e. predicted increased ponding related to MOD 10).

Surveys have been sufficiently performed on the following SAII species and were not found:

- *Petrogale penicillata* (Brush-tailed Rock-wallaby);
- *Rhodomyrtus psidioides* (Native Guava).

Based on the PCTs suspected to be present in areas where ponding has been predicted, the following SAII species were considered as having potential to occur:

- *Chalinolobus dwyeri* (Large-eared Pied Bat);
- *Miniopterus australis* (Little Bent-winged Bat);
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat);
- *Mixophyes balbus* (Stuttering Frog);
- *Rhizanthella slateri* (Eastern Australian Underground Orchid); and
- *Tyto tenebricosa* (Sooty Owl).

However, impacts of ponding pertain to sedimentary soils within the valley floor only. Hence, this minor extent of ponding is not likely to inundate rock structures, and so should not directly impact upon critical habitat of *C. dwyeri*; *M. australis*; *M. orianae oceanensis* or *Tyto tenebricosa*. These species associate with high relief, rocky areas. Moreover, a small increase in ponding is expected to modify habitat for *Mixophyes balbus* (Stuttering Frog), rather than remove it, so an SAII for this species is not expected.

The Project has potential to only impact the SAII species *R. slateri*. *R. slateri* was not surveyed for within the recommended survey period according to BioNet (DPIE 2021a), and hence presence was assumed.

Based on Section 9.1 of the BAM, the BDAR is to provide further information regarding the assessment of SAIIs. This assessment is provided below. The extent of threatened species at risk of an SAII, identified or assumed to occur within the Project Area, are shown in **Figure 7-1**.

a. The action and measures taken to avoid the direct and indirect impact on the potential entity for a SAII

The Project will avoid clearing-related impacts on *R. slateri* as it involves underground mining. However, there is potential to impact these species through ponding associated with mine subsidence. Nevertheless, the potential impacts of the Mandalong Southern Extension Project on flooding have been minimised by the iterative process Centennial Mandalong has undertaken over time to develop mine designs that minimise potential impacts on surface waters, including catchment areas, watercourse impacts, flood regimes, regional infrastructure and annual flows. As such, there is only a minor increase of ponding related to the Project of <0.001 ha that may impact habitat of this species.

b. The size of the local population directly and indirectly impacted by the development, clearing or biodiversity certification

The nearest record of *R. slateri* is near Wisemans Ferry (Latitude -33.4; Longitude 151.06; DPIE 2020b), approximately ~ 40 km to the southwest of the Project Area. As part of the extensive field surveys undertaken by RPS for Centennial Mandalong, this species has not been observed. Hence, given the minor (<0.001 ha) extent of ponding resulting from MOD 10, it is unlikely that this would impact *R. slateri*.

c. The extent to which the impact exceeds any threshold for the potential entity

Records of *R. slateri* are only known from fewer than 10 locations. As the nearest location this species has been recorded is over 40 km from the Project Area, it is considered that the minor extent of predicted ponding (i.e. <0.001 ha), is unlikely to exceed a threshold of impact for this entity.

d. The likely impact (including direct and indirect impacts) that the development, clearing or biodiversity certification will have on the habitat of the local population

1. An estimate of the change in habitat available to the local population as a result of the proposed development

The Project is expected to lead to no more than a negligible change in habitat for *R. slateri* (i.e. ponding of <0.001 ha of potential habitat), given the abundance of similar nature habitat available in the local area, including the Olney State Forest (i.e. 44,000 ha area of bushland, much of which is exempt from mining).

2. The proposed loss, modification, destruction or isolation of the available habitat used by the local population

Based on the assumed presence of *R. slateri*, ponding associated with MOD 10 may lead to loss of <0.001 ha of habitat for these species. Given the dispersed distribution of this species and distance from known populations (i.e. 40 km from the Project Area), this potential loss of habitat is considered negligible.

3. Modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development.

The increased ponding (<0.001 ha) associated with the Project is not expected to modify habitat required to maintain processes important to *R. slateri* given the relatively minor extent of habitat to be impacted, when considering Given the dispersed distribution of this species and distance from known populations (i.e. 40 km from the Project Area; see sections c. and g.).

e. The likely impact on the ecology of the local population

R. slateri is known to only occur at fewer than 10 locations, over 40 km from the Project Area. Hence, it is highly unlikely that this species is to occur in the <0.001 ha of predicted ponding.

f. A description of the extent to which the local population will become fragmented or isolated as a result of the proposed development

Given the small nature of the potential impact (<0.001 ha), this is not expected to fragment or isolate a local population of *R. slateri*.

g. The relationship of the local population to other population/populations of the species

For *R. slateri*, no local population is known of, and hence it is not expected that the Project would impact a local population of this species (i.e. the nearest known population is over 40 km southwest of the Project Area; DPIE 2021a).

h. The extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population

Except for the minor extent (i.e. <0.001 ha) of potential impact to habitat for *R. slateri*, it is not expected that the Project would enhance threats and indirect impacts to these species.

i. An estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion

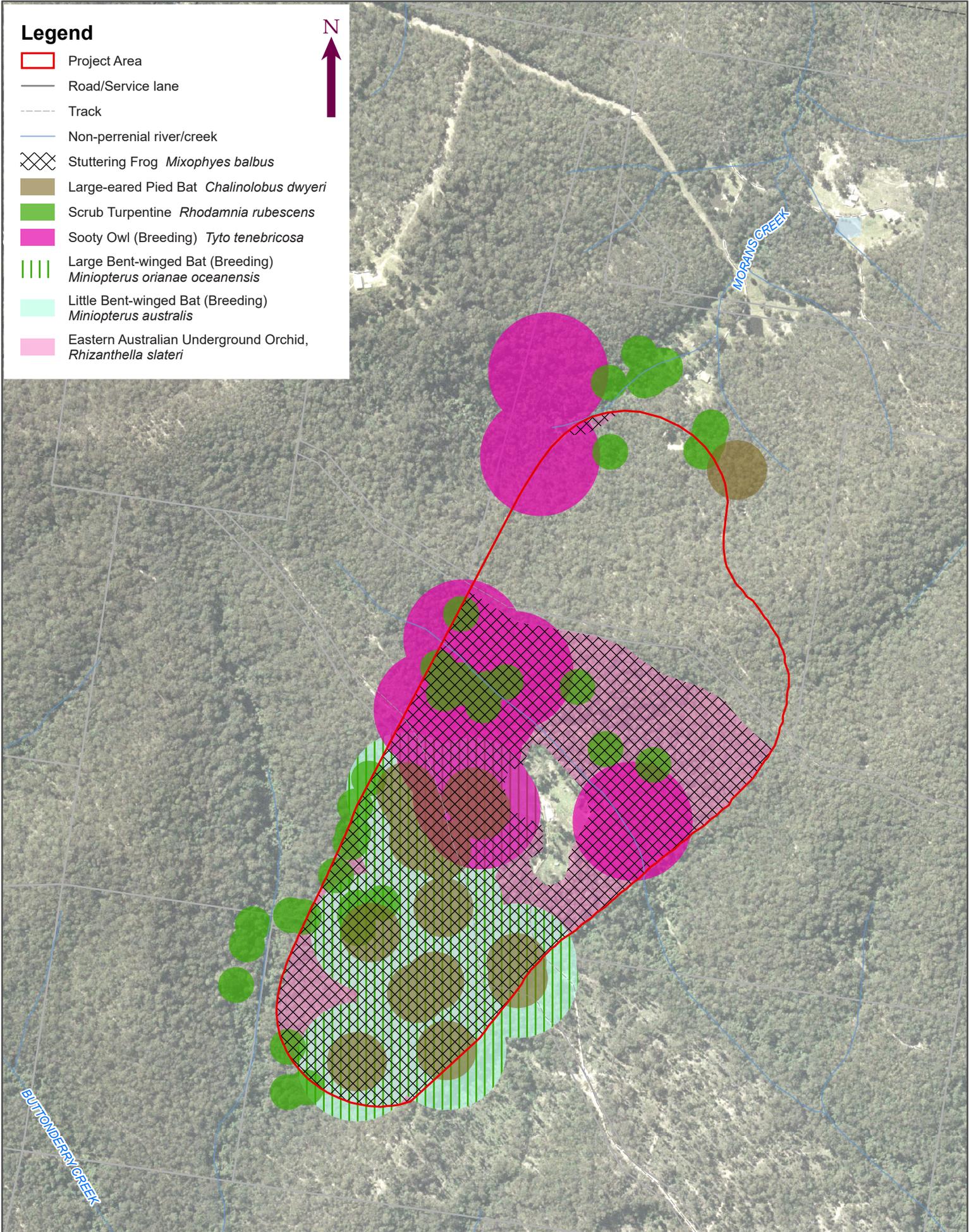
The extent of *R. slateri* populations occur within reserves is unknown due to the rarity of this species (i.e. < 10 populations known).

j. The measure/s proposed to contribute to the recovery of the species in the IBRA subregion

Saving our Species programs have been established to assist with the recovery of *R. slateri*. The Project Area is not a priority management site for this species.

Legend

- Project Area
- Road/Service lane
- Track
- Non-perennial river/creek
- Stuttering Frog *Mixophyes balbus*
- Large-eared Pied Bat *Chalinobus dwyeri*
- Scrub Turpentine *Rhodamnia rubescens*
- Sooty Owl (Breeding) *Tyto tenebricosa*
- Large Bent-winged Bat (Breeding) *Miniopterus orianae oceanensis*
- Little Bent-winged Bat (Breeding) *Miniopterus australis*
- Eastern Australian Underground Orchid, *Rhizanthella slateri*



**FIGURE 7-1
THREATENED SPECIES AT RISK OF AN SAIL
WITHIN THE PROJECT AREA**

VERSION: **B**
 DATE EXPORTED: **24/08/2021 8:47 AM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE 1:8,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial

PROJECT: 149823

PURPOSE: BDAR

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overview plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other legislative purpose, use or matter. This plan is prepared without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party obtaining copies or reliance on this plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.

d. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 e. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 f. RPS Australia East Pty Ltd, or any local authority against the recommendation of the accuracy, reliability, suitability or completeness of any representations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.



8 REQUIREMENT TO OFFSET

The potential offset liability for the Project is presented below. As mentioned above, the potential impacts associated with MOD 10 on biodiversity values are considered unlikely and limited to a very small area (i.e. <10 m²), which according to Umwelt (2021) is likely to be related to modelling artifacts (i.e. use of different LiDAR datasets between approved and proposed landforms). As such, it is proposed that BAM-C calculations here are considered within an Adaptive Management Framework, where credit liabilities are honoured only when an impact greater than negligible is detected. Noting that the minimum area is 0.01 ha (i.e. ten times the modelled remnant ponding increase), it is proposed that this area value is used as a threshold to trigger offsets (as outlined in **Section 6.4.1.2**).

The Biodiversity Credit Report is provided in **Appendix C**. Locations of impacts requiring offset and areas not requiring assessment are provided in **Figure 8-1** and **Figure 8-2**, respectively.

8.1 Impacts requiring an offset

8.1.1 Ecosystem credits

In the case that ponding-related impacts associated with MOD 10 materialise, ecosystem credits required to offset impacts related to ponding are presented in **Table 8-1**. Note that minimum value allowance for area within the BAM-C is 0.01 ha. As the area of impact is to be <0.001 ha (i.e. ten times less), it is considered that the offset liability presented here overestimates the potential impact, as the area of impact within each zone had to be rounded up to this minimum threshold of 0.01 ha (the minimum value in the BAM-C).

Based on the unexpected impact on vegetation communities, it is proposed that 0.01 ha increase in remnant ponding is used as a threshold to trigger offset requirements, which is to be included in the Extraction Plan BMP under an Adaptive Management Framework (as outlined in **Section 6.4.1.2**).

Table 8-1 Ecosystem credit liability

Zone	PCT	Vegetation integrity loss	Area (ha)	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAIL	No. ecosystem credits
2	PCT 1556 Tallowood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast (Moderate)	36.2	0.01 ¹	High Sensitivity to Potential Gain	1.5	No	1
3	PCT 1568 Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast (Moderate)	36	0.01 ¹	High Sensitivity to Potential Gain	1.5	No	1
4	PCT 1573 Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment (Moderate)	36.4	0.01 ¹	High Sensitivity to Potential Gain	1.5	No	1

1. The area to be impacted is <0.001 ha. As this value is too small for the BAM-C to recognise, it has been rounded up to the lowest recognised number.

8.1.2 Areas not requiring assessment

An ~1.92 ha area of cleared/disturbed land does not require assessment (**Figure 8-2**). This area is mostly dominated by exotic species, with native vegetation cleared for a private property. ~0.00022 ha of ponding related impacts is predicted in this disturbed/cleared area.

8.2 Species credits

Species credits required to offset impacts related to ponding are presented in **Table 8-2**.

Table 8-2 Species credit liability

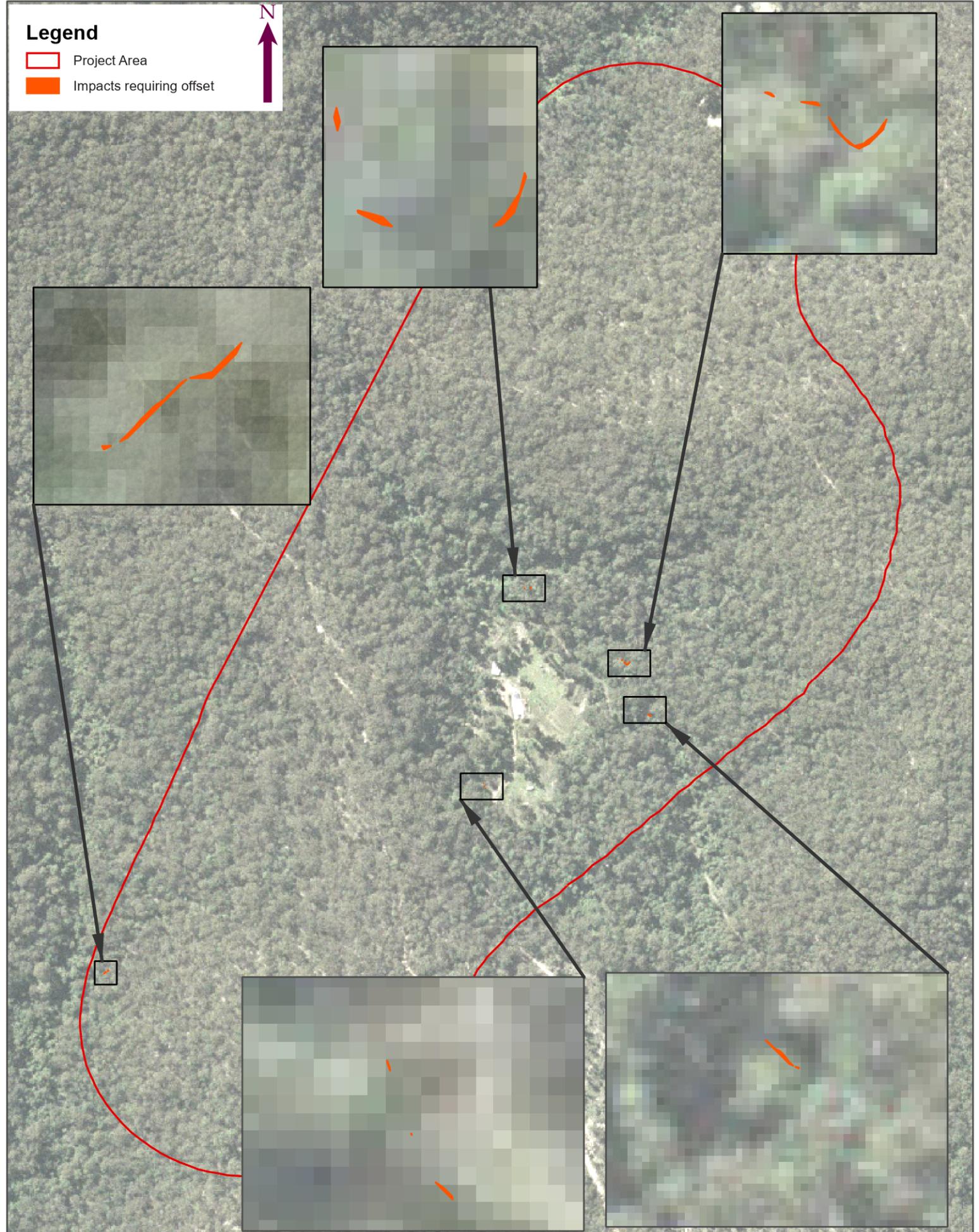
Species	Vegetation Zones	Area / Count	Biodiversity risk weighting	Potential SAIL	No. species credits
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo	2: PCT 1556_Moderate 3: PCT 1568_Moderate 4: PCT 1573_Moderate	Area	2	No	1
<i>Cercartetus nanus</i> Eastern Pygmy-possum	2: PCT 1556_Moderate 3: PCT 1568_Moderate 4: PCT 1573_Moderate	Area	2	No	1
<i>Cryptostylis hunteriana</i> Leafless Tongue Orchid	2: PCT 1556_Moderate 3: PCT 1568_Moderate	Area	1.5	No	1
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle	2: PCT 1556_Moderate 3: PCT 1568_Moderate	Area	2	No	1
<i>Hoplocephalus bitorquatus</i> Pale-headed Snake	2: PCT 1556_Moderate 3: PCT 1568_Moderate 4: PCT 1573_Moderate	Area	2	No	1
<i>Hoplocephalus stephensii</i> Stephens' Banded Snake	2: PCT 1556_Moderate 3: PCT 1568_Moderate 4: PCT 1573_Moderate	Area	2	No	1
<i>Litoria brevipalmata</i> Green-thighed Frog	2: PCT 1556_Moderate 3: PCT 1568_Moderate	Area	1.5	No	1
<i>Litoria littlejohni</i> Littlejohn's Tree Frog	3: PCT 1568_Moderate	Area	2	No	1
<i>Lophoictinia isura</i> Square-tailed Kite	2: PCT 1556_Moderate 3: PCT 1568_Moderate	Area	1.5	No	1
<i>Mixophyes balbus</i> Stuttering Frog	2: PCT 1556_Moderate 3: PCT 1568_Moderate 4: PCT 1573_Moderate	Area	3	Yes	1
<i>Mixophyes iteratus</i> Giant Barred Frog	2: PCT 1556_Moderate 3: PCT 1568_Moderate 4: PCT 1573_Moderate	Area	3	No	1
<i>Myotis macropus</i> Southern Myotis	2: PCT 1556_Moderate 3: PCT 1568_Moderate 4: PCT 1573_Moderate	Area	2	No	1
<i>Ninox connivens</i> Barking Owl	2: PCT 1556_Moderate 3: PCT 1568_Moderate	Area	3	No	1
<i>Ninox strenua</i> Powerful Owl	2: PCT 1556_Moderate 3: PCT 1568_Moderate	Area	2	No	1
<i>Petaurus norfolcensis</i> Squirrel Glider	2: PCT 1556_Moderate 3: PCT 1568_Moderate	Area	2	No	1
<i>Phascogale tapoatafa</i> Brush-tailed Phascogale	2: PCT 1556_Moderate 3: PCT 1568_Moderate	Area	2	No	1
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	2: PCT 1556_Moderate 3: PCT 1568_Moderate 4: PCT 1573_Moderate	Area	2	No	1

REPORT

Species	Vegetation Zones	Area / Count	Biodiversity risk weighting	Potential SAI	No. species credits
<i>Rhizanthella slateri</i> Eastern Australian Underground Orchid	2: PCT 1556_Moderate 3: PCT 1568_Moderate 4: PCT 1573_Moderate	Area	3	Yes	1
<i>Tetratheca juncea</i> Black-eyed Susan	3: PCT 1568_Moderate	Area	2	No	1
<i>Tyto novaehollandiae</i> Masked Owl	2: PCT 1556_Moderate 3: PCT 1568_Moderate	Area	2	No	1
<i>Tyto tenebricosa</i> Sooty Owl	3: PCT 1568_Moderate	Area	2	No	1

Note that area values were rounded up to the minimum data entry value available in the BAM-C (i.e. total potential impact on a species polygon due to ponding is <0.001 yet BAM-C data entry is limited to two decimal places). As such, to allow a more accurate representation of this small impact in the BAM-C, only one value of 0.01 ha was added for species detected or assumed to be present.

Based on the unexpected impacts on these species credit species, it is proposed that a 0.01 ha increase in remnant ponding is to be used as a threshold to trigger offset requirements. This threshold for triggering an offset is to be included in the Extraction Plan BMP under an Adaptive Management Framework (as outlined in **Section 6.4.1.2**). This approach is considered pragmatic since assigning 0.01 ha for each relevant zone already grossly overestimates the predicted impact and its associated offset liability.



**FIGURE 8-1
IMPACTS REQUIRING OFFSET**

VERSION: **A**
 DATE EXPORTED: **10/08/2021 2:35 PM**
 TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS.



SCALE 1:5,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: **Centennial**
 PROJECT: **149823**
 PURPOSE: **BDAR**

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overlay plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose, past or future. The plan is generated without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out of date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party.
 3. RPS Australia East Pty Ltd is not providing any warranty or representation in this plan.

RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 5. RPS Australia East Pty Ltd is not providing any warranty or representation in this plan.
 RPS Australia East Pty Ltd
 6. the accuracy, reliability, validity or completeness of any recommendations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.



Legend

- Project Area
- Areas not requiring Assessment



**FIGURE 8-2
AREAS NOT REQUIRING ASSESSMENT**

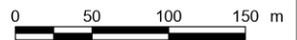
VERSION: **A**

DATE EXPORTED: **10/08/2021 2:46 PM**

TECHNICIAN: **Natalie.Wood**

LOCATION:
Mandalong

DATA SOURCES
Centennial, RPS.



SCALE: 1:4,959 AT A4 SIZE
SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: **Centennial**

PROJECT: **149823**

PURPOSE: **BDAR**

IMPORTANT NOTE
1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overlay plan. This plan is solely limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose without the express written consent of the author. The author assumes no liability or duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
2. RPS Australia East Pty Ltd will not be liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
a. a Third Party publishing, using or relying on this plan;
b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unusable;
c. any inaccuracies or other faults with information or data sourced from a Third Party.

3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd.
5. RPS Australia East Pty Ltd. In any local authority issued the recommendations of RPS Australia East Pty Ltd.
6. The accuracy, reliability, validity or completeness of any recommendations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.

7. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
8. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd.
9. RPS Australia East Pty Ltd. In any local authority issued the recommendations of RPS Australia East Pty Ltd.
10. The accuracy, reliability, validity or completeness of any recommendations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.



9 CONCLUSION

This BDAR addresses Stage 1 (Biodiversity Assessment) and Stage 2 (Impact Assessment) of the BAM. Maps have been provided in compliance with BAM, including the layout of the final project footprint in relation to biodiversity values, including impacts requiring/not requiring offsets.

In accordance with the objectives of the Biodiversity Offset Scheme (BOS), the mine layout for MOD 10 was designed to avoid and minimise impacts on biodiversity values. That is, impacts of the Mandalong Southern Extension Project on flooding have been minimised by the iterative process Centennial Mandalong has undertaken over time to develop mine designs that minimise potential impacts on surface waters, including catchment areas, watercourse impacts, flood regimes, regional infrastructure and annual flows. Specifically, the following steps were also undertaken to reduce impacts associated with MOD 10:

- LW33 (as part of MOD 9) will no longer be extracted. The potential impacts on biodiversity associated with this longwall would be avoided (and accordingly result in a reduction in approved impacts on biodiversity values);
- An original version of MOD 10 included the extension of LW30-33. By avoiding this extension, potential impacts to biodiversity in this area will be avoided; and
- The original version of MOD 10 and addition of LW34 initially extended into Lot 502 DP730395. This land parcel was inaccessible for survey. To avoid uncertain impacts on biodiversity values on that property, LW34 was shortened to avoid potential impacts on this property.

9.1 Need for Offsetting

MOD 10 is expected to lead to a negligible increase in remnant ponding (i.e. ponding that occurs after prolonged rainfall and/or flooding). Modelling undertaken by Umwelt (2021) suggests an increase of <10 m² of ponding, which is <1% change in ponding, which is to be confined to existing flow paths. They conclude that negligible change in remnant ponding is expected along Morans Creek and only minor increases expected along Buttonderry Creek. Moreover, Umwelt (2021) attribute much of this change in remnant ponding to modelling artifacts (i.e. use of different LiDAR datasets for approved and proposed mining landforms). As such, Umwelt conclude that MOD 10 proposed landform remnant ponding is essentially unchanged relative to the approved SSD-5144 MOD 9. Hence, the expression of ponding impacts associated with MOD 10 on biodiversity values are considered unlikely and calls for an Adaptive Management Approach to respond to impacts when (if) they occur.

Putting aside the basis for predicting impacts (i.e. reliance on modelling and associated assumptions), the question is posed here to the decision maker – is the BOS applicable in this case as the MOD is not likely to an increased impact on biodiversity values? It should be noted that by avoiding the extraction of the approved LW33 (combined with shortening of LW30, 31 and 34), MOD 10 as proposed is likely to lead to a net reduction in potential impacts relative to the approved Mandalong Southern Extension Project. Accordingly, measures to avoid impacts means that the MOD 10 is not likely to have a net increased impact on biodiversity values. The implementation of an Adaptive Management Approach through the Extraction Plan process is proposed to determine if and when offsetting is required (i.e. greater than negligible impact is identified).

9.2 Offsetting Measures

Given that the BAM Calculator has a minimum area of 0.01 ha for an impact, it is suggested here that the need to offset impacts is triggered when impacts associated with ponding following extraction of LW34 exceed 0.01 ha (i.e. the minimum area input within the BAM Calculator). In this case, ecosystem and species credits should be honoured, as calculated in this BDAR which applied this minimum BAM-C area value. Note that within this BDAR, a precautionary approach was applied to calculating the potential offset liability by considering the vegetation to be directly impacted to be fully cleared by the ponding and assuming presence of Species Credit Species where surveys were not sufficient to rule out their presence.

In the case that impacts of MOD 10 are expressed, and the minimum area threshold within BAM-C of 0.01 ha impact threshold is met or exceeded, the Ecosystem Credits required for the Project are:

- 1 Ecosystem Credit for PCT 1556 Tallowood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast;

- 1 Ecosystem Credit for PCT 1568 Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast; and
- 1 Ecosystem Credit for PCT 1573 Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment.

In the same sense (i.e. offsetting in accordance with a detected impact 0.01 ha or greater), the Species Credits for threatened species required for the Project are:

- 1 *Callocephalon fimbriatum* (Gang-gang Cockatoo) Species Credit;
- 1 *Cercartetus nanus* (Eastern Pygmy-possum) Species Credits;
- 1 *Cryptostylis hunteriana* (Leafless Tongue Orchid) Species Credit;
- 1 *Haliaeetus leucogaster* (White-bellied Sea-Eagle) Species Credit;
- 1 *Hoplocephalus bitorquatus* (Pale-headed Snake) Species Credit;
- 1 *Hoplocephalus stephensii* (Stephens' Banded Snake) Species Credit;
- 1 *Litoria brevipalmata* (Green-thighed Frog) Species Credit;
- 1 *Litoria littlejohni* (Littlejohn's Tree Frog) Species Credit;
- 1 *Lophoictinia isura* (Square-tailed Kite) Species Credit;
- 1 *Mixophyes balbus* (Stuttering Frog) Species Credit;
- 1 *Mixophyes iteratus* (Giant Barred Frog) Species Credit;
- 1 *Myotis macropus* (Southern Myotis) Species Credit;
- 1 *Ninox connivens* (Barking Owl) Species Credit;
- 1 *Ninox strenua* (Powerful Owl) Species Credit;
- 1 *Petaurus norfolcensis* (Squirrel Glider) Species Credit;
- 1 *Phascogale tapoatafa* (Brush-tailed Phascogale) Species Credit;
- 1 *Pteropus poliocephalus* (Grey-headed Flying-fox) Species Credit;
- 1 *Rhizanthella slateri* (Eastern Australian Underground Orchid) Species Credit;
- 1 *Tetradlea juncea* (Black-eyed Susan) Species Credit;
- 1 *Tyto novaehollandiae* (Masked Owl) Species Credit; and
- 1 *Tyto tenebricosa* (Sooty Owl) Species Credit.

9.3 Offsetting Strategy

In the case that offsetting requirements are triggered, these credit requirements will need to be satisfied in accordance with the NSW BOS through retiring credits, based on like-for-like rules where possible. Payments into the Biodiversity Conservation Fund may be made where suitable credits are not available.

9.4 Adaptive Management for Uncertain Impacts

Mitigation measures proposed for the Project are presented in **Section 6.4**, which introduces adaptive management measures to allow for ongoing monitoring of potential prescribed impacts. Specifically, monitoring programs will be employed in an attempt to detect and respond to potential impacts arising from ponding of surface water (e.g. impacts to ground-water dependent ecosystems) and impacts to karst, caves, crevices, cliffs and other geological features of significance (e.g. impacts to cave-associated microbats). Regarding ponding-related impacts, this monitoring would be used to determine if ponding impacts meet or exceed the BAM-C minimum area threshold of 0.01 ha, and hence trigger the need to offset these impacts. This monitoring program will be incorporated into the Biodiversity Management Plan prepared as part of the Extraction Plan to ensure impacts do not exceed those predicted to occur in this BDAR.

Threatened species which require further surveys and or monitoring to validate the assumption that cave structures will not be impacted are:

- *Miniopterus australis* (Little Bent-winged Bat);
- *Chalinolobus dwyeri* (Large-eared Pied Bat); and
- *Tyto tenebricosa* (Sooty Owl).

10 REFERENCES

- Bell S. A. and Driscoll C (2015). Vegetation Mapping Report, Lake Macquarie Local Government Area. Unpublished report to Lake Macquarie City Council. Produced by East Coast Flora Survey.
- Bell S. A. (2016a). Conversion Lake Macquarie Native Vegetation Community Map Units to Plant Community Types (PCTs) March 2016. Accessed July 2021. <https://lakemac.com.au/page.aspx?pid=109&vid=25&fid=138&ftype=FGrp>
- Bell S.A.J. (2016b). Volume 2: Vegetation Community Profiles, Lake Macquarie Local Government Area; Working Draft v2. Report to Lake Macquarie City Council. Eastcoast Flora Survey, Kotara, NSW.
- Department of Agriculture, Water and Environment [DAWE] (2021a). Australian Government's Species Profiles and Threats (SPRAT) database. Accessed July 2021. <http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>
- DAWE (2020b). EPBC Act Protected Matters Search Tool. Accessed July 2021. <http://www.environment.gov.au/epbc/protected-matters-search-tool>
- Department of Primary Industries [DPI] (2021). Fisheries NSW Spatial Data Portal. Accessed May 2021. https://webmap.industry.nsw.gov.au/Html5Viewer/index.html?viewer=Fisheries_Data_Portal
- Department of Planning, Industry and Environment [DPIE] (2021a). BioNet Atlas of NSW Wildlife. Accessed October 2020. <http://www.bionet.nsw.gov.au/>
- DPIE (2021b). BioNet Vegetation Classification. Accessed November 2021. <https://www.environment.nsw.gov.au/research/Visclassification.htm>
- DGS (2021). Subsidence Assessment for the Proposed LW34 at the Mandalong Mine: SSD-5144 Approval Modification (Mod 10). Report prepared for Centennial Mandalong.
- Lake Macquarie City Council (2015). Lake Macquarie Native Vegetation and Corridors Map.
- National Parks and Wildlife Service (2003). Descriptions for NSW (Mitchell) Landscapes Version 2.
- NSW Threatened Species Scientific Committee (2019) Final determination: Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions - Endangered Ecological Community listing.
- Office of Environmental and Heritage (2018). NSW Threatened Species Committee: Conservation Assessment of *Rhodamnia rubescens*. Accessed December 2020. <https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Scientific-Committee/Determinations/2019/rhodamnia-rubescens-final-determination.pdf?la=en&hash=987642E506014570FDE9E3E376A7724E40CB3D4C>
- RPS Australia East Pty Ltd (2013). Mandalong Southern Extension Project: Flora and Fauna Assessment. Report prepared for Centennial Mandalong.
- RPS (2019) Mandalong LW23-24a 2019 Annual ecological monitoring. Report prepared for Centennial Mandalong.
- RPS (2020) Mandalong LW23-24a 2019 Annual ecological monitoring. Report prepared for Centennial Mandalong.
- State of NSW and Office of Environment and Heritage [OEH] (2018). Biodiversity Assessment Method Operational Manual – Stage 1.
- State of NSW and DPIE (2019). Biodiversity Assessment Method Operational Manual – Stage 2.
- State of NSW (2020). Biodiversity Assessment Method. Department of Planning, Industry and Environment, Sydney.
- Umwelt (2021). Flood Impact Assessment. Mandalong Southern Extension Project Modification 10. Report prepared for Centennial Mandalong.
- Underwood, A. J. (1991). Beyond BACI: Experimental designs for detecting human environmental impacts on temporal variations in natural populations. *Marine and Freshwater Research* 42(5): 569-587.

Appendix A

Biodiversity Inventory Report

MANDALONG MOD 10: ADDITION OF LONGWALL 34

Biodiversity Inventory Report



149823

2

24 November 2021

REPORT

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
0	Internal Review	Dr Hayden Beck	Mark Aitkens	Mark Aitkens	12 July 2021
1	Final to client	Dr Hayden Beck	Mark Aitkens	Mark Aitkens	26 August 2021
2	Final following BCD feedback	Dr Hayden Beck	Mark Aitkens	Mark Aitkens	24 November 2021

Approval for issue

Dr Hayden Beck



24 November 2021

This report was prepared by RPS within the terms of RPS' engagement with its client and in direct response to a scope of services. This report is supplied for the sole and specific purpose for use by RPS' client. The report does not account for any changes relating the subject matter of the report, or any legislative or regulatory changes that have occurred since the report was produced and that may affect the report. RPS does not accept any responsibility or liability for loss whatsoever to any third party caused by, related to or arising out of any use or reliance on the report.

Prepared by:

RPS

Dr Hayden Beck
Senior Ecologist

Unit 2A, 45 Fitzroy Street
Carrington NSW 2294

T +61 2 4940 4200
E hayden.beck@rpsgroup.com.au

Prepared for:

Centennial Mandalong

James Wearne
Group Manager Approvals/Environment

100 Miller Road
Fassifern NSW

T +61 2 4935 8944
E james.wearne@centennialcoal.com.au

Contents

1	INTRODUCTION	1
1.1	The Project	1
1.2	Project Area Particulars	2
1.3	Purpose of this BIR	4
1.4	Scope of Works	4
1.5	Regulatory Context	5
2	STAFF QUALIFICATIONS AND INVOLVEMENT	7
2.1	Staff involvement.....	7
2.2	Qualifications.....	7
3	METHODOLOGY	8
3.1	Desktop Assessment	8
3.1.1	Databases.....	8
3.1.2	Spatial Datasets.....	8
3.1.3	Literature.....	8
3.1.4	Likelihood of Occurrence	9
3.2	Flora Surveys	10
3.2.1	Vegetation Mapping.....	10
3.2.2	BAM Plots	10
3.2.3	Quality Control.....	11
3.2.4	Targeted Flora Surveys	11
3.3	Fauna Surveys	20
3.3.1	Anabat surveys	20
3.3.2	Camera trap surveys	20
3.3.3	Elliot trap surveys	20
3.3.4	Spotlighting	21
3.3.5	Identification of diurnal bird nest trees/ Grey-headed Flying-fox roosts	21
3.3.6	Herpetofauna Census.....	21
3.3.7	Secondary Indications and Incidental Observations.....	22
3.3.8	Habitat Survey	23
3.4	Survey Dates and Weather Conditions.....	33
3.5	Limitations	36
3.5.1	Seasonality	36
3.5.2	Data Availability and Accuracy	36
4	RESULTS.....	37
4.1	Desktop Assessment	37
4.1.1	Database Interrogation	37
4.1.2	Literature Review	38
4.1.3	Spatial Datasets.....	38
4.1.4	Candidate Species Survey Matrix – BAM Calculator	39
4.1.5	Survey adequacy	41
4.2	Vegetation Cover	43
4.2.1	Plant Community Types (PCTs)	43
4.3	Flora Surveys	56
4.3.1	Threatened Flora	56
4.3.2	Weeds.....	56
4.4	Fauna Surveys	58
4.4.1	Targeted Herpetofauna Census	58
4.4.2	Habitat Values.....	58
5	IMPACT ASSESSMENT	64

REPORT

5.1	NSW State Groundwater Dependant Ecosystems	64
5.2	Coastal Management State Environmental Planning Policy 2018.....	64
5.3	Environmental Protection and Biodiversity Conservation Act 1999.....	66
5.3.1	Listed Migratory Species	66
5.3.2	Listed Threatened Species	66
5.3.3	Threatened Ecological Communities	67
6	CONCLUSIONS AND RECOMMENDATIONS	68
6.1	State Requirements (BC Act).....	68
6.2	Commonwealth Requirements (EPBC Act)	68
7	REFERENCES	70

Tables

Table 1-1	Relevant Legislation, Policy and Guidelines	5
Table 3-1	Likelihood of Occurrence criteria.....	9
Table 3-2	Application of BCD's targeted flora survey guidelines	13
Table 3-2	Rainfall during amphibian surveys	22
Table 3-4	Application of BCD's targeted fauna survey guidelines to surveys for mammals.....	24
Table 3-5	Application of BCD's targeted fauna survey guidelines to surveys for hollow-dependant day-flying birds	31
Table 3-3	Weather conditions during survey period.....	34
Table 4-1	Threatened Species with 'moderate' or greater likelihood of occurrence	37
Table 4-2	Previously detected threatened species	38
Table 4-3	Candidate species list and survey timing for PCT 1528, 1556, 1568 and 1573	39
Table 4-4	PCTs and condition classes within the Project Area	43
Table 4-5	Weeds detected within the Project Area and their management requirements.....	56
Table 4-6	Threatened fauna detected	58
Table 4-7	Hollow-bearing trees recorded within 100 m of predicted ponding areas.....	59
Table 4-8	Caves recorded within 100 m of predicted ponding areas.....	59
Table 5-1	Migratory birds listed under EPBC Act.....	66

Plates

Plate 3-1	Pooling of water during frog survey on 26 October 2020	22
Plate 4-1	Jackwood - Lilly Pilly - Sassafras riparian warm temperate rainforest of the Central Coast	46
Plate 4-2	Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast	48
Plate 4-3	Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast (Moderate condition)	50
Plate 4-4	Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment (Moderate condition)	52
Plate 4-5	Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast.....	54
Plate 4-6	Cleared/ Disturbed Land	55

Figures

Figure 1-1	Project Area Location	3
Figure 3-1	Target Flora Searches for <i>Corybas dowlingii</i> (Red Helmet Orchid); <i>Cynanchum elegans</i> (White-flower Wax Plant) and <i>Melaleuca groveana</i> (Grove's Paperbark)	16

REPORT

Figure 3-2	Target Flora Searches for <i>Melaleuca biconvexa</i> (Biconvex Paperbark).....	17
Figure 3-3	Target Flora Searches for <i>Rhodamnia rubescens</i> (Scrub Turpentine).....	18
Figure 3-4	Target Flora Searches for <i>Rhodomyrtus psidioides</i> (Native Guava)	19
Figure 3-5	Fauna survey effort for <i>Macropus parma</i> (Parma Wallaby) and <i>Phascolarctos cinereus</i> (Koala).....	28
Figure 3-6	Fauna survey effort for <i>Petrogale penicillata</i> (Brush-tailed Rock-wallaby)	29
Figure 3-7	Fauna survey effort for <i>Potorous tridactylus</i> (Long-nosed Potoroo)	30
Figure 3-8	Fauna survey effort for <i>Calyptorhynchus lathamii</i> (Glossy Black-Cockatoo)	32
Figure 4-1	Plot locations and vegetation communities	44
Figure 4-2	Threatened flora recorded.....	57
Figure 4-3	Threatened/ migratory fauna recorded	61
Figure 4-4	Habitat trees recorded.....	62
Figure 4-5	Caves recorded	63
Figure 5-1	Groundwater Dependent Ecosystems (BOM 2021b).....	65

Appendices

Appendix A	Staff Qualifications
Appendix B	EPBC Act Protected Matters Search
Appendix C	Likelihood of Occurrence
Appendix D	BAM Plot Photographs
Appendix E	BAM Plot Data
Appendix F	Flora list
Appendix G	Fauna List
Appendix H	Anabat data analysis
Appendix I	Cave survey
Appendix J	EPBC Act: Assessment of Significance

1 INTRODUCTION

RPS Australia East Pty Ltd (RPS) was engaged by Centennial Coal (the proponent) to prepare this Biodiversity Inventory Report (BIR) as supporting documentation for an application to modify State Significant Development (SSD) - 5144 (Modification 10 or MOD 10) by including the development of Longwall (LW) 34 (herein referred to as the 'Project').

This BIR documents the survey methods used to investigate the biodiversity values of the Project Area and the results associated with these investigations. This involves reporting results from relevant surveys, undertaken in adjacent, contiguous bushland that is connected to the Project Area, to inform on the biodiversity values relevant to the Project.

This BIR is a supporting document to the Biodiversity Development Assessment Report (BDAR); a mandatory assessment requirement for Major Projects prepared in accordance with relevant sections of the NSW *Biodiversity Conservation Act 2016* (BC Act). For this purpose, flora and fauna surveys performed within the Project Area were undertaken in a manner to comply with the Biodiversity Assessment Method (BAM; State of NSW 2020). The BIR also assesses matters not addressed in the BDAR, including the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and relevant State Environmental Planning Policies (SEPPs).

The following terms are used in this document:

- **Project** – Modification to Mandalong Mine SSD-5144 for the addition of LW34 (MOD 10);
- **Project Area** – Land within the angle-of-draw (i.e. angle between the goaf and the point on the ground surface to which subsidence is expected to occur; AOD);
- **Assessment Area** – Land within a 1500 m buffer from the outer extent of the Project Area; and
- **Local Area** or **Locality** – Land within 10 km of the Project Area.

1.1 The Project

Mandalong Mine (Mandalong) is an existing underground coal mine near Morisset, approximately 35 kilometres (km) south-west of Newcastle, predominantly in the Lake Macquarie local government area (LGA) (**Figure 1-1**). Mandalong is operated by Centennial Mandalong Pty Limited (Centennial Mandalong).

Centennial Mandalong has approval to extract run-of-mine (ROM) coal from the West Wallarah and Wallarah-Great Northern seams using a combination of longwall and continuous mining methods. Mandalong operates under State significant development (SSD) consent SSD-5144, which was granted on 12 October 2015 by the NSW Planning Assessment Commission under Part 4, Division 4.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

As identified in Mandalong's *Mining Operations Plan* (MOP) (Centennial Coal 2018), the progression of underground mining is regularly reviewed dependent on ongoing monitoring and geological conditions. Centennial Mandalong recently encountered poor geological conditions within the Mandalong Southern Extension Area, including a fault zone and igneous sill.

In response to these conditions and in order to maintain coal production, improve mining conditions and improve the financial viability of Mandalong, amendments to the approved mine plan were sought as part of a modification to SSD-5144 (herein referred to as MOD 9). As part of MOD 9, Centennial Mandalong sought approval to amend the approved mine plan, including the reorientation of LW30-LW33.

Since the approval of MOD 9 in April 2021, Centennial Mandalong has continued to review the progression of underground mining within the Mandalong Southern Extension Area. As a result of these investigations, the decision has been made to shorten LW30 and remove LW33 from the mine plan. The shortening of LW30 and removal of LW33 are estimated to result in the sterilisation of approximately 0.4 million tonnes (Mt) and 1.6 Mt of coal, respectively. Consequently, Centennial Mandalong has explored options to optimise the mine plan to access additional coal resources.

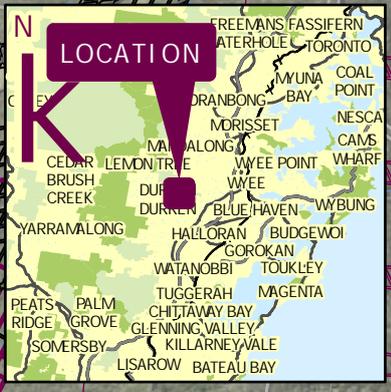
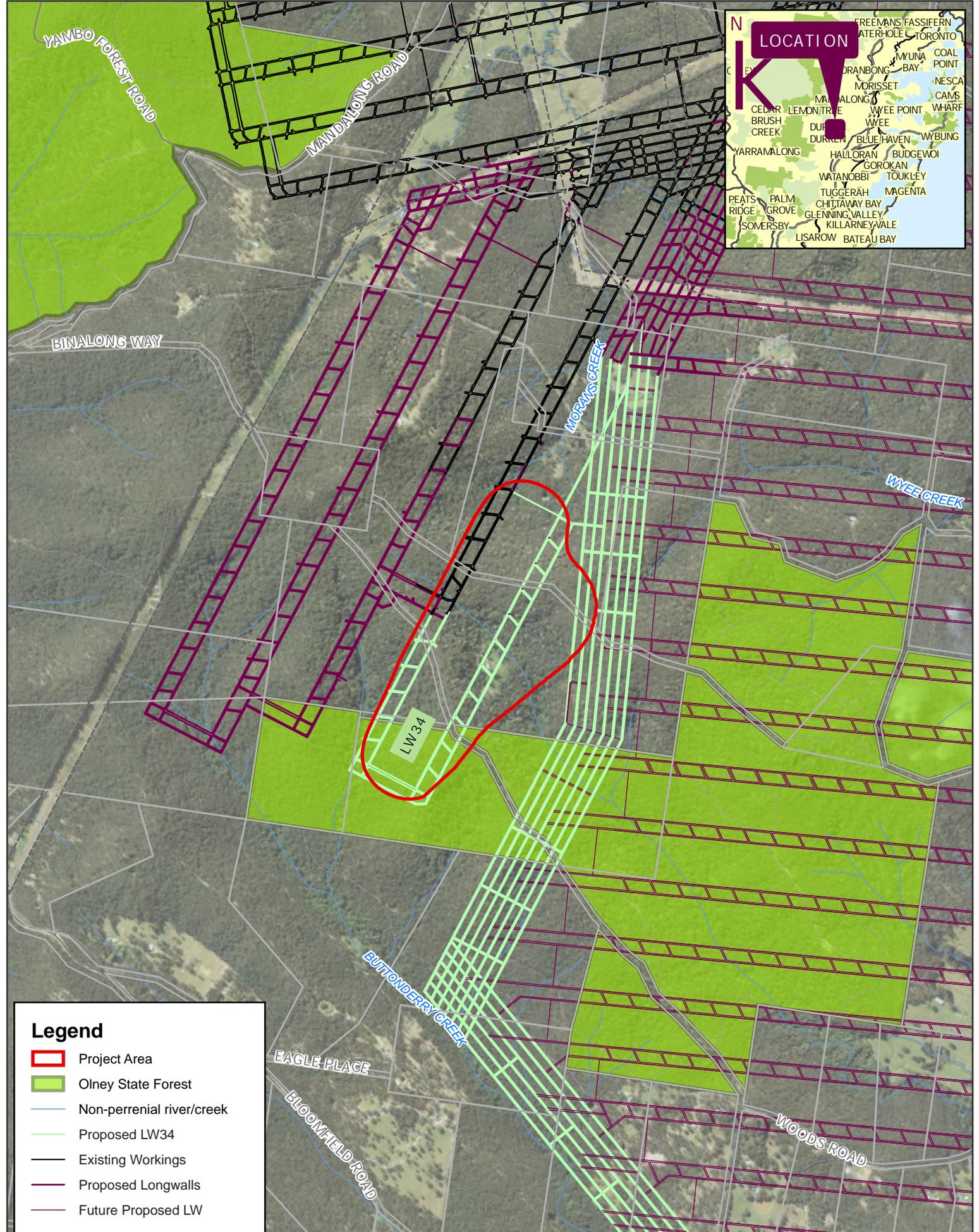
Centennial Mandalong is seeking to modify SSD-5144, pursuant to Section 4.55(2) of the EP&A Act, to change Mandalong's approved mine plan to include LW34 (herein referred to as MOD 10 or the proposed modification). The addition of LW34 will maximise resource extraction within the West Wallarah Seam and

REPORT

Mandalong's development consent boundary and improve the continuity of coal extraction and employment at Mandalong. Two updates to Appendix 8 of SSD-5144 are also proposed.

1.2 Project Area Particulars

Locality:	Mandalong, NSW
LGA:	Lake Macquarie City Council (LMCC) and Central Coast Council (CCC)
Lot/DP:	Lot 114 DP755238; Lot 122 DP755238; Lot 502 DP730395; Lot 2 DP805044; Lot 145 DP755238; Lot 3 DP805044; and Lot 115 DP755238.
Project Area:	Footprint of the Project Area is approximately 52.17 ha. The location of the Project Area is shown in Figure 1-1 .
Boundaries:	The Project Area is predominantly surrounded by vegetated lands in all directions on private land and State Forest.
Zoning:	Under the provisions of the LMCC and CCC Local Environment Plans (LEPs), the Project Area is zoned as E2 Environmental Conservation and E3 Environmental Management and RU3 Forestry. Other land uses within the Assessment Area are RU1 Primary Production, RE1 Public Recreation and RU2 Rural Landscape.
Current Land Use:	Bushland makes up most of the Project Area. Other land uses tributaries of Morans, Mannering and Buttonderry creeks; local roads (including Toepfers Road and Kiar Ridge Road); private dwellings, ancillary buildings, fences and driveways; and Aboriginal cultural and historic heritage sites.
Topography:	Project Area is dominated by undulating coastal hills ranging up to 210 m Above Sea Level (ASL) down to Buttonderry creek at approximately 50 m ASL. The land contains numerous watercourses, many of which are ephemeral, low order tributaries. The topography within the Project Area has been altered by local roads, earthworks associated with private properties and past state forestry activities.



Legend

- Project Area
- Olney State Forest
- Non-perennial river/creek
- Proposed LW34
- Existing Workings
- Proposed Longwalls
- Future Proposed LW

**FIGURE 1-1
PROJECT AREA**

VERSION:
A
DATE EXPORTED:
24/08/2021 2:37 PM
TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong

DATA SOURCES
Centennial, RPS, © Department of Finance, Services & Innovation 2018



SCALE 1:17,500 AT A4 SIZE
SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
PROJ: 149823
PURPOSE: BIR

IMPORTANT NOTE
1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overlay plan. This plan is strictly limited to the Purpose and does not apply directly or indirectly and will not be used for any other purpose, in whole or in part. The plan is provided without the responsibility of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to a Third Party publishing, using or relying on the plan.

3. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreliable.

4. Any inaccuracies or other faults with information or data sourced from a Third Party.

5. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate.

6. The Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd.

7. RPS Australia East Pty Ltd with any local authority against the recommendation of RPS Australia East Pty Ltd.

8. The accuracy, reliability, suitability or completeness of any representations or statements made or referred to by RPS Australia East Pty Ltd in this plan.



1.3 Purpose of this BIR

The purpose of this BIR is to describe the biodiversity values of the Project Area as a basis for assessing the impacts of the Project as per the requirement to do so under Section 1.7 of the EP&A Act. This BIR has focused on threatened biodiversity listed under the BC Act and EPBC Act to allow for the preparation of the following assessments:

- Biodiversity Development Assessment Report (BDAR) as required for proposed development that is likely to significantly affect threatened species (Section 7.7 of the BC Act); and
- *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (DoE 2013), specifically for listings under Section 18 and 18A of the EPBC Act.

In relation to the above, the BIR is focused on evaluating the likelihood of occurrence and incidence of threatened biodiversity (i.e. threatened species, populations, ecological communities) listed under the BC Act and/or EPBC Act using methods and guidance specified in the BAM and Project brief. In addition, this BIR provides information that will support the assessment of impact to relevant Matters of National Environmental Significance (MNES) listed under the EPBC Act. MNES relevant to this report are those listed under Sections 178, 181, 183 and 209 (threatened species, ecological communities, threatening processes and migratory species), as amended on 14/12/2020.

The following documents and guidelines have been considered when preparing the BIR:

- Threatened Species Assessment Guidelines (DPIE);
- NSW State Groundwater Dependent Ecosystem Policy (NOW);
- Risk Assessment Guidelines for Groundwater Dependent Ecosystems (NOW);
- State Environmental Planning Policy (SEPP) Koala Habitat Protection 2021;
- State Environmental Planning Policy (Koala Habitat Protection) 2021;
- Coastal Management SEPP; and
- *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (DoE 2013).

The BIR will also have regard for survey methodologies prescribed in various State and Commonwealth guidelines if deemed relevant to this stage of the Project.

1.4 Scope of Works

The scope of this BIR is to:

- Identify vascular plant species occurring within the Project Area, including any threatened species listed under the BC Act or EPBC Act;
- Identify and map the extent of vegetation communities and Plant Community Types (PCTs) within the Project Area, including any Threatened Ecological Communities (TECs) listed under the BC Act and/or EPBC Act;
- Identify any fauna species, including threatened and migratory species, and populations or their habitats, which occur within the Project Area and are known to occur in the wider locality;
- Report datasets necessary for performing computations in the online BAM Calculator (BAM-C);
- Assess the likely impact of the Project on threatened biodiversity listed under the EPBC Act that are relevant to the Project; and
- Consider relevance of local environmental legislation, including relevant SEPPs.

Information presented in this BIR is to be used to inform the preparation of the corresponding BDAR for the Project.

1.5 Regulatory Context

The Project is a modification under Section 4.55(2) of the EP&A Act to an existing SSD consent SSD-5144 for the Mandalong Mine granted on 12 October 2015. As the Project is a modification to an SSD, the BAM is mandatory. The regulatory context that defines the assessment framework for the Project is outlined in **Table 1-1**.

Table 1-1 Relevant Legislation, Policy and Guidelines

Legislation, Policy and Guidelines	Comment
State	
Biodiversity Assessment Method (BAM 2020)	The NSW Biodiversity Assessment Method (BAM) is part of the Biodiversity Offsets Scheme (BOS). The BAM outlines how to assess changes in native vegetation, threatened species and their habitats. BAM provides the number and class of biodiversity credits that need to be offset to achieve 'no net loss' of biodiversity.
<i>Biodiversity Conservation Act 2016</i>	Provides lists of species, populations and ecological communities with a legal threatened status in NSW. Introduces the Biodiversity Offsets Scheme (BOS) and <i>Biodiversity Assessment Method Order 2017 (BAM)</i> . Threatened species, ecological communities and their habitats impacted by Projects determined under Part 5 of the EP&A Act are assessed in accordance with the 'Test of Significance' as prescribed in Section 7.3 of the BC Act.
<i>Biosecurity Act 2015</i>	Prescribes the statutory requirements for managing pests, diseases, weeds and contaminants in NSW. Applies to construction activities and occupation of the Project Area.
<i>Environmental Planning and Assessment Act 1979</i>	The Project is being assessed under Part 4 of the EP&A Act. Section 1.7 of the EP&A Act requires consideration of Part 7 of the BC Act.
State Environmental Planning Policy (Koala Habitat Protection) 2020	State Environmental Planning Policy (Koala Habitat Protection) 2020 applies to the LMCC portion of the Project Area. SEPP (Koala Protection) 2020 repeals and replaces the State Environmental Planning Policy (SEPP) (Koala Habitat Protection) 2019. The Koala Habitat Protection SEPP is closely aligned with the previous SEPP 44 – Koala Habitat Protection (SEPP 44). with similar definitions of 'potential' and 'core' koala habitat. SEPP (Koala Habitat Protection) 2021 applies to the CCC portion of the Project Area. Note that this SEPP does not apply to SSDs and so has not been addressed here.
State Environmental Planning Policy Koala Habitat Protection 2021	The Koala SEPP 2021 reinstates the policy framework of SEPP Koala Habitat Protection 2019 to 83 Local Government Areas (LGA) in NSW, which includes CCC. For CCC, Koala SEPP 2021 applies to all zones. Note that this SEPP does not apply to SSDs and so has not been addressed here.
Coastal Management SEPP (2018)	The Coastal Management SEPP sets the land use planning framework for coastal management and ensures implementation of the planning objectives of the Coastal Management Act 2016. This policy repeals and consolidates SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection).
<i>National Parks and Wildlife Act 1974</i>	The intent of the <i>National Parks and Wildlife Act 1974</i> is to conserve NSW's natural and cultural heritage; fostering public appreciation, understanding and enjoyment of the State's natural and cultural heritage; and managing any lands reserved for the purposes of conserving and fostering public appreciation and enjoyment of the State's natural and/or cultural heritage. Under this act, any impacts on the conservation reserve network, including National Parks, state conservation areas, karst conservation reserves, nature reserves and regional parks, need to be considered.
<i>Fisheries Management Act 1994</i>	Provides lists of species, populations and ecological communities with a legal threatened status in NSW. One of the objectives of this act is to 'conserve key fish habitats'.

REPORT

Legislation, Policy and Guidelines	Comment
Commonwealth	
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	Provides lists of MNES such as threatened species, ecological communities, threatening processes and migratory species (Sections 178, 181, 183 and 209 respectively). Outlines circumstances where a Proponent is required to refer a proposed action for assessment under the EPBC Act (i.e. Section 68).
<i>Significant Impact Guidelines 1.1 – Matters of National Environmental Significance</i>	These significant impact guidelines aid in determining if a proposed action is likely to have a significant impact on a MNES. Consideration of survey methods for specific MNES required where potential impacts are identified.

2 STAFF QUALIFICATIONS AND INVOLVEMENT

2.1 Staff involvement

The preparation of this BIR and associated BDAR was managed and issued for approval by Dr Hayden Beck (Accredited BAM Assessor – BAAS19000). The report was reviewed by Mark Aitkens (Accredited BAM Assessor BAAS17034).

Fieldwork was undertaken by Dan Creevey, Hayden Beck, Rhys Corrigan, Tara Boreham and John Hembra.

2.2 Qualifications

Academic qualifications and professional experience of key RPS staff involved in the documentation are provided in **Appendix A**.

3 METHODOLOGY

Investigation methods, including desktop information sources and survey methods, are detailed in the following sections.

3.1 Desktop Assessment

3.1.1 Databases

Relevant information was reviewed to gain an understanding of the biodiversity values occurring or potentially occurring within the Project Area. Information sources reviewed within 10 km of the Project Area (i.e. locality) were:

- BAM-C candidate species output (BAM-C; accessed June 2021);
- Flora and Fauna records contained in NSW BioNet Atlas (DPIE 2021a; accessed June 2021); and
- Flora and Fauna records contained in the EPBC Act Protected Matters Search tool (DAWE 2021a; accessed June 2021; **Appendix B**).

A preliminary LoO was produced from this information to provide a framework for determining investigation methods necessary for performing adequate site investigations.

3.1.2 Spatial Datasets

Desktop analysis of vegetation cover including a review of the resources listed below:

- Lake Macquarie Native Vegetation Community Mapping (Bell and Driscoll 2016a; Bell and Driscoll 2016b; Bell 2016c);
- Natural Vegetation of the Wyong Local Government Area (Bell 2002);
- Mitchell Landscapes (NPWS 2003a);
- IBRA Region and subregion mapping (IBRA7); and
- Recent aerial imagery of the Project Area.

3.1.3 Literature

Previous reports that considered the occurrence of threatened species or ecological communities within the Project Area and or Locality were reviewed. These information sources included:

- RPS (2013) Mandalong Southern Extension Project;
- RPS (2016) Mandalong Transmission Line TL24 Relocation Project;
- RPS (2018a) Mandalong 33kv Transmission Easement BDAR and BIR;
- RPS (2019a) Mandalong Mine Substation BDAR and BIR;
- RPS (2018b, 2019b and 2020a) Mandalong LW22-29 annual ecological monitoring;
- RPS (2019c and 2020b) Mandalong LW30-33 Baseline data collection; and
- RPS (2020c) Mandalong MOD 10 Version 1 Ecological Surveys.

Commercially available aerial imagery, regional mapping and literature was also explored to identify areas of potential biodiversity value in the Project Area. Information sources included:

- Aerial Photograph Interpretation (API) to prepare preliminary vegetation mapping for the Project Area;
- Bell S.A. (2002) The natural vegetation of the Wyong Local Government Area, Central Coast, New South Wales: Technical Report. Unpublished Final Report to Wyong Shire Council, August 2002. East Coast Flora Survey;

REPORT

- Bell S. A. (2016) Conversion Lake Macquarie Native Vegetation Community Map Units to Plant Community Types (PCTs) March 2016. Accessed October 2020 <https://lakemac.com.au/page.aspx?pid=109&vid=25&fid=138&ftype=FGGrp>
- Bell S. A. and Driscoll C (2016a) Volume 1: Vegetation Mapping Report, Lake Macquarie Local Government Area Stages 1 – 6. Unpublished report prepared by East Coast Flora Survey for Lake Macquarie City Council <https://www.lakemac.com.au/files/assets/public/development/native-vegetation-community-map-report.pdf>
- Bell S. A. and Driscoll C (2016b) Volume 2: Vegetation Community Profiles, Lake Macquarie Local Government Area. Unpublished report prepared by East Coast Flora Survey for Lake Macquarie City Council <https://www.lakemac.com.au/files/assets/public/development/native-vegetation-community-profiles.pdf>
- Department of Land and Water Conservation (2002) NSW State Groundwater Dependent Ecosystem Policy;
- Eamus D. (2009) Identifying groundwater dependent ecosystems, A guide for land and water managers. Australian Government – Land and Water Australia;
- LMCC (2015) Lake Macquarie Native Vegetation and Corridors Map;
- NPWS (2003b) Lower Hunter and Central Coast Regional Environment Management Strategy Vegetation Survey, Classification and Mapping; Lower Hunter and Central Coast Region (LHCCREMS);
- A review of Geographic Information System (GIS) data including (but not limited to) aerial photography, topographic maps, SEPP 14 Wetland Mapping, Soil Landscapes and Acid Sulphate Soil Potential; and
- Collective knowledge gained within the RPS team from extensive fieldwork throughout the Mandalong South Extension Area.

3.1.4 Likelihood of Occurrence

A list of threatened species, populations and ecological communities (collectively referred to as ‘threatened biodiversity’) identified as potentially occurring in the Project Area was compiled through a Likelihood of Occurrence Analysis (LoO; **Appendix C**). Criteria the LoO was assessed is provided in **Table 3-1**.

Table 3-1 Likelihood of Occurrence criteria

Likelihood	Description
None	Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Study Area. The Study Area is also likely located outside the species known ‘area of occurrence’ and may also occur outside the species ‘extent of occurrence’ [i.e. standard grid size of 2x2 km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Low	Vegetation classification-based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Study Area is likely to be located outside the species known ‘area of occurrence’ but may be within the known ‘extent of occurrence’ [i.e. standard grid size of 2x2 km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs.
Moderate	Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Study Area. The Study Area may or may not be located within the species known ‘area of occurrence’ but is within the known ‘extent of occurrence’ [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy.
High	Habitat values within the Study Area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known ‘extent of occurrence’ and ‘area of occurrence’ [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-

REPORT

Likelihood	Description
	existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy.
Known	Species observed and habitat values within the Study Area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs).

A preliminary LoO was performed prior to field surveys to guide investigation methods and effort. This was subsequently refined following the completion of field surveys.

As per BAM 2020, it was considered that a Candidate Species may only be dismissed from requiring survey when:

- presence is assumed;
- an expert report is prepared; or
- more appropriate local data is gained.

3.2 Flora Surveys

Flora surveys were conducted in accordance with the BAM, with the aim to identify the vegetation communities and quantify their integrity within the Project Area.

3.2.1 Vegetation Mapping

The Lake Macquarie Vegetation Community Mapping (Bell and Driscoll 2016a) and the Natural Vegetation of the Wyong Local Government Area Vegetation Community Mapping (Bell 2002) were consulted to construct a preliminary map of vegetation communities within the Project Area. Bell and Driscoll (2016a and b) and Bell (2002) were then used to update this vegetation map, following revision of the latest aerial photography (e.g. Google Earth™ 2020) prior to field surveys. Plant Community Types (PCTs) were assigned using the conversion table (i.e. prescribing PCTs to previously classified Mapping Units) by Bell (2016). Updates also included the assigning of notional condition classes, based on observed areas of differing vegetation condition within aerial photographs. Following field surveys, which ground-truthed the vegetation types and condition zones using Rapid Data Points (RDPs).

Data collected at each RDP used to map various important habitat features included:

- Tree and dominant understory species within a 10 m radius of the RDP including OEH (2017) diameter at breast height (DBH) classes; and
- Weed cover (measured as projected foliage cover).

Following the refinement of the vegetation map following this initial fieldwork, the PCT extents were calculated using Geographic Information System (GIS; ArcGIS™) to inform the minimum number of BAM plots required.

3.2.2 BAM Plots

Seventeen BAM plots were performed within the Project Area, measuring the composition, structure and functional components of the vegetation cover. The BAM plots were placed locations that best represented the vegetation zone being assessed. The locations of BAM plots in context to the revised vegetation mapping is provided in **Section 4.2**.

Data recorded in each plot included:

- One standard 20 x 20 m plot, to assess the composition and structure attributes, including trees, shrubs, grasses, forbs, ferns and other growth forms;
- One standard 20 x 50 m plot (1000 m²) to assess the function attributes: number of large trees [i.e. > 50 cm Diameter at breast height (DBH)], stem size class, tree regeneration, length of fallen logs, high threat exotic vegetation cover and hollow-bearing trees; and

REPORT

- Five 1 m² sub-plots to assess average litter cover for the plots.

The methods for collecting data from within a BAM plot are described in State of NSW (2020).

Note: due to design changes for MOD 10, there were changes in the extent of the Project Area, and so some plots undertaken fall outside the finalised Project Area. Nevertheless, these plots were considered representative of their respective Vegetation Zones within the Project Area, as they were consistent PCTs and condition states, whilst belonged to the same tract of contiguous vegetation.

3.2.3 Quality Control

To ensure the floristic data collected were reliable, all BAM plots were undertaken by teams of two ecologists, with an in-depth understanding of native vegetation within the Central Coast region. Where there was uncertainty identifying a species, a specimen (i.e. leaves, buds, fruit and or flowers) were collected and later identified using relevant guides and keys (including PlantNET; National Herbarium of NSW 2021). In cases where further resolution was required, samples were sent to the National Herbarium of NSW for identification.

When estimating vegetation cover and abundance, these variables were independently assessed by the two observers. If a disparity occurred, the observers discussed the value in question until an agreement was reached to control for observer bias.

As a further quality control measure, RPS senior staff conducted training sessions and routinely checked floristic, cover and abundance data collected within BAM plots for accuracy. All data electronically entered are also subject to internal quality control audits.

3.2.4 Targeted Flora Surveys

Direct impacts from the Project on biodiversity were considered those potentially associated with increased ponding due to predicted subsidence from longwall mining; as modelled by Umwelt (2021). In the case that subsidence increases ponding within the Project Area, habitats may be altered by expanding areas of inundation or water logging. This has potential to impact threatened species by inundating their habitat in areas within low-lying depressions, often nearby areas currently subject to pooled water during periods of prolonged rainfall. Hence, surveys focused primarily on riparian areas due to the potential for ponding-related impacts associated with subsidence resulting from the Project.

Targeted flora searches were conducted with the aim of locating threatened flora species identified as Candidate Species (Species credits; BC Act) or those having moderate or greater likelihood of occurrence within the targeted survey area of the Project Area. Specific emphasis was given to those threatened plants that may occur in riparian areas, due to their potential to be impacted by ponding. Targeted searches were conducted by teams of two Ecologists, using parallel transects. Surveys were performed with reference to the methods, timing and effort provided by DPIE (2020a). The locations and timing of the targeted flora searches are shown on **Figure 3-1** [for *Corybas dowlingii* (Red Helmet Orchid); *Cynanchum elegans* (White-flower Wax Plant) and *Melaleuca groveana* (Grove's Paperbark)]; **Figure 3-2** for *Melaleuca biconvexa* (Biconvex Paperbark); **Figure 3-3** for *Rhodamnia rubescens* (Scrub Turpentine) and **Figure 3-4** for *Rhodomyrtus psidioides* (Native Guava). These species were grouped together as they share common associated PCTs in the Project Area.

Note that the GPS tracks displayed are representative of the effort and subject to spatial inaccuracy due to tree canopy interference/ satellite connectivity and device limitations. Steep and rocky terrain and dense lantana thickets along riparian areas constrained spacing of parallel transects in some locations. All efforts were made to achieve this targeted survey spacing, however safety of staff is a priority for RPS and no unnecessary risks were taken. Where surveys deviated from the targeted spacing due to safety concerns, these unsafe areas were observed from a distance, as per DPIE (2020).

Table 3-2 demonstrates how the targeted flora survey meets BCD's targeted flora survey guidelines (DPIE 2020).

3.2.4.1 Multi-species survey

Multi-species surveys were undertaken. In any survey effort, no more than five species in the same stratum were searched for simultaneously, given the maximum target species surveyed for in the same stratum (i.e. trees) was three.

REPORT

Table 3-2 Application of BCD’s targeted flora survey guidelines

Species (Common name)	BC Act	EPBC Act	Associated PCT/s within Project Area	Total area of suitable habitat in Project Area (ha)	Total area of suitable habitat in Impact Area (ha)	Survey months (as per BAM-C)	Dates of targeted survey	Targeted transect spacing ^{2, 3}	Any additional survey requirements	Notes regarding vegetation condition	Survey guideline met (Y/N)
<i>Corybas dowlingii</i> Red Helmet Orchid ¹	E	-	1568	7.20	0.00031	June; July	15 June 21; 16 June 21; 17 June 21; 18 June 21.	5-10 m focused within riparian area (where impact is predicted). Note that more intensive searches were made once patches of <i>Corybas/ Acianthus</i> spp. (similar leaf morphology) were encountered.	Requires flowering material to positively identify the species. Use a local reference population to refine survey timing (i.e. when known local population is in flower); flowers between Jun - Jul. May require multiple surveys to detect (i.e. survey in June, if not found survey again in July)	No prolonged drought or an extreme stochastic disturbance event	Y
<i>Cynanchum elegans</i> White-flower Wax Plant	E	E	1568	7.20	0.00031	All year	19 May 20; 6 August 20; 6 October 20; 7 October 20; 8 October 20; 25 October 20; 27 October 20; 3 November 20; 4 November 20; 15 June 21 16 June 21; 17 June 21; 18 June 21.	5-10 m focused within riparian area (where impact is predicted).	None	No prolonged drought or an extreme stochastic disturbance event	Y
<i>Melaleuca biconvexa</i>	V	V	1573	2.48	0.000078	All year	19 May 20; 6 August 20; 6 October 20;	5-10 m focused within riparian area	None	No prolonged drought or an extreme	Y

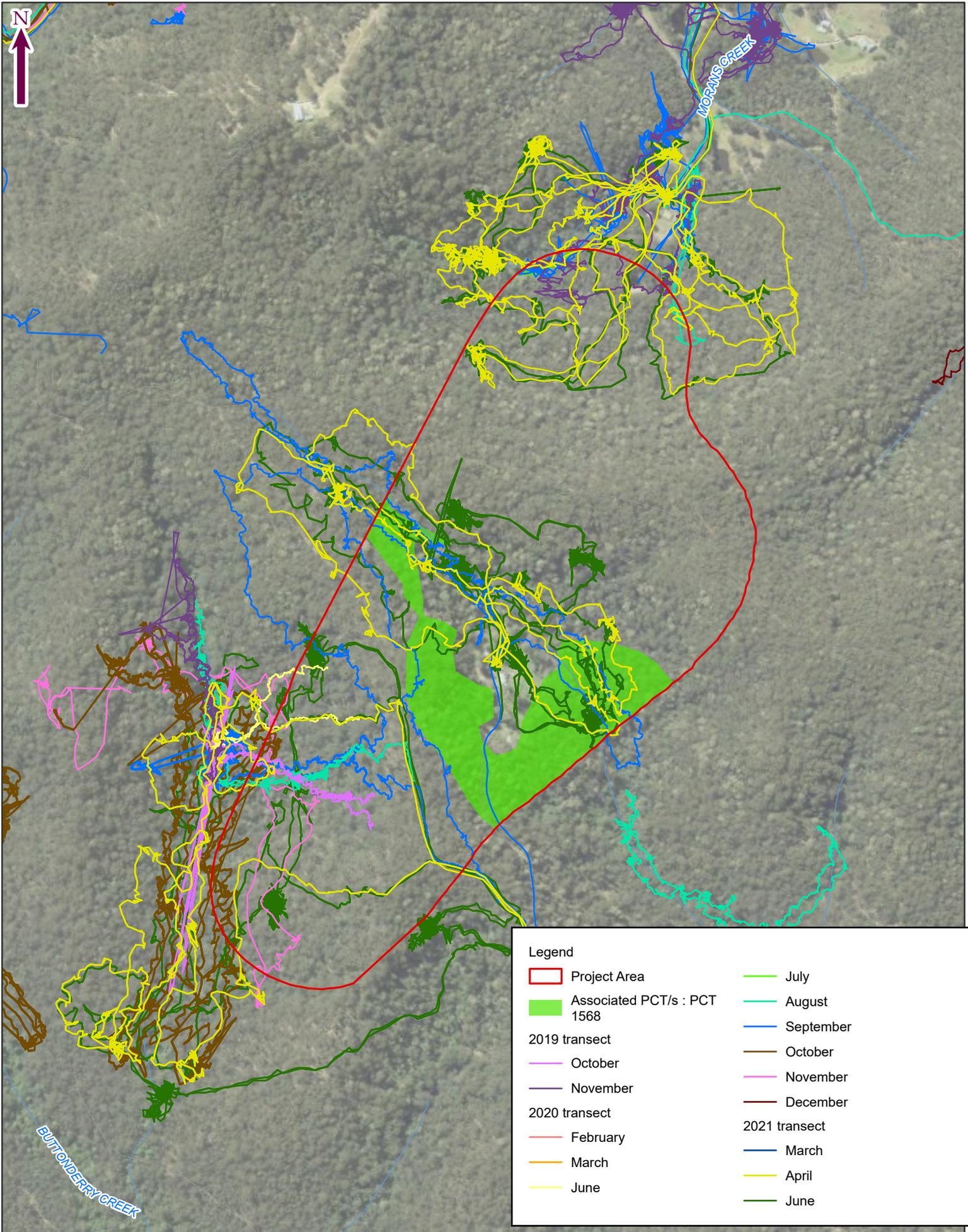
REPORT

Species (Common name)	BC Act	EPBC Act	Associated PCT/s within Project Area	Total area of suitable habitat in Project Area (ha)	Total area of suitable habitat in Impact Area (ha)	Survey months (as per BAM-C)	Dates of targeted survey	Targeted transect spacing ^{2, 3}	Any additional survey requirements	Notes regarding vegetation condition	Survey guideline met (Y/N)
Biconvex Paperbark							7 October 20; 8 October 20; 25 October 20; 27 October 20; 3 November 20; 4 November 20; 15 June 21 16 June 21; 17 June 21; 18 June 21.	(where impact is predicted).		stochastic disturbance event	
<i>Melaleuca groveana</i> Grove's Paperbark	V	-	1568	7.20	0.00031	All year	19 May 20; 6 August 20; 6 October 20; 7 October 20; 8 October 20; 25 October 20; 27 October 20; 3 November 20; 4 November 20; 15 June 21 16 June 21; 17 June 21; 18 June 21.	5-10 m focused within riparian area (where impact is predicted).	None	No prolonged drought or an extreme stochastic disturbance event	Y
<i>Rhodamnia rubescens</i> Scrub Turpentine	CE	CE	1528; 1556; 1568; 1573	34.82	0.00047	All year	19 May 20; 6 August 20; 6 October 20; 7 October 20; 8 October 20; 25 October 20;	5-10 m focused within riparian area (where impact is predicted).	None	No prolonged drought or an extreme stochastic disturbance event	Y

REPORT

Species (Common name)	BC Act	EPBC Act	Associated PCT/s within Project Area	Total area of suitable habitat in Project Area (ha)	Total area of suitable habitat in Impact Area (ha)	Survey months (as per BAM-C)	Dates of targeted survey	Targeted transect spacing ^{2, 3}	Any additional survey requirements	Notes regarding vegetation condition	Survey guideline met (Y/N)
<i>Rhodomyrtus psidioides</i> Native Guava	CE	CE	1556; 1568; 1573	34.78	0.00047	All year	27 October 20; 3 November 20; 4 November 20; 15 June 21 16 June 21; 17 June 21; 18 June 21.	5-10 m focused within riparian area (where impact is predicted).	None	No prolonged drought or an extreme stochastic disturbance event	Y

1. Species found flowering during survey timing adjacent to the Project Area. 2. Steep and rocky terrain and dense lantana thickets along riparian areas constrained spacing of parallel transects in some locations. All efforts were made to achieve this targeted survey spacing, however safety of staff is a priority for RPS and no unnecessary risks were taken. Where surveys deviated from the targeted spacing due to safety concerns, these unsafe areas were observed from a distance, as per DPIE (2020). 3. The majority of the Project Area was primarily tall open forest/ woodland according to <https://www.anbg.gov.au/cpbr/herbarium/collecting/vegetation-types.html>



Legend

 Project Area	 July
 Associated PCT/s : PCT 1568	 August
2019 transect	 September
 October	 October
 November	 November
2020 transect	 December
 February	2021 transect
 March	 March
 June	 April
	 June

FIGURE 3-1
TARGET FLORA SEARCHES FOR CORYBAS DOWLINGII (RED HELMET ORCHID); CYNANCHUM ELEGANS (WHITE-FLOWER WAX PLANT) AND MELALEUCA GROVEANA (GROVE'S PAPERBARK)

VERSION:
A
 DATE EXPORTED:
24/11/2021 5:05 PM
 TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS, © Department of Finance, Services & Innovation 2018

0 100 200 m

SCALE 1:7,500 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

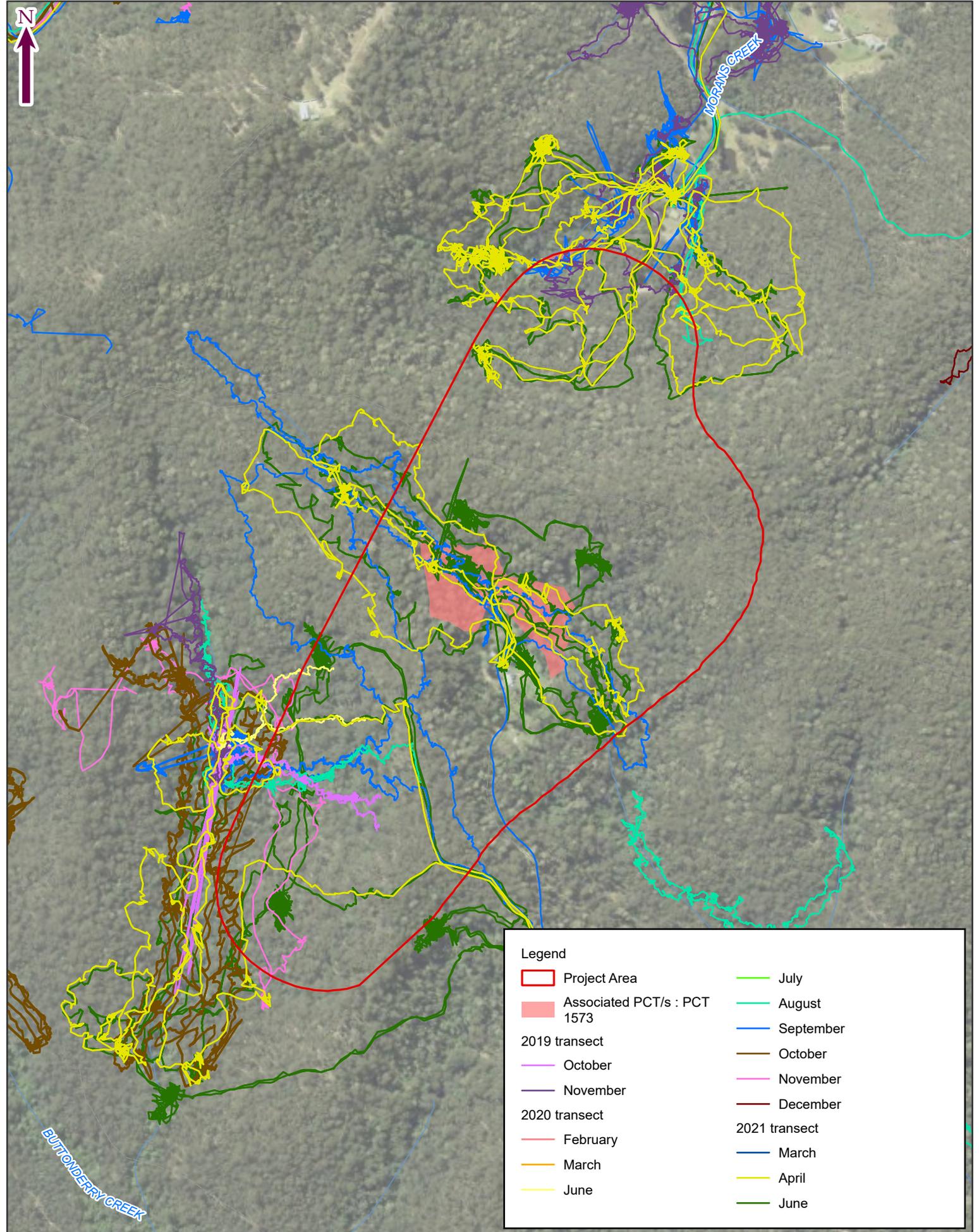
CLIENT: Centennial
 PROJ: 149823
 PURPOSE: BIR

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overview plan. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other operational purpose, site or matter. The plan is prepared without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreliable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party;

d. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 e. the Client or any Third Party not verifying information in the plan where recommended by RPS Australia East Pty Ltd.
 f. RPS Australia East Pty Ltd, in reliance on the information or data provided to it by the Client or a Third Party, where the information is incorrect, incomplete, inaccurate, out-of-date or unreliable.





Legend

Project Area	July
Associated PCT/s : PCT 1573	August
2019 transect	September
October	October
November	November
2020 transect	December
February	2021 transect
March	March
June	April
	June

FIGURE 3-2
TARGET FLORA SEARCHES FOR MELALEUCA BICONVEXA
(BICONVEX PAPERBARK)

VERSION:
A
DATE EXPORTED:
24/11/2021 5:29 PM
TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS, © Department of Finance, Services & Innovation 2018

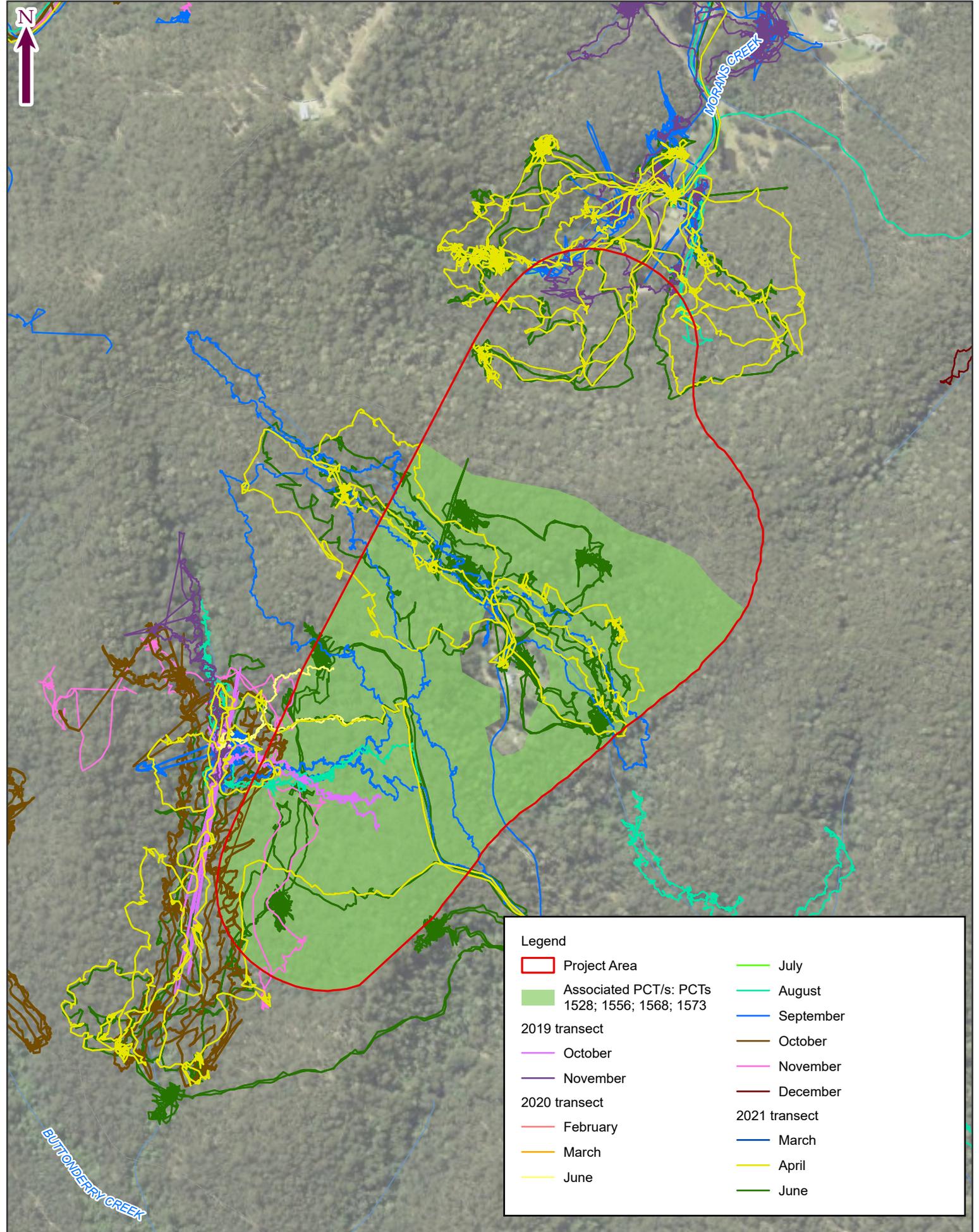


SCALE: 1:7,500 AT A4 SIZE
SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
PROJ.: 149823
PURPOSE: BIR

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic coverage plan. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other operational purpose, use or matter. The plan is provided without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. the Client or any Third Party publishing, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreliable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party;
 d. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 e. the Client or any Third Party not verifying information in the plan where recommended by RPS Australia East Pty Ltd;
 f. RPS Australia East Pty Ltd, or any local authority against the recommendations of RPS Australia East Pty Ltd;
 g. the accuracy, reliability, suitability or completeness of any approximations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.





Legend

 Project Area	— July
 Associated PCT/s: PCTs 1528; 1556; 1568; 1573	— August
2019 transect	— September
— October	— October
— November	— November
2020 transect	— December
— February	2021 transect
— March	— March
— June	— April
	— June

FIGURE 3-3
TARGET FLORA SEARCHES FOR RHODAMNIA RUBESCENS (SCRUB TURPENTINE)

VERSION:
A
DATE EXPORTED:
24/11/2021 5:27 PM
TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS, © Department of Finance, Services & Innovation 2018

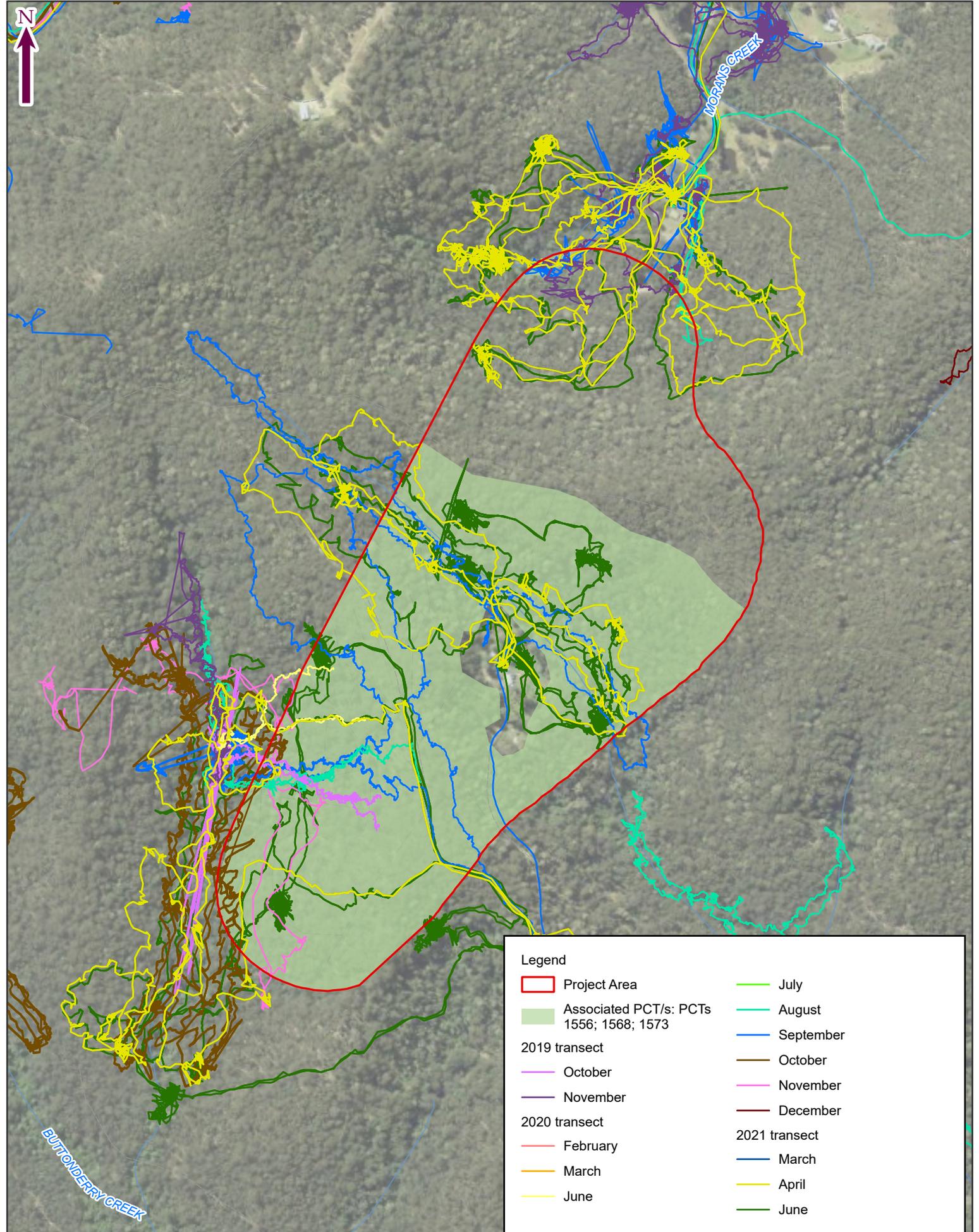


SCALE: 1:7,500 AT A4 SIZE
SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
PROJ.: 149823
PURPOSE: BIR

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic overview plan. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other operational purpose, site or matter. The plan is provided without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
 2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on this plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out of date or unreliable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party;
 d. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 e. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd.
 RPS Australia East Pty Ltd, in acknowledgement of this plan, warrants the accuracy, reliability, suitability or completeness of any representations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.





Legend

 Project Area	— July
 Associated PCT/s: PCTs 1556; 1568; 1573	— August
2019 transect	— September
— October	— October
— November	— November
2020 transect	— December
— February	2021 transect
— March	— March
— June	— April
	— June

FIGURE 3-4
TARGET FLORA SEARCHES FOR RHODOMYRTUS PSIDIROIDES (NATIVE GUAVA)

VERSION:
A
 DATE EXPORTED:
24/11/2021 5:25 PM
 TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS, © Department of Customer Service 2020



SCALE 1:7,500 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
 PROJ: 149823
 PURPOSE: BIR

IMPORTANT NOTE

1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic coverage plan. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other (operational, purpose, use or matter). The plan is prepared without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on this plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out of date or unreliable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party;

3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 d. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd.
 Acknowledgment of this plan with any local authority against the recommendations of RPS Australia East Pty Ltd, the accuracy, reliability, suitability or completeness of any representations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.

3.3 Fauna Surveys

As the Project Area is connected to contiguous bushland (and associated habitat for threatened species), previous survey efforts undertaken by RPS within five years of this report, across the Assessment and considered relevant to the Project are reported here. Nevertheless, for the purpose of this assessment, survey results pertaining to areas that may be subjected to ponding (i.e. direct impacts) were given emphasis due to implications for offsetting requirements as part of the BDAR, as per the rationale outlined in **Section 3.2.4**.

Field survey methods, timing and effort used in this investigation were guided by results from the desktop assessment (i.e. identification of threatened fauna species listed under the BC Act and/or EPBC Act that may occur within the refined survey Project Area) and initial BAM-C output.

Survey techniques performed in this investigation are outlined below. Survey locations for targeted threatened fauna (where surveys address guideline requirements) are shown in **Figure 3-5**. **Table 3-2** demonstrates how the targeted fauna survey meets BCD's targeted fauna survey guidelines (where available) for species deemed to be surveyed for adequately (i.e. candidate species not assumed present or discounted through an expert report). A summary of adequacy of survey effort, in terms of spatial and temporal representativeness against DPIE guidelines, is also provided in **Section 4.1.5**.

3.3.1 Anabat surveys

Candidate Species Targeted: Large-eared Pied Bat (*Chalinolobus dwyeri*); Little Bent-wing bat (*Miniopterus australis*); Large Bent-wing bat (*Miniopterus schreibersii oceanensis*), Southern Myotis (*Myotis macropus*) and *Vespadelus troughtoni* (Eastern Cave Bat)

Microbat echolocation calls were recorded using Anabat Express Detector units set to remotely record for the entire night inclusive of civil twilight hours (recording period based on GPS location and time of year). Units were set-up at the entrance of caves found to offer potential maternity roost habitat, as determined through cave surveys (see **Section 3.3.8.2**). In total, Anabat units were set-up for two days at six locations for two nights at each.

Bat call analysis was undertaken by Fly-by-night Bat Surveys. Each call sequence ('pass') was assigned to one of two categories, according to the confidence with which identification could be made, being:

- Pass identified to species level and could not be confused with another species; or
- Probable - Pass identified to species level and there is a low chance of confusion with another species.

Two units were established within the Project Area, with an additional four positioned nearby, in bushland adjoining the Project Area. Each unit was set for two nights.

3.3.2 Camera trap surveys

Candidate Species Targeted: *Petaurus norfolcensis* (Squirrel Glider), *Cercartetus nanus* (Eastern Pygmy-possum); *Phascogale tapoatafa* (Brush-tailed Phascogale); *Planigale maculata* (Common Planigale); and *Macropus parma* (Parma Wallaby)

Terrestrial camera traps were located at ground level to sample for ground-dwelling mammals, including small-medium mammals, such as wallabies, dasyurids (e.g. Antechinus and Dunnarts), rodents (e.g. rats and mice) and bandicoots. Feral animals were also captured using this method (e.g. wild dogs, foxes and cats). These camera traps were baited with a rolled oats mixture.

Two units were established within the Project Area, with an additional four positioned nearby, in bushland adjoining the Project Area. Each unit was set for four nights.

3.3.3 Elliot trap surveys

Candidate Species Targeted: *Petaurus norfolcensis* (Squirrel Glider), *Cercartetus nanus* (Eastern Pygmy-possum); *Phascogale tapoatafa* (Brush-tailed Phascogale)

Arboreal trapping was undertaken using tree mounted Elliott A size traps. Traps were mounted on brackets set at approximately 3 m in height on trees with a diameter at breast height (DBH) greater than 30 cm. Traps

REPORT

were baited with rolled oats, peanut butter and honey mixture, and the tree trunks were sprayed liberally with a brown sugar and water mix each day in the late afternoon. Traps were checked early the following morning. One transect, consisting of six arboreal Elliott A traps, was established adjacent to the Project Area as part of baseline surveys for LW25-29). These traps were set for four nights; totalling 24 arboreal Elliott A trap nights. All Elliott traps were all positioned in bushland adjoining the Project Area.

3.3.4 Spotlighting

Candidate Species Targeted: *Cercartetus nanus* (Eastern Pygmy-possum); *Hoplocephalus bitorquatus* (Pale-headed Snake); *Hoplocephalus stephensii* (Stephens' Banded Snake); *Macropus parma* (Parma Wallaby); *Petaurus norfolcensis* (Squirrel Glider); *Phascolarctos cinereus* (Koala); *Planigale maculata* (Common Planigale); *Potorous tridactylus* (Long-nosed Potoroo); *Pteropus poliocephalus* (Grey-headed Flying-fox); and *Turnix maculosus* (Red-backed Button-quail)

Spotlighting was undertaken using a 75-watt hand-held spotlight and head torch whilst walking across the Project Area, targeting areas of appropriate habitat. Eight evenings of spotlighting were undertaken; four that extended both within and adjacent to the Project Area, and four evenings surveys adjacent to the Project Area only. Each survey effort was undertaken over 2 to 4 hours.

3.3.5 Identification of diurnal bird nest trees/ Grey-headed Flying-fox roosts

Candidate Species Targeted: Square Tailed Kite; White-bellied Sea Eagle and Grey-headed Flying-fox

Coinciding with threatened flora survey transects (Section 3.2.4) and habitat tree surveys (Section 3.3.8.1), surveys were undertaken to detect nesting/ roosting of threatened diurnal birds and selected mammal species. During this survey effort, any nests and or utilised hollows were observed from ground-level on foot to identify nesting/ roosting activity.

3.3.6 Herpetofauna Census

Candidate Species Targeted: *Litoria littlejohni* (Littlejohn's Tree Frog), *Pseudophryne australis* (Red-crowned Toadlet), *Crinia tinnula* (Wallum Froglet), *Litoria aurea* (Green and Golden Bell Frog), *Litoria brevipalmata* (Green-thighed Frog), *Mixophyes iteratus* (Giant Barred Frog) and *Uperoleia mahonyi* (Mahony's Toadlet)

Herpetofauna (frog and reptile) searches undertaken targeting areas of appropriate habitat and focusing on areas of predicted impact (i.e. riparian areas).

Note that for the Green-Thighed Frog (*Litoria brevipalmata*), surveys are required following heavy rainfall, which is required to generate the pooling of water to instigate breeding (DECC 2009). DPIE (2020b) notes that this occurs typically when rainfall is >50 mm in 24 hrs. This criterion was met prior to surveys which were conducted on 26th October 2020, with pooling within and nearby the Project Area shown in **Plate 3-1**. **Table 3-3** shows the rainfall over the survey period.



Plate 3-1 Pooling of water during frog survey on 26 October 2020

Table 3-3 Rainfall during amphibian surveys

Date	Rainfall in 24hrs (mm)	Cumulative rainfall in 72hrs (mm)	Survey inside Project Area	Survey adjacent Project Area
21 January 2020	1.2	1.4	Yes	Yes
22 January 2020	3.4	4.6	-	Yes
25 March 2020	0	2.0	Yes	Yes
26 October 2020 ¹	62.8	101.2	-	Yes
2 November 2020	3.6	3.6	-	Yes
4 November 2020	0	3.6	Yes	Yes

1. Rainfall was sufficient to allow for a representative survey for *L. brevipalmata* (Green Thighed Frog).

3.3.7 Secondary Indications and Incidental Observations

Opportunistic sightings of secondary indications (scratches, scats, diggings, tracks etc.) of resident fauna were noted. Such indicators included:

- Distinctive scats left by mammals;
- Scratch marks made by various types of arboreal animals;
- Nests made by various guilds of birds;
- Feeding scars on Eucalyptus trees made by Gliders;
- Whitewash, regurgitation pellets and prey remains from Owls;
- Aural recognition of bird and frog calls;
- Skeletal material of vertebrate fauna; and
- Chewed *Allocasuarina* spp. cones - indicative of feeding by Glossy Black-cockatoo (*Calyptorhynchus lathamii*).

3.3.8 Habitat Survey

Habitat surveys were undertaken to assess the condition and value of habitat across the Project Area. Significant fauna habitat features, including hollow-bearing trees (HBT), hollow logs and termite nests, were identified and noted. The assessment also considered the potential value of the Project Area (and surrounds) for all major guilds of native flora and fauna.

Habitat assessments for threatened species, known to occur or likely to occur in the locality, were undertaken to identify any specific habitat requirements for threatened fauna species within the Project Area. Habitat parameters taken into consideration included: home range, feeding, roosting, breeding, movement patterns and corridor requirements. Factors considered include topography, soil, light and hydrology.

3.3.8.1 Habitat tree survey

Targeted HBT surveys were undertaken to identify the presence of potential habitat for hollow-associated threatened fauna habitat within or nearby areas predicted to be impacted by subsidence-related ponding. That is, all hollow-bearing trees within 100 m of creeklines (i.e. identified as predicted to have ponding related impacts) were marked by GPS. To allow identification of the potential habitat provided to threatened fauna, the characteristics of the hollows were also noted, including the number and size of the hollows. Surveys for nesting Glossy Black Cockatoo were undertaken in conjunction with this task.

3.3.8.2 Cave survey

To identify the potential for breeding roosts for threatened microbats, suitable cave structures were surveyed across the Project Area. Focus was given to marking up of caves located toward riparian areas, where ponding related impacts associated with mining are proposed. A desktop assessment was firstly undertaken to identify areas with potential caves; focusing on areas with steep topography and or areas marked up during an archaeological survey for potential shelter locations using by the First Nations People. These areas were then traversed on foot, with each suitable cave structure marked on GPS. The following attributes were also recorded for each cave:

- Cliff height/ slope;
- Fissures (maximum width; maximum depth; length);
- Cave/ overhang (maximum width; maximum height; length);
- Area of honeycombing;
- Presence of bat scats;
- Bat species/ numbers; and
- Signs of other species use.

REPORT

Table 3-4 Application of BCD’s targeted fauna survey guidelines to surveys for mammals

Species (Common name)	BC Act	EPBC Act	Associated PCT/s within Project Area	Habitat constraints or requirements	Total area of suitable habitat in Project Area (ha)	Total area of suitable habitat in Impact Area (ha)	Survey months (as per BAM-C)	Dates of targeted survey	Name of guidelines used and requirements	Any additional survey requirements	Notes regarding factors influencing survey	Survey guideline met (Y/N)
<i>Macropus parma</i> (Parma Wallaby) ¹	V	-	1556; 1568; 1573	-	34.75	0.00047	All year	Baited Camera traps 11 Jan 21; 12 Jan 21; 13 Jan 21; 14 Jan 21. Spotlighting 21 Jan 20; 22 Jan 20; 25 Mar 20; 26 Oct 20; 2 Nov 20; 4 Nov 20.	No BAM survey guideline for mammals. Infrared cameras installed in/near rocky outcrop areas (40 nights total). Spotlight surveys in or in contiguous vegetation adjoining Project Area (six nights).	None	Fine warm weather with no rainfall over camera trap survey period.	Y
<i>Petrogale penicillata</i> (Brush-tailed Rock-wallaby) ¹	E	V	1556; 1568 ²	Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines	32.30	0.000393	All year	Baited Camera traps 11 Jan 21; 12 Jan 21; 13 Jan 21; 14 Jan 21. Faecal pellet surveys (in conjunction with cave surveys) 3 Nov 20;	No BAM survey guideline for mammals. As per TBDC, Infrared cameras installed in/near rocky outcrop areas (40 nights total). Also consistent with this guideline were searches for faecal pellets (undertaken during cave surveys; four days). Surveys for signs of activities (e.g, scats,	Systematic faecal pellet surveys and time lapse cameras should be considered as appropriate methods of survey.	Fine warm weather with no rainfall over camera trap survey period. . See Section 3.4 for weather during other survey components.	Y

REPORT

Species (Common name)	BC Act	EPBC Act	Associated PCT/s within Project Area	Habitat constraints or requirements	Total area of suitable habitat in Project Area (ha)	Total area of suitable habitat in Impact Area (ha)	Survey months (as per BAM-C)	Dates of targeted survey	Name of guidelines used and requirements	Any additional survey requirements	Notes regarding factors influencing survey	Survey guideline met (Y/N)
<i>Phascolarctos cinereus</i> (Koala) ¹	V	V	1556; 1568; 1573	Areas identified via survey as important habitat	34.75	0.00047	All year	4 Nov 20; 5 Nov 20; 6 Nov 20. Spotlighting 21 Jan 20; 22 Jan 20; 25 Mar 20; 26 Oct 20; 2 Nov 20; 4 Nov 20.	tracks and remains) and camera traps installed around clifflines and caves is also an appropriate method of detection according to DSEWPC (2011). No BAM survey guideline for mammals. DoE (2014) survey guideline followed with daytime searches for direct and indirect (scats and scratches) made during threatened plant surveys and undertaking spotlighting surveys. Note that far more extensive surveys have been undertaken across the Mandalong Valley by RPS over more than five years of biodiversity surveys for several annual monitoring	None	Fine warm weather with no rainfall over camera trap survey period. See Section 3.4 for weather during other survey components (note that daytime searches were undertaken in conjunction with threatened flora/hollow-bearing tree surveys).	Y

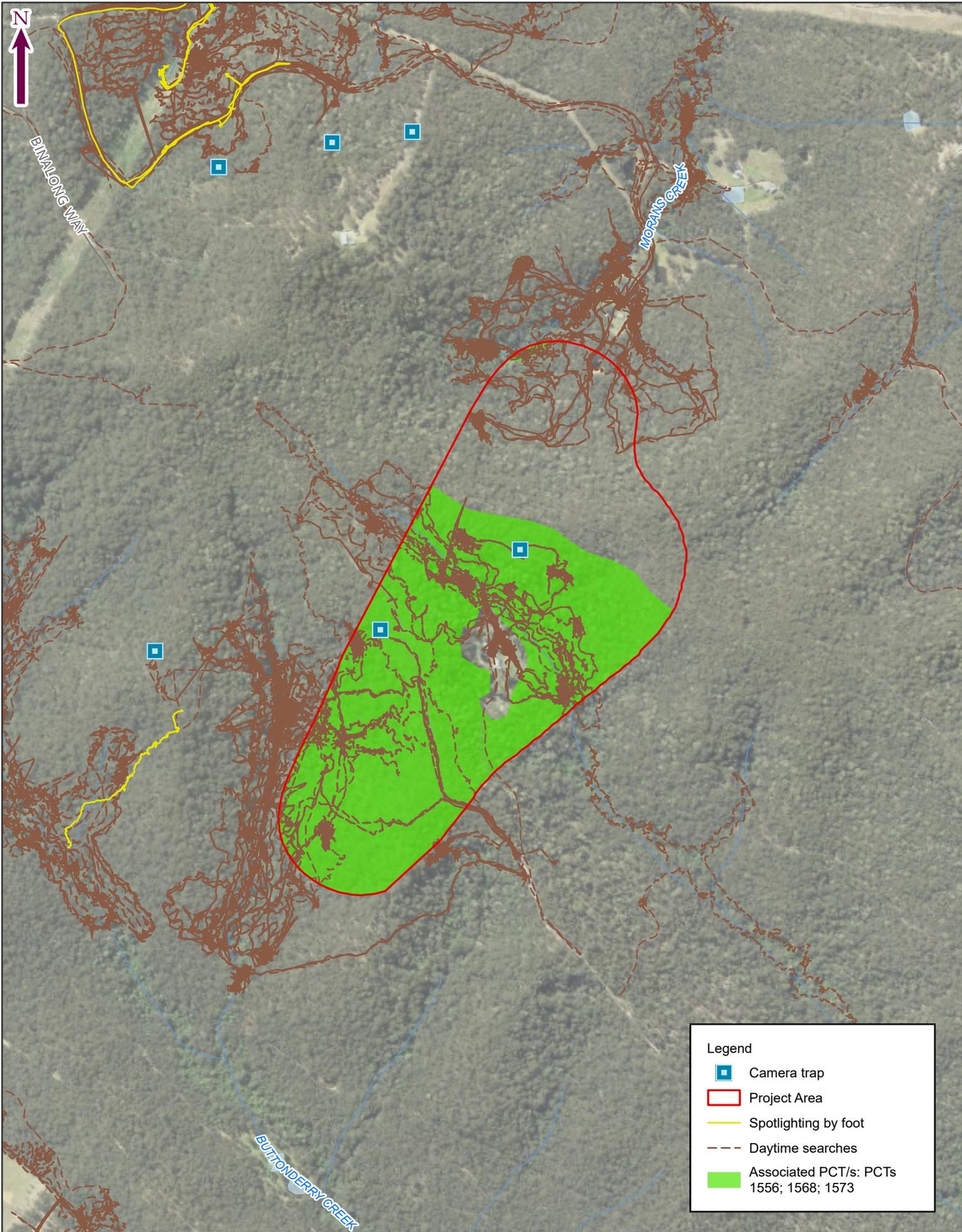
REPORT

Species (Common name)	BC Act	EPBC Act	Associated PCT/s within Project Area	Habitat constraints or requirements	Total area of suitable habitat in Project Area (ha)	Total area of suitable habitat in Impact Area (ha)	Survey months (as per BAM-C)	Dates of targeted survey	Name of guidelines used and requirements	Any additional survey requirements	Notes regarding factors influencing survey	Survey guideline met (Y/N)
								17 Jun 21; 18 Jun 21. Baited camera traps 11 Jan 21; 12 Jan 21; 13 Jan 21; 14 Jan 21. Spotlighting 21 Jan 20; 22 Jan 20; 25 Mar 20; 26 Oct 20; 2 Nov 20; 4 Nov 20.	and assessment campaigns, with no koala or signs thereof detected.			
<i>Potorous tridactylus</i> (Long-nosed Potoroo) ¹	V	V	1528; 1556; 1568; 1573	Dense shrub layer or alternatively high canopy cover exceeding 70% (i.e. to capture populations inhabiting wet sclerophyll and rainforest)	34.82	0.00047	All year	Daytime searches (in conjunction with threatened flora surveys) 19 May 20; 6 Aug 20; 6 Oct 20; 7 Oct 20; 8 Oct 20; 25 Oct 20;	No BAM survey guideline for mammals. Camera trapping undertaken (40 nights survey effort). Although camera trapping was in sub-optimal habitat, DSEWPC (2011) guidelines were adhered to with daytime searches undertaken in conjunction with threatened plant	It is possibly slightly easier to locate in spring but with suitable survey effort and using appropriate techniques (such as camera trapping) it should be detectable all year round. All cameras should be deployed for	Fine warm weather with no rainfall over camera trap survey period. Section 3.4 for weather during other survey components (note that daytime searches were undertaken	Y

REPORT

Species (Common name)	BC Act	EPBC Act	Associated PCT/s within Project Area	Habitat constraints or requirements	Total area of suitable habitat in Project Area (ha)	Total area of suitable habitat in Impact Area (ha)	Survey months (as per BAM-C)	Dates of targeted survey	Name of guidelines used and requirements	Any additional survey requirements	Notes regarding factors influencing survey	Survey guideline met (Y/N)
								27 Oct 20; 3 Nov 20; 4 Nov 20; 15 Jun 21 16 Jun 21; 17 Jun 21; 18 Jun 21.	surveys and spotlighting undertaken in potentially suitable habitat resources, such as areas with a dense understorey. Note that across all the threatened flora and spotlight surveys no potential individuals (i.e. ground-dwelling mammal other than kangaroos/wallabies) were observed.	a minimum of 14 nights.	in conjunction with parallel flora surveys).	
								Baited Camera traps 11 Jan 21; 12 Jan 21; 13 Jan 21; 14 Jan 21.				
								Spotlighting 21 Jan 20; 22 Jan 20; 25 Mar 20; 26 Oct 20; 2 Nov 20; 4 Nov 20.				

1. Species highly mobile with a large foraging range. Hence survey effort encompassed adjacent, contiguous suitable habitat. 2. Note that suitable rocky habitat in the Project Area was primarily associated with PCT 1588 and 1556.



Legend

- Camera trap
- Project Area
- Spotlighting by foot
- Daytime searches
- Associated PCT/s: PCTs 1556; 1568; 1573

FIGURE 3-5
FAUNA SURVEY EFFORT FOR MACROSPUS PARMA (PARMA WALLABY) AND PHASCOLARCTOS CINEREUS (KOALA)

VERSION:
A
 DATE EXPORTED:
24/11/2021 5:35 PM
 TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS, © Department of Customer Service 2020



SCALE 1:10,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

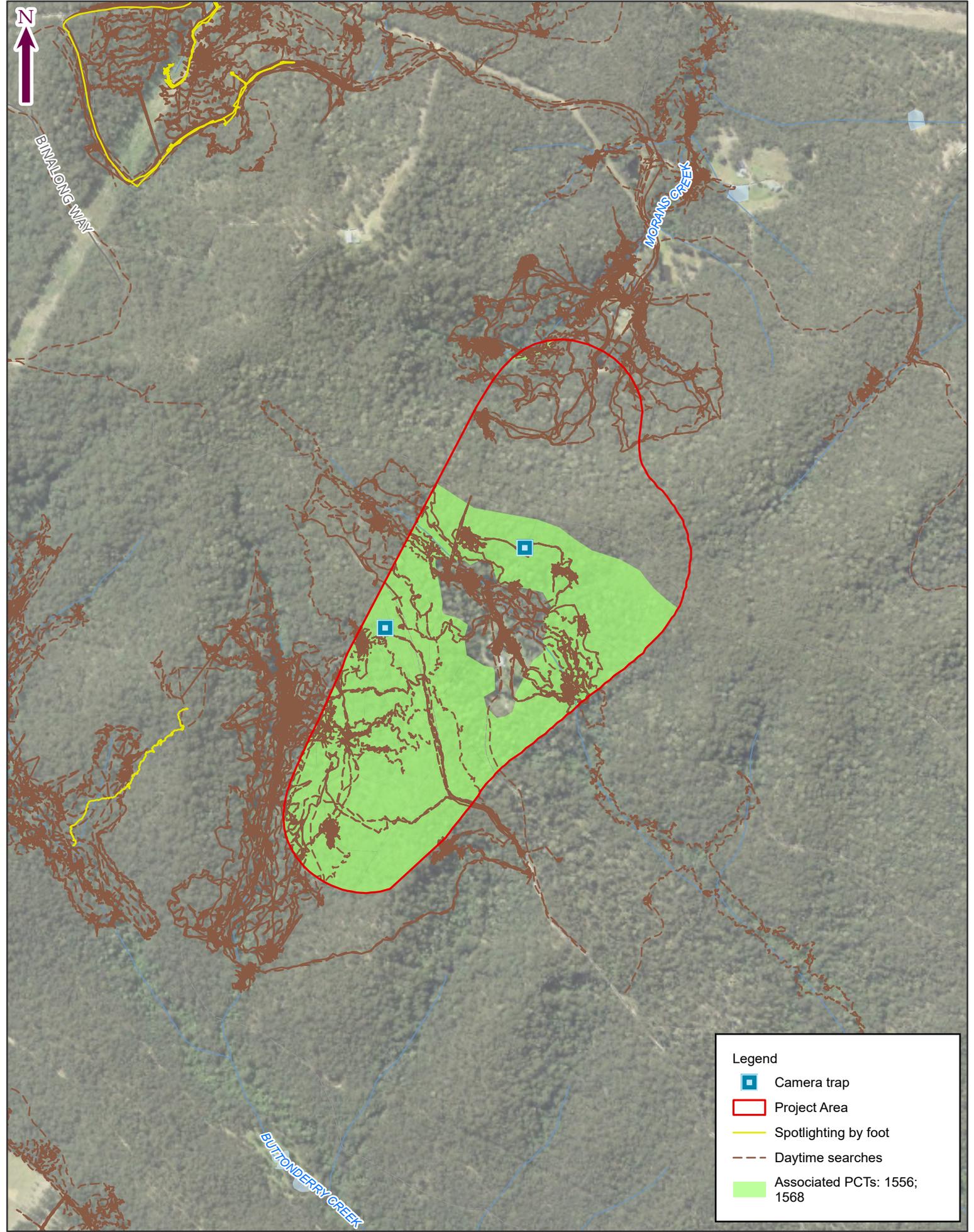
CLIENT: Centennial
 PROJ: 149823
 PURPOSE: BIR

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of producing a photographic survey plan. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other legislative purpose, use or matter. The plan is prepared without the accuracy or a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party in following, using or relying on the plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreliable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party;

d. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 e. the Client or any Third Party not verifying information in the plan where recommended by RPS Australia East Pty Ltd;
 f. independent of this plan with any local authority expertise or the recommendation of RPS Australia East Pty Ltd;
 g. the accuracy, reliability, suitability or completeness of any representations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.





Legend

- Camera trap
- Project Area
- Spotlighting by foot
- Daytime searches
- Associated PCTs: 1556; 1568

FIGURE 3-6
FAUNA SURVEY EFFORT FOR PETROGALE PENICILLATA
(BRUSH-TAILED ROCK-WALLABY)

VERSION:
A
 DATE EXPORTED:
24/11/2021 5:42 PM
 TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS, © Department of Finance, Services & Innovation 2018



SCALE 1:10,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
 PROJ: 149823
 PURPOSE: BIR

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of producing a photographic survey plan. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other purpose, use or matter. The plan is prepared without the accuracy of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party's liability, claims or reliance on this plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreliable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party;

d. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 e. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 f. independent of this plan with any local authority agencies or the recommendations of RPS Australia East Pty Ltd;
 g. the accuracy, reliability, suitability or completeness of any representations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.



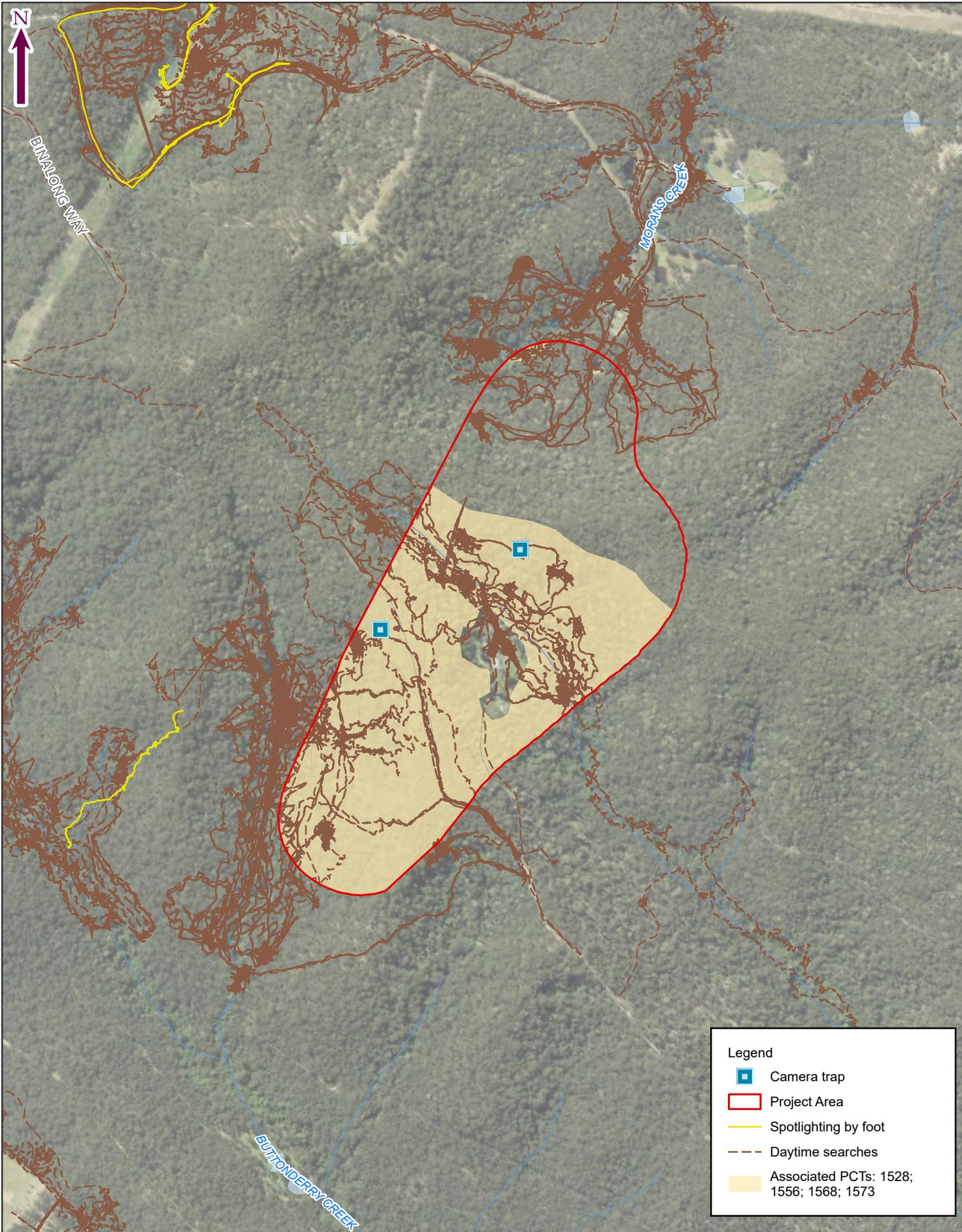


FIGURE 3-7
FAUNA SURVEY EFFORT FOR *POTOROUS TRIDACTYLUS*
(LONG-NOSED POTOROO)

VERSION:
A
 DATE EXPORTED:
24/11/2021 5:49 PM
 TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS, © Department of Finance, Services &
 Innovation 2018



SCALE 1:10,000 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
 PROJ: 149823
 PURPOSE: BIR

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of producing a photographic survey plan. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other legislative purpose, use or matter. The plan is provided without the accuracy or a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party's publishing, using or relying on this plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party;

d. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 e. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
 f. RPS Australia East Pty Ltd with any local authority regarding the recommendations of RPS Australia East Pty Ltd;
 g. the accuracy, reliability, suitability or completeness of any representations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.



REPORT

Table 3-5 Application of BCD’s targeted fauna survey guidelines to surveys for hollow-dependant day-flying birds

Species (Common name)	BC Act	EPBC Act	Associated PCT/s within Project Area	Habitat constraints or requirements	Total area of suitable habitat in Project Area (ha)	Total area of suitable habitat in Impact Area (ha)	Survey months (as per BAM-C)	Dates of targeted survey	Name of guidelines used and requirements	Any additional survey requirements	Notes regarding factors influencing survey	Survey guideline met (Y/N)
<i>Calyptorhynchus lathamii</i> Glossy Black-Cockatoo	-	-	1556; 1568; 1573	Living or dead tree with hollows greater than 15 cm diameter and greater than 8 m above ground.	34.75	0.00047	January to September	Nest searches (in conjunction with threatened flora surveys/ Hollow-bearing Tree Survey) 19 May 20; 6 Aug 20; 6 Oct 20; 7 Oct 20; 8 Oct 20; 25 Oct 20; 27 Oct 20; 3 Nov 20; 4 Nov 20; 15 Jun 21 16 Jun 21; 17 Jun 21; 18 Jun 21.	No BAM survey guideline for mammals. Survey requirement in TBDC followed.	Assessors should look for SIGNS OF BREEDING on site as follows; (a) begging birds of any age or sex; or (b) lone adult males identified during the breeding season (April to August); or (c) an occupied nest.	Mostly fine weather during survey, with light shower on one day. See Section 3.4 for weather during other survey components.	Y



FIGURE 3-8
FAUNA SURVEY EFFORT FOR CALYPTORHYNCHUS LATHAMI
(GLOSSY BLACK-COCKATOO)

VERSION:
A
 DATE EXPORTED:
24/11/2021 5:54 PM
 TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong

DATA SOURCES
 Centennial, RPS, © Department of Customer Service 2020

0 100 200 m
 SCALE 1:7,500 AT A4 SIZE
 SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
 PROJ: 149823
 PURPOSE: BIR

IMPORTANT NOTE
 1. This plan was prepared for the sole purposes of the client for the specific purpose of producing a photographic coverage plan. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other operational purpose, use or matter. The plan is prepared without the accountability of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
 a. a Third Party publishing, using or relying on this plan;
 b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
 c. any inaccuracies or other faults with information or data sourced from a Third Party;

d. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
 e. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd.
 RPS Australia East Pty Ltd, in any local authority against the recommendations of RPS Australia East Pty Ltd, of the accuracy, reliability, suitability or completeness of any recommendations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.



3.4 Survey Dates and Weather Conditions

Weather conditions and timing of tasks undertaken during flora and fauna surveys relevant to the Project Area are provided in **Table 3-6**. Weather information was accessed from Cooranbong (station numbers 61412) at Latitude 33.09° S, Longitude 151.46° E, and 10 m ASL elevation. Data was also supplemented with a nearby station (061014) (BOM 2021a). The weather station is approximately 11 km to the northeast of the Project Area.

REPORT

Table 3-6 Weather conditions during survey period

Date	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)	Max wind speed and direction	Task	Survey inside Project Area	Survey adjacent Project Area
21 Jan 2019	NA	NA	NA	NA	Elliott trapping/ bird survey	-	Yes
22 Jan 2019	NA	NA	NA	NA	Elliott trapping/ bird survey	-	Yes
23 Jan 2019	NA	NA	NA	NA	Elliott trapping/ bird survey	-	Yes
24 Jan 2019	NA	NA	NA	NA	Elliott trapping/ bird survey	-	Yes
24 Sep 2019	NA	NA	NA	NA	BAM Plot Surveys	Yes	Yes
23 Oct 2019	11.1	24.7	0	ESE @ 28km/hr	BAM Plot Surveys	-	Yes
24 Oct 2019	NA	NA	NA	NA	BAM Plot Surveys	Yes	Yes
25 Oct 2019	12.3	34.9	0.2	N @ 41km/hr	BAM Plot Surveys	-	Yes
21 Jan 2020	16.0	34.5	0.6	W @ 35 km/hr	Aural/visual Frog survey/ Spotlight	Yes	Yes
22 Jan 2020	18.7	32.9	0	ESE @ 33 km/hr	Aural/visual Frog survey/ Spotlight	-	Yes
24 Mar 2020	NA	NA	NA	NA	Aural/visual Frog survey/ BAM Plot Surveys	-	Yes
25 Mar 2020	13.7	24.5	0	WNW @ 28 km/hr	Aural/visual Frog survey/ Spotlight	Yes	Yes
19 May 2020	NA	NA	NA	NA	BAM Plot Surveys/ Threatened Flora survey	Yes	Yes
16 Jun 2020	4.1	21.0	0	NNW @ 19km/hr	BAM Plot Surveys/ RDPs/ Threatened Flora survey	-	Yes
17 Jun 2020	4.0	19.4	0.2	SSE @ 24km/hr	BAM Plot Surveys/ RDPs/ Threatened Flora survey	-	Yes
19 Jun 2020	7.2	19.7	0.2	N @ 17 km/hr	BAM Plot Surveys/ RDPs/ Threatened Flora survey	-	Yes
6 Aug 2020	3.5	16.3	0	WNW @ 28km/hr	BAM Plot Surveys/ RDPs/ Threatened Flora survey	Yes	Yes
12 Aug 2020	7.3	17.5	0.2	ESE @ 19km/hr	BAM Plot Surveys	-	Yes
3 Sep 2020	8.0	28.1	0	NNW @ 44km/hr	BAM Plot Surveys/ RDPs	Yes	Yes
4 Sep 2020	18.9	25.4	0	NW @ 31 km/hr	BAM Plot Surveys	-	Yes
11 Sep 2020	7.8	19.6	1.2	ESE @ 28 km/hr	BAM Plot Surveys	-	Yes
6 Oct 2020	14.6	21.0	0	S @ 30 km/hr	Threatened Flora survey	-	Yes
7 Oct 2020	16.8	22.9	0	E @ 17 km/hr	Threatened Flora survey	Yes	Yes
8 Oct 2020	15.0	31.1	0.4	WNW @ 44 km/hr	Threatened Flora survey	Yes	Yes
25 Oct 2020	14.4	16.6	14.6	S @ 22 km/hr	Threatened Flora survey	Yes	Yes
26 Oct 2020	13.1	15.7	62.8	SSE @ 43 km/hr	Aural/visual Frog survey/ Spotlight	-	Yes
27 Oct 2020	13.1	20.3	23.8	SSW @ 24 km/hr	Threatened Flora survey	-	Yes

REPORT

Date	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)	Max wind speed and direction	Task	Survey inside Project Area	Survey adjacent Project Area
2 Nov 2020	15.2	22.6	3.6	S @ 31 km/hr	Aural/visual Frog survey/ Spotlight	-	Yes
3 Nov 2020	9.9	22.1	0	ESE @ 26 km/hr	Cave survey (including searched for signs of Brush-tailed Rock Wallaby)/ Spotlight/ BAM Plot survey/ Threatened Flora survey	Yes	Yes
4 Nov 2020	8.7	25.5	0	E @ 24 km/hr	Cave survey (including searched for signs of Brush-tailed Rock Wallaby)/ Threatened Flora survey/ Spotlight/ Aural/visual Frog survey	Yes	Yes
5 Nov 2020	14.3	20.6	0	WSW @ 30 km/hr	Cave survey (including searched for signs of Brush-tailed Rock Wallaby)	Yes	Yes
6 Nov 2020	13.1	21.1	21.6	SW @ 37 km/hr	Cave survey (including searched for signs of Brush-tailed Rock Wallaby)	Yes	Yes
11 Jan 2021	13.5	26.7	0	E @ 31 km/hr	Anabat and camera trap surveys	Yes	Yes
12 Jan 2021	13.5	28.7	0	ESE @ 26 km/hr	Anabat and camera trap surveys	Yes	Yes
13 Jan 2021	15.4	27.9	0	E @ 37 km/hr	Anabat and camera trap surveys	Yes	Yes
14 Jan 2021	16.5	35.4	0	N @ 24 km/hr	Anabat and camera trap surveys	Yes	Yes
2 Mar 2021	20.2	32.3	0	N @ 19 km/hr	BAM Plot and Threatened Flora survey	Yes	Yes
15 June 2021	4.5	20.0	0	ESE @ 15 km/hr	Threatened Flora survey/ Hollow-bearing tree mark-up	Yes	-
16 June 2021	2.3	20.4	0	N @ 24 km/hr	Threatened Flora survey/ Hollow-bearing tree mark-up	Yes	-
17 June 2021	4.8	17.8	0.4	W @ 44 km/hr	Threatened Flora survey/ Hollow-bearing tree mark-up	Yes	-
18 June 2021	8.3	19.2	0	W @ 37 km/hr	Threatened Flora survey/ Hollow-bearing tree mark-up	Yes	-
21 June 2021	8.0	18.4	2.0	SW @ 22 km/hr	BAM plots	Yes	-
22 June 2021	8.2	17.0	0.2	SE @ 11 km/hr	BAM plots	Yes	-
23 June 2021	5.8	19.6	2.2	NNE @ 13 km/hr	BAM plots	Yes	-
24 June 2021	10.6	22.1	0.2	NNE @ 29 km/hr	BAM plots	Yes	-

3.5 Limitations

Limitations associated with this assessment are presented in the following sections. The limitations have been considered specifically in relation to threatened species assessments, results and conclusions.

3.5.1 Seasonality

Some plant species that occur in the local area, such as cryptic species, are annuals and are present only in the seed bank for much of the year. Other plant species are perennial but are inconspicuous or difficult to identify unless flowering.

Similarly, some fauna species have potential to occur on a seasonal, vagrant or migratory basis and may be absent from the locality for much of the year. Fauna species that are easily disturbed or cryptic may not have been detected. Hence, it is possible that several flora and fauna species occurring in the Project Area were not detected in the current survey due to the above factors.

These potential limitations have been minimised by literature research, through identification of potential habitats for flora and fauna species. Assessment of the potential for targeted species to occur on the Project Area based on:

- Results for field surveys undertaken in adjacent, contiguous bushland;
- The type and condition of habitats present;
- The land use throughout the Project Area and surrounds; and
- The landscape context.

The precautionary principle (assumed presence) was applied where suitable habitat was identified and survey was not performed adequately to discount presence or species were predicted to use habitat components (i.e. food, shelter and or living space) at some stage during their life cycle.

3.5.2 Data Availability and Accuracy

The collated threatened flora and fauna species records provided by NSW BioNet Atlas for the region are known to vary in accuracy and reliability. Traditionally, this is due to the reliability of information provided to the NSW BioNet Atlas (DPIE 2021a) for collation and/or the need to protect specific threatened species locations. For the purposes of this report, threatened species records were considered to have an accuracy of ± 1 km, up to 2 km for more sensitive records.

Threatened flora and fauna records within the region were predominantly sourced from the NSW BioNet Atlas (DPIE 2021a) and an EPBC Act Protected Matters Search Tool (DAWE 2021a). Similar limitations are known to exist with regards to these data sources and their accuracy.

A Trimble Differential GPS unit was used by RPS to record data in field survey. This unit is capable of sub-metre accuracy following post processing, however accuracy of <5 m is more typically achieved.

4 RESULTS

4.1 Desktop Assessment

4.1.1 Database Interrogation

Database search results (DPIE 2021a; DAWE 2021a) identified 33 threatened flora and 68 threatened or migratory fauna species with the potential to occur within the locality. A comprehensive list of threatened species, including their habitat types, is provided in **Appendix C**.

A summary of the threatened or migratory species with a moderate or greater likelihood of occurrence based on DPIE database search, literature review, EPBC Protected Matters Search Tool and BAM-C output is provided in **Table 4-1**. Note that this threatened species list was refined to consider the potential to occur within riparian areas, due to the ponding-related impacts that may occur with the Project (note that this rationale is detailed further in **Section 3.2.4**).

Table 4-1 Threatened Species with 'moderate' or greater likelihood of occurrence

Scientific Name	Common Name	BC Act	EPBC Act	Sensitive to ponding-related impact
Fauna				
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	CE	No
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-	No
<i>Litoria brevipalmata</i>	Green-thighed Frog	V	-	Yes
Flora				
<i>Asperula aesthenes</i>	Trailing Woodruff	V	V	Yes
<i>Corybas dowlingii</i>	Red Helmet Orchid	E	-	Yes
<i>Cryptostylis hunteriana</i>	Leafless Tongue-orchid	V	V	Yes
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	Yes
<i>Maundia triglochinosoides</i>	-	V	-	Yes
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	V	V	Yes
<i>Persicaria elatior</i>	Tall Knotweed	V	V	Yes
<i>Rhodamnia rubescens</i>	Scrub Turpentine	CE	CE	Yes
<i>Rhodomyrtus psidioides</i>	Native Guava	CE	CE	Yes
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E	V	Yes
<i>Tetradlea juncea</i>	Black-eyed Susan	V	V	Yes

Key: V: Vulnerable; E: Endangered; CE: Critically Endangered

REPORT

4.1.2 Literature Review

Threatened species listed in **Table 4-2** have previously been detected in or near the Project Area.

Table 4-2 Previously detected threatened species

Scientific Name	Common Name	BC Act	EPBC Act	Source
Fauna				
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo	V	-	RPS (2013), RPS (2018)
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V	-	RPS (2013)
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper	V	-	RPS (2016)
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	RPS (2013)
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	-	RPS (2013)
<i>Litoria brevipalmata</i>	Green-thighed Frog	V	-	RPS (2018)
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	-	RPS (2013)
<i>Miniopterus australis</i>	Little Bentwing-bat	V	-	RPS (2016), RPS (2018)
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat	V	-	RPS (2018)
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V	-	RPS (2016)
<i>Ninox strenua</i>	Powerful Owl	V	-	RPS (2013), RPS (2018)
<i>Petaurus australis</i>	Yellow-bellied Glider	V	-	RPS (2013)
<i>Phoniscus papuensis</i>	Golden-tipped Bat	V	-	RPS (2013)
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	RPS (2013)
Flora				
<i>Asperula aesthens</i>	Trailing Woodruff	V	V	RPS (2020)
<i>Corybas dowlingii</i>	Red-helmet Orchid	V	-	RPS (2019)
<i>Genoplesium insigne</i>	Variable Midge Orchid	CE	CE	RPS (2020c)
<i>Grevillea parviflora subsp. parviflora</i>	Small-flowered Grevillea	V	V	RPS (2013), RPS (2018)
<i>Maunderia triglochinosoides</i>	-	V	-	RPS (2018)
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	V	V	RPS (2013); RPS (2018)
<i>Rhodamnia rubescens</i>	Scrub Turpentine	CE	-	RPS (2019)
<i>Tetradlea juncea</i>	Black-eyed Susan	V	V	RPS (2013), RPS (2018)

4.1.3 Spatial Datasets

The Project Area is located within the Sydney Basin IBRA region and Wyong subregion (SYB06) and Gosford – Cooranbong Coastal Slopes Mitchell Landscape (NPWS 2003a). This is described as:

“Coastal fall of the Sydney Basin, rolling hills and sandstone plateau outliers of Triassic Narrabeen sandstones, extensive rock outcrop and low cliffs along ridge margins, general elevation 0 to 75 m. Texture-contrast soils on lithic sandstones and shales. Loamy sand alluvium along creeks. Organic sand and mud in lagoons and swamps. Open forest and woodland of smooth-barked apple (*Angophora costata*), red bloodwood (*Corymbia gummifera*), brown stringybark (*Eucalyptus capitellata*), Sydney peppermint (*Eucalyptus piperita*), spotted gum (*Corymbia maculata*), bastard mahogany (*Eucalyptus carnea*), northern grey ironbark (*Eucalyptus siderophloia*) and grey gum (*Eucalyptus punctata*) on hills and slopes. Small areas of closed forest with; turpentine (*Syncarpia glomulifera*), lilly pilly (*Acmena smithii*), mountain cedar wattle (*Acacia elata*), coachwood (*Ceratopetalum apetalum*), sassafras (*Doryphora sassafras*) and water gum (*Tristanopsis laurina*) in gullies under high escarpments. Prickly-leaved tea-tree (*Melaleuca stypheliodes*) and other shrubs with swamp mahogany (*Eucalyptus robusta*), swamp oak (*Casuarina glauca*), sedges and common reed (*Phragmites australis*) on swampy creek flats. Coastal heath subject to salt spray on headlands” (NPWS 2003a).

REPORT

Vegetation mapping and inspection of recent aerial photography indicates a limited amount of vegetation clearing within the locality resulting in a very large and generally continuous tract of native vegetation that extends to the Olney State Forest and further into the Great Dividing Range.

The Project Area is connected to surrounding vegetation with partial interruptions evident by way of unsealed tracks, fencing and cleared areas associated with the rural properties. Apart from some fenced boundaries and cleared areas associated with these rural areas, it is considered that movement of most fauna species through the Project Area should be largely unconstrained. Note that steep rises associated with the valley ridges may present some challenges to dispersal for some ground-dwelling species.

4.1.4 Candidate Species Survey Matrix – BAM Calculator

A refined candidate species list was used to focus survey efforts on threatened flora and fauna that may use habitat within the Project Area. This was constructed through entering the sub-bioregion, landscape and PCTs present into the BAM-C. A matrix indicating the required timing of surveys was then produced to inform survey requirements. Species and appropriate survey periods (i.e. grey shading) are provided in **Table 4-3**, with the timing of survey efforts indicated by a cross (i.e. ☒).

Table 4-3 Candidate species list and survey timing for PCT 1528, 1556, 1568 and 1573

Species Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Method (effort)	Survey adequacy
<i>Callocephalon fimbriatum</i> Gang-gang Cockatoo	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NA	No
<i>Calyptorhynchus lathami</i> Glossy Black-Cockatoo	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	BC	Yes				
<i>Cercartetus nanus</i> Eastern Pygmy-possum	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SL; CT	No
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AB; HS	No
<i>Corybas dowlingii</i> Red Helmet Orchid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	TFS	Yes				
<i>Cryptostylis hunteriana</i> Leafless Tongue Orchid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NA	No
<i>Cynanchum elegans</i> White-flower Wax Plant	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	TFS	Yes				
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NA	No
<i>Hoplocephalus bitorquatus</i> Pale-headed Snake	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SL	No
<i>Hoplocephalus stephensii</i> Stephens' Banded Snake	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SL	No
<i>Litoria aurea</i> Green and Gold Bell Frog	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	FS	No
<i>Litoria brevipalmata</i> Green-thighed Frog	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	FS	No
<i>Litoria littlejohni</i> Littlejohn's Tree Frog	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	FS	No
<i>Lophoictinia isura</i> Square-tailed Kite	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NA	No
<i>Macropus parma</i> Parma Wallaby	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SL; CT	Yes
<i>Melaleuca biconvexa</i> Biconvex Paperbark	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	TFS	Yes				

REPORT

Species Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Method (effort)	Survey adequacy
<i>Melaleuca groveana</i> Grove's Paperbark	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	TFS	Yes				
<i>Miniopterus australis</i> Little Bent-winged Bat	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AS; HS	No
<i>Miniopterus orianae oceanensis</i> Large Bent-winged Bat	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AS; HS	No
<i>Mixophyes balbus</i> Stuttering Frog	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	FS	No
<i>Mixophyes iteratus</i> Giant Barred Frog	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	FS	No
<i>Myotis macropus</i> Southern Myotis	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	AS; HS	No
<i>Ninox connivens</i> Barking Owl	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	HS	No
<i>Ninox strenua</i> Powerful Owl	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	HS	No
<i>Petaurus norfolcensis</i> Squirrel Glider	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SL; CT	No
<i>Petrogale penicillata</i> Brush-tailed Rock-wallaby	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SL; CT	Yes
<i>Phascogale tapoatafa</i> Brush-tailed Phascogale	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SL; CT	No
<i>Phascolarctos cinereus</i> Koala	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SL; CT	Yes
<i>Planigale maculata</i> Common Planigale	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SL; CT	Yes
<i>Potorous tridactylus</i> Long-nosed Potoroo	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SL; CT	Yes
<i>Pteropus poliocephalus</i> Grey-headed Flying-fox	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SL	No
<i>Rhizanthella slateri</i> Eastern Australian Underground Orchid	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NA	No
<i>Rhodamnia rubescens</i> Scrub Turpentine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	TFS	Yes				
<i>Rhodomyrtus psidioides</i> Native Guava	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	TFS	Yes				
<i>Tetradlea juncea</i> Black-eyed Susan	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	NA	No
<i>Turnix maculosus</i> Red-backed Button-quail	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	SL; CT	Yes
<i>Tyto novaehollandiae</i> Masked Owl	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	HS	No
<i>Tyto tenebricosa</i> Sooty Owl	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	HS	No

Note: x indicates timing of survey effort. Methodology codes: AS = Anabat survey; BC = Bird Census; CT = Camera Trap; FS = Aural/visual Frog survey; SL = Spotlight; TFS = Threatened Flora Survey; NA = no targeted survey.

4.1.5 Survey adequacy

Targeted threatened species surveys were undertaken with an emphasis on species that were likely to be impacted by predicted ponding associated with the Project, as per the rationale provided in **Section 3.2.4**.

Over the course of the Project, the AOD boundary was modified such that some survey efforts (e.g. Anabat and camera traps) were outside the final Project Area. However, it is considered that this survey effort was representative for the mobile target species with large home ranges, with suitable and belonging to a contiguous tract of vegetation that also includes the Project Area. Specifically, it was considered that the camera trap and spotlighting survey effort applied in adjacent bushland was representative of the following species with large home ranges: *Macropus parma* (Parma Wallaby); *Petrogale penicillata* (Brush-tailed Rock-wallaby); *Phascogale cinereus* (Koala); *Planigale maculata* (Common Planigale); and *Potorous tridactylus* (Long-nosed Potoroo). Additionally, survey effort was also considered representative of the following Candidate species:

- *Calyptorhynchus lathami* (Glossy Black-Cockatoo);
- *Corybas dowlingii* (Red Helmet Orchid);
- *Cynanchum elegans* (White-flower Wax Plant);
- *Melaleuca biconvexa* (Biconvex Paperbark);
- *Melaleuca groveana* (Grove's Paperbark);
- *Rhodamnia rubescens* (Scrub Turpentine); and
- *Rhodomyrtus psidioides* (Native Guava).

Survey effort was not considered to be representative of the following Candidate species, given the timing or spatiotemporal representation of sampling effort:

- *Callocephalon fimbriatum* (Gang-gang Cockatoo);
- *Cercartetus nanus* (Eastern Pygmy-possum);
- *Chalinolobus dwyeri* (Large-eared Pied Bat);
- *Cryptostylis hunteriana* (Leafless Tongue Orchid);
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle);
- *Hoplocephalus bitorquatus* (Pale-headed Snake);
- *Hoplocephalus stephensii* (Stephens' Banded Snake);
- *Litoria brevipalmata* (Green-thighed Frog);
- *Litoria littlejohni* (Littlejohn's Tree Frog);
- *Lophoictinia isura* (Square-tailed Kite);
- *Miniopterus australis* (Little Bent-winged Bat);
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat);
- *Mixophyes balbus* (Stuttering Frog);
- *Mixophyes iteratus* (Giant Barred Frog);
- *Myotis macropus* (Southern Myotis);
- *Ninox connivens* (Barking Owl);
- *Ninox strenua* (Powerful Owl);
- *Petaurus norfolcensis* (Squirrel Glider);
- *Phascogale tapoatafa* (Brush-tailed Phascogale);
- *Pteropus poliocephalus* (Grey-headed Flying-fox);
- *Rhizanthella slateri* (Eastern Australian Underground Orchid);

REPORT

- *Tetratheca juncea* (Black-eyed Susan);
- *Tyto novaehollandiae* (Masked Owl); and
- *Tyto tenebricosa* (Sooty Owl).

To better inform the allocation of species polygons for the above species, habitat constraints (i.e. those species with DPIE recognised habitat niche requirements) were recorded for relevant species. These attributes were namely habitat trees (offering hollows of appropriate dimensions) and caves, with this approach detailed further in **Section 3.3.8**. Specifically, habitat constraints were recorded for:

- *Callocephalon fimbriatum* (Gang-gang Cockatoo; Habitat Tree Survey);
- *Chalinolobus dwyeri* (Large-eared Pied Bat; Cave Survey);
- *Miniopterus australis* (Little Bent-winged Bat; Cave Survey);
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat; Cave Survey);
- *Myotis macropus* (Southern Myotis; Waterbodies >3 m in width; as informed by remnant ponding GIS data provided by Umwelt 2021);
- *Ninox connivens* (Barking Owl; Habitat Tree Survey);
- *Ninox strenua* (Powerful Owl; Habitat Tree Survey);
- *Tyto novaehollandiae* (Masked Owl; Habitat Tree Survey); and
- *Tyto tenebricosa* (Sooty Owl; Habitat Tree and Cave Survey).

4.2 Vegetation Cover

4.2.1 Plant Community Types (PCTs)

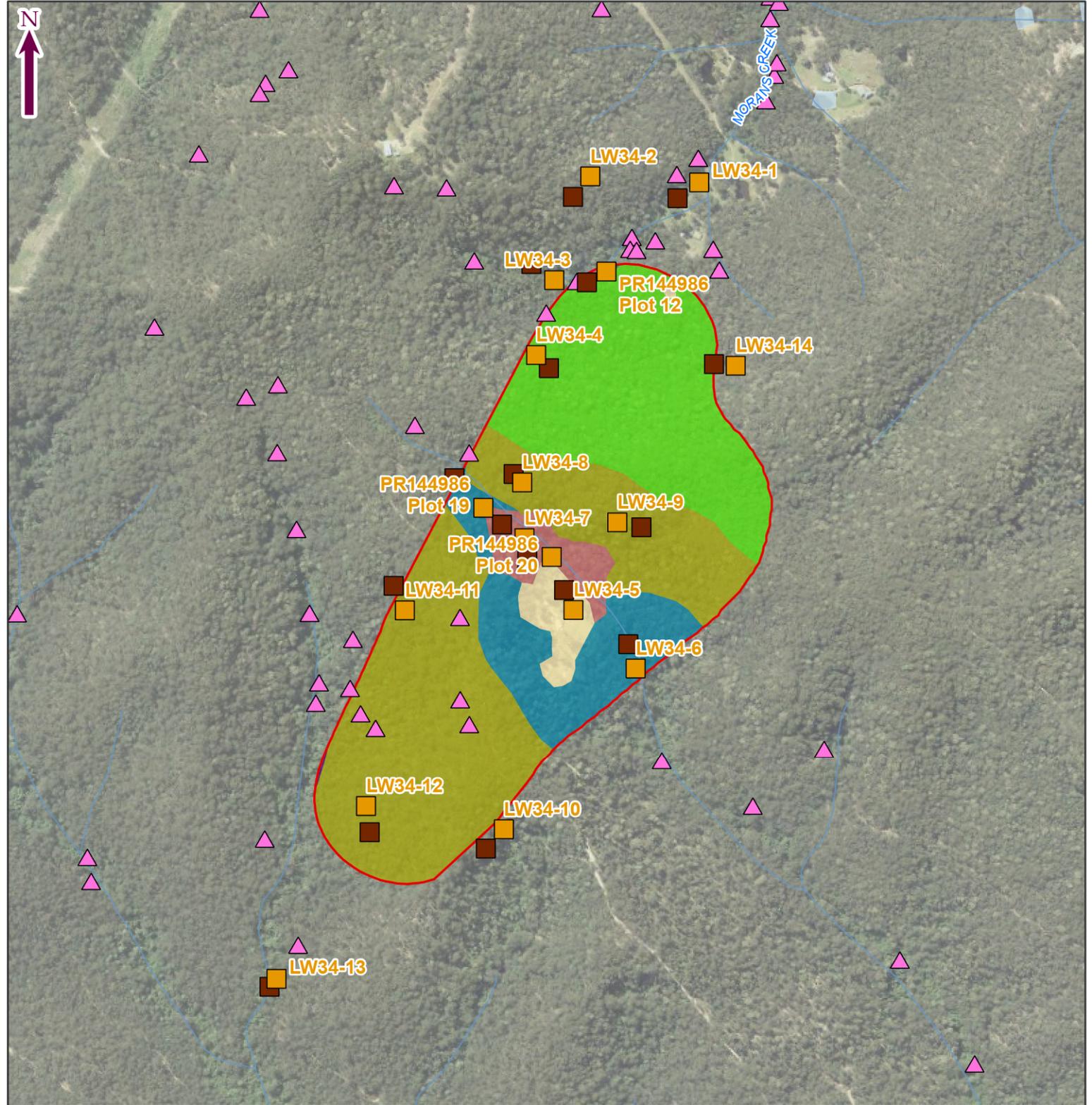
Five PCTs were located within the Project Area. These PCTs are listed in **Table 4-4** and are displayed in **Figure 4-1**.

Table 4-4 PCTs and condition classes within the Project Area

Zone	PCT	Condition	Project Area (ha) ¹	No. BAM plots undertaken	No. BAM plots required
1	1528 - Jackwood - Lilly Pilly - Sassafras riparian warm temperate rainforest of the Central Coast	Moderate/ Good	0.04	1	1
2	1556 - Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast	Moderate	25.10	5	4
3	1568 - Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast	Moderate	7.20	4	3
4	1573 - Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment	Moderate/ Good	2.48	2	2
5	1588 - Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	Moderate	15.44	3	3
6	Cleared / Disturbed	Not native	1.92	2	1

1. Misalignment of listed Project Area size reported elsewhere and total areas in this table is due to rounding.

A description of this vegetation type is provided in **Sections 4.2.1.1 to 4.2.1.5**. BAM plot photographs and data are provided in **Appendix D** and **E**.



Legend

- BAM plot - start
- BAM plot - end
- Rapid-data point
- Project Area

Plant Community Types

- 1528 - Jackwood - Lilly Pilly - Sassafras riparian warm temperate rainforest of the Central Coast
- 1556 - Tallowood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
- 1568 - Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast
- 1573 - Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment
- 1588 - Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast
- Cleared / Disturbed

**FIGURE 4-1
PLOT LOCATIONS AND VEGETATION
COMMUNITIES**

VERSION:
A
DATE EXPORTED:
13/08/2021 1:29 PM
TECHNICIAN:
Natalie.Wood

LOCATION:
Mandalong

DATA SOURCES
Centennial, RPS, © Department of Finance, Services & Innovation 2018



SCALE 1:10,000 AT A4 SIZE
SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
PROJ: 149823
PURPOSE: BIR

IMPORTANT NOTE
1. This plan was prepared for the sole purposes of the client for the specific purpose of providing a photographic coverage plan. This plan is strictly limited to the purposes and does not apply directly or indirectly and will not be used for any other purpose, in whole or in part. The plan is prepared without the assumption of a duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.
2. RPS Australia East Pty Ltd will not be held liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
a. a Third Party publishing, using or relying on the plan;
b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out of date or unreasonable;
c. any inaccuracies or other faults with information or data sourced from a Third Party.
3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
5. engagement of this plan with any local authority regarding the recommendations of RPS Australia East Pty Ltd;
6. the accuracy, reliability, suitability or completeness of any applications or estimates made or referred to by RPS Australia East Pty Ltd in this plan.



4.2.1.1 1528 - Jackwood - Lilly Pilly - Sassafras riparian warm temperate rainforest of the Central Coast

Jackwood – Lilly Pilly – Sassafras riparian warm temperate rainforest of the Central Coast		
Vegetation Formation	Rainforest	
Vegetation class	Northern Warm Temperate Rainforest	
Vegetation Type	PCT ID	1528
	Common Community Name	Jackwood – Lilly Pilly – Sassafras riparian warm temperate rainforest of the Central Coast
Description	Closed forests with a diverse canopy characterised by <i>Acmena smithii</i> , <i>Cryptocarya glaucescens</i> and <i>Doryphora sassafras</i> .	
Condition	Moderate/ Good; This PCT occurs in one condition state (moderate) as indicated in Plate 4 1 .	
Approximate extent within the Project Area	~0.04 ha	
BAM Plot no.	LW 34-3	
Species relied upon for PCT identification	Species Name	Mean relative abundance (400 m² BAM Plot)
	<i>Cryptocarya glaucescens</i>	15.00
	<i>Ficus coronata</i>	0.20
	<i>Alphitonia excelsa</i>	8.00
	<i>Archontophoenix cunninghamiana</i>	15.00
	<i>Alectryon subcinereus</i>	0.30
	<i>Wilkiea huegeliana</i>	2.00
	<i>Pittosporum multiflorum</i>	2.00
	<i>Morinda jasminoides</i>	0.30
	<i>Cissus antarctica</i>	5.00
	<i>Lastreopsis microsora</i>	0.07
	<i>Hypolepis muelleri</i>	0.27
	<i>Gymnostachys anceps</i>	0.10
	<i>Oplismenus imbecillis</i>	0.20
Other consistent diagnostic features	Floodplains; valley floors; sheltered riparian sites of the Central Coast; mainly on sandstones; at elevations below 50 m.	
Justification of evidence used to identify the PCT	<p>This vegetation community is in sheltered riparian areas on the valley floor within the Central Coast, with alluvial soils consistent with this PCT. The elevation in the location of this zone is low (~60 m asl), at the back of the coastal floodplain. Vegetation was consistent with a rainforest growth formation, depicted by a high-density canopy and lower density understory. The vegetation aligns closest to MU1a under Bell (2016b), which has been allocated to PCT 1528 by Bell (2016a). Many of the diagnostic species listed in the BioNet Vegetation Classification System (DPIE 2021C) were present adjacent or inside plots, as indicated above.</p> <p>Floristic analysis of dominant canopy/mid stratum species within this zone were entered into the BioNet Vegetation Classification (DPIE 2021b; filtered for Wyong Sub-region): <i>Archontophoenix cunninghamiana</i>; <i>Eucalyptus microcorys</i>; <i>Ficus coronata</i>; <i>Cryptocarya glaucescens</i>; <i>Backhousia myrtifolia</i> and <i>Alphitonia excelsa</i>. The top matches were PCTs 1528; 616; 905; 1522 and 1526. PCT 1528 had the</p>	

REPORT

highest match of the search criteria (4 key species were diagnostic) with landscape/geographical position and soil/geological nature consistent. As a comparison, dry rainforests PCT 616 was ruled out as it was not a dry rainforest (i.e. not in a rain-shadow or other area of low rainfall). PCT 905 was ruled out as it typically occurs on clay soils enriched from clay (soils were alluvial sands primarily), whilst *Ceratopetalum apetalum* and *Livistonia australis* (key diagnostic species for PCT 905) were lacking. While, PCT 1522 had some diagnostic species that were present (albeit outside plot), however failed to explain the majority of dominant canopy present (only matched 2 dominant species).

The confidence in PCT selection was 80%.

TEC Status	This PCT corresponds with BC Act-listed Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions TEC.
Estimate of percentage cleared	32%
Notes	No predicted ponding expected in this area.



Plate 4-1 Jackwood - Lilly Pilly - Sassafras riparian warm temperate rainforest of the Central Coast

4.2.1.2 1556 - Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast

Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast

Vegetation Formation	Wet Sclerophyll Forest (Grassy sub-formation)	
Vegetation class	Northern Hinterland Wet Sclerophyll Forest	
Vegetation Type	PCT ID	1556
	Common Community Name	Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast
Description	Open forests with a canopy dominated by <i>Eucalyptus microcorys</i> . The mid-storey consists of an open shrub layer and the ground layer is dominated by grasses with various ferns; and forbs.	
Condition	Moderate; This PCT occurs in one condition state (moderate) as indicated in Plate 4 2.	
Approximate extent within the Project Area	~25.10 ha	
BAM Plot no.	LW34-8; LW34-9; LW34-10; LW34-11; LW34-12	
Species relied upon for PCT identification	Species Name	Mean relative abundance (400 m² BAM Plot)
	<i>Eucalyptus microcorys</i>	10.60
	<i>Eucalyptus pilularis</i>	15.00
	<i>Allocasuarina torulosa</i>	8.20
	<i>Persoonia linearis</i>	0.40
	<i>Imperata cylindrica</i>	0.16
	<i>Entolasia stricta</i>	0.10
	<i>Themeda triandra</i>	0.34
	<i>Dianella caerulea</i>	0.34
	<i>Lomandra longifolia</i>	2.28
	<i>Lepidosperma laterale</i>	0.10
	<i>Lobelia purpurascens</i>	0.20
Other consistent diagnostic features	Upper slopes & valleys in dissected terrain; coastal flats and rises; ranges of the lower North Coast at mid to lower elevations.	
Justification of evidence used to identify the PCT	<p>This vegetation community is in the upper slopes and valleys in the ranges of the Central Coast, located at mid to lower elevations above rainforests located at the valley floor. As such, the landscape/ geographic position was consistent with PCT 1556.</p> <p>The vegetation aligns closest to MU9I under Bell (2016b), which has been allocated to PCT 1556 by Bell (2016a). Many of the diagnostic species listed in the BioNet Vegetation Classification System (DPIE 2021C) were present, as indicated above.</p> <p>Floristic analysis of dominant canopy species within this zone were entered into the BioNet Vegetation Classification (DPIE 2021b; filtered for Wyong Sub-region and Wet Sclerophyll Forest Grassy formation): <i>Eucalyptus microcorys</i>; <i>Eucalyptus pilularis</i>; <i>Allocasuarina torulosa</i>; <i>Syncarpia glomulifera</i>; and <i>Angophora costata</i> (observed nearby plots). The top matching PCTs were: PCTs 1556; 1564; 1579; 684; and 695. The vegetation was consistent floristically with PCT 1556 (all but <i>Syncarpia glomulifera</i> matched), whilst the landscape/geographical position and soil/geological nature were also consistent with this PCT. PCT 1564 was ruled out due to largely a lack of <i>Angophora floribunda</i>, whilst there were not numerous</p>	

REPORT

shrubs and climbers, which typifies this PCT. PCTs 1579 and 684 were a close match, but lacked *Eucalyptus microcorys*, which was a dominant canopy species in the zone (it occurred in 4 of the five plots). PCTs 695 was also not suitable due to a lack of *Lophostemon confertus* (Brush Box).

The confidence in PCT selection was 80%.

TEC Status

Although this PCT can correspond with BC Act-listed River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions TEC, vegetation within the Project Area was inconsistent with this TEC since it was not positioned on a river flat of the coastal floodplain. That is, river flats are typically level landforms that occur below 20 m ASL (DECC 2007b), whilst the lowest point of the Project Area is approximately 60 m ASL with typically steep terrain. This PCT does not correspond to any EPBC Act-listed TEC.

Estimate of percentage cleared

41%

Notes

None



Plate 4-2 Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast

REPORT

4.2.1.3 1568 - Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast

Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast		
Vegetation Formation	Wet Sclerophyll Forest (Shrubby sub-formation)	
Vegetation class	Northern Coast Wet Sclerophyll Forest	
Vegetation Type	PCT ID	1568
	Common Community Name	Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast
Description	All open forests to open forests with a canopy dominated by <i>Syncarpia glomulifera</i> and <i>Eucalyptus pilularis</i> . The mid-storey is semi-mesic and includes diverse small trees and shrubs along with climbers. The ground layer is dominated by ferns.	
Condition	Moderate; This PCT occurs in one condition state (moderate) as indicated in Plate 4 3 .	
Approximate extent within the Project Area	~7.20 ha	
BAM Plot no.	LW 34-6; LW 34-13; PR144986 Plot 12; PR144986 Plot 19	
Species relied upon for PCT identification	Species Name	Mean relative abundance (400 m² BAM Plot)
	<i>Eucalyptus pilularis</i>	6.00
	<i>Eucalyptus saligna</i>	1.50
	<i>Cryptocarya microneura</i>	0.13
	<i>Synoum glandulosum</i>	23.33
	<i>Pittosporum revolutum</i>	0.35
	<i>Dianella caerulea</i>	0.03
	<i>Doodia aspera</i>	0.05
	<i>Gymnostachys anceps</i>	0.10
	<i>Dianella caerulea</i>	0.50
	<i>Wilkiea huegeliana</i>	0.20
Other consistent diagnostic features	Sandstones ranges of the Central Coast at elevations below 450 m.	
Justification of evidence used to identify the PCT	<p>Landscape and geological position of vegetation was consistent with PCT 1568 given it was located on sandstones ranges of the Central Coast at elevations below 450 m. Located toward the gully floor on typically alluvial sediments, coinciding with the occurrence of <i>Eucalyptus saligna</i>. The vegetation aligns closest to MU5 under Bell (2016b), which has been allocated to PCT 1568 by Bell (2016a). Many of the diagnostic species listed in the BioNet Vegetation Classification System (DPIE 2020C) were present adjacent or inside plots, as indicated above.</p> <p>Floristic analysis of dominant canopy/mid story species within this zone were entered into the BioNet Vegetation Classification (DPIE 2021b; filtered for Wyong Sub-region and Wet Sclerophyll Forest Shrubby formation): <i>Eucalyptus pilularis</i>; <i>Eucalyptus saligna</i>; <i>Eucalyptus propinqua</i>; <i>Syncarpia glomulifera</i>; <i>Archontophoenix cunninghamiana</i>; <i>Corymbia maculata</i>; and <i>Synoum glandulosum</i>. The top matching PCTs were: PCTs 1568; 1915; 684; 1245 and 694. PCT 1568 were the best fit given the landscape position (Central coast below 450 m), Sandstone geology (typically alluvial sand), whilst had the most matching diagnostic species in the floristic assessment. PCTs 694 and 1245 were not suitable as they are located in Illawarra not Central Coast. PCT 684 has several diagnostic species lacking in the vegetation zone (i.e. Flooded Gum and Brush Box). PCT 684 occurs on hillslopes</p>	

REPORT

are Mandalong Valley but *Eucalyptus acemenoides* and *Angophora floribunda* were lacking, whilst PCT 684 does not support *Eucalyptus saligna*. PCT 1915 is typified by *Eucalyptus botryoides*, *Angophora floribunda*, *Angophora costata* and *Livistonia australis*, which were lacking from this zone.

The confidence in PCT selection was 90%.

TEC Status	Not Listed
Estimate of percentage cleared	40%
Notes	None



Plate 4-3 Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast (Moderate condition)

4.2.1.4 1573 – Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment

Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment

Vegetation Formation	Wet Sclerophyll Forest (Shrubby sub-formation)	
Vegetation class	Northern Coast Wet Sclerophyll Forest	
Vegetation Type	PCT ID	1573
	Common Community Name	Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment
Description	Open forests to tall open forests consisting of a eucalypt canopy over a small tree layer of mesic species. The lower mid-storey consists mainly of vines; with sparse shrubs. The under-storey is ferny; with only sparse grasses and forbs. Occurs on steep near coastal ranges of the lower North coast and Northern Tablelands escarpment between 150 and 900 m elevation; predominately on mid to lower slopes.	
Condition	Moderate/ Good; This PCT occurs in one condition state (moderate) as indicated in Plate 4 4 .	
Approximate extent within the Project Area	~2.48 ha	
BAM Plot no.	LW34-7; PR144986 Plot 20	
Species relied upon for PCT identification	Species Name	Mean relative abundance (400 m² BAM Plot)
	<i>Acmena smithii</i>	0.05
	<i>Cryptocarya glaucescens</i>	20.00
	<i>Eupomatia laurina</i>	12.50
	<i>Schizomeria ovata</i>	2.50
	<i>Synoum glandulosum</i>	1.25
	<i>Adiantum formosum</i>	0.50
	<i>Cissus antarctica</i>	1.00
	<i>Oplismenus imbecillis</i>	2.60
Other consistent diagnostic features	Occurred on lower slopes of coastal ranges, just below the 150 to 900 m elevation criteria (~120-130 m ASL).	
Justification of evidence used to identify the PCT	<p>Located on footslopes of the Central Coast at elevations broadly consistent with this PCT description. The vegetation aligns closest to MU1 under Bell (2016b), which has been allocated to PCT 1573 by Bell (2016a). Many of the diagnostic species listed in the BioNet Vegetation Classification System (DPIE 2020C) were present adjacent or inside plots, as indicated above.</p> <p>Floristic analysis of dominant canopy/mid story species within this zone were entered into the BioNet Vegetation Classification (DPIE 2021b; filtered for Wyong Sub-region and Wet Sclerophyll Forest Shrubby formation): <i>Eucalyptus saligna</i> (located nearby plots); <i>Syncarpia glomulifera</i>; <i>Synoum glandulosum</i>; <i>Eupomatia laurina</i>; <i>Cryptocarya glaucescens</i>; <i>Cryptocarya microneura</i>; <i>Alphitonia excelsa</i>; <i>Acmena smithii</i> and <i>Clerodendrum tomentosum</i>. The top matching PCTs were: PCTs 1245; 1915; 1568; 1573; and 747. PCT 1573 was the best fit given the landscape position (Central coastal foothills), highly mesic nature of the zone, whilst had 5 of the 10 matching diagnostic species in the floristic assessment. PCT 1245 was discounted since it is located in Illawarra not Central Coast. PCT 684 has several diagnostic species lacking in the vegetation zone (i.e. Flooded Gum and Brush Box). PCT 1915 is typified by <i>Eucalyptus botryoides</i>, <i>Angophora floribunda</i>, <i>Angophora costata</i> and <i>Livistonia australis</i>, which were lacking from this zone. PCT 1568 was similar (had 5 of 10 of the species searched) but <i>Eucalyptus pilularis</i> was</p>	

REPORT

lacking from the vegetation zone, which is a key diagnostic species of PCT 1568. It was also typically located up the catchment from PCT 1568, which occurs more toward the lower foot slopes and floodplains.

The confidence in PCT selection was 80%.

TEC Status

Not Listed

Estimate of percentage cleared

NA

Notes

None



Plate 4-4 Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment (Moderate condition)

REPORT

4.2.1.5 1588 - Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast

Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast		
Vegetation Formation	Dry Sclerophyll Forest (Shrub/grass sub-formation)	
Vegetation class	Hunter-Macleay Dry Sclerophyll Forest	
Vegetation Type	PCT ID	1588
	Common Community Name	Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast
Condition	Moderate; This PCT occurs in one condition state (moderate) as indicated in Plate 4 5 .	
Description	Open forests characterised by <i>Eucalyptus paniculata</i> . The understorey is typically shrubby with sparse climbers. The ground layer is characteristically grassy with various graminoids and forbs.	
Approximate extent within the Project Area	~15.44 ha	
BAM Plot no.	LW 34-2; LW 34-4; LW 34-14	
Species relied upon for PCT identification	Species Name	Relative abundance (400 m² BAM Plot)
	<i>Breynia oblongifolia</i>	0.07
	<i>Dianella caerulea</i>	0.4
	<i>Pandorea pandorana</i>	0.03
	<i>Themeda triandra</i>	0.07
	<i>Dianella caerulea</i>	1.25
Other consistent diagnostic features	Low rises; upper slopes; coastal lowlands of the Central Coast mainly on sandstones.	
Justification of evidence used to identify the PCT	<p>Located on upper slopes of Central Coast on sandstones range. vegetation aligns closest to MU15 Coastal Foothills Spotted Gum Ironbark Forest under Bell (2016b), which has been allocated to PCT 1588 by Bell (2016a). Specifically, vegetation best aligned with MU 15 due to dominance of <i>Allocasuarina torulosa</i>, <i>Corymbia maculata</i> and <i>Eucalyptus fergusonii</i>, which occurred within each plot. <i>Eucalyptus pilularis</i> was also present, however the occurrence of this species did not fit any other MU given the presence of the three commonly occurring tree species just mentioned. Moreover, many of the diagnostic species listed in the BioNet Vegetation Classification System (DPIE 2020c) were present, as indicated above. As noted by Bell (2016a), best fit is PCT 1216 Spotted Gum – Grey Ironbark open forest on the foothills of the Central Coast, Sydney Basin Bioregion, but that has been decommissioned.</p> <p>There was subtle variance in the floristic composition of this zone according to slight changes in aspect and ecotonal influences from ground water, leading to a mosaic of canopy species across the area. The zone had some characteristics of PCT 1556 (e.g. <i>Eucalyptus microcorys</i> and <i>Eucalyptus pilularis</i>), however the dominance of <i>Corymbia maculata</i> and various Ironbark species throughout the zone (mostly <i>Eucalyptus siderophloia</i>) suggested that a Spotted Gum - Ironbark Forest was a more suitable classification. Floristic analysis of dominant canopy/mid story/ ground cover species within this zone were entered into the BioNet Vegetation Classification (DPIE 2021b; filtered for Wyong Sub-region and Dry Sclerophyll Forest Shrub/grass sub-formation): <i>Corymbia maculata</i>; <i>Eucalyptus fergusonii</i>; <i>Eucalyptus pilularis</i>; <i>Eucalyptus siderophloia</i>; <i>Allocasuarina torulosa</i>; <i>Breynia oblongifolia</i>; <i>Lomandra longifolia</i>; and <i>Themeda triandra</i>. Of the Spotted Gum Ironbark vegetation communities, PCTs 1590; 1602 and 1588 were the best matches given others in the top 5 were from Clarence or Macleay Valley. PCT 1588</p>	

REPORT

was considered the best of these three since *Eucalyptus umbra* and *Eucalyptus paniculata* occurs (but not detected in plots), whilst the landscape position was a match given it is located on the coastal lowland of the Central Coast on sandstone geology. PCT 1590 was deemed unsuitable since *Eucalyptus fibrosa* was lacking (not observed across the entire zone). PCT 1602 was unsuitable due to a lack of *Eucalyptus crebra* (not observed across the entire zone).

The confidence in PCT selection was 70%.

TEC Status

This PCT can correspond with BC Act-listed Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion TEC. However, this TEC extends north from Port Stephens, and hence this vegetation is not classified as this TEC. The Project Area is also above the coastal floodplain.

This community is also not consistent with Lower Hunter Spotted Gum Ironbark Forest as *Corymbia maculata* dominates in association with *Eucalyptus umbra*, *E. siderophloia* and *Allocasuarina torulosa* (as per NSW Threatened Species Scientific Committee 2019). Further, nowhere is there a patch comprising Spotted Gum and Red Ironbark as co-dominants.

Estimate of percentage cleared

56%

Notes

No predicted ponding expected in this area.



Plate 4-5 Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast

4.2.1.6 Cleared/ Disturbed Land

Description:	Cleared land for rural property development and associated activities.
BAM Plot Number:	LW34-1; LW 34-5
Diagnostic upper stratum species:	None
Diagnostics middle stratum species:	None
Diagnostic ground stratum species:	None
Classification:	This vegetation does not correspond to any EPBC Act listed TEC.
Condition:	This vegetation is classified as non-native, as indicated in Plate 4-6 .



Plate 4-6 Cleared/ Disturbed Land

4.3 Flora Surveys

In total, 263 flora species were detected within the BAM plots; 233 native and 30 exotic species. **Appendix F** lists the full list of species recorded with BAM plots and RDPs.

4.3.1 Threatened Flora

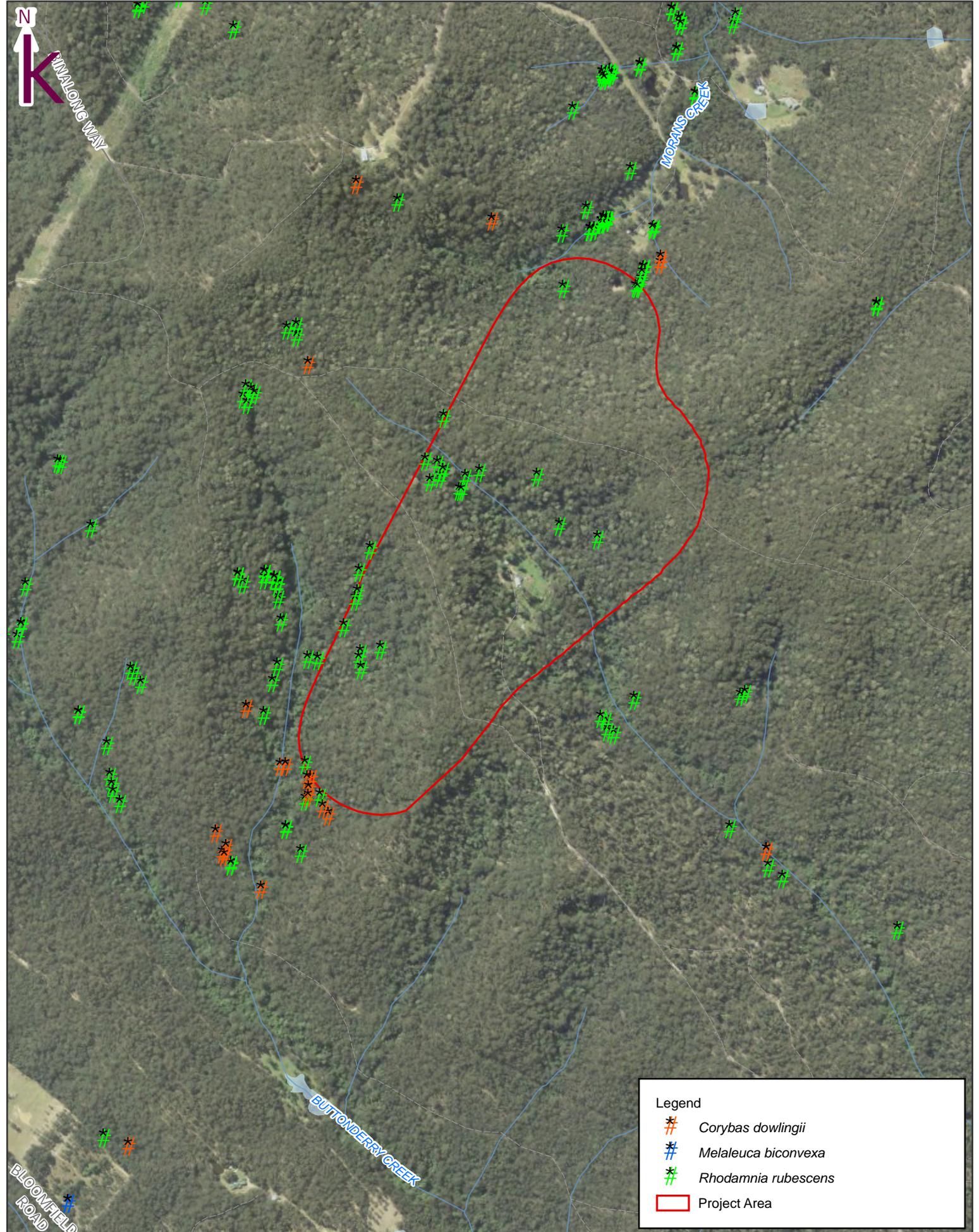
One threatened flora species, *Rhodamnia rubescens* (Scrub Turpentine; BC Act: Critically Endangered; EPBC Act: Critically Endangered), was detected within the Project Area during surveys. In total, 89 individual *R. rubescens* were found. The location of this threatened species is shown in **Figure 4-2**.

4.3.2 Weeds

All weeds detected during surveys are provided in **Table 4-5** in consideration of NSW WeedWise (DPI 2021). Weeds were also classified as BAM 'High Threat Weeds' (HTW) and Weeds of National Significance (WoNS) where relevant. The Project Area is subject to the Greater Sydney Regional Strategic Weed Management Plan 2017-2022.

Table 4-5 Weeds detected within the Project Area and their management requirements

Scientific Name	Common Name	BAM HTW	WoNS	Duty under <i>Biosecurity Act 2015</i>
<i>Ageratina adenophora</i>	Crofton Weed	<input checked="" type="checkbox"/>	<input type="checkbox"/>	General Biosecurity Duty All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.
<i>Alternanthera philoxeroides</i>	Alligator Weed	<input checked="" type="checkbox"/>	<input type="checkbox"/>	General Biosecurity Duty All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.
<i>Bidens pilosa</i>	Cobbler's Peg	<input checked="" type="checkbox"/>	<input type="checkbox"/>	General Biosecurity Duty All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.
<i>Cyperus eragrostis</i>	Umbrella Sedge	<input checked="" type="checkbox"/>	<input type="checkbox"/>	General Biosecurity Duty All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.
<i>Paspalum dilatatum</i>		<input checked="" type="checkbox"/>	<input type="checkbox"/>	General Biosecurity Duty All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.
<i>Lantana camara</i>	Lantana	<input type="checkbox"/>	<input checked="" type="checkbox"/>	General Biosecurity Duty All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.



Legend

-  *Corybas dowlingii*
-  *Melaleuca biconvexa*
-  *Rhodamnia rubescens*
-  Project Area

**FIGURE 4-2
THREATENED FLORA RECORDED**

VERSION:
A
DATE EXPORTED:
24/08/2021 2:08 PM
TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong

DATA SOURCES
Centennial, RPS, © Department of Finance, Services & Innovation 2018



SCALE 1:10,000 AT A4 SIZE
SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
PROJ: 149823
PURPOSE: BIR

IMPORTANT NOTE

1. This plan was prepared for the sole purposes of the client for the specific purpose of producing a photographic overlay plan. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other purpose, use or matter. This plan is provided without the responsibility or duty of care to any other person (other than the Client) (Third Party) and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be liable (in negligence or otherwise) for any direct or indirect loss, damage, liability or claim arising out of or incidental to:

- a. This Third Party's reliance on or using of this plan;
- b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreliable;
- c. Any inaccuracies or other faults with information or data sourced from a Third Party.

3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate.

4. The Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd.

5. RPS Australia East Pty Ltd, with any local authority requires the recommendation of RPS Australia East Pty Ltd of the accuracy, reliability, suitability or completeness of any representations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.



4.4 Fauna Surveys

Threatened fauna detected during field surveys (either opportunistic or during targeted surveys) within or nearby the Project Area are detailed in **Table 4-6**.

Table 4-6 Threatened fauna detected

Scientific Name Common Name	BC Act	EPBC Act	Detected inside Project Area	Detected outside Project Area
<i>Chalinolobus dwyeri</i> Large-eared Pied Bat	Vulnerable	Vulnerable	No	Yes
<i>Miniopterus australis</i> Little Bent-winged Bat	Vulnerable	Not Listed	No	Yes
<i>Calyptorhynchus lathami</i> Glossy Black Cockatoo	Vulnerable	Not Listed	Yes	Yes
<i>Climacteris picumnus</i> Brown Treecreeper (eastern subspecies)	Vulnerable	Not Listed	No	Yes
<i>Pteropus poliocephalus</i> Grey-headed Flying Fox	Vulnerable	Vulnerable	No	Yes
<i>Petaurus australis</i> Yellow-bellied Glider	Vulnerable	Not Listed	No	Yes
<i>Petauroides volans</i> Greater Glider	Not Listed	Vulnerable	No	Yes
<i>Haliaeetus leucogaster</i> White-breasted Sea Eagle	Vulnerable	Not Listed	No	Yes
<i>Tyto novaehollandiae</i> Masked Owl	Vulnerable	Not Listed	Yes	No
<i>Tyto tenebricosa</i> Sooty Owl	Vulnerable	Not Listed	No	Yes

Table Note

A small glider observed northwest and outside of the Project Area was identified as either a Squirrel Glider (*Petaurus norfolcensis*; BC Act = Vulnerable; EPBC Act = Not Listed) or Sugar Glider (*Petaurus breviceps*; BC Act = Not Listed; EPBC Act = Not Listed). In the absence of scientific certainty, the precautionary approach was adopted with the individual identified as a Squirrel Glider.

Fauna detected during surveys are provided in **Appendix G**. The Anabat echolocation call analysis for microbats is provided in **Appendix H**.

4.4.1 Targeted Herpetofauna Census

No threatened herpetofauna were detected within the Project Area during diurnal or nocturnal surveys. Common amphibian species recorded within the Project Area are identified in **Appendix G**.

4.4.2 Habitat Values

Habitat values identified within the Project Area for fauna included: HBTs; caves; sandstone boulders and rocks; ephemeral creeks; and termite mounds. These habitat features provide potential foraging and / or breeding habitat for a range of bird, reptile, amphibian and mammal species. **Sections 4.4.2.1 and 4.4.2.2** present results from targeted habitat surveys that focused on habitat constraints for Candidate Species: cave- and tree hollow-associated fauna. These habitat attributes were used to inform the development of Species Polygons for relevant threatened fauna within the BDAR.

4.4.2.1 Hollow bearing trees

Twenty hollow-bearing trees were located within the vicinity of the predicted ponding areas (i.e. within approximately 100 m of creek lines). The attributes of these trees are summarised in **Table 4-7** and displayed in **Figure 4-4**.

Table 4-7 Hollow-bearing trees recorded within 100 m of predicted ponding areas

HBT ID	Species	DBH (cm)	Hollow Class		
			C1 (>20cm)	C2 (11-20cm)	C3 (<10cm)
5	Dead stag	51 - 60	1	-	-
12	<i>Corymbia maculata</i>	61 - 70	-	2	-
13	<i>Eucalyptus pilularis</i>	81 - 90	1	1	-
14	<i>Eucalyptus microcorys</i>	81 - 90	1	-	-
15	<i>Eucalyptus microcorys</i>	71 - 80	1	-	-
16	<i>Eucalyptus pilularis</i>	>100	1	-	-
17	<i>Eucalyptus pilularis</i>	>100	-	2	-
18	<i>Eucalyptus microcorys</i>	71 - 80	-	1	-
19	Dead stag	51 - 60	1	-	-
20	<i>Eucalyptus propinqua</i>	71 - 80	-	2	-
33	<i>Eucalyptus acmenoides</i>	71 - 80	-	1	-
34	<i>Eucalyptus pilularis</i>	>100	1	2	-
35	<i>Corymbia maculata</i>	>100	2	-	-
63	Dead stag	>100	-	2	2
64	<i>Eucalyptus siderophloia</i>	81 - 90	1	3	-
65	<i>Corymbia maculata</i>	>100	3	-	-
66	<i>Angophora floribunda</i>	51 - 60	-	2	-
68	<i>Eucalyptus microcorys</i>	41 - 50	-	1	-
153	<i>Eucalyptus propinqua</i>	81 - 90	-	1	1
264	<i>Eucalyptus pilularis</i>	>100	1	4	-

4.4.2.2 Caves

Nineteen caves were recorded inside or near the Project Area as potential bat habitat during the current study. Of these, bat scat was detected in three caves. An additional eight caves were marked up as shelter sites for First Nations People (two with art), which may also provide microbat roosting habitat. The locations of these caves, including those with scats present, is shown in **Figure 4-5**. Details regarding the attributes of these caves summarised in **Table 4-8** and photographs are provided in **Appendix I**.

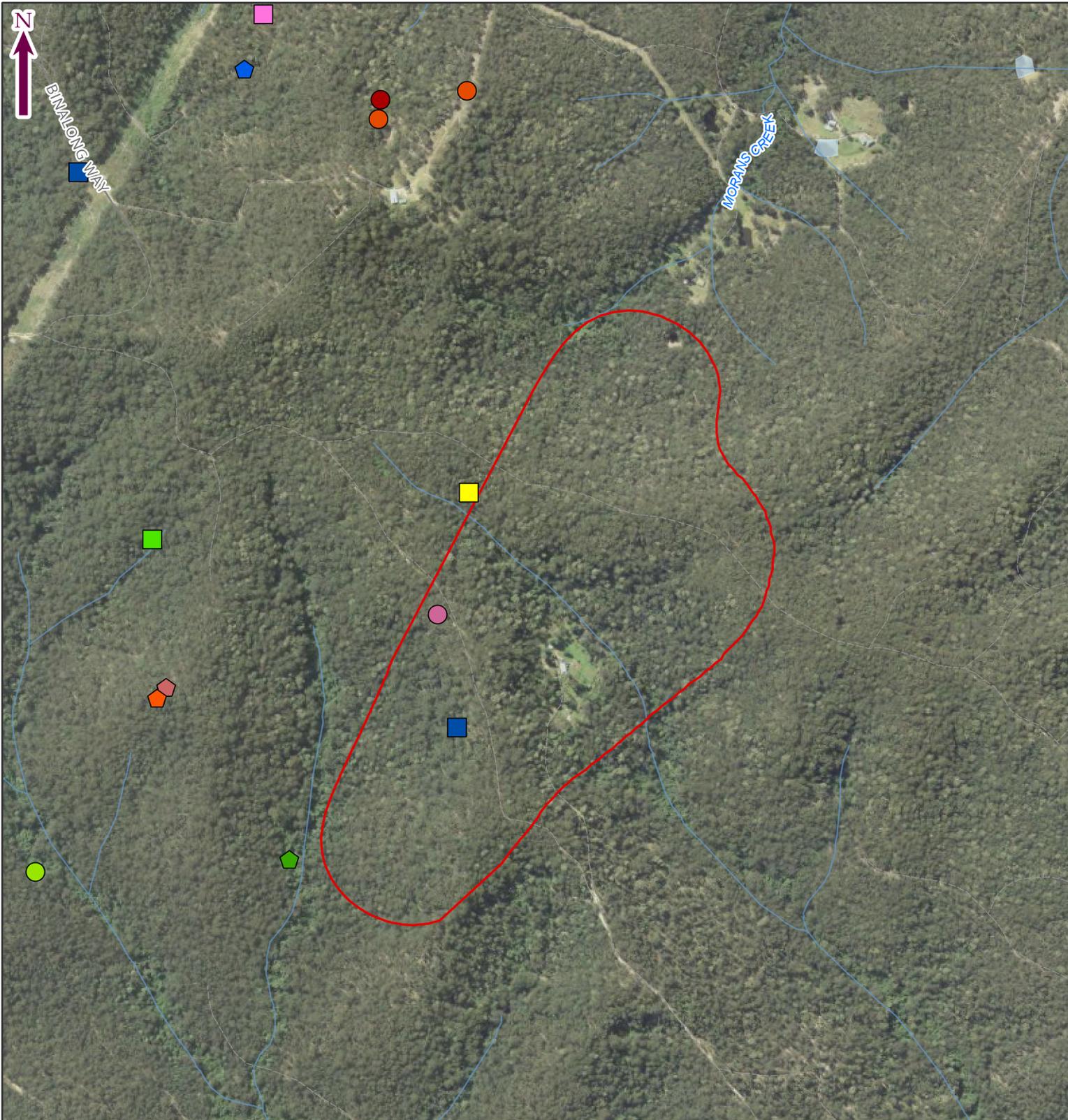
The potential for these caves to constitute habitat for cave-associated threatened bats was informed by Mr Glenn Hoye (Fly By Night Bat Surveys; 25 years' experience researching microbats).

Table 4-8 Caves recorded within 100 m of predicted ponding areas

CAVE ID	Overhang max width (m)	Overhang max depth (m)	Overhang max length (m)	Bat scat present	Bats present
C32	2.66	1.83	1.83	-	-
C33	2.6	1.99	1.99	-	-
C34	5.27	2.97	2.97	-	-
C35	4.24	2.94	2.94	-	-
C36	4.07	4.64	4.64	-	-

REPORT

CAVE ID	Overhang max width (m)	Overhang max depth (m)	Overhang max length (m)	Bat scat present	Bats present
C37	4.44	7.22	7.22	-	-
C38	4.43	4.3	4.3	-	-
C39	5.05	4.56	4.56	-	-
C40	2.98	4.85	4.85	-	-
C41	2.61	2.76	2.76	-	-
C42	3.23	2.68	2.68	-	-
C43	3.61	2.73	2.73	-	-
C44	3.25	3.64	3.64	-	-
C45	2.31	2.97	2.97	Yes	-
C46	2.27	1.95	1.95	-	-
C47	4.15	3.79	3.79	-	-
C56	7.1	1.35	4.69	Yes	-
NA	NA	NA	NA	Yes	-
NA	NA	NA	NA	-	-

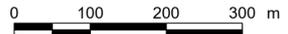


Legend					
	Black-faced Monarch - <i>Monarcha melanopsis</i>		Grey-headed Flying-fox - <i>Pteropus poliocephalus</i>		Sooty Owl - <i>Tyto tenebricosa</i>
	Brown Treecreeper - <i>Climacteris picumnus</i>		Large-eared Pied Bat - <i>Chalinolobus dwyeri</i>		Squirrel Glider - <i>Petaurus norfolcensis</i>
	Brown Treecreeper (eastern subspecies) - <i>Climacteris picumnus victoriae</i>		Little Bent-winged Bat - <i>Miniopterus australis</i>		White-breasted Sea Eagle - <i>Haliaeetus leucogaster</i>
	Glossy Black-Cockatoo - <i>Calyptorhynchus lathami</i>		Little Lorikeet - <i>Glossopsitta pusilla</i>		Yellow-bellied Glider - <i>Petaurus australis</i>
	Greater Glider - <i>Petauroides volans</i>		Masked Owl - <i>Tyto novaehollandiae</i>		Project Area
			Rufous Fantail - <i>Rhipidura rufifrons</i>		

FIGURE 4-3
THREATENED/MIGRATORY FAUNA RECORDED

VERSION:
A
DATE EXPORTED:
13/07/2021 4:25 PM
TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong



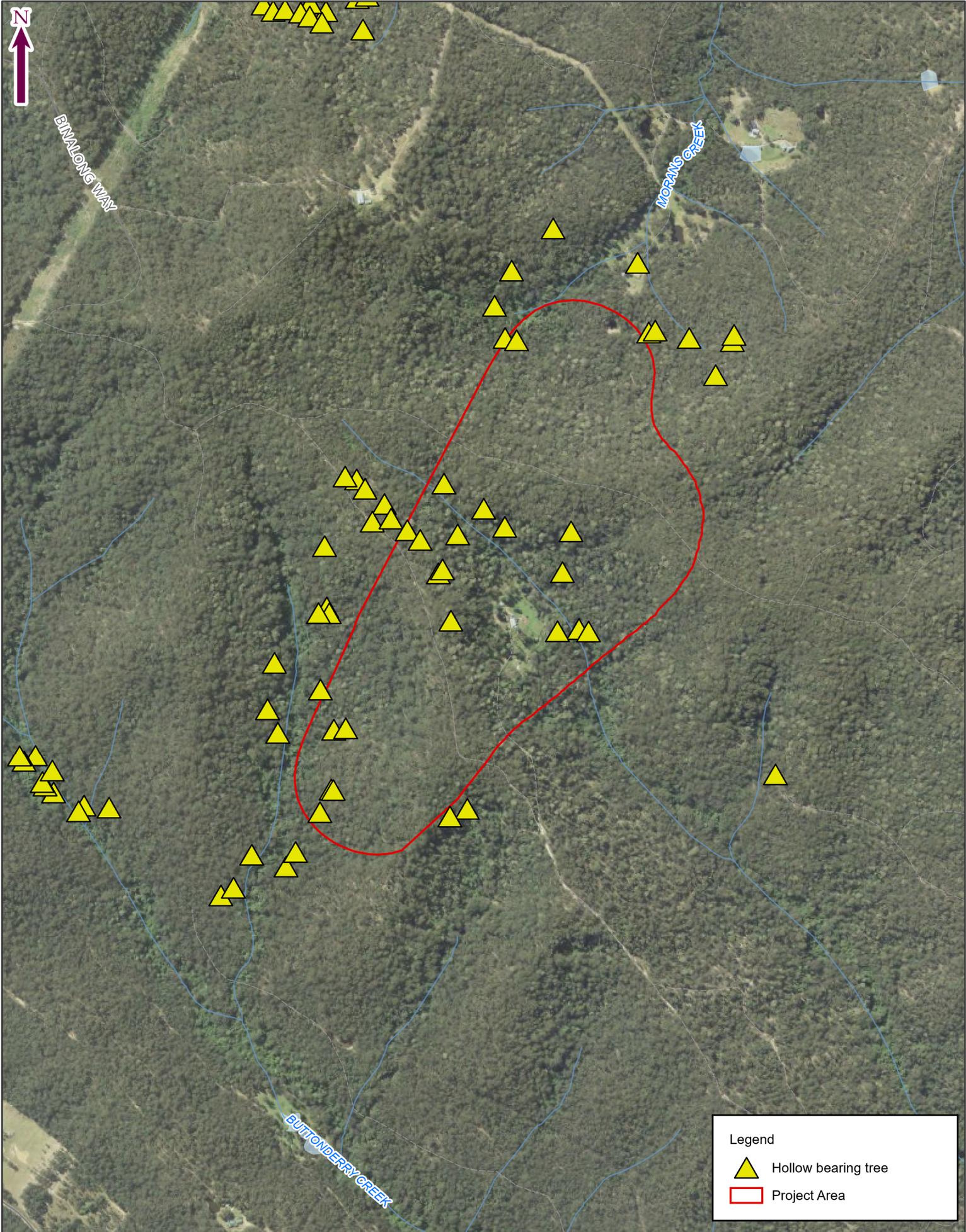
DATA SOURCES
Centennial, RPS, © Department of Finance, Services & Innovation 2018

SCALE 1:10,000 AT A4 SIZE
SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
PROJ: 149823
PURPOSE: BIR

DISCLAIMER NOTE
1. This plan was prepared for the site purposes of the client for the specific purpose of producing a photographic aerial plan. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other application, program, use or action. The plan is presented without the assumption of a duty of care to any other person (other than the Client) ("Third Party"), and may not be relied on by Third Party.
2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
a. a Third Party publishing, using or relying on the plan;
b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unrepresentative;
c. any inaccuracies or other faults with information or data sourced from a Third Party.
3. RPS Australia East Pty Ltd, relying on surface indicators that are incorrect or inaccurate;
4. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
5. judgement of this plan with any local authority against the recommendation of RPS Australia East Pty Ltd;
6. the accuracy, reliability, suitability or completeness of any approximations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.





Legend

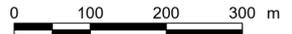
-  Hollow bearing tree
-  Project Area

**FIGURE 4-4
HABITAT TREES RECORDED**

VERSION:
A
DATE EXPORTED:
13/07/2021 4:50 PM
TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong

DATA SOURCES
Centennial, RPS, © Department of Finance, Services & Innovation 2018



SCALE 1:10,000 AT A4 SIZE
SPATIAL REFERENCE: GDA 1994 MGA Zone 56

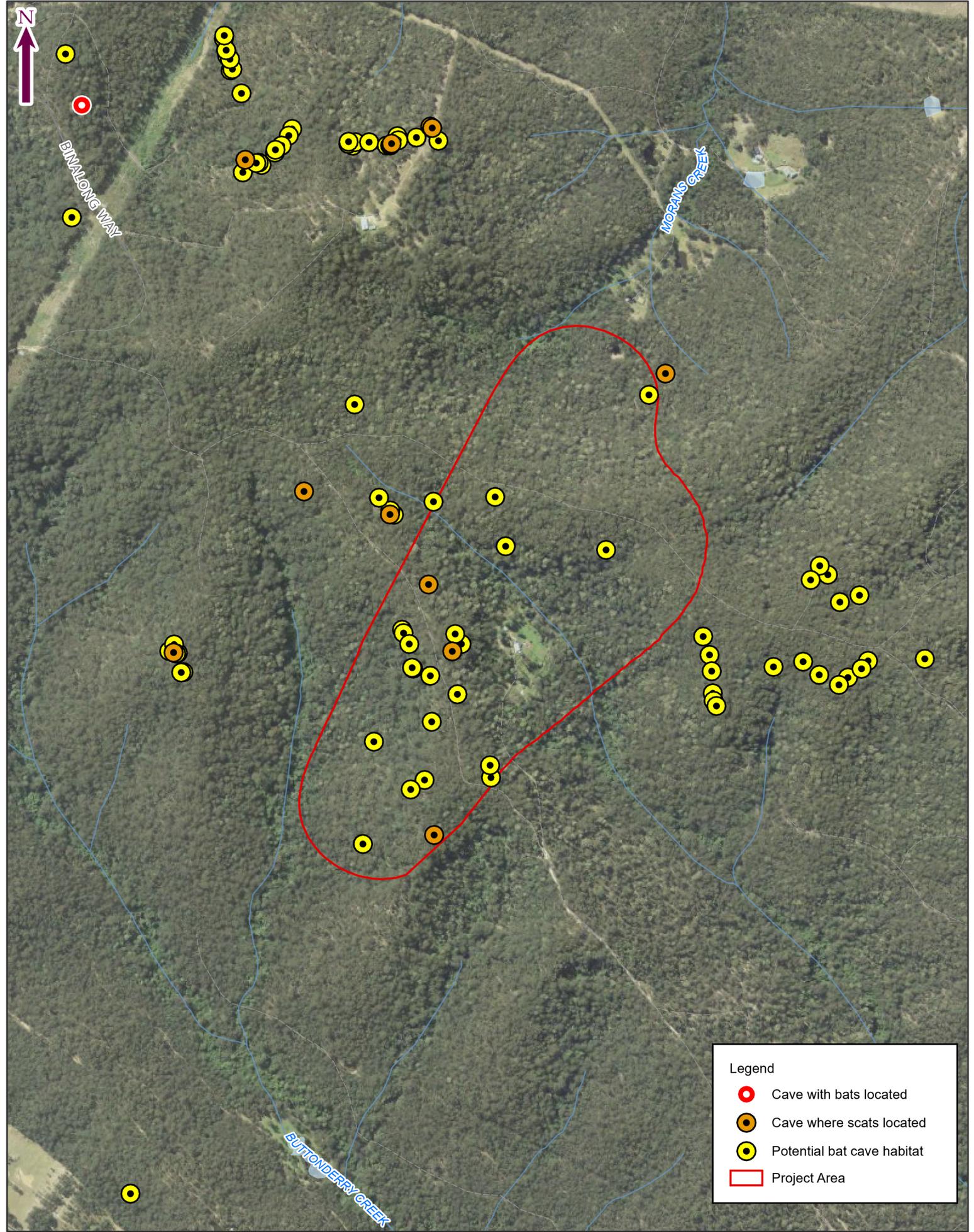
CLIENT: Centennial
PROJ: 149823
PURPOSE: BIR

DISCLAIMER NOTE
1. This plan was prepared for the site purposes of the client for the specific purpose of producing a photographic aerial plan. This plan is strictly limited to the purpose and does not extend directly or indirectly and will not be used for any other application, program, use or matter. The plan is presented without the assumption of a duty of care to any other person (other than the Client ("Third Party")) and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
a. Third Party activities using or relying on the plan;
b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
c. any inaccuracies or other faults with information or data sourced from a Third Party.

d. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
e. Third Party activities using or relying on information in the plan where recommended by RPS Australia East Pty Ltd;
f. RPS Australia East Pty Ltd;
g. the accuracy, reliability, suitability or completeness of any approximations or estimates made or referred to by RPS Australia East Pty Ltd in this plan.





Legend

- Cave with bats located
- Cave where scats located
- Potential bat cave habitat
- Project Area

**FIGURE 4-5
CAVES RECORDED**

VERSION:
A
DATE EXPORTED:
13/07/2021 5:05 PM
TECHNICIAN:
Robert Suansri

LOCATION:
Mandalong

DATA SOURCES
Centennial, RPS, © Department of Finance, Services & Innovation 2018



SCALE 1:10,000 AT A4 SIZE
SPATIAL REFERENCE: GDA 1994 MGA Zone 56

CLIENT: Centennial
PROJ: 149823
PURPOSE: BIR

DISCLAIMER NOTE
1. This plan was prepared for the site purposes of the client for the specific purpose of producing a photographic cave map. This plan is strictly limited to the purpose and does not apply directly or indirectly and will not be used for any other purpose, program, use or order. The plan is prepared without the assistance of a body of cave for any other person (other than the Client) ("Third Party"), and may not be relied on by Third Party.
2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
a. a Third Party providing, using or relying on the plan;
b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
c. any inaccuracies or other faults with information or data sourced from a Third Party.
3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
4. the Client or any Third Party not verifying information in the plan where recommended by RPS Australia East Pty Ltd;
5. RPS Australia East Pty Ltd;
6. the accuracy, reliability, suitability or completeness of any approximations or estimates made or referred to by RPS Australia East Pty Ltd in the plan.



5 IMPACT ASSESSMENT

5.1 NSW State Groundwater Dependant Ecosystems

The potential for Groundwater Dependent Ecosystems was explored using the Groundwater Dependent Ecosystems Atlas (GDE Atlas). The GDE Atlas was developed as a national dataset of Australian GDEs to inform groundwater planning and management (BOM 2021b). According to the GDE Atlas, potential GDEs within the Project Area are displayed in **Figure 5-1**.

The primary source of groundwater in the region, owing to the underlying sandstone, is likely to be a sedimentary rock groundwater system.

The PCTs on the Project Area that have a moderate or greater potential to be a GDE include:

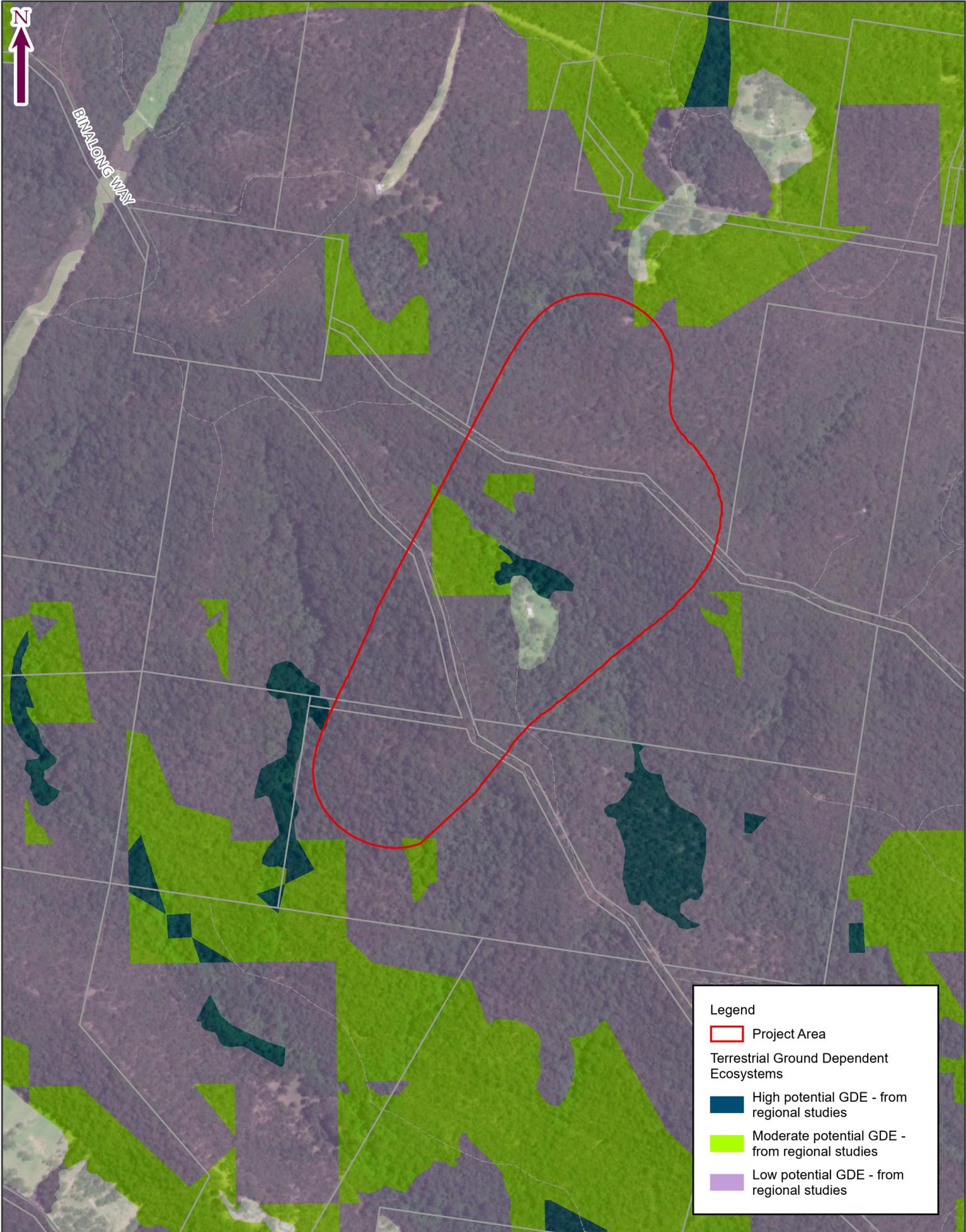
- 1528 - Jackwood - Lilly Pilly - Sassafras riparian warm temperate rainforest of the Central Coast;
- 1556 - Tallowood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast;
- 1568 - Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast; and
- 1573 - Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment.

Based on the nature of the Project, impacts on groundwater are expected to be negligible. That is, a minor increase in groundwater influence within areas predicted for ponding (i.e. <1 ha) are not expected to lead to a significant shift in vegetation communities (composition or integrity) given the strong association of PCTs with groundwater where ponding is predicted. Nevertheless, ongoing annual monitoring will be undertaken as part of the Extraction Plan Biodiversity Management Plan (BMP) to detect and respond to any community shifts that may arise from mining-related subsidence in the unexpected case that they do occur.

Note that, to date, ongoing annual monitoring of predicted ponding-related impacts associated with other sets of longwalls has yet to detect a more than negligible impact upon GDE's (including PCTs 1568 and 1573).

5.2 Coastal Management State Environmental Planning Policy 2018

The Project Area is outside of any planning considerations under the Coastal Management SEPP, including Coastal Wetlands, Littoral Rainforest, Coastal Vulnerability Area, Coastal Environment Area and Coastal Use Area (DPE 2021).

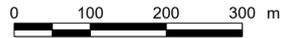


**FIGURE 5-1
GROUND DEPENDENT ECOSYSTEMS (BOM
2021B)**

**VERSION:
A**
**DATE EXPORTED:
13/07/2021 4:49 PM**
**TECHNICIAN:
Robert Suansri**

**LOCATION:
Mandalong**

DATA SOURCES
Centennial, RPS, Maxar



SCALE: 1:10,000 AT A4 SIZE
SPATIAL REFERENCE: GDA 1994 MGA Zone 56

Legend

- Project Area

Terrestrial Ground Dependent Ecosystems

- High potential GDE - from regional studies
- Moderate potential GDE - from regional studies
- Low potential GDE - from regional studies

CLIENT: Centennial
PROJ.: 149823
PURPOSE: BIR

DISCLAIMER NOTE
1. This plan was prepared for the site purposes of the client for the specific purpose of producing a photographic aerial plan. This plan is strictly limited to the purpose and does not extend directly or indirectly and will not be used for any other purpose, program, use or action. The plan is prepared without the assumption of a duty of care to any other person (other than the Client) ("Third Party"), and may not be relied on by Third Party.

2. RPS Australia East Pty Ltd will not be liable for negligence or otherwise for any direct or indirect loss, damage, liability or claim arising out of or incidental to:
a. a Third Party publishing, using or relying on the plan;
b. RPS Australia East Pty Ltd relying on information provided to it by the Client or a Third Party where the information is incorrect, incomplete, inaccurate, out-of-date or unreasonable;
c. any inaccuracies or other faults with information or data sourced from a Third Party.

3. RPS Australia East Pty Ltd relying on surface indicators that are incorrect or inaccurate;
4. the Client or any Third Party not verifying information in the plan where recommended by RPS Australia East Pty Ltd;
5. judgement by RPS Australia East Pty Ltd;
6. RPS Australia East Pty Ltd;
7. the accuracy, reliability, suitability or completeness of any approximations or estimates made or referred to by RPS Australia East Pty Ltd in the plan.



5.3 Environmental Protection and Biodiversity Conservation Act 1999

5.3.1 Listed Migratory Species

Seventeen nationally listed migratory terrestrial and wetland species were recorded on the DAWE online database or are considered to have potential habitat available within the locality (**Table 5-1**).

Table 5-1 Migratory birds listed under EPBC Act

Scientific Name	Common Name
Migratory Terrestrial Species	
<i>Cuculus optatus</i>	Oriental Cuckoo, Horsfield's Cuckoo
<i>Hirundapus caudacutus</i>	White-throated Needletail
<i>Monarcha melanopsis</i>	Black-faced Monarch
<i>Monarcha trivirgatus</i>	Spectacled Monarch
<i>Motacilla flava</i>	Yellow Wagtail
<i>Myiagra cyanoleuca</i>	Satin Flycatcher
<i>Rhipidura rufifrons</i>	Rufous Fantail
Migratory Wetland Species	
<i>Actitis hypoleucos</i>	Common Sandpiper
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper
<i>Calidris canutus</i>	Red Knot
<i>Calidris ferruginea</i>	Curlew Sandpiper
<i>Calidris melanotos</i>	Pectoral Sandpiper
<i>Gallinago hardwickii</i>	Latham's Snipe
<i>Limosa lapponica</i>	Bar-tailed Godwit
<i>Numenius madagascariensis</i>	Eastern Curlew
<i>Pandion haliaetus</i>	Osprey
<i>Tringa nebularia</i>	Common Greenshank

Of these species Rufous Fantail (*Rhipidura rufifrons*) and Black-faced Monarch (*Monarcha melanopsis*) were recorded nearby the Project Area (**Figure 4-3**).

Due to the minor extent of impact on habitat for these above listed migratory birds, as a result of the predicted increase in ponding relating to subsidence (i.e. <1 ha), the Project is unlikely to impact on any area considered to be 'important habitat' for these migratory species or impact a significant proportion of a migratory population.

5.3.2 Listed Threatened Species

Forty-five nationally threatened species have been recorded or may occur within the locality. Through the LoO, 13 EPBC Act listed species were deemed as having a moderate or greater likelihood of occurring within the Project Area and have potential to be impacted by ponding (**Appendix C**). EPBC Act Listed threatened species with a moderate or greater likelihood of occurring (and impacted by ponding) are:

- *Angophora inopina* (Charmhaven Apple; EPBC Act: Vulnerable);
- *Cryptostylis hunteriana* (Leafless Tongue-orchid; EPBC Act: Vulnerable);
- *Cynanchum elegans* (White-flowered Wax Plant; EPBC Act: Endangered);
- *Diuris praecox* (Rough Doubletail; EPBC Act: Vulnerable);
- *Mixophyes iteratus* (Giant Barred Frog; EPBC Act: Endangered);

REPORT

- *Heleioporus australiacus* (Giant Burrowing Frog; EPBC Act: Vulnerable);
- *Litoria aurea* (Green and Golden Bell Frog; EPBC Act: Vulnerable);
- *Petauroides volans* (Greater Glider; EPBC Act: Vulnerable);
- *Pteropus poliocephalus* (Grey-headed Flying Fox; EPBC Act: Vulnerable);
- *Litoria littlejohni* (Littlejohn's Tree Frog; EPBC Act: Vulnerable);
- *Melaleuca biconvexa* (Biconvex Paperbark; EPBC Act: Vulnerable);
- *Persicaria elatior* (Tall Knotweed; EPBC Act: Vulnerable);
- *Rhodamnia rubescens* (Scrub Turpentine; EPBC Act: Critically Endangered);
- *Rhodomyrtus psidioides* (Native Guava; EPBC Act: Critically Endangered);
- *Mixophyes balbus* (Stuttering Frog; EPBC Act: Vulnerable);
- *Syzygium paniculatum* (Magenta Lilly Pilly; EPBC Act: Vulnerable); and
- *Tetradlea juncea* (Black-eyed Susan; EPBC Act: Vulnerable).

Out of the above species the following EPBC Act listed species were detected within or nearby the Project Area:

- *Pteropus poliocephalus* (Grey-headed Flying-fox);
- *Petauroides volans* (Greater Glider);
- *Chalinobolus dwyeri* (Large-eared Pied Bat); and
- *Rhodamnia rubescens* (Scrub Turpentine; EPBC Act: Critically Endangered).

One individual Grey-headed Flying Fox was detected to the west of the Project Area (foraging only). Moreover, one Greater Glider (*Petauroides volans*) was detected in contiguous vegetation, nearby the Project Area. As the Project is expected to modify only a small extent of vegetation (i.e. < 1 ha) by ponding, it is not expected to have a significant impact on EPBC Act listed fauna, which typically have large foraging ranges.

Large-eared Pied Bat (*Chalinobolus dwyeri*) were found outside the Project Area at monitoring sites 3 and 4 (see **Figure 3-5** and **Appendix H**). Note that this species was not detected within the two monitoring sites within the Project Area.

Of the above species, the greatest potential impact on the above MNES entities was considered to be for the Critically Endangered *R. rubescens*, as it occurs within the Project Area. Although this species can be locally abundant, they have recently been listed due to impacts by Myrtle Rust (*Puccinia psidii*) (DAWE 2020b). Nevertheless, all *R. rubescens* individuals were found outside the predicted ponding areas. An assessment of significance is provided for this species is provided in **Appendix J**, concluding that there is unlikely to be a significant impact on this species.

5.3.3 Threatened Ecological Communities

No TEC listed under the EPBC Act were detected within the Project Area. As such, no assessment for EPBC Act Listed TECs is provided in this report.

6 CONCLUSIONS AND RECOMMENDATIONS

This BIR provides ecological survey results required to inform the preparation of a BDAR for impacts on biodiversity values arising from the addition of Longwall (LW) 34 as part of Modification 10 to SSD-5144. This report also assesses matters not addressed in the BDAR, such as assessments required under the EPBC Act and relevant SEPPs. Conclusions and recommendations are provided in the following sections.

6.1 State Requirements (BC Act)

Five PCTs were located within the Project Area. These PCTs were:

- 1528 - Jackwood - Lilly Pilly - Sassafras riparian warm temperate rainforest of the Central Coast (Moderate condition);
- 1556 - Tallowood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast (Moderate condition);
- 1568 - Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast (Moderate condition);
- 1573 - Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment (Moderate condition); and
- 1588 - Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast (Moderate condition).

Of these PCTs, subsidence related impacts associated with ponding may occur to PCT 1556 (Zone 2), 1568 (Zone 3) and 1573 (Zone 4).

Of the BC Act listed threatened flora, only *Rhodamnia rubescens* (Scrub Turpentine; BC Act = Critically Endangered; EPBC Act = Critically Endangered) was detected.

The following fauna species listed under the BC Act (or signs thereof) were found within or nearby the Project Area:

- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus*; BC Act = Vulnerable; EPBC Act = Not Listed);
- Glossy Black Cockatoo (*Calyptorhynchus lathami* (Glossy Black-Cockatoo; BC Act = Vulnerable; EPBC Act = Not Listed);
- Grey-headed Flying Fox (*Pteropus poliocephalus*; BC Act = Vulnerable; EPBC Act = Vulnerable);
- Large-eared Pied Bat (*Chalinolobus dwyeri*; BC Act = Vulnerable; EPBC Act = Vulnerable);
- Little Bent-winged Bat (*Miniopterus australis*; BC Act = Vulnerable; EPBC Act = Not Listed);
- Masked Owl (*Tyto novaehollandiae*; BC Act = Vulnerable; EPBC Act = Not Listed); and
- Sooty Owl (*Tyto tenebricosa*; BC Act = Vulnerable; EPBC Act = Not Listed).
- Squirrel Glider (*Petaurus norfolcensis*; BC Act = Vulnerable; EPBC Act = Not Listed)'
- White-breasted Sea Eagle (*Haliaeetus leucogaster*; BC Act = Vulnerable; EPBC Act = Not Listed); and
- Yellow-bellied Glider (*Petaurus australis*; BC Act = Vulnerable; EPBC Act = Not Listed).

Impacts to the above listed PCT and Species Credit Species are addressed in the BDAR.

6.2 Commonwealth Requirements (EPBC Act)

No TECs listed under the EPBC Act were detected within the Project Area. As such, no assessment for EPBC Act listed TECs is required. Moreover, due to the minor increase in ponding expected, it is considered unlikely that the Project would result in a significant impact to any EPBC Act listed threatened species.

Of the potential EPBC Act listed fauna with potential to occur, Large-eared Pied Bat (*Chalinolobus dwyeri*), Grey-headed Flying Fox (*Pteropus poliocephalus*) and Greater Glider (*Petauroides volans*; EPBC Act =

REPORT

Vulnerable) were found within or nearby the Project Area. It was considered unlikely that the Project would have a significant impact on these mobile species, with large home ranges, due to the scale and nature of the impacts associated with the Project.

Eighty-nine *Rhodamnia rubescens* (Scrub Turpentine) individuals were detected in the Project Area. An Assessment of Significance was undertaken in **Appendix J** due to potential impacts on Critically Endangered *Rhodamnia rubescens* (Scrub Turpentine) due to potential impacts on this sensitive receiver, as it can be associated with riparian areas that could be subject to mining-related ponding.

Based on the self-assessment (AoS), it is considered that the Project is unlikely to have a significant impact on *R. rubescens*. As such, we believe the action does not constitute a controlled action (i.e. not a significant impact on this species). Nevertheless, Centennial may consider referring the Project to the Minister for the Minister's decision under Section 68 (2) of the EPBC Act for the purposes of regulatory certainty. Alternatively, it is recommended that Centennial retain this assessment as evidence of a proper self-assessment being undertaken for this species.

7 REFERENCES

- Bell S.A. (2002). The natural vegetation of the Wyong Local Government Area, Central Coast, New South Wales: Technical Report. Unpublished Final Report to Wyong Shire Council, August 2002. East Coast Flora Survey.
- Bell S. A. (2016). Conversion Lake Macquarie Native Vegetation Community Map Units to Plant Community Types (PCTs) March 2016. Accessed October 2020
<https://lakemac.com.au/page.aspx?pid=109&vid=25&fid=138&ftype=FGp>
- Bell S. A. and Driscoll C (2016a). Volume 1: Vegetation Mapping Report, Lake Macquarie Local Government Area Stages 1 – 6. Unpublished report prepared by East Coast Flora Survey for Lake Macquarie City Council <https://www.lakemac.com.au/files/assets/public/development/native-vegetation-community-map-report.pdf>
- Bell S. A. and Driscoll C (2016b). Volume 2: Vegetation Community Profiles, Lake Macquarie Local Government Area. Unpublished report prepared by East Coast Flora Survey for Lake Macquarie City Council <https://www.lakemac.com.au/files/assets/public/development/native-vegetation-community-profiles.pdf>
- Bureau of Meteorology (2021a). Daily Weather Observations. Accessed July 2021
<http://www.bom.gov.au/climate/dwo/IDCJDW2159.latest.shtml>
- Bureau of Meteorology (2021b). The Groundwater Dependent Ecosystems Atlas (GDE Atlas). Accessed November 2020 <http://www.bom.gov.au/water/groundwater/gde/>
- Carnegie A., Kathuria A., Pegg G., Entwistle P. (2016). Impact of the invasive rust *Puccinia psidii* (myrtle rust) on native Myrtaceae in natural ecosystems in Australia. *Biological Invasions*. 18(1) 127-144.
- Centennial Coal (2018). Mandalong Mining Operations Plan.
- Department of Agriculture, Water and the Environment [DAWE] (2021a). Protected Matters Search. Accessed June 2020.
- DAWE (2021b). Species Profile and Threats Database. Accessed July 2021.
<http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>
- Department of Environment and Climate Change NSW [DECC] (2007a). Threatened species assessment guidelines: The assessment of significance.
- DECC (2007b). River-flat Eucalypt Forest on Coastal Floodplain EEC Identification Guidelines. Accessed February 2021. https://www.environment.nsw.gov.au/resources/threatenedspecies/River_flat_Eucalypt_Forest_A3_High_Res.pdf
- DECC (2009). Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians, Sydney, NSW
- Department of the Environment [DoE] (2013). Significant Impact Guidelines 1.1 - Matters of National Environmental Significance.
- DoE (2014). EPBC Act referral guidelines for the vulnerable koala (combined populations of Queensland, New South Wales and the Australian Capital Territory).
- Department of Land and Water Conservation NSW (2002). The NSW State Groundwater Dependent Ecosystems Policy.
- Department of Planning and Environment NSW [DPE] (2021). Coastal SEPP Mapping Tool. Accessed July 2021. http://webmap.environment.nsw.gov.au/PlanningHtml5Viewer/?viewer=SEPP_CoastalManagement
- Department of Planning, Industry and Environment NSW [DPIE] (2020a) Surveying Threatened Plants and their Habitats. Department of Planning, Industry and Environment, Sydney.
- DPIE (2020b) NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method. Department of Planning, Industry and Environment, Sydney.
- DPIE (2021a). Atlas of NSW Wildlife, Accessed June 2020. Department of Planning, Industry and Environment, Sydney.

REPORT

DPIE (2021b). BioNet Vegetation Classification. Accessed November 2021.
<https://www.environment.nsw.gov.au/research/Visclassification.htm>

Department of Primary Industries [DPI] (2012). Risk Assessment Guidelines for Groundwater Dependent Ecosystems, NSW Department of Primary Industries, Office of Water, Sydney.

DPI (2021). NSW WeedWise. Accessed July 2021. <http://weeds.dpi.nsw.gov.au/>

Department of Sustainability, Environment, Water, Population and Communities [DSEWPC] (2011). Survey guidelines for Australia's threatened mammals.

Eamus, D. (2009) Identifying groundwater dependent ecosystems, A guide for land and water managers. Australian Government – Land and Water Australia

Greater Sydney Local Land Services (2017) Greater Sydney Regional Strategic Weed Management Plan 2017-2022.

Lake Macquarie City Council (2015). Lake Macquarie Native Vegetation and Corridors Map. Accessed July 2021. <https://www.arcgis.com/apps/webappviewer/index.html?id=6d879fae76ed47858c993a74b88b8ba6>

National Herbarium of NSW (2021). PlantNET. Royal Botanic Garden, Sydney, Australia. Accessed July 2021.

National Parks and Wildlife Service (2003a). Descriptions for NSW (Mitchell) Landscapes Version 2.

National Parks and Wildlife Service (2003b). Lower Hunter and Central Coast Regional Environment Management Strategy Vegetation Survey, Classification and Mapping; Lower Hunter and Central Coast Region (LHCCREMS).

RPS (2013) Mandalong Southern Extension Project. Flora and Fauna Assessment. Report prepared for Centennial Mandalong.

RPS (2016) Mandalong Transmission Line TL24 Relocation Project. Flora and Fauna Assessment. Report prepared for Centennial Mandalong.

RPS (2018a) Mandalong 33kv Transmission Easement BDAR and BIR. Report prepared for Centennial Mandalong.

RPS (2018b) Mandalong LW22-29 annual ecological monitoring. Report prepared for Centennial Mandalong.

RPS (2019a) Mandalong Mine Substation BDAR and BIR.

RPS (2018b, 2019b and 2020a) Mandalong LW22-29 annual ecological monitoring. Reports prepared for Centennial Mandalong.

RPS (2019c) Mandalong LW30-33 Baseline surveys.

RPS (2020b) Mandalong LW30-33 Baseline surveys.

RPS (2020c) Mandalong MOD 10 Version 1 Ecological Surveys. Draft report prepared for Centennial Mandalong.

Simpson, K., and Day N. (2010). Field Guide to the Birds of Australia. Penguin Group, Australia.

State of NSW (2020). Biodiversity Assessment Method. DPIE, Sydney.

Tyler M. J. And Knight F. (2011). Field Guide to the Frogs of Australia. Revised Edition. CSIRO Publishing, Australia.

Umwelt (2021). Flood modelling for LW34 (MOD 10)

Wilson S. and Swan G. (2003). A Complete Guide to Reptiles of Australia. Reed New Holland, Sydney.

Appendix A

Staff Qualifications



Hayden Beck

Senior Ecologist

Role at RPS

Senior Ecologist

Location

Newcastle, NSW, Australia

Qualifications

BSc (Mar Sc); BEnvSc (Hons); MSc (Res); PhD

BAM Accredited Assessor (BAAS19000)

AUSRIVAS Macroinvertebrate Bioassessment Training

Contaminated Site Assessment, Remediation and Management (CSARM) short course, UTS4X4 driving Certificate

White Card

Rail Industry Safety Induction – RISI

Memberships

Ecological Consultants Association of NSW (Practicing Member)

Why Hayden for this role

Hayden specialises in terrestrial, aquatic and marine ecology. As an Ecologist at RPS, Hayden undertakes fieldwork and prepares reports for diverse projects, including the mining and housing sectors.

Being a Biodiversity Assessment Method (BAM) Accredited Assessor, Hayden has considerable experience preparing Biodiversity Assessment Reports under the NSW *Biodiversity Conservation Act 2016*.

Relevant projects

Woolooga Solar Farm, Lightsource BP, 2020 - 2021

Hayden prepared Preliminary Documentation to assist with Commonwealth assessment for a proposed solar farm in Woolooga, QLD. Preparation of this report involved collating several specialist reports to assess impacts on biodiversity values. As part of this project, Hayden also prepared a Biodiversity Management Plan (BMP) and Offset Management Plan (OMP).

Fernleigh Track Extension REF and EIS, Lake Macquarie City Council, 2020

RPS was engaged for a Review of Environmental Factors (REF) and Environmental Impact Statement (EIS) for the Fernleigh Awabakal Shared Track (FAST) Extension from Belmont to Blacksmiths. Hayden provided ecological advice including Fauna trapping and aquatic ecology.

33kV Power Easement for Mandalong Coal Mine, Centennial Coal, 2019

Hayden prepared a Biodiversity Development Assessment Report (BDAR) to determine the offset liability for this State Significant Development (SSD). This project extended 7.6km easement will extent through multiple Plant Communities. Preparation of this report involved collating multiple years of field data and specialist reports to assess impacts on biodiversity values. As part of this project, Hayden supported the lodgement an EPBC Act referral due to uncertain impacts on threatened flora.

LW22-24a and LW 25-31 Mandalong Coal Mine, Centennial Coal, 2019 - 2021

Hayden organises annual monitoring of sensitive ecological communities, as well as frogs, to detect impacts of longwall mining. As a project manager, he coordinates teams of up to six ecologists to undertake surveys across a vast area.

Jemalong Solar Farm, Genex Power Pty Ltd, 2019

Hayden prepared an EPBC Act referral document for a proposed Solar Farm (SSD) in Jemalong, NSW. This Project involved assessing impacts of removing hollow-bearing trees on Swift Parrot and Corben's Long-eared Bat.

Relevant projects

Basalt Quarry, Boral, 2019

Hayden undertook a feasibility assessment for a proposed basalt mine at North Star, NSW. This project involved undertaking flora surveys across Semi-evergreen Vine Thicket EEC to determine the offset liability to develop the site. Three extraction options were assessed. Involvement included fieldwork, preparation of a report and presentation to the client.

NBN tower Installation, Vision Stream, 2019

Hayden prepared a BDAR to determine the offset liability for an infrastructure Project at Tallong, NSW. Impacts to ecosystems and threatened species were assessed for the installation of an access track, NBN tower and associated facilities.

Newcastle Light Rail (NLR) Project, Downer, 2019

Hayden prepared the ecological sections of an Infrastructure sustainability rating (ISCA) application for the 'As Built' stage of the NLR Project

Tikitere Quarry, SMK Consultants, 2017

Hayden assisted the ecological assessment of a basalt quarry at North Star, NSW. Tasks included fieldwork and assistance with reporting.

Concrete Batch Plant at Bushells Ridge, Advision, 2017

Hayden prepared a Flora and Fauna impact assessment for the proposed establishment of a concrete batch plant. This facility is currently being used to facilitate widening of the M1. This project involved several survey efforts targeting multiple threatened flora and fauna species, including a critically endangered orchid that was found on site.

Roads and Maritime Services, Road Upgrade Projects, 2016 to 2018

Hayden undertook Biodiversity Assessments for 15 road projects. Examples include:

- Widening of Golden Highway, Castlereagh Junction to Dunedoo;
- Shoulder Widening, Golden Highway (Segments 240 to 260), Denman;
- Culvert rehabilitation (23 sites): Old Pacific Highway, Kariong to Mooney;
- Manns Road Upgrade, West Gosford; and
- Drainage Upgrades to M1, Mt Pleasant, Roads and Maritime Services.

Dungog Council, Road Upgrade Projects, 2016

Hayden undertook Biodiversity Assessments and preclearance surveys for two road projects in Dungog Shire Council LGA.

Climate change impacts on tropical fishes, University of Technology Sydney, 2012-2015

This project was aimed at understanding factors mediating the geographic response of marine reef fishes to climate change. This project involved extensive, multi-year underwater surveys of temperate and tropical marine ecosystems in eastern Australia and western Japan. Various aquarium experiments were undertaken to study how predator-prey interactions may structure recruitment success of tropical fishes when colonising a new range. A new method was devised to survey rare reef fish species, which uses a towed GPS to delineate survey effort.

Impacts of soil pollution on reef fish recruitment, Kochi University, 2014

Studied impacts of red soil pollution on reef fish recruitment within Japan, which stems from water pollution arising from agricultural runoff. This project included coral and reef fish surveys, as well as laboratory experiments.

Characterisation of Stormwater pollution in Sydney Harbour, Marrickville, City of Sydney and Leichhardt Councils, 2010-2012

Measured and analysed water pollution within Sydney Harbour catchments, including metals, nutrients and suspended solids. This project involved generating water pollution budgets for different flow conditions, then devising a water treatment strategy.

Research Assistant, Macquarie University, 2007-2010

Organised and conducted fieldwork and laboratory experiments for several aquatic ecology-focused projects, including a sea urchin aquaculture venture and collaborations with James Cook University and NSW DPI. In this role, Hayden surveyed marine fishes and invertebrates throughout NSW.

Water Quality Officer, NSW Department of Environment, 2009

Undertook monitoring of water quality through Sydney's Waterways and Beaches. Role involved operating a small vessel to collect water samples from remote locations.

Connectivity of sea urchin populations between southern and eastern Australian Coastlines, Deakin University, 2007

Undertook hierarchically nested surveys of the sea urchin *Heliocidaris erythrogramma* along the coastline from Sydney to Adelaide. This study demonstrated potential breaks in connectivity between populations on the Southern and Eastern coastlines of Australia. Breeding experiments were undertaken to explore a genetic cause for patterns in colour variation of this sea urchin.



Mark Aitkens

Principal Ecologist

Role at RPS

Principal Ecologist

Location

Newcastle, NSW, Australia

Qualifications

Bachelor of Science
(Environmental Biology),
University of Technology
Sydney (UTS)

Accredited Biodiversity
Assessment Method
Assessor under Section
6.10 of the *Biodiversity
Conservation Act 2016*

Rail Industry Safety
Induction - RISI

Memberships

Ecological Society of
Australia

Why Mark for this role

Mark is a Principal Ecologist with 25 years' experience in the delivery of terrestrial and aquatic ecology services to the private and public sectors. Mark is accredited to perform assessments in accordance with the Biodiversity Assessment Methodology (BAM) and has conducted a range of BBAM and BAM assessments for State Significant Infrastructure and State Significant Developments. He is also experienced in the application of the EPBC Act preparation of EPBC Act offset calculations.

Mark is experienced in all aspects of project delivery including design and implementation of seasonally based flora and fauna surveys, identification of terrestrial and aquatic species and ecological communities, impact assessments, and design and implementation of monitoring programs.

Relevant projects

Fernleigh Awabakal Track Extension REF and EIS, Lake Macquarie City Council, 2020 - present

RPS was engaged for a Review of Environmental Factors (REF) and Environmental Impact Statement (EIS) for the Fernleigh Awabakal Shared Track (FAST) Extension from Belmont to Blacksmiths. Mark oversaw ecological field work requirements and preparation of biodiversity assessment documentation for the project including the preparation of a Biodiversity Development Assessment Report. This report informed an overarching Review of Environmental Factors, which aimed to avoid, minimise and mitigate impacts upon local biodiversity in the Lake Macquarie Local Government Area.

Medlow Bath upgrade, Transport for NSW (TfNSW), 2020 – 2021

As part of the Great Western Highway Upgrade Program, the Medlow Bath section will be upgraded to allow dual lanes and safety improvements. Mark prepared a biodiversity assessment report as part of the REF for the Medlow Bath upgrade project.

The Horsley Drive, Transport for NSW (TfNSW), 2021 – present

Mark is the project ecologist engaged for the preparation of an addendum biodiversity assessment to support an REF for the Horsley Drive upgrade between the M7 Motorway and Cowpasture Road to a four-lane divided road. Mark is actively working with the project team to identify impact avoidance, minimisation and mitigation measures suitable for the management of impacts on locally occurring threatened ecological communities including Cumberland Plain Woodland and River-flat Eucalypt Forest.

Relevant projects

NSW Telco Authority (Visionstream), 2018-2021

Preparation of biodiversity assessments for multiple existing and proposed telecommunication sites scattered throughout NSW involving a range of impacts including green field development (e.g. installation of lattice towers) to brownfield works (e.g. bush fire mitigation works). Assessments were performed in accordance with Part 5 of the EP&A Act (i.e. preparation of Test of Significance under Section 7.3 of the BC Act) to determine if the works are likely to have a significant impact on threatened species and ecological communities. Important measures for avoiding and minimising impacts on affected threatened species and ecological communities are provided to manage impacts.

Garfield Road West Upgrade, TfNSW, 2019 -2020

Mark prepared a specialist biodiversity assessment report prepared under Part 5 of the EP&A Act for inclusion in a REF for the reconstruction of Garfield West Road, Riverstone along a new alignment. Challenges successfully encountered included the management of roadside impacts on critically endangered ecological communities, threatened species habitat and key fish habitat (Eastern Creek).

TAP3 Project, TfNSW, 2017 - 2020

Mark is the project ecologist involved in the preparation of biodiversity assessment documentation for rail station upgrade for inclusion in the REF. Assessments have included the identification and assessment of threatened species and ecological communities found within the rail corridor for multiple rail stations located within the greater Sydney metropolitan area.

Kings Hill Concept Plan, Kings Hill Developments, 2015 - present

Mark prepared a Species Impact Statement for a 500 ha development site located within the Newcastle drinking water supply (Grahamstown Dam). Key affected species included the Koala, Brush-tailed Phascogale, woodland birds and threatened orchids. Impacts on coastal wetlands and swamp sclerophyll forest situated in mapped coastal wetlands were also prepared. Assessments were based on comprehensive seasonal surveys involving the project management of eight ecologists. Mark utilised innovative techniques to assess the projects impacts on the Koala (i.e. use of detection dogs and foliage nutrient analysis). Other commissions included the preparation of Biodiversity Management Plan for a dedicated Conservation Area, Vegetation Management Plan and Aquatic Impact Assessment.

Woolooga Solar Farm, lightsourceBP, 2020 - 2021

Mark provided high level support to the RPS environment team assisting with Commonwealth

assessment for a proposed solar farm in Woolooga, QLD. He also reviewed the RPS Biodiversity Management Plan (BMP) and Offset Management Plan (OMP) for this project.

Chaffey Dam, WaterNSW, 2020

Mark was involved in the reconfiguration of the approved Biodiversity Offset Strategy for the endangered Booroolong Frog. Involvement includes the reconsideration of offset mechanisms and locations in light of implementation challenges associated with land tenure, impacts of drought and broader conservation needs for the species. Mark is working with a team of specialists to achieve an improved offsetting outcome for the species.

Holsworthy Base Training Facility Project, 2020

A new training facility proposed on Commonwealth land within the Holsworthy Military Base required detailed biodiversity investigations and assessment against the Significant impact guidelines 1.2 - Actions on, or impacting upon, Commonwealth land and Actions by Commonwealth Agencies. Matters of National Environmental Significance identified (i.e. threatened species and ecological communities) were mapped and used to identify an impact footprint with the least impact on these matters (i.e. avoid, minimise). Assessments were performed for the Koala, a range of threatened flora and two critically endangered ecological communities. Mitigation measures were recommended.

Bulga to Broke Water Pipeline, Singleton Council, 2019

Biodiversity assessment for the installation of a water pipeline to supply potable water from Broke to Bulga. Works initially involved a routes selection process to determine the option with the least environmental impact. Detailed assessments were then performed for the preferred pipeline option, which included the mapping of site scale habitat to vegetation mapping including condition classes for critically endangered vegetation. Impact avoidance, minimisation and mitigation measures were provided within a Review of Environmental Factors assessment framework. State and Commonwealth assessments were performed for affected threatened species and ecological communities.

NBN Build, Visionstream, 2018 - 2019

Preparation of biodiversity assessments for multiple greenfield NBN Towers from Mullumbimby to Tallong (five sites). Biodiversity constraints were identified and managed within tight assessment timeframes to meet NBN delivery objectives.

NBN Build, Tata Consulting, 2016 - 2018

Preparation of biodiversity assessments for multiple greenfield NBN cabling installations from Tweed Heads to Merimbula and west to Braidwood (27 sites). Biodiversity constraints were identified and

managed within tight assessment timeframes to meet NBN delivery objectives.

Waterloo Road Upgrade, RMS, 2017

Mark prepared a specialist biodiversity assessment report as part of a Review of Environmental Factors for the Upgrade of Waterloo Road, North Ryde. Challenges successfully encountered included the management of roadside impacts on critically endangered ecological communities and threatened species habitat.

Wyong Hospital Enabling Works, Health Infrastructure NSW, 2016

Mark prepared a Flora and Fauna Assessment for the Wyong Hospital Enabling Works to inform a Review of Environmental Factors (REF). The approach adopted for field surveys for the Flora and Fauna Assessment was in accordance with the BioBanking Methodology (OEH 2014), enabling the surveys and results of the assessment to be transferrable to any BioBanking Assessments that may be required if the project became considered a Major Project (i.e. State Significant Infrastructure (SSI) or a State Significant Development (SSD)).

Bells Line of Road Upgrade, RMS, 2016 - 2017

Mark prepared a specialist biodiversity assessment report as part of a Review of Environmental Factors for the Upgrade of Bells Line of Road from Lithgow to Bell. Challenges successfully encountered included the management of roadside impacts on endangered ecological communities and threatened species habitat. Investigations included assessments for terrestrial and aquatic matters.

Finley Solar Farm EIS, ESCO, 2017

Mark was involved in RPS' preparation of an Environmental Impact Statement (EIS) for the Finley Solar Farm Project. The Finley Solar Farm would produce 170MW over 500 hectares of land. Numerous RPS service lines worked together to prepare the document. To date RPS have successfully liaised with the NSW Department of Planning and Environment, as well as the client, to progress the project smoothly in line with the desired outcomes.

Western Region Biodiversity Offset Strategy, Centennial Coal, 2018

Preparation of a biodiversity offset strategy for multiple approved coal mining operations in the NSW 'Western Coal Fields' near Lithgow. Involved a post hoc assessment of Project impacts and comparable offsets using the repealed Framework for Biodiversity Offsets (Major Projects) and Part 7A of the *Threatened Species Conservation Act 1995*. Demonstrated a suitable offset strategy for approved projects by gaining approval through the NSW Department of Planning and Environment and Office of Environment and Heritage.

Springvale Coal, Centennial Coal, 2018

Preparation and implementation of Biodiversity Management Plans (BMP) and Swamp Monitoring Programs (SMP) as subplans of Longwall Extractions Plans for the Springvale Coal Extension Project. BMPs and SMPs are reviewed by the Independent Monitoring Panel and State/Commonwealth regulators prior to the approval of secondary coal extraction. Works involved the synthesis of a growing knowledge base on best practice monitoring and management of endangered upland peat swamps listed on State and Commonwealth legislation.

Albion Park, Tower Holdings, 2015 - 2016

Prepared Biodiversity Management Plans for the protection of State and Commonwealth listed endangered and critically endangered plant species (*Zieria granulata* and *Cynanchum elegans*) and ecological communities (Illawarra and South Coast Lowland Forest and Woodland). Management prescriptions centred on weed and fire management, with the latter linked to asset protection zones for the adjoining approved residential subdivision.

Rosewood Estate Tamworth, 2014 - 2015

Project managed and prepared Preliminary Documentation for a 'controlled action' declared under the EPBC Act. Assessment involved a detailed consideration of White Box Yellow Box Blakely's Redgum Grassy Woodland and Derived Native Grasslands, a critically endangered ecological community.

Mary's Mount Blue Metal Quarry, Gunnedah Quarry Products, 2013 - 2014

Project managed and prepared Preliminary Documentation for a 'controlled action' declared under the EPBC Act for a quarry project linked to the delivery of ballast needed for the inland rail project. Assessment involved the consideration of MNES impacted by the quarry including, but not restricted to Semi-evergreen Vine Thicket EEC and the Koala. Calculated and report biodiversity offset requirements in accordance with Commonwealth Offsets Policy and incorporated into a Biodiversity Offset Strategy.

Pacific Highway Upgrade: Oxley Highway to Kempsey, RMS, 2012 - 2014

Assisted in the procurement of approvals under State and Commonwealth legislation including participation in risk assessments, field surveys, reporting, project design and impact assessments (i.e. EPBC Act Preliminary Documentation). Performed monitoring surveys for the State listed *Maundia triglochinos* and the State and Commonwealth listed Giant Barred Frog (*Mixophyes iteratus*) in accordance with a Before Impact Control After monitoring design. Analysed results and

reported findings including an evaluation of Project impacts and performance of mitigation measures.

Water Quality Monitoring Program, Orchard Hills Defence Facility, 2012

Prepared a Water Quality Monitoring Program for a defence facility in western Sydney. Monitoring works included measures of abiotic and biotic indicators for a catchment containing defence activities imbedded within a highly sensitive natural setting containing the critically endangered Cumberland Plain Woodland and nationally listed threatened species. The program included the monitoring of groundwater dependant ecosystems.

Midal Cabling Project, Midal Cabling, 2011 - 2012

The approved Midal aluminium cabling plant is a heavy industrial development located adjacent to the Tomago aluminium smelter. Mark's role in the approvals process involved the preparation of State and Commonwealth assessments for impacts on lands adjacent to the Tomago sands beds (Newcastle water supply). Considered impacts on the threatened New Holland Mouse and Ramsar Wetlands. The EPBC Act Referral adequately demonstrated that Project was not a controlled action.

Maitland to Minimbah Third Track Project, 2011 - 2012

As part of the Hunter8 Alliance, Mark performed integral part of the approvals, post approvals and biodiversity offsetting components of a 30 km section of new rail track constructed adjacent to the existing rail corridor between Maitland and Minimbah, NSW. Prepared and, implemented management plans for microbat exclusion from culverts, pre-clearance surveys and reporting, vegetation clearing audits, biodiversity offset site identification, evaluation and assessment.

Reconstruction of the Limbri to Weabonga Road, Tamworth Regional Council, 2011

Performed biodiversity surveys and assessment for the reconstruction of the Limbri to Weabonga Road following flood damage from the adjacent Swamp Oak Creek. The endangered Booroolong Tree Frog (*Litoria booroolongensis*) and Eel-tailed Catfish (*Tandanus tandanus*) were detected adjacent to the construction area. Impact minimisation involving the establishment of exclusion zones and frog hygiene (Chytrid control) was successfully used to avoid a significant impact on the species. Works could proceed in accordance with an EPBC Act 'Particular Manner' decision notice.

ELF Stage 2 Construction Biodiversity Assessment, Singleton Military Area, 2010

Prepared a Biodiversity Assessments for multiple defence training installations associated with the ELF program located within the Singleton Military

Area. Included the assessment of development and operational impacts such as 'ballistic pruning' on threatened flora and fauna species including the Slaty Redgum (*Eucalyptus glaucina*) and habitat occupied by threatened woodland birds.

Assessments adopted the 'good neighbour policy' (i.e. consideration of impacts on State listed threatened species and ecological communities).



Dan Creevey

Field Ecologist

Role at RPS

Field Ecologist

Location

Newcastle, NSW, Australia

Qualifications

Bachelor of Science

Why Dan Creevey for this role

At RPS, Dan is a Field Ecologist with experience in flora survey and monitoring techniques.

Dan Creevey is an adaptable, hardworking team member with a particular interest in botany. His exposure to several survey methods and ability to lead field and coordinate fieldwork suits him to this project.

Relevant projects

Kings Hill Development – Threatened Species and Vegetation Surveys & Mapping, 2018-2019

Assisted the RPS Ecology team in undertaking Targeted Threatened Species Searches and extensive Vegetation Mapping surveys.

LW22-24a and LW 25-31 Mandalong Coal Mine, Centennial Coal, 2019

Dan undertakes annual monitoring of sensitive ecological communities, as well as frogs, to detect impacts of longwall mining. Here, Dan works within a large team to undertake floristic plots and monitor threatened plants across a vast area.

Swamp Monitoring Project, Centennial Coal, 2019

Employing a variety of survey techniques to gather floristic data within Threatened Highland Peat Swamps on Sandstone (THPSS) vegetation community. Survey techniques include; monitoring ground control points, carrying out threatened species surveys and annual transect monitoring. Data was then analysed and reported to the client as part of ongoing monitoring programs.

Newstan Extension Ecology Assessment, Centennial Coal, 2019

Carrying out flora and fauna surveys for threatened species located above a proposed mine extension. These surveys involved walking wandering transects to locate threatened species, installing nest boxes and carrying out bird surveys. Data was then analysed and reported to the client.

Mandalong Annual Monitoring, Centennial Coal, 2019

Assisted in carrying out BAM plots in a variety of vegetation types. Data was then analysed and reported to the client as part of an ongoing monitoring program.

Threatened Flora Monitoring: *Astrotricha crassifolia* and *Prostanthera junonis*, Newcastle University, 2016-2017

Conducted fieldwork to assess the population dynamics of locate then monitor remanent populations.

Relevant projects

Springvale Blue Mountains Water Skink (*Eulamprus leurensis*) monitoring, Centennial Coal, 2019

Field monitoring to assess the population dynamics of Blue Mountains Water Skink within swamps of the Newnes Plateau.



Rhys Corrigan

Field Ecologist

Role at RPS

Field Ecologist

Location

Newcastle, NSW, Australia

Qualifications

Bachelor of Biotechnology (Hons), University of Newcastle, 2016

First Aid Certificate

White Card

4WD Ticket

Memberships

Member - Animal Care and Rescue Native Animal Trust Fund (Hunter Wildlife Rescue), 2016 - present

Why Rhys for this role

Rhys has over 5 years' field experience conducting various wildlife, vegetation and habitat assessments. He has a sound understanding of State and Commonwealth legislation, along with substantial experience in wildlife research, rehabilitation, and monitoring for the purpose of conservation.

His expertise lies in flora and fauna surveys and monitoring efforts; regularly preparing documentation and reports for clients in relation to monitoring programs and their outcomes.

Relevant projects

Newnes Plateau Shrub Swamp EEC, Centennial Coal Springvale, 2018 – present

Rhys was engaged on this large-scale, long term monitoring project of Endangered Ecological Communities (EEC) across the Newnes Plateau; adjacent to Springvale Colliery. Tasks included flora monitoring, due diligence, fauna and ecological community monitoring and biodiversity management planning. Rhys also provided data management, baseline, seasonal and annual reporting for the project.

Airly Coal Mine Flora and Fauna Surveys and Assessment, Centennial Coal, 2018 – present

Rhys undertook a range of flora and fauna surveys to inform the Annual Airly Coal Mine Flora and Fauna Report. Project tasks included diurnal bird surveys, assessment of fauna habitat quality and value to threatened species, identification of project impacts and measures to avoid or mitigate potential impacts.

Kings Hill Concept Plan, Kings Hill Developments, 2018 – present

Rhys assisted in the preparation of a Species Impact Statement for a 500 ha development site with focal species being the Koala, Brush-tailed Phascogale, woodland birds and threatened orchids. Documentation was based on comprehensive seasonal surveys; utilising innovative techniques to assess the projects impacts on the Koala.

Temperate Highland Peat Swamp (THPSS) Monitoring, Centennial Coal, 2019

Rhys is engaged for a complex seasonal and annual monitoring program for this State and Commonwealth listed threatened ecological community. Monitoring includes flora based repeated measures sampling within a BACI monitoring design and Soil Adjusted Normalised Vegetation Index (SANDVI) analysis of remotely sensed imagery (7cm resolution RGBI imagery) on a quarterly basis.

Relevant projects

Newstan Extension Ecology Assessment, Centennial Coal, 2019

Rhys undertook flora and fauna surveys for threatened species located above a proposed mine extension. These surveys involved walking wandering transects to locate threatened species, installing nest boxes and carrying out bird surveys. Data was then analysed and reported to the client.

Boronia Deanei Monitoring, Springvale Colliery, 2018 – 2019

Rhys assisted in the development of an innovative method to detect *Boronia deanei* from the spatial analysis of areal imagery in combination with field-based surveys. This resulted in the development of a cost and time effective methodology for the monitoring of this population over an area of 200km².

Blue Mountains Water Skink (*Eulamprus leurensis*) monitoring, Centennial Coal, 2018 – 2019

Rhys assisted in the development of a habitat model for this species in correlation with field monitoring to assess the population dynamics of Blue Mountains Water Skink within swamps of the Newnes Plateau.

Large monitor species research, Western Australia, 2018*

Rhys performed trapping and manual handling of large monitor species (*V. panoptes*); dissection of reproductive tracts from specimens; recording data taken on morphometrics and reproductive tracts; engagement with local Indigenous communities to exchange information about the study; and assisted in cryopreservation of germ cells obtained from dissected specimens.

Project Manager, University of Newcastle for Newcastle Coal and Infrastructure Group, 2016 – 2018*

Responsible for managing the captive breeding program for endangered amphibians. This included managing and conducting the reintroduction and monitoring of green and golden bell frogs to the NCIG created habitat areas on Kooragang Island. Rhys organised, translocated, housed and monitored tadpoles in constructed offset habitat; developed effective ecological restoration strategies for endangered amphibians; regulated and maintained the health and well-being of the population.

Ecologist, University of Newcastle / University of Melbourne, 2015 – 2018*

Engaged to detect and quantify the amphibian chytrid fungus from samples using TaqMan qPCR assays for various clients using aseptic techniques.

Research for Conservation Biology Group, University of Newcastle, 2014 – 2016*

Rhys worked as part of the team to conduct research into the conservation of amphibians threatened with extinction. He conducted field surveys as part of the works for the Newcastle Coal and Infrastructure Group (NCIG); detected and quantified the amphibian chytrid fungus from samples using TaqMan qPCR assays in a controlled laboratory setting.

** projects undertaken for previous employers*



Tara Boreham

Ecologist

Role at RPS

Ecologist

Location

Newcastle, NSW, Australia

Qualifications

Bachelor of Science
(Chemistry; Biology),
Macquarie University

Certificate IV in Design

First Aid Certificate

White Card

Coal Order 43 Medical

Rail Industry Worker

RIIVEH305E Operate and
maintain a four wheel drive
vehicle

Why Tara for this role

Tara is an experienced Ecologist with a sound understanding of State and Commonwealth legislation. She has been involved in numerous Management Plans, Review of Environmental Factors, Biodiversity Assessments, flora and fauna targeted surveys, flora and fauna monitoring, vegetation surveys, weed mapping and Biodiversity Assessment Methodology surveys.

Tara has been responsible for desktop research and scientific database assessment, field surveys, reporting, mapping, data management and project management.

Relevant projects

Airly Coal Mine Flora and Fauna Surveys and Assessment, Centennial Coal, 2019 – present

Tara undertook a range of flora and fauna surveys to inform the Annual Airly Coal Mine Flora and Fauna Report. Project tasks included diurnal bird surveys, assessment of fauna habitat quality and value to threatened species, identification of project impacts and measures to avoid or mitigate potential impacts.

Newnes Plateau Shrub Swamp EEC, Centennial Coal Springvale, 2019 – present

Assistance on a long term monitoring project of Endangered Ecological Communities (EEC) across the Newnes Plateau; adjacent to Springvale Colliery. Tasks included flora monitoring, due diligence, fauna and ecological community monitoring and biodiversity management planning. Tara is also responsible for data management, mapping and aspects of reporting for the project.

Biodiversity Development Assessment Report, Centennial Coal Angus Place West, 2021

Tara was responsible for undertaking ecological investigations as according to the Biodiversity Assessment Methodology to inform a Biodiversity Development Assessment Report. She was responsible for field works, data management, plant identification and vegetation mapping.

Relevant projects

Review of Environmental Factors (Part 5)

The Horsley Drive Upgrade, Transport for NSW, 2021

Provision of a Biodiversity Assessment Report to inform the REF for the upgrade of The Horsley Drive, Fairfield.

Waratah West Cliffline Rehabilitation Works, Newcastle City Council, 2021

Provision of a Biodiversity Assessment Report to inform an REF for the rehabilitation of a cliff line in Waratah West.

Fern Creek Rehabilitation Works Warriewood, Northern Beaches Council, 2020*

Report preparation, site survey and mapping for the REF for the creek rehabilitation works and RFS creek crossing upgrades for the Northern Beaches Council. The project encountered a potential significant impact on the threatened Red-crowned Toadlet, therefore recommendations were made to first avoid and minimise impacts.

Centre Trail upgrade REF, NSW National Parks and Wildlife Service (NPWS), 2020*

Provision of a Review of Environmental Factors (REF) for the upgrade of Centre Trail fire trail in Kuring-gai Chase National Park.

Medowie Road Flora and Fauna Impact Assessment, Port Stephens Council, 2020*

Tara undertook a flora and fauna impact assessment at Medowie Road in Port Stephens.

Bundeena Drive REF, Sutherland Shire Council, 2020*

Provision of a Review of Environmental Factors (REF) for the reconstruction of a section of Bundeena Drive in the Royal National Park.

Dobroyd Head REF, NSW National Parks and Wildlife Service (NPWS), 2020*

Provision of a Review of Environmental Factors (REF) for the Dobroyd Head walking track upgrade.

Honeymoon Track Upgrade, NSW National Parks and Wildlife Service (NPWS), 2021*

Provision of a Constraints Assessment Report for the works on a popular walking track within the Royal National Park. The purpose of the report is to determine if sensitive features are present warranting the requirement for a Review of Environmental Factors (REF).

Two Creeks Track REF, NSW National Parks and Wildlife Service (NPWS), 2020*

Provision of a Review of Environmental Factors (REF) for the Two Creeks walking track upgrade.

Biodiversity Assessment Reports (Part 4)

Biodiversity Development Assessment Report, Private Landowner, 2020*

Provision of a Biodiversity Development Assessment Report (BDAR) for private development in Allambie Heights.

Georges River FFIA, Private Client, 2020*

Tara was engaged for the provision of a Flora and Fauna Impact Assessment (FFIA) for a development adjacent to the Georges River in the Canterbury-Bankstown LGA.

International Centre of Training Excellence FFIA, Blacktown City Council, 2020*

Tara undertook a Flora and Fauna Impact Assessment (FFIA) for the International Centre of Training Excellence at the Blacktown International Sports Park.

Targeted Threatened Species Searches

Dee Why Lagoon surveys, Northern Beaches Council, 2019-2020*

Tara undertook seasonal woodland and wetland bird surveys at Dee Why Lagoon for Northern Beaches Council.

Mustons Road Targeted Surveys, Port Stephens Council, 2020*

Tara undertook targeted Surveys for multiple cryptic threatened species at Mustons Road within the Port Stephens LGA.

Monitoring, MTE Developments, 2019 – 2020*

Tara undertook Dural Land Snail and Yellow-bellied Glider Monitoring at Cattai.

Targeted surveys, Centennial Coal, 2019 – 2020

Tara undertook targeted surveys for a number of threatened flora species and threatened species monitoring.

Cockle Creek catchment monitoring, Office of Environment and Heritage, 2020*

Tara undertook *Persoonia Mollis* subsp. *maxima* monitoring within the Cockle Creek catchment.

Biodiversity Monitoring

Newnes Plateau Shrub Swamp EEC, Centennial Coal Springvale, 2021 – present

Assistance on a long term monitoring project of Endangered Ecological Communities (EEC) across the Newnes Plateau; adjacent to Springvale Colliery. Tasks included flora monitoring, due diligence, fauna and ecological community monitoring and biodiversity management planning. Tara is also

responsible for data management, baseline, seasonal and annual reporting for the project.

Airly Coal Mine Flora and Fauna Surveys and Assessment, Centennial Coal, 2019 – present

Tara undertook a range of flora and fauna surveys to inform the Annual Airly Coal Mine Flora and Fauna Report. Project tasks included diurnal bird surveys, assessment of fauna habitat quality and value to threatened species, identification of project impacts and measures to avoid or mitigate potential impacts.

Vegetation Management Plans

Vegetation Management Plan, private client 2020*

Preparation of a three-year management plan for a private client within Sydney's north shore area aimed at habitat protection and enhancement.

Ecological Bushfire Management Plan, Williamstown and Orchard Hills RAAF, BGIS, 2020*

Preparation of a ecological bushfire management plan and environmental assessment as according to the RFS Bush Fire Environmental Assessment Code.

Vegetation and Heritage Management Plan, BGIS, 2020*

Preparation of a vegetation and heritage management plan for the historical garden at Glenbrook RAAF Base.

Vegetation Management Plan for Johnstons Creek Naturalisation, Diona/Sydney Water, 2020*

Preparation of a five year management plan for the vegetation within and surrounding Johnstons Creek in Annandale including management actions for the Coastal Saltmarsh Endangered Ecological Community.

Georges River Vegetation Management Plan, Private Client, 2020*

Provision of a Vegetation Management Plan for a development adjacent to the Georges River in the Canterbury-Bankstown LGA.

Biodiversity Action Plan, Waverley Council, 2020*

Provision of a Biodiversity Action Plan for remnant vegetation sites across the Waverly LGA.

Other specialist experience

Biodiversity study to inform a Local Environment Plan, Georges River Council, 2020

Desktop and field analysis of biodiversity hotspots within the local government area.

Post Fire Habitat Assessment, Centennial Coal, 2019

Tara undertook a Post Fire Habitat Assessment at Newnes Plateau for Centennial Coal.

Various floristic studies and bush regeneration, 2019-2020*

Bush regeneration, floristic studies and site monitoring at various sites across the Central Coast, Northern Beaches, Ku-ring-gai and Hornsby Shire LGAs, including works within the Umina Coastal Sandplain Woodland, Coorumbine Creek and ongoing WSUD maintenance.

Kangaroo River surveys, Macquarie University, 2018*

Tara undertook Kangaroo River longitudinal aquatic ecology surveys (AUSRIVA) and a rapid riparian assessment.

** projects undertaken for previous employers*

EPBC Act Protected Matters Search



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 31/05/21 12:43:03

[Summary](#)

[Details](#)

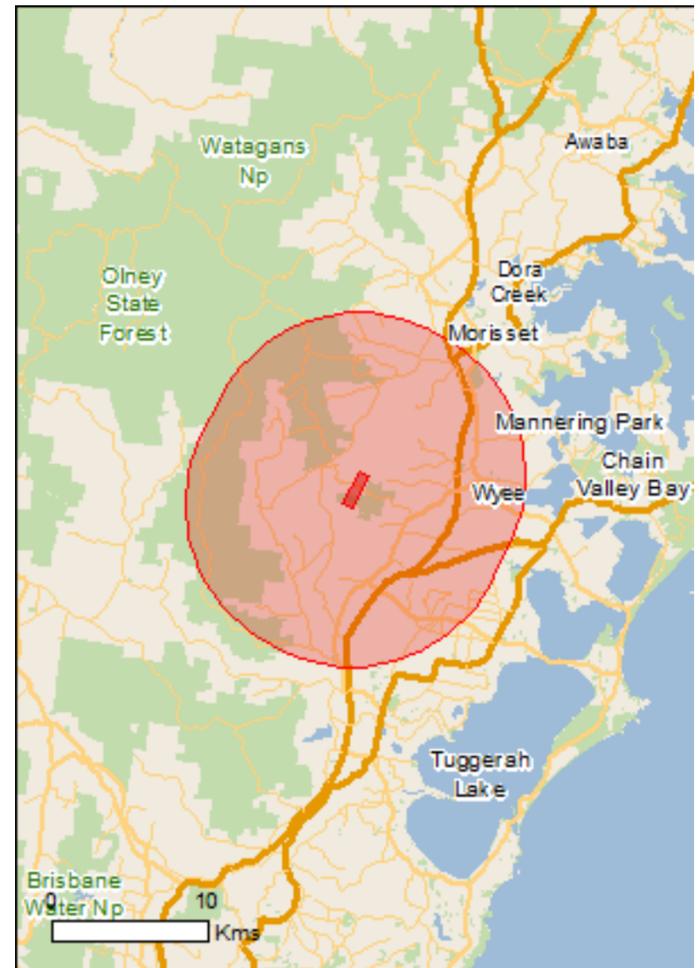
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

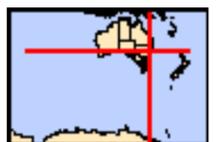
[Acknowledgements](#)



This map may contain data which are
©Commonwealth of Australia
(Geoscience Australia), ©PSMA 2015

[Coordinates](#)

[Buffer: 10.0Km](#)



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	51
Listed Migratory Species:	20

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	26
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	2
Regional Forest Agreements:	1
Invasive Species:	49
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities

[[Resource Information](#)]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species

[[Resource Information](#)]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species

Name	Status	Type of Presence
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	habitat known to occur within area Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area
Thinornis cucullatus cucullatus Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat may occur within area
Frogs		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat likely to occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat known to occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat known to occur within area
Mixophyes iteratus Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat known to occur within area
Mammals		
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		

Name	Status	Type of Presence
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat known to occur within area
Angophora inopina Charmhaven Apple [64832]	Vulnerable	Species or species habitat known to occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area
Corunastylis insignis Wyong Midge Orchid 1, Variable Midge Orchid 1 [84692]	Critically Endangered	Species or species habitat known to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat known to occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
Diuris praecox Newcastle Doubletail [55086]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus camfieldii Camfield's Stringybark [15460]	Vulnerable	Species or species habitat known to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Genoplesium baueri Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528]	Endangered	Species or species habitat may occur within area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat known to occur within area
Melaleuca deanei Deane's Melaleuca [5818]	Vulnerable	Species or species habitat may occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat known to occur within area
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat may occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat known to occur within area
Rhodomyrtus psidioides Native Guava [19162]	Critically Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Rutidosis heterogama Heath Wrinklewort [13132]	Vulnerable	Species or species habitat known to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area
Tetraloche juncea Black-eyed Susan [21407]	Vulnerable	Species or species habitat known to occur within area
Thelymitra adorata Wyong Sun Orchid [84724]	Critically Endangered	Species or species habitat known to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area

Reptiles

Hoplocephalus bungaroides Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area
--	------------	--

Listed Migratory Species

[[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area

Migratory Wetlands Species

Name	Threatened	Type of Presence
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Australian Telecommunications Commission

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species

Name	Threatened	Type of Presence
Calidris acuminata Sharp-tailed Sandpiper [874]		habitat may occur within area Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur

Name	Threatened	Type of Presence within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable*	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Extra Information

State and Territory Reserves [\[Resource Information \]](#)

Name	State
Jiliby	NSW
LNE Special Management Zone No1	NSW

Regional Forest Agreements [\[Resource Information \]](#)

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species

Name	Status	Type of Presence
Anredera cordifolia		habitat likely to occur within area
Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Asparagus scandens Asparagus Fern, Climbing Asparagus Fern [23255]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Dolichandra unguis-cati Cat's Claw Vine, Yellow Trumpet Vine, Cat's Claw Creeper, Funnel Creeper [85119]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species

Name	Status	Type of Presence
Pinus radiata		habitat likely to occur within area
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla		
Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii		
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta		
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis		
Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus		
Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands		[Resource Information]
Name	State	
Tuggerah Lake	NSW	

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.189222 151.407781,-33.18678 151.402116,-33.171191 151.411472,-33.173418 151.416707,-33.189222 151.407781

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [-Office of Environment and Heritage, New South Wales](#)
- [-Department of Environment and Primary Industries, Victoria](#)
- [-Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [-Department of Environment, Water and Natural Resources, South Australia](#)
- [-Department of Land and Resource Management, Northern Territory](#)
- [-Department of Environmental and Heritage Protection, Queensland](#)
- [-Department of Parks and Wildlife, Western Australia](#)
- [-Environment and Planning Directorate, ACT](#)
- [-Birdlife Australia](#)
- [-Australian Bird and Bat Banding Scheme](#)
- [-Australian National Wildlife Collection](#)
- [-Natural history museums of Australia](#)
- [-Museum Victoria](#)
- [-Australian Museum](#)
- [-South Australian Museum](#)
- [-Queensland Museum](#)
- [-Online Zoological Collections of Australian Museums](#)
- [-Queensland Herbarium](#)
- [-National Herbarium of NSW](#)
- [-Royal Botanic Gardens and National Herbarium of Victoria](#)
- [-Tasmanian Herbarium](#)
- [-State Herbarium of South Australia](#)
- [-Northern Territory Herbarium](#)
- [-Western Australian Herbarium](#)
- [-Australian National Herbarium, Canberra](#)
- [-University of New England](#)
- [-Ocean Biogeographic Information System](#)
- [-Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [-Geoscience Australia](#)
- [-CSIRO](#)
- [-Australian Tropical Herbarium, Cairns](#)
- [-eBird Australia](#)
- [-Australian Government – Australian Antarctic Data Centre](#)
- [-Museum and Art Gallery of the Northern Territory](#)
- [-Australian Government National Environmental Science Program](#)
- [-Australian Institute of Marine Science](#)
- [-Reef Life Survey Australia](#)
- [-American Museum of Natural History](#)
- [-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [-Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- [-Other groups and individuals](#)

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

© Commonwealth of Australia

Department of Agriculture Water and the Environment

GPO Box 858

Canberra City ACT 2601 Australia

+61 2 6274 1111

Likelihood of Occurrence

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Acacia bynoeana</i> (Bynoe's Wattle)	E	V	Grows mainly in heath and dry sclerophyll forest in sandy soils. Mainly south of Dora Creek-Morriset area to Berrima and the Illawarra region, west to the Blue Mountains, also recorded from near Kurri Kurri in the Hunter Valley and from Morton National Park.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
<i>Angophora inopina</i>	V	V	Endemic to the Central Coast region of NSW. The known northern limit is near Karuah where a disjunct population occurs; to the south populations extend from Toronto to Charmhaven with the main population occurring between Charmhaven and Morisset. Occurs most frequently in red bloodwood – scribbly gum woodland, wet heath, red mahogany – paperbark sedge woodland and stringybark – red bloodwood forest.	5	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species recently observed in the locality (NSW BioNet records).
<i>Anseranas semipalmata</i> (Magpie Goose)	V	-	Mainly found in shallow wetlands less than 1 m deep, with a dense growth of rushes or sedges.	0	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Anthochaera phrygia</i> (Regent Honeyeater)	CE	E,M	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. The distribution of the species has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests.	0	occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes. Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Botaurus poiciloptilus</i> (Australasian Bittern)	E	E	The Australasian Bittern is widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes and spikerushes.	0	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
<i>Burhinus grallarius</i> (Bush Stone-curlew)	E	-	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and in the south-east it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy groundlayer and fallen timber. Largely nocturnal, being especially active on moonlit nights.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Caladenia tessellata</i> (Thick-lip Spider Orchid)	E	V	The Tessellated Spider Orchid is found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. Known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct.	0	activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records). None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
<i>Calidris canutus</i> (Red Knot)	-	E	The Red Knot is common in all the main suitable habitats around the coast of Australia. Very large numbers are regularly recorded in north-west Australia, with 80 Mile Beach and Roebuck Bay being particular strongholds. The only places it is not found in significant numbers are the northern part of the Great Australian Bight in South Australia and Western Australia, and along much of the NSW coast, where wader habitat is rather scarce (excluding the Hunter Estuary). It is widespread along the coast south of Townsville and along the coasts of NSW and Victoria. In Australasia the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps.	0	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
<i>Calidris ferruginea</i> (Curlew Sandpiper)	E	-	The Curlew Sandpiper is distributed around most of the coastline of Australia. It occurs along the entire coast of	0	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
			NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes the inland		surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
<i>Callocephalon fimbriatum</i> (Gang-gang Cockatoo)	V	-	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine snow gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.	2	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Calyptorhynchus lathamii</i> (Glossy Black-Cockatoo)	V	-	Inhabits forest with low nutrients, characteristically with key Allocasuarina spp. Tends to prefer drier forest types with a middle stratum of Allocasuarina below Eucalyptus or Angophora. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead. Endangered population in the Riverina.	9	Known. Species observed and habitat values within the Project Area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).
<i>Cercartetus nanus</i> (Eastern Pygmy-possum)	V	-	Inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a favoured food source. Will often nest in tree hollows, but can also construct its own nest. Because of its small size it is able to utilise a range of hollow sizes including very small hollows. Individuals will use a number of different hollows and an individual has been recorded	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
			using up to 9 nest sites within a 0.5ha area over a 5 month period.		quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Chalinolobus dwyeri</i> (Large-eared Pied Bat)	V	V	Located in a variety of drier habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range. Can also be found on the edges of rainforests and in wet sclerophyll forests. This species roosts in caves and mines in groups of between 3 and 37 individuals.	5	High. Habitat values within the Project Area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Chthonicola sagittata</i> (Speckled Warbler)	V	-	The Speckled Warbler lives in a wide range of eucalypt dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	0	High. Habitat values within the Project Area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Climacteris picumnus victoriae</i> (Brown Treecreeper (eastern subspecies))	V	-	Found in eucalypt woodlands (including box-gum woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and river red gum forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded,	2	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
			though less commonly, in similar woodland habitats on the coastal ranges and plains.		
<i>Corybas dowlingii</i>	E	-	Sheltered areas such as gullies and southerly slopes in tall open forest on well-drained gravelly soil at elevations of 10-200 m.	18	High. Habitat values within the Project Area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Cryptostylis hunteriana</i> (Leafless Tongue-orchid)	V	V	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (<i>Eucalyptus sclerophylla</i>), Silvertop Ash (<i>E. sieberi</i>), Red Bloodwood (<i>Corymbia gummifera</i>) and Black Sheoak (<i>Allocasuarina littoralis</i>); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (<i>C. subulata</i>) and the Tartan Tongue Orchid (<i>C. erecta</i>).	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
<i>Cynanchum elegans</i> (White-flowered Wax Plant)	E	E	Recorded from rainforest gullies scrub and scree slopes from the Gloucester district to the Wollongong area and inland to Mt Dangar.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Daphoenositta chrysoptera</i> (Varied Sittella)	V	-	Inhabits wide variety of dry eucalypt forests and woodlands, usually with either shrubby under storey or grassy ground cover or both, in all climatic zones of Australia. Usually in areas with rough-barked trees, such as stringybarks or ironbarks, but also in paperbarks or mature Eucalypts with hollows.	2	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Dasyornis brachypterus</i> (Eastern Bristlebird)	E	E	Found in coastal woodlands, dense scrub and heathlands, particularly where it borders taller woodlands.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Dasyurus maculatus maculatus</i> (Spotted-tailed Quoll)	V	E	Spotted-tailed Quoll are found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Only in Tasmania is it still considered common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Diuris praecox</i> (Rough Doubletail)	V	V	Occurs between Ourimbah and Nelson Bay. Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
<i>Ephippiorhynchus asiaticus</i> (Black-necked Stork)	E	-	Mainly found on shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands. They also forage within or around estuaries and along intertidal shorelines, such as saltmarshes, mudflats and sandflats, and mangrove vegetation.	0	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
<i>Eucalyptus camfieldii</i>	V	V	Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace Area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park. Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
					habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
<i>Euphrasia arguta</i>	CE	CE	Occur in eucalypt forest with a mixed grass and shrub understorey within Nundle State forest. Sites have either been logged in the last few decades, or appear to have regrown from past clearing.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
<i>Falco hypoleucos</i> (Grey Falcon)	E	-	Usually restricted to shrubland, grassland and wooded watercourses of arid and semi-arid regions, although it is occasionally found in open woodlands near the coast. Also occurs near wetlands where surface water attracts prey.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
<i>Falsistrellus tasmaniensis</i> (Eastern False Pipistrelle)	V	-	Inhabit sclerophyll forests, preferring wet habitats where trees are more than 20 m high. Two observations have been made of roosts in stem holes of living eucalypts. There is debate about whether or not this species moves to lower altitudes during winter, or whether they remain	1	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
			sedentary but enter torpor . This species also appears to be highly mobile and records showing movements of up to 12 km between roosting and foraging sites .		'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Genoplesium baueri</i> (Bauer's Midge Orchid)	E	E	Grows in dry sclerophyll forest and moss gardens over sandstone. Flowers February to March. Has been recorded between Ulladulla and Port Stephens. Currently the species is known from just over 200 plants across 13 sites. The species has been recorded in Berowra Valley Regional Park, Royal National Park and Lane Cove National Park and may also occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
<i>Genoplesium insigne</i> (Variable Midge Orchid)	E	-	Grows in patches of kangaroo grass amongst shrubs and sedges in heathland and forest. Associated vegetation at Chain Valley Bay is described as dry sclerophyll woodland dominated by scribbly gum, red bloodwood, smooth-barked apple and black she-oak.	3	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Glossopsitta pusilla</i> (Little Lorikeet)	V	-	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt	11	High. Habitat values within the Project Area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
			forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes.		2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Grantiella picta</i> (Painted Honeyeater)	V	-	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits boree, brigalow and box-gum woodlands and box-ironbark forests.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Grevillea parviflora</i> <i>subsp. parviflora</i> (Small-flowered Grevillea)	V	V	Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Often occurs in open, slightly disturbed sites such as along tracks.	8	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Haliaeetus leucogaster</i> (White-bellied Sea- Eagle)	V	M	Inhabits coastal and near coastal areas, building large stick nests, and feeding mostly on marine and estuarine fish and aquatic fauna.	2	High. Habitat values within the Project Area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat.

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Heleioporus australiacus</i> (Giant Burrowing Frog)	V	V	The Giant Burrowing Frog has been recorded breeding in a range of water bodies associated with more sandy environments of the coast and adjacent ranges from the Sydney Basin south the eastern Victoria. It breeds in hanging swamps, perennial non-flooding creeks and occasionally permanent pools, but permanent water must be present to allow its large tadpoles time to reach metamorphosis.	0	Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records). Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
<i>Hirundapus caudacutus</i> (White-throated Needletail)	-	M	An aerial species found in feeding concentrations over cities, hilltops and timbered ranges.	1	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Hoplocephalus bitorquatus</i> (Pale-headed Snake)	V	-	The Pale-Headed Snake has a patchy distribution from north-east Queensland to north-east NSW. In NSW it occurs from the coast to the western side of the Great Divide as far south as Tuggerah and out to the western plains. It is found mainly in dry eucalypt forests and woodlands, cypress woodland and occasionally in rainforest or moist eucalypt forest where it favours	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
			streamside areas, particularly in drier habitats. They shelter during under loose bark or in hollows and have a preference for frogs as prey, although lizards and small mammals are also taken. This species breeds and shelters in hollows in live and dead trees and in and under fallen timber. It is best detected from mid spring to mid autumn and is mostly nocturnal.		(IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
<i>Hoplocephalus bungaroides</i> (Broad-headed Snake)	E	V	Occurs almost exclusively in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they spend most of the year sheltering in and under rock crevices and exfoliating rock. However, some individuals will migrate to tree hollows to find shelter during hotter parts of summer.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Hoplocephalus stephensii</i> (Stephens' Banded Snake)	V	-	The Stephens Banded Snake is found through the coast and adjacent ranges of NSW from the Central Coast northwards and into SE Queensland. It is most commonly found living in wet sclerophyll and rainforest areas, but can be found in taller dry forest areas and even in some areas of dry forest where there is significant rock outcropping. They spend the majority of the time in tree tops, either in large hollows or in dense vegetation, coming to the ground for forage for a range of vertebrates.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Irediparra gallinacea</i> (Comb-crested Jacana)	V	-	Inhabits permanent wetlands with a good surface cover of floating vegetation, especially water-lilies.	0	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Lathamus discolor</i> (Swift Parrot)	E	CE	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.	0	grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes. Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Limosa lapponica</i> (Bar-tailed Godwit)	-	M	Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. It is rarely found on inland wetlands or in areas of short grass, such as farmland, paddocks and airstrips, although it is commonly recorded in paddocks at some locations overseas.	0	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
<i>Litoria aurea</i> (Green and Golden Bell Frog)	E	V	Inhabits a very wide range of water bodies including marshes, dams and streams, particularly those containing emergent vegetation such as bullrushes or spikerushes. It also inhabits numerous types of man-made water bodies including quarries and sand extraction sites. Optimum habitat includes water-bodies that are un-shaded, free of predatory fish such as Plague Minnow, have a grassy area nearby and diurnal sheltering sites available.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Litoria brevipalmata</i> (Green-thighed Frog)	V	-	This species is distributed from south-east Queensland to the NSW Central Coast. It occurs in a range of habitat types including rainforest, moist eucalypt forest, dry eucalypt forest and heath, but is most closely associated with wetter forest types in the southern part of its range. Calling and breeding is highly correlated with heavy rainfalls that lead to the formation of large ephemeral pools in a range of sites, but always in association with some native vegetation. Calling occurring only for one or two nights at a time anywhere between September and May.	1	activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
<i>Litoria littlejohni</i> (Littlejohn's Tree Frog)	V	V	Occurs in wet and dry sclerophyll forests and heathland associated with sandstone outcrops between 280 and 1000 m on the eastern slopes of the Great Dividing Range from the Central Coast down into Victoria. Individuals have been collected from a wide range of water bodies that includes semi-permanent dams, permanent ponds, temporary pools and permanent streams, with calling occurring from fringing vegetation or on the banks. Individuals have been observed sheltering under rocks on high exposed ridges during summer and within deep leaf litter adjacent to the breeding site. Calling occurs in all months of the year, often in association with heavy rains. The tadpoles are distinctive, being large and very dark in colouration.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
<i>Lophoictinia isura</i> (Square-tailed Kite)	V	-	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by <i>Eucalyptus longifolia</i> , <i>Corymbia maculata</i> , <i>E. elata</i> or <i>E. smithii</i> . Individuals appear to occupy large hunting ranges of more than 100km ² . They require large living trees for breeding, particularly near water with	1	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
			surrounding woodland -forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.		quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Macropus parma</i> (Parma Wallaby)	V	-	Once occurred from north-eastern NSW to the Bega area in the southeast. Their range is now confined to the coast and ranges of central and northern NSW from the Gosford district to the Queensland border. Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Maundia triglochoides</i>	V	-	Grows in swamps, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients. Flowering occurs during warmer months. Diaspore is the seed and root tubers, which are probably dispersed by water.	3	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species recently observed in the locality (NSW BioNet records).
<i>Melaleuca biconvexa</i> (Biconvex Paperbark)	V	V	Grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north.	573	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
					known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species recently observed in the locality (NSW BioNet records).
<i>Melaleuca deanei</i> (Deane's Paperbark)	V	V	Grows in wet heath on sandstone in coastal districts from Berowra to Nowra.	0	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
<i>Melaleuca groveana</i>	V	-	Grows in heath and shrubland, often in exposed sites, at high elevations, on rocky outcrops and cliffs. It also occurs in dry woodlands.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
<i>Miniopterus australis</i> (Little Bentwing-bat)	V	-	Coastal north-eastern NSW and eastern Queensland. Little Bent-wing Bat is an insectivorous bat that roost in caves, in old mines, in tunnels, under bridges, or in	34	High. Habitat values within the Project Area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
			similar structures. They breed in large aggregations in a small number of known caves and may travel 100s km from feeding home ranges to breeding sites. Little Bent-wing Bat has a preference for moist eucalypt forest, rainforest or dense coastal banksia scrub where it forages below the canopy for insects.		occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Miniopterus schreibersii oceanensis</i> (Eastern Bentwing-bat)	V	-	Eastern Bent-wing Bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	13	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Mixophyes balbus</i> (Stuttering Frog)	E	V	Associated with streams in dry sclerophyll and wet sclerophyll forests and rainforests of more upland areas of the Great Dividing Range of NSW and down into Victoria. Breeding occurs along forest streams with permanent water where eggs are deposited within nests excavated in riffle zones by the females and the tadpoles swim free into the stream when large enough to do so. Outside of breeding, individuals range widely across the forest floor and can be found hundreds of metres from water	1	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species recently observed in the locality (NSW BioNet records).
<i>Mixophyes iteratus</i> (Giant Barred Frog)	E	E	This species is found along larger streams of the coast and adjacent ranges of NSW and SE QLD. It inhabits rainforest and wet sclerophyll forest, but is also found	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features)

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
			within cleared farmland where fringing vegetation is retained, including lantana beds. Many sites where the Giant Barred Frog is known to occur are the lower reaches of streams which have been affected by major disturbances such as clearing, timber harvesting and urban development in their headwaters.		are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
<i>Mormopterus norfolkensis</i> (Eastern Freetail-bat)	V	-	Most records are from dry eucalypt forests and woodlands to the east of the Great Dividing Range. Appears to roost in trees, but little is known of this species' habits.	23	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Myotis macropus</i> (Southern Myotis)	V	-	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. Generally roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage.	2	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
					negative effects of active/ uncontrolled KTPs. Species recently observed in the locality (NSW BioNet records).
<i>Neophema pulchella</i> (Turquoise Parrot)	V	-	The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
<i>Ninox connivens</i> (Barking Owl)	V	-	Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Ninox strenua</i> (Powerful Owl)	V	-	Occupies wet and dry eucalypt forests and rainforests. Can occupy both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas. It is most commonly recorded within red turpentine in tall open forests and black she-oak within open forests. Large mature trees with hollows at least 0.5 m deep are required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of	5	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
			hollow-dependent arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm.		potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Numenius madagascariensis</i> (Eastern Curlew)	-	CE	The Eastern curlew spends its breeding season in northeastern Asia, including Siberia to Kamchatka, and Mongolia. Its breeding habitat is composed of marshy and swampy wetlands and lakeshores. Most individuals winter in coastal Australia, with a few heading to South Korea, Thailand, Philippines and New Zealand, where they stay at estuaries, beaches, and salt marshes. It uses its long, decurved bill to probe for invertebrates in the mud. It may feed in solitary but it generally congregates in large flocks to migrate or roost. Its call is a sharp, clear whistle, cuuue-reee, often repeated.	0	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
<i>Persicaria elatior</i>	V	V	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
<i>Persoonia hirsuta</i> (Hairy Geebung)	E	E	Distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. A large area of occurrence, but occurs in small populations, increasing the species's fragmentation in the landscape. Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. Usually present as isolated individuals or very small populations. Probably killed by fire (as other <i>Persoonia</i> spp. are) but will regenerate from seed.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Petauroides volans</i> (Greater Glider)	-	V	The Greater Glider occurs in eucalypt forests and woodlands. Utilise tree hollows	0	habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
<i>Petaurus australis</i> (Yellow-bellied Glider)	V	-	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria.	24	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Petaurus norfolcensis</i> (Squirrel Glider)	V	-	Generally occurs in dry sclerophyll forests and woodlands but is absent from dense coastal ranges in the southern part of its range . Requires abundant hollow bearing trees and a mix of eucalypts, banksias and acacias . There is only limited information available on den tree use by Squirrel gliders, but it has been observed using both living and dead trees as well as hollow stumps. Within a suitable vegetation community at least one species should flower heavily in winter and one species of eucalypt should be smooth barked. Endangered population in the Wagga Wagga LGA.	1	High. Habitat values within the Project Area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Petrogale penicillata</i> (Brush-tailed Rock-wallaby)	E	V	Found in rocky areas in a wide variety of habitats including rainforest gullies, wet and dry sclerophyll forest, open woodland and rocky outcrops in semi-arid country. Commonly sites have a northerly aspect with numerous ledges, caves and crevices.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Petroica boodang</i> (Scarlet Robin)	V	-	The Scarlet Robin is found from SE Queensland to SE South Australia and also in Tasmania and SW Western Australia. In NSW, it occurs from the coast to the inland slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	2	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Phascogale tapoatafa</i> (Brush-tailed Phascogale)	V	-	The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occasional records west to the divide. Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Phascolarctos cinereus</i> (Koala)	V	V	Inhabits eucalypt forests and woodlands. The suitability of these forests for habitation depends on the size and species of trees present, soil nutrients, climate and rainfall .	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
<i>Phoniscus papuensis</i> (Golden-tipped Bat)	V	-	Distributed along the east coast of Australia in scattered locations from Cape York Peninsula in Queensland to Bega in southern NSW. Found in rainforest and adjacent sclerophyll forest. Roost in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests located in rainforest gullies on small first- and second-order streams.	1	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Planigale maculata</i> (Common Planigale)	V	-	Common Planigales inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. The female builds a nest lined with grass, eucalypt leaves or shredded bark.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Potorous tridactylus tridactylus</i> (Long-nosed Potoroo)	V	V	Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy.	0	habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records). Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Pseudomys gracilicaudatus</i> (Eastern Chestnut Mouse)	V	-	In NSW the Eastern Chestnut Mouse mainly occurs north from the Hawkesbury River area as scattered records along to coast and eastern fall of the Great Dividing Range extending north into Queensland. There are however isolated records in the Jervis Bay area. In NSW the Eastern Chestnut Mouse is mostly found, in low numbers, in heathland and is most common in dense, wet heath and swamps. In the tropics it is more an animal of grassy woodlands. Optimal habitat appears to be in vigorously regenerating heathland burnt from 18 months to four years previously. By the time the heath is mature, the larger Swamp Rat becomes dominant, and Eastern Chestnut Mouse numbers drop again.	1	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Pseudomys novaehollandiae</i> (New Holland Mouse)	-	V	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
					potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Pseudophryne australis</i> (Red-crowned Toadlet)	V	-	Occurs on wetter ridge tops and upper slopes of sandstone formations on which the predominant vegetation is dry open forests and heaths. This species typically breeds within small ephemeral creeks that feed into larger semi-perennial streams. After rain these creeks are characterised by a series of shallow pools lined by dense grasses, ferns and low shrubs and usually contain leaf litter for shelter. Eggs are terrestrial and laid under litter, vegetation or rocks where the tadpoles inside will reach a relatively late stage of development before waiting for flooding waters before hatching will occur.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
<i>Pteropus poliocephalus</i> (Grey-headed Flying-fox)	V	V	This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km.	7	High. Habitat values within the Project Area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Ptilinopus magnificus</i> (Wompoo Fruit-dove)	V	-	Distributed north of the Hunter River in NSW on the coast and coastal ranges. Inhabits rainforest, monsoon forest, adjacent eucalypt forest and brush box forest.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Ptilinopus regina</i> (Rose-crowned Fruit-dove)	V	-	Coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful.	0	the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
<i>Ptilinopus superbus</i> (Superb Fruit-dove)	V	-	The Superb Fruit-dove occurs principally from north-eastern in Queensland to north-eastern NSW. It is much less common further south, where it is largely confined to pockets of suitable habitat as far south as Moruya. There are records of vagrants as far south as eastern Victoria and Tasmania. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
<i>Rhizanthella slateri</i>	V	E	Habitat requirements are poorly understood and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest.	0	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
					occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
<i>Rhodamnia rubescens</i> (Scrub Turpentine)	CE	-	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	322	Known. Species observed and habitat values within the Project Area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).
<i>Rhodomyrtus psidioides</i> (Native Guava)	CE	-	Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines. This species is characterised being extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	4	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Rostratula australis</i> (Australian Painted Snipe)	E	E, M	In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	0	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity).

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
					Presence unlikely associated with habitat occupancy involving important lifecycle processes.
<i>Rutidosia heterogama</i>	V	V	Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
<i>Saccolaimus flaviventris</i> (Yellow-bellied Sheath-tail-bat)	V	-	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	4	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species recently observed in the locality (NSW BioNet records).
<i>Scoteanax rueppellii</i> (Greater Broad-nosed Bat)	V	-	Prefer moist gullies in mature coastal forests and rainforests, between the Great Dividing Range and the coast. They are only found at low altitudes below 500 m. In dense environments they utilise natural and human-made opening in the forest for flight paths. Creeks and small rivers are favoured foraging habitat. This species roosts in hollow tree trunks and branches.	3	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
					potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Sternula nereis nereis</i> (Fairy Tern)	-	V	Distribution includes the southern half of NSW coast. Fairy Terns utilise a variety of habitats including offshore, islands in estuaries or lakes, wetlands, beaches and spits.	0	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
<i>Syzygium paniculatum</i> (Magenta Lilly Pilly)	E	V	Found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State forest. On the south coast the species occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral rainforest. On the central coast it occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
<i>Tetratheca juncea</i> (Black-eyed Susan)	V	V	Confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock. It is usually found in low open forest-woodland with a mixed shrub understorey and grassy groundcover. The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape. Cryptic species that requires survey in September-October.	114	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Thelymitra adorata</i> (Wyong Sun Orchid)	CE	-	Occurs from 10-40 m a.s.l. in grassy woodland or occasionally derived grassland in well-drained clay loam or shale derived soils. The vegetation type in which the majority of populations occur (including the largest colony) is a spotted gum - ironbark forest with a diverse grassy understorey and occasional scattered shrubs.	12	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species recently observed in the locality (NSW BioNet records).
<i>Thesium australe</i> (Austral Toadflax)	V	V	Grows in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland or grassy woodland. Grows on kangaroo grass tussocks but has also been recorded within the exotic coolatai grass.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
<i>Thinornis rubricollis</i> <i>rubricollis</i> (Hooded Plover)	CE	V	The Hooded Plover occurs on sandy beaches and inland saltlakes of south-eastern and south-western Australia. Within NSW, the Hooded Plover occurs along the southern coast, north to Jervis Bay. In souther-eastern Australian, the Hooded Plover is found mostly on long stretches of sandy shore, backed by tussock and creeper covered dunes with nearby inland lakes.	0	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the Project Area. The Project Area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
<i>Thylogale stigmatica</i> (Red-legged Pademelon)	V	-	Inhabits forest with a dense understorey and ground cover, including rainforest, moist eucalypt forest and vine scrub.	0	occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes. Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
<i>Turnix maculosus</i> (Red-backed Button- quail)	V	-	Red-backed Button-quail inhabit grasslands, open and savannah woodlands with grassy ground layer, pastures and crops of warm temperate areas, typically only in regions subject to annual summer rainfall greater than 400 mm. In NSW, said to occur in grasslands, heath and crops. Said to prefer sites close to water, especially when breeding. Observations of populations in other parts of its range suggest the species prefers sites near water, including grasslands and sedgeland near creeks, swamps and springs, and wetlands.	0	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The Project Area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
<i>Tyto novaehollandiae</i> (Masked Owl)	V	-	Inhabits a diverse range of wooded habitat that provide tall or dense mature trees with hollows suitable for nesting and roosting. Mostly recorded in open forest and woodlands adjacent to cleared lands. Nest in hollows, in trunks and in near vertical spouts or large trees, usually	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known

REPORT

Scientific Name (Common Name)	BC Act	EPBC Act	Habitat	Records (DPIE 2021a)	Likelihood of Occurrence
			living but sometimes dead. Nest hollows are usually located within dense forests or woodlands. Masked owls prey upon hollow-dependent arboreal marsupials, but terrestrial mammals make up the largest proportion of the diet.		'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
<i>Tyto tenebricosa</i> (Sooty Owl)	V	-	Often found in tall old-growth forests, including temperate and subtropical rainforests. In NSW mostly found on escarpments with a mean altitude less than 500 metres. Nests and roosts in hollows of tall emergent trees, mainly eucalypts often located in gullies. Nests have been located in trees 125 to 161 centimetres in diameter.	9	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
<i>Vespadelus troughtoni</i> (Eastern Cave Bat)	V	-	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the Project Area. The Project Area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).

Appendix D

BAM Plot Photographs

REPORT

Plot	Bearing	PCT	Start	Photograph	End
LW34-1		Cleared/ Disturbed Land			
LW34-2		1588			

REPORT

Plot	Bearing	PCT	Start	Photograph	End
LW34-3		1528			
LW34-4		1588			

REPORT

Plot	Bearing	PCT	Start	Photograph	End
LW34-5		Cleared/ Disturbed Land			
		1568			
LW34-6					

REPORT

Plot	Bearing	PCT	Start	Photograph	End
LW34-7		1573			
LW34-8		1556			

REPORT

Plot	Bearing	PCT	Start	Photograph	End
LW34-9		1556			
LW34-10		1556			

REPORT

Plot	Bearing	PCT	Start	Photograph	End
LW34-11		1556			
LW34-12		1556			

REPORT

Plot	Bearing	PCT	Start	Photograph	End
LW34-13		1568	 A photograph showing a forest plot with many thin, vertical tree trunks and a ground covered in brown leaf litter. A large, mossy log lies on the ground in the foreground.	 A photograph showing a forest plot with many thin, vertical tree trunks and a ground covered in brown leaf litter. A large, mossy log lies on the ground in the foreground.	
LW34-14		1588	 A photograph showing a forest plot with a mix of tree trunks, some with light-colored bark. A person in an orange shirt is visible on the left side, looking at a device. The ground is covered in leaf litter and some green plants.	 A photograph showing a forest plot with a mix of tree trunks, some with light-colored bark. A person in an orange shirt is visible on the left side, looking at a device. The ground is covered in leaf litter and some green plants.	

REPORT

Plot	Bearing	PCT	Start	Photograph	End
------	---------	-----	-------	------------	-----

Plot 12 –
PR144986

1568



Plot 19 –
PR144986

1568



REPORT

Plot	Bearing	PCT	Start	Photograph	End
Plot 20 – PR144986		1573			

Appendix E

BAM Plot Data

REPORT

Plot ¹	PCT	Area	Patchsize	Condition class	zone	easting	northing	bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	structTree	structShrub	structGrass	structForbs	structFerns	structOther	funLargeTrees	funHollowtrees	funLitterCover	funLenFallenLogs	funTreeSte m5to9	funTreeSte m10to19	funTreeSte m20to29	funTreeSte m30to49	funTreeSte m50to79	funTreeSte m80to99	eatExotic	funHighThreat
LW34_1	1568	2	1001	Zone6_Poor	56	351854	6328374	234	1	0	4	14	0	1	0	0	3	9	0	0	0	7	0	0	0	0	0	1	1	0	0	
LW34_2	1588	15	1001	Zone5_Moderate	56	351651	6328385	220	6	11	8	13	2	10	58	35	16	6	1	4	0	0	80	53	1	1	1	1	1	1	0	
LW34_3	1528	0	1001	Zone1_Moderate_Good	56	351584	6328190	305	4	12	3	7	9	12	26	55	0	1	23	27	0	0	48	25	1	1	1	1	0	1	0	
LW34_4	1588	15	1001	Zone5_Moderate	56	351550	6328049	136	5	5	8	7	4	12	62	1	14	1	0	2	1	5	91	51	1	1	1	1	1	1	0	
LW34_5	1568	2	1001	Zone6_Poor	56	351619	6327569	335	2	2	4	9	1	4	0	0	2	3	1	2	0	0	9	7	0	1	1	1	0	1	2	
LW34_6	1568	7	1001	Zone3_Moderate	56	351735	6327459	343	5	3	4	5	3	11	65	15	1	1	1	14	0	0	73	23	1	1	1	1	0	1	0	
LW34_7	1573	2	1001	Zone4_Moderate_Good	56	351528	6327704	301	5	10	1	1	7	11	46	34	0	0	8	75	1	0	80	80	1	1	1	1	1	1	0	
LW34_8	1556	25	1001	Zone2_Moderate	56	351524	6327809	315	8	8	7	13	4	8	78	4	7	3	2	11	0	0	66	48	1	1	1	1	1	1	0	
LW34_9	1556	25	1001	Zone2_Moderate	56	351701	6327734	102	7	4	6	11	5	14	61	22	1	3	8	20	0	0	55	67	1	1	1	1	1	1	0	
LW34_10	1556	25	1001	Zone2_Moderate	56	351490	6327155	223	5	5	4	15	3	13	38	10	1	3	72	28	1	0	68	95	1	1	1	1	1	1	0	
LW34_11	1556	25	1001	Zone2_Moderate	56	351305	6327569	336	4	8	4	11	6	13	31	25	3	1	2	40	2	0	85	85	1	1	1	1	0	1	0	
LW34_12	1556	25	1001	Zone2_Moderate	56	351232	6327199	172	7	6	8	8	1	12	57	3	8	2	1	2	1	6	90	35	1	1	1	1	1	1	0	
LW34_13	1568	7	1001	Zone3_Moderate	56	351065	6326874	221	7	4	4	5	4	10	63	35	1	1	2	11	1	0	89	31	1	1	1	1	1	1	0	
LW34_14	1588	15	1001	Zone5_Moderate	56	351922	6328029	274	6	5	10	7	1	6	113	17	21	4	0	6	0	0	92	11	1	1	1	1	1	1	0	
144986_12	1568	7	1001	Zone3_Moderate	56	351681	6328206	241	10	11	2	2	4	10	84	69	6	1	11	15	1	1	85	51	0	1	1	1	1	0	0	
144986_19	1568	7	1001	Zone3_Moderate	56	351451	6327761	316	10	15	6	9	12	17	45	70	1	1	17	4	0	0	74	75	1	1	1	1	1	1	0	
144986_20	1573	2	1001	Zone4_Moderate_Good	56	351579	6327669	266	6	9	10	11	8	16	32	26	14	2	1	75	1	0	85	66	1	1	1	1	1	1	10	

1. Plot data provided above is for the entire Project Area. Within the BAM-C finalised case, the plot data presented represented the Zones to be impacted by ponding only (i.e. Zones 2, 3 and 4).

Appendix F

Flora list

REPORT

Scientific Name	LW34-1		LW34-2		LW34-3		LW34-4		LW34-5		LW34-6		LW34-7		LW34-8		LW34-9		LW34-10		LW34-11		LW34-12		LW34-13		LW34-14		PR144986 Plot 12		PR144986 Plot 19		PR144986 Plot 20			
	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A		
<i>Acacia elongata</i>								0.2	1					0.2	2											1.5	3									
<i>Acacia floribunda</i>																														0.1	2					
<i>Acacia implexa</i>																															4.0	2				
<i>Acacia longissima</i>																		0.2	2					0.5	4											
<i>Acacia maidenii</i>							3.0	15					0.2	1																						
<i>Acacia ulicifolia</i>			0.2	2																					0.2	2										
<i>Acianthus fornicatus</i>			0.1	50										0.1	1																					
<i>Acianthus spp.</i>																				0.1	10															
<i>Acmena smithii</i>												2.0	5											15.0	7			5.0	10							
<i>Adiantum aethiopicum</i>																				0.5	20	0.1	20			0.1	10						0.1	3		
<i>Adiantum formosum</i>												1.0	20			2.0	25					0.1	5					1.0	50	0.6	6	0.1	8			
<i>Adiantum hispidulum</i>					0.3	50						0.6	30			1.0	30					0.1	10							0.2	15	0.4	20			
<i>Ageratina Adenophora*</i>								0.2	15																											
<i>Alectryon spp.</i>																					0.1	1														
<i>Alectryon subcinereus</i>					0.3	5						0.3	1														0.2	1								
<i>Allocauarina torulosa</i>							30.0	33							15.0	13	10.0	5	1.0	3	7.0	4	8.0	7	1.0	2	20.0	16			0.2	1				
<i>Alphitonia excelsa</i>					8.0	3																									15.0	2				
<i>Alternanthera philoxeroides*</i>	0.1	2																																		
<i>Aneilema acuminatum</i>																															0.2	30				
<i>Angophora floribunda</i>														5.0	1																15.0	2				
<i>Aphanopetalum resinosum</i>																								0.1	2			0.5	1							
<i>Apium australe</i>																0.1	1																			
<i>Archontophoenix cunninghamiana</i>					15.0	20						0.1	1	70.0	50			0.1	1			0.2	4			3.0	5			5.0	8	0.2	1	0.2	4	
<i>Arthropodium milleflorum</i>																														0.1	6					
<i>Arthropodium spp.</i>			0.1	1																																
<i>Asplenium australasicum</i>					0.2	10						0.1	1									0.1	2													
<i>Asplenium flabellifolium</i>																														0.1	3					
<i>Axonopus compressus*</i>	1.0	30																																		
<i>Backhousia leptopetala</i>					5.0	5						55.0	80																		8.0	4	3.0	2		
<i>Backhousia myrtifolia</i>					5.0	5						15.0	11													25.0	20			50.0	12	55.0	13			
<i>Baloghia inophylla</i>																														0.3	1					
<i>Bidens pilosa*</i>								0.1	2																											
<i>Billardiera scandens</i>		0.1	10			0.1	2							0.1	1									0.1	2			0.1	5							
<i>Blechnum cartilagineum</i>												0.3	5													0.1	5			0.5	6					
<i>Blechnum nudum</i>														0.2	5	0.2	5																			

REPORT

Scientific Name	LW34-1	LW34-2	LW34-3	LW34-4	LW34-5	LW34-6	LW34-7	LW34-8	LW34-9	LW34-10	LW34-11	LW34-12	LW34-13	LW34-14	PR144986 Plot 12	PR144986 Plot 19	PR144986 Plot 20														
<i>Blechnum</i> spp.					1.0	40																									
<i>Bouteloua dactyloides</i> *					95.0	1,000																									
<i>Breynia oblongifolia</i>		0.1	1		0.1	1		0.1	3							0.1	6														
<i>Brunoniella pumilio</i>																0.1	10														
<i>Calanthe triplicata</i>			0.5	5									0.5	5																	
<i>Callitris muelleri</i>												0.5	1																		
<i>Calochlaena dubia</i>	0.1	2						0.2	5	10.0	250	0.5	20				0.4	20													
<i>Cardamine hirsuta</i> *					1.0	50																									
<i>Carex brunnea</i>																	2.0	15													
<i>Carex inversa</i>																	2.0	30													
<i>Carex maculata</i>																0.1	5	0.8	15												
<i>Carex</i> spp.	2.0	200		0.1	5																										
<i>Cassytha glabella</i>				0.1	3				0.1	1				0.1	2																
<i>Cassytha pubescens</i>		0.2	50																												
<i>Cayratia clematidea</i>					0.1	3				0.1	5	0.2	10				0.1	8													
<i>Centella asiatica</i>	0.2	20															0.1	15													
<i>Ceratopetalum apetalum</i>										0.1	1																				
<i>Cheilanthes sieberi</i>				0.1	3									0.2	15																
<i>Christella dentata</i>																0.1	4	0.1	4												
<i>Cinnamomum camphora</i> *																0.1	1														
<i>Cissus antarctica</i>		0.1	5	5.0	30	0.1	5		5.0	15	0.1	2	0.1	1	0.3	8	0.1	5	20.0	40		0.1	1	1.0	25	0.3	8	5.0	20		
<i>Cissus hypoglauca</i>			5.0	20				8.0	15	2.0	20			3.0	15	25.0	50	15.0	30			4.0	10			0.2	8				
<i>Claoxylon australe</i>												6.0	5																		
<i>Clematis aristata</i>			0.1	1	0.1	1	0.1	1			0.1	2																			
<i>Clerodendrum tomentosum</i>						0.1	1							0.1	1										0.2	6	0.2	5			
<i>Commelina cyanea</i>			0.1	10						0.1	8	0.2	10														0.5	30			
<i>Conyza</i> spp. *					0.4	25																									
<i>Cordyline stricta</i>			0.5	10										0.5	5										0.5	5					
<i>Corybas pruinosis</i>												0.1	20																		
<i>Corybas</i> spp.														0.1	10																
<i>Corymbia maculata</i>		20.0	6		25.0	11			5.0	2	5.0	1			15.0	4	10.0	2	40.0	13	8.0	2									
<i>Croton verreauxii</i>			0.1	1									0.1	1			0.2	2													
<i>Cryptocarya glaucescens</i>			15.0	2																											
<i>Cryptocarya microneura</i>		0.2	2					40.0	4															0.5	1						
<i>Cyathea australis</i>																											0.3	1			
<i>Cyclophyllum longipetalum</i>	0.1	10																						0.5	1						

REPORT

Scientific Name	LW34-1	LW34-2	LW34-3	LW34-4	LW34-5	LW34-6	LW34-7	LW34-8	LW34-9	LW34-10	LW34-11	LW34-12	LW34-13	LW34-14	PR144986 Plot 12	PR144986 Plot 19	PR144986 Plot 20												
<i>Cymbidium spp.</i>										0.1	1																		
<i>Cynodon dactylon</i>					1.0	20																							
<i>Cyperus eragrostis*</i>	0.1	10																											
<i>Cyperus flaccidus</i>																0.2	15	0.5	50										
<i>Cyperus gracilis</i>																		3.0	60										
<i>Cyperus laevigatus</i>																		0.2	20										
<i>Cyperus spp.</i>			0.1	5		0.2	3																						
<i>Daviesia squarrosa</i>		0.1	5													15.0	15												
<i>Dendrobium speciosum</i>										0.1	1																		
<i>Denhamia silvestris</i>		0.2	15	0.1	10			0.2	10	0.2	15	0.2	15					0.2	15										
<i>Desmodium rhytidophyllum</i>		0.1	2		0.3	20				0.2	10	0.2	10		0.1	5		0.2	10										
<i>Dianella caerulea</i>		0.5	20							0.2	5	0.1	5	0.1	10	1.0	20												
<i>Dianella caerulea var. producta</i>				0.1	2	0.1	3			0.3	10							0.6	35										
<i>Dianella spp.</i>										0.5	8																		
<i>Dichondra repens</i>	0.1	10				0.5	100												0.2	30									
<i>Dioscorea transversa</i>			0.2	20			0.1	1	0.1	1		0.1	5	1.0	50	2.0	20	1.0	20	0.5	20	0.8	15	0.2	10				
<i>Diospyros australis</i>								1.0	3						0.1	1				5.0	10	2.0	6	10.0	8				
<i>Diploglottis australis</i>																						0.2	10						
<i>Doodia aspera</i>			8.0	200			0.5	30	3.0	70		4.0	200	1.0	40	0.5	30		2.0	40		8.0	400	5.0	30				
<i>Dysoxylum fraserianum</i>																							0.8	2					
<i>Elaeodendron australe</i>																			0.2	2		5.0	4						
<i>Embelia australiana</i>				0.1	1		0.1	1	0.1	1		0.4	201	0.2	30	0.1	20		0.1	2		0.5	5	0.1	2	0.1	5		
<i>Empodisma minus</i>															0.2	30	0.1	10											
<i>Entolasia marginata</i>																								0.3	4				
<i>Entolasia stricta</i>		0.5	20		0.1	5				0.2	4			0.1	10			0.2	30	0.1	10	1.5	45		0.1	10			
<i>Eucalyptus fergusonii</i>																			2.0	2									
<i>Eucalyptus microcorys</i>		2.0	1	3.0	1	3.0	25	0.2	1	20.0	3			30.0	6	15.0	3	2.0	1		6.0	1		15.0	2		4.0	2	
<i>Eucalyptus pilularis</i>		30.0	6											20.0	2	10.0	1	30.0	5	15.0	2								
<i>Eucalyptus propinqua</i>				1.0	5					20.0	7											8.0	1	20.0	1				
<i>Eucalyptus punctata</i>		5.0	10													8.0	2				6.0	2							
<i>Eucalyptus saligna</i>							10.0	5																	35.0	3			
<i>Eucalyptus siderophloia</i>										0.4	1													30.0	7				
<i>Eupomatia laurina</i>			20.0	25						25.0	10			0.5	1			0.5	2										
<i>Eustrephus latifolius</i>								0.1	1																0.1	6			
<i>Ficus coronata</i>			0.2	2						5.0	15							3.0	2					5.0	10	1.0	2	5.0	2
<i>Ficus rubiginosa</i>					0.1	2																							
<i>Ficus spp.</i>										1.0	1																		

REPORT

Scientific Name	LW34-1	LW34-2	LW34-3	LW34-4	LW34-5	LW34-6	LW34-7	LW34-8	LW34-9	LW34-10	LW34-11	LW34-12	LW34-13	LW34-14	PR144986 Plot 12	PR144986 Plot 19	PR144986 Plot 20													
<i>Gahnia radula</i>																0.2	4													
<i>Gahnia sieberiana</i>										0.1	2	2.0	10																	
<i>Gahnia spp.</i>									0.5	1																				
<i>Galium spp.</i>		0.1	50							0.1	10	0.1	1	0.1	2															
<i>Gamochaeta spp. *</i>					0.2	10																								
<i>Geitonoplesium cymosum</i>		0.1	5	0.1	1	0.1	8		0.1	2		0.1	10	0.1	5	0.2	20	0.2	20	0.1	4	0.1	5	5.0	1					
<i>Geranium neglectum</i>																										0.1	10			
<i>Geranium spp.</i>					0.6	150																								
<i>Glochidion ferdinandi</i>																											3.0	2	8.0	3
<i>Glycine clandestina</i>				0.1	1																						0.1	4		
<i>Glycine tabacina</i>												0.1	20	0.1	10	0.1	4													
<i>Gonocarpus spp.</i>		0.2	50																											
<i>Goodenia hederacea</i>												0.1	3																	
<i>Goodenia heterophylla</i>		0.5	40						0.2	5															0.3	50				
<i>Guioa semiglauca</i>																												4.0	3	
<i>Gymnostachys anceps</i>			0.1	1		0.2	5		0.1	5	0.1	1	0.1	2		0.5	5									1.0	5		0.2	5
<i>Gynochthodes jasminoides</i>																											0.2	20		
<i>Hardenbergia violacea</i>		0.1	5																											
<i>Hibbertia dentata</i>				0.1	1				10.0	300	0.2	10	0.2	20	0.1	5											0.1	3		
<i>Hibbertia scandens</i>		0.2	6		0.3	10						0.2	3		0.1	1														
<i>Hibiscus heterophyllus subsp. heterophyllus</i>					0.2	1																						8.0	6	
<i>Homalanthus populifolius</i>		0.1	1	0.1	5	0.1	1		0.1	1				0.1	2															
<i>Hydrocotyle laxiflora</i>						0.1	30		0.1	15	1.0	300		0.1	20															
<i>Hydrocotyle spp.</i>			0.1	10								0.2	30															0.2	10	
<i>Hydrocotyle tripartita</i>	2.0	200			0.2	50																								
<i>Hymenophyllum cupressiforme</i>																												3.0	50	
<i>Hymenosporum flavum</i>																												0.1	2	
<i>Hypericum gramineum</i>	0.2	20																												
<i>Hypericum spp.</i>					0.1	5																								
<i>Hypochaeris radicata*</i>	0.4	30																										0.1	3	
<i>Imperata cylindrica</i>				5.0	100			0.4	20				0.4	30		0.2	10													
<i>Juncus subsecundus</i>																												0.2	20	
<i>Juncus usitatus</i>	1.0	80																												
<i>Lagenifera stipitata</i>		0.1	5					0.1	5				0.1	1																
<i>Lantana camara*</i>			2.0	3	4.0	15																					0.1	5	10.0	20

REPORT

Scientific Name	LW34-1	LW34-2	LW34-3	LW34-4	LW34-5	LW34-6	LW34-7	LW34-8	LW34-9	LW34-10	LW34-11	LW34-12	LW34-13	LW34-14	PR144986 Plot 12	PR144986 Plot 19	PR144986 Plot 20													
<i>Lastreopsis decomposita</i>			2.0	75			0.5	20																						
<i>Lastreopsis microsora</i>																0.2	8	0.2	10											
<i>Legnephora moorei</i>																		0.1	1											
<i>Lepidosperma laterale</i>		0.1	2			1.0	6					0.1	10		0.1	5														
<i>Leucopogon lanceolatus</i>		0.2	10									0.1	1																	
<i>Lindsaea dimorpha</i>		0.5	40																											
<i>Lindsaea linearis</i>									0.1	5																				
<i>Lindsaea microphylla</i>				0.1	2				0.1	3																				
<i>Livistona australis</i>									0.3	2		0.2	2		0.1	4		0.2	2	65.0	10									
<i>Lobelia pratioides</i>					0.2	50	0.1	5																						
<i>Lobelia purpurascens</i>	0.1	20	3.0	80		0.1	20			0.2	50	0.1	15	0.2	20	0.1	10	0.2	30		2.0	150		0.1	10					
<i>Lomandra confertifolia</i>																						0.1	1							
<i>Lomandra filiformis</i>						0.1	1																		0.1	3				
<i>Lomandra longifolia</i>		1.0	15		6.0	50				5.0	30	0.2	2		0.2	10	6.0	10	0.5	10	8.0	75	3.0	12						
<i>Lomandra multiflora</i> <i>subsp. multiflora</i>		0.2	10		0.1	2				0.1	1	0.1	1		0.2	20		0.6	20											
<i>Lysimachia arvensis*</i>	0.3	30																												
<i>Marsdenia rostrata</i>				0.2	3																					0.1	4			
<i>Melicope micrococca</i>																										1.0	3			
<i>Melodinus australis</i>								0.2	5																					
<i>Microlaena stipoides</i>	0.1	30			0.1	5		0.1	1		0.5	15	0.1	5	0.5	40	0.1	20			0.5	25			0.1	15				
<i>Microsorium diversifolium</i>			10.0	250						2.0	50																			
<i>Microsorium pustulatum</i>																										6.0	25	0.2	15	
<i>Modiola caroliniana*</i>	0.1	20				5.0	150																							
<i>Morinda jasminoides</i>				0.3	60			0.3	10	0.2	5			0.1	2	0.1	10	0.1	1	0.1	5			0.3	20		0.5	20		
<i>Myrsine howittiana</i>																										0.8	10			
<i>Myrsine variabilis</i>			20.0	50				0.5	1	0.3	20																			
<i>Nasturtium officinale*</i>	0.1	10																												
<i>Neolitsea dealbata</i>								0.3	1																		0.2	2		
<i>Notelaea longifolia</i>														0.2	1			2.0	5											
<i>Notelaea spp.</i>																										0.1	1			
<i>Omalanthus populifolius</i>																										0.1	4	0.1	8	
<i>Opercularia diphylla</i>		0.1	10		0.1	3					0.1	10		0.1	5			0.2	25											
<i>Oplismenus aemulus</i>	0.2	30																							3.0	200				
<i>Oplismenus imbecillis</i>		0.5	60	0.2	40	0.2	120	0.2	15	0.2	10	0.2	10	0.1	3	0.1	10	0.5	50	1.0	80	0.8	30	0.1	10	0.2	20		5.0	100
<i>Ottochloa gracillima</i>																											0.2	15		
<i>Oxalis perennans</i>	0.6	40										0.1	20	0.1	10															

REPORT

Scientific Name	LW34-1	LW34-2	LW34-3	LW34-4	LW34-5	LW34-6	LW34-7	LW34-8	LW34-9	LW34-10	LW34-11	LW34-12	LW34-13	LW34-14	PR144986 Plot 12	PR144986 Plot 19	PR144986 Plot 20
<i>Oxalis</i> spp.		0.1 15			0.3 30				0.1 25							0.1 5	
<i>Pandorea jasminoides</i>														0.1 2			
<i>Pandorea pandorana</i>						0.1 1		0.1 1	0.1 5			0.1 2			0.1 6	0.1 10	
<i>Parsonia straminea</i>		0.1 3		0.1 2					0.5 5			0.1 10		0.1 1			
<i>Paspalum dilatatum</i>					2.0 25												
<i>Pellaea falcata</i>			2.0 5					1							0.3 25		0.2 10
<i>Pellaea paradoxa</i>			0.2 20			0.2 15					1.0 30				0.5 20		
<i>Pellaea</i> spp.			0.1 5	0.1 2													
<i>Peperomia blanda</i>															0.1 5		
<i>Persoonia linearis</i>				0.6 4				1.0 5				1.0 3		0.3 1			
<i>Phyllanthus</i> spp.				0.1 3													
<i>Pittosporum multiflorum</i>		0.2 5	2.0 10				1.0 20								0.5 5	0.2 4	0.1 4
<i>Pittosporum revolutum</i>															0.2 5	0.3 2	0.1 2
<i>Pittosporum undulatum</i>		3.0 4										1.0 5		0.1 3			
<i>Plantago lanceolata</i> *	0.3 30																
<i>Platycerium</i> spp.													0.1 1				
<i>Platysace lanceolata</i>								0.5 30									
<i>Plectorrhiza</i> spp.			0.1 3														
<i>Plectranthus parviflorus</i>	0.1 1				0.1 3	0.1 5		0.2 10			0.2 20						0.1 10
<i>Plectranthus</i> spp.								0.2 5									
<i>Poa labillardierei</i> var. <i>labillardierei</i>		1.0 20															
<i>Podolobium ilicifolium</i>		0.2 5										0.1 1					
<i>Polia crispata</i>																0.1 4	
<i>Polystichum australiense</i>															2.0 50	0.2 10	
<i>Pomax umbellata</i>								1.0 100						0.2 30			
<i>Pseuderanthemum variabile</i>	5.0 50	1.0 50	0.1 10			0.2 10	0.1 10	0.1 2	0.2 50	0.5 30	0.2 20	0.5 30	0.1 10	0.2 75		0.1 15	0.1 10
<i>Psychotria loniceroides</i>		0.1 1						0.1 1	1.0 5	2.0 10	0.1 5					0.1 2	0.1 1
<i>Pteridium esculentum</i>		0.1 2		0.1 1				2.0 25		70.0 100		0.5 20					
<i>Pterostylis nutans</i>		0.1 20															
<i>Pterostylis</i> spp.			0.1 30					0.2 50		0.1 30							
<i>Pyrrosia rupestris</i>			0.3 50				0.2 15		0.4 50							0.8 25	0.1 10
<i>Ranunculus</i> spp.	0.1 10																
<i>Rhodamnia rubescens</i> ¹				0.1 1					0.3 1							1.0 3	
<i>Richardia humistrata</i> *	11.0 530																
<i>Ripogonum album</i>																	2.0 10
<i>Ripogonum fawcettianum</i>							1.0 10								5.0 50		

REPORT

Scientific Name	LW34-1	LW34-2	LW34-3	LW34-4	LW34-5	LW34-6	LW34-7	LW34-8	LW34-9	LW34-10	LW34-11	LW34-12	LW34-13	LW34-14	PR144986 Plot 12	PR144986 Plot 19	PR144986 Plot 20																
<i>Rosa</i> spp. *					0.5	5																											
<i>Rubus moluccanus</i>										0.3	10																						
<i>Rubus nebulosus</i>							0.5	8									0.1	5															
<i>Rumex</i> spp.	0.2	20			1.0	50																											
<i>Rytidosperma pallidum</i>		8.0	25																														
<i>Rytidosperma</i> spp.				0.1	1									0.2	6																		
<i>Sarcochilus hillii</i>																0.1	25																
<i>Sarcochilus olivaceus</i>																0.1	4																
<i>Sarcochilus</i> spp.													0.1	2																			
<i>Sarcopetalum harveyanum</i>																0.3	4																
<i>Schelhammera undulata</i>										1.0	50		0.1	5																			
<i>Schizomeria ovata</i>																	5.0	2															
<i>Schoenus</i> spp.					0.2	20																											
<i>Scolopia braunii</i>			0.2	1											5.0	50																	
<i>Senecio linearifolius</i>																	0.1	10															
<i>Senna septemtrionalis</i> *																	0.1	4															
<i>Setaria sphacelata</i> *					0.5	25											1.0	40															
<i>Sida rhombifolia</i> *					0.1	5																											
<i>Sigesbeckia orientalis</i> subsp. <i>orientalis</i>				0.1	1												0.1	5															
<i>Smilax australis</i>		0.2	10	0.5	20	0.2	5		0.2	5		0.1	1	0.3	10	0.2	20	1.0	20	0.2	5	2.0	20		1.0	20	0.2	8	0.1	1			
<i>Solanum nigrum</i> *																													0.1	2			
<i>Solanum prinophyllum</i>				0.1	1						0.1	1	0.1	2																			
<i>Stellaria media</i> *					1.0	200																											
<i>Stenotaphrum secundatum</i> *	80.0	1,000																															
<i>Stephania japonica</i>					0.2	1																											
<i>Syncarpia glomulifera</i>		1.0	3					15.0	5	3.0	1	1.0	10	15.0	2	5.0	3	0.5	1	25.0	20	30.0	9		25.0	1							
<i>Synoum glandulosum</i> subsp. <i>glandulosum</i>		31.0	1	0.3	10				0.5	5	1.0	5	20.0	30	7.0	7	15.0	10	0.5	3					1.0	5	4.0	8	2.0	8			
<i>Syzygium australe</i>			5.0	3																	10.0	3			0.5	25							
<i>Taraxacum officinale</i> *					0.1	1																											
<i>Tetragium nitens</i>		0.1	1	0.2	8	0.1	2		0.1	1	1.0	15	0.1	1	5.0	30		0.1	10	0.1	2	0.1	3		0.5	20	0.6	10	0.6	8			
<i>Themeda triandra</i>		5.0	20		2.0	100				1.0	50	0.2	20					0.5	40					10.0	100								
<i>Trifolium repens</i> *	0.2	80																															
<i>Trochocarpa laurina</i>										2.0	4	5.0	6					0.5	2	1.0	2				3.0	5	1.0	1					
<i>Tylophora barbata</i>																											0.1	1					
<i>Verbena</i> spp.	0.1	1																															
<i>Veronica plebeia</i>																																	

REPORT

Scientific Name	LW34-1	LW34-2	LW34-3	LW34-4	LW34-5	LW34-6	LW34-7	LW34-8	LW34-9	LW34-10	LW34-11	LW34-12	LW34-13	LW34-14	PR144986 Plot 12	PR144986 Plot 19	PR144986 Plot 20	
<i>Viola betonicifolia</i>					0.3	50												
<i>Viola hederacea</i>	0.2	40		0.1	1				0.3	200	0.2	30	0.1	20	0.2	50		
<i>Wilkiea huegeliana</i>			2.0	5			0.2	1							1.0	1	0.1	2
<i>Xanthorrhoea resinosa</i>		3.0	4															
<i>Xanthorrhoea spp.</i>												1.0	5					
<i>Zieria smithii</i>							0.5	15										

1. BC Act: Critically Endangered; EPBC Act: Critically Endangered; * = exotic species

Appendix G

Fauna List

REPORT

Family	Scientific Name	Common Name	Number	Detection method
Amphibians				
Myobatrachidae	<i>Mixophyes fasciolatus</i>	Great Barred Frog	3	Heard; Observed
Myobatrachidae	<i>Pseudophryne coriacea</i>	Red-Backed Toadlet	10+	Heard
Myobatrachidae	<i>Uperoleia laevigata</i>	Smooth Toadlet	10+	Heard
Pelodyradidae	<i>Litoria fallax</i>	Eastern Dwarf Tree Frog	10+	Heard
Pelodyradidae	<i>Litoria tylerii</i>	Tylers Tree Frog	1	Heard
Pelodyradidae	<i>Limnodynastes peronii</i>	Perons Tree Frog	2	Heard; Observed
Pelodyradidae	<i>Litoria revelata</i>	Whirring Tree Frog	2	Heard
Birds				
Accipitridae	<i>Haliaeetus leucogaster</i>	White-bellied sea eagle	1	Observed
Alcedinidae	<i>Dacelo novaeguineae</i>	Kookaburra	2	Observed
Artamidae	<i>Strepera graculina</i>	Pied currawong	1	Heard
Cacatuidae	<i>Cacatua galerita</i>	Sulphur-crested cockatoo	1	Heard
Campephagidae	<i>Coracina novaehollandiae</i>	Black-faced cuckooshrike	1	Heard
Campephagidae	<i>Edolisoma tenuirostre</i>	Common Circadbird	1	Heard
Climacteridae	<i>Cormobates leucophaea</i>	White-throated treecreeper	1	Heard; Observed
Climacteridae	<i>Climacteris picumnus</i>	Brown treecreeper	2	Heard
Columbidae	<i>Leucosarcia melanoleuca</i>	Wonga Pigeon	2	Observed
Columbidae	<i>Macropygia phasianella</i>	Brown cuckoo-dove	1	Observed
Coraciidae	<i>Eurystomus orientalis</i>	Oriental dollarbird	1	Heard
Corcoracidae	<i>Corcorax melanorhamphos</i>	White-winged chough	1	Heard
Cuculidae	<i>Chrysococcyx lucidus</i>	Shining bronze cuckoo	1	Heard
Cuculidae	<i>Cacomantis flabelliformis</i>	Fan-tailed cuckoo	2	Observed/ Heard
Maluridae	<i>Malurus cyaneus</i>	Superb Fairy-wren	10	Observed
Meliphagidae	<i>Caligavis chrysops</i>	Yellow-faced honeyeater	1	Observed
Meliphagidae	<i>Lichmera indistincta</i>	Brown Honeyeater	1	Heard
Meliphagidae	<i>Manorina melanophrys</i>	Bell Miner	1	Heard
Meliphagidae	<i>Myzomela sanguinolenta</i>	Scarlet Myzomela	1	Heard
Menuridae	<i>Menura novaehollandiae</i>	Superb lyrebird	2	Heard
Monarchidae	<i>Myiagra inquieta</i>	Restless flycatcher	1	Heard
Monarchidae	<i>Monarcha melanopsis</i>	Black-faced monarch	1	Observed
Pachycephalidae	<i>Pachycephala rufiventris</i>	Rufous whistler	1	Heard
Pardalotidae	<i>Pardalotus punctatus</i>	Spotted Pardalote	1	Heard
Pardalotidae	<i>Pardalotus striatus</i>	Striated Pardalote	1	Heard
Phasianidae	<i>Coturnix ypsilophora</i>	Brown quail	1	Observed
Psittaculidae	<i>Trichoglossus chlorolepidotus</i>	Scaly-breasted lorikeet	1	Heard
Psittaculidae	<i>Trichoglossus moluccanus</i>	Rainbow lorikeet	1	Heard
Ptilonorhynchidae	<i>Ailuroedus crassirostris</i>	Green Catbird	1	Observed
Ptilonorhynchidae	<i>Ptilonorhynchus violaceus</i>	Satin bowerbird	1	Observed
Rallidae	<i>Fulica atra</i>	Eurasian coot	1	Observed
Rallidae	<i>Porphyrio melanotus</i>	Australasian swamphen	5	Observed

REPORT

Family	Scientific Name	Common Name	Number	Detection method
Rhipiduridae	<i>Rhipidura rufifrons</i>	Rufous fantail	1	Observed
Tytonidae	<i>Tyto novaehollandiae</i>	Masked Owl	1	Observed
Tytonidae	<i>Tyto tenebricosa</i>	Sooty Owl	1	Heard
Mammals				
Acrobatidae	<i>Acrobates pygmaeus</i>	Feather-tailed Glider	3	Observed
Vespertilionidae	<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	8 calls to high confidence	Anabat; see Appendix I
Dasyuridae	<i>Antechinus stuartii</i>	Brown Antechinus	1	Elliot trap
Macropodidae	<i>Macropus rufogriseus</i>	Red-necked Wallaby	5	Observed
Vespertilionidae	<i>Miniopterus australis</i>	Little Bent-winged Bat	1 call to high confidence	Anabat; see Appendix I
Petauridae	<i>Petaurus norfolcensis</i>	Squirrel Glider	2	Heard
Pteropodidae	<i>Pteropus poliocephalus</i>	Grey-headed Flying Fox	1	Heard
Petauridae	<i>Petaurus australis</i>	Yellow-bellied Glider	5	Observed
Muridae	<i>Rattus fuscipes</i>	Bush Rat	3	Camera trap; Elliot trap
Rhinolophidae	<i>Rhinolophus megaphyllus</i>	Eastern Horseshoe Bat	10; 1,886 calls to high confidence	Observed; Anabat; see Appendix I
Phalangeridae	<i>Trichosurus vulpecula</i>	Common brushtail possum	1	Camera trap
Caninae	<i>Vulpes vulpes</i> *	Red Fox	1	Camera trap
Reptiles				
Carphodactylidae	<i>Phyllurus platurus</i>	Broad-tailed gecko	3	Observed
Colubridae	<i>Dendrelaphis punctulatus</i>	Common tree snake	1	Observed
Elapidae	<i>Pseudonaja textilis</i>	Eastern brown snake	1	Observed
Varanidae	<i>Varanus varius</i>	Goanna	1	Observed

* = introduced species.

Anabat data analysis

Glenn Hoye
Biodiversity Monitoring Services
PO Box 271
BELMONT NSW 2280
Tel (02) 49477794
Email: glenn@flybynightbatsurveys.com.au

Hayden Beck
Senior Ecologist
RPS Australia Asia Pacific
Unit 2A, 45 Fitzroy Street
CARRINGTON NSW 2294
Ph. (02) 4940 4200
Mobile: 0417 049 493
email: hayden.beck@rpsgroup.com.au

5th February 2021

Results of microbat echolocation call survey at sandstone overhangs, near Mandalong, New South Wales.

Dear Hayden,

Following are the results from your microbat echolocation call survey at potential control and impact sites, near Mandalong, New South Wales. Six predominantly cave roosting microbats could be expected to occur along sandstone escarpments and areas containing overhangs in the Mandalong area; the Eastern Horseshoe Bat (*Rhinolophus megaphyllus*), Large-eared Pied Bat (*Chalinolobus dwyeri*), Little Bent-winged Bat (*Miniopterus australis*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Southern Myotis (*Myotis macropus*) and Eastern Cave Bat (*Vespadelus troughtoni*).

The results from analysis of microbat echolocation calls at control and impact sites are detailed in *Table 1*. The total echolocation passes are noted with passes identified to a confident level in brackets.

Table 1: Activity of target microbat species at control and impact sites

Site	Date	R.meg	C.dwy	M.aus	M.oce	M.mac	V.tro
Control 1*	11/01/2021	12(11)	0(0)	0(0)	0(0)	0(0)	0(0)
Control 1	12/01/2021	22(20)	0(0)	0(0)	0(0)	0(0)	0(0)
Control 2	11/01/2021	11(4)	0(0)	1(0)	0(0)	0(0)	0(0)
Control 2	12/01/2021	32(25)	0(0)	0(0)	0(0)	0(0)	0(0)
Control 3	11/01/2021	519(503)	0(0)	0(0)	0(0)	0(0)	0(0)
Control 3	12/01/2021	191(172)	0(0)	0(0)	0(0)	0(0)	0(0)
Control 4**	13/01/2021	1(1)	0(0)	0(0)	0(0)	0(0)	0(0)
Control 4**	14/01/2021	-	-	-	-	-	-
Control 5	13/01/2021	2(2)	0(0)	2(2)	0(0)	0(0)	0(0)
Control 5	14/01/2021	3(3)	0(0)	2(0)	0(0)	0(0)	0(0)
Control 6	13/01/2021	50(31)	0(0)	0(0)	0(0)	0(0)	0(0)
Control 6	14/01/2021	121(87)	0(0)	0(0)	0(0)	0(0)	0(0)
Impact 1	11/01/2021	7(6)	0(0)	0(0)	0(0)	0(0)	0(0)
Impact 1	12/01/2021	4(3)	0(0)	0(0)	0(0)	0(0)	0(0)
Impact 2	11/01/2021	236(214)	1(0)	4(0)	0(0)	0(0)	0(0)
Impact 2	12/01/2021	174(163)	0(0)	8(6)	0(0)	0(0)	0(0)
Impact 3	11/01/2021	9(9)	0(0)	0(0)	0(0)	0(0)	0(0)
Impact 3	12/01/2021	11(11)	2(0)	0(0)	0(0)	0(0)	0(0)
Impact 4	13/01/2021	7(7)	6(6)	1(0)	0(0)	0(0)	0(0)
Impact 4	14/01/2021	7(6)	3(2)	1(1)	0(0)	0(0)	0(0)
Impact 5	13/01/2021	579(541)	0(0)	0(0)	0(0)	0(0)	0(0)
Impact 5	14/01/2021	9(8)	0(0)	0(0)	0(0)	0(0)	0(0)
Impact 6	13/01/2021	9(0)	0(0)	0(0)	1(0)	0(0)	0(0)
Impact 6	14/01/2021	59(59)	0(0)	0(0)	1(0)	0(0)	0(0)

*check detector settings, division ratio caused problems with data presentation.

**detector ran out of battery after first call recorded on 13/01/2021. No data, needs resampling, especially since the photos show large numbers of scats on the floor of the cave.

The number of echolocation calls identified to a high level of confidence to a species are marked in brackets.

As seen in *Table 1*, the Eastern Horseshoe Bat was recorded at all sites, with very high activity at control sites 3 and 6 and impact sites 2, 5 and 6. This activity may be indicative of a largish roost in the vicinity of these sites and thought should be given to undertaking capture of this species at these sites to establish if a maternity roost or large non maternity roost is present. While this species is not listed as threatened loss of a maternity roost would significantly impact local populations. Impact site 4 had the highest activity of the Large-eared Pied Bat, with lesser activity at impact sites 3 and 2. The Little Bent-winged Bat was generally recorded at lower levels of activity at the control and impact sites. The Eastern Bent-winged Bat, Southern Myotis and Eastern Cave Bat were either not recorded or only recorded from a couple of passes.

Trapping for the Large-eared Pied Bat should be undertaken at impact sites 2, 3 and 4 next breeding season (Nov-Jan) to ascertain if breeding is taking place in the vicinity. Harp trapping of the Eastern Horseshoe Bat should be undertaken next summer at control sites 3 and 6 and impact sites 2, 5 and 6 to determine if these sites are used for breeding or are substantial non-breeding roost sites. Control sites 3 and 6 and impact sites 2, 4, 5 and 6 would be worth maintaining as monitoring sites. Investigation of additional sites would be warranted, particularly to ascertain sites where the Large-eared Pied Bat occurs at similar activity levels as impact site 4.

Detectors failed on a number of nights: control 4 on 13/01/2021 and 14/01/2021. Data from these sites should be recollected. Data from control 1 on 11/01/2021 looked to be missing until it was found to be hundreds of kHz higher than it should have been. The date on the detector was reading 1970. This unit should be thoroughly checked and tested before being redeployed. Also, check the division ratios and setting on all your detectors are set the same, and ensure division ratio on CFread is correct when downloading flash cards from older detector.

From viewing the photos of the detectors from sites, placement of the detectors may have also impacted the results. Detectors placed facing into cave entrances, or across narrow entrances is not the most optimal sampling location. Bats often give non characteristic calls within the confines of caves. Placement of the detector outside the cave either facing along the cliffline (across the entrance) of larger caves, or facing from the cave mouth out along the expected exit flyway, will record better pulses and give a better indication of cave use.

References

- Hoye, G.A. and Hall, L.S. (2008) Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) in Van Dyck, S. & Strahan, R. ed. *The Mammals of Australia*. Third Edition. Reed New Holland, Chatswood. p.507-508.
- Hoye, G.A. Law, B.S. and Allison, F.R. (2008) East-coast Free-tailed Bat (*Mormopterus norfolkensis*) in Van Dyck, S. & Strahan, R. ed. *The Mammals of Australia*. Third Edition. Reed New Holland, Chatswood. p.491-492.
- Hoye, G.A. and Schulz, M. (2008) Large-eared Pied Bat (*Chalinolobus dwyeri*) in Van Dyck, S. & Strahan, R. ed. *The Mammals of Australia*. Third Edition. Reed New Holland, Chatswood. p.531-532.
- Richards, G.C., Hoye, G.A., Lumsden, L.F, Law, B.S. and Milne, D.J. (2008) Large-footed Myotis (*Myotis macropus*) in Van Dyck, S. & Strahan, R. ed. *The Mammals of Australia*. Third Edition. Reed New Holland, Chatswood. p.544-545.

Best wishes



Glenn Hoye

Appendix I

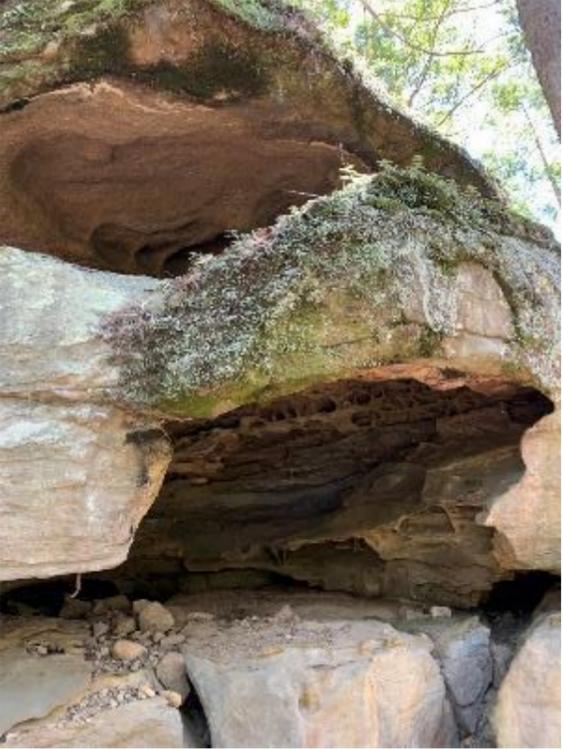
Cave survey

REPORT

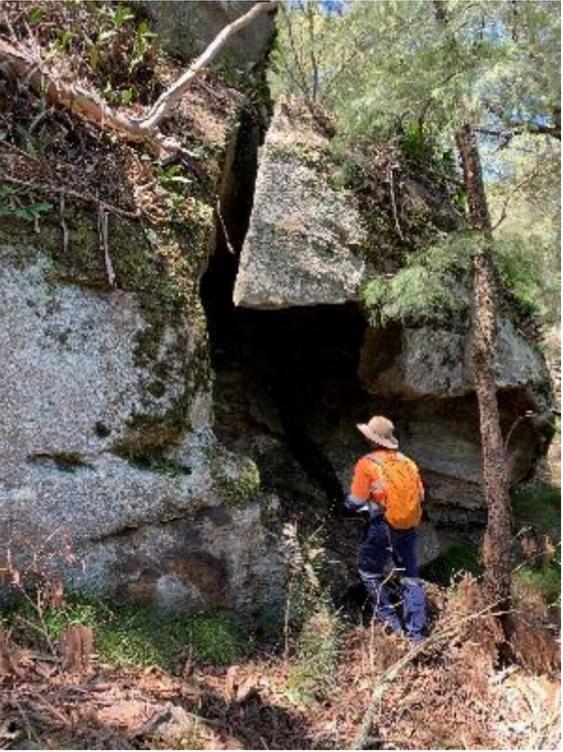
Cave Attribute Measurements

Number	Grid East	Grid North	Cliff Height (m)	Slope (°)	Fissures			Cave/Overhang			Honeycombing area (m2)	Bat Scats	Bat Species/No.	Photograph
					Max width (m)	Max Depth (m)	Length (m)	Width (m)	Max Height (m)	Length (m)				
C32	351293	6327345	5	10	-	-	-	2.66	1.9	1.83	0	-	-	
C33	351270	6327128	1.8	10	-	-	-	2.6	1.51	1.99	0	-	-	
C34	351476	6327551	5	10	-	-	-	5.27	2.53	2.97	6	-	-	

REPORT

Number	Grid East	Grid North	Cliff Height (m)	Slope (°)	Fissures			Cave/Overhang			Honeycombing area (m2)	Bat Scats	Bat Species/No.	Photograph
					Max width (m)	Max Depth (m)	Length (m)	Width (m)	Max Height (m)	Length (m)				
C35	351463	6327572	5.5	10	-	-	-	4.24	2.01	2.94	5	-	-	
C36	351352	6327581	5.5	10	-	-	-	4.07	3.07	4.64	0.5	-	-	

REPORT

Number	Grid East	Grid North	Cliff Height (m)	Slope (°)	Fissures			Cave/Overhang			Honeycombing area (m2)	Bat Scats	Bat Species/No.	Photograph
					Max width (m)	Max Depth (m)	Length (m)	Width (m)	Max Height (m)	Length (m)				
C37	351355	6327574	3	15	20	>2	1.5	4.44	1.6	7.22	1	-	-	
C38	351367	6327551	4	10	1.5	2.24	2.5	4.43	3.08	4.3	0.5	-	-	

REPORT

Number	Grid East	Grid North	Cliff Height (m)	Slope (°)	Fissures			Cave/Overhang			Honeycombing area (m2)	Bat Scats	Bat Species/No.	Photograph
					Max width (m)	Max Depth (m)	Length (m)	Width (m)	Max Height (m)	Length (m)				
C39	351375	6327499	6	40	-	-	-	5.05	1.62	4.56	2	-	-	
C40	351373	6327501	6	40	-	-	-	2.98	1.52	4.85	1.5	-	-	
C41	351411	6327484	2.5	8	-	-	-	2.61	1.49	2.76	0.5	-	-	

REPORT

Number	Grid East	Grid North	Cliff Height (m)	Slope (°)	Fissures			Cave/Overhang			Honeycombing area (m2)	Bat Scats	Bat Species/No.	Photograph
					Max width (m)	Max Depth (m)	Length (m)	Width (m)	Max Height (m)	Length (m)				
C42	351414	6327387	5.5	15	1.5	2	1.5	3.23	3.14	2.68	1	-	-	
C43	351399	6327263	4	15	-	-	-	3.61	1.83	2.73	0	-	-	

REPORT

Number	Grid East	Grid North	Cliff Height (m)	Slope (°)	Fissures			Cave/Overhang			Honeycombing area (m2)	Bat Scats	Bat Species/No.	Photograph
					Max width (m)	Max Depth (m)	Length (m)	Width (m)	Max Height (m)	Length (m)				
C44	351370	6327243	5	10	-	-	-	3.25	2.07	3.64	0.5	-	-	
C45	351419	6327147	1.8	10	-	-	-	2.31	1.25	2.97	0.2	Yes - small amount	-	
C46	351538	6327268	4.5	5	-	-	-	2.27	1.39	1.95	0	-	-	

REPORT

Number	Grid East	Grid North	Cliff Height (m)	Slope (°)	Fissures			Cave/Overhang			Honeycombing area (m2)	Bat Scats	Bat Species/No.	Photograph
					Max width (m)	Max Depth (m)	Length (m)	Width (m)	Max Height (m)	Length (m)				
C47	351536	6327294	4	5	-	-	-	4.15	2.61	3.79	0	-	-	
C56	351407.46	6327676.62	7	10	-	-	-	7.1	4.69	4.69	1.5	Yes	-	
C57	351455.94	6327536.73	-	-	-	-	-	-	-	-	-	Yes	-	NA

Appendix J

EPBC Act: Assessment of Significance

REPORT

Significant Impact Criteria for Endangered or Critically Endangered Species

Rhodamnia rubescens

Lead to a long-term decrease in the size of a population

Unlikely. *Rhodamnia rubescens* is relatively common throughout the local area, as indicated by frequent records in the local area (i.e. 163 ind. within 10 km search area, as per DPIE 2021a). Targeted surveys were undertaken by RPS across the Project Area using parallel transects to find 89 individuals within the Project Area. None of these were located within areas where ponding is predicted due to subsidence associated with MOD 10.

To date, annual monitoring of *R. rubescens* for extracted longwalls LW22-24a and LW25-29 has yet to detect impacts associated with ponding on this species. Further, annual monitoring of Groundwater Dependent Ecosystems for these extracted longwalls has yet to detect any more than negligible changes that may be associated with subsidence-related ponding, even within the valley flats where ponding impacts for Mandalong South Extension were predicted to be most extensive. Hence, even under a ponding scenario, the loss of *R. rubescens* due to mining activities by Mandalong Mine have yet to be detected.

Moreover, the key threat to this species which led to its conservation listing is related to Myrtle Rust infection, rather than land clearing. Hence, under the unlikely case that one individual were impacted by ponding (either directly or indirectly through incurring stress), this is not expected to translate to a long-term decrease of a population since a 96-99% decline is predicted for this species due to Myrtle Rust alone over the next 30-40 years (NSW TSSC 2018a).

To minimise and avoid impacts to biodiversity values (including *R. rubescens*), the following steps were also undertaken to reduce impacts associated with MOD 10:

- LW30 (as part of MOD 9) will no longer be extracted. The potential impacts on biodiversity associated with this longwall (including *R. rubescens* recorded in the vicinity) would be avoided;
- An original version of MOD 10 included the extension of LW30-33. By avoiding this extension, potential impacts to biodiversity in this area was avoided; and
- The original version of MOD 10 and addition of LW34 (MOD 10; Project) initially extended into Lot 502 DP730395. This land parcel was inaccessible for survey. To avoid uncertain impacts on biodiversity values on that property, LW34 was shortened to avoid potential impacts on this property.

As such, although it is considered possible that the Project may impact no individuals, this is not expected to lead to a long-term decrease in the size of a *R. rubescens* population given the lack of impact detected when monitoring this species in already extracted areas, limited predicted impact (i.e. no individuals impacted given the small extent of expected ponding), whilst a widespread loss of the species is expected solely due to disease.

Reduce the area of occupancy of the species

Unlikely. The area of occupancy (AOO) for *R. rubescens* is estimated to be 3,360 km² (NSW TSSC 2018a). *R. rubescens* is relatively common throughout Wet Sclerophyll Forest and Rainforest within the local area, as indicated by frequent records throughout Mandalong Valley (i.e. 163 ind. within 10 km search area, as per DPIE 2021a).

Given the expression of subsidence-related ponding has yet to be detected within annual monitoring of *R. rubescens* for extracted areas of LW22-24a and LW25-29, it is not expected that the ponding would directly impact the occupancy of *R. rubescens*. Hence, it is not predicted that the Project would reduce the area of occupancy of *R. rubescens*.

Fragment an existing population into two or more populations

Unlikely. Suitable habitat for this species is available throughout the local area, including the Mandalong valley. This is evidenced by relatively high frequency of and widely dispersed records throughout the local area (i.e. 163 ind. within 10 km search area, as per DPIE 2021a). Based on the availability of suitable habitat, and minor extent of

REPORT

Significant Impact Criteria for Endangered or Critically Endangered Species	<i>Rhodamnia rubescens</i>
Adversely affect habitat critical to the survival of a species	habitat that may be impacted by ponding (i.e. <0.001 ha), it is considered that the action is unlikely to fragment a population of this species.
Disrupt the breeding cycle of a population	Unlikely. Suitable habitat for this species is available throughout the local area, including the Mandalong valley. This is evidenced by a relatively high frequency of and widely dispersed records throughout the local area (i.e. 163 ind. within 10 km search area, as per DPIE 2021a). Based on the availability of suitable habitat, and minor extent of bushland that may be impacted by ponding (i.e. <0.001 ha), it is considered that the proposed action is unlikely to affect habitat critical to the survival of the species.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	Unlikely. The breeding success of this species is highly impacted by Myrtle Rust infection, with few viable seeds in the wild (Sommerville et al. 2019). Based on its' limited reproductive success, the extent of suitable habitat in the local area, and the relatively small extent of land to be impacted by ponding (i.e. <0.001 ha), it is considered unlikely that the ponding would disrupt the breeding cycle of a population.
Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	Unlikely. Suitable habitat for this species is available throughout the gullies of Mandalong Valley. Much of this suitable habitat in the local area is also located within the Olney State Forest, which is largely protected from harmful activities. As such, the relatively small area of potential habitat located within the inaccessible property does present habitat for the species. However, only a very minor extent (i.e. <0.001 ha) may be prone to increased ponding associated with mining. As more than negligible mining related impact (i.e. ponding) is yet to be detected for existing Mandalong mine workings on groundwater dependant threatened plants or ecosystems, any impact expressed by the action is expected to be negligible in the context of the habitat availability in the local area. As such, it is not expected that the action would modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Introduce disease that may cause the species to decline	Unlikely. The action is restricted to coal extraction only, with no surface works. Hence, it is not expected that the action would result in invasive species harmful to <i>R. rubescens</i> . The key threat to this species is Myrtle Rust. This pathogen is already widespread throughout the Mandalong Valley, and it is not expected that the ponding associated with the Project would increase the amplify the spread of the disease.
Interfere with the recovery of the species	Unlikely. This species is threatened by Myrtle Rust. All plant parts have been documented as being affected by Myrtle Rust infection, including leaves, stems, flowers and fruits. Across the range of the species, infection is widespread (i.e. disease was detected in all 43 sites surveyed across the species range of 18 sites by Carnegie et al 2016). Moreover, Myrtle Rust has been widely documented throughout the Mandalong Valley associated with <i>R. rubescens</i> (H. Beck, Pers. Obs. 2021). Hence, it is not expected that the action would introduce disease, as the primary threat to the species (i.e. Myrtle Rust) is already present.
Interfere with the recovery of the species	Unlikely. There is no recovery plan for the species under the EPBC Act. Currently, 13% of the species' distribution occurs on reserve, which does not encompass the Project Area (within NSW National Parks and Wildlife Service estate; DPIE 2021a). There are no priority management sites in or nearby to the Project Area. Hence, it is considered unlikely that the Project would interfere with the recovery of this species.

Appendix B Current VI Scores

REPORT

Note that data was collected electronically, so datasheets have not been appended. Please see summary of plot data and estimated future VI (following ponding impacts) as entered into BAM-C below. See Appendix A for species composition data for plots.

Table A1 BAM-C Input for Zone 1: PCT 1528 (Moderate)

Plot	Comp Tree	Comp Shrub	Comp Grass	Comp Forbs	Comp Ferns	Comp Other	Struc Tree	Struc Shrub	Struc Grass	Struc Forbs	Struc Ferns	Struc Other	Fun Large Trees	Fun Hollow trees	Fun Litter Cover	Fun Len Fallen Logs	Fun Tree Stem 5to9	Fun Tree Stem 10to19	Fun Tree Stem 20to29	Fun Tree Stem 30to49	Fun TreeStem 50 to79	Fun Tree Regen	Fun High Threat Exotic
LW34-3	4	12	3	7	9	12	26.2	55.1	0.4	1.1	23.1	27.2	0	0	48.2	25.0	1	1	1	1	0	1	0.0

Table A2 BAM-C Input for Zone 2: PCT 1556 (Moderate)

Plot	Comp Tree	Comp Shrub	Comp Grass	Comp Forbs	Comp Ferns	Comp Other	Struc Tree	Struc Shrub	Struc Grass	Struc Forbs	Struc Ferns	Struc Other	Fun Large Trees	Fun Hollow trees	Fun Litter Cover	Fun Len Fallen Logs	Fun Tree Stem 5to9	Fun Tree Stem 10to19	Fun Tree Stem 20to29	Fun Tree Stem 30to49	Fun TreeStem 50 to79	Fun Tree Regen	Fun High Threat Exotic
LW34-8	8	8	7	13	4	8	78.4	3.8	7.3	3.3	2.4	10.9	0	0	66.4	48.0	1	1	1	1	1	1	0.0
LW34-9	7	4	6	11	5	14	61.0	21.8	1.2	2.7	7.6	20.3	0	0	55.0	67.0	1	1	1	1	1	1	0.0
LW34-10	5	5	4	15	3	13	38.1	9.6	1.2	3.1	71.5	27.7	1	0	68.0	95.0	1	1	1	1	1	1	0.0
LW34-11	4	8	4	11	6	13	30.5	24.9	3.3	1.3	1.9	39.6	2	0	84.8	85.0	1	1	1	1	0	1	0.0
LW34-12	7	6	8	8	1	12	57.0	3.2	8.4	2.2	0.5	2.2	1	6	90.4	35.0	1	1	1	1	1	1	0.0

REPORT

Table A4 BAM-C Input for Zone 3: PCT 1568 (Moderate)

Plot	Comp Tree	Comp Shrub	Comp Grass	Comp Forbs	Comp Ferns	Comp Other	Struc Tree	Struc Shrub	Struc Grass	Struc Forbs	Struc Ferns	Struc Other	Fun Large Trees	Fun Hollow trees	Fun Litter Cover	Fun Len Fallen Logs	Fun Tree Stem 5to9	Fun Tree Stem 10to19	Fun Tree Stem 20to29	Fun Tree Stem 30to49	Fun TreeStem 50to79	Fun Tree Regen	Fun High Threat Exotic
LW34-6	5	3	4	5	3	11	65.1	15.3	1.4	0.7	0.8	14.2	0	0	72.6	23.0	1	1	1	1	0	1	0.0
LW34-13	7	4	4	5	4	10	63.2	35.4	0.8	1.3	2.3	11.0	1	0	88.8	31.0	1	1	1	1	1	1	0.0
PR144986 Plot 12	10	11	2	2	4	10	84.0	68.5	6.0	1.2	11.3	14.8	1	1	85.0	51.0	0	1	1	1	1	0	0.0
PR144986 Plot 19	10	15	6	9	12	17	44.8	69.8	0.8	1.0	17.2	3.8	0	0	74.0	75.0	1	1	1	1	1	1	0.2

Table A6 BAM-C Input for Zone 4: PCT 1573 (Moderate)

Plot	Comp Tree	Comp Shrub	Comp Grass	Comp Forbs	Comp Ferns	Comp Other	Struc Tree	Struc Shrub	Struc Grass	Struc Forbs	Struc Ferns	Struc Other	Fun Large Trees	Fun Hollow trees	Fun Litter Cover	Fun Len Fallen Logs	Fun Tree Stem 5to9	Fun Tree Stem 10to19	Fun Tree Stem 20to29	Fun Tree Stem 30to49	Fun TreeStem 50to79	Fun Tree Regen	Fun High Threat Exotic
LW34-7	5	10	1	1	7	11	45.5	33.8	0.2	0.1	7.6	75.4	1	0	80.4	80.0	1	1	1	1	1	1	0.0
PR144986 Plot 20	6	9	10	11	8	16	32.4	25.5	14.2	1.8	1.4	74.9	1	0	85.0	66.0	1	1	1	1	1	1	10.4

Table A8 BAM-C Input for Zone 5: PCT 1588 (Moderate)

Plot	Comp Tree	Comp Shrub	Comp Grass	Comp Forbs	Comp Ferns	Comp Other	Struc Tree	Struc Shrub	Struc Grass	Struc Forbs	Struc Ferns	Struc Other	Fun Large Trees	Fun Hollow trees	Fun Litter Cover	Fun Len Fallen Logs	Fun Tree Stem 5to9	Fun Tree Stem 10to19	Fun Tree Stem 20to29	Fun Tree Stem 30to49	Fun TreeStem 50to79	Fun Tree Regen	Fun High Threat Exotic
LW34-2	6	11	8	13	2	10	58.2	35.4	16.3	6.0	0.6	4.2	0	0	79.6	53.0	1	1	1	1	1	1	0.0
LW34-4	5	5	8	7	4	12	62.0	1.0	13.6	0.9	0.4	1.5	1	5	90.8	51.0	1	1	1	1	1	1	0.0
LW34-14	6	5	10	7	1	6	113.1	17.2	21.4	3.7	0.2	5.5	0	0	91.6	11.0	1	1	1	1	1	1	0.0

Table A9 BAM-C Input for Zone 6: Disturbed/ cleared land

Plot	Comp Tree	Comp Shrub	Comp Grass	Comp Forbs	Comp Ferns	Comp Other	Struc Tree	Struc Shrub	Struc Grass	Struc Forbs	Struc Ferns	Struc Other	Fun Large Trees	Fun Hollow trees	Fun Litter Cover	Fun Len Fallen Logs	Fun Tree Stem 5to9	Fun Tree Stem 10to19	Fun Tree Stem 20to29	Fun Tree Stem 30to49	Fun TreeStem 50to79	Fun Tree Regen	Fun High Threat Exotic
LW34-1	1	0	4	14	0	1	0.1	0.0	3.3	9.3	0.0	0.1	0	0	7.2	0.0	0	0	0	1	1	0	0.2
LW34-5	2	2	4	9	1	4	0.3	0.4	1.6	3.3	1.0	2.4	0	0	8.6	7.0	0	1	1	1	0	1	2.3

Appendix C

Biodiversity Credit Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00026541/BAAS19000/21/00026542	Centennial Mandalong SSD-5144 MOD 10	10/06/2021
Assessor Name	Report Created	BAM Data version *
Hayden John Beck	24/11/2021	45
Assessor Number	BAM Case Status	Date Finalised
BAAS19000	Finalised	18/11/2021
Assessment Revision	Assessment Type	
1	Major Projects	

* 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)	BC Act Listing status	EPBC Act listing status	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAI	Ecosystem credits
Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast											
2	1568_Zone 3_Moderate	Not a TEC	78.8	78.8	0.01			High Sensitivity to Potential Gain	1.50		1
										Subtotal	1

Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment										
3	1573_Zone 4_Moderate e_Good	Not a TEC	76.9	76.9	0.01			High Sensitivity to Potential Gain	1.50	1
									Subtotal	1
Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast										
1	1556_Zone 2_Moderate e	Not a TEC	78.2	78.2	0.01			High Sensitivity to Potential Gain	1.50	1
									Subtotal	1
									Total	3

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAI	Species credits	
<i>Callocephalon fimbriatum / Gang-gang Cockatoo (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Not Listed	2	False	1	
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed	2	False	0	
1573_Zone4_Mode rate_Good	36.4	36.4	0	Vulnerable	Not Listed	2	False	0	
								Subtotal	1
<i>Cercartetus nanus / Eastern Pygmy-possum (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Not Listed	2	False	1	

BAM Credit Summary Report

1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed	2	False	0
1573_Zone4_Mode rate_Good	36.4	36.4	0	Vulnerable	Not Listed	2	False	0
							Subtotal	1
<i>Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)</i>								
1556_Zone2_Mode rate	36.2	36.2	0	Vulnerable	Vulnerable	3	True	0
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Vulnerable	3	True	0
1573_Zone4_Mode rate_Good	36.4	36.4	0	Vulnerable	Vulnerable	3	True	0
							Subtotal	0
<i>Cryptostylis hunteriana / Leafless Tongue Orchid (Flora)</i>								
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Vulnerable	1.5	False	1
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Vulnerable	1.5	False	0
							Subtotal	1
<i>Haliaeetus leucogaster / White-bellied Sea-Eagle (Fauna)</i>								
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Not Listed	2	False	1
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed	2	False	0
							Subtotal	1

<i>Hoplocephalus bitorquatus / Pale-headed Snake (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Not Listed	2	False		1
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed	2	False		0
1573_Zone4_Mode rate_Good	36.4	36.4	0	Vulnerable	Not Listed	2	False		0
								Subtotal	1
<i>Hoplocephalus stephensii / Stephens' Banded Snake (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Not Listed	2	False		1
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed	2	False		0
1573_Zone4_Mode rate_Good	36.4	36.4	0	Vulnerable	Not Listed	2	False		0
								Subtotal	1
<i>Litoria brevipalmata / Green-thighed Frog (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Not Listed	1.5	False		1
								Subtotal	1
<i>Litoria littlejohni / Littlejohn's Tree Frog (Fauna)</i>									
1568_Zone3_Mode rate	36.0	36.0	0.01	Vulnerable	Vulnerable	2	False		1
								Subtotal	1

<i>Lophoictinia isura / Square-tailed Kite (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Not Listed	1.5	False		1
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed	1.5	False		0
								Subtotal	1
<i>Miniopterus australis / Little Bent-winged Bat (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0	Vulnerable	Not Listed	3	True		0
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed	3	True		0
1573_Zone4_Mode rate_Good	36.4	36.4	0	Vulnerable	Not Listed	3	True		0
								Subtotal	0
<i>Miniopterus orianae oceanensis / Large Bent-winged Bat (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0	Vulnerable	Not Listed	3	True		0
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed	3	True		0
1573_Zone4_Mode rate_Good	36.4	36.4	0	Vulnerable	Not Listed	3	True		0
								Subtotal	0
<i>Mixophyes balbus / Stuttering Frog (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0.01	Endangered	Vulnerable	3	True		1

BAM Credit Summary Report

1568_Zone3_Mode rate	36.0	36.0	0	Endangered	Vulnerable	3	True	0
1573_Zone4_Mode rate_Good	36.4	36.4	0	Endangered	Vulnerable	3	True	0
							Subtotal	1
<i>Mixophyes iteratus / Giant Barred Frog (Fauna)</i>								
1556_Zone2_Mode rate	36.2	36.2	0.01	Endangered	Endangered	2	False	1
1568_Zone3_Mode rate	36.0	36.0	0	Endangered	Endangered	2	False	0
1573_Zone4_Mode rate_Good	36.4	36.4	0	Endangered	Endangered	2	False	0
							Subtotal	1
<i>Myotis macropus / Southern Myotis (Fauna)</i>								
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Not Listed	2	False	1
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed	2	False	0
1573_Zone4_Mode rate_Good	36.4	36.4	0	Vulnerable	Not Listed	2	False	0
							Subtotal	1
<i>Ninox connivens / Barking Owl (Fauna)</i>								
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Not Listed	2	False	1
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed	2	False	0

								Subtotal	1
<i>Ninox strenua / Powerful Owl (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Not Listed		2	False	1
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed		2	False	0
								Subtotal	1
<i>Petaurus norfolcensis / Squirrel Glider (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Not Listed		2	False	1
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed		2	False	0
								Subtotal	1
<i>Phascogale tapoatafa / Brush-tailed Phascogale (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Not Listed		2	False	1
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed		2	False	0
								Subtotal	1
<i>Pteropus poliocephalus / Grey-headed Flying-fox (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Vulnerable		2	False	1
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Vulnerable		2	False	0
1573_Zone4_Mode rate_Good	36.4	36.4	0	Vulnerable	Vulnerable		2	False	0

								Subtotal	1
<i>Rhizanthella slateri / Eastern Australian Underground Orchid (Flora)</i>									
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Endangered	3	True		1
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Endangered	3	True		0
1573_Zone4_Mode rate_Good	36.4	36.4	0	Vulnerable	Endangered	3	True		0
								Subtotal	1
<i>Rhodamnia rubescens / Scrub Turpentine (Flora)</i>									
1556_Zone2_Mode rate	N/A	N/A	0	Critically Endangered	Not Listed	3	True		0
1568_Zone3_Mode rate	N/A	N/A	0	Critically Endangered	Not Listed	3	True		0
1573_Zone4_Mode rate_Good	N/A	N/A	0	Critically Endangered	Not Listed	3	True		0
								Subtotal	0
<i>Tetradlea juncea / Black-eyed Susan (Flora)</i>									
1568_Zone3_Mode rate	36.0	36.0	0.01	Vulnerable	Vulnerable	2	False		1
								Subtotal	1
<i>Tyto novaehollandiae / Masked Owl (Fauna)</i>									
1556_Zone2_Mode rate	36.2	36.2	0.01	Vulnerable	Not Listed	2	False		1
1568_Zone3_Mode rate	36.0	36.0	0	Vulnerable	Not Listed	2	False		0

								Subtotal	1
<i>Tyto tenebricosa / Sooty Owl (Fauna)</i>									
1568_Zone3_Mode rate	36.0	36.0	0.01	Vulnerable	Not Listed	3	True		1
								Subtotal	1

Appendix D Offset Trading Groups



BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00026541/BAAS19000/21/00026542	Centennial Mandalong SSD-5144 MOD 10	10/06/2021
Assessor Name	Assessor Number	BAM Data version *
Hayden John Beck	BAAS19000	45
Proponent Names	Report Created	BAM Case Status
	24/11/2021	Finalised
Assessment Revision	Assessment Type	Date Finalised
1	Major Projects	18/11/2021

* 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
Nil		
Species		
Chalinolobus dwyeri / Large-eared Pied Bat		
Miniopterus australis / Little Bent-winged Bat		
Miniopterus orianae oceanensis / Large Bent-winged Bat		



BAM Biodiversity Credit Report (Like for like)

Mixophyes balbus / Stuttering Frog

Tyto tenebricosa / Sooty Owl

Rhodamnia rubescens / Scrub Turpentine

Rhizanthella slateri / Eastern Australian Underground Orchid

Additional Information for Approval

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)



BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast	Not a TEC	0.0	1	0	1
1568-Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast	Not a TEC	0.0	1	0	1
1573-Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment	Not a TEC	0.0	0	1	1

1556-Tallowwood - Smooth-barked Apple - Blackbutt grass tall open forest of the Central and lower North Coast	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Northern Hinterland Wet Sclerophyll Forests This includes PCT's: 690, 697, 698, 755, 1092, 1262, 1267, 1268, 1281, 1385, 1548, 1549, 1550, 1556, 1557, 1558, 1564, 1565, 1580, 1582, 1584, 1585, 1845, 1846, 1847, 1914	Northern Hinterland Wet Sclerophyll Forests <50%	1556_Zone2_Moderate	Yes	1	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 (Like for like)

1568-Blackbutt - Turpentine - Sydney Blue Gum mesic tall open forest on ranges of the Central Coast	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	North Coast Wet Sclerophyll Forests This includes PCT's: 487, 613, 661, 684, 686, 692, 693, 694, 695, 699, 747, 748, 752, 812, 826, 827, 1073, 1208, 1217, 1222, 1237, 1244, 1245, 1257, 1259, 1260, 1261, 1265, 1266, 1282, 1284, 1285, 1504, 1561, 1562, 1563, 1566, 1567, 1568, 1569, 1572, 1573, 1575, 1579, 1841, 1843, 1915	North Coast Wet Sclerophyll Forests <50%	1568_Zone3_Moderate	Yes	1	Wyong, Hunter, Pittwater and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1573-Sydney Blue Gum - Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region

BAM Biodiversity Credit Report (Like for like)

	North Coast Wet Sclerophyll Forests This includes PCT's: 487, 613, 661, 684, 686, 692, 693, 694, 695, 699, 747, 748, 752, 812, 826, 827, 1073, 1208, 1217, 1222, 1237, 1244, 1245, 1257, 1259, 1260, 1261, 1265, 1266, 1282, 1284, 1285, 1504, 1561, 1562, 1563, 1566, 1567, 1568, 1569, 1572, 1573, 1575, 1579, 1841, 1843, 1915	North Coast Wet Sclerophyll Forests <50%	1573_Zone4_Moderate_Good	No	1 Wyong, Hunter, Pittwater and Yengo. 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
Callocephalon fimbriatum / Gang-gang Cockatoo	1556_Zone2_Moderate, 1568_Zone3_Moderate, 1573_Zone4_Moderate_Good	0.0	1.00

BAM Biodiversity Credit Report (Like for like)

Cercartetus nanus / Eastern Pygmy-possum	1556_Zone2_Moderate, 1568_Zone3_Moderate, 1573_Zone4_Moderate_Good	0.0	1.00
Chalinolobus dwyeri / Large-eared Pied Bat	1556_Zone2_Moderate, 1568_Zone3_Moderate, 1573_Zone4_Moderate_Good	0.0	0.00
Cryptostylis hunteriana / Leafless Tongue Orchid	1556_Zone2_Moderate, 1568_Zone3_Moderate	0.0	1.00
Haliaeetus leucogaster / White-bellied Sea-Eagle	1556_Zone2_Moderate, 1568_Zone3_Moderate	0.0	1.00
Hoplocephalus bitorquatus / Pale-headed Snake	1556_Zone2_Moderate, 1568_Zone3_Moderate, 1573_Zone4_Moderate_Good	0.0	1.00
Hoplocephalus stephensii / Stephens' Banded Snake	1556_Zone2_Moderate, 1568_Zone3_Moderate, 1573_Zone4_Moderate_Good	0.0	1.00
Litoria brevipalmata / Green-thighed Frog	1556_Zone2_Moderate	0.0	1.00
Litoria littlejohni / Littlejohn's Tree Frog	1568_Zone3_Moderate	0.0	1.00
Lophoictinia isura / Square-tailed Kite	1556_Zone2_Moderate, 1568_Zone3_Moderate	0.0	1.00
Miniopterus australis / Little Bent-winged Bat	1556_Zone2_Moderate, 1568_Zone3_Moderate, 1573_Zone4_Moderate_Good	0.0	0.00

BAM Biodiversity Credit Report (Like for like)

Miniopterus orianae oceanensis / Large Bent-winged Bat	1556_Zone2_Moderate, 1568_Zone3_Moderate, 1573_Zone4_Moderate_Good	0.0	0.00
Mixophyes balbus / Stuttering Frog	1556_Zone2_Moderate, 1568_Zone3_Moderate, 1573_Zone4_Moderate_Good	0.0	1.00
Mixophyes iteratus / Giant Barred Frog	1556_Zone2_Moderate, 1568_Zone3_Moderate, 1573_Zone4_Moderate_Good	0.0	1.00
Myotis macropus / Southern Myotis	1556_Zone2_Moderate, 1568_Zone3_Moderate, 1573_Zone4_Moderate_Good	0.0	1.00
Ninox connivens / Barking Owl	1556_Zone2_Moderate, 1568_Zone3_Moderate	0.0	1.00
Ninox strenua / Powerful Owl	1556_Zone2_Moderate, 1568_Zone3_Moderate	0.0	1.00
Petaurus norfolcensis / Squirrel Glider	1556_Zone2_Moderate, 1568_Zone3_Moderate	0.0	1.00
Phascogale tapoatafa / Brush-tailed Phascogale	1556_Zone2_Moderate, 1568_Zone3_Moderate	0.0	1.00
Pteropus poliocephalus / Grey-headed Flying-fox	1556_Zone2_Moderate, 1568_Zone3_Moderate, 1573_Zone4_Moderate_Good	0.0	1.00

BAM Biodiversity Credit Report (Like for like)

Rhizanthella slateri / Eastern Australian Underground Orchid	1556_Zone2_Moderate, 1568_Zone3_Moderate, 1573_Zone4_Moderate_Good	0.0	1.00
Rhodamnia rubescens / Scrub Turpentine	1556_Zone2_Moderate, 1568_Zone3_Moderate, 1573_Zone4_Moderate_Good	0.0	0.00
Tetradlea juncea / Black-eyed Susan	1568_Zone3_Moderate	0.0	1.00
Tyto novaehollandiae / Masked Owl	1556_Zone2_Moderate, 1568_Zone3_Moderate	0.0	1.00
Tyto tenebricosa / Sooty Owl	1568_Zone3_Moderate	0.0	1.00

Credit Retirement Options

Like-for-like credit retirement options

Callocephalon fimbriatum / Gang-gang Cockatoo	Spp	IBRA subregion
	Callocephalon fimbriatum / Gang-gang Cockatoo	Any in NSW
Cercartetus nanus / Eastern Pygmy-possum	Spp	IBRA subregion
	Cercartetus nanus / Eastern Pygmy-possum	Any in NSW
Chalinolobus dwyeri / Large-eared Pied Bat	Spp	IBRA subregion
	Chalinolobus dwyeri / Large-eared Pied Bat	Any in NSW

BAM Biodiversity Credit Report (Like for like)

Cryptostylis hunteriana / Leafless Tongue Orchid	Spp	IBRA subregion
	Cryptostylis hunteriana / Leafless Tongue Orchid	Any in NSW
Haliaeetus leucogaster / White-bellied Sea-Eagle	Spp	IBRA subregion
	Haliaeetus leucogaster / White-bellied Sea-Eagle	Any in NSW
Hoplocephalus bitorquatus / Pale-headed Snake	Spp	IBRA subregion
	Hoplocephalus bitorquatus / Pale-headed Snake	Any in NSW
Hoplocephalus stephensii / Stephens' Banded Snake	Spp	IBRA subregion
	Hoplocephalus stephensii / Stephens' Banded Snake	Any in NSW
Litoria brevipalmata / Green-thighed Frog	Spp	IBRA subregion
	Litoria brevipalmata / Green-thighed Frog	Any in NSW
Litoria littlejohni / Littlejohn's Tree Frog	Spp	IBRA subregion
	Litoria littlejohni / Littlejohn's Tree Frog	Any in NSW
Lophoictinia isura / Square-tailed Kite	Spp	IBRA subregion

BAM Biodiversity Credit Report (Like for like)

	Lophoictinia isura / Square-tailed Kite	Any in NSW
Miniopterus australis / Little Bent-winged Bat	Spp	IBRA subregion
	Miniopterus australis / Little Bent-winged Bat	Any in NSW
Miniopterus orianae oceanensis / Large Bent-winged Bat	Spp	IBRA subregion
	Miniopterus orianae oceanensis / Large Bent-winged Bat	Any in NSW
Mixophyes balbus / Stuttering Frog	Spp	IBRA subregion
	Mixophyes balbus / Stuttering Frog	Any in NSW
Mixophyes iteratus / Giant Barred Frog	Spp	IBRA subregion
	Mixophyes iteratus / Giant Barred Frog	Any in NSW
Myotis macropus / Southern Myotis	Spp	IBRA subregion
	Myotis macropus / Southern Myotis	Any in NSW
Ninox connivens / Barking Owl	Spp	IBRA subregion
	Ninox connivens / Barking Owl	Any in NSW

BAM Biodiversity Credit Report (Like for like)

Ninox strenua / Powerful Owl	Spp	IBRA subregion
	Ninox strenua / Powerful Owl	Any in NSW
Petaurus norfolcensis / Squirrel Glider	Spp	IBRA subregion
	Petaurus norfolcensis / Squirrel Glider	Any in NSW
Phascogale tapoatafa / Brush-tailed Phascogale	Spp	IBRA subregion
	Phascogale tapoatafa / Brush-tailed Phascogale	Any in NSW
Pteropus poliocephalus / Grey-headed Flying-fox	Spp	IBRA subregion
	Pteropus poliocephalus / Grey-headed Flying-fox	Any in NSW
Rhizanthella slateri / Eastern Australian Underground Orchid	Spp	IBRA subregion
	Rhizanthella slateri / Eastern Australian Underground Orchid	Any in NSW
Rhodamnia rubescens / Scrub Turpentine	Spp	IBRA subregion
	Rhodamnia rubescens / Scrub Turpentine	Any in NSW
Tetradlea juncea / Black-eyed Susan	Spp	IBRA subregion

BAM Biodiversity Credit Report (Like for like)

	Tetratheca juncea / Black-eyed Susan	Any in NSW
Tyto novaehollandiae / Masked Owl	Spp	IBRA subregion
	Tyto novaehollandiae / Masked Owl	Any in NSW
Tyto tenebricosa / Sooty Owl	Spp	IBRA subregion
	Tyto tenebricosa / Sooty Owl	Any in NSW

Appendix E

BCD Correspondence

Hayden Beck

From: Denise Wallace <Denise.Wallace@environment.nsw.gov.au> on behalf of OEH ROD BAM Support Mailbox <bam.support@environment.nsw.gov.au>
Sent: Monday, 9 August 2021 5:18 PM
To: Hayden Beck
Subject: BSM-3443 Your form "Biodiversity Offsets Scheme enquiry form" got a response

CAUTION: This email originated from outside of RPS.

Hayden

Thank you for contacting the BAM Support Team. Your reference number is BSM-3443. Your enquiry has been forwarded to a subject matter expert for attention.

Subject Matter Expert

Please respond to the bam.support@environment.nsw.gov.au mailbox

Kind regards
The BAM Support Team

-----Original Message-----

From: Response Report <report@formassembly.com>
Sent: Monday, 9 August 2021 3:00 PM
To: OEH ROD BAM Support Mailbox <bam.support@environment.nsw.gov.au>
Subject: Your form "Biodiversity Offsets Scheme enquiry form" got a response

Your form "Biodiversity Offsets Scheme enquiry form" has received the following response:

Submitted on: 08/09/2021 03:00:18 PM
Completion time: 41 sec.

Biodiversity Offsets Scheme enquiry form Q. Your enquiry related to:
R. Accredited Assessors

Q. What would you like to ask about
R. Biodiversity Assessment Method Support (including BAM-C/BOAMS)

Q. Tell us more:
R. Good afternoon,

I am currently preparing a BDAR for an underground mine (SSD MOD) and assessing the matter of subsidence. I am in need of some support about inputting data into BAM-C and applicability of the BOS if a negligible impact on native vegetation and or habitat is expected.

On a project I am working on there is a potential subtle increase in ponding of surface water, which may have a very minor impact upon native vegetation (i.e. <0.001 ha). No native vegetation associated with the MOD will be cleared.

The modelled impact is an increase in ponding of <0.001 ha, which is split across three PCTs. Within the BAM-C, when these areas are entered it comes up automatically as zero due to their small size (i.e. it does not recognise these very low values). What is the correct way forward in this case? Is it to: 1. Round-up to 0.01 ha (the minimum value recognised in BAM-C) or 2. accept the value assigned (which is 0)? If the later, would this mean that an offset may not be applicable?

Also, should I: 1. add all zones, even though no impact on them is expected? Or 2. only enter the zones where impacts are expected? If the later, I note that BAM-C does not allow for a zero Area Value when calculating Vegetation Integrity Scores.

More broadly, are BDARs still required for SSD MODs for underground mining projects where no impacts on native vegetation/habitat are expected? For example, first workings can lead to <100mm subsidence, and have negligible impacts on ground/surface water and or impacts to rock habitat features (i.e. cliffs, crevices, caves etc). Would the requirement still be a BDAR but with no offset?

Your timely advice on this matter would be much appreciated.

Warm regards,

Hayden

Your details

Q. First name:

R. Hayden

Q. Surname:

R. Beck

Q. Email:

R. hayden.beck@rpsgroup.com.au

Q. Phone:

R. 0421440518

This email is intended for the addressee(s) named and may contain confidential and/or privileged information.

If you are not the intended recipient, please notify the sender and then delete it immediately.

Any views expressed in this email are those of the individual sender except where the sender expressly and with authority states them to be the views of the NSW Office of Environment, Energy and Science.

PLEASE CONSIDER THE ENVIRONMENT BEFORE PRINTING THIS EMAIL