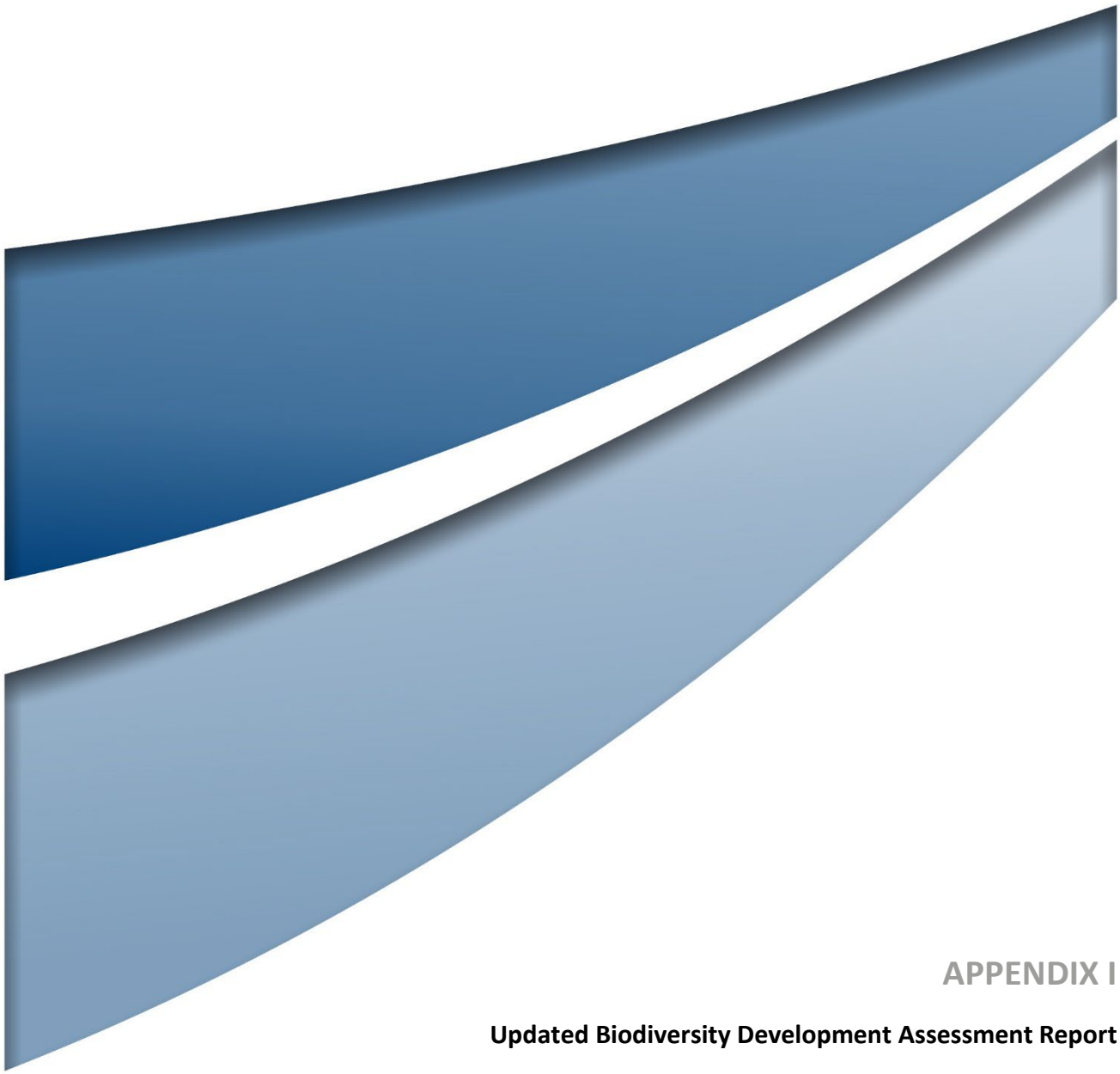


APPENDIX I

Updated Biodiversity Development Assessment Report

umwelt
Environmental & Social Consultants

AUSTRALIAN RESOURCE DEVELOPMENT GROUP

STONE RIDGE QUARRY

Biodiversity Development Assessment Report

FINAL

March 2024

AUSTRALIAN RESOURCE DEVELOPMENT GROUP

STONE RIDGE QUARRY

Biodiversity Development Assessment Report

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Australian Resource Development Group

Project Director:	David Holmes
Project Manager:	Penelope Williams
Technical Director:	Kate Connolly
Technical Manager:	Jacob Manners
Report No.	4158/R08
Date:	March 2024

umwelt
Environmental & Social Consultants

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Disclaimer

This document has been prepared for the sole use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that for which it was supplied by Umwelt (Australia) Pty Ltd (Umwelt). No other party should rely on this document without the prior written consent of Umwelt.

Umwelt undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. Umwelt assumes no liability to a third party for any inaccuracies in or omissions to that information. Where this document indicates that information has been provided by third parties, Umwelt has made no independent verification of this information except as expressly stated.

©Umwelt (Australia) Pty Ltd

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V1	Kate Connolly	30 May 2023	David Holmes	30 May 2023
V2	Kate Connolly	19 March 2024	David Holmes	19 March 2024

Executive Summary

Australian Resource Development Group (ARDG) (the Proponent) engaged Umwelt to prepare this Biodiversity Development Assessment Report (BDAR) for the proposed Stone Ridge Quarry located at Balickera, NSW (the project).

The Project is a State Significant Development (SSD-10432) under the *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP) as it is development that extracts more than 500,000 tpa of extractive material and also extracts from a resource of more than 5 million tonnes. A development application (DA) for the Project is required to be submitted under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Project Area is located on land managed by Forestry Corporation of New South Wales (FCNSW) and ARDG holds a Deed of Agreement (Deed) in relation to the Project Area for a Forest Materials Licence (FML) with FCNSW under section 42 of the *Forestry Act 2012* (Forestry Act).

This Biodiversity Development Assessment Report (BDAR) has been prepared to assess the potential impacts of the revised Project in accordance with the Biodiversity Assessment Method (BAM) (DPIE 2020a) and Section 6.12 of the NSW *Biodiversity Conservation Act 2016* (BC Act) and generally follows the Department of Planning and Environment (DPE) template for a BDAR.

An exhibited version of this Biodiversity Development Assessment Report (BDAR) was prepared by Umwelt (2023) and submitted as part of the EIS documentation for the Project. The BDAR (Umwelt 2023) was publicly exhibited and reviewed by Government agencies, including the Biodiversity Conservation Division (BCD), with detailed comments provided by BCD during July 2023. In response the comments received the Proponent has further altered the development footprint to reduce the biodiversity impacts associated with the Project. This BDAR has been prepared as part of the Response to Submissions documentation to assess the revised development footprint and provide additional information in relation to the comments received.

The surveys and assessments resulted in the identification of the following Plant Community Types (PCTs) which will be impacted by the project:

- PCT 762 Cabbage Gum open forest or woodland on flats of the North Coast (0.33 ha)
- PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest (39.27 ha)
- PCT 1618 Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast (0.88 ha)
- PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands (27.54 ha).

The completion of surveys and assessments has identified habitat within the development footprint for the following threatened entities listed within the NSW *Biodiversity Conservation Act 2016* (BC Act) and/or the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act):

- Squirrel Glider (*Petaurus norfolcensis*)
- Brush-tailed Phascogale (*Phascogale tapoatafa*)
- Koala (*Phascolarctos cinereus*)
- South-eastern Glossy Black-Cockatoo (*Calyptorhynchus lathami lathami*)
- Varied Sitella (*Daphoenositta chrysoptera*)
- Little Lorikeet (*Glossopsitta pusilla*)
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*)
- Little Bent-winged Bat (*Miniopterus australis*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions endangered ecological community as listed under the BC Act
- Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions endangered ecological community as listed under the EPBC Act.

The following key impact avoidance and mitigation measures have been identified for the project:

- Reduction of the Disturbance Area over multiple iterations to reduce the disturbance area footprint, including further substantial reduction through removal of the northern pit area as part of the current revised Project development footprint.
- Avoidance of the north-western section of the Subject land, which contains areas occupied by the Rusty Greenhood (*Pterostylis chaetophora*) and a habitat which potentially facilitates wildlife movement to the west.
- Avoidance of impacts to PCT 1716, which corresponds to the Subtropical Coastal Floodplain Forest endangered ecological community listed under the BC Act and Subtropical eucalypt floodplain forest and woodland listed under the EPBC Act.
- Alignment of the site access to the existing access track from Italia Road, to minimise impacts to the PCT 762 Cabbage Gum open forest or woodland on flats of the North Coast.

Following the application of avoidance and mitigation measures, the following biodiversity credits are required to offset the impacts of the project:

Entity	Credits Required
PCT 762 Cabbage Gum open forest or woodland on flats of the North Coast	13
PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	1092
PCT 1618 Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	34
PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	763
Squirrel Glider (*Petaurus norfolcensis*)	2519
Brush-tailed Phascogale (*Phascogale tapoatafa*)	2519
Koala (*Phascolarctos cinereus*)	2519

The biodiversity offset strategy for the project is being developed in consultation with the NSW Department of Planning Housing and Infrastructure (DPHI) (formerly the Department of Planning and Environment (DPE) and the Biodiversity Conservation Division (BCD) of the Department of Climate Change, Energy, the Environment and Water (DCCEEW) and will be based on the offset options available under the BC Act, Including:

- Land based offsets (potentially within the Wallaroo State Forest).
- Purchasing of credits from the market. And/or
- Payment into the Biodiversity Conservation Fund.

Declarations

i. Certification under clause 6.15 *Biodiversity Conservation Act 2016*

I certify that this report has been prepared by Umwelt (Australia) and to the best of my knowledge is based on the requirements of, and information provided under the Biodiversity Assessment Method (2020) and clause 6.12 of the *Biodiversity Conservation Act 2016* (BC Act).

Name: Jacob Manners

Signature: 

Date: 21 March 2024

BAM Assessor Accreditation no: BAAS17099

Project Team

Name	Experience / Qualifications	Years of Industry Experience	BAM Accreditation Number	Contribution to the project
Kate Connolly	BEnvScMgt	>16	BAAS17005	Biodiversity Assessment Project Director / BAM Plot Surveys / Threatened flora surveys
Jacob Manners	GCert ArbCult, BSc, MWldMgt	>16	BAAS17099	Biodiversity Assessment Project Manager / Accredited assessor / BAM plot surveys / plant community mapping / microbat call analysis
Phillipa Fagan	BBioCon, MenvBusMgt	15	BAAS18117	BAM plot surveys / plant community mapping / threatened flora and fauna surveys
Patricia Robinson	BEnvSc	13	BAAS18123	Threatened flora surveys / BAM Plot Surveys
Belinda Howe	BEnvScMgt	7	BAAS21019	Threatened flora and fauna surveys
Rhys Osborne	BBioSc, BEnvScMgt	9	BAAS20026	Threatened flora and fauna surveys
William Brown	BEnvScMgt	6	-	Threatened flora and fauna surveys
Amber Wilson	BEnvScMgt	7	-	Threatened flora and fauna surveys
Brayden Luke	BSc	5	-	Threatened flora and fauna surveys
Alex Cottle	BEnvScMgt	3	-	Report preparation / Threatened flora and fauna surveys
Tim Cusack	BEnvSC, BZool	1		Report preparation
Dayna Mitchell	BEnvScMgt	3	-	Threatened flora and fauna surveys
Logan Shea	BEnvScMgt	2	-	Threatened flora and fauna surveys
Stewart Jefferys	BSc	27	-	GIS Mapping
Kate Faber	BEnvScMgt	6	-	Threatened flora surveys

Abbreviations

AHD	Australian Height Datum
ARDG	Australian Resource Development Group
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method Calculator
BC Act	*Biodiversity Conservation Act 2016* (NSW)
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Report
BOAMS	Biodiversity Offsets and Agreement Management System
BOS	Biodiversity Offsets Scheme
CEEC	critically endangered ecological community
Development Footprint	The area of land that is directly impacted by a proposed development, the disturbance footprint.
Development Site	An area of land that is subject to a proposed development under the EP&A Act, including areas which will be retained and impacted by the project (synonymous with Subject Land and Project Area).
DBH	diameter at breast height over bark
EC	ecological community listed under the EPBC Act
EIS	Environmental Impact Statement
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
EEC	endangered ecological community
GIA	Groundwater Impact Assessment
HTW	high threat weed
IBRA	Interim Biogeographic Regionalisation for Australia
LLS Act	*Local Land Services Act 2013* (NSW)
MNES	matters of national environmental significance
NPW Act	*National Parks and Wildlife Act 1974* (NSW)
NSW	New South Wales
PCT	plant community type
SAII	serious and irreversible impact
SEARs	Secretary's Environmental Assessment Requirements
SSD	State Significant Development

Subject Land	The land subject to the development application (synonymous with development site). The development footprint/disturbance footprint is located within the Subject Land area.
SWIA	Surface Water Impact Assessment
TBDC	Threatened Biodiversity Data Collection
TEC	threatened ecological community
The Project	The proposed Stone Ridge Quarry
VEC	vulnerable ecological community

Table of Contents

Executive Summary i

Declarations iv

Project Team v

Abbreviations vi

1.0 Introduction 1

1.1 Background Information 1

1.2 Proposed Development 1

1.2.1 Development Overview 1

1.2.2 Location and Subject Land Description 2

1.2.3 Proposed Development Description 2

1.2.4 Other Documentation 3

1.3 Biodiversity Offsets Scheme Entry 7

1.4 Excluded impacts / Category 1 Land 7

1.5 Matters of National Environmental Significance 7

1.6 Information Sources 8

2.0 Methods 10

2.1 Site Context Methods 10

2.1.1 Landscape Features 10

2.2 Native Vegetation, Threatened Ecological Communities and Vegetation Integrity Methods 11

2.2.1 Existing Information 11

2.2.2 Mapping Native Vegetation Extent, Plant Community Types and Vegetation Condition Zones 11

2.2.3 Plot-Based Floristic and Vegetation Integrity Survey 12

2.3 Threatened Flora Survey Methods 16

2.3.1 Review of Existing Information & Survey Guidelines 16

2.3.2 BioNet Atlas Threatened Flora Records 16

2.3.3 Habitat Constraints Assessment 18

2.3.4 Threatened Flora Field Surveys 18

2.4 Threatened Fauna Survey Methods 25

2.4.1 Review of Existing Information & Survey Guidelines 25

2.4.2 BioNet Atlas Threatened Fauna Records 25

2.4.3 Habitat Constraints Assessment 29

2.4.4 Field Surveys 29
2.5 Threatened Fungi 43
2.6 Weather Conditions 43
2.7 Limitations 43
3.0 Site Context 44
3.1 Assessment Area and Type 44
3.2 Landscape Features 44
3.2.1 IBRA Bioregions and IBRA Subregions 44
3.2.2 Rivers, Streams, Estuaries and Wetlands 44
3.2.3 Habitat Connectivity 46
3.2.4 Karst, Caves, Crevices, Cliffs, Rocks or Other Geological Features of Significance 49
3.2.5 Areas of Outstanding Biodiversity Value 49
3.2.6 NSW (Mitchell) Landscapes 49
3.2.7 Additional Landscape Features Identified in the SEARS 49
3.3 Native Vegetation Cover 49
4.0 Native Vegetation, Threatened Ecological Communities and Vegetation Integrity 50
4.1 Native Vegetation Extent 50
4.1.1 Changes to the Mapped Native Vegetation Extent 50
4.1.2 Areas that are not Native Vegetation 50
4.2 Plant Community Types 52
4.2.1 Overview of Plant Community Types Present 52
4.2.2 Detailed Descriptions and Justification for Plant Community Types Present 55
4.3 Threatened Ecological Communities 69
4.3.1 Threatened Ecological Community Summary 69
4.3.2 Biodiversity Conservation Act Threatened Ecological Communities 72
4.3.3 Environment Protection and Biodiversity Conservation Act Threatened Ecological Communities 72
4.4 Plant Community Type Condition Zones 73
4.5 Vegetation Integrity (Vegetation Condition) 75
4.5.1 Vegetation Integrity Survey Plots 75
4.5.2 Vegetation Integrity Scores 75
4.5.3 Use of Benchmark Data 75
4.6 Groundwater Dependant Ecosystems 75
5.0 Habitat Suitability for Threatened Species 78
5.1 Identification of Threatened Species for Assessment 78

5.1.1 Ecosystem Credit Species 78
5.1.2 Species Credit Species 84
5.2 Presence Determination for Candidate Species Credit Species 94
5.2.1 Threatened Flora Species 94
5.2.2 Threatened Fauna Species 98
5.3 Threatened Species Surveys 107
5.3.1 Candidate Threatened Flora Species Surveys 107
5.3.2 Candidate Threatened Fauna Species Surveys 111
5.3.3 Expert Reports and Use of More Appropriate Local Data 129
5.3.4 Suitable Habitat for BC Act Listed Species Credit Entities Observed for which Impacts have been Avoided 129
5.3.5 Suitable Habitat for BC Act Listed Species Credit Entities Impacted 134
5.3.6 Results for BC Act Listed Ecosystem Credit Species 140
5.3.7 Results for EPBC Act Listed Species 142
6.0 Identifying Prescribed Impacts 145
6.1 Prescribed Impact Assessment 145
7.0 Avoid and Minimise Impacts 151
7.1 Avoid and Minimise Direct and Indirect Impacts 151
7.1.1 Project Location 151
7.1.2 Project Design and Planning 154
7.2 Avoid and Minimise Prescribed Impacts 157
7.2.1 Project Location 158
7.2.2 Project Design 159
7.3 Other Measures Considered 159
7.3.1 Do Nothing Option 159
7.4 Summary of Measures to Avoid and Minimise Impacts 159
8.0 Impact Assessment 161
8.1 Direct Impacts 161
8.1.1 Residual Direct Impacts 161
8.1.2 Change in Vegetation Integrity Score 163
8.2 Indirect Impacts 165
8.3 Prescribed Impacts 169
8.3.1 Karst, Caves, Crevices, Cliffs, Rocks or Other Geological Features of Significance 169
8.3.2 Human Made Structures 169
8.3.3 Non-Native Vegetation 170
8.3.4 Excluded Areas – Category 1 Land 170

8.3.5 Habitat Connectivity 170
8.3.6 Waterbodies, Water Quality and Hydrological Processes 171
8.3.7 Groundwater Dependant Ecosystems 172
8.3.8 Vehicle Strikes 173
8.3.9 Prescribed Impact Data Limitations, Predictions and Assumptions 174
8.4 Mitigating Residual Impacts – Management Measures and Implementation 174
8.4.1 Workforce Education and Training 174
8.4.2 Implementation of Vegetation Protection Zones for Areas to be Retained 174
8.4.3 Ecologist Pre-Clearance Surveys and Supervision of Works 175
8.4.4 Erosion and Sedimentation Control 175
8.4.5 Weed Management 176
8.4.6 Preparation and Implement of Construction Environmental Management Plan 176
8.5 Adaptive Management Strategy for Uncertain Impacts (Where Relevant) 180
8.6 Other Relevant Biodiversity Impact Assessment Legislation 182
8.6.1 Environment Protection and Biodiversity Conservation Act 182
8.6.2 State Environmental Planning Policy (Biodiversity and Conservation 2021) Chapter 3 Koala Habitat Protection 183
9.0 Serious and Irreversible Impacts 185
9.1 Assessment for Serious and Irreversible Impacts on Biodiversity Values 185
10.0 Impact Summary 186
10.1 Determining an Offset Requirement for Impacts 186
10.1.1 Impacts on Native Vegetation and TECs (Ecosystem Credits) 186
10.1.2 Impacts on Threatened Species and Their Habitat (Species Credits) 187
10.1.3 Indirect and Prescribed Impacts 187
10.2 Impacts that Do Not Need Further Assessment 187
11.0 Biodiversity Credit Obligations 188
11.1 Ecosystem Credits 188
11.2 Species Credits 193
11.3 Biodiversity Offset Strategy 193
12.0 References 197

Figures

Figure 1.1	Site Map	4
Figure 1.2	Location Map	5
Figure 1.3	Development Footprint	6
Figure 1.4	Biodiversity Values Map	9
Figure 2.1	Field Survey Locations – BAM Plot Locations	15
Figure 2.2	Threatened Flora Survey Locations	21
Figure 2.3	Threatened Fauna Survey Locations	42
Figure 3.1	Rivers, Streams, Estuaries and Wetlands Downstream of the Subject Land	45
Figure 3.2	Regional Habitat Connectivity	47
Figure 3.3	Local Habitat Connectivity	48
Figure 4.1	Native Vegetation Extent	51
Figure 4.2	Plant Community Types and Vegetation Zones	54
Figure 4.3	Threatened Ecological Community Locations	71
Figure 4.4	Probable Vegetation Groundwater Ecosystems Mapped by Probability Class	76
Figure 5.1	Observation Locations and Areas of Suitable Habitat for Rusty Greenhood (*Pterostylis chaetophora*)	131
Figure 5.2	Observation Locations and Areas of Suitable Habitat for the Southern Myotis (*Myotis macropus*)	133
Figure 5.3	Squirrel Glider Species Polygon	135
Figure 5.4	Brush-tailed Phascogale Species Polygon	137
Figure 5.5	Koala Species Polygon	139
Figure 5.6	Ecosystem Credit Species Observation Locations	141
Figure 6.1	Prescribed Impact Features	150
Figure 7.1	Impact Avoidance and Minimisation Areas	153
Figure 8.1	Final Impact Areas on the Subject Land	162
Figure 11.1	Vegetation Removal and Overburden Stripping Stages	195

Photos

Photo 5.1	Rusty Greenhood within area to be Retained	96
Photo 5.2	Chewed *Allocasuarina torulosa* seed cones	102
Photo 5.3	Camera Trap Image of Squirrel Glider	104
Photo 5.4	Camera trap image of Brush-tailed Phascogale	105
Photo 5.5	Camera trap image of koala	106

Tables

Table 2.1	Landscape Features Assessed and Data Sources	10
Table 2.2	Plant Community Type Survey Plot Stratification details	14
Table 2.3	BioNet Atlas Threatened Flora Records within 5 km	17
Table 2.4	Candidate Threatened Flora Species Targeted and Field Survey Methods Used	19
Table 2.5	BioNet Atlas Threatened Fauna Records within 5 km	26
Table 2.6	Details of diurnal threatened fauna surveys completed	30
Table 2.7	Details of nocturnal threatened fauna surveys completed	34
Table 2.8	Details of Remote Detection Threatened Fauna Surveys Completed	37
Table 2.9	Previous targeted microbat surveys in Balickera Tunnel and locality	38
Table 2.10	Targeted threatened fauna which utilise tree hollows and their tree hollow requirements	40
Table 2.11	Hollow bearing tree survey results	41
Table 3.1	Native Vegetation Cover in the 1500 m Buffer Assessment Area	49
Table 4.1	Plant Community Types Identified within the Project Area	53
Table 4.2	PCT 762 Sheltered Moderate to Good Condition Zone	55
Table 4.3	PCT 1590 Moderate to Good Condition Zone	57
Table 4.4	PCT 1618 Moderate to Good Condition	61
Table 4.5	PCT 1619 Moderate to Good Condition – Apple Variant	63
Table 4.6	PCT 1619 Moderate to Good Condition Apple-Ironbark Variant	65
Table 4.7	PCT 1716 Exposed Regenerating Condition Zone	67
Table 4.8	Summary of TECs within the Development Footprint	70
Table 4.9	PCT Condition Zones and Patch Sizes	74
Table 4.10	Vegetation Integrity Condition Scores	75
Table 5.1	Predicted Ecosystem Credit Species	79
Table 5.2	Predicted Flora Species Credit Species	84
Table 5.3	Predicted Threatened Fauna Species Credit Species	87
Table 5.4	Determining the Presence of Candidate Threatened Flora Species Credit Species within the Development Footprint	94
Table 5.5	Summary of Candidate Fauna Species Observed within the Development Footprint	99
Table 5.6	Summary of Targeted Surveys Completed for Candidate Threatened Flora Species	107
Table 5.7	Summary of targeted surveys completed for candidate threatened fauna species	111
Table 5.8	Rusty Greenhood Species Observation Details	129
Table 5.9	Southern Myotis Species Observation Details	132
Table 5.10	Squirrel Glider Species Polygon Details	134
Table 5.11	Brush-Tailed Phascogale Species Polygon Details	136
Table 5.12	Koala Species Polygon Details	138
Table 5.13	Results for EPBC Act Listed Species Observed	142
Table 5.14	EPBC Act Listed Threatened Species Predicted to Occur and Offset with Ecosystem Credits	143
Table 6.1	Prescribed Impacts Identified	146
Table 7.1	Extent of Impact Avoidance Achieved for PCTs and Species Credit Entities	155
Table 7.2	Avoidance and Minimisation Measures for Direct, Indirect and Prescribed Impacts	160
Table 8.1	Summary of Residual Direct impacts	161
Table 8.2	Impacts to Vegetation Integrity	164

Table 8.3 Summary of Residual Indirect Impacts 166
Table 8.4 Summary of Proposed Mitigation and Management Measures for Residual Impacts (Direct, Indirect, and Prescribed) 177
Table 8.5 Implementation Details for Proposed Impact Mitigation and Management Measures 178
Table 8.6 Adaptive Management Strategy Details for Uncertain Impacts 181
Table 8.7 MNES Assessment Conclusions and Offsetting Summary 182
Table 10.1 Impacts that Require an Offset – Ecosystem credits 186
Table 10.2 Impacts that Require an Offset – Species Credits 187
Table 11.1 Ecosystem Credit Class and Matching Credit Profiles 189
Table 11.2 Species Credit Class and Matching Credit Profiles 193
Table 11.3 Proposed Staged Credit Retirement Details 196

Appendices

Appendix A BDAR Requirements Compliance
Appendix B EPBC Act Matters of National Environmental Significance Report
Appendix C Threatened Ecological Community Analysis
Appendix D Plot Data
Appendix E Royal Botanic Gardens Sydney Plant Identification Advice
Appendix F Biodiversity Credit Reports

1.0 Introduction

1.1 Background Information

Australian Resource Development Group (ARDG) (the Proponent) engaged Umwelt to prepare this revised Biodiversity Development Assessment Report (BDAR) for a new hard rock quarry, known as Stone Ridge Quarry (the Project). The Project is located within the Wallaroo State Forest at Balickera, NSW. The Subject Land is within the Local Government Area of Port Stephens and is located approximately 30 km north of Newcastle.

This Report provides an assessment of the biodiversity values of the Subject Land, documents the application of the avoid, minimise and offset framework and assesses the likely biodiversity impacts of the Project.

This BDAR has been prepared to assess the potential impacts of the Project in accordance with the *Biodiversity Conservation Act 2016* (NSW) (BC Act), the Biodiversity Assessment Method (BAM) (DPIE 2020a) and the Secretary's Environmental Assessment Requirements (SEARs) in relation to Biodiversity. The Project is State significant development (SSD) under Division 4.7 of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and the development application for the Project is therefore required to be accompanied by a BDAR in accordance with Section 7.9 of the BC Act.

An exhibited version of this BDAR was prepared by Umwelt (2023) and submitted as part of the EIS documentation for the Project. The BDAR (Umwelt 2023) was publicly exhibited and reviewed by Government agencies, including BCD and Port Stephens Council, with detailed comments provided in 2023. In response to the comments received for the Project, the Proponent has further altered the development footprint to reduce the biodiversity impacts associated with the Project by removing the north pit. This BDAR has been prepared as part of the Response to Submissions documentation to assess the revised development footprint and provide additional information in relation to the comments received.

As discussed further in **Section 1.5**, the Project requires approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act). The BAM has been endorsed as the assessment method for Matters of National Environmental Significance under a Bilateral Agreement made under the EPBC Act. The Australian Government is the decision-maker for whether the Project will be approved under the EPBC Act.

A summary of the SEARs and BAM biodiversity assessment requirements and compliance is provided in **Appendix A**.

1.2 Proposed Development

1.2.1 Development Overview

The Project is seeking to access a high quality, hard rock resource suitable for producing a wide range of quarry products, particularly for the Lower Hunter, Central Coast and northern Sydney construction materials markets.

The Project is State significant development (SSD) and requires development consent under Part 4 of the EP&A Act.

1.2.2 Location and Subject Land Description

Wallaroo State Forest comprises three separate areas of land that have a combined area in excess of 3,600 ha. The Development Footprint (68.02 ha) is located within a Licence Area (391 ha) inside the boundaries of the western part of Wallaroo State Forest. The central part of the site referred to in this report as 'Stone Ridge' (previously informally referred to as 'Hamburger Hill') is a rocky volcanic ridge that trends northeast-southwest and has been the focus of the resource assessment investigations undertaken by the Proponent. The boundary of the Subject Land is shown on the Site Map provided as **Figure 1.1** and the Location Map, provided as **Figure 1.2**. Operational and constructions works will be undertaken wholly within the Disturbance Area (development footprint) mapped.

Stone Ridge is the main topographic feature within the Subject Land. It comprises two rocky hills separated by a low saddle. The hill at the southwest end of the ridge has a maximum elevation of 107.5 m AHD (Australian Height Datum), whereas the hill to the northeast has a maximum elevation of 83 m AHD. More gently undulating topography to the northwest and southeast of the subject land is associated with more weathered volcano-sedimentary geology that typically ranges in elevation from 20–60 m AHD. A prominent broad low ridge ('South Ridge') extends from the central south-eastern flank of Stone Ridge, approximately 1600 m southeast to the Pacific Highway. This ridge has a maximum elevation of approximately 62 m AHD.

The Subject Land supports ephemeral tributaries of Caswells Creek and Nine Mile Creek. The northern part of the Subject Land contains first and second order tributaries of Caswells Creek, which flows to an area historically diverted from Mosman Swamp (part of the Williams River catchment) to Grahamstown Dam via the Balickera Canal. The south-eastern part of the Subject Land contains first and second order tributaries of Nine Mile Creek, which flows directly to the Grahamstown Dam. The Grahamstown Dam overflows to the Williams River just upstream of the confluence with the Hunter River.

The Subject Land is predominantly located on Eagleton Volcanics of the Gilmore Volcanic Group Rock Unit, with a band of Mount Johnstone Formation conglomerate along the southern boundary. The area of the Eagleton Volcanics is of particular interest for quarrying of hard rock material.

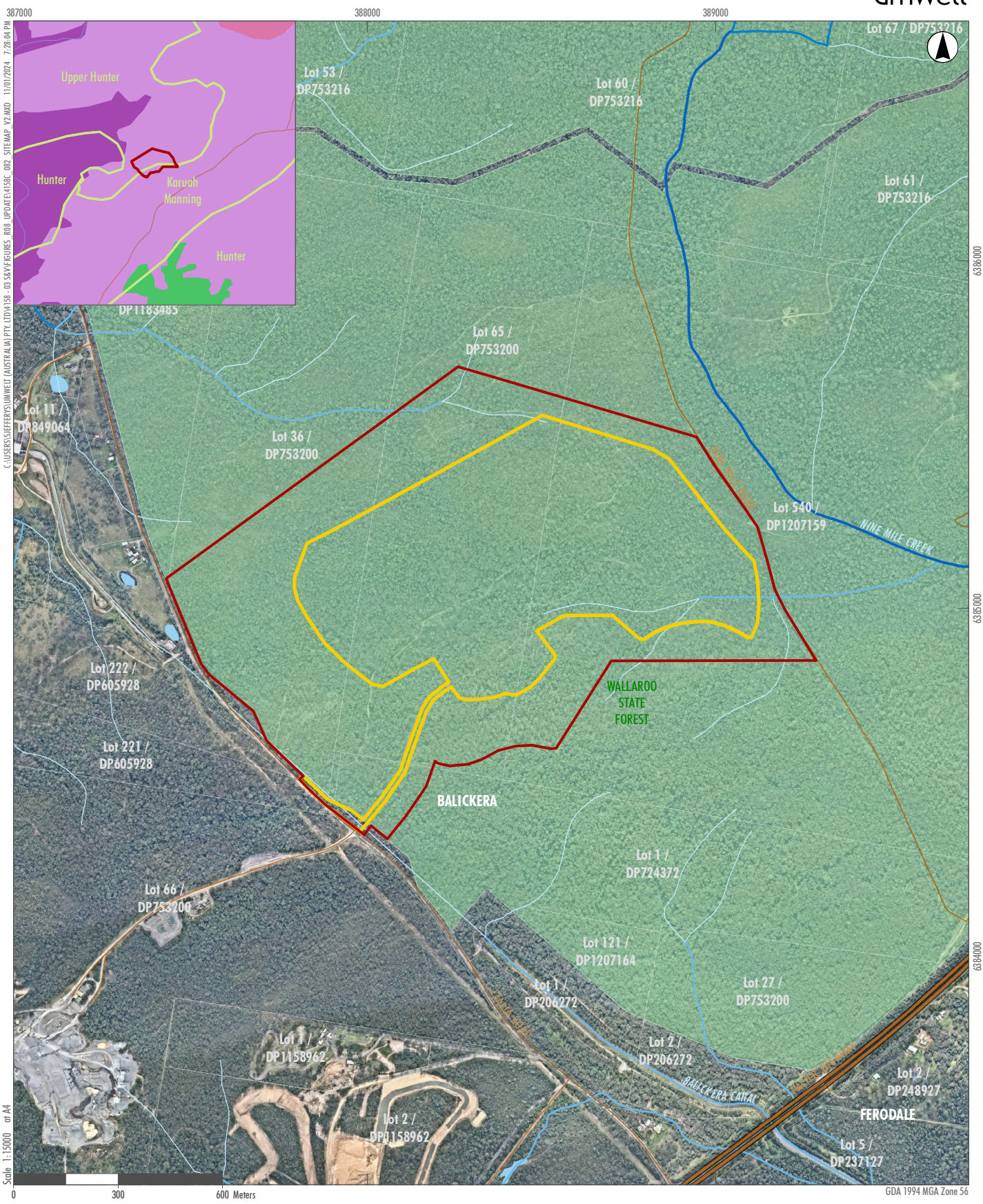
1.2.3 Proposed Development Description

The proposed development footprint areas associated with the Project are mapped in **Figure 1.3**. The key components of the Project include:

- an extraction area with sufficient resources to support the extraction and processing of material to enable the transport of up to 1.5 Mtpa over 30 years
- processing and stockpiling area
- storage area for overburden/plant and equipment
- product loading area
- surface water management infrastructure
- weighbridge and administration area (offices, parking, amenities)
- site access and internal roadways
- buffer areas.

1.2.4 Other Documentation

Other information sources relied upon are referenced in the text and are listed in the References Section of this Report (**Section 12.0**).



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- State Forest
- Pacific Highway
- Road
- Waterbody
- Lot Boundaries

Stream Order

- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream
- 4th Order Stream

- IBRA Subregions (inset only)

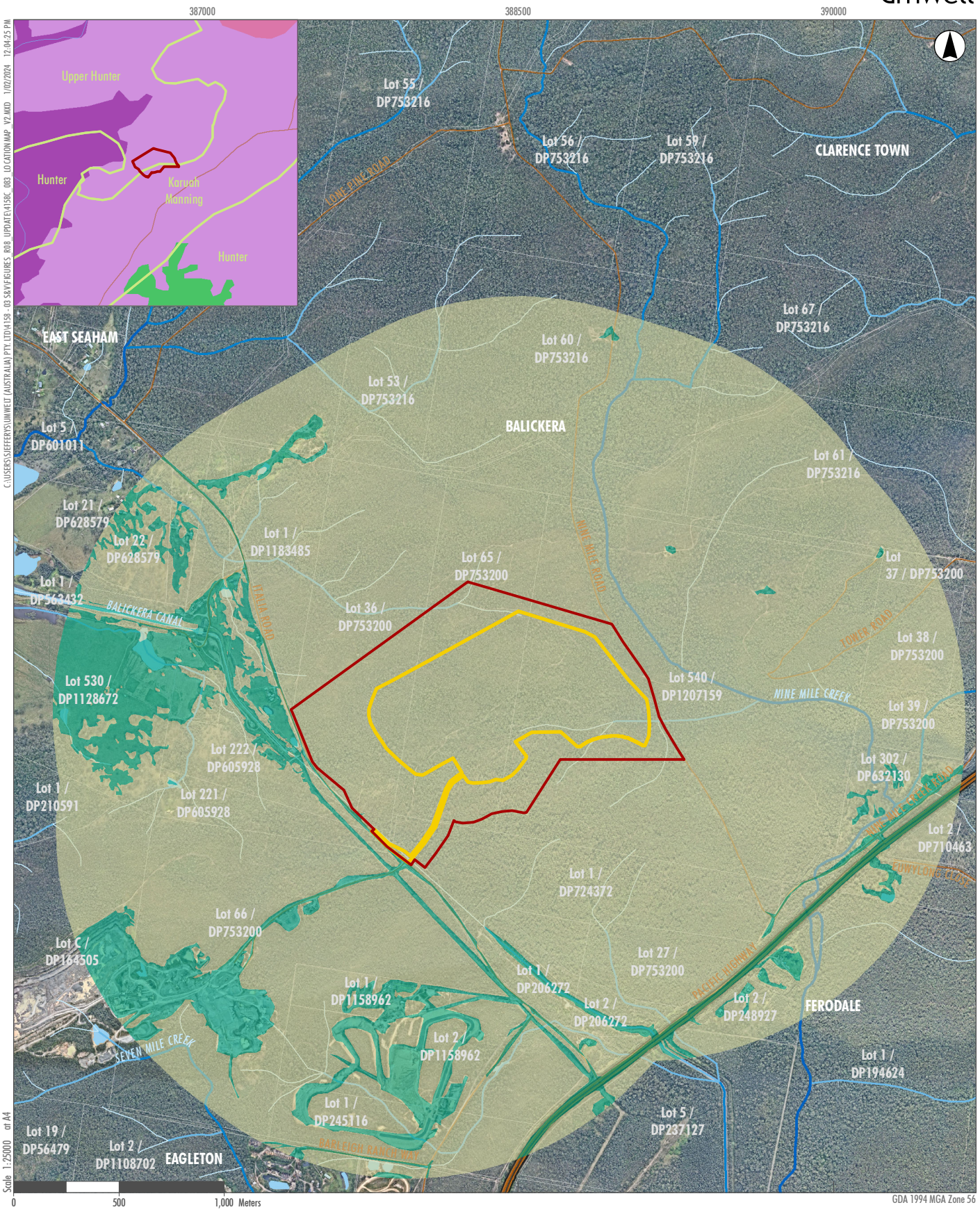
Mitchell Landscapes (inset only)

- Lower Hunter Channels and Floodplains
- Newcastle Coastal Ramp
- Stroud Mountains
- Sydney - Newcastle Barriers and Beaches

FIGURE 1.1

Site Map

Image source: Nearmap (August 2022) Data source: NSW FSDF (2022)



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Pacific Highway
- Road
- Waterbody
- Lot Boundaries

Vegetation Cover within Assessment Area

- Native Vegetation
- Cleared Land

Stream Order

- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream
- 4th Order Stream

- IBRA Subregions (inset only)

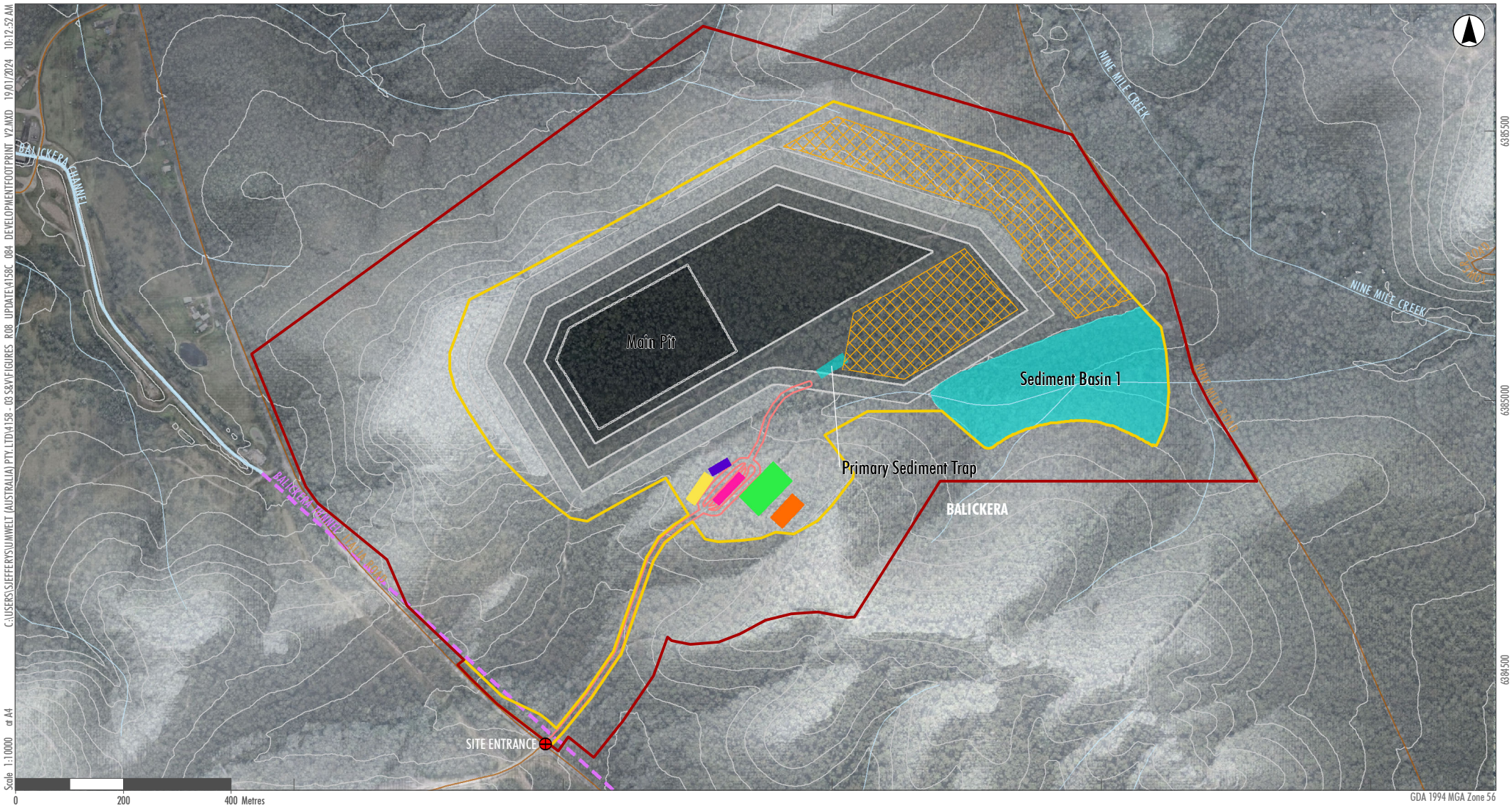
Mitchell Landscapes (inset only)

- Lower Hunter Channels and Floodplains
- Newcastle Coastal Ramp
- Stroud Mountains
- Sydney - Newcastle Barriers and Beaches

FIGURE 1.2

Location Map

Image source: Nearmap (August 2022) Data source: NSW FSDF (2022), Umwelt (2023)



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line
- Contour Line
- Office
- Weighbridge
- Workshop
- Truck Parking
- Light Vehicle Parking
- Access Road
- Stockpile and Plant Area
- Dams

Image Source: Nearmap (August 2022) Data source: NSW FSDF (2022), Umwelt (2023)

FIGURE 1.3

Development Footprint

1.3 Biodiversity Offsets Scheme Entry

The biodiversity offset scheme (BOS) applies to all State significant development projects and the SEARs require a BDAR to be prepared for the Project in accordance with Section 7.9 of the BC Act. The Subject Land is included on the Biodiversity Values Map layer and, as shown in **Figure 1.4**, includes areas mapped as Core Habitat within an approved Koala Plan of Management.

1.4 Excluded impacts / Category 1 Land

Clause 6.8(3) of the BC Act specifies that the Biodiversity Assessment Method (BAM) is to exclude the assessment of the impacts of any clearing of native vegetation and loss of habitat on category 1-exempt land (as defined in Part 5A of the NSW *Local Land Services Act 2013* (LLS Act)), other than prescribed impacts (as defined in clause 6.1 of the NSW Biodiversity Conservation Regulation 2017 (BC Regulation)).

The LLS Act does not apply to State Forestry Land (LLS Act S60Ac).

1.5 Matters of National Environmental Significance

The Project has been determined by the Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) to be a Controlled Action due to likely significant impact to listed threatened species and ecological communities. The Project therefore requires approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act, 1999* (EPBC Act).

The threatened species for which a likely significant impact has been identified are:

- Koala (*Phascolarctos cinereus*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*).

DCCEEW has noted the Project may significantly impact the following species:

- Swift Parrot (*Lathamus discolor*)
- Spotted-tailed Quoll South-eastern mainland population (*Dasyurus maculatus maculatus*)
- Yellow-bellied Glider (south-eastern) (*Petaurus australis australis*)
- New Holland Mouse (*Pseudomys novaehollandiae*)
- South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*).

An area of the endangered ecological community (EEC), Coastal Swamp Sclerophyll Forest of NSW and South East QLD, was identified as potentially being impacted by the Project at the referral stage. Further floristic surveys and analysis have determined that this EEC, as listed under the EPBC Act, is not present within the subject land, however the Subtropical Eucalypt Floodplain Forest and Woodland of the NSW North Coast and South East QLD EEC listed under the EPBC Act is present. Further details on Threatened Ecological Communities (TECs) are provided in **Section 4.3** of this Report.

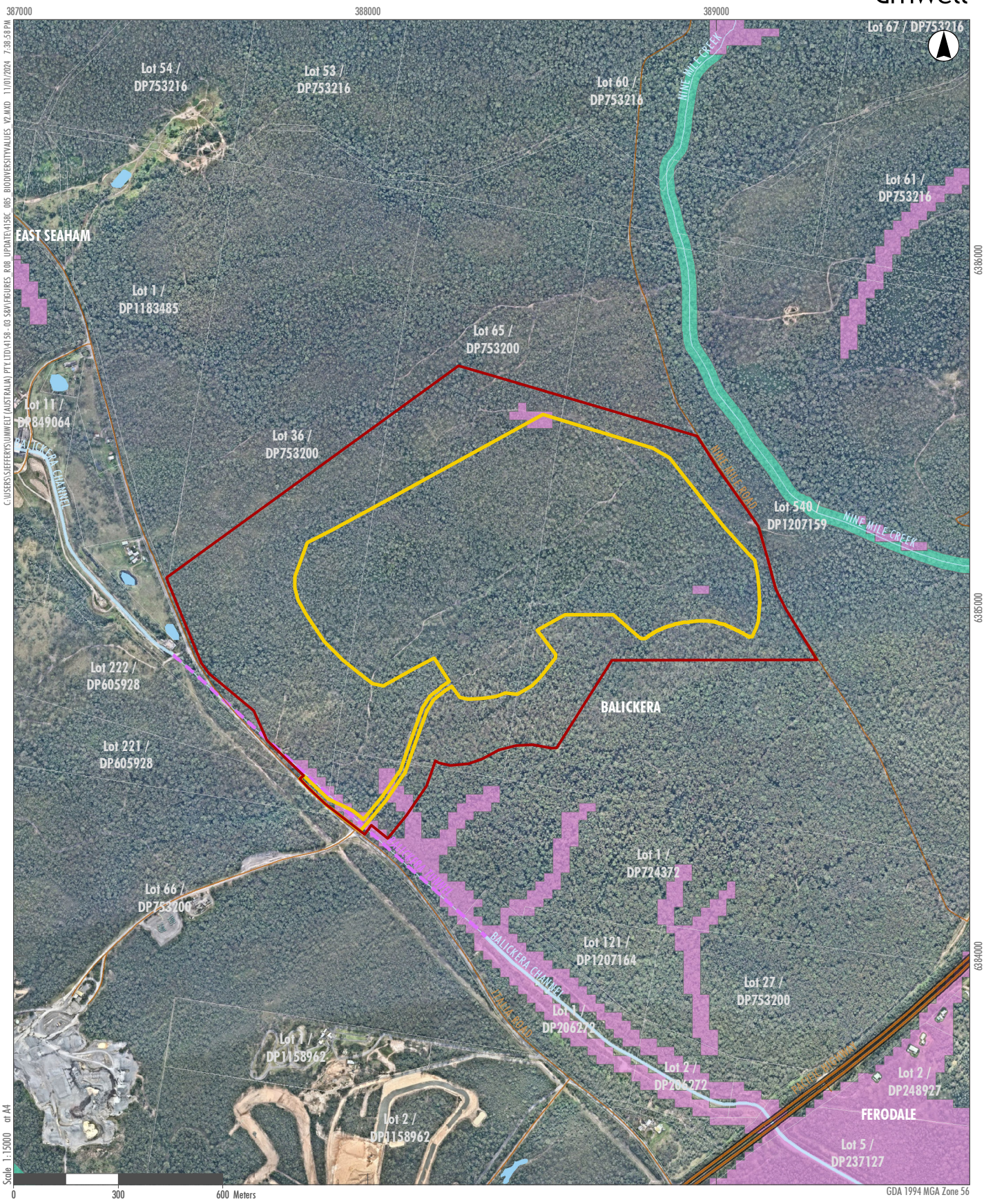
The BAM has been endorsed as the assessment method for Matters of National Environmental Significance (MNES) under a Bilateral Agreement made under the EPBC Act. The Australian Government is the decision-maker for whether the Project will be approved under the EPBC Act. Nationally listed threatened species, TECs and migratory species have been considered and assessed as part of this BDAR. A separate MNES assessment addressing the requirements of the Project Assessment Notes provided by DCCEEW is included in **Appendix B**.

1.6 Information Sources

The following guidance documents and available resources relevant to the preparation of this Biodiversity Development Assessment Report were reviewed:

- Biodiversity Development Assessment Method (NSW DPIE 2020a)
- Biodiversity Assessment Method Operational Manual – Stage 1 (NSW DPE 2022a)
- Biodiversity Assessment Method Operational Manual – Stage 2 (NSW DPE 2023a)
- Biodiversity Assessment Method (BAM) Calculator User Guide (NSW OEH 2017a)
- NSW BioNet including the BioNet Atlas, BioNet Vegetation Database and Threatened Biodiversity Data Collection (TBDC) (NSW DPE 2024)
- Guidance for the Biodiversity Development Assessment Report Template (including the template) (NSW DPE 2022b).

Other information sources and guidelines relied upon are referenced in the text and listed in the References Section of this Report.



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Waterbody
- Lot Boundaries

Biodiversity Values Map Layer (v14.3)

- Biodiverse riparian land
- Core Habitat within an approved Koala Plan of Management (Koala SEPP)

FIGURE 1.4

Biodiversity Values Map

Image source: Nearmap (August 2022) Data source: NSW FSDF (2022)

2.0 Methods

2.1 Site Context Methods

2.1.1 Landscape Features

As detailed in Section 3 of the BAM (NSW DPIE 2020a), a landscape assessment for the Project is required, which was initially conducted as a desktop assessment and confirmed during the field surveys (where practicable). The following landscape and site context features in **Table 2.1** were identified for the Assessment Area (1500 m buffer) in accordance with Section 3 of the BAM (NSW DPIE 2020a) from analysis and reference to available spatial information:

Table 2.1 Landscape Features Assessed and Data Sources

Landscape and Site Context Features	Data Source
IBRA Bioregions	NSW Interim Biogeographic Regions of Australia Version 7 (Australian Government Department of the Environment and Energy 2018)
IBRA Subregions	NSW Interim Biogeographic Regions of Australia Version 7 (Australian Government Department of the Environment and Energy 2018)
NSW Mitchell Landscapes	NSW (Mitchell) Landscapes Version 3.1 (NSW OEH 2017b)
Native Vegetation extent within designated assessment buffer area (1500 m)	Aerial Imagery
Patch Size	Aerial Imagery
Cleared Areas	Aerial Imagery
Rivers and Streams (classified according to stream order)	NSW Hydrography
Estuaries and wetlands	Directory of important wetlands in Australia
Connectivity Features	Aerial imagery
Karst, caves, cliffs, rocks and other geological features of significance	Aerial imagery and topographic maps
Areas of outstanding biodiversity value	Areas of Outstanding Biodiversity Value Register

2.2 Native Vegetation, Threatened Ecological Communities and Vegetation Integrity Methods

2.2.1 Existing Information

The following existing information was reviewed to inform the identification of Plant Community Types (PCTs) (**Section 4.2**) and TECs (**Section 4.3**):

- NSW BioNet Atlas incorporating the NSW Vegetation Information System (NSW DPE 2024).
- EPBC Act Protected Matters Search Tool (Australian Government DCCEEW 2024a).
- NSW State Vegetation Type Map Version C2.0M2.0 (NSW DPE 2023c).
- The NSW Scientific Committee Final Determinations made for various TECs under the BC Act.
- Approved Conservation Advice published for various TECs under the EPBC Act.
- Biodiversity Assessment Report – Eagleton Quarry, 13 Barleigh Ranch Way, Eagleton NSW (Kleinfelder 2017).
- Hunter, Central & Lower North Coast Vegetation Classification & Mapping Project (Volumes 1 & 2) (Somerville 2009a; 2009b).
- New South Wales Seamless Geology dataset (Single Layer), version 2.1 (Colquhoun *et al.* 2021).
- Probable Vegetation Groundwater Dependant Ecosystems Hunter / Central Rivers (NSW DPI Water 2022).

2.2.2 Mapping Native Vegetation Extent, Plant Community Types and Vegetation Condition Zones

The native vegetation extent (**Section 4.1**) within the Subject Land was determined during site surveys, through GIS Mapping and aerial photograph interpretation using recent aerial imagery. Native vegetation and plant community type mapping was undertaken using best-practice techniques to delineate vegetation communities across the Subject Land. Vegetation mapping involved the following key steps:

- Review of aerial imagery to assess vegetation distribution patterns as dictated by change in canopy texture, tone, and colour, as well as topography.
- Review of the modelled distribution of vegetation communities within broader scale regional based vegetation mapping.
- Preparation of a draft plant community type map based on interpretation of digital aerial imagery.
- Field-based ground-truthing of the draft plant community type mapping through completion of rapid point-based assessments of canopy vegetation at 136 grid-based rapid PCT assessment points to identify the dominate canopy species at each location across the Study Area. The locations of the grid-based rapid PCT assessment points are shown in **Figure 2.1**.
- Confirmation of vegetation community floristic delineations based on plot data.

Vegetation communities were delineated through the identification of repeating patterns of plant species assemblages in each of the identified strata. Slight variations in species composition are typical across the extent of a community and are often associated with microhabitats or ecotones with adjoining plant communities.

The extent of native ground-cover vegetation within offsite areas where a canopy of native species is absent has mostly been estimated based on the visual interpretation of aerial imagery, considering areas of cultivation and fenced boundaries. The offsite mapping of native vegetation extent is broad-scale and was prepared specifically for the estimation of native vegetation cover under the BAM (DPE, 2020a).

2.2.3 Plot-Based Floristic and Vegetation Integrity Survey

A stratified plot-based floristic vegetation survey of the development footprint was undertaken in accordance with Table 3 and Section 4.2.1 of the BAM.

Plot-based vegetation surveys were completed to assess vegetation composition, structure, function, enable calculation of the vegetation integrity scores for Vegetation Condition Zones, sample areas of expected environmental variation and verify the results of previous mapping and available site information. Each plot survey consisted of a 20 x 20 m plot nested within a larger 20 x 50 m plot. The plot data was collected in accordance with Sections 4.2.1 and Section 4.3.4 of the BAM.

The following was recorded for each plot:

- Unique plot reference.
- Plot GPS coordinates (easting and northing).
- Date of the survey.
- Name of field surveyors.
- Bearing along a 50 m transect through the plot.
- Physiographic features that may assist in PCT identification such as slope, aspect and soil characteristics.
- Signs of disturbance.
- Photographs of the vegetation.
- For the nested 20 x 20 m / 400 m^2 floristic plot all required vegetation composition and structure variables were recorded including:
    - Full species name for all native and exotic flora species (where sufficient diagnostic material was present).
    - Foliage cover recorded as a percentage for all alive and dead flora species rooted within and overhanging the boundaries of the plot.
    - Abundance rating for all flora species rooted within the plot.
    - All vascular plants recorded within floristic plots were identified using keys and nomenclature in PlantNet NSW Flora Online Identification Keys (The Royal Botanic Gardens and Domain Trust 202).

For the 20 m x 50 m plot all required vegetation function values were recorded including:

- Tree stem size class (presence/absence or estimated abundance).
- Tree regeneration (presence/absence).
- Combined length of all individual fallen logs ≥10 cm diameter and ≥50 cm in length.
- Hollow bearing trees (number of trees rooted in the plot with hollows ≥5 cm wide.
- Litter cover (all plant material that had detached from a plant and located on the ground surface) assessed as the average percentage cover of five 1 m^2 sub-plots spaced at 10 m intervals alternating either side of the plot midline.
- Number of large trees with a DBH ≥ the large tree benchmark for the PCT.

Plot locations were selected to ensure that they captured attributes relevant to each vegetation condition zone, to provide a representative assessment of the vegetation integrity of the vegetation condition zone, accounting for the level of variation in the broad condition state of the vegetation condition zone. Subsequent amendments to the development footprint during the design process to avoid impacts to biodiversity values have resulted in some plots located outside, but still adjacent to (and representative of), the development footprint.

At each plot, approximately 45 to 60 minutes was spent searching and recording all vascular flora species present within each strata of the 20 x 20 m floristic plot. Searches were generally undertaken through parallel transects from one side of the plot to another. An effort was made to search the tree canopy and tree trunks for mistletoes, vines, and epiphytes where present.

A total of 18 BAM Plots were previously surveyed within the subject land by Umwelt during 2018, however this plot data was not used for this assessment as the site was recovering from a bushfire and follow-up surveys in 2022 identified changes in the site vegetation due to regrowth. Consultation with the BCD Newcastle office in 2022 confirmed this approach.

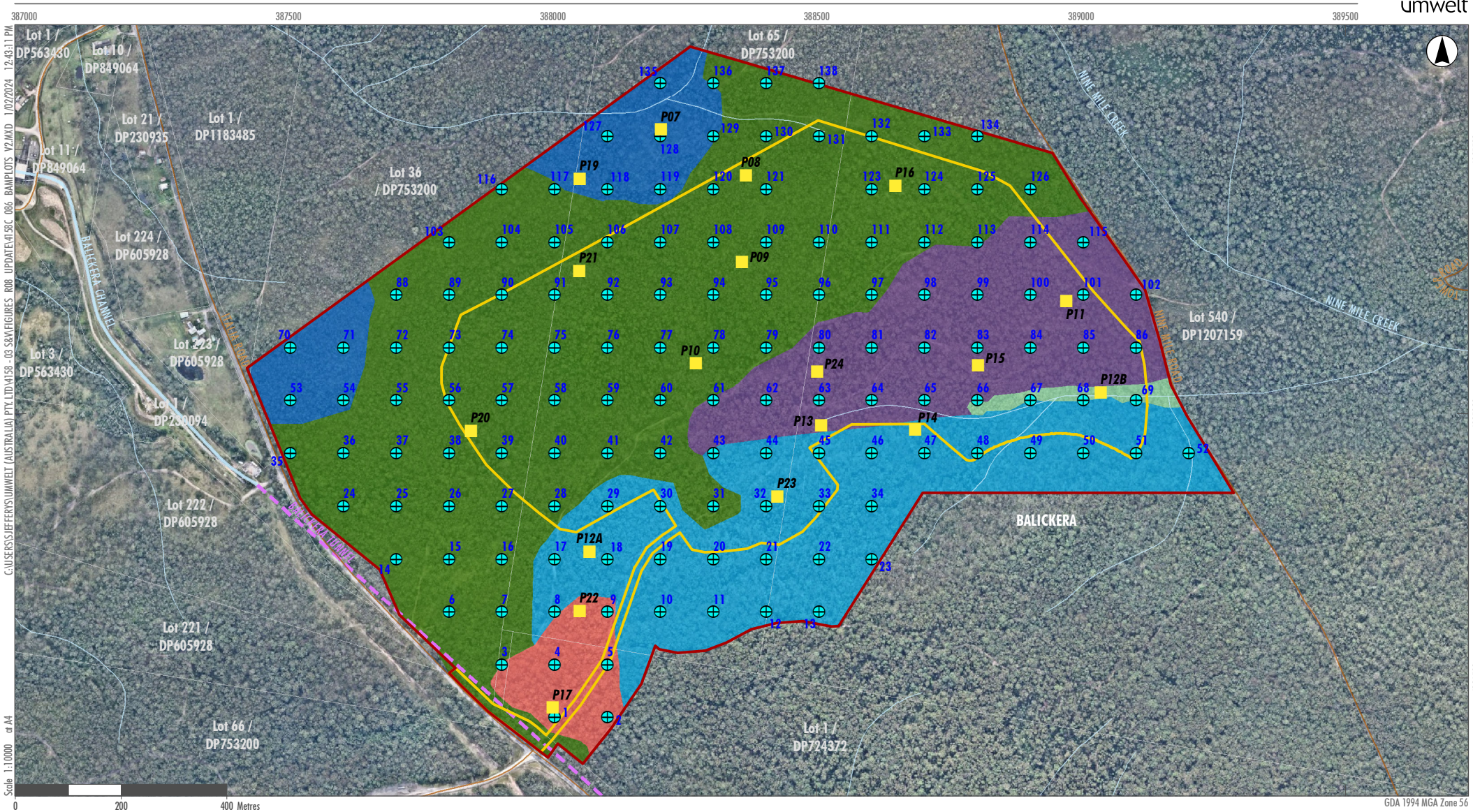
An additional 20 updated BAM plots were sampled by Umwelt ecologists on the following dates:

- 12 October 2022
- 9 November 2022
- 16 November 2022.

Plot survey locations are shown in **Figure 2.1** and plot survey stratification details for each plant community type and vegetation condition zone is listed in **Table 2.2**.

Table 2.2 Plant Community Type Survey Plot Stratification details

Current BAM-C PCT ID	PCT name	Vegetation Condition Zone	Area (ha) in development footprint	Quantity of Plots Required (BAM 2020 Table 3)	Plots Completed in 2022
762	Cabbage Gum open forest or woodland on flats of the North Coast	1 PCT 762 Intact	0.33	1	2 Plots (Plot 17, Plot 22)
1590	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	2 PCT 1590 - Intact	39.27	4	6 Plots (Plot 8, Plot 9, Plot 10, Plot 16, Plot 20, Plot 21)
1618	Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast	3 PCT 1618 - Intact	0.88	1	1 Plot (Plot 12B)
1619	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	4 PCT 1619 - Intact (Apple Variant)	18.91	3	4 Plots (Plot 11, Plot 13, Plot 15, Plot 24)
	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	5 PCT 1619 – Intact (Apple – Ironbark Variant)	8.63	3	3 Plots (Plot 12A, Plot 14, Plot 23)
1716	Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast.	6 PCT 1716 - Regenerating	0 (Impacts to PCT have been avoided)	0	2 Plots (Plot 07, Plot 19)



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line
- BAM Plots
- Rapid PCT Survey Locations

Plant Community Types

- PCT 762, Cabbage Gum open forest or woodland on flats of the North Coast - Intact
- PCT 1590, Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest - Intact
- PCT 1618, Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast - Intact
- PCT 1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple variant
- PCT 1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple-Ironbark variant
- PCT 1716, Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast – Regenerating

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

FIGURE 2.1

BAM Plot Locations and Rapid PCT Survey Locations

2.3 Threatened Flora Survey Methods

2.3.1 Review of Existing Information & Survey Guidelines

The following existing information and survey guidelines were reviewed to inform the threatened flora species surveys and assessment of habitat constraints and microhabitats:

- NSW Government Biodiversity Assessment Method Calculator (BAMC) (BAM Data Update Version 61 / Updated 22/06/2023).
- Threatened flora records held on the NSW BioNet Atlas of NSW Wildlife within the Subject Land (NSW DPE 2024).
- Vegetation associations reports for the relevant IBRA Bioregion and IBRA Sub-region for each PCT present, to determine threatened fauna species PCT associations.
- Habitat constraints listed in the NSW BioNet Atlas Threatened Biodiversity Data Collection (DPE 2024).
- Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment method (NSW DPIE 2020b)
- BAM Flora species with specific survey requirements spreadsheet (NSW DPIE 2020c).

2.3.2 BioNet Atlas Threatened Flora Records

A search of the BioNet Atlas of NSW Wildlife was undertaken to determine the presence of any threatened flora species previously recorded within the development footprint or the Assessment Area (NSW DPE 2024), and to inform this amended BDAR. Details of the threatened flora species recorded on the BioNet Atlas (NSW DPIE 2024) within a circular 5 km buffer of the Project Area are summarised in **Table 2.3** including the number or records and date of records within the search area. An assessment of likelihood of occurrence is also provided using the following criteria:

- High / Known – Suitable habitats which are known to support this species are present and the species is known or expected to occur within the Project Area based on observation or historical records.
- Moderate – Suitable habitats which are known to support this species are present within the development footprint and the species may occur (further surveys required).
- Low – Suitable habitats or microhabitats for this species are not present within the development footprint, or the development footprint is too disturbed to support this species and the species is not known or likely to occur.

Species known to occur or with a moderate or high likelihood of occurrence have been included for further assessment within this Report.

Table 2.3 BioNet Atlas Threatened Flora Records within 5 km

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Date Last Recorded within 5 km	Number of Recorded locations within 5 km	Likelihood of Occurrence
Angophora inopina	Charmhaven Apple	V	V	15/06/2000	2	High
Callistemon linearifolius	Netted Bottle Brush	V	-	-	0	High
Corybas dowlingii	Red Helmet Orchid	E	-	28/07/2021	210	Moderate
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	V	28/07/2006	6	Moderate
Maundia triglochinoides		V	-	-	0	Moderate
Pterostylis chaetophora	Rusty Greenhood	V	-	16/09/2021	519	High
Rhodamnia rubescens	Scrub Turpentine	CE	CE	-	0	Moderate
Rhodomyrtus psidioides	Native Guava	CE	CE	18/11/2006	1	Moderate
Tetratheca juncea	Black-eyed Susan	V	V	21/08/1961	1	Moderate

2.3.3 Habitat Constraints Assessment

The following field-based surveys were undertaken to assess the habitat constraints for the candidate threatened flora species:

- Field searches for habitat constraints identified from the desktop review of the TBDC.
- Direct observation of the quality and suitability of micro-habitats present.
- Collection of 136 rapid flora assessments across all plant community types, to assess the condition of the habitats present on 14 and 16 September 2022.
- Collection of site photographs to assess the condition of habitats present.

The results of the site-based habitat constraints assessment were utilised to inform the assessment of the confirmed candidate threatened species assessment in the BAM Calculator. Where species presence could not be ruled out in accordance with Section 5.2 of the BAM, surveys were conducted.

2.3.4 Threatened Flora Field Surveys

Searches for threatened flora species were completed in accordance with the NSW Survey Guide, '*Surveying threatened plants and their habitats'* (NSW DPIE 2020b) and any relevant species requirements listed in the Threatened Biodiversity Data Collection (NSW DPE 2024). Details of the field survey methods used and species targeted are listed in **Table 2.4** and the locations of the surveys completed are mapped in **Figure 2.2A** to **Figure 2.2D**.

Table 2.4 Candidate Threatened Flora Species Targeted and Field Survey Methods Used

Survey Group	Target Species	Species Survey Period	Survey Dates	Survey Method	Plant Community Type Associations / Areas Surveyed				
					762	1590	1618	1619	1716
Group 1	*Angophora inopina*	All year	25, 26, 28 July 2022	Parallel traverse	^	^	✓	✓	✓
	Eucalyptus glaucina	All Year	25, 26, 28 July 2022	Parallel traverse	^	✓	^	^	^
	Cynanchum elegans	All year	25, 26, 28 July 2022	Parallel traverse	^	✓	^	^	^
	Rhodamnia rubescens	All year	25, 26, 28 July 2022	Parallel traverse	^	^	^	^	^
	Rhodomyrtus psidioides	All year	25, 26, 28 July 2022	Parallel traverse	^	^	^	^	^
Group 2	*Callistemon linearifolius*	October–January	8,9,10,11,12 October 2018 12, 17, 19, 20, 25, 26, 31 October 2022	Parallel traverse	^	✓	✓	✓	^
	Grevillea parviflora subsp. parviflora	August–November	8, 9, 10, 11, 12 October 2018 12, 17, 19, 20, 25, 26, 31 October 2022	Parallel traverse	^	✓	✓	✓	^
	Rutidosis heterogama	All year	12, 17, 19, 20, 25, 26, 31 October 2022	Parallel traverse	^	✓	✓	✓	^
	Tetratheca juncea	September–October	25, 26, 30 October 2017 8, 9, 10, 11, 12 October 2018 12, 17, 19, 20, 25, 26, 31 October 2022	Parallel traverse	^	✓	✓	✓	^
	Pterostylis chaetophora	September–November	25, 26, 30 October 2017 8, 9, 10, 11, 12 October 2018 12, 17, 19, 20, 25, 26, 31 October 2022	Parallel traverse	^	✓	^	^	^

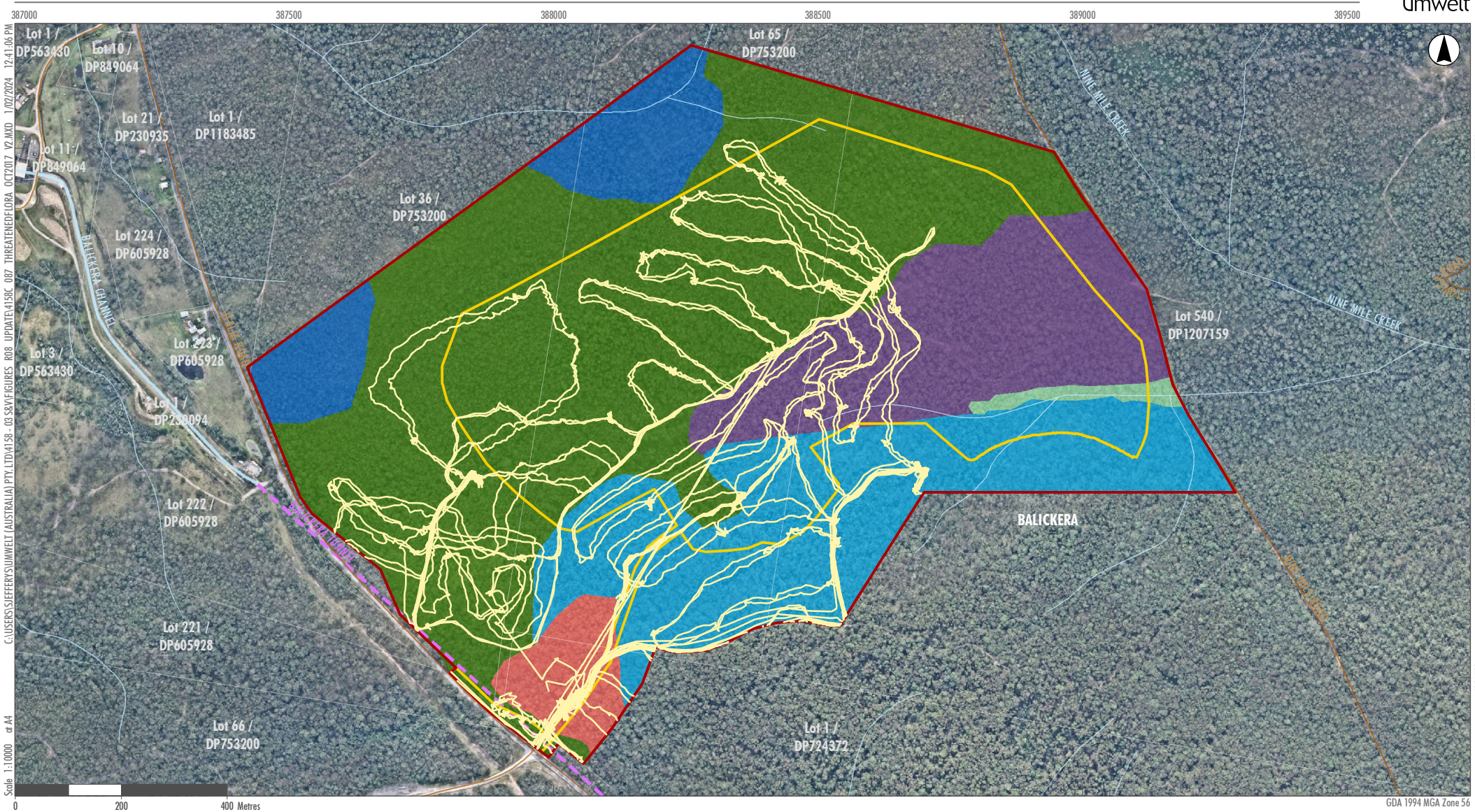
Survey Group	Target Species	Species Survey Period	Survey Dates	Survey Method	Plant Community Type Associations / Areas Surveyed				
					762	1590	1618	1619	1716
Group 3	*Maundia triglochinoides*	November–March	12, 17, 19, 20, 25, 26, 31 October 2022 9,11 November 2022	Initial searches to identify areas of potential aquatic habitat and plants completed in October 2022. Follow up traverses along drainage lines targeting fruiting plants completed in November 2022 (Triglochin identified)	^	^	^	^	^
Group 4	*Corybas dowlingii*	June–July	5, 6, 7, 8, 9 June 2023	Parallel traverse	^	^	✓	^	^

KEY TO SYMBOLS

✓ = Associated PCT, targeted species survey completed in PCT.

^ = Non-associated PCT, targeted surveys completed in areas of suitable habitat.

Blank cells = If blank non-associated PCT / targeted survey for species not completed in PCT as no suitable habitat present.



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line

Threatened Flora Transects

- October 2017

Plant Community Types

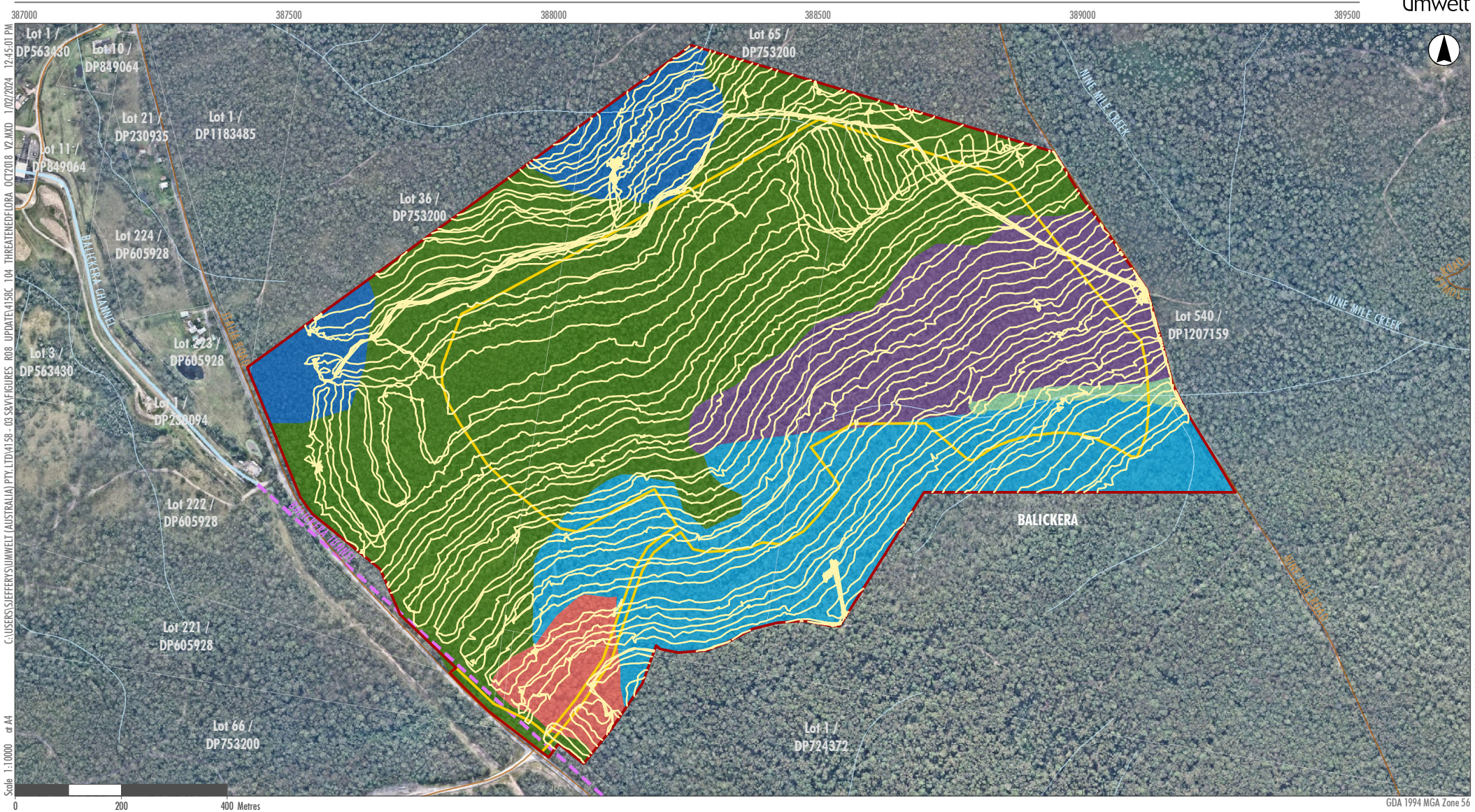
- PCT 762, Cabbage Gum open forest or woodland on flats of the North Coast - Intact
- PCT 1590, Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest - Intact
- PCT 1618, Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast - Intact
- PCT 1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple variant
- PCT 1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple-Ironbark variant
- PCT 1716, Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast – Regenerating

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

FIGURE 2.2A

Threatened Flora Survey Locations – October 2017

C:\USERS\JEFFERYS\UMWELT (AUSTRALIA) PTY. LTD\4158 - 03 S&V\FIGURES R08 UPDATE\4158C 087 THREATENEDFLORA OCT2017 V2.MXD 1/02/2024 12:41:06 PM



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line

Threatened Flora Transects

- October 2018

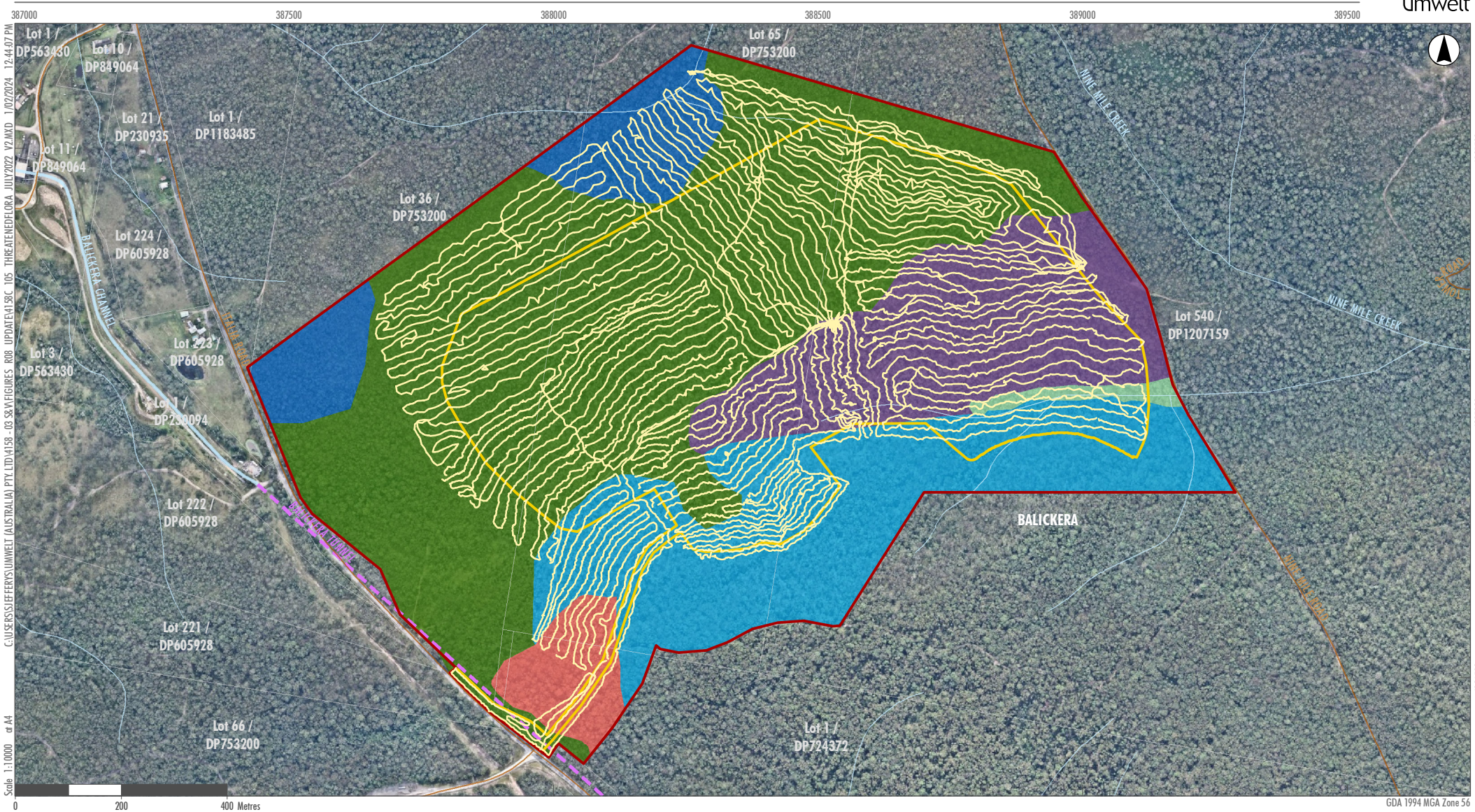
Plant Community Types

- PCT 762, Cabbage Gum open forest or woodland on flats of the North Coast - Intact
- PCT 1590, Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest - Intact
- PCT 1618, Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast - Intact
- PCT 1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple variant
- PCT 1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple-Ironbark variant
- PCT 1716, Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast – Regenerating

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

FIGURE 2.2B

Threatened Flora Survey Locations – October 2018



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line

Threatened Flora Transects

- July 2022

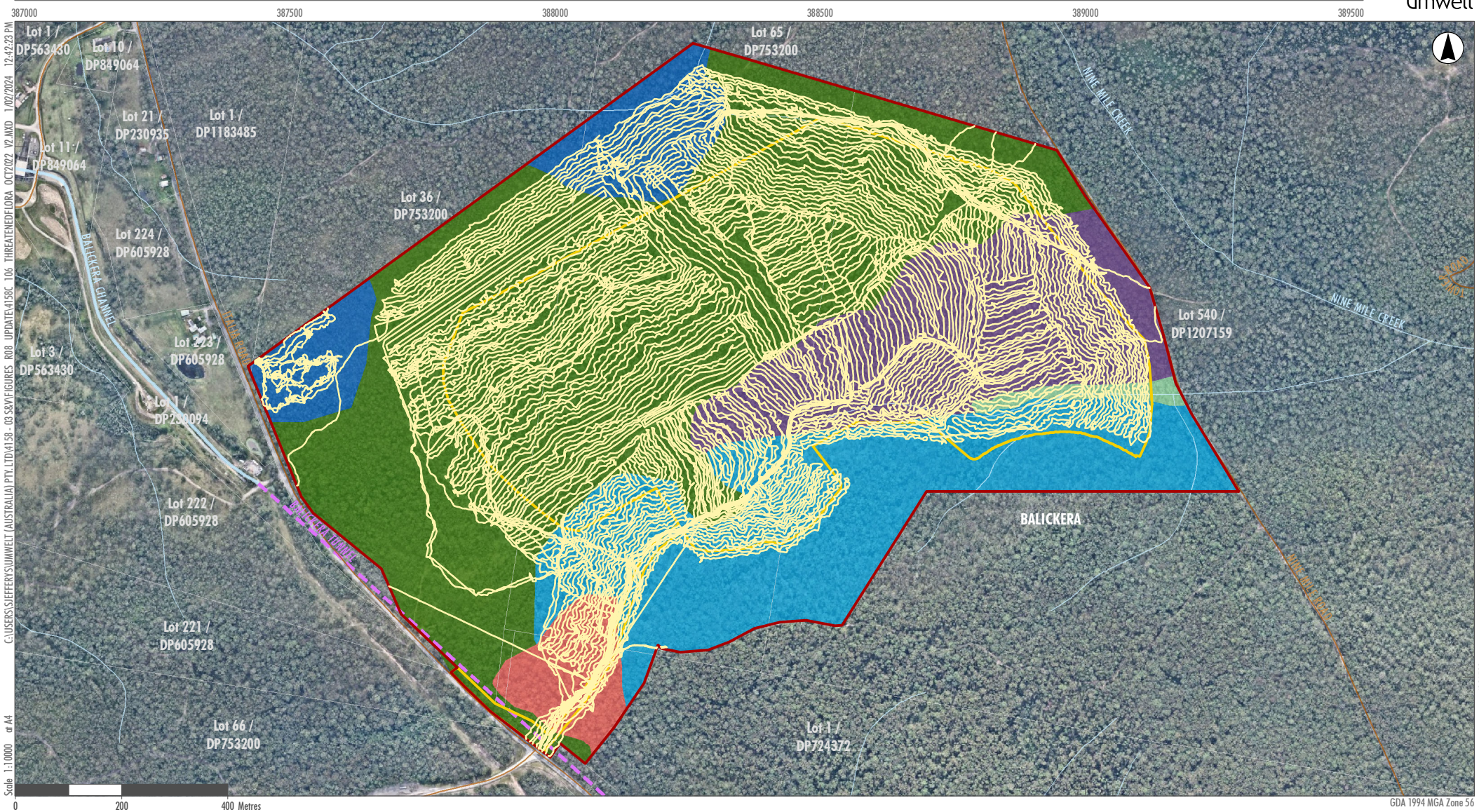
Plant Community Types

- PCT 762, Cabbage Gum open forest or woodland on flats of the North Coast - Intact
- PCT 1590, Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest - Intact
- PCT 1618, Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast - Intact
- PCT 1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple variant
- PCT 1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple-Ironbark variant
- PCT 1716, Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast – Regenerating

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

FIGURE 2.2C

Threatened Flora Survey Locations – July 2022



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Balickera Tunnel
- Drainage Line

Threatened Flora Transects

- October 2022

Plant Community Types

- PCT 762, Cabbage Gum open forest or woodland on flats of the North Coast - Intact
- PCT 1590, Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest - Intact
- PCT 1618, Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast - Intact
- PCT 1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple variant
- PCT 1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple-Ironbark variant
- PCT 1716, Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast – Regenerating

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

FIGURE 2.2D

Threatened Flora Survey Locations – October 2022

2.4 Threatened Fauna Survey Methods

2.4.1 Review of Existing Information & Survey Guidelines

The following existing information and survey guidelines were reviewed to inform the threatened fauna species surveys and assessment of habitat constraints and microhabitats:

- NSW Government BAM Calculator (BAM Data Update Version 6158 / Updated 2213/064/2023).
- Threatened fauna records held on the NSW BioNet Atlas of NSW Wildlife within the Subject Land (NSW DPE 2024).
- Vegetation associations reports for the relevant IBRA Bioregion and IBRA Sub-region for each PCT present to determine threatened fauna species PCT associations.
- Habitat constraints listed in the Threatened Biodiversity Data Collection (TBDC) (NSW DPE 2024).
- Species Credits' threatened bats and their habitats (NSW OEH 2018; NSW DPIE 2021).
- NSW Survey Guide for Threatened Frogs (NSW DPIE 2020d).
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft) (NSW DEC 2004).
- Koala (*Phascolarctos cinereus*) Biodiversity Assessment Method Survey Guide (NSW DPE 2022c).

2.4.2 BioNet Atlas Threatened Fauna Records

Details of the threatened fauna species recorded on the BioNet Atlas within a circular 5 km buffer of the Project Area are summarised in **Table 2.5**. Fauna species with a moderate or high potential to occur have been included for further assessment as either ecosystem credit, species credit or dual credit entities.

A search of the BioNet Atlas of NSW Wildlife was undertaken to determine the presence of any threatened fauna species previously recorded within the development footprint or the Assessment Area (NSW DPE 2024), and to inform this amended BDAR. Details of the threatened fauna species recorded on the BioNet Atlas (NSW DPIE 2024) within 5 km of the subject land are summarised in **Table 2.3** including the number or records and date of records within the search area. An assessment of likelihood of occurrence is also provided using the following criteria:

- High / Known – Suitable habitats which are known to support this species are present and the species is known or expected to occur within the Project Area based on observation or historical records.
- Moderate – Suitable habitats which are known to support this species are present within the development footprint and the species may occur (further surveys required).
- Low – Suitable habitats or microhabitats for this species are not present within the development footprint, or the development footprint is too disturbed to support this species and the species is not known and not likely to occur.

Species known to occur or with a moderate or high likelihood of occurrence have been included for further assessment within this Report.

Table 2.5 BioNet Atlas Threatened Fauna Records within 5 km

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Date Last Recorded	Number of Individuals Recorded	Likelihood of Occurrence
Anseranas semipalmata	Magpie Goose	V	-	25/11/2000	1	Low
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	31/08/2006	4	Moderate
Burhinus grallarius	Bush Stone-curlew	E	-	15/01/2010	2	Low
Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	V	V	28/07/2021	19	Moderate
Cercartetus nanus	Eastern Pygmy-possum	V	-	13/12/2005	1	Low
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	17/01/2013	1	Low
Chthonicola sagittata	Speckled Warbler	V	-	26/06/2014	3	Moderate
Circus assimilis	Spotted Harrier	V	-	31/07/2013	7	Low
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	10/11/2021	3	Low
Daphoenositta chrysoptera	Varied Sittella	V	-	04/01/2019	71	High (observed)
Dasyurus maculatus	Spotted-tailed Quoll	V	E	30/06/2006	15	High
Ephippiorhynchus asiaticus	Black-necked Stork	E	-	13/02/2018	12	Low
Epthianura albifrons	White-fronted Chat	V	-	31/12/2000	1	Low
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	17/01/2013		Moderate
Glossopsitta pusilla	Little Lorikeet	V	-	27/10/2020	136	High (observed)
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	13/10/2020	194	High (observed)
Hieraaetus morphnoides	Little Eagle	V	-	31/08/2012	23	Moderate
Hirundapus caudacutus	White-throated Needletail	-	V	21/01/2020	90	Moderate
Irediparra gallinaceae	Comb-crested Jacana	V	-	30/11/2014	2	Low
Ixobrychus flavicollis	Black Bittern	V	-	29/02/2004	2	Low

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Date Last Recorded	Number of Individuals Recorded	Likelihood of Occurrence
Lathamus discolor	Swift Parrot	E	CE	15/05/2020	11	High
Lophoictinia isura	Square-tailed Kite	V	-	14/08/2020	1	Moderate
Melanodryas cucullata cucullata	South-eastern Hooded Robin	E	E	30/08/2003	1	Low
Melithreptus gularis gularis	Black-chinned Honeyeater	V	-	31/05/2005	1	Low
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	10/01/2017	5	Moderate
Miniopterus australis	Little Bent-winged Bat	V	-	01/11/2022	82	High (observed)
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	25/09/2018	9	High (observed)
Myotis macropus	Southern Myotis	V	-	18/05/2022	11	High (observed)
Neophema pulchella	Turquoise Parrot	V	-	3/12/1997	1	Low
Ninox connivens	Barking Owl	V	-	31/01/2015	13	Moderate
Ninox strenua	Powerful Owl	V	-	19/03/2018	68	Observed
Oxyura australis	Blue-billed Duck	V	-	30/09/2017	2	Low
Petaurus australis	Yellow-bellied Glider	V	V	13/12/2005	1	Moderate
Petaurus norfolcensis	Squirrel Glider	V	-	24/12/2022	20	Observed
Petroica boodang	Scarlet Robin	V	-	25/01/2013	2	Low
Petrocia phoenicea	Flame Robin	V	-	30/04/2005	1	Low
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	24/12/2022	15	High (observed)
Phascolarctos cinereus	Koala	E	E	11/11/2023	219	High (observed)
Phoniscus papuensis	Golden-tipped Bat	V	-	-	0	Low
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	29/01/2020	235	Low

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Date Last Recorded	Number of Individuals Recorded	Likelihood of Occurrence
Pseudomys novaehollandiae	New Holland Mouse	-	V	27/09/2018	5	Low
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	27/09/2018	4	High (observed)
Ptilinopus regina	Rose-crowned Fruit-Dove	V	-	31/10/2007	2	Low
Ptilinopus magnificus	Wompoo Fruit-Dove	V	-	-	0	Low
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	25/09/2018	2	Moderate
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	18/03/2004	2	High (observed)
Vespadelus troughtoni	Eastern Cave Bat	V	-	17/01/2013	3	Low to moderate

2.4.3 Habitat Constraints Assessment

Field-based searches were undertaken to assess the habitat constraints for the candidate threatened fauna species, these searches included observation of habitat constraints identified from the desktop review of the TBDC and recording of the presence, quality and/or suitability of micro-habitats present including:

- hollow bearing trees, particularly those of suitable size for threatened cockatoo and owl breeding habitat
- koala use trees
- aquatic habitats suitable for amphibians
- rocky habitats suitable for reptiles
- outcrops, caves, tunnels and old buildings suitable for threatened microbat species.

The results of the site-based habitat constraints assessment were utilised to inform the assessment of the confirmed candidate threatened species assessment in the BAM Calculator. Where species presence could not be ruled out in accordance with Section 5.2 of the BAM, surveys were conducted.

2.4.4 Field Surveys

2.4.4.1 Fauna Survey Guidelines

Targeted surveys for candidate threatened fauna species were completed with reference to the Threatened Biodiversity Data Collection (NSW DPE 2024) and the following guidelines:

- NSW Survey Guide for Threatened Frogs, A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (NSW DPIE 2020d).
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (NSW DEC 2004).
- 'Species credit' threatened bats and their habitats, NSW survey guide for the Biodiversity Assessment Method (NSW OEH 2018; NSW DPE 2022).
- Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act, Department of Sustainability, Environment, Water, Population and Communities (DEWHA 2010a).
- Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act, Department of Sustainability, Environment, Water, Population and Communities (DSEWPC 2011).
- Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act, Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC 2010).

- Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act, Department of Sustainability, Environment, Water, Population and Communities (DEWHA 2010b).
- Camera Trapping: wildlife management and research (Meek and Fleming 2014).
- A review of koala habitat assessment criteria and methods (Youngentob *et al*., 2021)

Surveys for the Pale-headed Snake were commenced and substantially completed prior to the release of the DPE Threatened Reptiles BAM Survey Guide in November 2022 (NSW DPE 2022e). Surveys for this species consisted of spotlighting however did not apply funnel trapping methods.

Umwelt also noted a revised version of the guideline, 'Species Credits' threatened bats and their habitats (NSW DPIE 2021) had been made available on the accredited assessors resource page in December 2023. It is unclear when this revised version was made available to accredited assessors as Umwelt understands that no announcement relating to the update was made. As such, identification of candidate microbat species and targeted surveys were carried out in accordance with OEH (2018). Umwelt has made reference to the NSW DPIE (2021) guideline with respect to development of species polygons for threatened microbat species.

2.4.4.2 Diurnal Fauna Surveys

The following methods were utilised for targeted diurnal fauna surveys:

- nest site searches for candidate raptor species
- searches for threatened cockatoo feeding and breeding trees
- searches and assessment of potential threatened owl nest trees
- searches for microbat roots and ultrasonic call recording
- amphibian aural/visual and call playback nocturnal surveys
- spotlighting for threatened reptiles and mammals
- opportunistic observation.

The details of diurnal fauna surveys completed are provided in **Table 2.6** and fauna survey locations are mapped in **Figure 2.3**.

Table 2.6 Details of diurnal threatened fauna surveys completed

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
09/07/2018	• Diurnal winter bird census x 5 points.	Regent Honeyeater Swift Parrot South-eastern Glossy Black-Cockatoo White-bellied Sea-Eagle	10°C, no wind, fine	5 hrs x 2 people (1230-1730)

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
10/07/2018	• Diurnal winter bird census x 4 points.	Regent Honeyeater Swift Parrot South-eastern Glossy Black-Cockatoo White-bellied Sea-Eagle	13°C, partly cloudy, light wind, fine	5 hrs 25 min x 2 people (1205-1730)
11/07/2018	• Diurnal winter bird census x 5 points.	Regent Honeyeater Swift Parrot South-eastern Glossy Black-Cockatoo White-bellied Sea-Eagle	11°C, Light wind, fine	6.25 hrs x 2 people (1115-1730)
12/07/2018	• Diurnal winter bird census x 3 points.	Regent Honeyeater Swift Parrot South-eastern Glossy Black-Cockatoo White-bellied Sea-Eagle	11°C, no wind, fine	4 hrs x 2 people (1330-1730)
25/07/2022	• Diurnal fauna census • Avifauna breeding activity survey (stick nest and breeding hollow search).	Regent Honeyeater Swift Parrot South-eastern Glossy Black-Cockatoo White-bellied Sea-Eagle	18°C, NW breeze, no rai	4 hrs x 2 people (0830-1230)
26/07/2022	• Diurnal fauna census • Avifauna breeding activity survey (stick nest and breeding hollow search).	Regent Honeyeater Swift Parrot South-eastern Glossy Black-Cockatoo White-bellied Sea-Eagle	20°C, W wind, no rain	7.5 hrs x 2 people (0830-1600)
28/07/2022	• Candidate species habitat search and assessment.	Regent Honeyeater Swift Parrot South-eastern Glossy Black-Cockatoo Red-backed Buttonquail White-bellied Sea-Eagle	18°C, NW wind, no rain	6 hrs x 2 people (1000-1600)
29/07/2022	• Diurnal fauna census • Avifauna breeding activity survey (stick nest and breeding hollow search).	Regent Honeyeater Swift Parrot South-eastern Glossy Black-Cockatoo White-bellied Sea-Eagle	16°C, SW breeze, no rain	6.5 hrs x 2 people (0830-1500)

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
14/09/2022	• Diurnal fauna census • Avifauna breeding activity survey (stick nest and breeding hollow search) • Candidate species habitat search and assessment.	Regent Honeyeater Swift Parrot South-eastern Glossy Black-Cockatoo Red-backed Buttonquail Little Eagle Square-tailed Kite White-bellied Sea-Eagle	18°C, variable W-E breeze, no rain	8.5 hrs x 2 people (0830-1700)
16/09/2022	• Diurnal fauna census • Avifauna breeding activity survey (stick nest and breeding hollow search) • Candidate species habitat search and assessment.	Regent Honeyeater Swift Parrot South-eastern Glossy Black-Cockatoo Red-backed Buttonquail Little Eagle Square-tailed Kite White-bellied Sea-Eagle	25°C, WNW wind, no rain	7.5 hrs x 2 people (0830-1600)
17/10/2022	• Diurnal fauna census • Avifauna breeding activity survey (stick nest and breeding hollow search) • Bat breeding habitat search.	Regent Honeyeater Swift Parrot Gang-gang Cockatoo Grey-headed Flying-fox Little Eagle Square-tailed Kite White-bellied Sea-Eagle	21°C, SE wind, no rain	8.5 hrs x 2 people (0830-1700)
18/10/2022	• Diurnal fauna census • Avifauna breeding activity survey (stick nest and breeding hollow search) • Bat breeding habitat search.	Regent Honeyeater Swift Parrot Gang-gang Cockatoo Grey-headed Flying-fox Little Eagle Square-tailed Kite White-bellied Sea-Eagle	22°C, SE wind, overcast with light intermittent rain	10.5 hrs x 3 people (0700-1730)
19/10/2022	• Diurnal fauna census • Avifauna breeding activity survey (stick nest and breeding hollow search) • Bat breeding habitat search.	Regent Honeyeater Swift Parrot Gang-gang Cockatoo Grey-headed Flying-fox Little Eagle Square-tailed Kite White-bellied Sea-Eagle	25°C, variable NE-SE wind, overcast, no rain	8.5 hrs x 2 people (0830-1700)

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
25/10/2022	• Diurnal fauna census • Avifauna breeding activity survey (stick nest and breeding hollow search) • Bat breeding habitat search.	Regent Honeyeater Swift Parrot Gang-gang Cockatoo Grey-headed Flying-fox Little Eagle Square-tailed Kite White-bellied Sea-Eagle	27°C, N breeze, no rain.	8.5 hrs x 2 people (0830-1700)
26/10/2022	• Diurnal fauna census • Avifauna breeding activity survey (stick nest and breeding hollow search) • Bat breeding habitat search.	Regent Honeyeater Swift Parrot Gang-gang Cockatoo Grey-headed Flying-fox Little Eagle Square-tailed Kite White-bellied Sea-Eagle	29°C, moderate W wind, no rain	8.5 hrs x 2 people (0830-1700)
31/10/2022	• Diurnal fauna census • Avifauna breeding activity survey (stick nest and breeding hollow search) • Bat breeding habitat search.	Regent Honeyeater Swift Parrot Grey-headed Flying-fox Little Eagle Square-tailed Kite White-bellied Sea-Eagle	20°C, overcast, moderate W wind, no rain	4 hrs x 4 people (0900-1300)
1/11/2022	• Diurnal fauna census • Bat breeding habitat search.	Regent Honeyeater Swift Parrot Grey-headed Flying-fox Square-tailed Kite White-bellied Sea-Eagle	20°C, fine, W wind increasing, no rain	3 hrs x 2 people (1700-2000)
2/11/2022	• Diurnal fauna census • Bat breeding habitat search.	Regent Honeyeater Swift Parrot Grey-headed Flying-fox Square-tailed Kite White-bellied Sea-Eagle	20°C, calm, no rain	4 hrs x 2 people (1600-2000)
9/11/2022	• Diurnal fauna census • Bat breeding habitat search.	Regent Honeyeater Swift Parrot Red-backed Buttonquail Grey-headed Flying-fox Square-tailed Kite White-bellied Sea-Eagle	23°C, NE breeze, no rain	7.25 hrs x 2 people (0815-1530)

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
16/11/2022	• Diurnal fauna census • Bat breeding habitat search.	Regent Honeyeater Swift Parrot Red-backed Buttonquail Grey-headed Flying-fox Square-tailed Kite White-bellied Sea-Eagle	22°C, W breeze, no rain	7.75 hrs x 2 people (0815-1600)

2.4.4.3 Nocturnal Fauna Surveys

The following methods were utilised for targeted nocturnal fauna surveys:

- spotlighting and stag-watching searches
- amphibian aural/visual searches
- quiet listening for candidate threatened fauna calls
- targeted call playback.

Details of these surveys are provided in **Table 2.7**.

Table 2.7 Details of nocturnal threatened fauna surveys completed

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
19/03/2018	Nocturnal call playback x2 Spotlighting (Call playback GPS points not available)	Green and Golden Bell-frog Pale-headed snake Squirrel Glider Koala	28°C, no wind, no cloud	2 hrs x 2 people (1900-2100)
20/03/2018	Nocturnal call playback Spotlighting (Call playback GPS points not available)	Green and Golden Bell-frog Pale-headed snake Squirrel Glider Koala	25°C, light E breeze, fine	2 hrs 40 min x 2 people (1900-2140)
22/03/2018	Amphibian search / call playback x 2	Green and Golden Bell-frog	25°C, overcast, no wind, fine.	3 hrs x 2 people (1900-2200)
28/03/2018	Spotlighting / call playback x 2 (Call playback GPS points not available)	Squirrel Glider Koala Green and Golden Bell-frog	25°C, no wind, no cloud	2 hrs x 2 people (1900-2100)
09/07/2018	Nocturnal call playback x2 Spotlighting	Koala Greater Glider Squirrel Glider Grey-headed Flying-fox Barking Owl	10°C, no wind, fine.	2.5 hrs x 2 people (1730-2000)

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
		Masked Owl Powerful Owl		
10/07/2018	Nocturnal call playback x3 Spotlighting	Koala Greater Glider Squirrel Glider Grey-headed Flying-fox Barking Owl Masked Owl Powerful Owl	13°C, partly cloudy, light wind, fine	2 hrs 50 min x 2 persons (1730-2020)
11/07/2018	Nocturnal call playback x2 Spotlighting	Koala Greater Glider Squirrel Glider Grey-headed Flying-fox Barking Owl Masked Owl Powerful Owl	11°C, light wind, fine	1.75 hrs x 2 people (1730-1915)
12/07/2018	Nocturnal call playback x 4 Spotlighting	Koala Greater Glider Squirrel Glider Grey-headed Flying-fox Barking Owl Masked Owl Powerful Owl	11°C, no wind, fine	1.5 hrs x 2 people (1730-1900)
26/08/2019	Nocturnal call playback Spotlighting Stag watching	Koala Greater Glider Squirrel Glider Grey-headed Flying-fox Barking Owl Masked Owl Powerful Owl	15°C, fine	1.5 hrs x 2 people (1720-1910)
27/08/2019	Nocturnal call playback Spotlighting Stag watching	Koala Greater Glider Squirrel Glider Grey-headed Flying-fox Barking Owl Masked Owl Powerful Owl	14°C, light wind, no rain	2 hrs 10 min x 2 people (1720-1930)
1/11/2022	Amphibian surveys - aural/visual and call playback (4 person hrs)	Green and Golden Bell-frog	20°C, fine, wind increasing at end of survey, no rain.	2 hrs x 2 people (between 2000-2300)

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
1/11/2022	Spotlighting (2 persons hrs)	Pale-headed Snake Red-backed Button Quail Eastern Pygmy Possum Koala Greater Glider Squirrel Glider Brush-tailed Phascogale Grey-headed Flying-fox	20°C, fine, wind increasing at end of survey, no rain.	1 hr x 2 people (between 2000-2300)
2/11/2022	Amphibian surveys - aural/visual and call playback (4 person hrs)	Green and Golden Bell-frog	20°C, fine, wind increasing at end of survey, no rain.	2 hrs x 2 people (between 2000-2230)
2/11/2022	Spotlighting (1 person hr)	Pale-headed Snake Red-backed Button Quail Eastern Pygmy Possum Koala Greater Glider Squirrel Glider Brush-tailed Phascogale Grey-headed Flying-fox	20°C, fine, wind increasing at end of survey, no rain.	0.5 hrs x 2 people (between 2000-2230)
30/11/2022	Amphibian surveys - aural/visual and call playback (3 person hrs)	Green and Golden Bell-frog	19°C, E breeze, no rain.	1.5 hrs x 2 people (between 2000-2230)
30/11/2022	Spotlighting (2 person hrs)	Pale-headed Snake Red-backed Button Quail Eastern Pygmy Possum Koala Greater Glider Squirrel Glider Brush-tailed Phascogale Grey-headed Flying-fox	19°C, E breeze, no rain.	1 hr x 2 people (between 2000-2230)
1/12/2022	Amphibian surveys - aural/visual and call playback (3 person hrs)	Green and Golden Bell-frog	19°C, E breeze, no rain.	1.5 hrs x 2 people (between 2000-2230)
1/12/2022	Spotlighting and nocturnal call playback x 2 (2 person hrs)	Pale-headed Snake Barking Owl Red-backed Button Quail Eastern Pygmy Possum	19°C, E breeze, no rain.	1 hr x 2 people (between 2000-2230)

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
		Koala Greater Glider Squirrel Glider Brush-tailed Phascogale Grey-headed Flying-fox		
12/06/2023	Stag watching and quiet listening at all large hollow bearing trees (HT2, HT3 & HT6, HT5, HT4 & HT1).	Barking Owl Masked Owl Powerful Owl	10°C, S breeze, no rain	1.5 hrs x 4 people (between 1630-1800)
13/06/2023	Stag watching and quiet listening at all large hollow bearing trees (HT2, HT3 & HT6, HT5, HT4 & HT1). x 6 person hours	Barking Owl Masked Owl Powerful Owl	9°C, NW breeze, no rain	1.5 hrs x 4 people (between 1630-1800)

2.4.4.4 Remote Detection Fauna Surveys

The following methods were utilised for the completion of targeted fauna remote detection surveys, as detailed in **Table 2.8**:

- baited remote camera surveys
- ultrasonic microbat call recording.

Table 2.8 Details of Remote Detection Threatened Fauna Surveys Completed

Survey Date	Survey Methods	Species Targeted	Weather conditions	Survey Effort / Time
23 January 2018– 19 March 2018	Terrestrial baited remote camera survey	Threatened mammals	Variable	315 camera trap nights (10 cameras x up to 55 nights / survey dates reflect actual survey duration / battery life of cameras)
1/11/22– 1/12/22	Arboreal baited arboreal remote camera survey	Threatened mammals	Variable	600 recording nights (20 cameras x 30 nights)
23/01/2018– 24/01/2018	Microbat ultrasonic call recording (Anabat)	All threatened microbat species	Variable	4 recording nights (2 units x 2 nights)
28/11/2022– 08/12/2022	Microbat ultrasonic call recording (Anabat)	All threatened microbat species	Variable	8 recorder nights (1 unit)
01/12/2022– 2/12/2022	Microbat ultrasonic call recording (Anabat)	All threatened microbat species	Variable	2 recorder nights (1 unit)
24/01/23– 12/02/23	Microbat ultrasonic call recording (Anabat)	All threatened microbat species	Variable	76 recorder nights (4 Units x 19 nights)

2.4.4.5 Targeted Microbat Surveys Associated with Balickera Tunnel

Previous targeted microbat surveys in the Balickera Tunnel and surrounding area as part of the Balickera Tunnel remediation project by WSP (2023) and Eco Logical Australia (2021) are listed in **Table 2.9** below.

Table 2.9 Previous targeted microbat surveys in Balickera Tunnel and locality

Survey Methods	Weather Conditions	Survey Effort / Dates	Completed by?
Thermal video recording	Calm conditions (no rain or wind experienced)	19 & 20 July 2022: : 2 nights, 91 minutes. 19 & 20 October 2022: 2 nights, 125 minutes. 7 & 8 February 2023: 2 nights, 126 minutes. 9 & 10 May 2023: 2 nights, 97 minutes.	WSP (2023)
Ultrasonic detector	In July 2022, wet conditions with cool temperatures (8-18°) and moderate to strong winds. In October 2022, showers, mild temperatures (12-24°) and moderate winds. In February 2023, no rain, generally cool, clear and calm conditions during nights and warm temperatures (18-30°) with north-east winds during day. May 2023, cool temperatures (7-22°), moderate to dusty winds during day, cool, clear and calm at night.	2 sites within the Project site and 7 sites at alternative roost monitoring locations. Winter 2022 = 22 Nights (7/07/2022-22/07/2022 18/07/2022-22/07/2022 19/07/2022-22/07/2022) October 2022 = 14 nights (17/10/2022-21/10/2022) February 2023 = 4 nights (6/02/2023-10/02/2023) May 2023 = 4 nights (8/05/2023-12/05/2023)	WSP (2023)
Harp trapping	During the days the weather was cool temperatures (7-22°), moderate to gusty winds. The weather was cool, clear and calm at night.	One night with 3 harp traps at the Balickera Tunnel upstream portal. Set prior to sunset (11/05/2023)	WSP (2023)
Internal inspections of Balickera Tunnel for bat colony roost locations using an autonomous surface vessel (ASV)	February 2023: No rain, generally cool, clear and calm conditions during nights and warm temperatures (18-30°) with north-east winds during day. May 2023: During the days the weather was cool temperatures (7-22°), moderate to dusty winds. The weather was cool, clear and calm at night.	2 inspections of approx. 600 m travel distance from the upstream portal (7/02/2023 & 9/05/2023).	WSP (2023)
Diurnal bat box inspections	In July 2022, wet conditions with cool temperatures (8-18°) and moderate to strong winds.	10 bat box inspections completed during post remediation monitoring sessions (7/07/2022, 17/10/2022, 18/10/2022,	WSP (2023)

Survey Methods	Weather Conditions	Survey Effort / Dates	Completed by?
	In October 2022, showers, mild temperatures (12-24°) and moderate winds. In February 2023, no rain, generally cool, clear and calm conditions during nights and warm temperatures (18-30°) with north-east winds during day. May 2023, cool temperatures (7-22°), moderate to dusty winds during day, cool, clear and calm at night.	19/10/2022, 20/10/2022, 6/02/2023, 8/02/2023, 8/05/2023, 9/05/2023)	
Bridge Inspections	In July 2022, wet conditions with cool temperatures (8-18°) and moderate to strong winds. In October 2022, showers, mild temperatures (12-24°) and moderate winds. In February 2023, no rain, generally cool, clear and calm conditions during nights and warm temperatures (18-30°) with north-east winds during day. May 2023, cool temperatures (7-22°), moderate to dusty winds during day, cool, clear and calm at night.	Opportunistically at 3 locations during each monitoring season (specific dates not available).	WSP (2023)
Harp trapping	No rainfall	Traps at both portals from 30 minutes before sunset to 3 hours after sunset. 5 traps (10/03/2020) 6 traps (9/06/2020) 6 traps (7/09/2020) 4 traps (upstream portal only) (27/01/2021)	Eco Logical Australia (2021)
Ultrasonic recording	Some rainfall	Both portals all night (30 mins before sunset to 30 mins after sunrise) 8 nights (9-13/03/2020) 8 nights (9-13/06/2020) 8 nights (7-11/09/2020) 8 nights (25-29/01/2021) Total of 32 nights	Eco Logical Australia (2021)
Thermal imaging	No rainfall	Both portals from first bat emergence for 1 hour for 8 nights across all seasons for two nights (11 & 12 /03/2020).	Eco Logical Australia (2021)

Survey Methods	Weather Conditions	Survey Effort / Dates	Completed by?
Regional microbat assessment	Some rainfall	Visual inspection of 14 sites Ultrasonic recording at 6 sites (7-10/09/2020, 7-11/10/2020, 26-19/01/2021)	Eco Logical Australia (2021)

2.4.4.6 Hollow-bearing Tree Surveys

Hollow-bearing trees were located and recorded during threatened fauna habitat surveys across the Development Footprint. Target threatened fauna species which utilise tree hollows are detailed in **Table 2.10**. The results of the hollow-bearing tree surveys are recorded in **Table 2.11**.

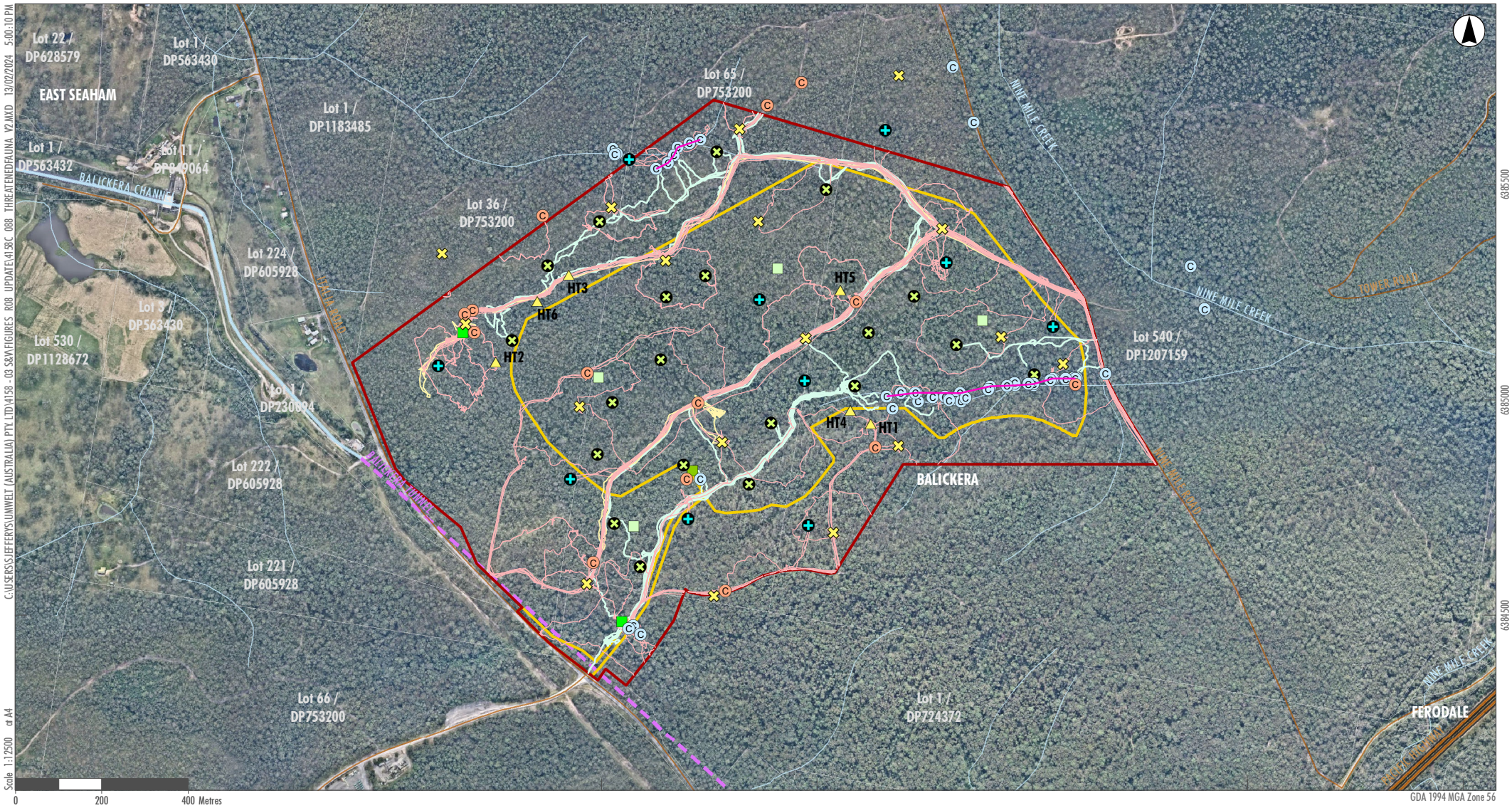
Table 2.10 Targeted threatened fauna which utilise tree hollows and their tree hollow requirements

Scientific Name	Common Name	Tree Hollow Requirements	Candidate species survey results (See Section 5.3.2 for additional information)
Callocephalon fimbriatum	Gang-gang cockatoo	Hollow bearing trees; Eucalypt tree species with hollows greater than 7 cm diameter.	No signs of breeding detected on site and a targeted search for potential nest trees is not required in accordance with the TBDC survey requirements.
Calyptorhynchus lathami lathami	South-eastern glossy-black cockatoo	Hollow bearing trees; Living or dead tree with hollows greater than 15 cm diameter and greater than 8 m above ground.	No signs of breeding activity detected on site and therefore a targeted search for potential nest trees is not required in accordance with the TBDC survey requirements.
Ninox connivens	Barking owl	Hollow bearing trees; Living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground.	No signs of breeding activity detected on site and therefore a targeted search for potential nest trees is not required. Large-hollow bearing trees suitable for the Barking Owl were located and stag watched as part of the targeted surveys completed for the Powerful Owl.
Ninox strenua	Powerful owl	Hollow bearing trees; Living or dead trees with hollow greater than 20 cm diameter	Species detected on site outside of breeding season on 19 & 28 March 2018. Signs of breeding activity were not detected on site. Step 1(c) of the TBDC survey methodology was undertaken to find potential nest trees and stag watching surveys were undertaken over two nights for each potential nest tree. No active nest trees were observed. BCD has raised that all of the large hollow-bearing trees with hollows >20 cm present have not been surveyed as potential nest trees for the Powerful Owl and have provided a geotagged photograph to demonstrate this.

Scientific Name	Common Name	Tree Hollow Requirements	Candidate species survey results (See Section 5.3.2 for additional information)
			The photograph provided corresponds to HT6 shown in **Figure 2.3** and described below in **Table 2.11**. This tree was subject to two nights of targeted stag watching for threatened owls on 12 & 13 June 2023.
Tyto novaehollandiae	Masked owl	Hollow bearing trees; Living or dead trees with hollows greater than 20 cm diameter.	No signs of breeding activity detected on site and therefore a targeted search for potential nest trees is not required. Large-hollow bearing trees suitable for the Masked Owl were located and stag watched as part of the targeted surveys completed for the Powerful Owl.

Table 2.11 Hollow bearing tree survey results

Hollow Bearing Tree Number	Hollow Size Class	Species	Diameter at Breast Height (DBH) (cm)	Notes
HT1	Large >20 cm	*Eucalyptus fibrosa*	100	Hollow count = 5 (not all large)
HT2	Medium 10 to 20 cm	*Eucalyptus canaliculata*	50	Hollow count = 2
HT3	Medium 10 to 20 cm	*Dead Tree*	70	Stag tree with fire scarring Hollow count = 2
HT4	Medium 10 to 20 cm	*Dead Tree*	100	Hollow count = 3
HT5	Medium 10 to 20 cm	*Angophora costata*	60	Hollow count = 2
HT6	Medium 10 to 20 cm	*Corymbia maculata*	90	Hollow count = 1



C:\USERS\SJEFFERYS\UMWELT (AUSTRALIA) PTY LTD\4158 - 03 S&W\FIGURES R08 UPDATE\4158C 088 THREATENEDFAUNA V2.MXD 13/02/2024 5:00:10 PM

Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Amphibian Aural Visual Survey Transects
- Amphibian Call Playback
- Nocturnal Call Playback
- Diurnal Bird Census Point
- Hollows-bearing Trees (>20cm hollow opening)
- Baited Remote Camera Locations 2018
- Baited Remote Camera Locations 2022
- Microbat Ultrasonic Call Recorder Locations 2018
- Microbat Ultrasonic Call Recorder Locations 2022
- Microbat Ultrasonic Call Recorder Locations 2023
- Spotlight Transect Locations March 2018
- Spotlight Transect Locations August 2019
- Spotlight Transect Locations November/December 2022

FIGURE 2.3

Threatened Fauna Survey Locations

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

2.5 Threatened Fungi

No threatened fungi species were identified as predicted or candidate threatened species.

2.6 Weather Conditions

All surveys were completed during suitable weather conditions. The weather conditions during fauna surveys are listed in **Table 2.6** and **Table 2.7.**

2.7 Limitations

No notable limitations were encountered during the completion of threatened species surveys.

3.0 Site Context

3.1 Assessment Area and Type

The 1500 m buffer Assessment Area, including the development footprint and the area of land within the 1500 m buffer zone surrounding the development footprint are shown on the Location Map in **Figure 1.2**. The Project has been assessed as a site-based assessment.

3.2 Landscape Features

Landscape features identified within the Subject Land are shown on the Site Map provided **as Figure 1.1** and landscape features in the assessment area are shown on the Location Map provided as **Figure 1.2**. Further information on landscape features is provided in **Section 3.2.1** to **Section 3.2.7**.

3.2.1 IBRA Bioregions and IBRA Subregions

The Subject Land is located within the NSW North Coast Interim Biogeographic Regionalisation for Australia (IBRA) bioregion. The Subject Land occurs on the boundary of the Upper Hunter and Karuah Manning IBRA subregions and is mostly located within the Upper Hunter IBRA subregion.

3.2.2 Rivers, Streams, Estuaries and Wetlands

The locations of the streams classified by stream order within the Subject Land are shown on the Site Map, provided as **Figure 1.1** and the locations of streams and rivers within the 1500 m buffer Assessment Area are shown on the Location Map, provided as **Figure 1.2**. The wetlands and estuaries downstream of the subject land are shown in **Figure 3.1**.

The Subject Land supports ephemeral tributaries of Caswells Creek and Nine Mile Creek. The northern part of the Subject land contains first and second order sections of Caswells Creek, which flows to an area historically diverted from Mosman Swamp (part of the Williams River catchment). Caswells Creek flows into the western section of Balickera Channel. Flows from the west part of the Channel are pumped into the eastern section at the Balickera pump station, which is located to the west of the Balickera Tunnel to Grahamstown Dam.

The south-eastern part of the Subject Land contains first and second order sections of Nine Mile Creek, which flows directly to the Grahamstown Dam.

The Grahamstown Dam overflows to the Hunter River catchment. The RAMSAR listed Hunter Estuary Wetlands – Kooragang Nature Reserve is downstream of the Grahamstown Dam spillway.

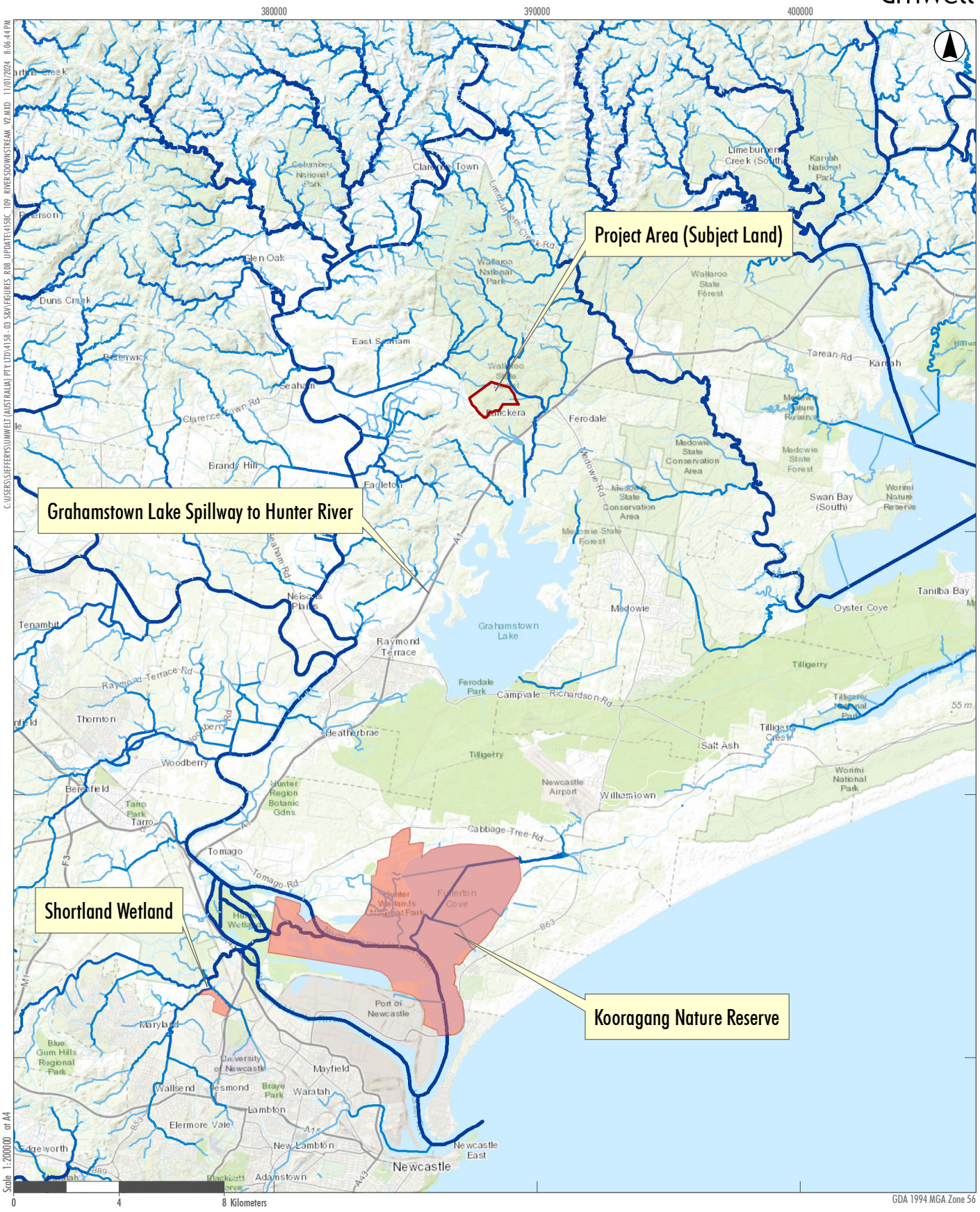


FIGURE 3.1

Rivers, Streams, Estuaries and Wetlands Downstream of the Subject Land

Image source: ESRI Basemap (2021) Data source: NSW FSDF (2022)

3.2.3 Habitat Connectivity

The Fauna Corridors for North East NSW dataset (NSW DPE 2010) shows the subject land as part of a regional fauna corridor, which narrows beyond the site to the south-west (Fauna Corridors layer shown in **Figure 3.2**).

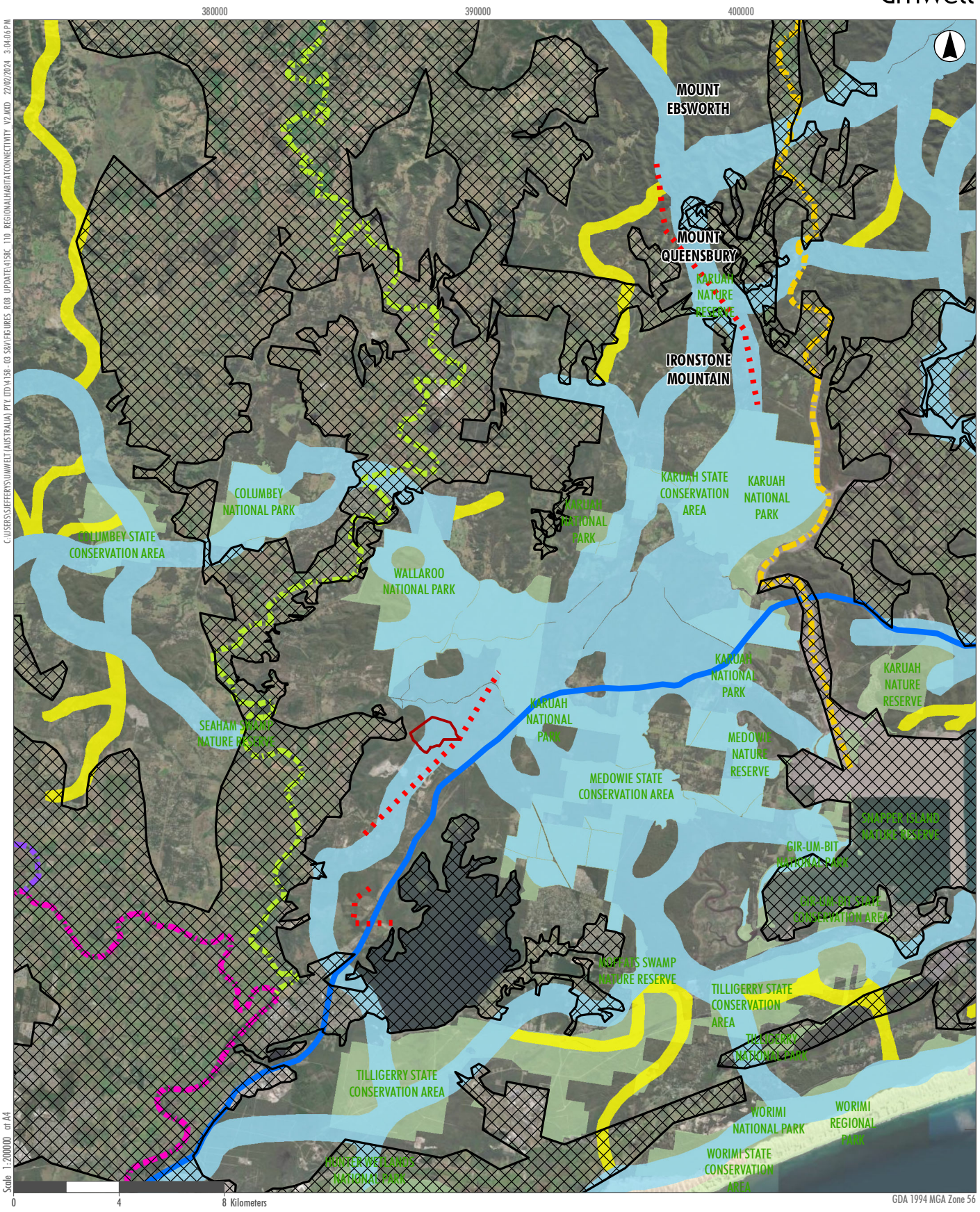
In a regional context, the Subject Land is part of a larger habitat patch which is notionally bounded by Karuah River in the east, the Pacific Highway in the south and the Williams River in the west. Connectivity in the north is provided through remnant vegetation within Mount Queensbury, Karuah Nature Reserve, Ironstone Mountain and the Karuah National Park to a larger area within the Mount Ebsworth region. Direct connectivity past the Pacific Highway is limited to under a bridge which flows to the Grahamstown Dam. Connectivity for mobile fauna species is likely to be achieved over the Pacific Highway, however this road provides a significant vehicle strike risk for terrestrial species such as the Koala.

Regionally, the Subject Land is surrounded by large areas of intact native vegetation within the Wallaroo State Forest, with direct connection to Wallaroo National Park, Karuah National Park and Karuah State Conservation Area. The Pacific Highway separates the Wallaroo State Forest and the Subject Land from other local conservation areas to the east of the Pacific Highway, such as parts of the Karuah National Park, the Medowie State Conservation Area, the Medowie Nature Reserve, Moffats Swamp Nature Reserve and Tilligerry State Conservation Area.

At a local scale, the existing land bridge pinch point associated with the Balickera Canal is approximately 1,200 m wide (distance between the two portals). It is recognised that the proposed development footprint would result in the creation of two new pinch points (approximately 410 m and 675 m wide) between the development footprint and the northern and southern portals of the Balickera tunnel and associated land bridge. Both proposed new pinch points are limited in longitudinal extent. The width of the remaining native vegetation between the development footprint and Italia Road will be reduced to a width of approximately 320 m and the retention of a wildlife corridor along Italia Road has been a key design consideration for the Project.

There are also two additional existing pinch points located to the west of Italia Road, around the northern and southern sides of the Seaham Quarry proposed and existing disturbance footprint. These existing pinch points have widths of approximately 170 m on the northern side and 210 m on the southern side of the Seaham Quarry footprint shown in **Figure 3.3**. It is considered that these existing pinch points are narrower than the new pinch points that would be created by the proposed Stone Ridge Quarry. It is considered that the Stone Ridge Quarry would not isolate any areas of habitat and would not create any pinch points that are narrower than the existing pinch points that already existing in a local connectivity context.
The disturbance footprint for the proposed Stone Ridge Quarry has also been further reduced as part of the response to submissions by a reduction of approximately 200 m width along the northern boundary and approximately 90 m width along the western boundary.

In addition to a reduced speed limit along the proposed quarry access road (15 m wide), the Project would implement driver education program and reduced speed limit for heavy vehicles travelling into or leaving the quarry on Italia Road as part of the Driver's Code of Conduct to reduce the potential for road related fauna impacts. It is also recommended that Council investigate reducing the speed limit (which is currently 80 km/hr) for all motorists along this section of Italia Road.



Legend

- Project Area (Subject Land)
- Local Habitat Linkage
- Broad Area Habitat Linkage Barrier
- National Parks (NPWS Estate)

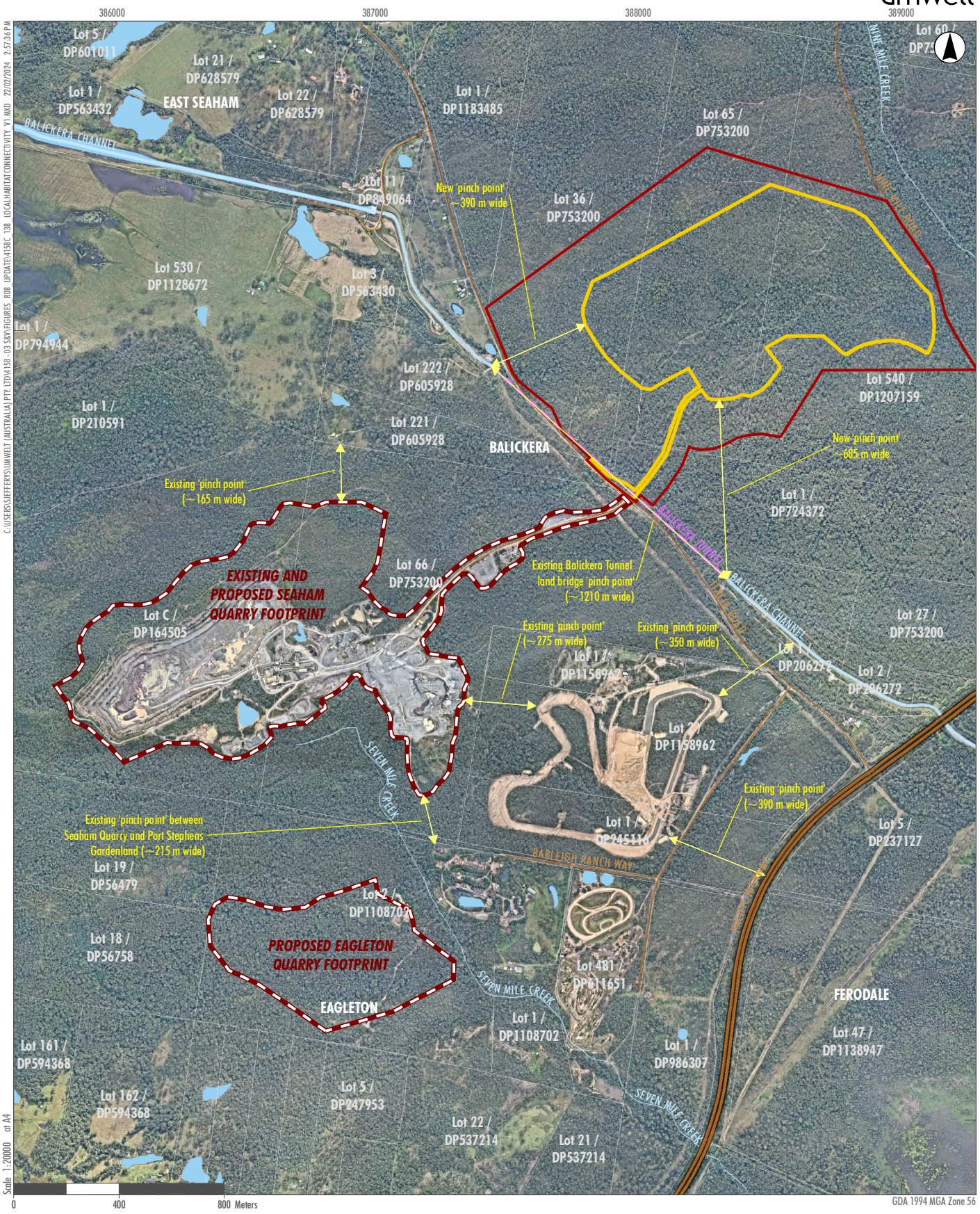
Fauna Corridors

- Regional
- Subregional
- Hunter River (likely barrier to connectivity)
- Karuah River (likely barrier to connectivity)
- Paterson River (likely barrier to connectivity)
- Williams River (likely barrier to connectivity)
- Pacific Highway (Barrier / risk of vehicle strike)

FIGURE 3.2

Regional Habitat Connectivity

Image Source: ESRI Basemap (2021) Data source: NSW FSDF (2022), DPE (2010), Umwelt (2022)



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Proposed Quarry Footprints
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Waterbody
- Lot Boundaries

FIGURE 3.3

Local Habitat Connectivity

Image source: Nearmap (August 2022) Data source: NSW FSDF (2022)

3.2.4 Karst, Caves, Crevices, Cliffs, Rocks or Other Geological Features of Significance

No karst, caves, crevices, cliffs, rocks or other geological features of significance were observed within the Subject Land.

3.2.5 Areas of Outstanding Biodiversity Value

The Subject Land and Assessment Area do not contain any areas of outstanding biodiversity value, as identified under the BC Act.

3.2.6 NSW (Mitchell) Landscapes

The Subject Land is mapped as occurring within the Newcastle Coastal Ramp Mitchell Landscape.

3.2.7 Additional Landscape Features Identified in the SEARS

There are no specific additional landscape features identified for assessment in the SEARs.

3.3 Native Vegetation Cover

The native vegetation cover within the Assessment Area was determined through site surveys of the Subject Land and aerial photograph interpretation using ArcMap software and Nearmap aerial imagery dated 6 August 2022. Field reconnaissance of areas of private land were not undertaken due to access constraints and is considered unnecessary due to the high quality of aerial imagery available.

Table 3.1 summarises the extent of native vegetation cover within the Assessment Area and **Figure 1.2** shows the extent of native vegetation cover within the 1500 m buffer Assessment Area.

Table 3.1 Native Vegetation Cover in the 1500 m Buffer Assessment Area

Native Vegetation Cover	
1500 m Buffer Assessment Area (ha)	1391.70
Total Area of native vegetation cover (ha)	1234.00
Percentage of native vegetation cover (%)	88.7
Class (0–10, >10–30, >30–70 or >70 %)	>70%

4.0 Native Vegetation, Threatened Ecological Communities and Vegetation Integrity

4.1 Native Vegetation Extent

The parts of the development footprint assessed as native vegetation for the purposes of the vegetation integrity surveys are shown in **Figure 4.1**.

4.1.1 Changes to the Mapped Native Vegetation Extent

No changes were observed during surveys to the mapped native vegetation extent visible on the aerial imagery utilised for this assessment.

4.1.2 Areas that are not Native Vegetation

No areas of non-native vegetation were identified.



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line

Subject Land Native Vegetation Cover

- Native Vegetation
- Cleared Land

FIGURE 4.1

Subject Land Native Vegetation Cover

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

4.2 Plant Community Types

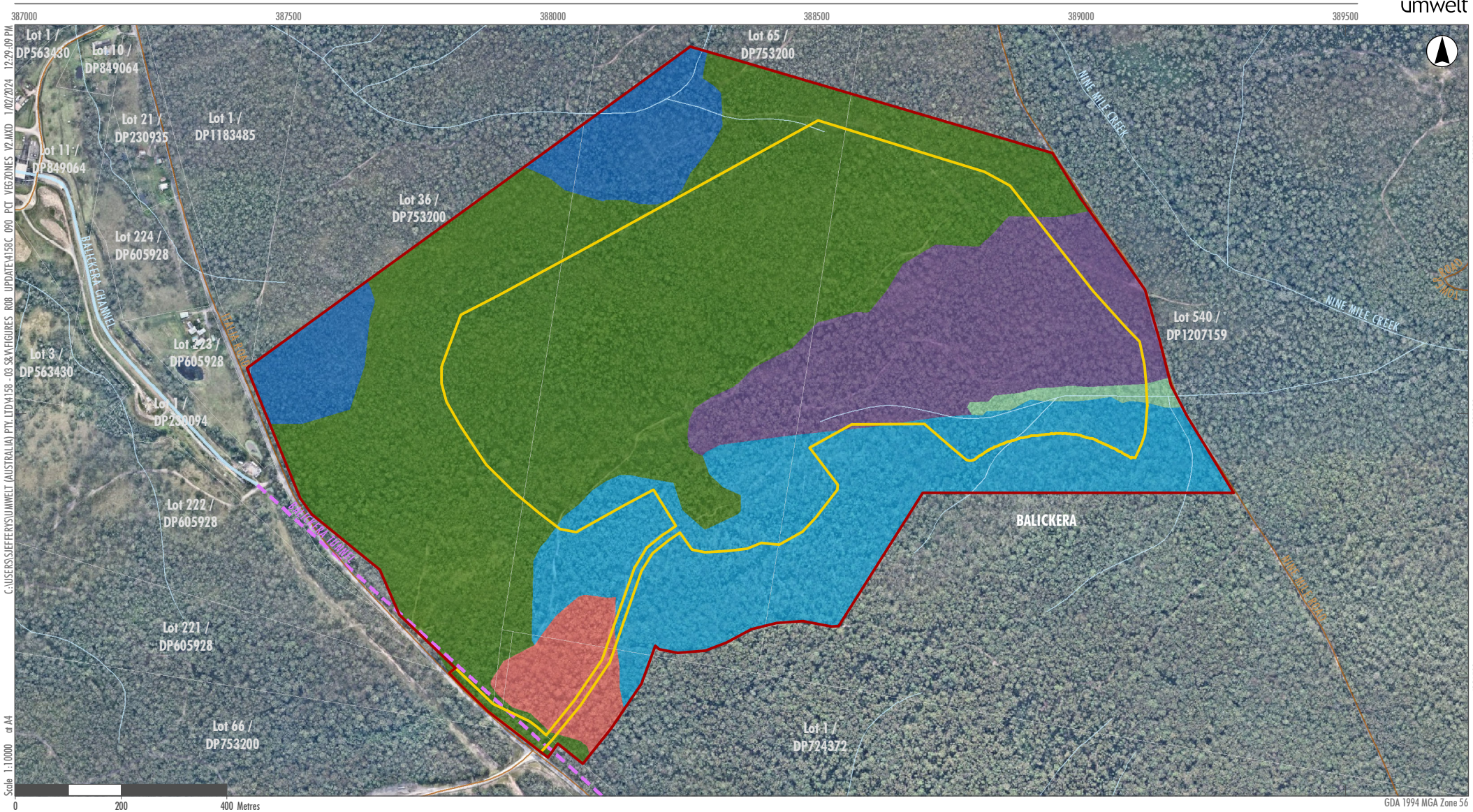
4.2.1 Overview of Plant Community Types Present

The PCTs identified in this assessment are based on the PCTs available prior to the release of the revised PCTs for eastern NSW and associated update to the BAM Calculator which occurred in February 2023. In-progress BAM-C assessments and projects with substantially progressed surveys are able to undertake this approach, in accordance with the transitional arrangements.

Vegetation within the development footprint has been assessed using BioNet Vegetation Classification tool as aligning to the PCTs identified within **Table 4.1** and mapped in **Figure 4.2**. Detailed descriptions of each PCT, including justification of PCT selections are provided in **Section 4.2.2**.

Table 4.1 Plant Community Types Identified within the Project Area

Current BAM-C PCT ID	Likely NSW VIS PCT Equivalent	PCT name	Vegetation Class	Vegetation Formation	Vegetation Condition Zone	NSW VIS Percentage Cleared Estimate	Extent within Project Area (ha)	Extent within Development Footprint (ha)
762	4042	Cabbage Gum open forest or woodland on flats of the North Coast	Grassy Woodlands	Coastal Valley Grassy Woodlands	Z1 PCT 762 Intact	70%	4.54	0.33
1590	3433	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests	Z2 PCT 1590 - Intact	48%	72.69	39.27
1618	3435	Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast	Dry Sclerophyll Forests (Shrubby Sub-formation)	Coastal Dune Dry Sclerophyll Forests	Z3 PCT 1618 - Intact	56%	1.15	0.88
1619	3581	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	Z4 PCT 1619 - Intact (Apple Variant)	45%	30.09	18.91
	3432	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	Z5 PCT 1619 – Intact (Apple – Ironbark Variant)		21.45	8.63
1716	3436	Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast.	Forested Wetlands	Coastal Swamp Forests	–Not applicable, PCT will not be directly impacted	66%	9.80	0
						Total area	**139.72**	**68.02**



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line

Plant Community Types

- PCT 762, Cabbage Gum open forest or woodland on flats of the North Coast - Intact
- PCT 1590, Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest - Intact
- PCT 1618, Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast - Intact
- PCT 1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple variant
- PCT 1619, Smooth-barked Apple-Red Bloodwood-Brown Stringybark-Hairpin Banksia heathy open forest of coastal lowlands - Intact / Apple-Ironbark variant
- PCT 1716, Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast – Regenerating

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

FIGURE 4.2

Plant Community Types and Vegetation Zones

4.2.2 Detailed Descriptions and Justification for Plant Community Types Present

4.2.2.1 PCT 762 Cabbage Gum Open Forest or Woodland on Flats of the North Coast

This PCT occurs as a tall forest in a sheltered location in the south-western corner of the development footprint. The characteristics of this PCT are described in **Table 4.2**.

Table 4.2 PCT 762 Sheltered Moderate to Good Condition Zone

PCT Name	Cabbage Gum Open Forest or Woodland on Flats of the North Coast
BAM C PCT Number (Decommissioned)	PCT 762
Likely Equivalent NSW VIS PCT Name and Number	4042 – Lower North Riverflat Eucalypt-Paperbark Forest
Vegetation Condition Zone	1 – moderate to good
Extent within development footprint (ha)	0.33 ha
Plots Completed	2 Plots (Plot 17, Plot 22)
Formation	Grassy Woodlands
Class	Coastal Valley Grassy Woodlands
Photo	
Location	This PCT occurs in the south-western part of the site in an area of lower lying topography associated with an unmapped drainage line.
Canopy Description	The canopy is characterised by *Eucalyptus tereticornis* with a mix of other eucalypts, including *Eucalyptus globoidea, Eucalyptus fibrosa* and *Eucalyptus canaliculata*.

PCT Name	Cabbage Gum Open Forest or Woodland on Flats of the North Coast
Sub-canopy	There is a tall subcanopy of paperbarks to approximately 10 m tall, composed of *Melaleuca styphelioides, Melaleuca sieberi, Melaleuca decora, Melaleuca nodosa* and *Callistemon salignus*.
Mid-storey Description	The mid-storey is sparse and characterised by *Leucopogon juniperinus, Breynia oblongifolia, Leptospermum polygalifolium, Acacia irrorata* and *Hibbertia aspera*.
Ground Cover Description	The groundcover is dominated by grasses and sedges, including *Aristida vagans, Carex inversa, Carex longebrachiata, Digitaria divaricatissima, Echinopogon caespitosus, Entolasia marginata, Entolasia stricta, Imperata cylindrica, Microlaena stipoides, Oplismenus aemulus, Schoenus apogon* and *Themeda triandra.*
Introduced Species	Exotic cover is very low and limited to the shrub and ground layers. Exotic species observed include *Lantana camara, Bidens pilosa* and *Senecio madagascarensis*.
PCT Allocation Justification	**General:** PCT 762 is described in the VIS as being constructed from a range of classification sources with only sparse descriptive data and no traceable plot data available. **Location:** PCT 762 is known to occur on coastal lowlands on poorly drained lower slopes, valley flats and creek banks. **Community structure:** PCT 762 is described in the VIS as having an upper stratum of trees with a tussock grass / graminoid ground layer. This description corresponds with the area assigned to this PCT. **Species assemblage:** The floristics description for PCT 762 in the VIS is depauperate, however *Eucalyptus tereticornis* is listed as a component of the canopy. While the name of PCT 762 suggests it includes or is dominated by Cabbage Gum (*Eucalyptus amplifolia*), the VIS only lists *Eucalyptus moluccana*, *Eucalyptus tereticornis* and *Angophora floribunda* as characteristic upper stratum species. **Other PCTs considered**: PCT 1716 Prickly-leaved paperbark forest on coastal lowlands of the Central Coast and Lower North Coast was considered and discounted due to a lack of *Eucalyptus tereticornis* in the canopy. PCT 1716 also has the structural characteristics of a tall shrubland or low open forest which is incongruous with the tall open forest present. PCT 1594 Cabbage Gum-Rough-barked Apple grassy woodland on alluvial floodplains of the lower Hunter, was considered, however is described in the VIS as being dominated by *E. amplifolia*. PCT 1749 Grey Gum – Red Gum – Paperbark shrubby open forest on coastal lowlands of the Northern Sydney Basin and Lower North Coast, was also considered and determined to be a poor fit, as it is part of the Hunter Lowland Redgum Forest TEC which is not present and is characterised by a canopy of *Eucalyptus punctata* in association with *Eucalyptus tereticornis* within a limited range restricted to riparian zones in the Rothbury and Stanford Merthyr areas. BCD have also provided the following advice on the selection of PCT 762: '*BCD has reviewed the floristic data for BAM plots P17 and P22, in the vegetation zone in question. Site data was compared with attributes for the following PCTs: 762, 1064, 1594, 1595, 1598 and 1749, all of which were selected based on geographic location and presence of Eucalyptus tereticornis. None of the PCTs are a good fit for the on-ground vegetation. Based on IBRA subregion, position in landscape, and presence on landscape PCT 762 is the best fit. PCT 1594 was also considered as an option, but the position in landscape, vegetation structure and presence of E. amplifolia makes this a weak match*'.

PCT Name	Cabbage Gum Open Forest or Woodland on Flats of the North Coast
	Current VIS PCT Characteristics: PCT 4042 is identified in the VIS lineage information as replacing PCT 762, which has now been decommissioned in the VIS. PCT 4042 is characterised as a very tall to extremely tall sclerophyll open forest with a sub-canopy of Melaleuca trees and a grassy and herbaceous ground cover on low-lying alluvial soils on the Central and North Coast. The characteristic tree species *Glochidion ferdinandi, Notelaea longifolia, Eucalyptus tereticornis, Eucalyptus globoidea, Corymbia maculata, Eucalyptus siderophloia* were recorded within plots. The sub-canopy contains a prominent layer of paperbarks and the landscape position for PCT 4042 of creek flats below 50 m ASL aligns with the mapped area.
BC Act Status	This PCT corresponds with the River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC. Further analysis of BC Act listed TECs is provided in **Section 4.3.2** and **Appendix C**.
EPBC Act Status	This PCT corresponds to the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions EEC listed under the EPBC in October 2022. Further analysis of EPBC Act listed TECs is provided **in Section 4.3.3**.

4.2.2.2 PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark Shrubby Open Forest

This PCT is described in **Table 4.3**, it occupies the largest area within the development footprint.

Table 4.3 PCT 1590 Moderate to Good Condition Zone

PCT Name	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest
BAM C PCT Number (Decommissioned)	PCT 1590
Likely Equivalent NSW VIS PCT Name and Number	3433 – Hunter Coast Foothills Spotted Gum-Ironbark Grassy Forest
Vegetation Condition Zone	2 - Intact
Extent within development footprint (ha)	39.27 ha
Plots Completed	6 Plots (Plot 8, Plot 9, Plot 10, Plot 16, Plot 20, Plot 21)
Formation	Dry Sclerophyll Forests (Shrub/grass sub-formation)
Class	Hunter-Macleay Dry Sclerophyll Forests

PCT Name	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest
Photo	
Location	PCT 1590 is the dominant vegetation type across the study area. It occurs along the ridge and foot slope areas of the development footprint.
Canopy Description	The canopy forms an open forest and is dominated by *Corymbia maculata*, which occurs in association with *Eucalyptus fibrosa, Eucalyptus umbra, Eucalyptus canaliculata*, *Eucalyptus siderophloia, Eucalyptus globoidea* and *Eucalyptus tereticornis*.
Sub-canopy	A tall mid-layer of regenerating eucalypts occurs, often in association with *Melaleuca nodosa*.
Mid-storey Description	A prominent shrub layer is present and is typically composed of *Pultenaea villosa, Leptospermum polygalifolium, Acacia longifolia, Hakea dactyloides, Acacia ulicifolia, Breynia oblongifolia, Indigofera australis, Jacksonia scoparia, Leucopogon juniperinus, Notelaea longifolia and Pittosporum multiflorum*.
Ground Cover Description	The ground cover is dominated by grasses and includes *Cyathochaeta diandra, Dichelachne crinita, Echinopogon caespitosus, Entolasia marginata, Entolasia stricta, Hibbertia aspera, Imperata cylindrica, Lomandra filiformis, Microlaena stipoides var. stipoides, Panicum simile, Poa affinis, Schoenus apogon* and *Themeda triandra*.
Introduced Species	*Lantana camara* and *Senecio madagascarensis* were observed in low densities.
PCT Allocation Justification	**General:** PCT 1590 is described in the VIS as a Spotted Gum (*Corymbia maculata*) dominated open forest. **Location:** PCT 1590 is known to occur on flats, low rises (hillslopes) and low ranges of the lower Hunter Valley and Central Coast. The development footprint matches these locational characters. **Community structure:** PCT 1590 is described in the VIS an open forest with a mid-storey composed of a diverse open shrub layer with various small climbers and a ground layer which is characteristically grassy with a mix of forbs, small ferns and other graminoids. This community structure is characteristic of the vegetation assigned to this PCT. **Species assemblage:**

PCT Name	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest
	PCT 1590 is characterised by the canopy species, *Corymbia maculata, Eucalyptus umbra* and *Eucalyptus fibrosa*. These are also typically the dominant canopy species throughout the areas mapped as this PCT. **Other PCTs considered**: There is a continuum of Spotted Gum / Ironbark dominated open forest PCTs that occur throughout the Hunter Valley and lower Mid-north Coast. This PCT was selected as it is considered to be the best floristic and locational match based on the results of the plot surveys completed. The following other Spotted Gum / Ironbark dominated PCTs were also considered and ruled out: **PCT 1589 – Spotted Gum – Broad-leaved Mahogany – Grey Gum grass – shrub open forest on Coastal Lowlands of the Central Coast** - Excluded due to presence of *Eucalyptus punctata* and lack of *Eucalyptus fibrosa* in the description and site locations outside of the Central Coast area. **PCT 1592 - Spotted Gum - Red Ironbark - Grey Gum shrub - grass open forest of the Lower Hunter** - Excluded due to lack poor floristic match including lack of Grey Gum (*Eucalyptus punctata*) in the canopy and lack or low density of many of the characteristic mid stratum species such as *Lissanthe strigosa* and *Podolobium ilicifolium*. **PCT 1593 – Red Ironbark - Spotted Gum - Prickly-leaved Paperbark shrubby open forest of the Lower Hunter** - Excluded due to poor floristic match, including lack of prominent areas dominated by *Eucalyptus fibrosa* with *Corymbia maculata* as a sub-dominant. Several of the common middle stratum species are also absent or in low density including B*ursaria spinosa, Pultenaea spinosa, Acacia parvipinnula, Correa reflexa* and *Macrozamia flexuosa.* **PCT 1600 - Spotted Gum - Red Ironbark - Narrow-leaved Ironbark - Grey Box shrub-grass open forest of the lower Hunter** - Excluded due to poor floristic match, including the absence of *Eucalyptus crebra* and *Eucalyptus moluccana* within the canopy. **PCT 1601 - Spotted Gum - Narrow-leaved Ironbark-Red Ironbark shrub - grass open forest of the central and lower Hunter** - Excluded due to poor floristic match, including lack of *Eucalyptus crebra* and many of the characteristic middle stratum species including *Daviesia ulicifolia, Lissanthe strigosa, Bursaria spinosa* and *Acacia parvipinnula*. **PCT 1602 Spotted Gum - Narrow-leaved Ironbark shrub - grass open forest of the central and lower Hunter** - Excluded due to poor floristic match, particularly the lack of *Eucalyptus crebra* in the canopy. **PCT 1604 Narrow-leaved Ironbark - Grey Box - Spotted Gum shrub - grass woodland of the central and lower Hunter** - Excluded due to poor floristic match, particularly the lack of *Eucalyptus crebra* and *Eucalyptus moluccana* in the canopy. **Current VIS PCT Characteristics:** PCT 1590 has a moderate relationship to PCT 3433, one of three PCTs with which it has been replaced. PCT 3433 is defined in the VIS as a tall to very tall sclerophyll open forest with dry and soft-leaved shrubs and a grassy ground cover on the undulating foothills of the Hunter Coast hinterland from Tuggerah to Stratford, and Lower Hunter Valley around Cessnock.

PCT Name	Spotted Gum – Broad-leaved Mahogany – Red Ironbark shrubby open forest
	The canopy of PCT 3433 is described as almost always including one or more ironbarks (*Eucalyptus fibrosa* or *Eucalyptus siderophloia*), very frequently with *Corymbia maculata*. Mahoganies (*Eucalyptus umbra* or *Eucalyptus acmenoides*) are also commonly present in the canopy. The canopy species listed for this PCT (except for *Eucalyptus acmenoides*), were encountered and are common throughout the development footprint. The sparse mid-stratum almost always includes one or more *Acacia* species, of which *Acacia falcata* and *Acacia ulicifolia* are the most frequent and abundant. The shrubs and small trees that complete the mid-stratum very frequently include *Daviesia ulicifolia* and commonly *Bursaria spinosa* and melaleucas (*Melaleuca nodosa* or *Melaleuca decora*). The mid-dense ground layer typically includes graminoids, forbs, twiners and a hardy fern. *Entolasia stricta* is almost always present with *Themeda triandra*, *Lobelia purpurascens*, *Microlaena stipoides*, *Aristida vagans*, *Lomandra multiflora* subsp. *multiflora*, *Glycine clandestina* and *Cheilanthes sieberi* subsp. *sieberi* all very frequent. This PCT occurs primarily on Permian sediments, however is also present on claystones of the Narrabeen Group. It is known from elevations below 130 metres asl in a moist climate with a mean annual rainfall of 1030 mm.
BC Act Status	This PCT does not correspond to any TECs listed under the BC Act. Consideration was given to the potential presence of the Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions endangered ecological community. This PCT corresponds with MU 65 Spotted Gum / Broad-leaved Mahogany/Red Ironbark moist shrubby open forest, of Somerville 2009. The site contains the differences noted in the final determination for MU 65, notably a canopy of *Corymbia maculata* dominating in association with *Eucalyptus umbra, Eucalyptus fibrosa, Eucalyptus siderophloia* and *Allocasuarina torulosa.* The shrub layer also exhibits more frequent occurrence of *Acacia ulicifolia, Breynia oblongifolia, Leucopogon juniperinus* and *Notelaea longifolia* and scarcity or absence of *Grevillea montana, Grevillea parviflora, Melaleuca decora*, and *Pultenaea spinosa*. Further detailed analysis of BC Act listed TECs is provided in **Section 4.3.2** and **Appendix C.**
EPBC Act Status	Consideration was given to the potential alignment of this PCT with the Central Hunter Valley Eucalypt Forest and Woodland CEEC. The presence of this CEEC was excluded based on lack of key diagnostic characteristics including lack of Permian geology and presence of high densities of *Eucalyptus fibrosa* (>2 trees per ha), a species which must be largely absent for the listed community to occur. Further detailed analysis of EPBC Act listed TECs is provided in **Section 4.3.3**.

4.2.2.3 PCT 1618 Smooth-Barked Apple - White Stringybark - Red Mahogany - Melaleuca Sieberi Shrubby Open Forest on Lowlands of the Lower North Coast

A description of PCT 1618 is provided in **Table 4.4**. This PCT occupies a narrow shallow drainage line in the south-easter section of the development footprint.

Table 4.4 PCT 1618 Moderate to Good Condition

PCT Name	Smooth-barked Apple – White Stringybark – Red Mahogany – *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast
BAM C PCT Number (Decommissioned)	PCT 1618
Likely Equivalent NSW VIS PCT Name and Number	3435 – Hunter Coast Lowland Flats Damp Forest
Vegetation Condition Zone	3 - Moderate to good
Extent within development footprint (ha)	0.88 ha
Plots Completed	1 Plot (Plot 12B)
Formation	Dry Sclerophyll Forests (Shrubby Sub-formation)
Class	Coastal Dune Dry Sclerophyll Forests
Photo	
Location	This PCT occurs in a shallow drainage line in the south-easter section of the development footprint.
Canopy Description	The canopy is dominated by *Eucalyptus resinifera* in association with *Angophora costata*, *Eucalyptus fibrosa, Eucalyptus globoidea* and *Eucalyptus tereticornis*.
Sub-canopy	A prominent tall shrub layer of Melaleucas is present and includes *Melaleuca decora, Melaleuca linariifolia, Melaleuca nodosa* and *Melaleuca sieberi*.
Mid-storey Description	The mid-storey is sparse and is composed of *Leptospermum polygalifolium, Acacia falcata, Sannantha crassa, Glochidion ferdinandi, Pultenaea retusa* and *Pultenaea villosa*.

PCT Name	Smooth-barked Apple – White Stringybark – Red Mahogany – *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast
Ground Cover Description	The ground cover is influenced by high moisture levels and is dominated by *Carex inversa, Echinopogon caespitosa, Entolasia marginata, Entolasia stricta, Imperata cylindrica, Microlaena stipoides, Panicum simile* and *Schoenus apogon*.
Introduced Species	No notable incursions of exotic flora were observed.
PCT Allocation Justification	**General:** This PCT is described in the VIS as an open forest with an overstorey dominated by *Angophora costata*. The mid-storey is identified as tall and shrubby, but also with a diversity of smaller shrubs. The ground layer is described as being dominated by grasses, graminoides and forbs. The above description provided in the VIS lacks detail, however the vegetation assigned to this PCT correlates well with PCT 3435 which replaces and has a strong association to this decommissioned PCT. **Location:** PCT 1618 is known to occur on coastal valley flats and low coastal hills of the lower North Coast and Central Coast, mainly on sandy substrates. This PCT occurs in association with a shallow drainage line within the development footprint. **Community structure:** PCT 1618 is described in the VIS an open forest with a tall mid-storey. This community structure is characteristic of the vegetation assigned to this PCT. **Species assemblage:** PCT 1618 is characterised by the canopy species, *Angophora costata, Eucalyptus globoidea* and *Eucalyptus resinifera.* These species were all observed within the single plot surveyed. The mid-storey species, *Melaleuca sieberi, Melaleuca nodosa, Melaleuca linariifolia, Leptospermum polygalifolium, Pultenaea retusa and Pultenaea villosa* are listed within the VIS for this PCT and were recorded within the plot sampled. **Other PCTs considered**: PCT 762 was considered due to the presence of *Eucalyptus tereticornis*, however was discounted due to the low abundance of this species and the presence of the other dominant eucalypts. **Current VIS PCT Characteristics:** PCT 1618 has been decommissioned (but remains the only relevant PCT in BAM-C) and replaced by PCT 3435 and PCT 3998. PCT 3998 is aligned with Eucalyptus robusta which was not observed. PCT 3435 corresponds well with the vegetation assigned to PCT 1618, having a mid to high canopy composed of *Angophora costata*, *Eucalyptus resinifera*, *Eucalyptus globoidea* with lower densities of *Corymbia maculata, Eucalyptus fibrosa, Eucalyptus umbra* and *Eucalyptus tereticornis*.
BC Act Status	It is considered that this PCT corresponds to River-flat Eucalypt Forest on Coastal Floodplains EEC. Further analysis of BC Act listed TECs is provided in **Section 4.3.2** and **Appendix C**.
EPBC Act Status	This PCT corresponds to the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions EEC listed under the EPBC in October 2022. Further analysis of EPBC Act listed TECs is provided in **Section 4.3.3**.

4.2.2.4 PCT 1619 Smooth-Barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia Heathy Open Forest of Coastal Lowlands

PCT 1619 has been assessed in two condition zones, approximately dissected by a watercourse in the southern section of the site which forms a tributary of Nine Mile Creek. Both condition zones are in moderate to good condition, however Condition Zone 4 is described in **Table 4.5** as an Apple (*Angophora costata*) variant and Condition Zone 5 is described in **Table 4.6** as a Hunter Coast Foothills Apple-Ironbark (*Angophora costata – Eucalyptus fibrosa*) variant. These variants align well to separate updated PCTs in the VIS which will eventually replace the decommissioned PCT 1619 available in BAM-C.

Table 4.5 PCT 1619 Moderate to Good Condition – Apple Variant

PCT Name	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia Heath Open Forest of Coastal Lowlands
BAM C PCT Number (Decommissioned)	PCT 1619
Likely Equivalent NSW VIS PCT Name and Number	3581 – Hunter Coast Foothills Apple Forest
Vegetation Condition Zone	4 - Moderate to good (apple variant)
Extent within development footprint (ha)	18.91 ha
Plots Completed	4 Plots (Plot 11, plot 13, Plot 15, Plot 24)
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)
Class	Sydney Coastal Dry Sclerophyll Forests
Photo	
Location	This PCT condition zone is located on footslopes and sandy soils as a single patch in the central and south-eastern parts of the site, to the north of the watercourse which forms a tributary of Nine Mile Creek.

PCT Name	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia Heath Open Forest of Coastal Lowlands
Canopy Description	The canopy is dominated by *Angophora costata, Eucalyptus globoidea* and *Corymbia gummifera* in association with *Eucalyptus resinifera, Eucalyptus piperita* and *Eucalyptus canaliculata*. *Eucalyptus fibrosa* is notably absent.
Sub-canopy	The subcanopy, where present is mostly composed of *Allocasuarina littoralis*, *Allocasuarina torulosa* and eucalypts saplings.
Mid-storey Description	The mid-storey is heathy and dominant species include *Leptospermum polygalifolium, Glochidion ferdinandi, Pultenaea paleacea, Banksia spinulosa, Lambertia formosa, Callistemon salignus, Pultenaea villosa* and *Dillwynia retorta*.
Ground Cover Description	The ground cover is dominated by grasses, graminoides and sedges including *Anisopogon avenaceus, Entolasia stricta, Lomandra obliqua, Ptilothrix deusta, Imperata cylindrica, Themeda triandra, Cyathochaeta diandra, Microlaena stipoides* and *Xanthorrhoea latifolia*.
Introduced Species	No notable incursions of exotic flora species were observed.
PCT Allocation Justification	**General:** PCT 1590 is described in the VIS as an open forest dominated by *Angophora costata* and *Corymbia gummifera* with a shrubby mid-storey and a ground layer of grasses, graminoids and scattered forbs. These characteristics resemble the vegetation mapped as this PCT condition zone. **Location:** The VIS describes this PCT as occurring on coastal lowlands and low ranges of the lower North Coast and Central Coast on sandy substrates. These characteristics resemble the vegetation mapped as this PCT condition zone. **Community structure:** PCT 1619 is described as an open forest with a shrubby understorey. These structure attributes correspond to the vegetation within the development footprint mapped as this PCT. **Species assemblage:** PCT 1619 is characterised by the canopy species, *Angophora costata, Corymbia gummifera* and *Eucalyptus capitellata.* All three species are present, with Eucalyptus capitellata being present in low densities only and not typically recorded in the plots sampled. The majority of the middle stratum and ground stratum species identified in the VIS for this PCT are also present. **Other PCTs considered:** PCT 1618 was considered however PCT 1619 is a better floristic match due to the presence of *Corymbia gummifera* and *Eucalyptus capitellata*. **Current VIS PCT Characteristics:** PCT 1619 has a moderate relationship to PCT 3581, which is one of three PCTs which has replaced it. PCT 3581 is defined in the VIS (NSW DPE 2024) as a tall to very tall sclerophyll open forest with a dry shrub layer and a grassy ground layer found on enriched sedimentary hills and rises on coastal plains between Gosford and Wallis Lake.

PCT Name	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia Heath Open Forest of Coastal Lowlands
	The canopy of PCT 3581 is identified as almost always including a high cover of *Angophora costata* with *Corymbia gummifera* and commonly *Eucalyptus piperita*. Frequently occurring shrubs include *Persoonia linearis, Podolobium ilicifolium, Persoonia levis, Breynia oblongifolia, Leptospermum polygalifolium* and *Acacia* spp.
BC Act Status	This PCT does not correspond to any TECs listed under the BC Act. Further analysis of BC Act listed TECs is provided in **Section 4.3.2** and **Appendix C**.
EPBC Act Status	This PCT does not correspond to any TECs listed under the EPBC Act. Further analysis of EPBC Act listed TECs is provided in **Section 4.3.3**.

Table 4.6 PCT 1619 Moderate to Good Condition Apple-Ironbark Variant

PCT Name	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia Heath Open Forest of Coastal Lowlands
BAM C PCT Number (Decommissioned)	PCT 1619
Likely Equivalent NSW VIS PCT Name and Number	3432 – Hunter Coast Foothills Apple-Ironbark Grassy Forest
Vegetation Condition Zone	5 - Moderate to good (apple / ironbark variant)
Extent within development footprint (ha)	8.63 ha
Plots Completed	3 Plots (Plot 12, plot 14, Plot 23)
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)
Class	Sydney Coastal Dry Sclerophyll Forests
Photo	

PCT Name	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia Heath Open Forest of Coastal Lowlands
Location	This PCT is located on footslopes and sandy soils as a single patch in the central and south-eastern parts of the site.
Canopy Description	The canopy is dominated by *Angophora costata*, *Corymbia gummifera, Eucalyptus fibrosa, Eucalyptus globoidea, Eucalyptus resinifera* and *Eucalyptus globoidea*.
Sub-canopy	The subcanopy, where present is mostly composed of *Allocasuarina littoralis* and eucalypt saplings.
Mid-storey Description	The mid-storey is heathy and dominant species include *Daviesia ulicifolia, Dillwynia retorta, Dodonaea triquetra, Leptospermum polygalifolium*, *Leptospermum trinervium, Pultenaea paleacea, Pultenaea villosa, Breynia oblongifolia, Acrotriche divaricata, Notelaea longifolia* and *Glochidion ferdinandi*.
Ground Cover Description	The ground cover is dominated by grasses, graminoides and sedges including *Carex inversa, Dianella caerulea, Echinopogon caespitosus, Entolasia marginata, Entolasia stricta, Gonocarpus teucrioides, Imperata cylindrica, Lobelia purpurascens, Lomandra obliqua, Microlaena stipoides, Panicum simile, Ptilothrix deusta* and *Themeda triandra*.
Introduced Species	Very low levels of *Senecio madagascarensis* were observed.
PCT Allocation Justification	**General:** PCT 1590 is described in the VIS as an open forest dominated by *Angophora costata* and *Corymbia gummifera* with a shrubby mid-storey and a ground layer of grasses, graminoids and scattered forbs. These characteristics resemble the vegetation mapped as this PCT condition zone, with the addition of the notable presence of *Eucalyptus fibrosa*. **Location:** The VIS describes this PCT as occurring on coastal lowlands and low ranges of the lower North Coast and Central Coast on sandy substrates. These locational characteristics resemble the vegetation mapped as this PCT condition zone, however the soils appear to have lower levels of sand. **Community structure:** PCT 1619 is described as an open forest with a shrubby understorey. These structure attributes correspond to the vegetation within the development footprint mapped as this PCT. **Species assemblage:** PCT 1619 is characterised by the canopy species, *Angophora costata, Corymbia gummifera* and *Eucalyptus capitellata. Angophora costata* and *Corymbia gummifera* are both present with Eucalyptus capitellata being absent or in very low densities. **Other PCTs considered:** PCT 1618 was considered however PCT 1619 is a better floristic match due to the presence of *Corymbia gummifera* and *Eucalyptus capitellata* in that PCT. **Current VIS PCT Characteristics:** PCT 1619 is described as having a moderate relationship to PCT 3432, which is one of three PCTs which has replaced it. PCT 3432 is considered to strongly represent the vegetation assigned to this PCT and condition zone.

PCT Name	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia Heath Open Forest of Coastal Lowlands
	PCT 3432 is defined in the VIS (NSW DPE 2024) as a tall to very tall sclerophyll open forest with a sparse dry shrub layer and grassy ground cover found on coastal hills, rises and escarpment foot slopes between Wyong and The Branch on the Lower North and Hunter coasts. The canopy of PCT 3432 is identified as having a frequent occurrence of *Angophora costata* in association with *Corymbia gummifera, Corymbia maculata* or occasionally *Eucalyptus umbra*. There are five ironbark species which have been recorded for PCT 3432, with only *Eucalyptus fibrosa* being common. Stringybarks have been described as collectively common, with no single species occurring more than occasionally. Many of the shrub and ground covers recorded in PCT 3432 are also present.
BC Act Status	This PCT does not correspond to any TECs listed under the BC Act. Further analysis of BC Act listed TECs is provided in **Section 4.3.2** and **Appendix C.**
EPBC Act Status	This PCT does not correspond to any TECs listed under the EPBC Act. Further analysis of EPBC Act listed TECs is provided in **Section 4.3.3**.

4.2.2.5 PCT 1716 Prickly-Leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast.

This PCT is located on the northern part of the Project Area in an exposed location with a north-facing aspect. It appears to be in a regenerating condition following likely historically logging and bushfires. This PCT is described in **Table 4.7**.

Table 4.7 PCT 1716 Exposed Regenerating Condition Zone

PCT Name	Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast
BAM C PCT Number (Decommissioned)	PCT 1716
Likely Equivalent NSW VIS PCT Name and Number	3436 – Hunter Coast Sandy Creekflat Paperbark Scrub
Vegetation Condition Zone	6 - Regenerating
Extent within development footprint (ha)	The development footprint has been modified to avoid removal of this PCT. There are no areas of this PCT within the development footprint.
Plots Completed	2 Plots (Plot 07, Plot 19)
Formation	Forested Wetlands
Class	Coastal Swamp Forests

PCT Name	Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast
Photo	
Location	This PCT occurs in the northern part of the site in areas of low-lying topography which are poorly draining.
Canopy Description	There is a sparse eucalypt canopy composed of *Eucalyptus tereticornis*, *Eucalyptus siderophloia* and *Corymbia maculata* to approximately 10 m high.
Sub-canopy	The sub-canopy is composed of a dense *Melaleuca nodosa* scrub to approximately 4 m high.
Mid-storey Description	The mid-storey is composed of *Callistemon salignus, Acacia implexa* and *Leptospermum polygalifolium*.
Ground Cover Description	The understorey is dominated by sedges and grasses including *Entolasia marginata, Haloragis heterophylla, Microlaena stipoides, Panicum simile, Ptilothrix deusta, Schoenus apogon* and *Themeda triandra*.
Introduced Species	No notable incursions of exotic flora species were observed.
PCT Allocation Justification	**General:** PCT 1716 is described in the VIS as a myrtaceous; seasonally wet tall shrubland/low open forest with emergent Eucalypts. The main canopy may contain a variety of species in association with M. nodosa. The ground stratum is relatively dense and is dominated by grasses. This community is found on poorly drained areas on the undulating coastal lowlands from Wamberal north to Yarratt State Forest. This community typically occurs on unconsolidated sediments or on fine-grained sedimentary geologies at elevations up to 100 m. The vegetation mapped as this PCT is consistent with this general description provided for the PCT. **Location:** Within the development footprint PCT 1716 occurs in low lying poorly drained areas. **Community structure:** PCT 1716 is described in the VIS as a tall shrubland to low open forest. This description corresponds with the area assigned to this PCT.

PCT Name	Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast
	Species assemblage: The area allocated to this PCT corresponds with the VIS floristics description which identifies a variety of species occurring in association with Melaleuca nodosa, including emergent eucalypts. *Melaleuca nodosa* is dominant and *Eucalyptus tereticornis*, *Eucalyptus siderophloia* and *Corymbia maculata* occur as emergent eucalypts. **Other PCTs considered:** PCT 1715 Prickly-leaved Paperbark - Flax-leaved Paperbark swamp forest on poorly drained soils of the Central Coast was considered and discounted as it is described as occurring in the Tuggerah Lakes and Wamberal areas, typically on Narrabeen Sandstone. PCT 762 Cabbage Gum Open Forest or Woodland on Flats of the North Coast was considered. This PCT occurs within the development footprint in association with a sheltered drainage line. PCT 762 is typically a tall forest rather than a tall shrubland and has a more prominent eucalypt canopy. **Current VIS PCT Characteristics:** PCT 3436 is identified as in the VIS lineage information as replacing PCT 1716, which has now been decommissioned in the VIS. PCT 3436 accords well with the vegetation assigned to PCT 1716 in relation to both floristic and locational characters. The VIS describes the main diagnostic feature of PCT 3436 as a closed canopy that almost always is completely dominated by *Melaleuca nodosa*.
BC Act Status	This PCT corresponds with the Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion EEC. Further analysis of BC Act listed TECs is provided in **Section 4.3.2** and **Appendix C**.
EPBC Act Status	This PCT corresponds to the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions EEC listed under the EPBC Act which was listed in October 2022. Further analysis of EPBC Act listed TECs is provided in **Section 4.3.3**.

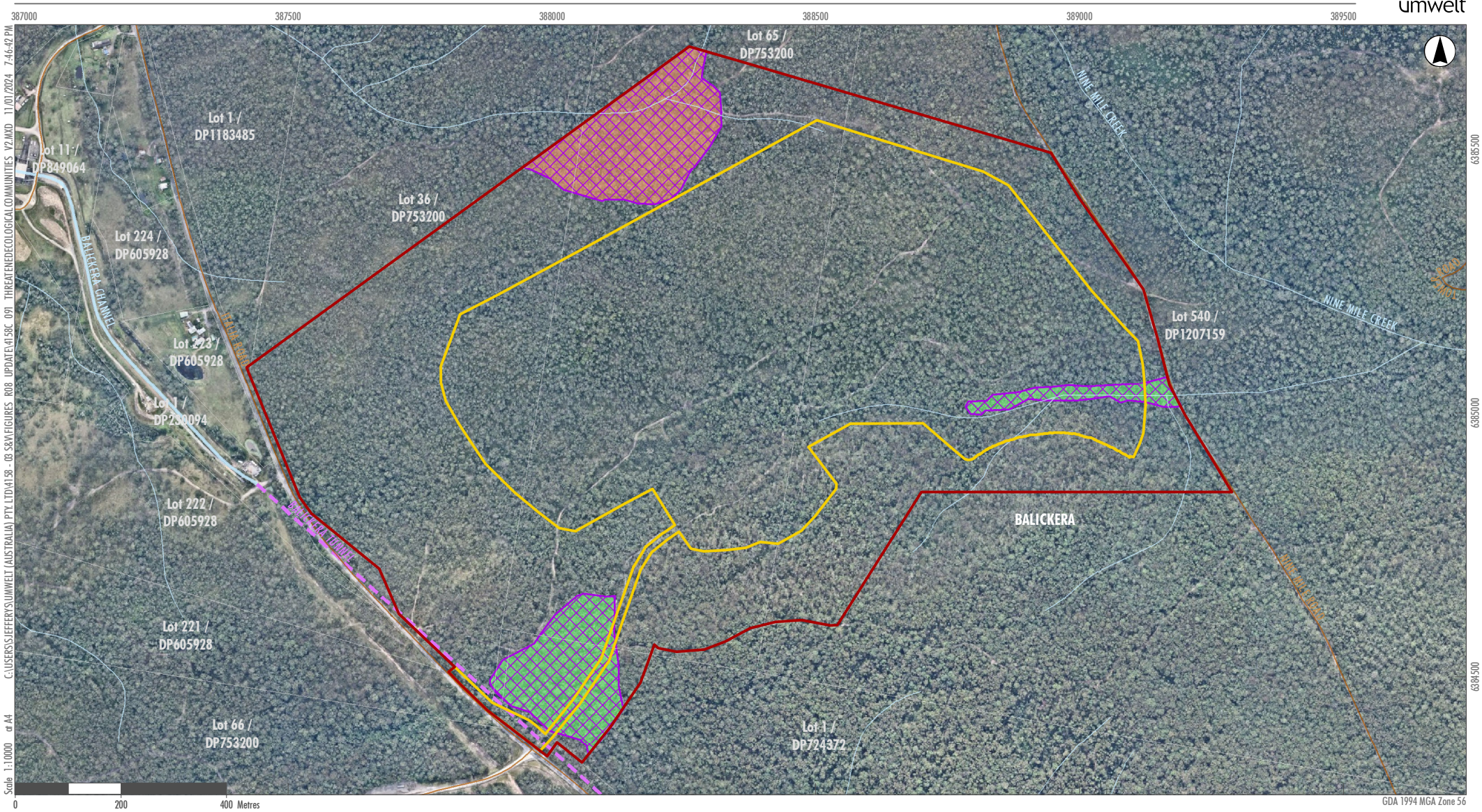
4.3 Threatened Ecological Communities

4.3.1 Threatened Ecological Community Summary

A summary of the TECs observed within the development footprint are listed in **Table 4.8** and the extent of each TEC is mapped in **Figure 4.3**. Detailed assessments of potentially occurring TECs are provide in **Section 4.3.2** for TECs listed under the BC Act and **Section 4.3.3** for TECs listed under the EPBC Act.

Table 4.8 Summary of TECs within the Development Footprint

Corresponding TEC Name	Profile ID (from TBDC)	Act and Listing Status	Associated PCTs and vegetation condition zones within the development footprint	Area (ha)
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	10787	Endangered Ecological Community Listed under the BC Act	PCT 762 Intact	0.33 ha
			PCT 1618 Intact	0.88 ha
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	N/A	Endangered Ecological Community Listed under the EPBC Act	PCT 762 Intact PCT 1618 Intact	1.21 ha



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line

EPBC TEC

- Subtropical eucalpyt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions

BC TEC

- River Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney and South East Corner Bioregions
- Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion

FIGURE 4.3

Threatened Ecological Communities within the Subject Land

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

4.3.2 Biodiversity Conservation Act Threatened Ecological Communities

Umwelt has undertaken targeted surveys and assessments for threatened ecological communities (TECs) listed under the BC Act, within the subject land. The following TECs listed within the BC Act were considered to have potential to occur within the subject land:

- Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC
- Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions EEC
- Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions EEC
- Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions EEC
- Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions EEC
- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC
- Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion EEC
- Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC.

A detailed analysis of the potential occurrence of each threatened ecological community is provided in Section 1 of **Appendix C** and includes assessments of the relevant final determinations published by the NSW Scientific Committee. The assessments undertaken have identified that the following two threatened ecological communities listed under the BC Act are present within the subject land:

- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions, which corresponds to parts of the subject land mapped as PCT 762 and PCT 1618.
- Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion, which corresponds to the parts of the Project Area mapped as PCT 1716. The development footprint has been modified to avoid direct impacts to areas of PCT 1716 and associated areas of this EEC as listed under the BC Act.

4.3.3 Environment Protection and Biodiversity Conservation Act Threatened Ecological Communities

The following TECs listed within the EPBC Act were considered to have potential to occur within the subject land:

- Central Hunter Valley eucalypt forest and woodland.
- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland.
- Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions.

A detailed analysis of the potential occurrence of each threatened ecological community is provided in Section 2 of **Appendix C** and includes assessments of the relevant approved conservation advice and key diagnostic characteristics published by the Australian Government. The assessments undertaken have determined that one nationally listed endangered ecological community, Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions, occurs with the subject land and development footprint. This TEC is represented within the development footprint by PCT 762 and PCT 1618. Within the Project Area, PCT 1716 also corresponds to this TEC, however the development footprint has been modified to avoid impacts to this PCT.

4.4 Plant Community Type Condition Zones

A description of each PCT vegetation condition zone within the development footprint is provided in **Section 4.2** of this Report. A map of the PCT vegetation condition zones is provided in **Figure 4.2** and the details of each PCT condition zone, including area, patch size class and the BAM survey plots required and completed are provided in **Table 4.9**.

Table 4.9 PCT Condition Zones and Patch Sizes

Vegetation Condition Zone	PCT ID number and name	Condition / other defining feature	Area (ha)	Patch size class (select multiple if areas of native vegetation are discontinuous)	No. vegetation integrity plots required	No. vegetation integrity plots completed	No. vegetation integrity plots used in assessment	Plot IDs of vegetation integrity plots used in assessment
1	762 Cabbage Gum open forest or woodland on flats of the North Coast	Intact	0.33	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	1	2	2	Plot 17 Plot 22
2	1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Intact	39.27	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	4	6	6	Plot 8 Plot 9 Plot 10 Plot 16 Plot 20 Plot 21
3	1618 Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	Intact	0.88	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	1	1	1	Plot 12B
4	1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Intact / Apple variant	18.91	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	4	4	4	Plot 11 Plot 13 Plot 15 Plot 24
5	1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Intact / Apple-Ironbark Forest variant	8.63	☐ <5 ha ☐ 5–24 ha ☐ 25–100 ha ☒ >100 ha	3	3	3	Plot 12 Plot 14, Plot 23

4.5 Vegetation Integrity (Vegetation Condition)

4.5.1 Vegetation Integrity Survey Plots

Details on the number of BAM plots (floristic and vegetation integrity survey plots) required and completed for each vegetation condition zone, in accordance with Table 3 of the BAM, are provided in **Table 4.10**. The vegetation integrity plot survey locations are shown in **Figure 2.1** and the vegetation integrity plot survey data is provided in **Appendix D**.

4.5.2 Vegetation Integrity Scores

The vegetation integrity condition scores for the BAM Plots completed are provided in **Table 4.10**. This table represents the combined scores from all plots completed for each vegetation condition zone, including the vegetation integrity score and the presence of hollow bearing trees.

Table 4.10 Vegetation Integrity Condition Scores

Plant Community Type No.	Vegetation zone description (condition class)	Composition condition score	Structure condition score	Function condition score	Vegetation integrity score	Hollow bearing trees present?
762	Intact	88.3	74.8	74.1	78.8	No
1590	Intact	97	62.7	66.9	74.1	Yes
1618	Intact	87.9	76.7	70.7	78.1	No
1619	Intact /Apple variant	80.8	69	63.5	70.7	Yes
	Intact / Apple – Ironbark variant	89.3	81.8	71.5	80.5	No

4.5.3 Use of Benchmark Data

The standard BAM-C benchmark values were used in this assessment for each vegetation zone.

4.6 Groundwater Dependant Ecosystems

The revised Project Groundwater Impact Assessment (GIA) prepared by GHD (2024), identifies that the most conservative predicted radius of drawdown for Stage 8 (i.e., 468 m, based on Kmax) was used to assess the impacts to existing groundwater dependant ecosystems. The revised Project Groundwater Impact Assessment (GIA) prepared by GHD (2024) is provided as part of the response to submissions documentation. Probable vegetation groundwater dependent ecosystems and associated probability classes are mapped in **Figure 4.4**.



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line

GDE Probability

- High
- Medium
- Low
- Cleared Land

Stage 8 Predicted Groundwater Drawdown based on most conservative hydraulic conductivity value (Kmax = 9.2x103m/day)*

- 200m – 3.47m drawdown
- 250m – 1.76m drawdown
- 300m – 0.86m drawdown
- 380m – 0.12m drawdown

* Groundwater drawdown mapping is based on data provided in the Groundwater Impact Assessment prepared by GHD Pty Ltd

FIGURE 4.4

Probable Vegetation Groundwater Dependent Ecosystems mapped by probability class (DPE Water)

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), DPE (2022), Umwelt (2023)

GHD (2024) identify that the background document for the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016 (DPI 2016a in GHD 2024) refers to the High Priority Groundwater Dependent Ecosystem Map (DPI 2016b in GHD 2024) which was reviewed to identify any high priority GDEs within the New England Fold Belt Coast Groundwater Source.

GHD (2024) identify that the nearest high priority GDEs are located near the Williams River to the north and east of Seaham, approximately eight and five kilometres from the Project. These high priority GDEs are well outside the predicted radius of drawdown and will not be impacted by the Project.

GHD (2024) have also reviewed the Probable Vegetation Groundwater Dependent Ecosystems – Hunter/Central Rivers dataset (DPI Water 2022) to identify vegetation types that have a probability of being groundwater dependent ecosystems. The dataset indicates that there are areas of high, medium and low probability GDEs in the area with, high probability terrestrial type GDEs being associated with Nine Mile Creek to the north and north-east of the project, and Caswell's Creek and Williams Creek to the west.

Within the Project Area it is considered that PCT 1719 Prickly-leaved Paperbark Forest on the Coastal Lowlands of the Central Coast and North Coast, shown in **Figure 4.2**, corresponds to the areas mapped as high probability GDEs, and this PCT has now been removed from the development footprint and will not be directly impacted.

GHD (2024) identify that based on the standing water levels measured in groundwater monitoring bores (n= 10), the average depth to groundwater in the fractured rock aquifer at the project site is between 7.31 and 23.3 m below ground level. Average groundwater levels in monitoring bores in the northern part of the site where the high probability GDEs are present (within the maximum extent of predicted drawdown), are between approximately 7 and 13 metres below ground level. However, groundwater in these areas is actually significantly deeper (i.e., 20 m below the surface) due to the presence of an extensive zone of low permeability dacite which acts as an aquitard, confining groundwater to deeper, more permeable units at a depth (see Figure 3.5 in GHD 2024).

GHD (2024) identify that drawdown in the fractured rock aquifer (assuming the most conservative drawdown prediction) in the northern part of the Project Area containing the high probability GDEs would be in the order of 0 to 5 m. Given the depth to groundwater in this area (i.e., 20 m below surface), it is evident that the presence of high probability GDEs is due to shallow groundwater in the overlying alluvial/colluvial material (recharged from creeks and rainfall), rather than the deeper, fractured rock aquifer, from which it is disconnected in this area. Therefore, the modelled drawdown of groundwater in the deeper, fractured rock system is not predicted to adversely impact these high probability GDEs.

The Project is expected be completed after 30 years. With time, groundwater levels in the aquifer surrounding the project will recover until equilibrium within the system occurs, and a pit lake forms within the final voids. Once the system is in equilibrium, the flux of water within the pit lake will only be from rainfall and evaporation. During the recovery stage however, groundwater inflows will occur, however any enhanced recharge that occurs as a result of the quarry in the post closure phase would reduce the time required for groundwater levels to recover.

5.0 Habitat Suitability for Threatened Species

5.1 Identification of Threatened Species for Assessment

5.1.1 Ecosystem Credit Species

The ecosystem credit species predicted to occur on or use the development footprint are identified in **Table 5.1**. Justification is provided for any species from the BAM-C automatically populated list excluded from assessment.

Table 5.1 Predicted Ecosystem Credit Species

Common Name	Scientific Name	Listing Status		Dual credit species	Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification for any Exclusions	Associated PCT and Condition Zone species retained within				Sensitivity to gain class
		BC Act	EPBC Act						Z1 -PCT 762	Z2 – PCT 1590	Z3 – PCT 1618	Z4/Z5- PCT 1619	
Anthochaera phrygia	Regent Honeyeater	CE	CE	Yes	BAM-C	N/A	Yes	N/A		x			High
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	No	BAM-C	N/A	Yes	N/A	x				Moderate
Callocephalon fimbriatum	Gang-gang Cockatoo	V	E	Yes	BAM-C		Yes	N/A		x		x	Moderate
Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	V	V	Yes	BAM-C	Presence of Allocasuarina and casuarina species	Yes	N/A	x	x	x	x	High
Chthonicola sagittata	Speckled Warbler	V	-	No	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-	No	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Daphoenositta chrysoptera	Varied Sittella	V	-	No	BAM-C	N/A	Yes	N/A	x	x	x	x	Moderate

Common Name	Scientific Name	Listing Status		Dual credit species	Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification for any Exclusions	Associated PCT and Condition Zone species retained within				Sensitivity to gain class
		BC Act	EPBC Act						Z1 -PCT 762	Z2 – PCT 1590	Z3 – PCT 1618	Z4/Z5- PCT 1619	
*Dasyurus maculatus**	Spotted-tailed Quoll	V	E	No	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	No	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Glossopsitta pusilla	Little Lorikeet	V	-	No	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Yes	BAM-C	Waterbodie; Within 1 km of a rivers, lakes, large dams or creeks, wetlands and coastlines	Yes	N/A	x	x	x	x	High
Hieraaetus morphnoides	Little Eagle	V	-	Yes	BAM-C	N/A	Yes	N/A	x	x	x	x	Moderate
Hirundapus caudacutus	White-throated Needletail	-	V	No	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Lathamus discolor	Swift Parrot (Foraging)	E	CE	Yes	BAM-C	N/A	Yes	N/A	x	x	x	x	Moderate

Common Name	Scientific Name	Listing Status		Dual credit species	Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification for any Exclusions	Associated PCT and Condition Zone species retained within				Sensitivity to gain class
		BC Act	EPBC Act						Z1 -PCT 762	Z2 – PCT 1590	Z3 – PCT 1618	Z4/Z5- PCT 1619	
Lophoictinia isura	Square-tailed Kite	V	-	Yes	BioNet Atlas	N/A	Yes	N/A	x	x	x	x	Moderate
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	V	-	No	BAM-C	N/A	Yes	N/A	x	x	x	x	Moderate
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	-	No	BAM-C	N/A	Yes	N/A		x	x	x	Moderate
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	No	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Miniopterus australis	Little Bent-winged Bat	V	-	Yes	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Yes	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Neophema pulchella	Turquoise Parrot	V	-	No	BAM-C	N/A	Yes	N/A		x	x	x	High
Ninox connivens	Barking Owl	V	-	Yes	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Ninox strenua	Powerful Owl	V	-	Yes	BAM-C	N/A	Yes	N/A	x	x	x	x	High

Common Name	Scientific Name	Listing Status		Dual credit species	Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification for any Exclusions	Associated PCT and Condition Zone species retained within				Sensitivity to gain class
		BC Act	EPBC Act						Z1 -PCT 762	Z2 – PCT 1590	Z3 – PCT 1618	Z4/Z5- PCT 1619	
*Petaurus australis**	Yellow-bellied Glider	V	V	No	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Petroica boodang	Scarlet Robin	V	-	No	BAM-C	N/A	Yes	N/A	x	x		x	Moderate
Petroica phoenicea	Flame Robin	V	-	No	BAM-C	N/A	Yes	N/A	x				Moderate
Phoniscus papuensis	Golden-tipped Bat	V	-	No	BAM-C	N/A	Yes	N/A		x	x	x	High
Pomatostomus temporalis temporalis	Grey-crowned Babbler (eastern subspecies)	V	-	No	BAM-C	N/A	Yes	N/A	x	x	x	x	Moderate
Pseudomys gracilicaudatus	Eastern Chestnut Mouse	V	-	No	BAM-C	N/A	Yes	N/A			x	x	High
*Pseudomys gracilicaudatus**	New Holland Mouse	-	V	No	SEARS – DCCEEW Project Assessment Notes / BioNet Atlas	N/A	Yes	Included as a precaution only, not associated with any PCTs within the development footprint	x	x	x	x	High

Common Name	Scientific Name	Listing Status		Dual credit species	Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification for any Exclusions	Associated PCT and Condition Zone species retained within				Sensitivity to gain class
		BC Act	EPBC Act						Z1 -PCT 762	Z2 – PCT 1590	Z3 – PCT 1618	Z4/Z5- PCT 1619	
*Pteropus poliocephalus**	Grey-headed Flying-fox	V	V	Yes	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	No	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	No	BAM-C	N/A	Yes	N/A	x	x	x	x	High
Stagonopleura guttata	Diamond Firetail	V	-	No	BAM-C	N/A	Yes	N/A	x	x			Moderate
Tyto novaehollandiae	Masked Owl	V	-	Yes	BAM-C	N/A	Yes	N/A	x	x	x	x	High

Key

to BC Act / EPBC Act Listing Status: V = vulnerable, E = endangered, CE = critically endangered.

* = Identified by DCCEEW as potentially significantly impacted by the Project.

5.1.2 Species Credit Species

5.1.2.1 Predicted Flora Species Credit Entities

The flora species credit species predicted to occur on the development footprint are identified in **Table 5.2**. An assessment of these species to determine those retained for further assessment is provided. Justification is provided for any species from the BAM-C automatically populated list excluded from assessment.

Table 5.2 Predicted Flora Species Credit Species

Scientific Name	Common Name	Listing status		Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification if excluded from further assessment	PCT and Vegetation Condition Zone species associated with (Retained = Y/ Excluded = N)			
		BC Act	EPBC Act					PCT 762	PCT 1590	PCT 1618	PCT 1619
Angophora inopina	Charmhaven Apple	V	V	BAM - C	N/A	Yes	N/A			Y	Y
Callistemon linearifolius	Netted Bottle Brush	V	-	BAM - C	N/A	Yes	N/A		Y	Y	Y
Corybas dowlingii	Red Helmet Orchid	E	-	BAM - C	N/A	Yes	N/A			Y	
Cynanchum elegans	White-flowered Wax Plant	E	E	BAM - C	N/A	Yes	N/A		Y		
Eucalyptus glaucina	Slaty Red Gum	V	V	BAM - C	N/A	Yes	N/A		Y		
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	V	V	BAM - C	N/A	Yes	N/A		Y	Y	Y

Scientific Name	Common Name	Listing status		Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification if excluded from further assessment	PCT and Vegetation Condition Zone species associated with (Retained = Y/ Excluded = N)			
		BC Act	EPBC Act					PCT 762	PCT 1590	PCT 1618	PCT 1619
Maundia triglochinoides		V	-	BioNet Atlas	Riparian areas/drainage lines, water ponding, man-made dams and drainage channels up to 1 m deep	Yes	Surveys targeted to watercourses only	-	-	-	-
Pterostylis chaetophora	Rusty Greenhood	V	-	BAM - C	N/A	Yes	N/A		Y		Y
Rhodamnia rubescens	Scrub Turpentine	CE	CE	BioNet Atlas	N/A	Yes	N/A	-	-	-	-
Rhodomyrtus psidioides	Native Guava	CE	CE	BioNet Atlas	N/A	Yes	N/A	-	-	-	-
Rutidosis heterogama	Heath Wrinklewort	V	V	BAM - C	N/A	Yes	N/A		Y	Y	Y
Tetratheca juncea	Black-eyed Susan	V	V	BAM - C	N/A	Yes	N/A		Y	Y	Y

Scientific Name	Common Name	Listing status		Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification if excluded from further assessment	PCT and Vegetation Condition Zone species associated with (Retained = Y/ Excluded = N)			
		BC Act	EPBC Act					PCT 762	PCT 1590	PCT 1618	PCT 1619
Thesium australe	Austral Toadflax	V	V	BAM - C	N/A	No	The Threatened Species Profile Database identifies that this species 'occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast'. The subject land is located at the eastern extent of the Upper Hunter IBRA subregion within a coastal area. The associated PCTs within the subject land consist of open forest vegetation near to the coast and are considered not consistent with the microhabitats and distribution of this species, which is typically further west for populations occurring in woodland. The nearest coastal headland records are at Seal Rocks (72 km NE) and the nearest inland woodland records are from the Mangoola / Wybong area (110 km to the north-west).			Y	Y
Key to BC Act / EPBC Act Listing Status *V = vulnerable, E = endangered, CE = critically endangered.*											

5.1.2.2 Threatened Fauna Candidate Species

The fauna species credit species predicted to occur on the development footprint are identified in **Table 5.3**.

Justification is provided for any species from the BAM-C automatically populated list excluded from assessment. Geographic limitations, vagrant species, habitat constraints, degradation or lack of suitable microhabitats are the permitted reasons for excluding species credit species.

Table 5.3 Predicted Threatened Fauna Species Credit Species

Scientific Name	Common Name	Listing status		Dual Credit Species	Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification if excluded from further assessment	PCT and Vegetation Condition Zone species associated with (Retained = Y/ Excluded = N / Blank = not associated with PCT)			
		BC Act	EPBC Act						PCT 762	PCT 1590	PCT 1618	PCT 1619
Anthochaera phrygia	Regent Honeyeater	CE	CE	Yes	BAM - C	As per mapped areas	Yes	No mapped areas present		N		
Callocephalon fimbriatum	Gang-gang Cockatoo	V	E	Yes	BAM - C	Hollow bearing trees; Eucalypt tree species with hollows greater than 9 cm diameter	Yes	N/A		Y	Y	Y
Calyptorhynchus lathami lathami	South-eastern Glossy Black-Cockatoo	V	V	Yes	BAM - C	Hollow bearing trees; Living or dead tree with hollows greater than 15 cm diameter and greater than 8 m above ground.	Yes	N/A	Y	Y	Y	Y

Scientific Name	Common Name	Listing status		Dual Credit Species	Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification if excluded from further assessment	PCT and Vegetation Condition Zone species associated with (Retained = Y/ Excluded = N / Blank = not associated with PCT)			
		BC Act	EPBC Act						PCT 762	PCT 1590	PCT 1618	PCT 1619
Cercartetus nanus	Eastern Pygmy-possum	V	-	No	BAM - C	N/A	Yes	N/A	Y	Y	Y	Y
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	No	BAM - C	N/A	Yes	N/A	Y		Y	Y
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Yes	BAM - C	Living or dead mature trees within suitable vegetation within 1 km of a rivers, lakes, large dams or creeks, wetlands and coastlines.	Yes	N/A	Y	Y	Y	Y
Hieraaetus morphnoides	Little Eagle	V	-	Yes	BAM - C	Nest trees - live (occasionally dead) large old trees within vegetation.	Yes	N/A	Y	Y	Y	Y
Hoplocephalus bitorquatus	Pale-headed Snake	V	--	No	BAM - C	N/A	Yes	N/A	Y	Y	Y	Y

Scientific Name	Common Name	Listing status		Dual Credit Species	Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification if excluded from further assessment	PCT and Vegetation Condition Zone species associated with (Retained = Y/ Excluded = N / Blank = not associated with PCT)			
		BC Act	EPBC Act						PCT 762	PCT 1590	PCT 1618	PCT 1619
Lathamus discolor	Swift Parrot	E	CE	Yes	BAM - C	As per mapped areas.	Yes	No mapped areas present.	N	N	N	N
Litoria aurea	Green and Golden Bell Frog	E	V	No	BAM - C	N/A	Yes	N/A		Y	Y	Y
Lophoictinia isura	Square-tailed Kite	V	-	Yes	BioNet Atlas	Nest Trees.	Yes	N/A	Y	Y	Y	Y
Miniopterus australis	Little Bent-winged Bat (Breeding)	V	-	Yes	BAM - C	Caves; Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with numbers of individuals >500; or from the scientific literature.	No	No breeding habitat present within the subject land or development footprint.	N	N	N	N
Miniopterus orianae oceanensis	Large Bent-winged Bat (Breeding)	V	-	Yes	BAM - C	Caves; Cave, tunnel, mine, culvert or other structure known or	No	No breeding habitat present within the	N	N	N	N

Scientific Name	Common Name	Listing status		Dual Credit Species	Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification if excluded from further assessment	PCT and Vegetation Condition Zone species associated with (Retained = Y/ Excluded = N / Blank = not associated with PCT)			
		BC Act	EPBC Act						PCT 762	PCT 1590	PCT 1618	PCT 1619
						suspected to be used for breeding including species records with microhabitat code "IC - in cave;" observation type code "E nest-roost;" with numbers of individuals >500		subject land or development footprint.				
Myotis macropus	Southern Myotis	V	-	No	BAM - C	Waterbodies; This include rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200 m of the site, 3 m wide or greater.	Yes, retained for indirect impact assessment only	All watercourses present and within 200 m are <3 m wide. Retained for indirect assessment of potential impacts to breeding habitat within the Balickera Tunnel.	N	N	N	N

Scientific Name	Common Name	Listing status		Dual Credit Species	Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification if excluded from further assessment	PCT and Vegetation Condition Zone species associated with (Retained = Y/ Excluded = N / Blank = not associated with PCT)			
		BC Act	EPBC Act						PCT 762	PCT 1590	PCT 1618	PCT 1619
Ninox connivens	Barking Owl (Breeding)	V	-	Yes	BAM - C	Hollow bearing trees; Living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground.	Yes	Retained for assessment, although excluded from PCTs with no suitable breeding habitat / hollow bearing trees.	N	Y	N	Y
Ninox strenua	Powerful Owl (Breeding)	V	-	Yes	BAM - C	Hollow bearing trees; Living or dead trees with hollow greater than 20 cm diameter	Yes	Retained for assessment, although excluded from PCTs with no suitable breeding habitat / hollow bearing trees.	N	Y	N	Y
Petauroides volans	Southern Greater Glider	E	V	No	BAM - C	N/A	Yes	N/A		Y	Y	Y
Petaurus norfolcensis	Squirrel Glider	V	-	No	BAM - C	N/A	Yes	N/A	Y	Y	Y	Y

Scientific Name	Common Name	Listing status		Dual Credit Species	Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification if excluded from further assessment	PCT and Vegetation Condition Zone species associated with (Retained = Y/ Excluded = N / Blank = not associated with PCT)			
		BC Act	EPBC Act						PCT 762	PCT 1590	PCT 1618	PCT 1619
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	No	BAM - C	N/A	Yes	N/A	Y	Y	Y	Y
*Phascolarctos cinereus**	Koala	E	E	No	BAM - C	N/A	Yes	N/A	Y	Y	Y	Y
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	V	V	Yes	BAM - C	Breeding camps	Yes	N/A	Y	Y	Y	Y
Turnix maculosus	Red-backed Button-quail	V	-	No	BAM - C	N/A	Yes	N/A	Y	Y		
Tyto novaehollandiae	Masked Owl (Breeding)	V	-	Yes	BAM - C	Hollow bearing trees; Living or dead trees with hollows greater than 20 cm diameter.	Yes	Retained for assessment, although excluded from PCTs with no suitable breeding habitat / hollow bearing trees.	N	Y	N	Y

Scientific Name	Common Name	Listing status		Dual Credit Species	Sources	Habitat Constraints / Geographic Limitations	Species retained for further assessment?	Justification if excluded from further assessment	PCT and Vegetation Condition Zone species associated with (Retained = Y/ Excluded = N / Blank = not associated with PCT)			
		BC Act	EPBC Act						PCT 762	PCT 1590	PCT 1618	PCT 1619
Vespadelus troughtoni	Eastern Cave Bat	V	-	No	BioNet Atlas	Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds.	No	No associated PCTs present.				

Key

to BC Act / EPBC Act Listing Status: V = vulnerable, E = endangered, CE = critically endangered.

* Identified by DCCEEW as potentially significantly impacted by the Project.

5.2 Presence Determination for Candidate Species Credit Species

5.2.1 Threatened Flora Species

A summary of the methods used and determination of presence for candidate threatened flora species credit species is provided in **Table 5.4**. Further details on the surveys completed for the candidate threatened species are documented in **Section 5.3**.

Table 5.4 Determining the Presence of Candidate Threatened Flora Species Credit Species within the Development Footprint

Scientific Name	Common Name	Listing status		Method used to determine presence	Present within development footprint?	Further assessment required?
		BC Act	EPBC Act			
Angophora inopina	Charmhaven Apple	V	V	Targeted threatened species survey	Not observed	No
Callistemon linearifolius	Netted Bottle Brush	V	-	Targeted threatened species survey	Not observed	No
Corybas dowlingii	Red Helmet Orchid	E	-	Targeted threatened species survey	Not observed	No
Cynanchum elegans	White-flowered Wax Plant	E	E	Targeted threatened species survey	Not observed	No
Eucalyptus glaucina	Slaty Red Gum	V	V	Targeted threatened species survey	Not observed	No
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	V	V	Targeted threatened species survey	Not observed	No
Maundia triglochinoides		V	-	Targeted threatened species survey	Not observed	No

Scientific Name	Common Name	Listing status		Method used to determine presence	Present within development footprint?	Further assessment required?
		BC Act	EPBC Act			
Pterostylis chaetophora	Rusty Greenhood	V	-	Targeted threatened species survey	Observed within project area and development footprint has been reduced to avoid impacts to plants observed and potential species polygon areas.	No
Rhodamnia rubescens	Scrub Turpentine	CE	CE	Targeted threatened species survey	Not observed	No
Rhodomyrtus psidioides	Native Guava	CE	CE	Targeted threatened species survey	Not observed	No
Rutidosis heterogama	Heath Wrinklewort	V	V	Targeted threatened species survey	Not observed	No
Tetratheca juncea	Black-eyed Susan	V	V	Targeted threatened species survey	Not observed	No
Key to BC Act / EPBC Act Listing Status *V = vulnerable, E = endangered, CE = critically endangered.*						

The NSW Survey Guide for the BAM – Surveying threatened plants and their habitats (NSW DPIE 2020b) identifies that a threatened plant specimen must be identified to species level and submitted to a registered herbarium such as the National Herbarium of NSW, for inspection and formal identification. The following details of threatened flora species observed and other specimens sent to the National Herbarium of NSW are provided.

5.2.1.1 Rusty Greenhood (Pterostylis chaetophora)

The threatened flora species, **Rusty Greenhood *(Pterostylis chaetophora),*** was observed during surveys and the identification was formally confirmed by the National Herbarium of NSW in 2018. A total of 58 individuals were observed in the initial development footprint during surveys in 2018. The initial development footprint was subsequently reduced to avoid impacts to the main population of *Pterostylis chaetophora* present (refer to). Two individuals observed in 2018, which occur as outliers to the main population, were assessed within the previous version of this report as being located within the development footprint. The development footprint has subsequently been modified to avoid all locations of this species and to avoid direct impacts to the PCT within which this species was observed. Targeted flora species transect surveys undertaken in 2022 did not record any additional *Pterostylis chaetophora* in the development footprint. A photograph of the Rusty Greenhood from the area which will be retained is provided as **Photo 5.1**.



Photo 5.1 Rusty Greenhood within area to be Retained

5.2.1.2 Netted Bottle Brush (*Callistemon linearifolius*)

Previous site records for the Netted Bottle Brush (*Callistemon linearifolius*) were identified by samples sent to the National Herbarium of NSW in 2017 during a period when the subject land was in an early fire recovery phase. During 2022 targeted searches for *Callistemon linearifolius* were undertaken and the species was not observed, despite the presence of other Callistemon species. Resampling of Callistemon plants of all species observed across the subject land was undertaken, including at the locations where the National Herbarium of NSW had confirmed records of *Callistemon linearifolius*. Based on the results of the field surveys undertaken during 2022 and further advice received from the National Herbarium of NSW in 2023, it is considered that no *Callistemon linearifolius* was observed within the subject land during the current surveys and is not likely to be present. The advice received from the NSW Royal Botanic Gardens is provided in **Appendix E**.

5.2.1.3 Red Helmet Orchid (*Corybas dowlingii*)

Corybas dowlingii is synonymous with, and now recognised by the National Herbarium of NSW and Australian Plant Name Index, as *Corybas* x *dowlingii*, a hybrid between *Corybas aconitiflorus* and *Corybas barbarae*. Further advice on the assessment of threatened flora species in relation to hybrids and intergrades is provided by NSW DPIE (2020b), which identifies that hybrids or intergrades are not considered to be the listed threatened species under the BC Act, unless hybridisation or intergrades are specifically described in the NSW Threatened Species Scientific Committee final determination for that species. Consultation with BCD has identified that despite *C. dowlingii* being a hybrid between *C. aconitiflorus* and *C. barbarae*, it should still be considered as a listed entity under the BC Act.

One sample from an orchid of the genus Corybas was collected and sent to the National Herbarium of NSW for formal identification which was received in March 2023. The specimen sent was collected outside of the flowering season and lacked reproductive material and thus could only be confirmed as *Corybas* sp. Subsequent targeted searches for *C. dowlingii* were completed during June 2023, following confirmation of flowering at a reference population at Stoney Ridge Reserve at Salamander Bay. Corybas orchids were observed at 60 clump locations within the development footprint during surveys completed during the June 2023 flowering season. Five flowering specimens were photographed, picked and sent to the National Herbarium of NSW for formal identification. The samples sent were chosen due to having traits most similar to *Corybas dowlingii* compared to the other flowering Corybas plants observed, these traits included darkest flower colour and largest flower size. All of the samples sent were formally identified by the National Herbarium of NSW as *Corybas aconitiflorus*.

Based on the field observations and identification advice received from the National Herbarium of NSW it is **considered that the presence of *Corybas dowlingii* was not confirmed during surveys.**

5.2.1.4 Small-flowered Grevillea (*Grevillea parviflora* subsp. *parviflora*)

Three Grevillea samples tentatively identified in the field as *Grevillea humilis* subsp. *humilis* were collected and sent to the NSW National Herbarium in 2023 for formal identification (see correspondence in **Appendix E**). The identification of this material was confirmed as *Grevillea humilis* subsp. *humilis.*
No individuals of *Grevillea parviflora* subsp. *parviflora* were observed during surveys.

5.2.2 Threatened Fauna Species

A summary of the methods used and determination of presence for candidate threatened fauna species credit species is provided in **Table 5.5**. Further details on the surveys completed for the candidate threatened species are documented in **Section 5.3**.

Table 5.5 Summary of Candidate Fauna Species Observed within the Development Footprint

Scientific Name	Common Name	Listing Status		Method used to determine presence	Present?	Further assessment required? (BAM Subsections 5.2.5 and 5.2.6)
		BC Act	EPBC Act			
Anthochaera phrygia	Regent Honeyeater	CE	CE	Mapped important habitat	Not mapped	No
Callocephalon fimbriatum	Gang-gang Cockatoo	V	E	Targeted threatened species survey	Not observed	No
Calyptorhynchus lathami	South-eastern Glossy Black-Cockatoo	V	V^	Targeted threatened species survey	Evidence of use of site as foraging habitat detected (Chewed *Allocasuarina* seed cones), no breeding activity observed.	No
Cercartetus nanus	Eastern Pygmy-possum	V	-	Targeted threatened species survey	Not observed	No
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Targeted threatened species survey	Not observed	No
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Targeted threatened species survey	Evidence of site use for roosting habitat observed, but no breeding activity observed.	No
Hieraaetus morphnoides	Little Eagle	V	-	Targeted threatened species survey	Not observed	No
Hoplocephalus bitorquatus	Pale-headed Snake	V	-	Targeted threatened species survey	Not observed	No
Lathamus discolor	Swift Parrot	E	CE	Mapped important habitat	Not mapped	No
Litoria aurea	Green and Golden Bell Frog	E	V	Targeted threatened species survey	Not observed	No
Lophoictinia isura	Square-tailed Kite	V	-	Targeted threatened species survey	Not observed	No

Scientific Name	Common Name	Listing Status		Method used to determine presence	Present?	Further assessment required? (BAM Subsections 5.2.5 and 5.2.6)
		BC Act	EPBC Act			
Miniopterus australis	Little Bent-winged Bat (Breeding)	V	-	On site habitat assessment. Literature review has identified roost habitat present within the nearby Balickera Tunnel.	No potential breeding habitat present within subject land or development footprint. Roost habitat present in Balickera Tunnel. Balickera Tunnel does not provide breeding habitat (Eco Logical Australia 2021).	No
Miniopterus orianae oceanensis	Large Bent-winged Bat (Breeding)	V	-	On site habitat assessment. Literature review has identified roost habitat present within the nearby Balickera Tunnel.	No potential breeding habitat present within subject land or development footprint. Roost habitat present in Balickera Tunnel. Balickera Tunnel does not provide breeding habitat (Eco Logical Australia 2021).	No
Myotis macropus	Southern Myotis	V	-	Targeted threatened species survey	Yes, although habitat constraints for species polygon generation are not present (waterbodies with permanent pools/stretches 3 m or wider, including rivers, large creeks, billabongs, lagoons, estuaries, dams and other waterbodies, on or within 200 m of the site).	Yes
Ninox connivens	Barking Owl (Breeding)	V	-	Targeted threatened species survey at all hollow bearing trees with potential to be utilsied as breeding habitat.	Not observed	No
Ninox strenua	Powerful Owl (Breeding)	V	-	Targeted threatened species survey	Species observed, no evidence of site use for breeding habitat recorded.	No

Scientific Name	Common Name	Listing Status		Method used to determine presence	Present?	Further assessment required? (BAM Subsections 5.2.5 and 5.2.6)
		BC Act	EPBC Act			
Petauroides volans	Greater Glider	E	V	Targeted threatened species survey	Not observed	No
Petaurus norfolcensis	Squirrel Glider	V	-	Targeted threatened species survey	Yes	Yes
Phascogale tapoatafa	Brush-tailed Phascogale	V	-	Targeted threatened species survey	Yes	Yes
Phascolarctos cinereus	Koala	E	E	Targeted threatened species survey	Yes	Yes
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	V	V	Targeted threatened species survey	Not observed	No
Turnix maculosus	Red-backed Button-quail	V	-	Targeted threatened species survey	Not observed	No
Tyto novaehollandiae	Masked Owl (Breeding)	V	-	Targeted threatened species survey	Not observed	No
Vespadelus troughtoni	Eastern Cave Bat	V	-	Targeted threatened species survey	Calls from a Vespadelus sp. bat detected, however could not be assigned to species level identification. Species not detected during extensive harp trapping surveys completed for the Balickera Tunnel by Eco Logical Australia (2021) and WSP (2023).	No

Key to BC Act / EPBC Act Listing Status

V = vulnerable, E = endangered, CE = critically endangered.

Observation details are provided for the following species credit and dual credit threatened fauna.

5.2.2.1 South-eastern Glossy Black-Cockatoo (*Calyptorhynchus lathami lathami*)

Evidence of site use for foraging by this species was detected in the form of chewed ***Allocasuarina torulosa*** seed cones observed during surveys completed in June 2023, as shown in **Photo 5.2**. No site use by the South-eastern Glossy Black-Cockatoo as breeding habitat was observed during the surveys completed. Breeding habitat requiring species credits has been assessed as not present.



Photo 5.2 Chewed *Allocasuarina torulosa* seed cones

5.2.2.2 White-bellied Sea-Eagle (*Haliaeetus leucogaster*)

One immature White-bellied Sea-Eagle was observed perched on a tree within the development footprint on 25 October 2022. No repeat use of the site was detected and no nest trees were observed during surveys **and breeding habitat requiring species credits has been assessed as not present**.

5.2.2.3 Little Bent-winged Bat (*Miniopterus australis*)

Definite recordings of this species were obtained during surveys, however this species is a dual credit entity and only impacts to breeding habitat and within a 100 m buffer of breeding habitat require species credits. The nearest roost habitat is located within the Balickera Tunnel which has openings approximately 330 m to the west and 450 m to the south of the development footprint. Extensive harp trapping surveys have been completed by WSP (2023) and Eco Logical Australia (2021) to determine the breeding status of bats using the Balickera Tunnel, as part of the Balickera Tunnel Remediation Project. Eco Logical Australia (2021) identified through surveys that the population of Little Bent-winged Bats in the Balickera Tunnel approximately halves over summer when females leave to give birth and raise young in a maternity cave elsewhere. Very few females remain during the December to February period and the population gradually increases again over autumn and peaks throughout winter and early spring when the tunnel is used as an overwintering/hibernation roost.

The NSW DPIE (2021) BAM guideline for species credit threatened bats identifies that breeding habitat for this species is specific habitat features that are used, or presumed likely to be used as maternity sites, where female bats give birth and form nursery colonies (NSW DPIE 2021). Breeding habitat for this species is highly specific and the Balickera Tunnel is not likely to provide the necessary environmental conditions to support a maternity cave. Breeding habitat requiring species credits has been assessed as not present.

5.2.2.4 Large Bent-winged Bat (*Miniopterus orianae oceanensis*)

Probable recordings of this species were obtained during surveys, however this species is a dual credit entity and only impacts to breeding habitat and within a 100 m buffer of breeding habitat require species credits. The nearest roost habitat is located within the Balickera Tunnel which has openings approximately 330 m to the west and 450 m to the south of the development footprint. Extensive harp trapping surveys have been completed by WSP (2023) and Eco Logical Australia (2021) to determine the breeding status of bats using the Balickera Tunnel, as part of the Balickera Tunnel Remediation Project. Eco Logical Australia (2021) identified through surveys that the population of Large Bent-winged Bats in the Balickera Tunnel approximately halves over summer when females leave to give birth and raise young in a maternity cave elsewhere. Very few females remain during the December to February period and the population gradually increases again over autumn and peaks throughout winter and early spring when the tunnel is used as an overwintering/hibernation roost.

The NSW DPIE (2021) BAM guideline for species credit threatened bats identifies that breeding habitat for this species is specific habitat features that are used, or presumed likely to be used as maternity sites, where female bats give birth and form nursery colonies (NSW DPIE 2021). Breeding habitat for this species is highly specific and the Balickera Tunnel is not likely to provide the necessary environmental conditions to support a maternity cave. Breeding habitat requiring species credits has been assessed as not present.

5.2.2.5 Southern Myotis (*Myotis macropus*)

This species was identified from potential recordings from an undifferentiated species group which included *Myotis macropus, Nyctophilus geoffroyi* and *Nyctophilus gouldi*. These species are difficult to separate without good quality calls and the presence of this species has been assumed. Despite this, the Project will not impact any waterbodies with pools or stretches 3 m in width or wider, therefore no species credits are required.

The species has been recorded within the Balickera Tunnel, which has openings approximately 330 m to the west and 450 m to the south of the development footprint. Extensive harp trapping surveys were completed by WSP (2023) and Eco Logical Australia (2021) as part of the Balickera Tunnel Remediation Project. Eco Logical Australia (2021) have identified that this species has been recorded breeding within the tunnel between late October and February and is present throughout all seasons where it roosts in holes within concrete lined sections of the tunnel, particularly the upstream half of the tunnel. Eco Logical Australia (2021) have identified that this species also roosts and/or breeds in at least 7 other locations within 11 km, mostly under bridges associated with public road and in culverts.

5.2.2.6 Powerful Owl (*Ninox strenua*)

This species was recorded during call playback surveys on 19 March and 28 March 2018, no active nest trees have been identified within the subject land. Additional stag watching surveys of all hollow bearing trees which have characteristics suitable for breeding habitat for this species were undertaken during the 2023 breeding season on 12 and 13 of June, with no powerful owl activity observed at these hollows. Breeding habitat requiring species credits has been assessed as not present.

5.2.2.7 Squirrel Glider (*Petaurus norfolcensis*)

This species was recorded during baited remote camera surveys on 2 February 2018, as a probable level identification. Several photographic records for the closely related Sugar Glider were also obtained during surveys. The Squirrel Glider is a species assessed based on area of suitable habitat and its habitat is associated in the TBDC with all plant community types present. A photograph of the Squirrel Glider captured during surveys is provided as **Photo 5.3**.



Photo 5.3 Camera Trap Image of Squirrel Glider

5.2.2.8 Brush-tailed Phascogale (*Phascogale tapoatafa*)

This species was recorded during baited remote camera surveys. This species is assessed based on area of suitable habitat and its habitat is associated in the TBDC with all plant community types present, except PCT 1716. A remote camera photograph of a Brush-tailed Phascogale captured during surveys is provided as **Photo 5.4**.



Photo 5.4 Camera trap image of Brush-tailed Phascogale

5.2.2.9 Koala (*Phascolarctos cinereus*)

This species was recorded in baited remote camera surveys (1 location during 2018 and 2 locations during 2022) and during spotlighting surveys (1 location in 2022). This species is assessed based on area of suitable habitat and its habitat is associated in the Threatened Biodiversity Data Collection with all plant community types present (NSW DPE 2024). A remote camera photograph of a Koala captured during surveys is provided as **Photo 5.5**.



Photo 5.5 Camera trap image of koala

5.2.2.10 Grey-headed Flying-fox (*Pteropus poliocephalus*)

This species was observed foraging within the subject land during surveys. The National Flying Fox Monitoring Viewer (DCCEEW 2024b) identifies that there is a historical camp site within the Wallaroo State Forest within the vicinity of the subject land, however no Flying-foxes have been observed there for >10 years. The nearest active camp sites are at Moffatts Swamp and Tocal. No species credits are proposed as no active roost or breeding habitat is present.

5.2.2.11 Eastern Cave Bat (*Vespadelus troughtoni*)

This species was identified as potentially occurring due to an Umwelt ultrasonic call recording identified as an undifferentiated species group which included *Chalinolobus morio, Vespadelus pumilus, Vespadelus vulturnus* and *Vespadelus troughtoni*. Positive recordings of both *Chalinolobus morio* and *Vespadelus pumilus* were obtained. The species is not predicted to occur in the BAM-C.

There is no identified breeding habitat on the subject land or within 2 km that consists of caves, scarps, cliffs, rock overhangs or disused mines. There is potential roosting habitat present within the Balickera Tunnel, however this species was also not recorded within the Balickera Tunnel as part of extensive harp trapping surveys for the Balickera Tunnel Remediation Species Impact Statement prepared by Eco Logical Australia (2021), nor during post-remediation monitoring undertaken by WSP (2023).

This species is not associated with any of the plant community types present and therefore, as per the directions for preparing a species polygon for Eastern Cave Bat in the 'Species credit' threatened bats and their habitats: NSW Guide for the BAM (DPIE 2021) species credits are not required for this Project.
The Guide states that potential habitat is "***All areas with the PCTs associated with the species (as per the TBDC) on the subject land*** *where the subject land is within 2 kilometres of caves, scarps, cliffs, rock overhangs and disused mines*". In preparing a species polygon the Guide states that "*The species polygon boundary should align with all PCTs on the subject land that are within 2 kilometres of identified potential roost habitat features,* ***and with which the species is associated (as listed in the TBDC).***" (emphasis added).

5.3 Threatened Species Surveys

5.3.1 Candidate Threatened Flora Species Surveys

A summary of the targeted surveys completed for candidate threatened flora species is provided in **.**

Table 5.6 Summary of Targeted Surveys Completed for Candidate Threatened Flora Species

Flora Survey Details
Charmhaven Apple *Angophora* inopina **Habitat Description:** Grows in open woodand with a dense shrub understorey in sandy and clay soils over sandstone, predominantly on the NSW Central Coast. **Habitat or Geographical Constraints:** None listed. **Survey Guideline:** DPIE Surveying Threatened Plants and their Habitats NSW Survey Guide for the BAM. **Survey Requirement:** This species is a tree which requires parallel field traverses at 20 m spacing in dense vegetation and 40 m in open vegetation. **Survey Period:** All year. **Surveys completed:** Targeted 10 m parallel traverse survey completed during July 2022 incorporating 36 person hours of searches over 3 days (25–27 July 2022) by two ecologists. **Results:** This species was not observed during surveys and has been assessed as not present.
***Callistemon linearifolius* Netted Bottle Brush** **Habitat Description:** Grows in dry sclerophyll forest on the coast and adjacent ranges. **Habitat or Geographical Constraints:** Not listed. **Survey Guideline:** DPIE Surveying Threatened Plants and their Habitats NSW Survey Guide for the BAM. **Survey Requirement:** This species is a shrub which requires parallel field traverses at 10 m spacing in dense vegetation and 20 m in open vegetation. **Survey Period:** January, October, November, December. **Surveys completed:** Targeted parallel traverse survey completed during October 2018 incorporating 36 person hours completed over 5 days by two people (8–12 October 2018), and October 2022 incorporating 130.5 hours completed over 7 days by up to four people (12, 17, 19, 20, 25, 26, 31 October 2022).

Flora Survey Details
Results: Previous site records for the Netted Bottle Brush (*Callistemon linearifolius*) were identified by samples sent to the National Herbarium of NSW in 2017 during a period when the subject land was in an early fire recovery phase. During 2022 targeted searches for *Callistemon linearifolius* were undertaken and the species was not observed, despite the presence of other Callistemon species. Resampling of Callistemon plants of all species observed across the subject land was undertaken, including at the locations where the National Herbarium of NSW had confirmed records of *Callistemon linearifolius*. Based on the results of the field surveys undertaken during 2022 and further advice received from the National Herbarium of NSW in 2023, it is considered that no *Callistemon linearifolius* was observed within the subject land during the current surveys and is not likely to be present. The advice received from the National Herbarium of NSW is provided in Appendix E. This species was not observed during surveys and has been assessed as not present.
***Corybas dowlingii* Red Helmet Orchid** **Habitat Description:** Sheltered areas such as gullies and southerly slopes in tall open forest on well-drained gravelly soil at elevations of 10–200 m. **Habitat or Geographical Constraints:** Not listed. **Survey Guideline:** DPIE Surveying Threatened Plants and their Habitats NSW Survey Guide for the BAM. **Survey Requirement:** This species is an orchid which requires parallel field traverses at 5 m spacing in dense vegetation and 10 m in open vegetation. **Survey Period:** June, July. **Surveys completed:** Targeted parallel traverses completed during July 2023 incorporating 112.5 person hours completed over 5 days by three people (5–9 June 2023). **Results:** *Corybas dowlingii* is synonymous with and now recognised by the National Herbarium of NSW and Australian Plant Name Index as *Corybas* x *dowlingii*, a hybrid between *Corybas aconitiflorus* and *Corybas barbarae*. *Corybas* orchids were observed at 60 locations within the development footprint during surveys. The plants were observed to be in various stages from leaf only through to emergent and full flower form. Five specimens were photographed, picked and sent to the National Herbarium of NSW for formal identification. The samples sent were chosen due to having traits most similar to *Corybas dowlingii*, including largest size and dark colour (compared to the other plants present). All of the samples sent were formally identified by the National Herbarium of NSW as *Corybas aconitiflorus*. Based on the identification advice received from the National Herbarium of NSW it is considered that the presence of *Corybas dowlingii* was not observed during surveys.
***Cynanchum elegans* White-flowered Wax Plant** **Habitat Description:** The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest. **Habitat or Geographical Constraints:** Not listed. **Survey Guideline:** DPIE Surveying Threatened Plants and their Habitats NSW Survey Guide for the BAM. **Survey Requirement:** This species is in the epiphytes and climbers growth form which requires parallel field traverses at 5 m spacing in dense vegetation and 10 m in open vegetation. **Survey Period:** All year. **Surveys completed:** Targeted parallel traverses completed in July 2022 incorporating 36 person hours completed over 3 days by two people (25, 26, 28 July 2022). **Results:** This species was not observed during surveys and has been assessed as not present.
***Eucalyptus glaucina* Slaty Red Gum** **Habitat Description:** Grows in grassy woodland and dry eucalypt forest. Grows on deep, moderately fertile and well-watered soils. **Habitat or Geographical Constraints:** Not listed.

Flora Survey Details
Survey Guideline: DPIE Surveying Threatened Plants and their Habitats NSW Survey Guide for the BAM. **Survey Requirement:** This species is a tree which requires parallel field traverses at 20 m spacing in dense vegetation and 40 m in open vegetation. **Survey Period:** All year. **Surveys completed:** Targeted parallel traverses in July 2022 incorporating 36 person hours completed over 3 days by two people (25, 26, 28 July 2022). **Results:** This species was not observed during surveys and has been assessed as not present.
***Grevillea parviflora* subsp. *parviflora* Small-flower Grevillea** **Habitat Description:** Grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. **Habitat or Geographical Constraints:** Not listed. **Survey Guideline:** DPIE Surveying Threatened Plants and their Habitats NSW Survey Guide for the BAM. **Survey Requirement:** This species is a shrub which requires parallel field traverses at 10 m spacing in dense vegetation and 20 m in open vegetation. **Survey Period:** August, September, October, November. **Surveys completed:** Targeted parallel traverses in October 2018 incorporating 63 person hours completed over 5 days by 2 people (8–12 October 2018), and in October 2022 incorporating 130.5 person hours completed over 7 days by up to 4 people (12, 17, 19, 20, 25, 26, 31 October 2022). **Results:** Some floristic material (S=3) was collected during surveys and sent to the National Herbarium of NSW for formal identification confirmation as *Grevillea humilis* subsp. *humilis*. *Grevillea parviflora* subsp. *parviflora* was not observed during surveys and has been assessed as not present.
Maundia triglochinoides **Habitat Description:** Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30–60 cm deep on heavy clay, low nutrients. Habitat or Geographical Constraints: Riparian areas/drainage lines, water ponding, man-made dams and drainage channels up to 1 m deep. Semi-permanent/ephemeral wet areas. Shallow swamps and waterbodies up to 1 m deep. **Survey Guideline:** DPIE Surveying Threatened Plants and their Habitats NSW Survey Guide for the BAM. Survey Requirement: This species is in the herbs and forbs growth form which requires parallel field traverses at 5 m spacing in dense vegetation and 10 m in open vegetation. **Survey Period:** January, February, March, November, December. **Surveys completed:** Initial parallel transect completed out of season to detect non fruiting plants in October 2022 incorporating 130.5 person hours completed over 7 days by up to 4 people (12, 17, 19, 20, 25, 26, 31 October 2022). Follow-up targeted surveys of suitable habitat completed in November 2022 incorporating less than one hour searching watercourse areas and soaks (9, 11 November 2022). **Results:** This species was not observed during surveys and has been assessed as not present.
***Pterostylis chaetophora* Rusty Greenhood** **Habitat Description:** The preferred habitat is seasonally moist, dry sclerophyll forest with a grass and shrub understorey. **Habitat or Geographical Constraints:** Not listed. **Survey Guideline:** DPIE Surveying Threatened Plants and their Habitats NSW Survey Guide for the BAM. **Survey Requirement:** This species is an orchid which requires parallel field traverses at 5 m spacing in dense vegetation and 10 m in open vegetation. **Survey Period:** September, October, November.

Flora Survey Details
Surveys completed: Targeted parallel transect during October 2017 incorporating 54 person hours completed over three days by two people (25, 26, 30 October 2017), October 2018 incorporating 63 person hours completed over 5 days by 2 people (8–12 October 2018), and October 2022 incorporating 130.5 person hours completed over 7 days by up to 4 people (12, 17, 19, 20, 25, 26, 31 October 2022). **Results:** This species was observed during surveys (60 plants) and has been assessed as present, however all direct impacts to this species will be avoided.
***Rhodamnia rubescens* Scrub Turpentine** **Habitat Description:** Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. **Habitat or Geographical Constraints:** Not listed. **Survey Guideline:** DPIE Surveying Threatened Plants and their Habitats NSW Survey Guide for the BAM. **Survey Requirement:** This species is a shrub which requires parallel field traverses at 10 m spacing in dense vegetation and 20 m in open vegetation. **Survey Period:** All year. **Surveys completed:** Targeted parallel traverses during July 2022 incorporating 36 person hours completed over 3 days by 2 people (25, 26, 28 July 2022). **Results:** This species was not observed during surveys and has been assessed as not present.
***Rhodomyrtus psidioides* Native Guava** **Habitat Description:** Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines. **Habitat or Geographical Constraints:** Not listed. **Survey Guideline:** DPIE Surveying Threatened Plants and their Habitats NSW Survey Guide for the BAM. **Survey Requirement:** This species is a shrub which requires parallel field traverses at 10 m spacing in dense vegetation and 20 m in open vegetation. **Survey Period:** All year. **Surveys completed:** Targeted parallel traverses during July 2022 incorporating 36 person hours completed over 3 days by 2 people (25, 26, 28 July 2022). **Results:** This species was not observed during surveys and has been assessed as not present.
***Rutidosis heterogama* Heath Wrinklewort** **Habitat Description:** Grows in heath on sandy soils and moist areas in open forest, and has been recorded along disturbed roadsides. **Habitat or Geographical Constraints:** Not listed. **Survey Guideline:** DPIE Surveying Threatened Plants and their Habitats NSW Survey Guide for the BAM. **Survey Requirement:** This species is in the herbs and forbs growth form which requires parallel field traverses at 5 m spacing in dense vegetation and 10 m in open vegetation. **Survey Period:** All year. **Surveys completed:** Targeted parallel surveys during October 2022 incorporating 130.5 person hours completed over 7 days by up to 4 people (12, 17, 19, 20, 25, 26, 31 October 2022). **Results:** This species was not observed during surveys and has been assessed as not present.

Flora Survey Details
***Tetratheca juncea* Black-eyed Susan** **Habitat Description:** It is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest. Occurs on low nutrient, well drained soils on substrates that are generally sandy skeletal soil on sandstone or sandy-loam, or pH neutral clayey soil from conglomerates. **Habitat or Geographical Constraints:** None listed. **Survey Guideline:** DPIE Surveying Threatened Plants and their Habitats NSW Survey Guide for the BAM. **Survey Requirement:** This species is a low prostrate shrub which requires parallel field traverses at 10 m spacing in dense vegetation and 15 m in open vegetation. **Survey Period:** September, October. **Surveys completed:** Targeted parallel surveys during October 2017 incorporating 54 person hours completed over 3 days by 2 people (25, 26, 30 October 2017), October 2018 incorporating 63 person hours completed over 5 days by 2 people (8–12 October 2018), and October 2022 incorporating 130.5 person hours completed over 7 days by up to 4 people (12, 17, 19, 20, 25, 26, 31 October 2022). **Results:** This species was not observed during surveys and has been assessed as not present.

5.3.2 Candidate Threatened Fauna Species Surveys

Details of the surveys completed for candidate threatened fauna species are provided in **Table 5.7**.

Table 5.7 Summary of targeted surveys completed for candidate threatened fauna species

Fauna Survey Details
Regent Honeyeater *Anthochaera phrygia* **Credit type:** Dual credit species with mapped important habitat assessed for species credits and as potential SAII Entity and non-important habitat assessed for ecosystem credits. **Habitat Description (mapped important habitat):** The mapped areas include areas identified in The National Recovery Plan (DOE 2016a) as critical to the survival of the species formed the basis of the mapping for use in the BAM. These were refined to only include areas of suitable habitat based on expert opinion PCTs associated with the species (as per the TBDC). A dataset of occurrence records was generated from BioNet, BirdLife Australia, Australian National University Difficult Bird Research Group and expert opinion of historic, unrecorded breeding. Records were overlayed on the refined areas. All woodland vegetation within 200 m of a record was added. Records of known breeding events that occurred outside of the polygons created above were identified. Radial buffers of 1 km were applied to single breeding events (once off breeding at a location) and 5 km buffers applied to multiple breeding events (multiple events in the same year or over multiple years at one location). All woodland vegetation was selected within 1 km buffers. Within 5 km buffers, PCTs associated with the species were selected, along with all woodland vegetation within 200 m of a record. **Associated PCTs:** Not applicable for species assessed via mapped important habitat.

Fauna Survey Details
Survey Requirements: BCD have requested details of survey compliance with the Survey Guidelines for Australia's Threatened Birds (DEWHA 2010), which specifies 20 hours over 5 to 10 days per 50 ha of habitat. This species was surveyed for across 17 diurnal winter bird census point based area searches completed over 4 days on 9 July 2018 (5 hrs x 2 persons), 10 July (5 hrs 25 min x 2 persons), 11 July 2018 (6.25 hrs x 2 persons), 12 July (4 hrs x 2 persons). This species was also subject to targeted searches by 2-4 ecologists on over 16 days during which 239.5 person hours of survey were completed on 25 July 2022 (4 hrs x 2 people), 26 July 2022 (7.5 hrs x 2 people), 28 July 2022 (6 hrs x 2 people), 29 July 2022 (6.5 hrs x 2 people), 14 September 2022 (8.5 hrs x 2 people), 16 September 2022 (7.5 hrs x 2 people), 17 October 2022 (8.5 hrs x 2 people), 18 October 2022 (10.5 hrs x 3 people), 19 October (8.5 hrs x 2 people), 25 October (8.5 hrs x 2 people), 26 October (8.5 hrs x 2 people), 31 October 2022 (4 hrs x 4 people), 1 November 2022 (3 hrs x 2 people), 2 November 2022 (4 hrs x 2 people), 9 November 2022 (7.25 hrs x 2 people) and 16 November 2022 (7.75 hrs x 2 people). No surveys are required for this species under the BAM, as the foraging habitat component will be offset using ecosystem credits and important habitat which requires species credits, is not mapped within the Development Footprint. **Assessment Approach and Justification:** Important habitat for this species has been assessed as not present as there is none mapped within the development footprint. Foraging habitat for this species has been assessed as assumed present in accordance with the BAM requirements for ecosystem credit species.
Gang-gang Cockatoo *Callocephalon fimbriatum* **Credit Type:** Dual credit species with breeding habitat assessed for species credits and foraging habitat assessed for ecosystem credits. **Habitat Description:** In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas (NSW DPE 2023c). **Habitat or geographical constraints:** Eucalypt tree species with hollows at least 3 m above the ground and with hollow diameter of 7 cm or larger. **Survey Requirements:** Survey requirements are specified in the TBDC. This is a dual credit species. The identification of breeding habitat will require assumed presence, survey or an expert report. Survey period is October to January. Step 1. Assessors should look for signs of breeding on site as follows; (a) lone adult males identified during the breeding season (October to January); or (b) an occupied nest. If breeding is presumed present, progress to Step 3. Step 2. Where signs of breeding on site are present, potential nest trees should be identified. Potential nest trees are forest and woodland eucalypts containing hollows that are; (i) at least 3 m above the ground and (ii) with hollow diameter of 7 cm or larger. Step 3. Where potential nest trees are identified on site, monitor for this species during the breeding season (October to January) to confirm the presence of any actual nest trees on site. DPIE is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements). Step 4. If actual nest trees are confirmed on site, then the species polygons are to be drawn around those actual nest trees (i.e. trees that birds of the species are known to have used for nesting). The species polygons should be circular in shape and must include a buffer radius of 200 m around each actual nest tree. The purpose of the buffer is to identify the essential area for breeding and minimise disturbance/avoid clearing for a development application, or conserve and improve habitat for a biodiversity stewardship agreement. The shape of the buffer can be modified where evidence provided in the Biodiversity Assessment Report indicates an alternative shape would better meet the species needs in the context of the assessment site. For example, extant vegetation is linear, and the nest tree is already located near the edge of the wooded area.

Fauna Survey Details
Surveys Completed: Hollow bearing trees with hollows >7 cm in diameter and >3 m above ground were observed by field ecologists during habitat assessments undertaken. Diurnal bird surveys in accordance with Step 1 to 3 of the survey requirements were undertaken by two to three ecologists over five days (99.5 hours) on 17 October 2022 (8.5 hrs x 2 people), 18 October 2022 (10.5 hrs x 3 people), 19 October 2022 (8.5 hrs x 2 people), 25 October 2022 (8.5 hrs x 2 people) and 26 October 2022 (8.5 hrs x 2 people). These surveys included diurnal census on foot with watching and listening for signs of activity such as the presence of adult birds and begging chicks around potential nesting trees. **Assessment Approach and Justification:** This species was not observed during surveys and has been assessed as not present.
South-eastern Glossy Black-Cockatoo *Calyptorhynchus lathami lathami* **Credit Type:** Dual credit species with breeding habitat assessed for species credits and foraging habitat assessed for ecosystem credits. **Habitat Description:** Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of Sheoak occur (NSW DPE 2023c). **Habitat or geographical constraints:** Living or dead tree with hollows greater than 15 cm diameter and greater than 8 m above ground for species credit breeding habitat component and presence of Allocasuarina or Casuarina species for ecosystem credit foraging habitat component. **Survey Requirements:** Survey requirements are specified in the TBDC. This is a dual credit species. The identification of breeding habitat will require survey or an expert report. Survey period is January to September. Step 1. 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. Step 2. Where signs of breeding on site are present, POTENTIAL NEST TREES should be identified. Potential nest trees contain hollows that are; (i) at least 8 m above the ground; and (ii) in stems with a diameter of at least 30 cm; and (iii) hollow diameter is at least 15 cm; and (iv) stem angle is at least 45 degrees, and may be near-vertical or vertical. Step 3. Where potential nest trees are identified on site, monitor for this species during the breeding season (Apr – Aug) to confirm the presence of any ACTUAL NEST TREES on site. DPIE is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements). Step 4. If actual nest trees are confirmed on site, then the species polygons are to be drawn around those actual nest trees (i.e. trees that birds of the species are known to have used for nesting). The species polygons should be circular in shape and must include a buffer radius of 200 m around each actual nest tree. The purpose of the buffer is to identify the essential area for breeding and minimise disturbance/avoid clearing for a development application, or conserve and improve habitat for a biodiversity stewardship agreement. The shape of the buffer can be modified where evidence provided in the Biodiversity Assessment Report indicates an alternative shape would better meet the species needs in the context of the assessment site. For example, subject land under assessment is linear, and the nest tree is already located near the edge of the wooded area. **Surveys Completed:** Presence of Allocasuarina sp., which is a habitat constraint for the ecosystem credit for this species were confirmed during flora surveys and habitat searches for this species. Diurnal bird surveys in accordance with Step 1 of the survey requirements were undertaken by 2 ecologists over 10 days (121 hours) on 9 July 2018 (5 hrs x 2 people), 10 July 2018 (5 hrs 25 min x 2 people), 11 July 2018 (6.25 hrs x 2 people), 12 July 2018 (4 hrs x 2 people), 25 July 2022 (4 hrs x 2 people), 26 July 2022 (7.5 hrs x 2 people), 28 July 2022 (6 hrs x 2 people), 29 July 2022 (6.5 hrs x 2 people), 14 September 2022 (8.5 hrs x 2 people) and 16 September 2022 (7.5 hrs x 2 people). These surveys included diurnal census for adult birds through the Development Footprint and listening for signs of breeding such as begging chicks around potential nesting trees. Opportunistic observation surveys were also completed during orchid searches undertaken over 5 days in June 2023.

Fauna Survey Details
No signs of breeding, including begging birds, pairs of birds or lone adult males were detected during the breeding season and therefore steps 2–4 of the survey guidelines, including mapping of hollow bearing trees suitable for breeding, are not required. **Assessment Approach and Justification:** The ecosystem credit component of this species' habitat has been assessed as present as *Allocasuarina* sp. trees are present. Signs of foraging activity by this species were observed in the form of chewed *Allocasuarina torulosa* seed cones, however no direct sightings of this species were obtained and site use as breeding habitat by this species were not observed during surveys. This species has been assessed as not present.
Eastern Pygmy-possum *Cercartetus nanus* **Credit Type:** Full species credit. **Habitat Description:** Found in a broad range of habitats from rainforest, sclerophyll forest and woodland and heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksia, eucalyptus and bottlebrush species (NSW DPE 2023c). **Habitat or geographical constraints:** None listed. **Survey Requirements:** Survey period is October to March. TBDC provides no species-specific guideline requirements other than mentioning species is difficult to detect especially via spotlighting. **Surveys Completed:** Camera trapping was completed with 915 trap nights achieved including 315 trap nights with 10 cameras during 23 January to 19 March 2018 and 600 trap nights with 20 cameras during 1 November to 1 December 2022. Cameras were mounted on trees at approximately 1.5 m height and lures consisted of a weatherproof bait cannister loosely packed with a sticky rolled oats, honey and peanut butter mixture, mounted on trees sprayed liberally with a honey-water mixture. Spotlighting was completed for this species by 2 ecologists on 19 to 22 March 2018 (7 hr 40 mins x 2 people), 28 March 2018 (2 hrs x 2 people), 1 November 2022 (1 hr x 2 people), 2 November 2022 (0.5 hrs x 2 people), 30 November 2022 (1 hr x 2 people) and 1 December 2022 (1 hr x 2 people). **Assessment Approach and Justification:** This species was not observed during surveys and has been assessed as not present.
Large-eared Pied-bat *Chalinolobus dwyeri* **Credit Type:** Full species credit. **Habitat Description:** Found in well-timbered dry open forest and woodland areas at low to mid elevations (gullies) in areas containing or connected to extensive cliffs and caves (NSW DPE 2023c). Under the BAM suitable habitats are defined by NSW DPIE (2021) as all areas with the PCTs associated with the species (as per the TBDC) on the subject land where the subject land is within 2 kilometres of caves, scarps, cliffs, rock overhangs and disused mines. Breeding habitat is all potential habitat on the subject land where the subject land is within 100 metres of caves, scarps, cliffs, rock overhangs and disused mines. **Habitat or geographical constraints:** Within 2 km of potential roosting habitat including rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or old mines or tunnels. The presence of these habitat constraints is limited to the Balickera tunnel which has openings approximately 330 m to the west and 450 m to the south of the development footprint. **Survey Requirements:** Harp trapping and/or acoustic detection for 16 nights. Supplementary roost searches / radio tracking can also be completed. Surveys should be timed during mid November to January. Traps and/or detectors should be set in woodlands, valley floors, riparian areas and relatively fertile parts of the subject land where possible.

Fauna Survey Details
Surveys Completed by Umwelt: For the development footprint Umwelt completed a total of 90 nights of ultrasonic call recording including 4 nights with 2 detector units during January 2018, 10 nights with 2 detector units during November to December 2022 and 76 nights with 4 detector units during January to February 2023. The ultrasonic call recording surveys undertaken by Umwelt were all completed during the survey periods specified in the DPIE survey guidelines and the survey effort satisfies the DPIE (2021) survey guideline requirements for this species. **Surveys Completed for the Balickera Tunnel Remediation Project:** Surveys completed targeting bats roosting in the Balickera Tunnel and broader locality were undertaken as part of the recent Balickera Tunnel Remediation project by Eco Logical Australia (2021) and the associated post construction monitoring by WSP (2023). These surveys included a range of methods to gain information on the species of bats using the tunnel and locality, the numbers of bats present and their locations in the tunnel. The microbat species detection surveys completed by Eco Logical Australia (2021) for Balickera Tunnel included harp trapping and ultrasonic call recording. Harp trapping included the capture of microbats leaving the tunnel in order to determine which species were present and the sex, life stage and breeding status of those species. Harp traps were set at the existing stop gate directly outside the downstream tunnel entrance (but not during January 2021 due to flooding) and amongst the trees at the upstream tunnel entrance. Harp trapping was completed on 10 March 2020 (5 traps), 9 June 2020 (6 traps), 7 September 2020 (6 traps) and 27 January 2021 (4 traps) for 30 minutes before sunset to 3 hrs after sunset. Trapping all night and for consecutive trap nights was not undertaken for animal ethics reasons. Eco Logical Australia (2021) also completed 32 ultrasonic call recording nights over 16 nights with one detector at the upstream portal and one detector at the downstream portal all night (30 min before sunset to 30 min after sunrise). The survey dates for ultrasonic call recording were 9-13 March 2020 (2 x detectors for 4 nights), 9-13 June (2 x detectors for 4 nights), 7-11 September 2020 (2 x detectors for 4 nights) and 25-29 January 2021 (2 x detectors for 4 nights). Surveys were undertaken across several seasons (not just the breeding period), to increase the likelihood of identifying the full assemblage of species utilising the tunnel. Other surveys completed by (2021) included thermal imaging surveys of bats emerging from the tunnel, inspection and ultrasonic call recording at other potential microbat tunnel and bridge roost sites in the region and autonomous surface vessel inspections. The microbat species detection surveys completed by WSP (2023) for Balickera Tunnel included harp trapping and ultrasonic call recording. This consisted of 3 harp traps for one night on 11 May 2023 at the upstream portal of the Balickera Tunnel and ultrasonic call recording surveys at the upstream and downstream portals of Balickera Tunnel recording overnight with one detector at each site for 4 nights per monitoring session during July and October 2022, February and May 2023 (32 detector nights). Other surveys completed by WSP (2023) included autonomous surface vessel inspections during Summer 2023 and Autumn 2023, inspections of road bridge expansion gaps for roosting bats at Nine **Mile Creek Bridge,** Twelve Mile Creek Bridge, Balickera Canal Bridge and Grahamstown Canal Bridge and inspections of 10 bat nest boxes during July and October 2022 and February and May 2023 and thermal video recording for two nights during each monitoring session in July and October 2022 and February and May 2023. **Assessment Approach and Justification:** This species was not observed during comprehensive surveys undertaken by Umwelt within the development footprint or by Eco Logical Australia (2021) and WSP (2023) within or in areas adjoining the Balickera Tunnel. This species is typically found in areas with connectivity to extensive cliffs and caves, particularly areas with sandstone geology and these habitats are not present. This species has been assessed as not present.
White-bellied Sea-Eagle *Haliaeetus leucogaster* **Credit Type:** Dual credit species with breeding habitat (nests) assessed for species credits and foraging habitat assessed for ecosystem credits. **Habitat Description:** Typically nests in large emergent eucalypts in areas near the ocean, estuaries and larger freshwater waterbodies and watercourses. **Habitat or geographical constraints:** Living or dead mature trees within suitable vegetation within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines (DPE 2023c).

Fauna Survey Details
Survey Requirement: Survey July to December. Breeding habitat is live large old trees within 1 km of a rivers, lakes, large dams or creeks, wetlands and coastlines AND the presence of a large stick nest within tree canopy; or an adult with nest material; or adults observed duetting within breeding period. Due to the similarities in nest structure and use of the same nests by White-bellied Sea Eagles and Wedge-tailed Eagles, where a nest is observed without a bird present, searches for prey remains/feathers below the structure should be undertaken. The differing diets of both species and distinctive adult feathers, should provide evidence of nest use, however; where prey items/feathers are absent, repeat visits to the nest until a bird is observed should be undertaken. DPIE is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements). **Surveys Completed:** Habitat searches looking for White-bellied Sea-Eagles and signs of large stick nests were undertaken by 2–3 ecologists over 20 days (278.8 hours) on 9 July 2018 (5 hrs x 2 people), 10 July 2018 (5 hrs 25 min x 2 people), 11 July 2018 (6.25 hrs x 2 people), 12 July 2018 (4 hrs x 2 people), 25 July 2022 (4 hrs x 2 people), 26 July 2022 (7.5 hrs x 2 people), 28 July 2022 (6 hrs x 2 people), 29 July 2022 (6.5 hrs x 2 people), 14 September 2022 (8.5 hrs x 2 people), 16 September 2022 (7.5 hrs x 2 people), 17 October 2022 (8.5 hrs x 2 people), 18 October 2022 (10.5 hrs x 3 people), 19 October (8.5 hrs x 2 people), 25 October (8.5 hrs x 2 people), 26 October (8.5 hrs x 2 people), 31 October 2022 (4 hrs x 4 people), 1 November 2022 (3 hrs x 2 people), 2 November 2022 (4 hrs x 2 people), 9 November 2022 (7.25 hrs x 2 people) and 16 November 2022 (7.75 hrs x 2 people). **Assessment Approach and Justification:** One immature White-bellied Sea-Eagle was observed perched on a tree within the development footprint on 25 October 2022. No large stick nests were observed during surveys and breeding habitat for this species has been assessed as not present.
Little Eagle *Hieraaetus morphnoides* **Credit Type:** Dual credit species with breeding habitat (nests) assessed for species credits and foraging habitat assessed for ecosystem credits. **Habitat Description:** Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter (DPE 2023c). **Habitat or geographical constraints:** Nest trees - live (occasionally dead) large old trees within vegetation. **Survey Requirement:** Survey August to October. Breeding habitat is live (occasionally dead) large old trees within suitable vegetation AND the presence of a male and female; or any adult with nesting material; or an individual on a large stick nest in the top half of the tree canopy; or pairs displaying (soaring, diving, engaging in chases, or a male observed calling in flight with a female begging from tree). DPE is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements). **Surveys Completed:** Habitat searches looking for Little Eagles and signs of stick nests were undertaken by 2–3 ecologists over 8 days (147 hours) on 14 September 2022 (8.5 hrs x 2 people), 16 September 2022 (7.5 hrs x 2 people), 17 October 2022 (8.5 hrs x 2 people), 18 October 2022 (10.5 hrs x 3 people), 19 October (8.5 hrs x 2 people), 25 October (8.5 hrs x 2 people), 26 October (8.5 hrs x 2 people), 31 October 2022 (4 hrs x 4 people). **Assessment Approach and Justification:** No Little Eagles or potential nests were observed during surveys and this species has been assessed as not present.

Fauna Survey Details
Pale-headed Snake *Hoplocephalus bitorquatus* **Credit Type:** Full species credit **Habitat Description:** All PCTs associated with the species in the TBDC are considered to be suitable habitat according to DPE (2022c). This species is found mainly in dry eucalypt forests and woodlands, cypress forest and occasionally in rainforest or moist eucalypt forest and closer to riparian areas in dry environments. Shelter during the day between loose bark and tree-trunks, or in hollow trunks and limbs of dead trees (DPE 2023). **Habitat or geographical constraints:** None listed. **Survey Guideline Requirement:** Surveys for the Pale-headed Snake were commenced and substantially completed prior to the release of the DPE Threatened Reptiles BAM Survey Guide in November 2022, therefore compliance with the guideline is not required. The Guideline specifies spotlighting during November–March for 2 hrs x 4 replicates, 30 minutes after sunset with ambient temperature >18°C AND Funnel Traps Nov-Mar. 72 Trap nights x 4 nights per 50 ha. Where possible surveying 1–2 days after rain on humid nights. Surveys for this species consisted of spotlighting however did not apply funnel trapping methods as there was no species-specific requirements at the time the surveys were completed. **Surveys Completed:** Spotlighting was undertaken by 2 ecologists over 8 nights (26.3 person hrs) on 19 March 2018 (2 hrs x 2 people), 20 March 2018 (2 hrs 40 min x 2 people), 22 March 2018 (3 hrs x 2 people), 28 March 2018 (2 hrs x 2 people), 1 November 2022 (1 hr x 2 people), 2 November 2022 (0.5 hrs x 2 people), 30 November 2022 (1 hr x 2 people) and 1 December 2022 (1 hr x 2 people). **Assessment Approach and Justification:** This species was not observed during surveys and has been assessed as not present.
Swift Parrot *Lathamus discolor* **Credit type:** Dual credit species with mapped important habitat assessed for species credits and as potential SAII Entity and non-important habitat assessed for ecosystem credits. **Habitat Description (mapped important habitat):** The mapped important habitat areas were determined by applying a 2 km radial buffer around verified Swift Parrot sighting records from 1990-2022 extracted from BioNet and BirdLife Australia Atlas, where sightings of five or more birds recorded over any two or more years, or single sightings of 40 or more birds. The NSW State Vegetation Type Map (SVTM) version C1.1.M1.1 was then used to select Plant Community Types (PCTs) associated with the swift parrot (as per the Threatened Biodiversity Data Collection (TBDC)) within the 2 km buffers to create the important habitat map. Any isolated areas of vegetation less than one hectare were excluded. **Associated PCTs:** Not applicable for species assessed via mapped important habitat. **Survey requirements**: BCD have requested details of survey compliance with the Survey Guidelines for Australia's Threatened Birds (DEWHA 2010), which specifies 20 hours over 8 days per 50 ha of habitat. The species is typically present on the mainland of Australia between March and mid-October. This species was surveyed for across 17 diurnal winter bird census point based area searches completed over 4 days on 9 July 2018 (5 hrs x 2 persons), 10 July (5 hrs 25 min x 2 persons), 11 July 2018 (6.25 hrs x 2 persons), 12 July (4 hrs x 2 persons). This species was also subject to targeted searches by 2–3 ecologists on over 9 days during which 145.5 person hours of survey were completed on 25 July 2022 (4 hrs x 2 people), 26 July 2022 (7.5 hrs x 2 people), 28 July 2022 (6 hrs x 2 people), 29 July 2022 (6.5 hrs x 2 people), 14 September 2022 (8.5 hrs x 2 people), 16 September 2022 (7.5 hrs x 2 people), 17 October 2022 (8.5 hrs x 2 people), 18 October 2022 (10.5 hrs x 3 people), 19 October (8.5 hrs x 2 people). No surveys are required for this species under the BAM, as the foraging habitat component will be offset using ecosystem credits and important habitat which requires species credits, is not mapped within the Development Footprint. **Assessment Approach and Justification:** Important habitat for this species has been assessed as not present as there is none mapped within the development footprint. Foraging habitat for this species has been assessed as assumed present in accordance with the BAM requirements for ecosystem credit species.

Fauna Survey Details
Green and Golden Bell Frog *Litoria aurea* **Credit Type:** Full species credit species. **Habitat Description**: Inhabits a wide range of natural and man-made waterbodies, particularly areas containing Typha and Eleocharis spp. Its range has reduced significantly to isolated remnant populations possibly due to Plague Minnow (*Gambusia holbrooki*) and frog chytrid fungus. The NSW Survey Guide for Threatened Frogs identifies that suitable breeding and non-breeding shelter habitat consists of any waterbody with emergent aquatic vegetation and without the plague minnow (*Gambusia holbrooki*), although the green and golden bell frog will still occasionally breed in sites with this introduced pest fish. Foraging habitat and migratory habitat are areas of native and non-native vegetation. **Habitat or geographical constraints:** within 1 km of ephemeral wet areas, swamps and waterbodies (although where present the species polygon is only required within a buffer of 200 m of these areas). **Survey Requirement:** Survey during November to March using Aural-visual survey transects of 500 m length and 2 hr duration x 4 replicates. Other suitable methods include acoustic recorders and tadpole searches (which can replace up to two of the aural visual survey replicates). **Surveys completed:** Prior to the release of the NSW Survey Guide for Threatened Frogs (DPIE 2020) spotlighting searches and call playback by Umwelt ecologists was undertaken over 4 nights on 19 March 2018 (2 hrs x 2 people), 20 March 2018 (2 hrs 40 min x 2 people), 22 March 2018 (3 hrs x 2 people) and 28 March 2018 (2 hrs x 2 people). Following the release of the current NSW Survey Guide for Threatened Frogs (DPIE 2020) an additional 4 replicate nights (14 person hours) of aural-visual transect surveys with call playback was completed by two Umwelt Ecologists on 1 November 2022 (2 hrs x 2 people), 2 November 2022 (2 hrs x 2 people), 30 November 2022 (1.5 hrs x 2 people) and 1 December 2022 (1.5 hrs x 2 people). The survey transects were aligned to watercourses and damp areas of potential habitat within the development footprint and Project Area. **Assessment Approach and Justification:** No Green and Golden Bell Frogs were observed or heard calling during the surveys completed and this species has been assessed as not present.
Square-tailed Kite *Lophoictinia isura* **Credit Type:** Dual credit species with breeding habitat (nests) assessed for species credits and foraging habitat assessed for ecosystem credits. **Habitat Description:** Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter (DPE 2023c). **Habitat or geographical constraints:** Nest trees. **Survey Requirement:** Survey September to January. Square-tailed kites will need be in attendance to confirm breeding sites. Breeding habitat is live large old trees within suitable vegetation AND the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy. DPIE is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements). **Surveys completed:** Habitat searches looking for Square-tailed Kites and signs of stick nests were undertaken by 2–3 ecologists over 12 days (191.5 hours) on 14 September 2022 (8.5 hrs x 2 people), 16 September 2022 (7.5 hrs x 2 people), 17 October 2022 (8.5 hrs x 2 people), 18 October 2022 (10.5 hrs x 3 people), 19 October (8.5 hrs x 2 people), 25 October (8.5 hrs x 2 people), 26 October (8.5 hrs x 2 people), 31 October 2022 (4 hrs x 4 people), 1 November 2022 (3 hrs x 2 people), 2 November 2022 (4 hrs x 2 people), 9 November 2022 (7.25 hrs x 2 people) and 16 November 2022 (7.75 hrs x 2 people). **Assessment Approach and Justification:** No Square-tailed Kites or Square-tailed Kite nests were observed during surveys and this species has been assessed as not present.

Fauna Survey Details
Southern Myotis *Myotis macropus*
Credit Type: Full species credit.
Habitat Description: Generally roosts in groups of 10–15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, wharves, bridges and in dense foliage, forages over streams and pools catching insects and small fish (NSW DPE 2023c).
Under the BAM potential habitats are defined by NSW DPIE (2021) as all PCTs associated with the species (as per the TBDC) within 200 metres of the bank of any medium to large permanent creeks, rivers, lakes or other waterways (i.e. with pools/ stretches 3 metres or wider) on the subject land.
Habitat or geographical constraints: Waterbodies with permanent pools/stretches 3 m or wider, including rivers, large creeks, billabongs, lagoons, estuaries, dams and other waterbodies, on or within 200 m of the site.
There are no waterbodies with permanent pools or stretches 3 m or wider within 200 m of the development footprint.
Survey Requirements: No surveys are required for this species as its habitat constraints are not present in the development footprint. Where potential habitat is present survey requirements include harp trapping and/or passive acoustic detection for 16 nights or active detection for 8 hrs over 4 nights. Roost searches should also be completed with one 30 min search completed per structure. Surveys should be timed during October to March.
Surveys Completed by Umwelt: Microbat surveys completed for the development footprint by Umwelt included a total of 90 nights of ultrasonic call recording including 4 nights with 2 detector units during January 2018, 10 nights with 2 detector units during November to December 2022 and 76 nights with 4 detector units during January to February 2023. The ultrasonic call recording surveys undertaken by Umwelt were all completed during the survey periods specified in the DPIE survey guidelines and the survey effort satisfies the DPIE (2021) survey guideline requirements for this species.
Surveys Completed for the Balickera Tunnel Remediation Project: Surveys completed targeting bats roosting in the Balickera Tunnel and broader locality were undertaken as part of the recent Balickera Tunnel Remediation project by Eco Logical Australia (2021) and the associated post construction monitoring by WSP (2023). These surveys included a range of methods to gain information on the species of bats using the tunnel and locality, the numbers of bats present and their locations in the tunnel.
The microbat species detection surveys completed by Eco Logical Australia (2021) for Balickera Tunnel included harp trapping and ultrasonic call recording. Harp trapping included the capture of microbats leaving the tunnel in order to determine which species were present and the sex, life stage and breeding status of those species. Harp traps were set at the existing stop gate directly the downstream tunnel entrance (but not during January 2021 due to flooding) and amongst the trees at the upstream tunnel entrance. Harp trapping was completed on 10 March 2020 (5 traps), 9 June 2020 (6 traps), 7 September 2020 (6 traps) and 27 January 2021 (4 traps) for 30 minutes before sunset to 3 hrs after sunset. Trapping all night and for consecutive trap nights was not undertaken for animal ethics reasons. Eco Logical Australia (2021) also completed 32 ultrasonic call recording nights over 16 nights with one detector at the upstream portal and one detector at the downstream portal all night (30 min before sunset to 30 min after sunrise). The survey dates for ultrasonic call recording were 9–13 March 2020 (2 x detectors for 4 nights), 9–13 June (2 x detectors for 4 nights), 7–11 September 2020 (2 x detectors for 4 nights) and 25–29 January 2021 (2 x detectors for 4 nights). Surveys were undertaken across several seasons (not just the breeding period), to increase the likelihood of identifying the full assemblage of species utilising the tunnel. Other surveys completed by Ecological Australia (2021) included thermal imaging surveys of bats emerging from the tunnel, inspection and ultrasonic call recording at other potential microbat tunnel and bridge roost sites in the region and autonomous surface vessel inspections.

Fauna Survey Details
The microbat species detection surveys completed by WSP (2023) for Balickera Tunnel included harp trapping and ultrasonic call recording. This consisted of 3 harp traps for one night on 11 May 2023 at the upstream portal of the Balickera Tunnel and ultrasonic call recording surveys at the upstream and downstream portals of Balickera Tunnel recording overnight with one detector at each site for 4 nights per monitoring session during July and October 2022, February and May 2023 (32 detector nights). Other surveys completed by WSP (2023) included autonomous surface vessel inspections during Summer 2023 and Autumn 2023, inspections of road bridge expansion gaps for roosting bats at Nine Mile Creek Bridge, Twelve Mile Creek Bridge, Balickera Canal Bridge and Grahamstown Canal Bridge and inspections of 10 bat nest boxes during July and October 2022 and February and May 2023 and thermal video recording for two nights during each monitoring session in July and October 2022 and February and May 2023. **Assessment Approach and Justification:** Where the species has been recorded the species polygon is required for PCTs on the subject land with which the species is associated (as listed in the TBDC) that occur within 200 metres of the high bank, or high tide mark of creeks, rivers or other waterbodies greater than 3 metres wide. Non-associated PCTs should also be included if the species has been recorded in the PCT and the area occurs within 200 metres of a waterbody greater than 3 metres wide. This species was observed during surveys, however its habitat constraints have not been met within the development footprint and a species polygon is not required as all areas defined as potential habitat under the BAM will be avoided.
Barking Owl *Ninox connivens* **Credit Type:** Dual credit species with breeding habitat assessed for species credits and foraging habitat assessed for ecosystem credits. **Habitat Description**: Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Species is likely to breed and forage within very small patches of vegetation (< 5 ha), especially when the patch is riparian vegetation or where the small patch is within 400 m of another larger patch of vegetation. They are unlikely to nest in the hollows of a paddock tree if the tree is separated from a larger patch of vegetation by more than 400 m of cleared habitat (DPE 2023c). **Habitat or geographical constraints:** Breeding habitat constraint is living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground. **Survey Requirement:** Survey May to December. Where any known nest tree(s) occurs on site (e.g. known from existing data, studies or other documented evidence), a species polygon providing a circular buffer with a 100 m radius should be drawn around the known nest tree(s). In addition, or where there are no known nest trees on site, assessors should apply the following process: Step 1. Look for SIGNS OF BREEDING on site as follows; suitable habitat AND (a) presence of male and female OR (b) calling to each other (duetting) OR (c) find nest. Step 2. Where signs of breeding on site are present, POTENTIAL NEST TREES should be identified. Potential nest trees are living or dead trees with hollows greater than 20 cm diameter and greater than 4 m above the ground. Step 3. Where potential nest trees are identified on site then, night monitoring at the identified potential nest locations for a minimum of 2 nights should be undertaken to detect the presence of any owl of this species using a potential nest tree or demonstrating behaviour focussed on a potential nest tree (e.g. investigating the hollow or roosting within 10 m). DPIE is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake species surveys using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements).

Fauna Survey Details
Step 4. If monitoring of potential nest trees detects this owl species using, or demonstrating behaviour focussed on the trees (e.g. investigation of the hollow or roosting within 10 m) on site, the species polygons should be drawn around those trees (i.e. the identified potential nest trees where any owl of this species is observed using or focussing behaviour around the tree). The species polygons should be circular in shape and must include a buffer radius of 100 m around each tree. The purpose of the buffer is to minimise disturbance/avoid clearing, for a development application, or to conserve and improve habitat, for a biodiversity stewardship agreement, within the area essential for breeding. This includes habitat suitable for male roosts, feeding/grooming perches and fledgling requirements. It does not account for foraging habitat. The species uses paddock trees to extend foraging area from intact woodland. The shape of the buffer can be modified where evidence provided in the Biodiversity Assessment Report indicates an alternative shape would better meet the species needs in the context of the assessment site. For example, extant vegetation is linear, and the nest tree is already located near the edge of the wooded area. **Surveys Completed:** Nocturnal call playback and spotlighting surveys were completed by Umwelt Ecologists on the following dates: 9 July 2018 (2.5 hrs x 2 people), 10 July 2018 (2 hrs 50 min x 2 people), 11 July 2018 (1.75 hrs x 2 people), 12 July 2018 (1.5 hrs x 2 people), 26 August 2019 (1.5 hrs x 2 people), 27 August 2019 (2 hrs 10 min x 2 people). Following changes to the TBDC survey guidance, additional comprehensive targeted searches for hollow bearing trees were undertaken across the current development footprint on 14 and 16 September 2022 by two Umwelt ecologists. These surveys identified the presence of 6 hollow bearing trees with hollow openings large enough (>20 cm openings) to support potential breeding habitat. These hollow bearing trees (HT 1 to HT 6) are shown in **Figure 2.3** and were subject to two nights of stag watching each by 4 ecologists on 12 June 2023 and 13 June 2023, noting that two groups of two trees were in very close proximity and were surveyed in tandem. **Assessment Approach and Justification:** No Barking Owls were observed or heard calling during the surveys completed and this species has been assessed as not present.
Powerful Owl *Ninox strenua* **Credit Type:** Dual credit species with breeding habitat assessed for species credits and foraging habitat assessed for ecosystem credits. **Habitat Description:** Inhabits a range of vegetation types from woodland to open sclerophyll forest, tall wet forest and rainforest. Requires large tracts of vegetation but can occur in fragmented landscapes with areas occupied being 400 ha to greater than 4000 ha depending on prey density. Nests in large tree hollows (at least 0.5 m deep) in large eucalypts (80–240 cm trunk diameter) that are at least 150 years old. The female and young nest in the hollow and the male roosts nearby during the day often in a dense grove that provides concealment (DPE 2023c). **Habitat or geographical constraints**: Living or dead trees with hollow greater than 20 cm diameter. **Survey Requirement:** Survey May to August. The species can breed and forage in very small patches of vegetation, although this is hugely variable across their range. Where any nest tree(s) for which high fidelity is known to occur on site (e.g. known from existing data, studies or other documented evidence), a species polygon providing a circular buffer with a 100 m radius should be drawn around the known nest tree(s). In addition, or where there are no known nest trees on site, assessors should apply the following process: Step 1. Look for SIGNS OF BREEDING on site as follows; suitable habitat AND (a) presence of male and female OR (b) calling to each other (duetting) OR (c) find nest. Note that this species does not respond as well to call-play-back and could require stag watching and other evidence of nesting. Step 2. Where signs of breeding on site are present, POTENTIAL NEST TREES should be identified. Potential nest trees are living or dead trees with hollows greater than 20 cm diameter.

Fauna Survey Details
Step 3. Where potential nest trees are identified on site, night monitoring at the identified potential nest locations for a minimum of 2 nights should be undertaken to detect the presence of any owl of this species using a potential nest tree or demonstrating behaviour focussed on a potential nest tree (e.g. investigating the hollow or roosting within 10 m). DPIE is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake species surveys using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements). Step 4. If monitoring of potential nest trees detects this owl species using, or demonstrating behaviour focussed on the trees (e.g. investigation of the hollow or roosting within 10 m) on site, the species polygons should be drawn around those trees (i.e. the identified potential nest trees where any owl of this species is observed using, or focussing behaviour around the tree). The species polygons should be circular in shape and must include a buffer radius of 100 m around each tree. The purpose of the buffer is to minimise disturbance/avoid clearing, for a development application, or to conserve and improve habitat, for a biodiversity stewardship agreement, within the area essential for breeding. This includes habitat suitable for male roosts, feeding/grooming perches and fledgling requirements. It does not account for foraging habitat. The shape of the buffer can be modified where evidence provided in the Biodiversity Assessment Report indicates an alternative shape would better meet the species needs in the context of the assessment site. For example, extant vegetation is linear, and the nest tree is already located near the edge of the wooded area. **Surveys completed:** Nocturnal call playback and spotlighting surveys were completed by Umwelt Ecologists on the following dates: 9 July 2018 (2.5 hrs x 2 people), 10 July 2018 (2 hrs 50 min x 2 people), 11 July 2018 (1.75 hrs x 2 people), 12 July 2018 (1.5 hrs x 2 people), 26 August 2019 (1.5 hrs x 2 people), 27 August 2019 (2 hrs 10 min x 2 people). Following changes to the TBDC survey guidance, additional comprehensive targeted searches for hollow bearing trees were undertaken across the current development footprint on 14 and 16 September 2022 by two Umwelt ecologists. These surveys identified the presence of 6 hollow bearing trees with hollow openings large enough (>20 cm openings) to support potential breeding habitat. These hollow bearing trees (HT 1 to HT 6) are shown in **Figure 2.3** and were subject to two nights of stag watching each by 4 ecologists on 12 June 2023 and 13 June 2023, noting that two groups of two trees were in very close proximity and were surveyed in tandem. **Assessment Approach and Justification:** The Powerful Owl was recorded during spotlighting and call playback surveys completed outside of the TBDC specified breeding survey period on 19 March and 28 March 2018. No further observations of this species were made during targeted surveys and this species has been assessed as using the site for foraging habitat but not breeding habitat. No species credits are required and the foraging habitat for this species will be offset with ecosystem credits.
Southern Greater Glider *Petauroides volans* **Credit Type:** Full species credit. **Habitat Description:** Inhabits eucalypt forests and woodlands. Hollow dependent species that will have large trees with hollows within its home range. Home range is < 5 ha and typically 1 to 3 ha. This species is sensitive to forest clearing and fragmentation as its movements are primarily restricted to gliding between trees over distances of typically 30 m (but up to 100 m) (NSW Scientific Committee 2015). **Habitat or geographical constraints:** None listed. **Survey Requirement:** No species-specific survey guideline has been published under the BAM. The Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities (DEC 2004) is the most directly relevant guide listed on the BAM Assessors webpage, which covers survey methods for non-flying mammals. Spotlighting was chosen as the most effective survey method available for this species due to its arboreal habit and leaf-based diet. Spotlighting from a vehicle is specified at 2 x 1 km tracks with a maximum speed of 5 km per hour on 2 separate nights for up to 200 ha of stratification unit.

Fauna Survey Details
Spotlighting on foot is specified at 2 x 1 hour and 1 km up to 200 ha of stratification unit walking at 1 km per hour on 2 separate nights. **Surveys completed:** Spotlighting surveys were completed over multiple nights spanning several years between 2018 and 2022. The surveys comprised including 7 hrs 40 min of searching over 43 km completed by two people (driving and walking) over 3 nights in March 2018, 8.6 hrs of searching completed over 4 nights by 2 ecologists in July 2018, 3.5 hrs of searching over 6.8 km by two ecologists over 2 nights in August 2019, 2.5 hrs of searching over 14 km by 2 ecologists over 3 nights during November 2022 and 1 hr of searching over 5.9 km completed by two ecologists over 1 night in December 2022. **Assessment Approach and Justification:** This species was not observed during surveys and this species has been assessed as not present.
Squirrel Glider *Petaurus norfolcensis* **Credit Type:** Full species credit. **Habitat Description:** The Squirrel Glider inhabits floriferous eucalypt open forests and woodlands often with a Banksia or Acacia shrub layer. It requires den sites in tree cavities and a good winter supply of nectar (NSW Scientific Committee 2008). **Habitat or geographical constraints:** None listed. **Survey Requirement:** No species-specific survey guideline has been published under the BAM. The TBDC identifies that sites can be surveyed year-round and sites with bipinnate acacia, autumn to spring flowering trees and shrubs such as Eucalyptus robusta and Banksia sp. (for example, Bankisa integrifolia etc) should be subject to a more protracted survey period of between March-August. Relies on large old trees with hollows for breeding and nesting. These trees are also critical for movement and typically need to be closely-connected (i.e., no more than 50 m apart) to enable gliding. The NSW Credit Supply Taskforce (CST) has provided draft guidance that identifies arboreal Elliot traps, remote camera traps and spotlighting as suitable methods with a requirement for spotlighting in combination with one of the other two methods. The EPBC Act Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011c) provides a general guide for spotlighting effort of 2 x 200 m transects per 5 ha spaced at least 100 m and surveyed on two nights. The EPBC Act Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011c) provides a guide for camera trapping effort of 10 cameras x 14 nights per 5 ha, deployed over a 1 ha sampling area. **Surveys Completed:** Camera trapping was completed with 915 trap nights achieved including 315 terrestrial trap nights with 10 cameras during 23 January to 19 March 2018 and 600 arboreal trap nights with 20 cameras during 1 November to 1 December 2022. Terrestrial cameras were mounted on trees position facing fish-based baits pegged to the ground. Arboreal cameras were mounted on trees at approximately 1.5 m height and lures consisted of a weatherproof bait cannister loosely packed with a sticky rolled oats, honey and peanut butter mixture, mounted on trees sprayed liberally with a honey-water mixture. Spotlighting surveys were completed over multiple nights spanning several years between 2018 and 2022. The surveys comprised including 7 hrs 40 min of searching over 43 km completed by two people (driving and walking) over 3 nights in March 2018, 8.6 hrs of searching completed over 4 nights by 2 ecologists in July 2018, 3.5 hrs of searching over 6.8 km by two ecologists over 2 nights in August 2019, 2.5 hrs of searching over 14 km by 2 ecologists over 3 nights during November 2022 and 1 hr of searching over 5.9 km completed by two ecologists over 1 night in December 2022. **Assessment Approach and Justification:** This species was observed during surveys and suitable habitat is present. This species has been assessed as present.

Fauna Survey Details
Brush-tailed Phascogale *Phascogale tapoatafa*
Credit Type: Full species credit.
Habitat Description: Prefers dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabits heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. Feeds mostly on arthropods but will also eat other invertebrates, nectar and sometimes small vertebrates. Females have exclusive territories of approximately 20–40 ha, while males have overlapping territories often greater than 100 ha. Nest and shelter in tree hollows with entrances 2.5–4 cm wide and use many different hollows over a short time span. Mating occurs May - July; males die soon after the mating season whereas females can live for up to three years but generally only produce one litter.
Habitat or geographical constraints: None listed.
Survey Requirement: Survey must be undertaken using baited cameras. The bait type used must remain as an effective attractant until replaced. Honeyed oat balls will need to be replaced daily. Other effective baiting methods include using a baited canister with small holes and capped at either end, to limit bait theft by other species, or honey-water, sprayed very liberally in front of each camera. The baited canister and honey-water will require less frequent replenishment of the bait compared to a bait ball. Cameras should be set at head height, or above, facing the branch or tree trunk where a honey-based bait has been placed. Cameras must remain in place for a minimum of 4 weeks with cameras checked and baits replaced after 2 weeks. A minimum of 4 cameras, independent of the size of the subject land, must be used for sites up to 1 ha, then an additional 2 cameras for every ha of suitable habitat thereafter. Cameras must be evenly spaced across the site. Where potential habitat is disconnected by gaps of 50 m or more, each habitat patch should have a minimum of 4 cameras for the first ha, and 2 cameras for every ha thereafter. Malfunctioning cameras must be replaced and additional cameras and time must be invested to address the lost survey effort. That is, at least 22 working, baited, evenly spaced camera traps are required for the first 10 ha of suitable habitat.
Surveys Completed: Camera trapping was completed with 915 trap nights achieved including 315 terrestrial trap nights with 10 cameras during 23 January to 19 March 2018 and 600 arboreal trap nights with 20 cameras during 1 November to 1 December 2022. Terrestrial cameras were mounted on trees position facing fish-based baits pegged to the ground. Arboreal cameras were mounted on trees at approximately 1.5 m height and lures consisted of a weatherproof bait cannister loosely packed with a sticky rolled oats, honey and peanut butter mixture, mounted on trees sprayed liberally with a honey-water mixture. Spotlighting was completed as a supplementary survey method. Spotlighting surveys were completed over multiple nights spanning several years between 2018 and 2022. The surveys comprised including 7 hrs 40 min of searching over 43 km completed by two people (driving and walking) over 3 nights in March 2018, 8.6 hrs of searching completed over 4 nights by 2 ecologists in July 2018, 3.5 hrs of searching over 6.8 km by two ecologists over 2 nights in August 2019, 2.5 hrs of searching over 14 km by 2 ecologists over 3 nights during November 2022 and 1 hr of searching over 5.9 km completed by two ecologists over 1 night in December 2022.
Assessment Approach and Justification: This species was observed during surveys and suitable habitat does is present. This species has been assessed as present.
Koala *Phascolarctos cinereus*
Credit Type: Full species credit.
Habitat Description: Inhabits eucalypt woodlands and forests where it feeds on the foliage. It feeds on at least 70 eucalypt species and 30 non-eucalypt species, but in any one area will select a limited number of preferred browse tree species. Spends most of its time in trees but descends to the ground to disperse or move throughout its home range which vary between 2 ha to > 100 ha (DPE 2023c).
Habitat or geographical constraints: None listed.
Survey Requirement: The current survey guidelines for Koalas (DPE 2022d) were released following the completion of the targeted surveys for this species.

Fauna Survey Details
In accordance with the current surveys guidelines, areas of suitable habitat must be targeted with one direct and one indirect observation method including Spot Assessment Technique (SAT) (scat surveys) or detection dog searches and spotlighting, acoustic surveys or thermal drone surveys (DPE 2022d). **Surveys Completed:** Camera trapping was completed with 915 trap nights achieved including 315 terrestrial trap nights with 10 cameras during 23 January to 19 March 2018 and 600 arboreal trap nights with 20 cameras during 1 November to 1 December 2022. Terrestrial cameras were mounted on trees position facing fish-based baits pegged to the ground. Arboreal cameras were mounted on trees at approximately 1.5 m height and lures consisted of a weatherproof bait cannister loosely packed with a sticky rolled oats, honey and peanut butter mixture, mounted on trees sprayed liberally with a honey-water mixture. Spotlighting surveys were completed over multiple nights spanning several years between 2018 and 2022. The surveys comprised including 7 hrs 40 min of searching over 43 km completed by two people (driving and walking) over 3 nights in March 2018, 8.6 hrs of searching completed over 4 nights by 2 ecologists in July 2018, 3.5 hrs of searching over 6.8 km by two ecologists over 2 nights in August 2019, 2.5 hrs of searching over 14 km by 2 ecologists over 3 nights during November 2022 and 1 hr of searching over 5.9 km completed by two ecologists over 1 night in December 2022. **Assessment Approach and Justification:** This species was observed during camera trapping and spotlighting surveys and has been assessed as present.
Grey-headed Flying-fox *Pteropus poliocephalus* **Credit Type:** Dual credit. **Habitat Description:** Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. Annual mating commences in January and conception occurs in April or May; a single young is born in October or November. Site fidelity to camps is high; some camps have been used for over a century. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. Also forage in cultivated gardens and fruit crops. **Habitat or geographical constraints:** None listed. **Survey requirement:** Breeding camps will need to be identified by survey, as per Threatened Bat Survey Guide OEH Guidelines. The initial search for camps should encompass any recorded camps and roosting habitat likely to occur on the subject land. If a camp is located the survey only needs to take place in the camp (that is the area occupied by the target species) to identify breeding females. Camps used for breeding must be mapped. Use GPS to map outer perimeter of the camp to create the species polygon. **Surveys completed:** Diurnal habitat searches completed on 17 to 19 October 2022 (27.5 hrs x 2 to 3 people), 25 to 26 October 2022 (17 hrs x 2 people), 31 October 2022 (3 hrs x 2 people), 1 and 2 November 2022 (7 hrs x 2 people), 9 November 2022 (7.25 hrs x 2 people), and 16 November 2022 (7.25 hrs x 2 people). **Assessment approach and justification:** No camp sites were observed during surveys and breeding habitat for this species has been assessed as not present.
Red-backed Button-quail *Turnix maculosus* **Credit Type:** Full species credit **Habitat Description**: Over their Australian range, 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.

Fauna Survey Details
The species is associated with the following grasses (in various vegetation formations): speargrass Heteropogon, Blady Grass Imperata cylindrica, Triodia, Sorghum, and Buffel Grass Cenchrus ciliaris. Observations of populations in other parts of its range suggest the species prefers sites near water, including grasslands and sedgelands near creeks, swamps and springs, and wetlands. Red-backed Button-quail usually breed in dense grass near water, and nests are made in a shallow depression sparsely lined with grass and ground litter. The timing of breeding is not well known. In NSW, clutches recorded October to mid-February, but elsewhere in Australia, clutches recorded from late November to as late as May-June. It appears only the male incubates the clutch and tends the young, which are precocial. Red-backed Button-quail are nocturnal and crepuscular in their activity, and forage on the ground. They eat seeds and insects, but little is known of their diet. **Habitat or geographical constraints:** None listed. **Survey requirement:** Nocturnal surveys to flush birds from habitat should be used however identification is difficult and may require photos or handling individuals to distinguish from other more common species. Also important to note that call surveys including playback and songmeters not known to be effective as not known whether it responds, in what months it mostly calls, identification from button-quail species. **Surveys completed:** Diurnal searches completed on 25 to 26 July 2022 (11.5 hrs x 2 people), 28 to 29 July 2022 (12.5 hrs x 2 people), 14 September 2022 (8.5 hrs x 2 people), 16 to 19 October 2022 (35 hrs x 2 to 3 people), 25 to 26 October 2022 (17 hrs x 2 people), 31 October 2022 (4 hrs x 4 people), 1 to 2 November 2022 (7 hrs x 2 people), 9 November 2022 (7.25 hrs x 2 people), and 16 November 2022 (7.75 hrs x 2 people). Spotlighting completed on 1 to 2 November 2022 (1.5 hrs x 2 people), 30 November 2022 (1 hr x 2 people), and 1 December 2022 (1 hr x 2 people). **Assessment approach and justification:** This species was not observed during surveys and has been assessed as not present.
Masked Owl *Tyto novaehollandiae* **Credit Type:** Dual credit species with breeding habitat assessed for species credits and foraging habitat assessed for ecosystem credits. **Habitat Description:** A forest owl, but often hunts along the edges of forests, including roadsides. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting (DPE 2023c). DEC (2006) identify that this species nests in old hollow eucalypts, live or dead but commonly live, in a variety of topographic positions from gully to upper slope, with hollows greater than 40 cm wide and greater than 100 cm deep; there is no relationship with distance to streams and nest sites may be subject to a variety of disturbance regimes. **Habitat or geographical constraints:** Living or dead trees with hollows greater than 20 cm diameter. **Survey Requirement**: Survey May to August. DPIE is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake a species survey using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements). The survey steps for Powerful Owl surveys provided in the TBDC have been adopted which specifies the following. Step 1. Look for SIGNS OF BREEDING on site as follows; suitable habitat AND (a) presence of male and female OR (b) calling to each other (duetting) OR (c) find nest. Step 2. Where signs of breeding on site are present, POTENTIAL NEST TREES should be identified. Potential nest trees are living or dead trees with hollows greater than 20 cm diameter. Step 3. Where potential nest trees are identified on site, night monitoring at the identified potential nest locations for a minimum of 2 nights should be undertaken to detect the presence of any owl of this species using a potential nest tree or demonstrating behaviour focussed on a potential nest tree (e.g. investigating the hollow or roosting within 10 m). DPIE is currently developing survey guidance for threatened bird species. In the interim, assessors must undertake species surveys using best practice methods that can be replicated for repeat surveys (as per the BAM threatened species survey requirements).

Fauna Survey Details
Step 4. If monitoring of potential nest trees detects this owl species using, or demonstrating behaviour focussed on the trees (e.g. investigation of the hollow or roosting within 10 m) on site, the species polygons should be drawn around those trees (i.e. the identified potential nest trees where any owl of this species is observed using, or focussing behaviour around the tree). The species polygons should be circular in shape and must include a buffer radius of 100 m around each tree. The purpose of the buffer is to minimise disturbance/avoid clearing, for a development application, or to conserve and improve habitat, for a biodiversity stewardship agreement, within the area essential for breeding. This includes habitat suitable for male roosts, feeding/grooming perches and fledgling requirements. It does not account for foraging habitat. The shape of the buffer can be modified where evidence provided in the Biodiversity Assessment Report indicates an alternative shape would better meet the species needs in the context of the assessment site. For example, extant vegetation is linear, and the nest tree is already located near the edge of the wooded area. **Surveys completed:** Nocturnal call playback and spotlighting surveys were completed by Umwelt Ecologists on the following dates: 9 July 2018 (2.5 hrs x 2 people), 10 July 2018 (2 hrs 50 min x 2 people), 11 July 2018 (1.75 hrs x 2 people), 12 July 2018 (1.5 hrs x 2 people), 26 August 2019 (1.5 hrs x 2 people), 27 August 2019 (2 hrs 10 min x 2 people). Following changes to the TBDC survey guidance, additional comprehensive targeted searches for hollow bearing trees were undertaken across the current development footprint on 14 and 16 September 2022 by two Umwelt ecologists. These surveys identified the presence of 6 hollow bearing trees with hollow openings large enough (>20 cm openings) to support potential breeding habitat. These hollow bearing trees (HT 1 to HT 6) are shown in **Figure 2.3** and were subject to two nights of stag watching each by 4 ecologists on 12 June 2023 and 13 June 2023, noting that two groups of two trees were in very close proximity and were surveyed in tandem. **Assessment Approach and Justification:** This species was not observed during surveys and has been assessed as not present.
Eastern Cave Bat *Vespadelus troughtoni* **Credit Type:** Full species credit. **Habitat Description:** The habitat requirements of the Eastern Cave Bat are poorly known. It is a cave-roosting species usually found in dry open forest and woodland near cliffs or rocky overhangs. It has also been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals. It is also occasionally found along cliff-lines in wet eucalypt forest and rainforest (NSW DPE 2023c). Under the BAM potential habitats are defined by NSW DPIE (2021) as all areas with the PCTs associated with the species (as per the TBDC) on the subject land where the subject land is within 2 kilometres of caves, scarps, cliffs, rock overhangs and disused mines. Potential breeding habitats are all potential habitat on the subject land where the subject land is within 100 metres of caves, scarps, cliffs, rock overhangs and disused mines. **Habitat or geographical constraints:** Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds. **Survey Requirements:** No surveys are required for this species because there are no associated PCTs present within the development footprint, this species is not predicted to occur under the BAM and there are no previous confirmed records for this species within the development footprint. Survey requirements for potential habitat include a total of 16 harp trap or passive acoustic detection nights (over at least 4 nights) in areas of potential habitat per 50 ha between November to January. Potential habitat is all areas with the PCTs associated with the species (as per the TBDC) on the subject land where the subject land is within 2 km of caves, scarps, cliffs, rock overhangs and disused mines. Potential breeding habitat - all potential habitat on the subject land where the subject land is within 100 metres of caves, scarps, cliffs, rock overhangs and disused mines.

Fauna Survey Details
Passive acoustic detection is listed as a suitable survey method, however it is not suited to detecting breeding activity and cannot readily differentiate this species from *Chalinolobus morio*, *Vespadelus pumilus*, *Vespadelus vulturnus*, species with which it shares a similar call frequency and call shape and habitat distribution. If the species is present in breeding habitat, then breeding must be assumed. Harp traps placed in potential habitat, including breeding habitat, may be used and the age, sex and reproductive status of captured bats must be assessed and recorded. Traps and/or detectors should be set in woodlands, valley floors, riparian areas and relatively fertile parts of potential habitat on the subject land. **Surveys Completed by Umwelt:** Microbat surveys completed by Umwelt for the development footprint included a total of 90 nights of ultrasonic call recording including 4 nights with 2 detector units during January 2018, 10 nights with 2 detector units during November to December 2022 and 76 nights with 4 detector units during January to February 2023. The ultrasonic call recording surveys undertaken by Umwelt were all completed during the survey periods specified in the DPIE survey guidelines and the survey effort satisfies the DPIE (2021) survey guideline requirements for this species. **Surveys Completed for the Balickera Tunnel Remediation Project:** Surveys completed targeting bats roosting in the Balickera Tunnel and broader locality were undertaken as part of the recent Balickera Tunnel Remediation project by Eco Logical Australia (2021) and the associated post construction monitoring by WSP (2023). These surveys included a range of methods to gain information on the species of bats using the tunnel and locality, the numbers of bats present and their locations in the tunnel. The microbat species detection surveys completed by Eco Logical Australia (2021) for Balickera Tunnel included harp trapping and ultrasonic call recording. Harp trapping included the capture of microbats leaving the tunnel in order to determine which species were present and the sex, life stage and breeding status of those species. Harp traps were set at the existing stop gate directly outside the downstream tunnel entrance (but not during January 2021 due to flooding) and amongst the trees at the upstream tunnel entrance. A total of 21 harp trapping nights were completed on 10 March 2020 (5 traps), 9 June 2020 (6 traps), 7 September 2020 (6 traps) and 27 January 2021 (4 traps) for 30 minutes before sunset to 3 hrs after sunset. Trapping all night and for consecutive trap nights was not undertaken for animal ethics reasons. Eco Logical Australia (2021) also completed 32 ultrasonic call recording nights over 16 nights with one detector at the upstream portal and one detector at the downstream portal all night (30 min before sunset to 30 min after sunrise). The survey dates for ultrasonic call recording were 9–13 March 2020 (2 x detectors for 4 nights), 9-13 June (2 x detectors for 4 nights), 7–11 September 2020 (2 x detectors for 4 nights) and 25-29 January 2021 (2 x detectors for 4 nights). Surveys were undertaken across several seasons (not just the breeding period), to increase the likelihood of identifying the full assemblage of species utilising the tunnel. Other surveys completed by (2021) included thermal imaging surveys of bats emerging from the tunnel, inspection and ultrasonic call recording at other potential microbat tunnel and bridge roost sites in the region and autonomous surface vessel inspections. The microbat species detection surveys completed by WSP (2023) for Balickera Tunnel included harp trapping and ultrasonic call recording. This consisted of 3 harp traps for one night on 11 May 2023 at the upstream portal of the Balickera Tunnel and ultrasonic call recording surveys at the upstream and downstream portals of Balickera Tunnel recording overnight with one detector at each site for 4 nights per monitoring session during July and October 2022, February and May 2023 (32 detector nights). Other surveys completed by WSP (2023) included autonomous surface vessel inspections during Summer 2023 and Autumn 2023, inspections of road bridge expansion gaps for roosting bats at Nine Mile Creek Bridge, Twelve Mile Creek Bridge, Balickera Canal Bridge and Grahamstown Canal Bridge and inspections of 10 bat nest boxes during July and October 2022 and February and May 2023 and thermal video recording for two nights during each monitoring session in July and October 2022 and February and May 2023. **Assessment Approach and Justification:** This species was previously identified as potentially occurring due to an Umwelt ultrasonic call recording identified as an undifferentiated species group which included *Chalinolobus morio*, *Vespadelus pumilus*, *Vespadelus vulturnus* and *Vespadelus troughtoni*. Positive recordings of both *Chalinolobus morio* and *Vespadelus pumilus* were obtained, no positive calls of *Vespadelus troughtoni* were obtained and this species is not predicted to occur in the BAM-C.

Fauna Survey Details
There is no identified breeding habitat on the subject land or within 2 km that consists of caves, scarps, cliffs, rock overhangs or disused mines. There is potential roosting habitat present within the Balickera Tunnel, however this species was also not recorded within the Balickera Tunnel as part of extensive harp trapping surveys for the Balickera Tunnel Remediation Species Impact Statement prepared by Eco Logical Australia (2021), nor during post-remediation monitoring undertaken by WSP (2023). This species is not associated with any of the plant community types present and therefore, as per the directions for preparing a species polygon for Eastern Cave Bat in the 'Species credit' threatened bats and their habitats: NSW Guide for the BAM (DPIE 2021) species credits are not required for this Project. The Guide states that potential habitat is "All areas with the PCTs associated with the species (as per the TBDC) on the subject land where the subject land is within 2 kilometres of caves, scarps, cliffs, rock overhangs and disused mines". In preparing a species polygon the Guide states that "The species polygon boundary should align with all PCTs on the subject land that are within 2 kilometres of identified potential roost habitat features, and with which the species is associated (as listed in the TBDC)." (emphasis added).

5.3.3 Expert Reports and Use of More Appropriate Local Data

No expert reports were utilised in place of targeted surveys for the purposes of this assessment. This assessment has also not relied upon alternative data (more appropriate local data) to assess habitat suitability.

5.3.4 Suitable Habitat for BC Act Listed Species Credit Entities Observed for which Impacts have been Avoided

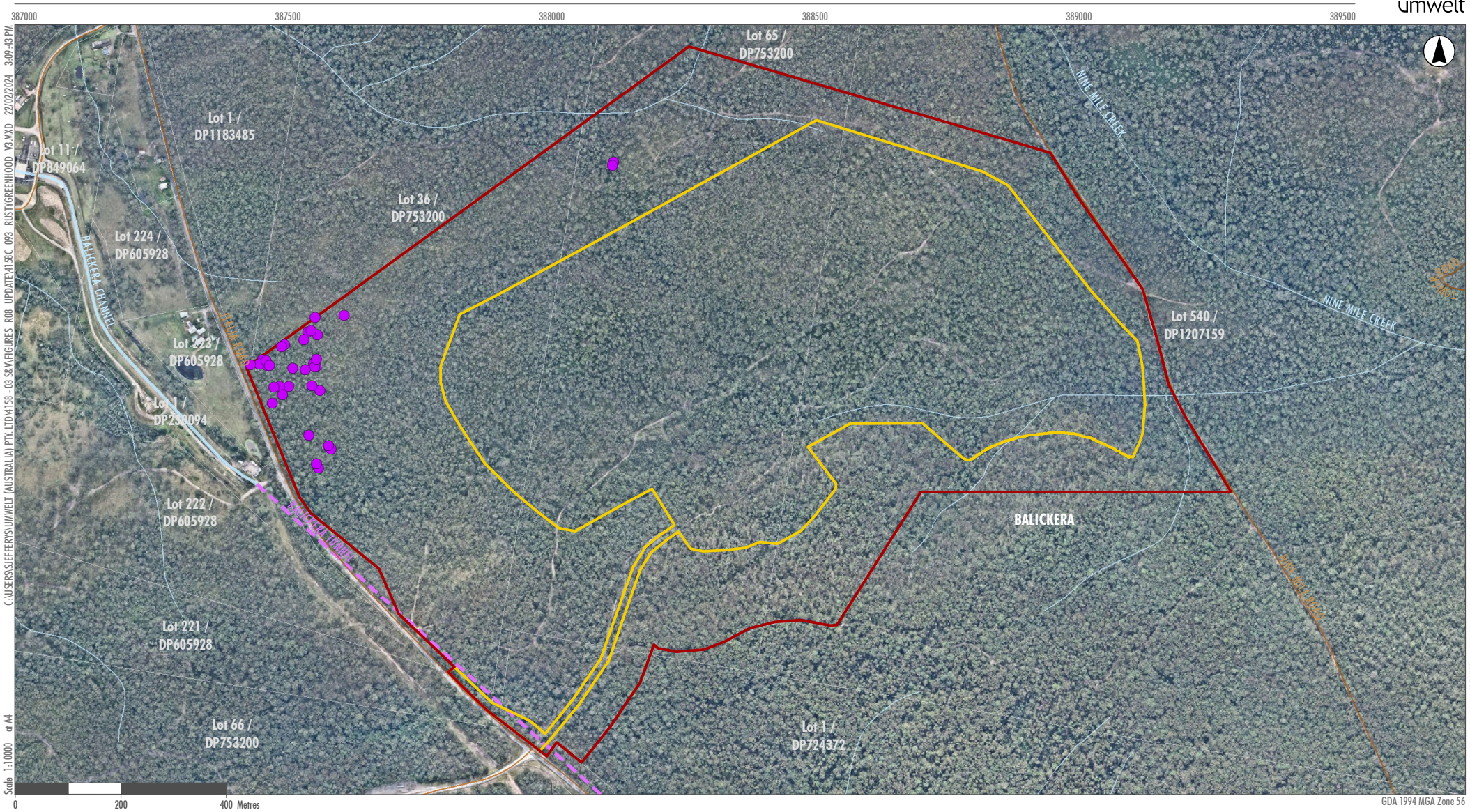
5.3.4.1 Rusty Greenhood (*Pterostylis chaetophora*)

The details for this species are summarised in **Table 5.8** and areas of suitable habitat are mapped in **Figure 5.1**. The TBDC identifies that this species is required to be assessed based on area of suitable habitat present within the development footprint. This species was recorded within PCT 1716 only and this PCT has been removed from the development footprint to ensure that impacts to this species will be avoided.

Table 5.8 Rusty Greenhood Species Observation Details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	2
SAII Entity	No
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	Not applicable
Number of individuals observed	60 individuals observed, project has been modified to avoid impacts to this species and areas of suitable habitat.
Extent of suitable habitat present within development footprint	Corresponds to PCT 1716 which has been removed from the development footprint.
TBDC species specific recommendations	Use flowering material to identify to species. Flowers Sep–early Nov.

Information Required	Species Polygon Details
Habitat condition (vegetation integrity score for each vegetation zone in the species polygon)	PCT 1716 Regenerating VI Score= 76.4



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line
- Rusty Greenhood (*Pterostylis chaetophora*) Observation Location

FIGURE 5.1

Rusty Greenhood (*Pterostylis chaetophora*) Observation Locations

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

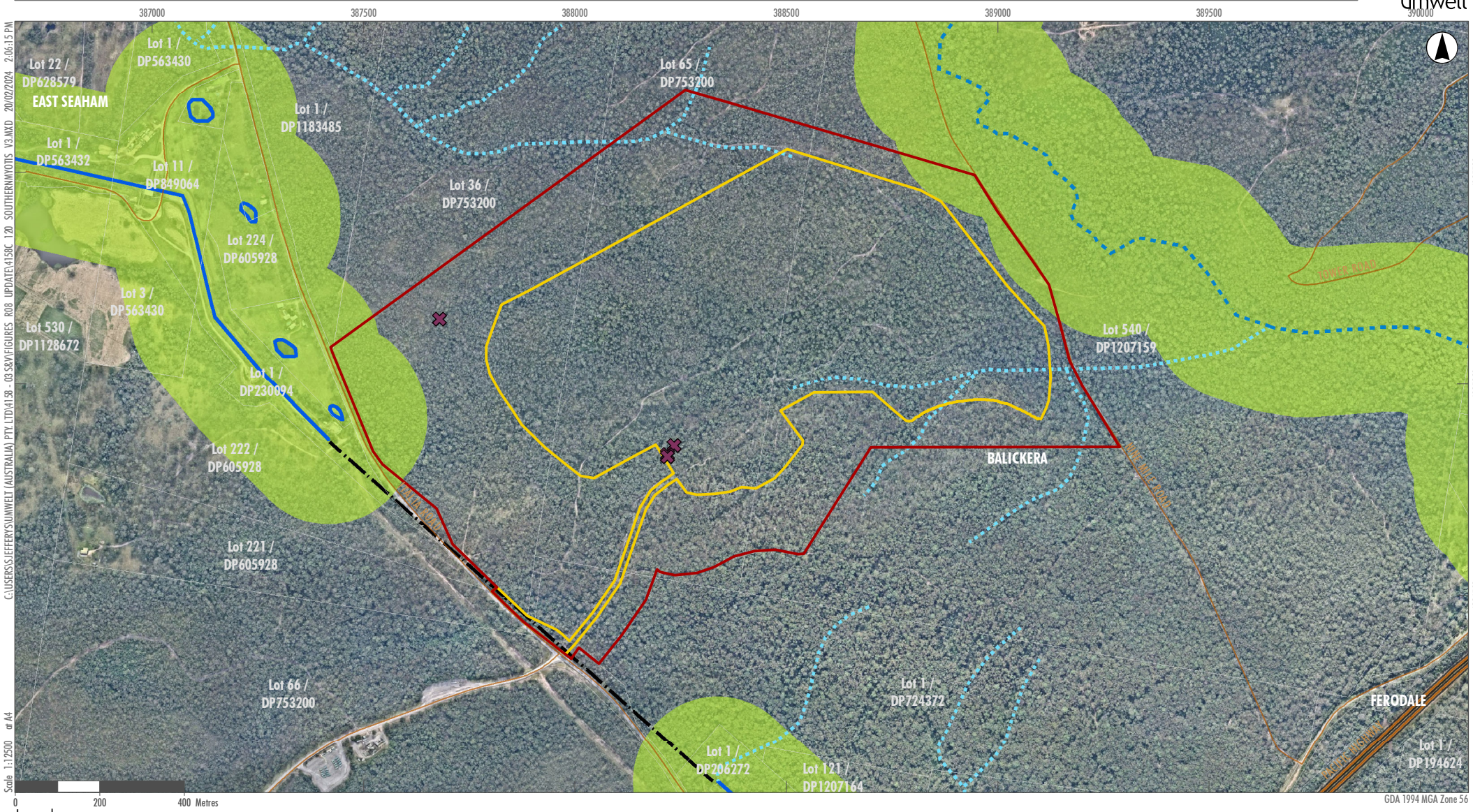
5.3.4.2 Southern Myotis (*Myotis macropus*)

Potential calls of the Southern Myotis (*Myotis macropus*) were recorded during surveys and the species is known to roost and breed in the Balickera Tunnel. The details for this species are summarised in **Table 5.9** and areas of suitable habitat are mapped in **Figure 5.2**. DPIE (2021) identify that Assessors need to use aerial imagery, or ground data to locate and map the high bank (or high tide mark for tidal waters) of any medium to large permanent creeks, rivers or other waterbodies (≥ 3 m wide) within 200 metres of the subject land. Species polygon boundaries should align with all PCTs on the subject land with which the species is associated (as listed in the TBDC) that occur within 200 metres of the high bank, or high tide mark of creeks, rivers or other waterbodies mapped. If the species was recorded in any additional PCTs on the subject land these PCTs should also be included in the species polygon where they occur within 200 m of suitable watercourses.

The locations of all permanent ≥ 3 m wide watercourses surrounding the Development Footprint are mapped in **Figure 5.2**. **Figure 5.2** demonstrates that the Project will not directly impact any permanent or semi-permanent watercourses ≥ 3 m wide and within 200 m of the Development Footprint, and therefore species credits are not required for this species.

Table 5.9 Southern Myotis Species Observation Details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	2
SAII Entity	No
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	The range of PCTs associated with the species (as per the TBDC) within 200 m of any medium to large permanent creeks, rivers, lakes or other waterways (i.e. with pools/ stretches 3 m or wider).
Extent of suitable habitat present within development footprint	The development footprint is >200 m from permanent creeks with pools or stretches 3 m or wider.



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Pacific Highway
- Road
- Non-permanent watercourses (<3m wide)
- Non-permanent watercourse (>3m wide)
- Permanent waterbodies & watercourses >3m wide
- Balickera Tunnel (contains Southern Myotis breeding habitat)
- Southern Myotis (*Myotis macropus*) detection location
- Potential Habitat for Southern Myotis (*Myotis macropus*) (within 200m of waterbody >3m wide)

FIGURE 5.2

Observation Locations and Areas of Suitable Habitat for the Southern Myotis (*Myotis macropus*)

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023), NSW OEH (2018)

5.3.5 Suitable Habitat for BC Act Listed Species Credit Entities Impacted

The following BC Act listed threatened species were observed during surveys and require species credits to offset the residual impacts associated with the project:

- Squirrel Glider (*Petaurus norfolcensis*)
- Brush-tailed Phascogale (*Phascogale tapoatafa*)
- Koala (*Phascolarctos cinereus*).

The details of the species polygons generated for each species are provided as follows.

5.3.5.1 Squirrel Glider (*Petaurus norfolcensis*) Species Polygon

The species polygon details for the Squirrel Glider are provided in **Table 5.10** and the species polygon is mapped in **Figure 5.3**.

Table 5.10 Squirrel Glider Species Polygon Details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	2
SAII Entity	No
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	Not applicable
Extent of suitable habitat present within development footprint	PCT 762 Intact = 0.33 ha PCT 1590 Intact = 39.27 ha PCT 1618 Intact = 0.88 ha PCT 1619 Intact Apple Variant = 18.91 ha PCT 1619 Intact Apple/Ironbark Variant = 8.63 ha Total = 68.02 ha
TBDC species specific recommendations	Not applicable
Habitat condition (vegetation integrity score for each vegetation zone in the species polygon)	PCT 762 Intact VI Score = 78.8 PCT 1590 Intact VI Score = 74.1 PCT 1618 Intact VI Score = 78.1 PCT 1619 Intact Apple Variant VI Score = 70.7 PCT 1619 Intact Apple/Ironbark Variant VI Score = 80.5 PCT 1716 Regenerating VI Score = 76.4



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line
- Species Polygon for Squirrel Glider (*Petaurus norfolcensis*)
- Squirrel Glider Observation Location (Remote Camera Record)

FIGURE 5.3

Squirrel Glider (*Petaurus norfolcensis*) Species Polygon

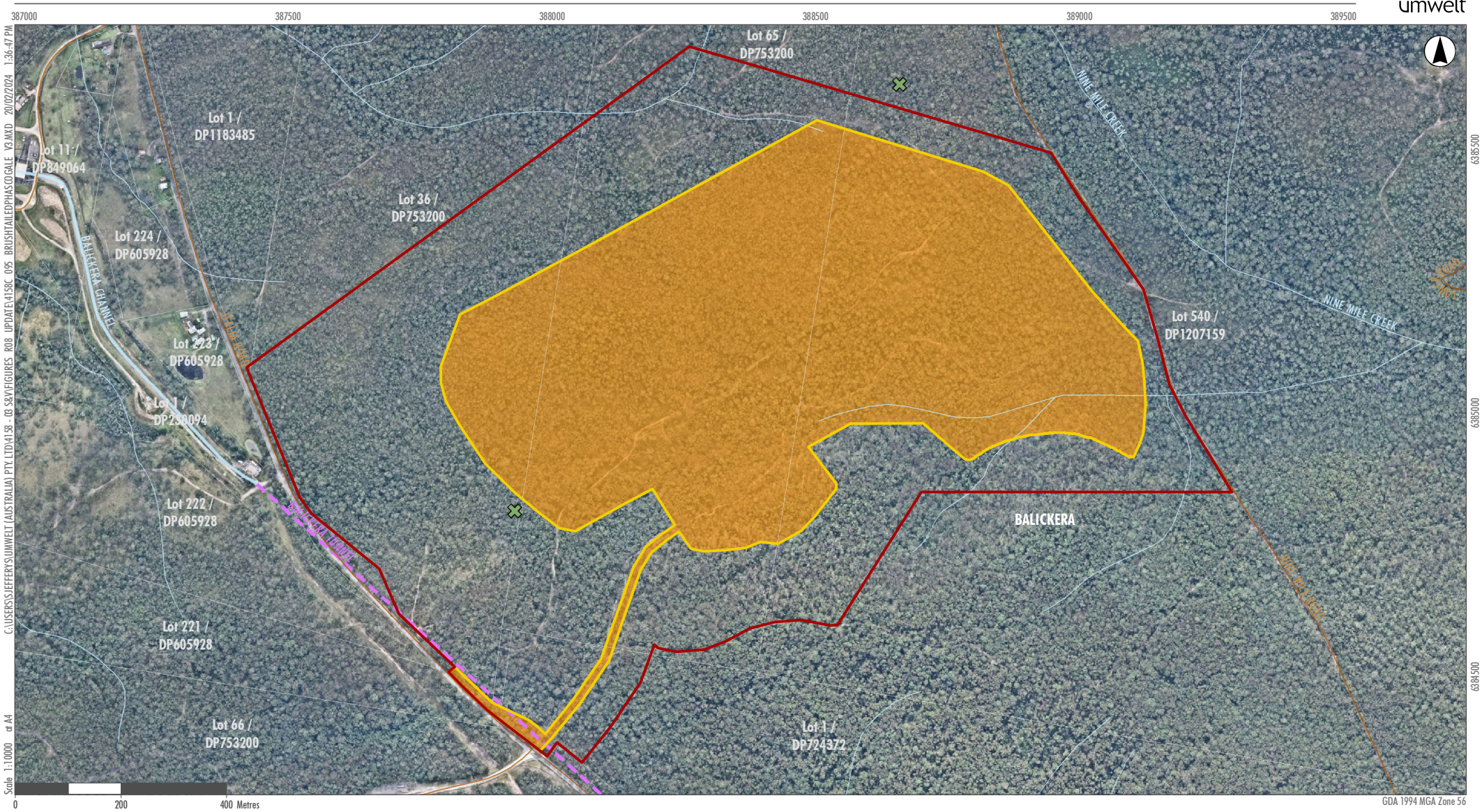
Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

5.3.5.2 Brush-Tailed Phascogale (*Phascogale tapoatafa*) Species Polygon

The species polygon details for the Brush-tailed Phascogale are provided in **Table 5.11** and the species polygon is mapped in **Figure 5.4**.

Table 5.11 Brush-Tailed Phascogale Species Polygon Details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	2
SAII Entity	No
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	Not applicable
Extent of suitable habitat present within development footprint	PCT 762 Intact = 0.33 ha PCT 1590 Intact = 39.27 ha PCT 1618 Intact = 0.88 ha PCT 1619 Intact Apple Variant = 18.91 ha PCT 1619 Intact Apple/Ironbark Variant = 8.63 ha Total = 68.02 ha
TBDC species specific recommendations	Not applicable
Habitat condition (vegetation integrity score for each vegetation zone in the species polygon)	PCT 762 Intact VI Score = 78.8 PCT 1590 Intact VI Score = 74.1 PCT 1618 Intact VI Score = 78.1 PCT 1619 Intact Apple Variant VI Score = 70.7 PCT 1619 Intact Apple/Ironbark Variant VI Score = 80.5 PCT 1716 Regenerating VI Score = 76.4



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line
- Species Polygon for Brush-tailed Phascogale (*Phascogale tapoatafa*)
- Brush-tailed Phascogale (*Phascogale tapoatafa*) Observation Location

FIGURE 5.4

Brush-tailed Phascogale (*Phascogale tapoatafa*) Species Polygon

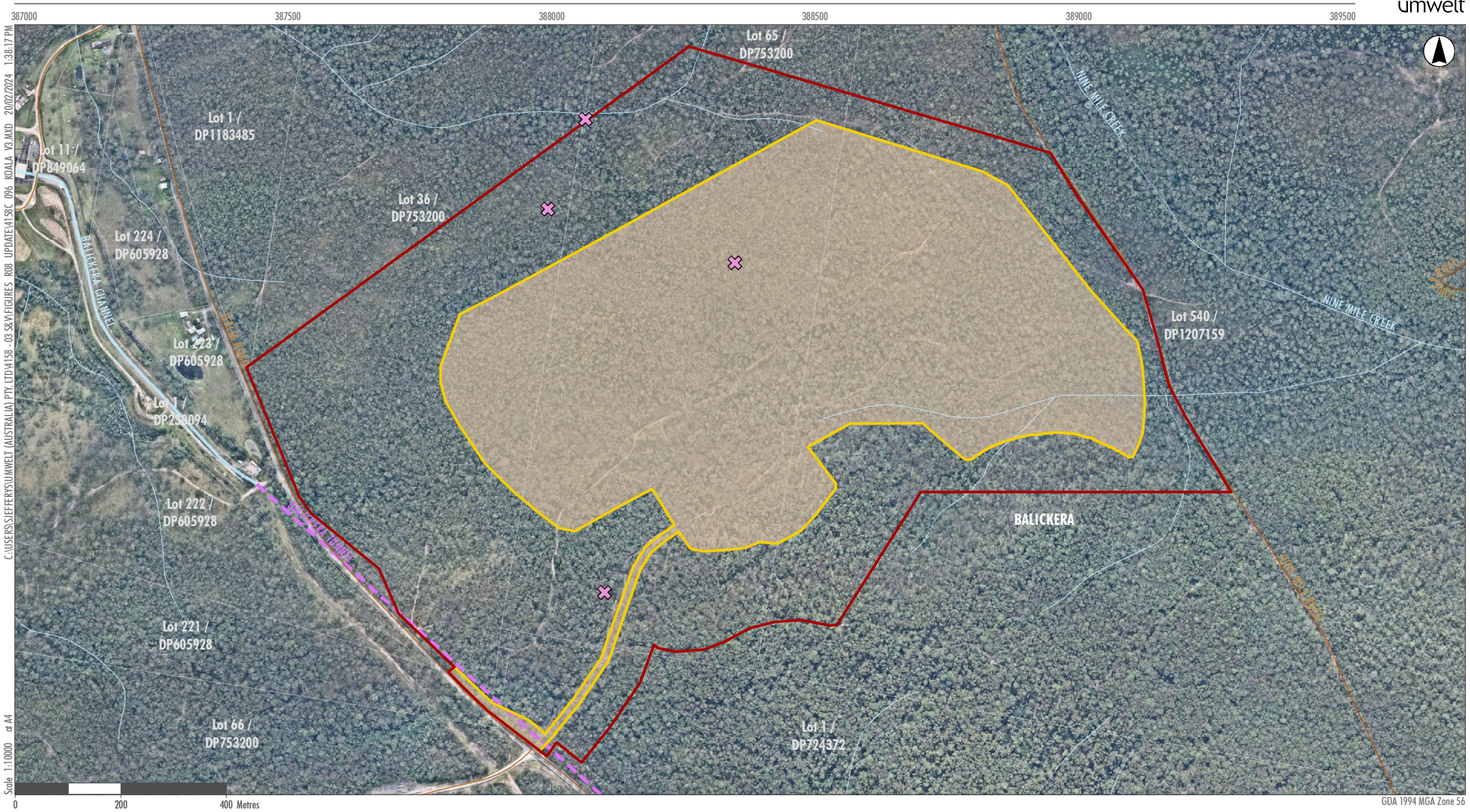
Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

5.3.5.3 Koala (*Phascolarctos cinereus*) Species Polygon

The species polygon details for the Koala are provided in **Table 5.12** and the species polygon is mapped in **Figure 5.5**.

Table 5.12 Koala Species Polygon Details

Information Required	Species Polygon Details
Biodiversity Risk Weighting	2
SAII Entity	No
Habitat constraints / microhabitats present on the Subject Land / vegetation zone	Not applicable
Extent of suitable habitat present within development footprint	PCT 762 Intact = 0.33 ha PCT 1590 Intact = 39.27 ha PCT 1618 Intact = 0.88 ha PCT 1619 Intact Apple Variant = 18.91 ha PCT 1619 Intact Apple/Ironbark Variant = 8.63 ha Total = 68.02 ha
TBDC species specific recommendations	Under the BAM (NSW DPIE 2020a) and the Koala BAM Survey Guide (NSW DPE 2022c), suitable habitat is habitat where the target species is expected to occur or periodically use and for the koala includes associated PCTs with a minimum of one koala use tree present. Koala use tree species are present within each of the PCTs within the development footprint and all PCTs present are associated with the species. The Koala BAM Survey Guide (NSW DPE 2022c) identifies that the species polygon for the koala is determined by mapping the vegetation zone in which the species was detected and any vegetation zones that are continuous with suitable habitat.
Habitat condition (vegetation integrity score for each vegetation zone in the species polygon)	PCT 762 Intact VI Score = 78.8 PCT 1590 Intact VI Score = 74.1 PCT 1618 Intact VI Score = 78.1 PCT 1619 Intact Apple Variant VI Score = 70.7 PCT 1619 Intact Apple/Ironbark Variant VI Score = 80.5 PCT 1716 Regenerating VI Score = 76.4



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line
- Species Polygon for Koala (*Phascolarctos cinereus*)
- Koala (*Phascolarctos cinereus*) Observation Location

FIGURE 5.5

Koala (*Phascolarctos cinereus*) Species Polygon

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

5.3.6 Results for BC Act Listed Ecosystem Credit Species

Observation locations for all ecosystem credit species observed are mapped in **Figure 5.6**. The following ecosystem credit species were observed within the subject land and/or development footprint during surveys.

5.3.6.1 South-eastern Glossy Black-Cockatoo (*Calyptorhynchus lathami lathami*)

Evidence of site use for foraging by this species was detected in the form of chewed *Allocasuarina torulosa* seed cones observed during surveys completed in June 2023, as shown in **Photo 5.5**. No site use by the South-eastern Glossy Black-Cockatoo as breeding habitat was observed during the surveys completed.

5.3.6.2 Varied Sitella (*Daphoenositta chrysoptera*)

This species was observed foraging within the development footprint on 9 November 2022.

5.3.6.3 Little Lorikeet (*Glossopsitta pusilla*)

This species was heard calling and was observed flying over the development footprint during multiple surveys. It is considered that the development footprint provides foraging habitat for this species.

5.3.6.4 White-bellied Sea-Eagle (*Haliaeetus leucogaster*)

One immature White-bellied Sea-Eagle was observed perched on a tree within the development footprint on 25 October 2022. No nest trees were observed during surveys.

5.3.6.5 Little Bent-winged Bat (*Miniopterus australis*)

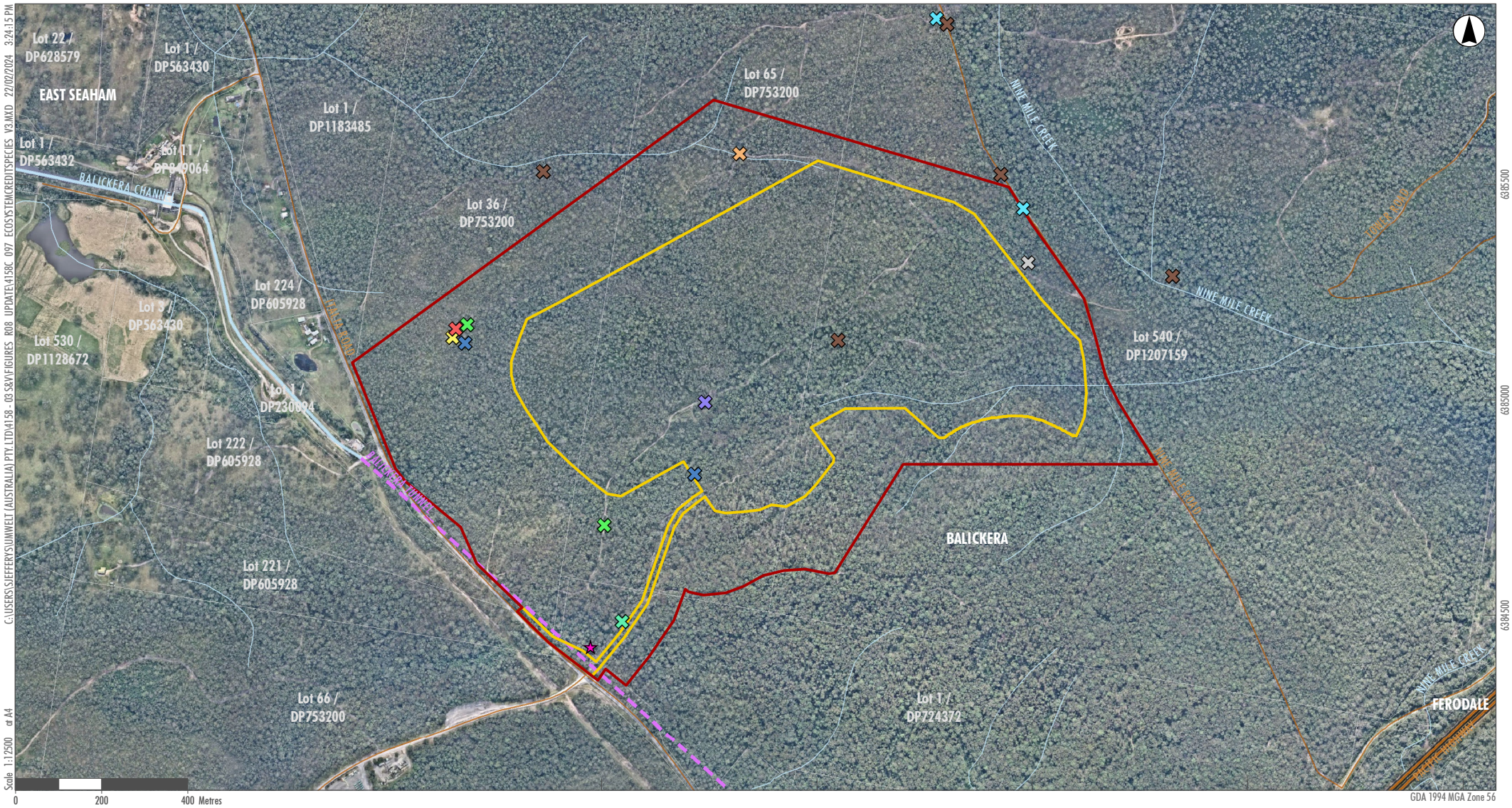
This species was recorded during ultrasonic call recording surveys during January 2018, December 2022, January 2023 and February 2023 foraging within the subject land. No breeding habitat for this species is present within the development footprint.

5.3.6.6 Large Bent-winged Bat (*Miniopterus orianae oceanensis*)

Probable recordings of this species foraging within the subject land were recorded during December 2022.

5.3.6.7 Greater Broad-nosed Bat (*Scoteanax rueppellii*)

Probable recordings of this species foraging within the subject land were recorded during December 2022.



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line

Ecosystem Credit Species

- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*) (non-breeding record)
- Little Bent-winged Bat (*Miniopterus australis*) (non-breeding record)
- Little Lorikeet (*Glossopsitta pusilla*)
- Powerful Owl (*Ninox strenua*) (non-breeding record)
- South-eastern Glossy Black-Cockatoo (*Calyptorhynchus lathami lathami*)
- Varied Sittella (*Daphoenositta chrysoptera*)
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*) (non-breeding record)
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)

EPBC Act Migratory Species

- Rufous Fantail (*Rhipidura rufifrons*)

FIGURE 5.6

Ecosystem Credit Species Observation Locations

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

5.3.7 Results for EPBC Act Listed Species

The DCCEEW have identified that the Project is likely to have a significant impact on the following threatened species:

- Koala (*Phascolarctos cinereus*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*).

The DCCEEW have identified that the Project may have a significant impact on the following additional threatened species:

- Swift Parrot (*Lathamus discolor*)
- Spotted-tailed Quoll (southeastern mainland population) (*Dasyurus maculatus maculatus*)
- Yellow-bellied Glider (south-eastern) (*Petaurus australis australis*)
- New Holland Mouse (*Pseudomys novaehollandiae*)
- South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*).

Further assessments of MNES are provided is **Appendix B**. The assessments undertaken identify that MNES significantly impacted by the Project are likely to be limited to the Koala and the Grey-headed Flying-fox.

Details of the EPBC Act listed threatened species observed during surveys or assumed to occur are described in **Table 5.13**.

Table 5.13 Results for EPBC Act Listed Species Observed

Common Name	Scientific Name	EPBC Act Status	Extent (ha) of suitable habitat present within development footprint
Koala	*Phascolarctos cinereus*	Endangered	This species was observed during surveys and is associated with all PCTs present. The extent of suitable habitat proposed for removal is 79.02 ha.
Grey-headed Flying-fox	*Pteropus poliocephalus*	Vulnerable	This species was observed foraging within the subject land during surveys. The National Flying Fox Monitoring Viewer (DCCEEW 2024b) identifies that there is a historical camp site within the Wallaroo State Forest within the vicinity of the subject land, however no Flying-foxes have been observed there for >10 years. The nearest active camp sites are at Moffatts Swamp and Tocal. No species credits are proposed as no active roost or breeding habitat is present.
Rufous Fantail	*Rhipidura rufifrons*	Migratory	One individual was observed within PCT 1716 on 16 November 2022. The extent of this PCT within the development footprint is 0.33 ha.

The EPBC Act listed threatened species which are predicted under the BAM to occur based on the PCTs present, will be offset by ecosystem credits are listed in **Table 5.14**. It is noted that no surveys are required for ecosystem credit species or the ecosystem credit component of dual credit species under the BAM.

Table 5.14 EPBC Act Listed Threatened Species Predicted to Occur and Offset with Ecosystem Credits

Common Name	Scientific Name	EPBC Act Status	Extent (ha) of associated PCTs present within the Development Footprint
Regent Honeyeater (foraging habitat)	*Anthochaera phrygia*	Critically Endangered	PCT 1590 = 39.27 Total = 39.27 ha
Gang-gang Cockatoo (Foraging habitat)	*Callocephalon fimbriatum*	Endangered	PCT 1618 = 0.88 PCT 1590 = 39.27 PCT 1619 (Apple Variant) = 18.91 PCT 1619 (Apple / Ironbark Variant) = 8.63 Total = 67.69 ha
South-eastern Glossy Black-Cockatoo (Foraging habitat)	*Calyptorhynchus lathami lathami*	Vulnerable	PCT 1618 = 0.88 PCT 1590 – 39.27 PCT 1619 (Apple Variant) = 18.91 PCT 1619 (Apple / Ironbark Variant) = 8.63 PCT 762 = 0.33 Total = 68.02 ha
Spotted-tailed Quoll	*Dasyurus maculatus maculatus*	Endangered	PCT 1618 = 0.88 PCT 1590 – 39.27 PCT 1619 (Apple Variant) = 18.91 PCT 1619 (Apple / Ironbark Variant) = 8.63 PCT 762 = 0.33
White-throated Needletail	*Hirundapus caudacutus*	Vulnerable	PCT 1618 = 0.88 PCT 1590 – 39.27 PCT 1619 (Apple Variant) = 18.91 PCT 1619 (Apple / Ironbark Variant) = 8.63 PCT 762 = 0.33 Total = 68.02 ha
Swift Parrot (foraging habitat)	*Lathamus discolor*	Critically Endangered	PCT 1618 = 0.88 PCT 1590 – 39.27 PCT 1619 (Apple Variant) = 18.91 PCT 1619 (Apple / Ironbark Variant) = 8.63 PCT 762 = 0.33 Total = 68.02 ha
Yellow-bellied Glider	*Petaurus australis*	Vulnerable	PCT 1618 = 0.88 PCT 1590 – 39.27 PCT 1619 (Apple Variant) = 18.91 PCT 1619 (Apple / Ironbark Variant) = 8.63 PCT 762 = 0.33 Total = 68.02 ha

Common Name	Scientific Name	EPBC Act Status	Extent (ha) of associated PCTs present within the Development Footprint
New Holland Mouse	*Pseudomys novaehollandiae*	Vulnerable	PCT 1618 = 0.88 PCT 1590 – 39.27 PCT 1619 (Apple Variant) = 18.91 PCT 1619 (Apple / Ironbark Variant) = 8.63 PCT 762 = 0.33 Total = 68.02 ha
Grey-headed Flying-fox (Foraging habitat)	*Pteropus poliocephalus*	Vulnerable	PCT 1618 = 0.88 PCT 1590 – 39.27 PCT 1619 (Apple Variant) = 18.91 PCT 1619 (Apple / Ironbark Variant) = 8.63 PCT 762 = 0.33 Total = 68.02 ha

6.0 Identifying Prescribed Impacts

6.1 Prescribed Impact Assessment

Prescribed impacts are those that may affect biodiversity values in addition to, or instead of, impacts from clearing native vegetation. Clause 6.1 of the *BC Regulation* defines *Prescribed Impacts* as

'The impacts of development on the following habitat of threatened species or ecological communities:

- *karst, caves, crevices, cliffs and other geological features of significance,*
- *rocks,*
- *human made structures,*
- *non-native vegetation,*
- *the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range,*
- *the impacts of development on movement of threatened species that maintains their lifecycle,*
- *the impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and TECs (including from subsidence or upsidence resulting from underground mining or other development),*
- *the impacts of wind turbine strikes on protected animals,*
- *the impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community.'*

An assessment which identifies the prescribed impacts which are likely to occur as a result of the proposed development are assessed in **Table 6.1** and a map of prescribed impact features is provided as **Figure 6.1**.

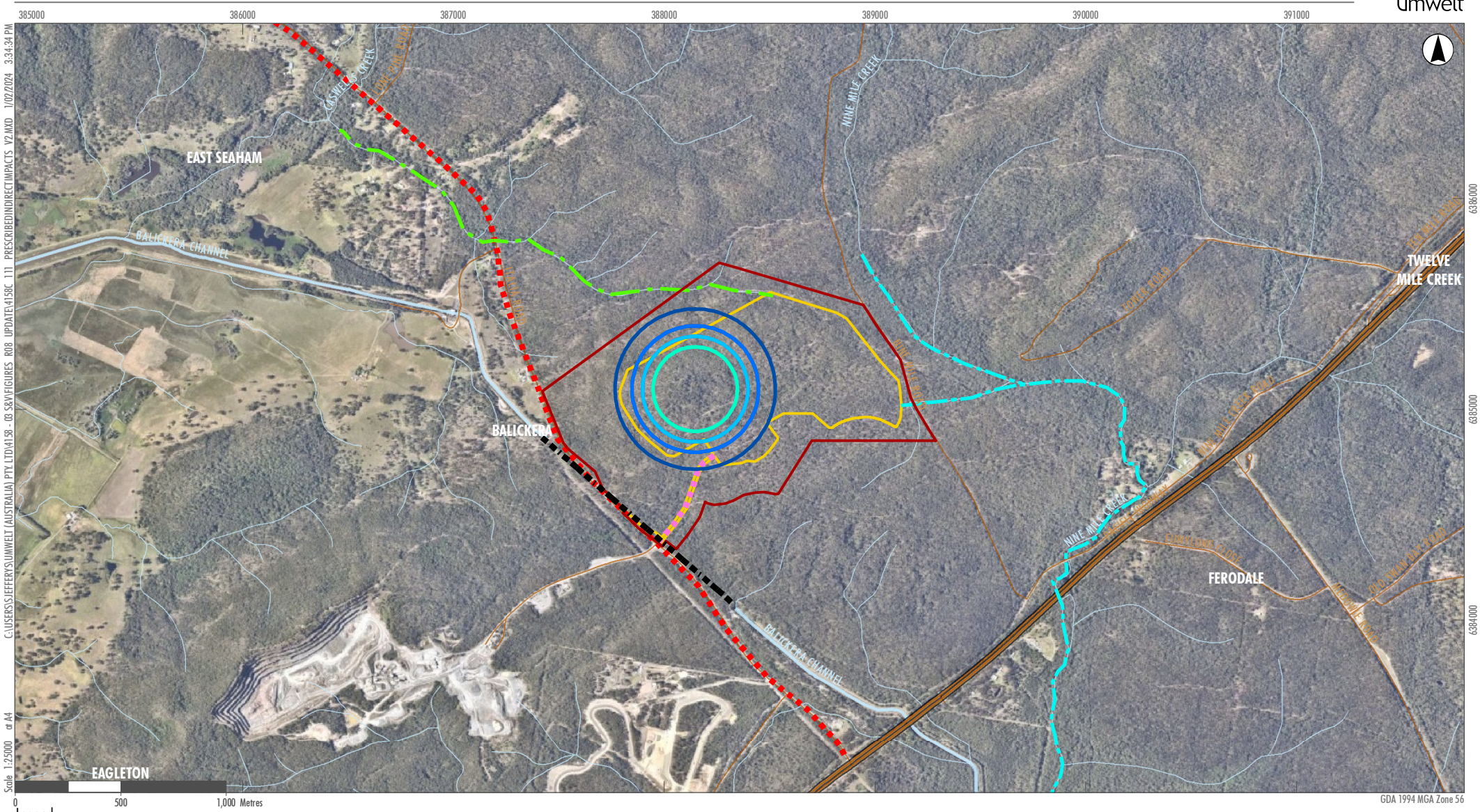
Table 6.1 Prescribed Impacts Identified

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature.
Karst, caves, crevices, cliffs, rocks or other geological features of significance	☐Yes / ☒No	There are no karst, caves, crevices, cliffs, rocks or other geological features of significance within the development footprint. There are areas of exposed surface rock with minor rock outcropping, however these areas do not provide any habitat of significance for threatened species.	Based on the results of the surveys completed it is considered that there will be no known threatened entities using the features identified.
Human-made structures	☒Yes / ☐No	No human-made structures are present within the development footprint. The development footprint is located in proximity to the southern entrance of the Balickera Tunnel and Canal which lies under the western edge and access to the development footprint.	Eco Logical Australia (2021) have identified that the Balickera tunnel provides important habitat for the following threatened microbat species: • Eastern Coastal Free-tailed Bat • Eastern False Pipistrelle • Large Bent-winged Bat • Little Bent-winged Bat • Southern Myotis. The tunnel provides suitable breeding habitat which is assumed to be of importance for the Southern Myotis. Surveys by WSP (2023) since the re-opening of Balickera Tunnel in May 2022 after remediation work found three of the original roosting holes of the Southern Myotis were occupied again on June 1, 2022. One hole was observed to have about 16 bats huddled together. The criteria in the MMP require a minimum of 50 bats to form and reproduce in a colony within two years after construction. However, the monitoring plan in the MMP is limited in its ability measure this outcome (WSP, 2023).

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature.
			The Blast Impact Assessment (Enviro Strata Consulting 2024) outlines that Balickera Tunnel is a man-made structure designed to carry water. Unlike natural caves that are dry and quiet most of the time, the tunnel has constant sound exposure. Fauna that live in the tunnel are likely to have adapted to this sound environment and adjusted their sensory thresholds accordingly. The water flow in Balickera Tunnel creates a noisy and dynamic condition, as the water hits the tunnel walls and causes noise and vibration. It is expected that the microbats that live in the tunnel are desensitised to these sound and vibration levels. The Balickera Tunnel Remediation Works have reduced the risk of dust or small rocks falling from the tunnel roof due to blast vibrations. The likelihood of blast vibrations causing such falls is not higher than the likelihood of bat activity causing them.
Non-native vegetation	☐Yes / ☒No	No areas of non-native vegetation are mapped within the development footprint.	Not applicable.
Habitat connectivity	☒Yes / ☐No	The development footprint is located on the western edge of the Wallaroo State Forest and forms a small part of a larger habitat patch. The development footprint provides a suitable connection point to habitat further west of Italia Road. Some habitat connectivity will be retained along the Italia Road interface, however the width of the connecting vegetation will be reduced and is already limited for terrestrial species by the Balickera Channel.	Habitat connectivity will be reduced, but still maintained for the Koala, Squirrel Glider and Brush-tailed Phascogale. The threatened entities observed during surveys that are highly mobile species, capable of traversing around or flying over the areas proposed for development are not likely to be affected through lifecycle impacts and are not likely to be isolated from areas of habitat with which they are currently connected. .

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature.
Waterbodies, water quality and hydrological processes	☒Yes / ☐No	The development footprint supports ephemeral tributaries of Nine Mile Creek. The northern part of the development footprint has now avoided the tributaries of Caswells Creek. The south-eastern part of the development footprint contains first and second order tributaries of Nine Mile Creek. An unmapped ephemeral watercourse is also present in the south-western section of the Project Area. All watercourses within the development footprint will be directly impacted by clearing and quarry operations.	Ephemeral watercourses present are part of habitat which comprises the Subtropical Coastal Floodplain Forest and River-flat Eucalypt Forest on Coastal Floodplain EECs which will be directly removed by the Project. No threatened entities were observed using the watercourses present, however the threatened fauna species which will be impacted by the Project may utilise these areas for nourishment. Threatened species and ecological communities downstream of the development footprint may also be impacted by altered flow regimes. Surface Water impacts and suitable mitigation measures are further documented with the Surface Water Impact Assessment (Engeny 2024). Hydrological impacts are further discussed in **Section 7.2.1.2** and **Section 8.3.6.1**.
Groundwater Dependant Ecosystems	☒Yes / ☐No	Probable Terrestrial GDEs, including high probability GDEs, have been mapped within the northern extent of the predicted area of groundwater drawdown. It has been identified that these areas are underlain by a dactite aquitard and reliant on shallow groundwater associated with rainfall and surface runoff and are disconnected from the deeper fractured rock groundwater system and therefore will not be impacted by the modelled groundwater drawdown associated with the Project.	It is considered that areas of the River-flat Eucalypt Forest on Coastal Floodplain and Subtropical Coastal Floodplain Forest EECs are potentially groundwater dependant, particularly areas mapped as high probability GDEs along the watercourse which intersects the northern part of the Project Area where direct impacts will be avoided. The ecosystem credit species predicted to occur and species credit entities observed have potential to use the PCTs identified as potential GDEs. Further impact assessment is provided in **Section 8.3.7**.
Wind turbine strikes (wind farm development only)	☐Yes / ☒No	This assessment is not a wind farm development.	Not applicable.

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature.
Vehicle strikes	☒Yes / ☐No	Vehicle movements will occur within the impact footprint. The Project is also likely to increase traffic on local roads	No threatened entities are likely to be affected by vehicle strikes within the development footprint, as vehicle movements will be at relatively low speed and largely limited to daylight hours when there is good visibility and reduced movement from nocturnal species. Potential for vehicle strikes outside of development footprint will be limited by the operational hours of the quarry and related to increase traffic, particularly heavy vehicles transporting quarry product. Adherence to local traffic requirements and a complaints register will be required to manage traffic and all drivers travelling to and from the quarry will have to adhere to a Driver Code of Conduct which will include a reduced speed limit to minimise the potential for wildlife strikes (existing speed limit is 80 km/hr).



C:\USERS\SJEFFERY\UMWELT (AUSTRALIA) PTY LTD\4158 - 03 S&V\FIGURES R08 UPDATE\4158C 111 PRESCRIBEDINDIRECTIMPACTS V2.MXD 1/02/2024 3:34:34 PM

Scale 1:25000 at A4

umwelt

Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Pacific Highway
- Road
- Drainage Line

Prescribed and Indirect Impacts

- Balickera Tunnel Location / Threatened Microbat Roosting Area
- Italia Road / Location of increased traffic and fauna strike risk
- Site access haul road / Location of increased traffic and fauna strike risk
- Downstream section of Caswells Creek with potential to be indirectly impacted
- Downstream section of Nine Mile Creek with potential to be indirectly impacted

Stage 8 Predicted Groundwater Drawdown based on most conservative hydraulic conductivity value (Kmax = 9.2x103m/day)*

- 200m – 3.47m drawdown
- 250m – 1.76m drawdown
- 300m – 0.86m drawdown
- 380m – 0.12m drawdown

* Groundwater drawdown mapping is based on data provided in the Groundwater Impact Assessment prepared by GHD Pty Ltd

FIGURE 6.1

Prescribed and Indirect Impacts

Image Source: Nearmap (2023) Data source: NSW FSDF (2022), Umwelt (2023)

7.0 Avoid and Minimise Impacts

7.1 Avoid and Minimise Direct and Indirect Impacts

7.1.1 Project Location

7.1.1.1 Location of Surface works in Areas with No or Low Biodiversity values

As the resource to be quarried is location specific, the extraction of this quarry resource cannot avoid disturbing areas with no or low biodiversity values. **Figure 7.1** shows the changes in proposed development footprint between earlier Project layout designs and the current revised and reduced development footprint. The existing entry track from Italia Road will be utilised as part of the site access. The other areas where surface works are proposed or required contain biodiversity values and no areas with no or low biodiversity values are present. As shown in **Figure 7.1**, the locations of surface works have been modified to avoid areas with biodiversity values that had previously proposed as being disturbed.

7.1.1.2 Location of Sub-Surface Works in Areas with No or Low Biodiversity Values

The proposed quarry will consist of an open pit and will not require any substantial sub-surface works other than the quarry itself.

7.1.1.3 Avoidance of Wildlife Corridors

The development footprint is located on the western edge of the Wallaroo State Forest and forms a small part of a larger regional and local habitat linkage. The development footprint provides a suitable connection point to habitat further west of Italia Road. The width of the connecting vegetation will be reduced, however areas which provide suitable wildlife corridors around the development footprint and along the Italia Road interface, will be retained and any new pinch points created will not be narrower than the existing pinch points present.

7.1.1.4 Location of Works to Minimise Interactions with Threatened Entities

The development footprint has been situated based on the presence of the hard rock resource to be quarried. As discussed in **Section 1.1.1.1** the Project disturbance footprint has been reduced to avoid occupied habitat for the threatened orchid species, *Pterostylis chaetophora* and avoid direct impacts to PCT 1716 Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast – which is considered to be a high probability GDE. The refined development footprint further minimises impacts to plant community types and threatened species habitats generally, including habitats for the threatened fauna species recorded.

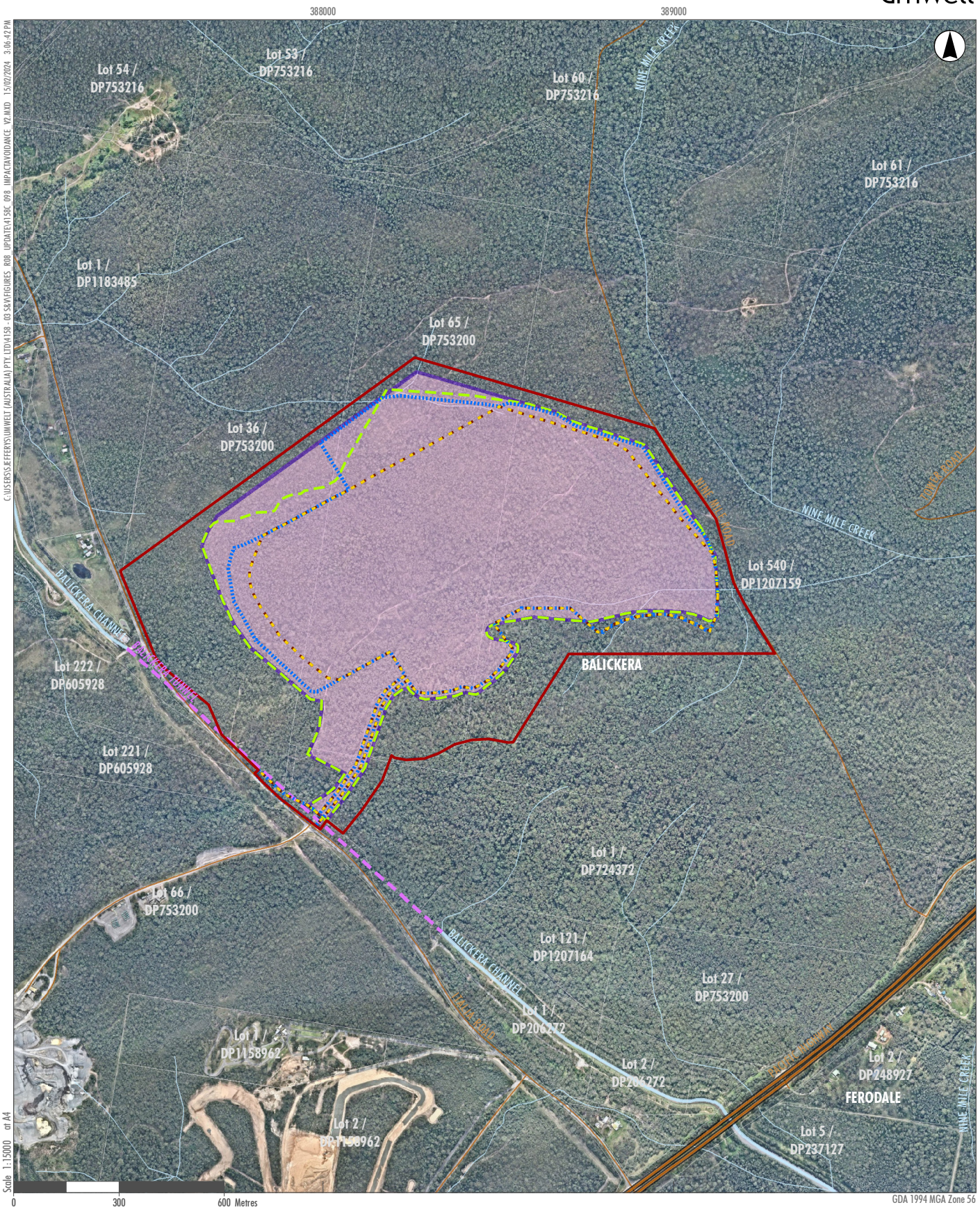
The Project will initially remove suitable habitat for threatened fauna entities, however ongoing interactions with threatened fauna entities are likely to be minimal within the cleared parts of the development footprint and will be managed through a Biodiversity Management Plan which is proposed to be prepared following approval of the Project.

7.1.1.5 Location of Works to Avoid Impacts on Waterbodies and Hydrological Processes

The first and second order ephemeral watercourses present within the development footprint will be impacted by the Project. The Revised Surface Water Impact Assessment (SWIA) prepared by Engeny (2024) identifies that the Project is located within the Grahamstown Dam drinking water catchment and strict water quality controls will be implemented to mitigate potential impacts to hydrological processes and downstream waterbodies.

7.1.1.6 Alternative Routes Considered

The Project has been designed to make use of the existing access track from Italia Road and is located to reduce the extent of excavation required to access the proposed quarry areas. It is considered that the use of other routes is not likely to result in further impact minimisation or avoidance.



Legend

- Project Area (Subject Land)
- Current Disturbance Area (Development Footprint Version 4)
- EIS Disturbance Area (Development Footprint Version 3 – May 2023)
- EPBC Referral Disturbance Area (Development Footprint Version 2 – February 2022)
- Scoping Report Disturbance Area (Development Footprint Version 1 – February 2020)
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Lot Boundaries

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

FIGURE 7.1

Impact Avoidance and Minimisation Areas

7.1.1.7 Alternative Sites within the Subject Land Considered

The previous and current development footprints associated with the Project are shown in **Figure 7.1**. The current development footprint within the approved lease area has been substantially since the Scoping and EPBC Referral stages and reduced from a maximum impact footprint of 93.7 ha to the current development footprint of 68.01 ha. The development footprint assessed in the EIS resulted in the avoidance of the main areas of occupied habitat for the threatened orchid species *Pterostylis chaetophora,* to consolidate the Project footprint to areas with the target resource and further minimise impacts to plant community types and threatened species habitats generally, including habitats for the threatened fauna species recorded. A reduction in the development footprint avoiding an addition 11.01 ha of habitat was achieved as part of the project modifications for the current response to submissions. This reduction in the impact area has focussed on further minimising impacts associated with threatened species habitat, threatened ecological communities, wildlife connectivity and high probability groundwater dependant ecosystems.

Alternative sites within the approved lease would not be likely to achieve the objectives of the Project due to the lack of suitable resource for extraction.

7.1.1.8 Alternative Project Locations

The Proponent has identified that they have undertaken a detailed assessment and extensive constraints analysis of other potential high quality resource opportunities in the region. Several sites with favourable attributes were identified and subsequently subjected to preliminary field investigations. None of the sites investigated, however, had either the necessary resource quality or quantity to warrant a commitment to further investigation. The Proponent has identified that the Project presents a rare opportunity for them within the Lower Hunter Region to develop a large tonnage, greenfield quarry operation on geology demonstrated to be favourable for production of the full range of high-quality quarry products, with close proximity to key markets and existing State road infrastructure. The proponent has identified that the Project represents an ideal site to meet medium and long-term demand for high quality aggregates in the region.

7.1.2 Project Design and Planning

7.1.2.1 Alterations to the Development Footprint

Investigations within the approved licence area identified an initial development footprint which has been successively refined in an iterative process to avoid impacts to biodiversity features on the Subject Land. The current and previous development footprints associated with the Project are shown in **Figure 7.1**.

The refinement to the development footprint have resulted in the avoidance of the areas of occupied habitat for the threatened orchid species, *Pterostylis chaetophora,* avoidance of clearing high probability groundwater dependant ecosystems, and minimisation of impacts to plant community types, threatened ecological communities and habitats for the threatened fauna species observed during surveys.

The extent of impact avoidance which has been achieved for plant community types and species credit entities, as a result of alterations to the development footprint, is documented in **Table 7.1**.

Table 7.1 Extent of Impact Avoidance Achieved for PCTs and Species Credit Entities

Entity	Initial Project Area Assessed (pre-scoping) Totals (ha)	Scoping Report Disturbance Area (Version 1) Totals (ha)	EPBC Referral Disturbance Area (Version 2) Totals (ha)	EIS Disturbance Area (Version 3) Totals (ha)	Current Disturbance Area (Version 4) Totals (ha)	Extent of Impact Avoidance (ha) Achieved between Initial project area investigations and Version 4
Condition Zone 1 PCT 762 Cabbage Gum open forest or woodland on flats of the North Coast - Moderate to good *River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC.*	4.54	2.29	2.30	0.33	0.33	4.21
Condition Zone 2 PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest - Moderate to good	72.69	50.06	53.57	45.63	39.27	33.42
Condition Zone 3 PCT 1618 Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast - Moderate to good *Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion EEC*	1.15	0.88	0.88	0.88	0.88	0.27
Condition Zone 4 PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands - Moderate to good / Apple variant	21.45	19.83	19.83	19.52	18.91	2.54
Condition Zone 5 PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands - Moderate to good / Apple-Ironbark Forest variant	30.09	12.55	12.53	8.75	8.63	21.46

Entity	Initial Project Area Assessed (pre-scoping) Totals (ha)	Scoping Report Disturbance Area (Version 1) Totals (ha)	EPBC Referral Disturbance Area (Version 2) Totals (ha)	EIS Disturbance Area (Version 3) Totals (ha)	Current Disturbance Area (Version 4) Totals (ha)	Extent of Impact Avoidance (ha) Achieved between Initial project area investigations and Version 4
Condition Zone 6 PCT 1716 Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast – Regenerating *Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion EEC*	9.80	3.25	4.64	3.91	Nil (impacts avoided)	9.8
Rusty Greenhood (*Pterostylis chaetophora*)	58 individuals / 9.8 ha	2 individuals / 3.25 ha	2 individuals / 4.64 ha	3.91 ha / 2 individuals	Nil (impacts avoided)	58 individuals / 9.8 ha
Squirrel Glider (*Petaurus norfolcensis*)	139.72	88.87	93.74	79.02	68.02	71.7
Brush-tailed Phascogale (*Phascogale tapoatafa*)	139.72	88.87	93.74	79.02	68.02	71.7
Koala (*Phascolarctos cinereus*)	139.72	88.87	93.74	79.02	68.02	71.7
Native forest and woodland habitats (all vegetation zones)	139.72	88.87	93.74	79.02	68.02	71.7

7.1.2.2 Design Measures

The site access has been designed to take advantage of the existing vehicle track from Italia Road, which has reduced the impacts to understorey vegetation associated with the site access. The current development footprint also reflects a redesign of the Project layout to consolidate impact areas and minimise the area of native vegetation and habitat proposed for removal.

7.1.2.3 Location of Ancillary Facilities in Areas with No Biodiversity Values, or in Areas of Poorest Habitat

The ancillary features include the processing and stockpile areas, detention basins, weight bridge, site sheds, parking and haul and access roads (refer to **Figure 1.3**).

The Subject Land does not contain areas with no biodiversity values or areas in poor condition.

7.1.2.4 Location of Ancillary Facilities to avoid Habitat of Threatened Entities

Ancillary features have been located and designed to minimise the impact footprint and where possible utilise areas which will be progressively quarried.

7.1.2.5 Actions that Provide for Ecological Rehabilitation, Restoration and/or Maintenance or Retained Areas

The proponent has committed to the investigation of the establishment of a Biodiversity Stewardship Site in retained areas of the Wallaroo State Forest. This will provide potential for the rehabilitation, restoration and/or maintenance of retained areas, located near the development footprint.

7.1.2.6 Alternative Modes or Technologies Considered

Alternative modes or technologies are not of relevance to the proposed development.

7.1.2.7 Project Design Constraints

The Project design is primarily constrained by the location of the available target resource and the access to Italia Road.

7.2 Avoid and Minimise Prescribed Impacts

Prescribed Impacts are additional impacts which require assessment; however, they are not impacts which require consideration when calculating the number and classes of biodiversity credits required. Prescribed impacts for this Project are identified in **Section 6.0** of this Report. The main prescribed impacts with potential to result from the Project include:

- impacts to habitat connectivity.
- impacts to waterbodies, water quality and hydrological processes.
- vehicle strikes.

A consideration of impact avoidance and minimisation for prescribed impacts is provided as follows.

7.2.1 Project Location

7.2.1.1 Habitat Connectivity

The development footprint is located on the western edge of the Wallaroo State Forest and forms a small part of a larger habitat patch. The development footprint provides a suitable connection point to habitat further west of Italia Road. The width of the connecting vegetation will be reduced, however areas which provide suitable wildlife corridors around the development footprint and along the Italia Road interface, will be retained and additional pinch points created will not be narrower than existing pinch points to the west around the Seaham Quarry.

7.2.1.2 Hydrological Impacts

Clearing for the development footprint will result in impacts to first and second order ephemeral streams and associated hydrological processes. The Surface Water Impact Assessment (Engeny 2024) has identified potential hydrological impacts associated with the project, including:

- Impacts to water quality.
- Minor to negligible reduction in catchment yield.
- Potential for stream instability.

THE SWIA further quantifies and provides the following mitigation measures for these potential impacts:

- Achievement of a Neutral or Beneficial (NorBE) outcome on water quality (as required for developments within the Grahamstown Dam catchment) provided adequate site storage capacity is available for all stages of the quarry operation, an appropriate water treatment system is installed and maintained to ensure controlled discharge water quality targets are achieved and appropriate water inventory management is implemented to minimise the volume and frequency uncontrolled discharges.
- Identification that the loss of catchment yield will have a negligible impact on overall Grahamstown Dam catchment yields as the Project WMS will occupy less than 0.50% of the Grahamstown Dam catchment and less than 0.03% of the Williams River catchment.
- Identification that any stream stability issues associated with discharges are expected to be manageable and any required mitigation measures (e.g., scour protection, discharge flow rate limits) will be informed by the hydrologic and hydraulic assessment.
- The Project will have no impact on local or broader catchment flood regimes.

7.2.1.3 Vehicle Strikes

The potential for vehicle strikes has been minimised through the location of the development footprint close to the access point at Italia Road. The Project is also located in an ideal location to take advantage of the proximity to the Pacific Highway, which is already a busy traffic route. No vehicle movement would occur between 10 pm and 6 am. In addition to a reduced speed limit along the proposed quarry access road (15 m wide), the Project would implement driver education program and a reduced speed limit for heavy vehicles travelling into or leaving the quarry on Italia Road as part of the Driver's Code of Conduct to reduce the potential for road related fauna impacts. It is also recommended that Council investigate reducing the speed limit (which is currently 80 km/hr) for all motorists along this section of Italia Road.

7.2.2 Project Design

7.2.2.1 Habitat Connectivity

The Project design has been refined to minimise impacts to habitat connectivity, through reductions in the overall area of clearing proposed. The existing level of habitat connectivity will be reduced but still maintained. It is considered that additional designed features to further minimise impacts associated with habitat connectivity are not warranted as canopy vegetation is present along the existing gap interfaces and the construction of a land bridge across Italia Road is outside of the scope of this project.

7.2.2.2 Hydrological Impacts

Due to the location and characteristics of the target resource, an open quarry pit design is required for extraction of the target resource. Erosion and sediment control and on-site water storage will be undertaken to minimise prescribed impacts to waterbodies and hydrological processes specifically associated with this type of project.

7.2.2.3 Vehicle Strikes

The Project has been designed to minimise the length of the site access from Italia Road. It is considered that due to the quarry operation hours and proximity to existing high traffic public roads, there is only a low potential for vehicle strikes to occur. It is considered that there are no further feasible design measures that would reduce the potential for vehicle strikes.

7.3 Other Measures Considered

7.3.1 Do Nothing Option

The 'Do nothing' option was considered as part of environmental impact assessment for this Project. This identified that the supply of high-quality aggregates to the construction sector in the Lower Hunter and Central Coast areas in the medium term is characterised by quarries that are generally in the latter stages of their development lives, and/or operations with either comparatively short resource lives and/or sub-optimal resource quality. Consequently, if no new resources are identified and brought to market, the growth areas of the Lower Hunter and Central Coast will experience significant supply-side pressure for high-quality quarry products, with negative flow-on to costs throughout the entire construction sector value chain.

The 'do nothing option' would avoid the environmental impacts associated with the construction, operation and decommissioning of the Project, such as biodiversity impacts, construction noise, traffic and dust and hydrology impacts. However, these impacts are considered to be manageable through the implementation of the management and mitigation measures and biodiversity offsetting proposed.

The 'do nothing option' is not considered to be a preferred option for the Proponent.

7.4 Summary of Measures to Avoid and Minimise Impacts

A summary of the measures proposed to avoid and minimise direct, indirect and prescribed impacts associated with the Project is provided in **Table 7.2**.

Table 7.2 Avoidance and Minimisation Measures for Direct, Indirect and Prescribed Impacts

Action	Outcome	Timing	Responsibility
Preliminary biodiversity constraints analysis	Preliminary assessment of biodiversity constraints to inform project design and minimise impacts to areas with high biodiversity values.	Project design	Project Ecologist, Planning Team and Proponent
Location and design of works in existing disturbed areas where possible	The site access has been aligned to an existing access track through the Wallaroo State Forest.	Project design	Project Ecologist, Planning Team and Proponent
Reduction of Subject Land boundary / development footprint	The development footprint has been reduced through an iterative process to achieve the current 68.01 ha area of proposed disturbance.	Project design	Proponent
Workforce education and training	Environmental awareness for workforce.	Pre-construction and during construction and operation	Site Manager
Implement Construction Environmental Management Plan	Management and minimisation of potential environmental impacts.	Project construction	Site Manager
Implementation of vegetation protection zones for areas to be retained	Protect retained habitats.	During construction and operation	Project Ecologist and Site Manager
Ecologist pre-clearance surveys and supervision of works	Minimisation of impacts to local fauna and their habitats through identification of fauna present and management to minimise harm.	Construction / site clearing phase	Project Ecologist and Site Manager
Fencing and access control	Site access controls and fencing will be implemented to prevent unauthorised site access and disturbance around the quarry pit. There will be an access gate for the haul road, however the haul road will not be fenced and wildlife connectivity across the haul road will be maintained.	Construction and operational phases	Site Manager
Erosion and sedimentation control	Minimise erosion and sedimentation within the site and downstream habitats through installation and maintenance of erosion and sediment controls and water quality infrastructure.	Construction and operational phases	Site Manager
Weed management	Prevent and manage weed incursions and spread.	During construction, site clearing and operational phases	Site Manager

8.0 Impact Assessment

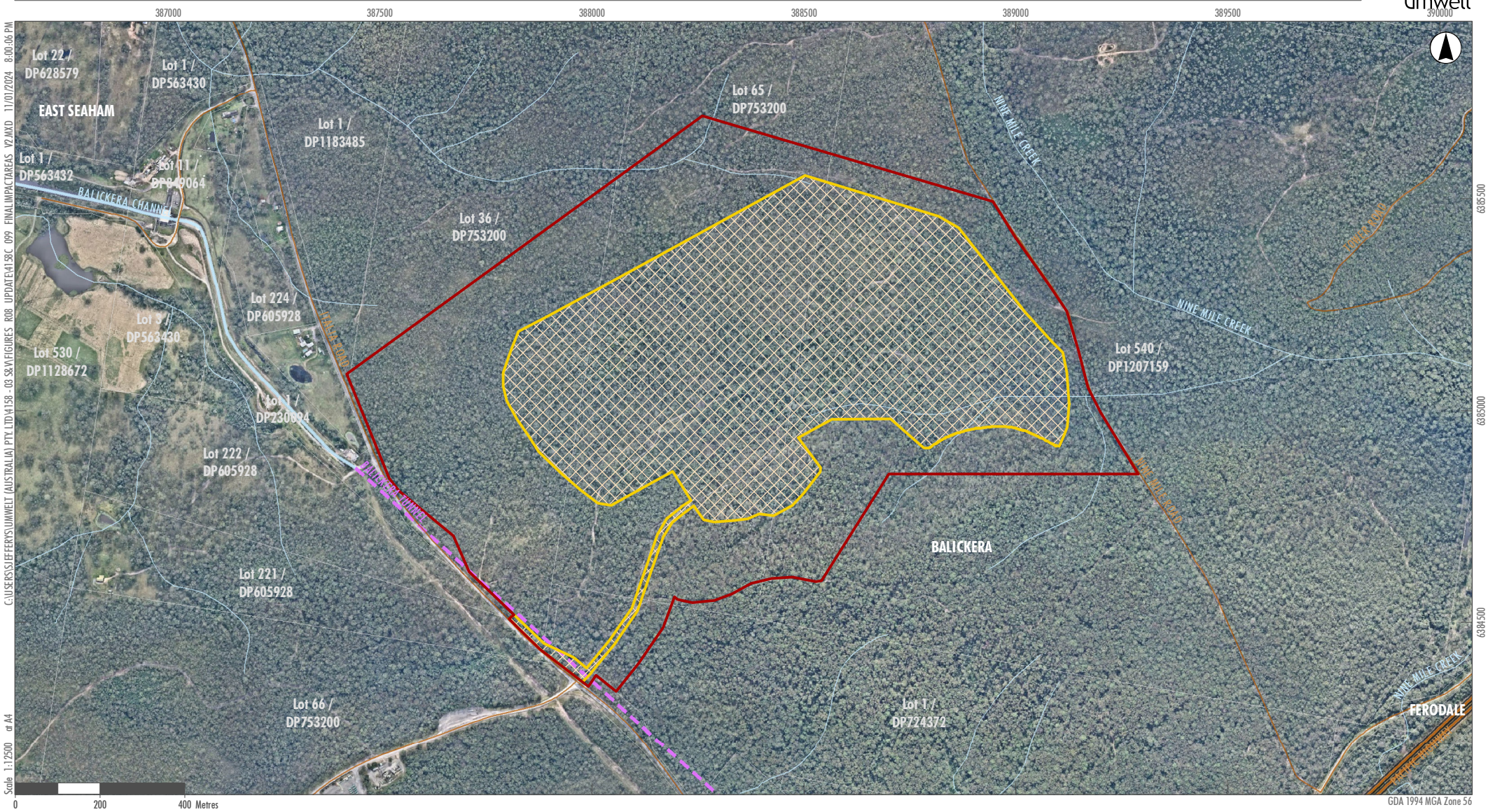
8.1 Direct Impacts

8.1.1 Residual Direct Impacts

The development footprint which will be impacted by the Project is mapped in **Figure 8.1**. **Table 8.1** summarises the extent of proposed residual direct impacts to plant community types and threatened entities observed or assumed to be present.

Table 8.1 Summary of Residual Direct impacts

Direct impact	BC Act status	EPBC Act status	Potential SAII entity	Project phase/timing of impact	Extent (ha)
Condition Zone 1 PCT 762 Cabbage Gum open forest or woodland on flats of the North Coast - Moderate to good	REFCF EEC	SEFFW EEC	No	Progressive staged clearing	0.33
Condition Zone 2 PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest - Moderate to good	Not listed	Not listed	No	Progressive staged clearing	39.27
Condition Zone 3 PCT 1618 Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast - Moderate to good	REFCF EEC	SEFFW EEC	No	Progressive staged clearing	0.88
Condition Zone 4 PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands - Moderate to good / Apple variant	Not listed	Not listed	No	Progressive staged clearing	18.91
Condition Zone 5 PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands - Moderate to good / Apple-Ironbark Forest variant	Not listed	Not listed	No	Progressive staged clearing	8.63
Squirrel Glider (*Petaurus norfolcensis*)	Vulnerable	Not listed	No	Progressive staged clearing	68.02
Brush-tailed Phascogale (*Phascogale tapoatafa*)	Vulnerable	Not listed	No	Progressive staged clearing	68.02
Koala (*Phascolarctos cinereus*)	Endangered	Endangered	No	Progressive staged clearing	68.02



Legend

- Project Area (Subject Land)
- Disturbance Area (Final Development Footprint)
- Final Impact Area Requiring Offsets – Ecosystem and Species Credits
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line
- Lot Boundaries

FIGURE 8.1

Final Impact Areas on the Subject Land

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

8.1.2 Change in Vegetation Integrity Score

For each vegetation zone the change in vegetation integrity is based on the development impacting to zero during construction. There are no vegetation integrity scores above zero after development and there would be no management actions required to maintain any remaining vegetation as it has been assumed that impact will occur to all vegetation within the vegetation zones.

Table 8.2 Impacts to Vegetation Integrity

PCT and Vegetation Condition Zone	Management zone	Area (ha)	Before development				After development				Change in VI score
			Composition	Structure	Function	VI score	Composition	Structure	Function	VI score	
1 – PCT 762 Intact	Impact Footprint	0.33	88.3	74.8	74.1	78.8	0	0	0	0	-78.8
2- PCT 1590 Intact	Impact Footprint	39.27	97	62.7	66.9	74.1	0	0	0	0	-74.1
3 – PCT 1618 Intact	Impact Footprint	0.88	87.9	76.7	70.7	78.1	0	0	0	0	-78.1
4 – PCT 1619 Intact Apple Variant	Impact Footprint	18.91	80.8	69	63.5	70.7	0	0	0	0	-70.7
5 – PCT 1619 Intact Apple-Ironbark Variant	Impact Footprint	8.63	89.3	81.8	71.5	80.5	0	0	0	0	-80.5

8.2 Indirect Impacts

Table 8.3 summarises the extent of the proposed residual indirect impacts to plant community types and threatened entities observed or assumed to be present within the development footprint. A map of the predictable indirect impacts associated with the Project is provided as **Figure 6.1**.

Table 8.3 Summary of Residual Indirect Impacts

Indirect impact	Threatened Entity Impacted	Project Impact Intensity	Frequency / Duration	Project phase/ timing of impact	Likelihood and consequences
Increased site occupation	Ecosystem credit species retained for assessment in **Table 5.1** and species credit threatened fauna species assessed as present in **Table 5.5.**	High	Frequent/ Ongoing	Construction and operation	Likely to occur, consequences are likely to include reduction in habitat suitability for threatened fauna in immediately adjoining areas.
Connectivity and corridors	Ecosystem credit species retained for assessment in **Table 5.1** and species credit threatened fauna species assessed as present in **Table 5.5**.	Low	Frequent / Ongoing	Staged construction, operation and once decommissioned	Will occur, consequences include reduced wildlife connectivity. Wildlife connectivity will be maintained through retention of suitable corridor areas.
Light spill impacts	Ecosystem credit species retained for assessment in **Table 5.1** and species credit threatened fauna species assessed as present in **Table 5.5.**	Low	Frequent/ Ongoing	Operation	Will occur, consequences likely to include minor alteration to fauna behaviours including avoidance of light and opportunistic utilisation of light spill areas.
Noise impacts	Ecosystem credit species retained for assessment in **Table 5.1** and species credit threatened fauna species assessed as present in **Table 5.5**.	Moderate	Frequent / Ongoing	Construction and operation	Will occur, consequences likely to include reduction in suitability of retained and close adjoining habitats for noise sensitive fauna species.

Indirect impact	Threatened Entity Impacted	Project Impact Intensity	Frequency / Duration	Project phase/ timing of impact	Likelihood and consequences
Air quality impacts	Ecosystem credit species retained for assessment in **Table 5.1** and species credit threatened species assessed as present in **Table 5.5.**	Low to moderate	Frequent / Ongoing	Construction and operation	Potential to occur within the immediate vicinity of the quarry pit and access road, but likely to be managed by appropriate dust suppression. Consequences include physical injury to airways of fauna species and short term reduced photosynthetic capacity for impacted flora. Controls for human health will also be applied to the Project.
Vibration impacts	Eco Logical Australia (2021) have identified that the Balickera tunnel provides habitat for the following threatened microbat species: • Eastern Coastal Free-tailed Bat • Eastern False Pipistrelle • Large Bent-winged Bat • Little Bent-winged Bat • Southern Myotis.	Low	Frequent / Ongoing for the life of the Project	Operation	The tunnel provides roosting habitat for threatened microbats and known breeding habitat for the Southern Myotis (Eco Logical Australia 2021). The revised Blasting Impact Assessment (Enviro Strata Consulting 2024) suggests that the Balickera Tunnel Remediation Works have reduced the risk of dust or small rocks falling from the tunnel roof due to blast vibrations. The likelihood of blast vibrations causing such falls is not higher than the likelihood of bat activity causing them. To protect the bats in the area, the vibration level should not exceed 10 mm/s, as recommended by a study referenced in the BIA (Enviro Strata Consulting 2024) by Martin (2015), and is also consistent with the ANZECC Guidelines (1990). The analysis showed that this limit can be achieved inside Balickera Tunnel by controlling the amount of MIC (maximum instantaneous charge) used. This is only relevant for a few blasts in the west end of the quarry in the last phase of the Project. No other blasting-related risks or vibration control measures were needed in the earlier phases of the Project. **Table 8.6** outlines adaptive management responses for vibration impacts on the tunnel.

Indirect impact	Threatened Entity Impacted	Project Impact Intensity	Frequency / Duration	Project phase/ timing of impact	Likelihood and consequences
Water impacts	Ecosystem credit species retained for assessment in **Table 5.1** and species credit threatened species assessed as present in **Table 5.5**.	Moderate	Infrequent (during and following rainfall events) / long term	Construction, and operation and ongoing once decommissioned	Likely to occur but limited. Consequences include removal of catchment and small sections of first and second order ephemeral streams in upper catchments. Reduced flows to downstream environments. Impacts managed through appropriate erosion and sediment controls and retention and treatment of runoff and intercepted water. Discharge of water controlled and will be managed to avoid downstream scouring.
Weed invasion	Ecosystem credit species retained for assessment in **Table 5.1** and species credit threatened species assessed as present in **Table 5.5**.	Low	Infrequent / long term	Construction, and operation and ongoing once decommissioned	Potential to occur, particularly in edge areas adjoining disturbed areas. Consequences include introductions of weeds, reduction in habitat suitability and competition with native species. Managed through proactive site weed management.
Pest animal species	Ecosystem credit species retained for assessment in **Table 5.1** and species credit threatened species assessed as present in **Table 5.5.**	Low	Infrequent / long term	Construction and operation	Feral animals are already present. Low potential for increased impacts, consequences include reduced habitat suitability and predation, grazing and/or trampling of threatened species.
Security fencing	Ecosystem credit species retained for assessment in **Table 5.1** and species credit threatened fauna species assessed as present in **Table 5.5.**	Low	Frequent / Long term	Construction and operation	Likely to occur. Consequences include reduction in habitat connectivity, although fencing will be undertaken for the quarry pit only and not the access road.

8.3 Prescribed Impacts

Prescribed impacts associated with the Project are identified in **Section 6.0** of this report and are further documented below.

8.3.1 Karst, Caves, Crevices, Cliffs, Rocks or Other Geological Features of Significance

8.3.1.1 Nature and Extent

The Project is not likely to impact caves, crevices, cliffs or geological features of significance.

Impacts are likely to occur to minor areas of rock outcropping which do not contain habitat structure for threatened species. These impacts are likely to be long-term and permanent.

8.3.1.2 Duration

This is likely to be one-off, permanent impact for the life of the Project which will occur during staged construction, site clearing and quarrying works.

8.3.1.3 Consequences

No threatened species have been recorded utilising these habitats and no significant consequences are predicted to occur.

8.3.2 Human Made Structures

8.3.2.1 Nature and Extent

No human made structures will be directly impacted by the project. The potential for vibration from blasting and heavy vehicle traffic on microbat roosting behaviour in the Balickera Tunnel have been considered by Enviro Strata Consulting (2023).

The Blasting Impact Assessment (Enviro Strat Consulting 2024) has identified that the Balickera Tunnel is likely to be an environment which has ongoing existing background noise levels associated with water flow and any microbats present are likely to have adapted to these noise levels. Enviro Strata Consulting (2024) have identified that there would not be any risk of air blast overpressure, fume impacts, flyrock impact or movement or detachment of strata within the tunnel and that vibration levels can be managed at up to 10 mm/s, which is an acceptable limit to manage potential impacts to microbats.

Remediation works are also expected to have reduced the risk of dust or small rocks falling from the tunnel roof due to blast vibrations The likelihood of blast vibrations causing such falls is predicted as not higher than the likelihood of bat activity causing them.

8.3.2.2 Duration

Blasting would occur for the life of the project and would typically occur once or twice a fortnight and be of short duration (1–2 seconds).

8.3.2.3 Consequences

Enviro Strata Consulting (2024) indicates the blasting effects on bats roosting in Balickera Tunnel will be reduced by several factors, such as blast frequency, short blast duration, previous exposure of bats to vibrations in the tunnel area and the tunnel length (fading vibration levels with distance). The acoustic environment within the tunnel (dynamic water impacts) is also likely to mask noise impacts from blasts and no changes to bat behaviour are predicted.

8.3.3 Non-Native Vegetation

No areas of non-native vegetation are present. Areas of non-native vegetation will not be impacted by the project.

8.3.4 Excluded Areas – Category 1 Land

No Excluded Areas of Category 1 Land are present. Areas of Excluded Category 1 Land will not be impacted by the project.

8.3.5 Habitat Connectivity

8.3.5.1 Nature and Extent

The development footprint is located on the western edge of the Wallaroo State Forest and forms a small part of a larger habitat patch. Due to the size of the intact habitat to the north, no significant impact to connectivity is anticipated in an east west direction north of Italia Road. There is potential for habitat connectivity impacts in relation to movement from the south, particularly for the Koala, Brush-tailed Phascogale and Squirrel Glider. There is a suitable connection point across Italia Road to the west of the development footprint noting that this corridor is already partly constrained to the west of Italia Road by the Boral Seaham Quarry. The project will reduce but not totally remove habitat connectivity for flora and fauna species, particularly between the Wallaroo State Forest and areas to the west of Italia Road, noting that any new pinch points created will not be less than 320 m in width and will be substantially wider than the existing pinch points for this east-west corridor surrounding the existing Seaham Quarry.

It is considered that no connectivity or associated genetic impacts to populations of the Koala, Brush-tailed Phascogale or Squirrel Glider are likely to occur as a result of the project.

In relation to cumulative impacts to connectivity, the potential impact areas associated with the Kings Hill Urban Release Area and the M1 Motorway Extension to Raymond Terrace, occur to the south-west of Italia Road. At the time of writing the development application for the Kings Hill Urban Release Area had been refused and the construction works for the Raymond Terrace M1 extension had recently commenced.

It is considered that the proposal would not contribute to an adverse cumulative impact to habitat connectivity across the M1 Motorway, however, would contribute to the cumulative reduction in habitat patch size and contribute to an additional connectivity pinch-point in the vicinity of Italia Road and the existing Boral Seaham Quarry.

Security fencing will be limited to around the quarry pit and operational areas, but not include the proposed access road. It is unlikely to impact fauna and a koala exclusion fence would limit access to the quarry pit and prevent koala access to operational areas.

8.3.5.2 Duration

This will be a one-off, permanent impact for the life of the project that will occur during construction and site operation. Ongoing impacts may also occur following decommissioning during the rehabilitation phase.

8.3.5.3 Consequences

The consequences include reduced wildlife connectivity, however areas of important habitat connectivity have been maintained. Due to the nature and layout of the site, which is surrounded by undeveloped land, there will be no significant changes to landscape connectivity for wildlife movement.

8.3.6 Waterbodies, Water Quality and Hydrological Processes

8.3.6.1 Nature and Extent

The development footprint supports ephemeral tributaries of Nine Mile Creek. The northern part of the development footprint contains first and second order tributaries of Caswells Creek which flow into the western section of Balickera Channel, the development footprint has been modified to avoid clearing of this watercourse. Water from the Western part of Balickera Channel is pumped east into the Balickera tunnel and flows to the Grahamstown Dam. The south-eastern part of the development footprint contains first and second order tributaries of Nine Mile Creek which flows directly to Grahamstown Dam.
An unmapped drainage line is also present in the south-western section of the development footprint.

All streams within the development footprint will be directly impacted by clearing and quarry operations, including clearing and terrain alteration for the development footprint which will impacts to first and second order ephemeral streams and associated hydrological processes. Water currently flowing down these watercourses following rain events will instead be intercepted by the quarry water management system with excesses volumes discharged to the Nine-Mile creek catchment when required.

The Surface Water Impact Assessment (Engeny 2024) has identified potential hydrological impacts associated with the project, including:

- Impacts to water quality.
- Minor to negligible reduction in catchment yield.
- Potential for stream instability.

8.3.6.2 Duration

The impacts associated with the project would commence during the initial clearing phase and be ongoing.

8.3.6.3 Consequences

THE SWIA (Engeny 2024) quantifies and provides the following mitigation measures for these potential impacts:

- Achievement of a Neutral or Beneficial (NorBE) outcome on water quality (as required for developments within the Grahamstown Dam catchment) provided adequate site storage capacity is available for all stages of the quarry operation, an appropriate water treatment system is installed and maintained to ensure controlled discharge water quality targets are achieved and appropriate water inventory management is implemented to minimise the volume and frequency uncontrolled discharges.

- Identification that the loss of catchment yield will have a negligible impact on overall Grahamstown Dam catchment yields as the Project WMS will occupy less than 0.50% of the Grahamstown Dam catchment and less than 0.03% of the Williams River catchment.
- Identification that there would be an increased runoff potential, with gross water balance being variable between the modelled quarry stages and between years of high and low rainfall.
- Identification that any stream stability issues associated with discharges are expected to be manageable and any required mitigation measures (e.g., scour protection, discharge flow rate limits) will be informed by the hydrologic and hydraulic assessment.
- The Project will have no impact on local or broader catchment flood regimes.

8.3.7 Groundwater Dependant Ecosystems

8.3.7.1 Nature and Extent

The Project Groundwater Impact Assessment (GIA) prepared by GHD (2024), identifies that the most conservative predicted radius of drawdown for Stage 8 (i.e., 468 m, based on Kmax) was used to assess the impacts to existing groundwater dependant ecosystems.

GHD (2024) identify that the background document for the Water Sharing Plan for the North Coast Fractured and Porous Rock Groundwater Sources 2016 (DPI 2016a in GHD 2024) refers to the High Priority Groundwater Dependent Ecosystem Map (DPI 2016b in GHD 2024) which was reviewed to identify any high priority GDEs within the New England Fold Belt Coast Groundwater Source.

GHD (2024) identify that the nearest high priority GDEs are located near the Williams River to the north and east of Seaham, approximately eight and five kilometres from the Project. These high priority GDEs are well outside the predicted radius of drawdown and will not be impacted by the Project.

GHD (2024) have also reviewed the Probable Vegetation Groundwater Dependent Ecosystems – Hunter/Central Rivers dataset (DPE Water 2022b) to identify vegetation types that have a probability of being groundwater dependent ecosystems. The dataset indicates that there are areas of high, medium, and low probability GDEs in the area with, high probability terrestrial type GDEs being associated with Nine Mile Creek to the north and north-east of the project, and Caswell's Creek and Williams Creek to the west.

Within the Project Area it is considered that PCT 1719 Prickly-leaved Paperbark Forest on the Coastal Lowlands of the Central Coast and North Coast, shown in **Figure 4.2**, corresponds to the areas mapped as high probability GDEs, and this PCT has now been removed from the development footprint and will not be directly impacted.

GHD (2024) identify that based on the standing water levels measured in groundwater monitoring bores (n= 10), the average depth to groundwater in the fractured rock aquifer at the project site is between 7.31 and 23.3 m below ground level. Average groundwater levels in monitoring bores in the northern part of the site where the high probability GDEs are present (within the maximum extent of predicted drawdown), are between approximately 7 and 13 metres below ground level. However, groundwater in these areas is significantly deeper (i.e., 20 m below the surface) due to the presence of an extensive zone of low permeability dacite which acts as an aquitard, confining groundwater to deeper, more permeable units at a depth (see Figure 3.5 in GHD 2024).

GHD (2024) identify that drawdown in the fractured rock aquifer (assuming the most conservative drawdown prediction) in the northern part of the Project Area containing the high probability GDEs would be in the order of 0 to 5 m. Given the depth to groundwater in this area (i.e., 20 m below surface), it is identified that the presence of high probability GDEs is due to shallow groundwater in the overlying alluvial/colluvial material (recharged from creeks and rainfall), rather than the deeper, fractured rock aquifer, from which it is disconnected in this area. Therefore, the modelled drawdown of groundwater in the deeper, fractured rock system is not predicted to adversely impact high probability GDEs.

GHD (2024) have also identified that the project is also unlikely to have an impact on aquatic GDEs or baseflow of streams in the drawdown zone, as the groundwater elevation is already below the creeks in the area.

8.3.7.2 Duration

The Project is predicted to not impact areas of high priority or high probability GDEs (GHD 2024).
The project is expected be completed after 30 years. With time, groundwater levels in the aquifer surrounding the project will recover until equilibrium within the system occurs, and a pit lake forms within the final voids. Once the system is in equilibrium, the flux of water within the pit lake will only be from rainfall and evaporation. During the recovery stage however, groundwater inflows will occur, however any enhanced recharge that occurs because of the quarry in the post closure phase would reduce the time required for groundwater levels to recover.

8.3.7.3 Consequences

GHD have identified the project meets the NSW AIP Level 1 Minimal Impact Considerations for GDEs and identifies that any drawdown associated with excavation for the quarry pit within the deeper fractured rock system is not likely to adversely affect high probability GDEs present.

8.3.8 Vehicle Strikes

8.3.8.1 Nature and Extent

Vehicle movements will occur within the impact footprint. The project is also likely to increase traffic on local roads. No vehicle movement would occur between 10 pm and 6 am. In addition to a reduced speed limit along the proposed quarry access road (15 m wide), the Project would implement driver education program and reduced speed limit for heavy vehicles travelling into or leaving the quarry on Italia Road as part of the Driver's Code of Conduct to reduce the potential for road related fauna impacts. It is also recommended that Council investigate reducing the speed limit (which is currently 80 km/hr) for all motorists along this section of Italia Road

8.3.8.2 Duration

The potential for increase vehicle strikes will occur for the life of the project.

8.3.8.3 Consequences

The consequences include mortality of fauna species. The project has been designed to minimise the length of the site access from Italia Road. It is considered that due to the quarry operation hours, proposed reduced speed limit for heavy vehicle drivers and proximity to existing high traffic public roads, there is only a low potential for additional vehicle strikes to occur.

8.3.9 Prescribed Impact Data Limitations, Predictions and Assumptions

The assessment of prescribed impacts provided is predominantly a qualitative assessment. Where quantitative data and studies have been relied upon, suitable references to the source material have been provided.

8.4 Mitigating Residual Impacts – Management Measures and Implementation

The following management measures are proposed to mitigate the residual impacts (direct, indirect and prescribed) associated with the project. The impact mitigation measures proposed for residual impacts are also further summarised in **Table 8.4**, with implementation details provided in **Table 8.5**.

8.4.1 Workforce Education and Training

The development of education packages and training can help to mitigate anthropogenic impacts on biodiversity resulting from the construction and operation of the project. The ability of non-ecological personnel to identify key threatened species or key ecological threats can help to mitigate impacts on threatened species. The following mitigation actions will be implemented for the project to develop a greater understanding and awareness of biodiversity issues in non-ecological trained personnel:

- Inductions for the workforce will be undertaken to make them aware of the key ecological issues present in the Subject Land to aid in their understanding of their role and responsibilities in the protection and/or minimisation of impacts to all native biodiversity.
- Inductions will identify the location of sensitive flora and fauna, including any defined exclusion / no-go areas, and the policies being implemented to protect the biodiversity values of such areas.
- Responsibilities with respect to weed management and biosecurity.
- Reduced speed limits for heavy vehicle drivers travelling on Balickera Road in the vicinity of the quarry.

8.4.2 Implementation of Vegetation Protection Zones for Areas to be Retained

During construction, temporary exclusion fencing or other form of suitable marking measure, will be used to demarcate disturbance areas in locations where necessary to avoid accidental damage to areas of vegetation outside of the development footprint. Access control is an important feature in protecting and demarcating areas outside the development footprint from vehicle access, human access, and accidental disturbance. Proposed measures include:

- Appropriate temporary fencing (or other form of suitable marking measures) and signposting of areas to prevent the uncontrolled entry of people, accidental disturbance and to minimise vehicular and human traffic.
- Clear and visible signage is to be appropriately located to inform the workforce and others of the restricted access or otherwise of areas outside the Development footprint.
- Worker education and awareness of exclusion areas, including as delivered through site induction information.

- The use of GPS enabled machinery (where available) to help prevent accidental disturbance of exclusion areas.

8.4.3 Ecologist Pre-Clearance Surveys and Supervision of Works

Pre-clearance surveys and tree felling supervision will be undertaken by an appropriately qualified and experienced ecologist to minimise potential impacts to fauna species, particularly hollow-dependent fauna. A detailed tree-felling supervision protocol is to be developed and documented as part of the Construction Environmental Management Plan for the project and should include:

- Pre-clearing relocation surveys for fauna.
- Staged clearing works with under-scrubbing prior to tree removal.
- Management of koalas to prevent harm during clearing works.
- Ecologist supervision of all hollow tree felling to manage hollow dependant fauna, including the Brush-tailed Phascogale and Squirrel Glider.
- Nest box installation within the licence area to compensate for hollows removed.
- Scheduling the clearing works for the most suitable time of year to minimise impacts during the breeding seasons of identified potential threatened species and other fauna that may breed on site, such as arboreal mammals and hollow dependent fauna.
- Comparative habitat assessments should be conducted on clearing sites and proposed release sites to ensure that habitat features are available in the released sites.
- Release sites should be identified and mapped prior to clearing and all appropriate approvals granted by the landholders.
- Tree clearing should not be conducted above 35°C in the interests of animal welfare.
- Communication should occur with wildlife care agencies and local veterinarians prior to the commencement of clearing to confirm the availability of resources for any captured/injured fauna that is unable to be released.
- Clearing should be conducted sequentially and directionally towards areas of refuge to prevent the creation of vegetation islands.
- Sectional dismantling of hollow-bearing trees to allow fauna to escape, or position felled trees so that hollows are facing upwards and out to allow fauna to escape overnight.

8.4.4 Erosion and Sedimentation Control

Erosion Sediment Control measures will be implemented for the project. Recommended measures include:

- Minimising the area of disturbance (as far as practicable).
- Diverting clean run-off water around disturbed areas where possible.

- Installation and ongoing maintenance of temporary erosion and sediment controls (e.g., sediment fencing) throughout the duration of the construction of the project.
- Design, implementation, and ongoing maintenance of permanent operational phase controls (e.g. catch drains) during the operational phase of the project.
- Stabilisation (i.e., landscaping and revegetation) of all disturbed areas not required for the operation of the project, to reduce the potential for future erosion.

8.4.5 Weed Management

Weed species could be inadvertently brought into the Subject Land or surrounding habitats with imported materials, on vehicles and mobile plant, or could invade naturally through removal of native vegetation and the creation of a suitable growth medium. The presence of weed species has the potential to decrease the value of vegetation for native species, particularly threatened species.

Weed management controls will include:

- The survey and treatment of invasive weed species prior to the disturbance of topsoil within the development footprint to prevent exacerbation of the outbreak and / or the spread of the subject species to previously unaffected areas within the development footprint.
- Ongoing environmental inspections and treatment of outbreaks of invasive weed species as required within the development footprint during the construction and operation of the project.
- All machinery and equipment will be cleaned thoroughly prior to entering the Subject Land. Cleaning must include the removal of all mud and plant matter (inside and out), followed by washing with high pressure water.

8.4.6 Preparation and Implement of Construction Environmental Management Plan

A Construction Environmental Management Plan will be prepared to document the environmental impact mitigation, performance targets and monitoring requirements for the construction and operational phases of the project. Proposed mitigation and management measures for residual impacts are documented in **Table 8.4**. Implementation details for the proposed impact mitigation and management measures are provided in **Table 8.5.**

Table 8.4 Summary of Proposed Mitigation and Management Measures for Residual Impacts (Direct, Indirect, and Prescribed)

Mitigation Measure	Method/Technique	Timing	Frequency	Responsibility	Likely Efficacy
Workforce education and training	Environmental awareness for construction and operational site workers.	Construction and operation	For all new contractors and employees as part of the general site induction.	Site Manager	Measure is likely to achieve intended outcome
Identification of approved disturbance areas and implementation of vegetation protection zones for areas to be retained	Temporary delineation of the development footprint until permanent fencing is installed.	Construction / site clearing	Prior to and during site clearing and construction. Permanent fencing to remain for the life of the development.	Site Manager and Project Ecologist	Measure is likely to achieve intended outcome
Ecologist pre-clearance survey of disturbance footprint prior to clearing and construction works and supervision of works	Minimisation of impacts to local fauna and their habitats through identification of fauna present and management to minimise harm.	Minimisation of impacts to local fauna and their habitats through identification of fauna present and management to minimise harm.	Prior to construction works and during site clearing.	Site Manager and Project Ecologist	Measure is likely to achieve intended outcome
Erosion and sedimentation control	Installation and maintenance of appropriate erosion and sediment controls and work practices.	Prior to and during clearing works until permanent controls such as sediment basins are installed and established.	Temporary erosion and sediment controls would be installed prior to commencement of construction and permanent measures such as stormwater detention basins would be maintained for the life of the development.	Site Manager	Measure is likely to achieve intended outcome
Weed management	Targeted spraying and/or grazing to suppress weed invasion.	All stages of the development	As needed	Site Manager / Project Ecologist	Measure is likely to achieve intended outcome

Mitigation Measure	Method/Technique	Timing	Frequency	Responsibility	Likely Efficacy
Fencing, Access Control and Fauna exclusion	Installation of a permanent security fence.	During operation	For the life of the development.	Site Manager	Measure is likely to achieve intended outcome
Preparation and Implement of Construction Environmental Management Plan	Develop plan to adequately manage environmental impacts during construction including dam dewatering controls, fencing and access control, weed management and erosion and sediment control.	To prepared prior to the commencement of works and implemented for all construction works and for the life of the development as necessary.	For the life of the development.	Proponent / Site Manager	Measure is likely to achieve intended outcome

Table 8.5 Implementation Details for Proposed Impact Mitigation and Management Measures

Measure/action	Monitoring and evaluation strategy	Performance criteria	Adaptive management threshold	Adaptive management response
Workforce education and training	Completion and maintenance of a site induction register.	Induction of all construction workers.	Failure of Site manager to induct workers.	Breach to be reported in annual compliance reporting. Suspension of the relevant works until construction workers are inducted.
Implementation of vegetation protection zones for areas to be retained	Monitoring to be undertaken by the Project Ecologist prior to commencement and monthly during construction works.	Protection of retained vegetation and habitats.	Breach of vegetation protection zones / damaged to retained habitats.	Breach to be reported in annual compliance reporting. Suspension of the relevant works until appropriate protection measures are implemented and appropriate remedial actions to remedy any adverse impacts are completed.

Measure/action	Monitoring and evaluation strategy	Performance criteria	Adaptive management threshold	Adaptive management response
Ecologist pre-clearance surveys and supervision of works	Reporting on preclearance surveys and works supervision to be undertaken by Project Ecologist.	Completion of proposed works.	Completion of clearing works without project ecologist supervision.	Breaches to be reported in annual compliance reporting to DPE.
Erosion and sedimentation control	Monitoring to be undertaken in accordance with requirements of Construction Environmental Management Plan.	Temporary erosion and sediment controls to be installed prior to works. Permanent controls to be maintained for the life of the development.	Monitoring detects lack or failure of required temporary or permanent erosion and sediment controls.	Breaches to be reported in annual compliance reporting to DPE.
Weed management	Monitoring to be undertaken in accordance with requirements of Construction Environmental Management Plan.	Weed growth to be continually suppressed within the development footprint.	Monitoring detects increasing weed infestations which are not being suppressed.	Alternative methods or herbicides to be used to achieve success.
Fencing, Access Control and Fauna exclusion	Monitoring to be undertaken in accordance with requirements of Construction Environmental Management Plan.	Exclusion of all target fauna species.	Repair or upgrade to fencing.	Fencing design to be improved to achieve effectiveness.
Preparation and Implement of Construction Environmental Management Plan	Implementation to be supervised by Project Ecologist or suitable environmental consultant.	Completion of all proposed environmental protection works and monitoring inspections.	Monitoring detects breach or failure to implement Construction Environmental Management Plan.	Breach to be included in annual compliance reporting to DPE.

8.5 Adaptive Management Strategy for Uncertain Impacts (Where Relevant)

It is considered that the potential impacts associated with the project are predictable and known however there is a level of uncertainty regarding modelled impacts which cannot be directly calculated before the impact occurs. Impacts which have been assessed by modelling include surface water impacts, groundwater drawdown and vibration and blasting. Adaptive strategies for impact mitigation measures are provided in **Table 8.6**.

Table 8.6 Adaptive Management Strategy Details for Uncertain Impacts

Impact Description	Base Line Data Required and Monitoring Method	Monitoring Frequency and Reporting Schedule	Performance Indicators for Management Intervention	Management Response	Risk of Monitoring Failure
Changes to vegetation structure and floristic composition resulting from modifications to the hydrological regime	BAM Vegetation Integrity Plots in retained potential areas of impact	Annual	>30% reduction in vegetation integrity score sustained over 3 consecutive years, attributable to the Project	Provision of BAM credits proportional to the vegetation integrity loss over the area affected.	Low
Changes to vegetation structure and floristic composition resulting from groundwater drawdown	BAM Vegetation Integrity Plots in retained potential areas of impact and additional survey and investigation work to determine nature and extent of GDE groundwater dependency in the drawdown zone prior to Stage 5.	Annual (to be commenced at least 2 years prior to predicted drawdown impacts outside the Disturbance Footprint)	To be developed in accordance with the recommendation of the GIA and any approval conditions. Suggest >30% reduction in vegetation integrity score sustained over 3 consecutive years, attributable to the Project.	Provision of BAM credits proportional to the vegetation integrity loss over the area affected.	Low
Modifications to habitat suitability resulting from blasting and vibration	BAM Vegetation Integrity Plots in retained areas and Species Credit Threatened Fauna Population Monitoring for the Koala, Squirrel Glider and Brush-tailed Phascogale. Implementation of a vibration monitoring program for Balickera Tunnel in Stages 8 and 9.	Annual	Lack of species presence within retained areas over 5 consecutive years, attributable to the project. Performance for vibration monitoring is a vibration criteria of 10 mm/s.	Provision of species credits if population reduction occurs for the project area. Management response to reduce vibration impacts to 10 mm/s to be determined by blast consultant.	Moderate potential for false negative results relating to population monitoring. For blast monitoring it is considered there is a low risk of failure.

8.6 Other Relevant Biodiversity Impact Assessment Legislation

8.6.1 Environment Protection and Biodiversity Conservation Act

An assessment of Matters of National Environmental Significance listed under the EPBC Act is provided in **Appendix B** of this Report. A summary of the offsetting approach and significant impact conclusions for MNES is provided in **Table 8.7**. The assessment completed in Appendix B has identified that the project is likely to have a significant impact on the following MNES entities:

- Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions
- Koala (*Phascolarctos cinereus*) (combined populations of Queensland, New South Wales and the Australian Capital Territory)
- Grey-headed Flying-fox (*Pteropus poliocephalus*).

All MNES threatened ecological communities, all ecosystem credit MNES species predicted to occur and all species credit MNES entities observed will be offset using the like for like credit rules under the BAM.

Table 8.7 MNES Assessment Conclusions and Offsetting Summary

MNES Entities	Presence on site	Area of habitat entity impacted	Significance of impact	Offsetting approach
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	Observed	1.21 ha	Potentially significant at a local scale, not likely to be significant at regional or national scale	Ecosystem credits
South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) Foraging Habitat	Observed	68.02	Not significant	Ecosystem credits
Spotted-tailed Quoll (*Dasyurus maculatus*)	Predicted (ecosystem credit species)	68.02	Not significant	Ecosystem credits
White-throated Needletail (*Hirundapus caudacutus*)	Predicted (ecosystem credit species)	68.02	Not significant	Ecosystem credits
Swift Parrot (*Lathamus discolor*) Foraging Habitat	Predicted (ecosystem credit species)	68.02	Not significant	Ecosystem credits
Yellow-bellied Glider (south-eastern) (*Petaurus australis australis*)	Predicted (ecosystem credit species)	68.02	Not significant	Ecosystem credits
Koala (*Phascolarctos cinereus*)	Observed	68.02	Significant	Species credits

MNES Entities	Presence on site	Area of habitat entity impacted	Significance of impact	Offsetting approach
New Holland Mouse (*Pseudomys novaehollandiae*)	Predicted (ecosystem credit species)	68.02	Not significant	Ecosystem credits
Grey-headed Flying-fox (*Pteropus poliocephalus*)	Observed	68.02	Significant impact at local scale to foraging habitat	Ecosystem credits
Rufous Fantail (*Rhipidura rufifrons*)	Observed	68.02	Not significant	Indirectly offset through ecosystem credits
Black-faced Monarch (*Monarcha melanopsis*)	Not observed	68.02	Not significant	Indirectly offset through ecosystem credits

8.6.2 State Environmental Planning Policy (Biodiversity and Conservation 2021) Chapter 3 Koala Habitat Protection

The project is a State significant development and therefore the provisions of State Environmental Planning Policy (SEPP) (Biodiversity and Conservation 2021) Chapter 3 Koala Habitat Protection, do not apply.

If the SEPP was applicable, a consideration as to whether the land contains potential and/or core koala habitat would be required and for core koala habitat any development approved would need to be consistent with the Port Stephens Comprehensive Koala Plan of Management (PSC 2002).

One Koala feed tree species listed within Schedule 1 of SEPP (Biodiversity and Conservation 2021), *Eucalyptus tereticornis,* was observed within the subject land during surveys. It was recorded at a density of at least 15% within plot 7 in PCT 1716, plot 12B in PCT 1618 and plot 22 in PCT 762. It is therefore considered that potential koala habitat (as defined under Chapter 3 of the SEPP) is present within the Project Area.

Core koala habitat under Chapter 3 of the SEPP means an area of land with a resident population of koalas, evidenced by attributes such as breeding females, being females with young, and recent sightings of and historical records of a population. Based on the koala records obtained during surveys completed by Umwelt and a review of BioNet Atlas records, it is considered that the subject land contains both recent sightings and historical records of a koala population.

The Port Stephens Koala Habitat Planning Map identifies that the subject land (comprising the Project Disturbance Area) contains mostly marginal koala habitat within small areas of preferred koala habitat and buffer and linking habitats over marginal habitat, mostly concentrated around the site access. Approximately 94% of the Project Disturbance Area is mapped as marginal koala habitat.

The Port Stephens CKPOM (Part 1 Appendix 4) provides performance criteria for development applications within the LGA for sites that contain or are adjacent to Preferred or Supplementary Habitat, Habitat Buffers or Habitat Linking Areas. The CKPOM identifies that the Guidelines for Koala Habitat Assessments are relevant for rezoning proposals and development applications under Part 4, of the EP&A Act. The performance criteria within the CKPOM is not relevant to state significant development, because SEPP (Biodiversity and Conservation 2021) Chapter 3 Koala Habitat Protection does not apply.

In compliance with the assessment requirements of the BAM (DPIE 2020a) and the Koala BAM Survey Guide (DPE 2022c), the entire subject land has been included within the species polygon determined for the koala.

9.0 Serious and Irreversible Impacts

9.1 Assessment for Serious and Irreversible Impacts on Biodiversity Values

The determination of a serious and irreversible impact on biodiversity values is to be made by the decision maker in accordance with the principles set out in the BC Regulation 2017. Under Clause 6.7 (2) of the BC Regulation 2017, an impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species or ecological community becoming extinct because of one of the following four principles:

- Principle 1: The impact will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline, or
- Principle 2: the impact it will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or
- Principle 3: it is an impact on the habitat of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or
- Principle 4: the impacted species or ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable.

No potential Serious and Irreversible Impact Entities were observed during surveys.

Breeding habitat for the Eastern Cave Bat, Little Bent-winged Bat and the Eastern Bent-winged Bat is a potential SAII entity. Confirmed calls of the Little Bent-winged Bat and Eastern Bent-winged Bat were recorded during surveys. A potential, although unlikely call for the Eastern Cave Bat was also obtained. Both species of the Bent-winged Bats are known to roost in the Balickera Tunnel, however the females are reported as absent during summer indicating that the tunnel is not used as breeding habitat (Eco Logical Australia 2021). The tunnel has also not been reported as providing roost or breeding habitat for the Eastern Cave Bat and the presence of this bat is not predicted by PCT associations and has not been confirmed to occur.

10.0 Impact Summary

10.1 Determining an Offset Requirement for Impacts

10.1.1 Impacts on Native Vegetation and TECs (Ecosystem Credits)

There are no PCTs which do not require an offset (as per BAM Subsection 9.2.1(3.)). The PCTs which require ecosystem credits are listed in **Table 10.1**. Biodiversity Credit Reports are provided as **Appendix F**.

Table 10.1 Impacts that Require an Offset – Ecosystem credits

Vegetation Zone	PCT name	TEC	Impact area (ha)	Current VI score	Future VI score	Change in VI score	Biodiversity risk weighting	Number of ecosystem credits required
PCT 762 - Intact	Cabbage Gum open forest or woodland on flats of the North Coast	Yes	0.33	78.8	0	-78.8	2	13
PCT 1590 - Intact	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	No	39.27	74.1	0	-74.1	1.5	1092
PCT 1618 - Intact	Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	Yes	0.88	78.1	0	-78.1	2	34
PCT 1619 - Intact / Apple variant	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	No	18.91	70.7	0	-70.7	1.5	502
PCT 1619 - Intact / Apple-Ironbark Forest variant	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	No	8.63	80.5	0	-80.5	1.5	261
							Total Ecosystem Credits	**1902**

10.1.2 Impacts on Threatened Species and Their Habitat (Species Credits)

Table 10.2 provides a summary of the species credit threatened that require an offset (as per BAM Subsection 9.2.2(2.)) and identifies the amount of credits required. Species polygons are mapped in **Figure 5.1** to **Figure 5.4**.

Table 10.2 Impacts that Require an Offset – Species Credits

Common Name	Scientific Name	BC Act status	EPBC Act status	Loss of habitat (ha) or individuals	Biodiversity risk weighting	Number of species credits required
Squirrel Glider	*Petaurus norfolcensis*	V	-	68.01 ha	2	2519
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	-	68.01 ha	2	2519
Koala	*Phascolarctos cinereus*	E	E	68.01 ha	2	2519
					Total Species Credits	**7557**

10.1.3 Indirect and Prescribed Impacts

No offsets are required or proposed for indirect and prescribed impacts.

10.2 Impacts that Do Not Need Further Assessment

Areas within the development footprint that do not contain native vegetation do not need to be assessed for ecosystem credits (as per BAM Section 9.3(1–2.)). There were no areas of non-native vegetation identified within the development footprint or Subject Land.

Potential calls of the Southern Myotis (*Myotis macropus*) and microbat calls which could only be attributed to a species group which includes the Eastern Cave Bat (*Vespadelus troughtoni*) were recorded during surveys. There are no plant community types present which are associated with the Eastern Cave Bat and the required habitat constraints for the Southern Myotis are not present within the development footprint (within 200 m of waterbodies with pools/stretches greater than 3 m wide). Therefore, no credits are required to be generated for these species credit entities.

11.0 Biodiversity Credit Obligations

Biodiversity Credit Reports which identify the like-for-like and variation credit requirements are provided in **Appendix F.** Further details on the biodiversity credit requirements for the project are provided as follows.

11.1 Ecosystem Credits

The ecosystem credit requirements and those that could be retired in accordance with the offset rules are listed in **Table 11.1**. It is noted that there are mismatches between TEC determinations made within this Report based on the relevant NSW Scientific Committee Final Determinations and the results of site surveys, and TECs selectable in BAM-C which are documented in **Table 11.1**.

For PCT 762 the BAM-C TEC association selectable is Subtropical Coastal Floodplain Forest, but the TEC association determined through surveys is River-flat Eucalypt Forest on Coastal Floodplain. This was identified in the exhibited version of this BDAR (Umwelt 2023) and BCD have requested that Umwelt amend the BAM-C to reflect the TEC determinations made, however there is no functionality in the BAM-C to make these changes.

Table 11.1 Ecosystem Credit Class and Matching Credit Profiles

Ecosystem Credit	Rule Type	Attributes Shared with Matching Credits						
		PCT Name	PCT Vegetation Class	PCT Vegetation Formation	Associated TEC	Offset Trading Group	Hollow bearing trees present?	IBRA Subregion
PCT 762 Cabbage Gum open forest or woodland on flats of the North Coast 13 credits	Like for Like	Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion. This includes PCT's: 621, 686, 761, 762, 837, 848, 852, 971, 1062, 1091, 1092, 1106, 1215, 1227, 1230, 1333, 1588, 1594, 1598 3087, 3102, 3420, 3428, 3574, 3984, 4002, 4003, 4005, 4032, 4033, 4036, 4042, 4045, 4046	Coastal Valley Grassy Woodlands	Grassy Woodlands	Yes	Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion EEC (Assessed as part of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC)	No	Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.
	Variation			Grassy Woodlands		Tier 3 or higher threat status	No	NSW North Coast or Any IBRA subregion that is within 100 km of the outer edge of the impacted site.

Ecosystem Credit	Rule Type	Attributes Shared with Matching Credits						
		PCT Name	PCT Vegetation Class	PCT Vegetation Formation	Associated TEC	Offset Trading Group	Hollow bearing trees present?	IBRA Subregion
PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest 1092 credits	Like for Like	715, 904, 922, 1178, 1215, 1588, 1589, 1590, 1591, 1592, 1593, 1600, 1601, 1602, 1608, 1612, 1626, 1748 3431, 3432, 3433, 3434, 3435, 3436, 3437, 3438, 3439, 3441, 3442, 3443, 3444, 3445, 3446, 3447	Hunter-Macleay Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrub/grass sub-formation)	No	Hunter-Macleay Dry Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status).	Yes	Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. Or any IBRA subregion that is within 100 km of the outer edge of the impacted site.
	Variation			Dry Sclerophyll Forests (Shrub/grass sub-formation)		Tier 4 or higher threat status	Yes	NSW North Coast or any IBRA subregion that is within 100 km of the outer edge of the impacted zone.
PCT 1618 Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	Like for Like	686, 828, 835, 941, 1108, 1109, 1212, 1228, 1293, 1318, 1326, 1386, 1504, 1556, 1594, 1618, 1720, 1794 3135, 3181, 3185, 3188, 3192, 3285, 3328, 4024, 4025, 4039, 4041, 4058, 4138	Coastal Dune Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrubby sub-formation)	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	No	Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. Or any IBRA subregion that is within 100 km of the outer edge of the impacted site.

Ecosystem Credit	Rule Type	Attributes Shared with Matching Credits						
		PCT Name	PCT Vegetation Class	PCT Vegetation Formation	Associated TEC	Offset Trading Group	Hollow bearing trees present?	IBRA Subregion
34 credits	Variation			Dry Sclerophyll Forests (Shrubby sub-formation)		Tier 3 or higher threat status	No	NSW North Coast or any IBRA subregion that is within 100 km of the outer edge of the impacted zone.
PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands -Intact Apple Variant 502 credits	Like for Like	1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787 3579, 3580, 3581, 3582, 3583, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598,	Sydney Coastal Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrubby sub-formation)	No	Sydney Coastal Dry Sclerophyll Forests - <50% cleared group (including Tier 4 or higher threat status).	Yes	Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. Or any IBRA subregion that is within 100 km of the outer edge of the impacted site.
	Variation			Dry Sclerophyll Forests (Shrubby sub-formation)		Tier 4 or higher threat status	Yes	NSW North Coast or any IBRA subregion that is within 100 km of the outer edge of the impacted zone.

Ecosystem Credit	Rule Type	Attributes Shared with Matching Credits						
		PCT Name	PCT Vegetation Class	PCT Vegetation Formation	Associated TEC	Offset Trading Group	Hollow bearing trees present?	IBRA Subregion
PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands -Intact Apple / Ironbark Variant 261 credits	Like for Like	1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787 3579, 3580, 3581, 3582, 3583, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598,	Sydney Coastal Dry Sclerophyll Forests	Dry Sclerophyll Forests (Shrubby sub-formation)	No	Sydney Coastal Dry Sclerophyll Forests - < 50% cleared group (including Tier 4 or higher threat status).	No	Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. Or any IBRA subregion that is within 100 km of the outer edge of the impacted site.
	Variation			Dry Sclerophyll Forests (Shrubby sub-formation)		Tier 4 or higher threat status	No	NSW North Coast or any IBRA subregion that is within 100 km of the outer edge of the impacted zone.

11.2 Species Credits

The species credit requirements and those that could be retired in accordance with the offset rules are listed in **Table 11.2**.

Table 11.2 Species Credit Class and Matching Credit Profiles

Species Credit	Attributes shared with matching credits				
	Name of threatened species	Kingdom	BC Act status	EPBC Act status	IBRA region
Squirrel Glider (*Petaurus norfolcensis*) 2519 credits	Variation Rules: Any species with same or higher category of listing under Part 4 of the BC Act Like for Like Rules: Squirrel Glider	Fauna	Vulnerable	Vulnerable	Variation Rules: Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. Or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site. Like for like rules: Any in NSW
Brush-tailed Phascogale (*Phascogale tapoatafa*) 2519 credits	Variation Rules: Any species with same or higher category of listing under Part 4 of the BC Act Like for Like Rules: Brush-tailed Phascogale	Fauna	Vulnerable	Not listed	Variation Rules: Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. Or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site. Like for like rules: Any in NSW
Koala (*Phascolarctos cinereus*) 2519 credits	Variation Rules: N/A - Offsets required to meet like-for-like rules under EPBC Act Like for Like Rules: Koala	Fauna	Endangered	Endangered	Variation Rules: Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. Or Any IBRA subregion that is within 100 kilometres of the outer edge of the impacted site. Like for like rules: Any in NSW.

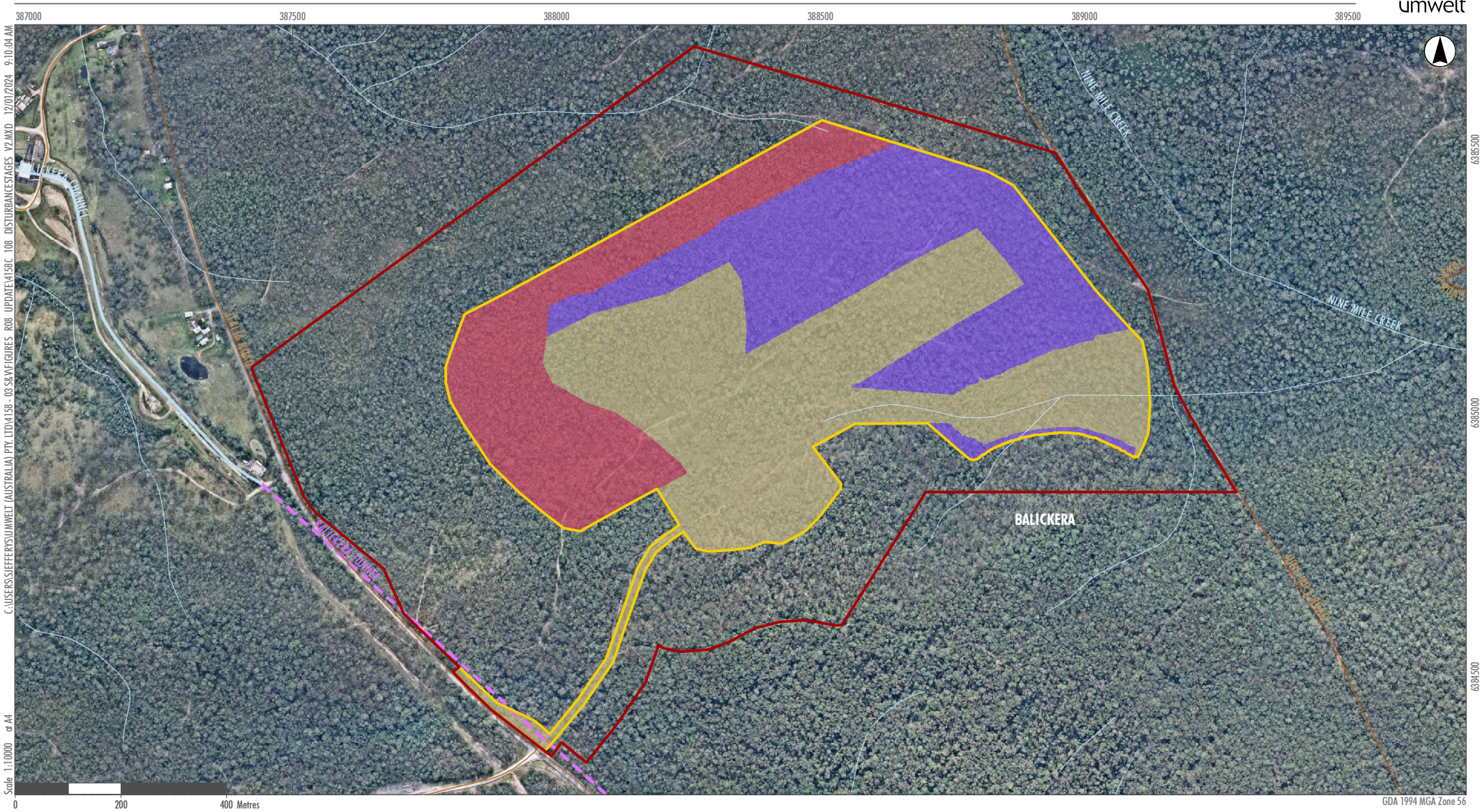
11.3 Biodiversity Offset Strategy

The retirement of biodiversity credits is proposed to be undertaken within the following three phases, based on the vegetation removal and overburden phases mapped in **Figure 11.1**:

- Phase 1 – 31.64 ha (Stages 0–2)
- Phase 2 – 20.75 ha (Stages 3–5)
- Phase 3 – 15.3 ha (Stages 6–9).

The proposed staged credit retirement will match the areas of staged impacts to entities requiring credits, as shown in **Table 11.3**. At present there is no specific proposal to fund a biodiversity conservation action or conduct ecological rehabilitation to generate biodiversity credits for the Project. Notwithstanding, the proponent will be consulting with relevant local stakeholders during preparation of the Biodiversity Offset Strategy to determine opportunities relating to biodiversity conservation actions / ecological rehabilitation in the local area.

In addition, the Proponent has committed to further investigate the retirement of biodiversity credits through the establishment of a Biodiversity Stewardship Site within the Wallaroo State Forest. Where credits are not generated and retired within the Wallaroo State Forest they will be purchased from the market or a payment will be made to the Biodiversity Conservation Fund. The like-for-like credit rules will be followed for nationally listed entities which require credits. The like-for-like or variation rules will be followed for all other entities which require credits.



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line

Stage

- Phase 1 (Stages 0-2)
- Phase 2 (Stages 3-5)
- Phase 3 (Stages 6-9)

FIGURE 11.1

Vegetation Removal and Overburden stripping Stages

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

Table 11.3 Proposed Staged Credit Retirement Details

Entity and Total Credits Required	Total Credits Required	Stage No.	Area of Impact on Entity per Stage (ha)	Credits to be retired per stage
PCT 762 Cabbage Gum open forest or woodland on flats of the North Coast	13	1	0.33	13
		2	-	-
		3	-	-
PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	1092	1	11.07	308
		2	13.48	375
		3	14.72	409
PCT 1618 Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	34	1	0.88	34
		2	-	-
		3	-	-
PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	763	1	19.36	537
		2	7.27	201
		3	0.91	25
Squirrel Glider (*Petaurus norfolcensis*)	2519	1	31.64	1172
		2	20.75	768
		3	15.63	579
Brush-tailed Phascogale (*Phascogale tapoatafa*)	2519	1	31.64	1172
		2	20.75	768
		3	15.63	579
Koala (*Phascolarctos cinereus*)	2519	1	31.64	1172
		2	20.75	768
		3	15.63	579

12.0 References

Australian Bureau of Meteorology (BOM) 2024, Climate Data Online, Rainfall and Temperatures, Australian Government. Accessed February 2024 Online at <http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=2021&p_c=-751265162&p_stn_num=061287 >

Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2024a, Protected Matters Search Tool. Department of Climate Change, Energy, the Environment and Water.

Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2024b, National Flying-Fox Viewer. Available from: < https://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf> Accessed February 2024.

Australian Government Department of Environment, Water, Heritage and the Arts (DEWHA) 2010a, Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act.

Australian Government Department of Environment, Water, Heritage and the Arts (DEWHA) 2010b, Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act.

Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2010, Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act.

Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) 2011, Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act.

Australian Government Department of the Environment 2015, *Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community*. Canberra: Department of the Environment.

Australian Government Department of the Environment and Energy 2018, Interim Biogeographic Regionalisation for Australia (IBRA), Version 7, Australian Government Department of the Environment and Energy.

Colquhoun G.P., Hughes K.S., Deyssing L., Ballard J.C., Folkes C.B, Phillips G., Troedson A.L. & Fitzherbert J.A. 2021. New South Wales Seamless Geology dataset (Single Layer), version 2.1 [Digital Dataset]. Geological Survey of New South Wales, Department of Regional NSW, Maitland.

Eco Logical Australia (ELA) 2021. Balickera Tunnel Remediation Works - Species Impact Statement. Prepared for Hunter Water Corporation.

Engeny 2024, Revised Surface Water Impact Assessment Stone Ridge, unpublished report prepared for Australian Resource Development Group.

Enviro Strata Consulting Pty Ltd 2024 Addendum Stone Ridge Quarry (Amended Quarry Plans) - Addendum to Blasting Impact Assessment, unpublished report prepared for Umwelt (Australia) on behalf of Australian Resource Development Group.

GHD 2024, Stone Ridge Quarry Groundwater Impact Assessment (V2) unpublished report prepared for Australian Resource Development Group.

Kleinfelder, 2017. Biodiversity Assessment Report – Eagleton Quarry, 13 Barleigh Ranch Way, Eagleton NSW.

Meek P. and Fleming, P. (eds) 2014. Camera Trapping. Wildlife Management and Research. Australasian Wildlife Management Society and the Royal Zoological Society of NSW. Melbourne, Victoria.

NSW Department of Environment and Conservation (DEC), 2004. Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft), NSW Department of Environment and Conservation, Hurstville.

NSW Department of Planning and Environment (DPE) 2010, Fauna Corridors for North East NSW. NSW Department of Planning, Industry and Environment, Parramatta.

NSW Department of Planning and Environment (DPE) 2022a, Biodiversity Assessment Method 2020 Operational Manual – Stage 1, NSW Department of Planning and Environment, Parramatta.

NSW Department of Planning and Environment (DPE) 2022b, Guidance for the Biodiversity Development Assessment Report Template (including the template), NSW Department of Planning and Environment, Parramatta.

NSW Department of Planning and Environment (DPE) 2022c, Koala (*Phascolarctos cinereus*) Biodiversity Assessment Method Survey Guide. NSW Department of Planning, Industry and Environment, Parramatta.

NSW Department of Planning and Environment (DPE) 2022d, Threatened Reptiles Biodiversity Assessment Method Survey Guide. NSW Department of Planning, Industry and Environment, Parramatta.

NSW Department of Planning and Environment (DPE) 2023a, Biodiversity Assessment Method 2020 Operational Manual – Stage 2, NSW Department of Planning and Environment, Parramatta.

NSW Department of Planning and Environment (DPE) 2023b, NSW State Vegetation Type Map Version C2.0M2.0, NSW Department of Planning and Environment.

NSW Department of Planning and Environment (DPE) 2024, NSW BioNet (incorporating BioNet Atlas, BioNet Vegetation Database and Threatened Biodiversity Profile Data Collection) Accessed February 2024 Online: <https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet>

NSW Department of Planning, Industry and Environment (DPIE) 2020a, Biodiversity Assessment Method Operational Method, NSW Department of Planning, Industry and Environment, Parramatta.

NSW Department of Planning, Industry and Environment (DPIE) 2020b, Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method, NSW Department of Planning, Industry and Environment, Parramatta.

NSW Department of Planning, Industry and Environment (DPIE) 2020c, BAM Flora species with specific survey requirements spreadsheet. Online: <https://www.lmbc.nsw.gov.au/bamcalc/app/assets/SurveyMonthsConditions_BAMC_Version1.1.xlsx>

NSW Department of Planning, Industry and Environment (DPIE) 2020d, NSW Survey Guide for Threatened Frogs, A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method. Online: < https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/nsw-survey-guide-for-threatened-frogs-200440.pdf >

NSW Department of Planning, Industry and Environment (DPIE) 2021, 'Species Credits' threatened bats and their habitats (V2), NSW Office of Environment and Heritage, Parramatta.

NSW Department of Primary Industries Water (DPIW) 2022, Probable Vegetation Groundwater Dependent Ecosystems – Hunter Central Rivers, Online: <https://datasets.seed.nsw.gov.au/dataset/probable-vegetation-gde-hunter-central-rivers>

NSW Office of Environment and Heritage (OEH) 2017a. Biodiversity Assessment Method (BAM) Calculator User Guide. Office of Environment and Heritage, Sydney.

NSW Office of Environment and Heritage (OEH) 2017b. NSW Mitchell Landscapes Version 3.1, NSW Office of Environment and Heritage.

NSW Office of Environment and Heritage (OEH) 2018, 'Species Credits' threatened bats and their habitats (V1), NSW Office of Environment and Heritage, Parramatta.

Port Stephens Council 2002, Port Stephens Council Comprehensive Koala Plan of Management, Port Stephens Council and the Australian Koala Foundation.

Somerville M. 2009a, Volume 1 of Hunter, Central & Lower North Coast Vegetation Classification and Mapping Project, Hunter-Central Rivers. Hunter-Central Rivers Catchment Management Authority (N.S.W.).

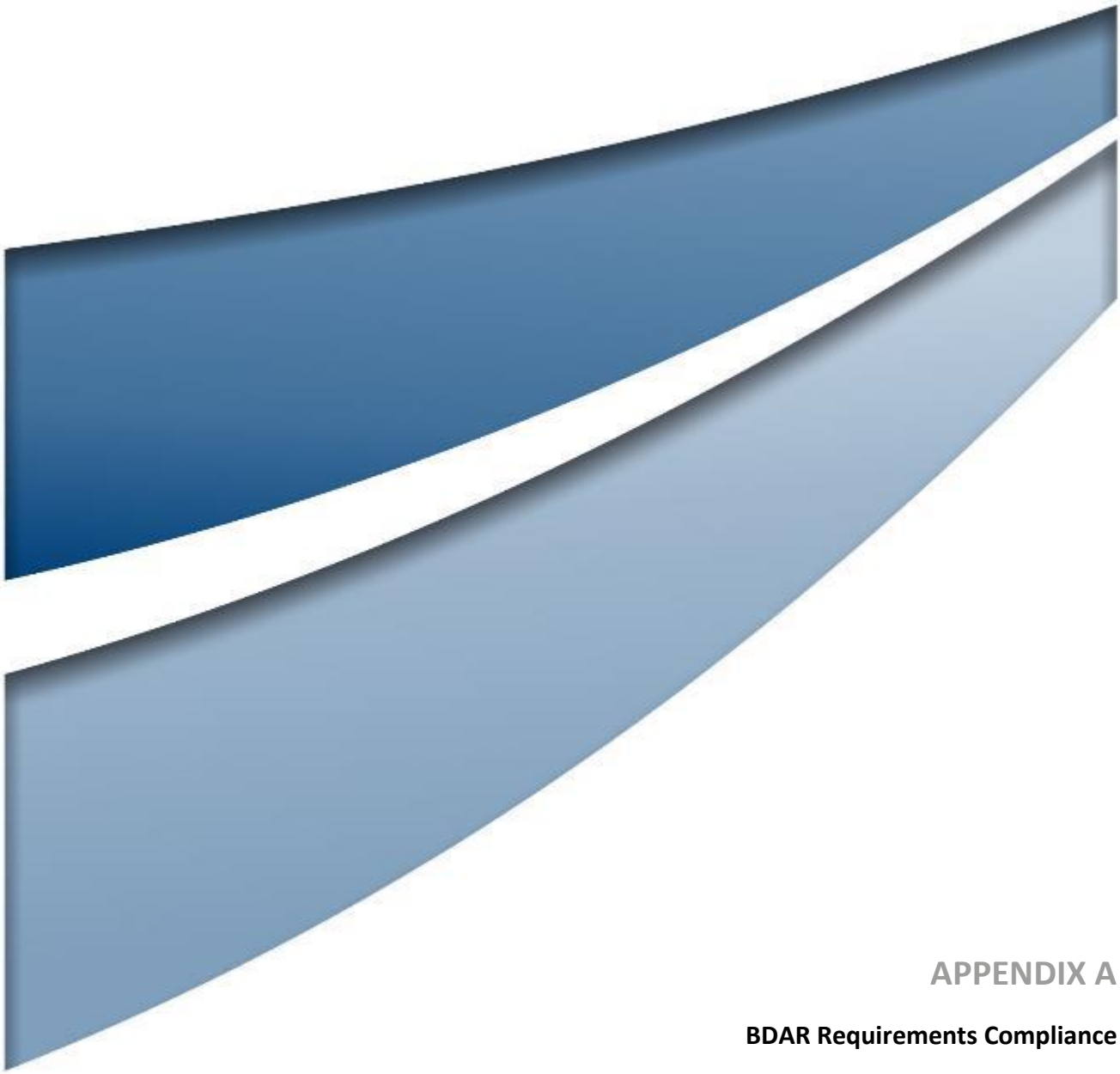
Somerville M. 2009b, Volume 2 of Hunter, Central & Lower North Coast Vegetation Classification and Mapping Project, Hunter-Central Rivers. Hunter-Central Rivers Catchment Management Authority (N.S.W.).

The Royal Botanic Gardens and Domain Trust 2024, PlantNet NSW Flora Online. Accessed May 2022 Online: <https://plantnet.rbgsyd.nsw.gov.au/floraonline.htm>

Umwelt (Australia) 2023, Stone Ridge Quarry Biodiversity Development Assessment Report, unpublished report prepared for Australian Resource Development Group.

WSP 2023, Balickera Remediation Project – Post-construction microchiropteran bat monitoring (Draft). Prepared for Hunter Water Corporation.

Youngentob, K.N, Marsh, K.F., Skewes, J., *A review of koala habitat assessment criteria and methods*, report prepared for the Department of Agriculture, Water and the Environment, Canberra, November. CC BY 4.0.



APPENDIX A

BDAR Requirements Compliance

SEARS & BDAR Compliance Requirements

1.0 SEARS Requirements Compliance Details

Compliance with the SEARs Biodiversity Assessment Requirements for the project is documented in **Table A1.1**.

Table A 1.1 Biodiversity Assessment Requirements for the project

Relevant Agency	Requirements	Comments
NSW DPIE SEARs	Accurate predictions of any vegetation clearing on site;	Vegetation clearing totals for each Plant Community Type (PCT) have been calculated using GIS software, in accordance with the requirements of the BAM. Vegetation clearing totals are provided in **Table 8.2** of the BDAR.
	A detailed assessment of the likely biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems, undertaken in accordance with the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report;	This Report provides an assessment of the likely biodiversity impacts associated with the project, in accordance with the requirements of the BAM. Groundwater dependant ecosystems are addressed in **Section 4.6** and **Section 6.1, Table 6.1** of the BDAR.
	A strategy to offset any residual impacts of the development in accordance with the Biodiversity Offsets Scheme;	A proponents biodiversity offset strategy is summarised in **Section 11.3** of the BDAR.
SEARS Agency Advice - DPIE – Hunter Central Coast Branch - Biodiversity and Conservation Division	Biodiversity impacts related to the proposed development (SSD 10432) are to be assessed in accordance with the Biodiversity Assessment Method and documented in a Biodiversity Development Assessment Report (BDAR). The BDAR must include information in the form detailed in the Biodiversity Conservation Act 2016 (s6.12), Biodiversity Conservation Regulation 2017 (s6.8) and Biodiversity Assessment Method.	This BDAR has been prepared in accordance with the BC Act, the BC Regulation, the Biodiversity Assessment Method, the NSW DPIE BDAR template associated Guidance for the Biodiversity Development Assessment Report Template documentation (DPIE 2022). The BDAR minimum information compliance requirements are addressed in **Section 2** of this Appendix.
	The BDAR must document the application of the avoid, minimise and offset framework including assessing all direct, indirect and prescribed impacts in accordance with the Biodiversity Assessment Method.	Impact avoidance and minimisation measures are addressed in **Section 7**. Direct impacts are documented in **Section 8.1**. of the BDAR. Indirect Impacts are documented in **Section 8.2** of the BDAR. Prescribed Impact are documented in **Section 8.3** of the BDAR.

Relevant Agency	Requirements	Comments
	The BDAR must include details of the measures proposed to address the offset obligation as follows; • The total number and classes of biodiversity credits required to be retired for the development/project; • The number and classes of like-for-like biodiversity credits proposed to be retired; • The number and classes of biodiversity credits proposed to be retired in accordance with the variation rules; • Any proposal to fund a biodiversity conservation action; • Any proposal to conduct ecological rehabilitation (if a mining project); • Any proposal to make a payment to the Biodiversity Conservation Fund.	The Biodiversity Offset Strategy for the project is documented in **Section 11.3** of the BDAR.
	If seeking approval to use the variation rules, the BDAR must contain details of the reasonable steps that have been taken to obtain requisite like-for-like biodiversity credits.	There is currently no proposal to use the variation rules.
	The BDAR must be prepared by a person accredited in accordance with the Accreditation Scheme for the Application of the Biodiversity Assessment Method Order 2017 under s6.10 of the Biodiversity Conservation Act 2016.	Details of the project team and accredited assessor are included in the Declarations page at the front of the BDAR.
Port Stephens Council	The BDAR must include the following:	
	A detailed assessment of the potential indirect impacts (including noise and vibration impacts) on any threatened species, populations, endangered ecological communities or their habitats, as well as groundwater dependent ecosystems must be made.	Addressed in **Section 8.2** of the BDAR.
	A detailed habitat and genetic connectivity assessment for Koala and Brush-tailed Phascogale to assess connectivity of the local population(s) north and south of the Balickera Canal to accurately assess potential impacts and to inform mitigation and offset strategies.	A description of the existing habitat connectivity is provided in **Section 3.2.3** of the BDAR. Impacts to habitat and genetic connectivity are addressed in **Section 8.3.5** of the BDAR.

Relevant Agency	Requirements	Comments
	A detailed cumulative impact assessment must be undertaken for the EIS and BDAR in accordance with the BAM, with particular consideration given to biodiversity, namely fauna habitat connectivity for threatened species including Brush-tailed Phascogale and the Koala. All projects in the locality with potential for cumulative impacts must be assessed, including but not limited to: Kings Hill Urban Release Areas and its associated critical infrastructure, adjacent quarry expansions and the proposed M1 motorway extension.	An assessment of the potential impacts to habitat connectivity is provided in **Section 8.2** of the BDAR. Impacts to habitat connectivity are addressed in **Section 8.3.5** of the BDAR.
	An assessment of the project against the Port Stephens Council Comprehensive Koala Plan of Management must be undertaken, including assessment against the performance criteria provided in Appendix 4 of the Comprehensive Koala Plan of Management.	The application of the Port Stephens Comprehensive Koala Plan of Management to the project is addressed in **Section 8.6.2** of the BDAR.
	Consultation must be undertaken with Hunter Water for assessing impact to threatened microbats in relation to potential breeding habitat contained in the nearby Balickera Tunnel.	The Detailed Balickera Tunnel Remediation Works Species Impact Statement prepared for Hunter Water Corporation by Eco Logical (2021) was reviewed as part of the BDAR. This document provides comprehensive details on the importance of the Balickera Tunnel to microbat species.
	Should potential impacts to any threatened EPBC Act listed biodiversity be likely consideration of the EPBC Act significant impact guidelines must be undertaken, and an EBPC Acct Referral undertaken should a significant impact be likely.	The proposal has been determined by DCCEW to be a controlled action.
	Details of weed management during construction and operation in accordance with existing State, regional or local weed management plans or strategies.	Weed management will be addressed as part of a Construction Environmental Management Plan prepared, subject to project approval.
	The following management plans should prepared in support of the application: A detailed statement of commitments for measures to be included in a Biodiversity Management plan including: o Compensatory hollows with a preference for augmented hollows o Site rehabilitation o Biodiversity Monitoring Plan	A commitment to the preparation of a Construction Environmental Management Plan is provide din **Section 8.4.7** of the BDAR.
	A commitment for satisfying the Biodiversity Offsetting requirements identified in the BDAR must be provided.	A Biodiversity Offsetting Strategy is provided in **Section 11.3** of the BDAR.

Relevant Agency	Requirements	Comments
	A detailed site stabilisation plan must be provided as part of the EIS, along with a conceptual rehabilitation strategy and a conceptual final landform.	Rehabilitation details are provided separately to the BDAR as part of the EIS.
Australian Government – Department of Climate Change, Energy, the Environment and Water	Project Assessment Notes issued as part of the SEARS	Addressed in **Appendix B** as part of the Matters of National Environmental Significance Assessment Report

2.0 BDAR Requirements Compliance Details

Compliance with the BDAR minimum information requirements of the BAM is documented in **Table A1.2**.

Table A1.2 Assessment of compliance with BDAR minimum information requirements

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
Introduction	**Chapters 2 and 3**	**Information**	
		Introduction to the biodiversity assessment including:	–
		☒ brief description of the proposal	**Section 1.2.1**
		☒ identification of subject land boundary, including: ☒ operational footprint ☒ construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure	**Section 1.2.2** and **Figures 1.1** and **1.2**
		☒ general description of the subject land	**Section 1.1.2**
		☒ sources of information used in the assessment, including reports and spatial data	**Section 1.6.** Also referenced in text and listed in the References Section
		☒ identification and justification for entering the BOS	**Section 1.1**
		Maps and tables	
		☒ Map of the subject land boundary showing the final proposal footprint, including the construction footprint for any clearing associated with temporary/ancillary construction facilities and infrastructure	**Figure 1.1**

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
Landscape	**Sections 3.1 and 3.2, Appendix E**	**Information**	
		Identification of site context components and landscape features, including:	–
		☒ general description of subject land topographic and hydrological setting, geology and soils	**Section 1.2.2**
		☒ per cent native vegetation cover in the assessment area (as described in BAM Section 3.2)	**Section 3.3** and **Figure 1.2**
		☒ IBRA bioregions and subregions (as described in BAM Subsection 3.1.3(2.))	**Section 3.2.1** and **Figures 1.1** and **1.2**
		☒ rivers and streams classified according to stream order (as described in BAM Subsection 3.1.3(3.) and Appendix E)	**Section 3.2.2** and **Figure 1.1** and **1.2**
		☒ wetlands within, adjacent to and downstream of the site (as described in BAM Subsection 3.1.3(3.))	**Section 3.2.2** and **Figure 3.1**
		☒ connectivity of different areas of habitat (as described in BAM Subsection 3.1.3(5–6.))	**Section 3.2.3**
		☒ karst, caves, crevices, cliffs, rocks and other geological features of significance and for vegetation clearing proposals, soil hazard features (as described in BAM Subsections 3.1.3(7.) and 3.1.3(12.))	**Section 3.2.4**
		☒ areas of outstanding biodiversity value occurring on the subject land and assessment area (as described in BAM Subsection 3.1.3(8–9.))	**Section 3.2.5**
		☒ any additional landscape features identified in any SEARs for the proposal	**Section 3.2.7**
		☒ NSW (Mitchell) landscape on which the subject land occurs	**Section 3.2.6**
		☒ details of field reconnaissance undertaken to confirm the extent and condition of landscape features and native vegetation cover (as described in Operational Manual Stage 1 Section 2.4)	**Section 3.3**
		Maps and tables	
		☒ Site Map ☒ Property boundary ☒ Boundary of subject land ☒ Cadastre of subject land (including labelling of Lot and DP or section plan if relevant) ☒ Landscape features identified in BAM Subsection 3.1.3	**Figure 1.1**

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
		☒ Location Map ☒ Digital aerial photography at 1:1,000 scale or finer ☒ Boundary of subject land ☒ Assessment area (i.e. the subject land and either 1500 m buffer area or 500 m buffer for linear development) ☒ Landscape features identified in BAM Subsection 3.1.3 ☒ Additional detail (e.g. local government area boundaries) relevant at this scale	**Figure 1.2**
		Landscape features identified in BAM Subsection 3.1.3 and to be shown on the Site Map and/or Location Map include:	–
		☒ IBRA bioregions and subregions ☒ rivers, streams and estuaries ☒ wetlands and important wetlands ☒ connectivity of different areas of habitat ☒ karst, caves, crevices, cliffs, rocks and other geological features of significance and if required, soil hazard features ☒ areas of outstanding biodiversity value occurring on the subject land and assessment area ☒ any additional landscape features identified in any SEARs for the proposal ☒ NSW (Mitchell) landscape on which the subject land occurs	**Figures 1.1** and **1.2**
		Data	
		☒ All report maps as separate jpeg files	–
		Individual digital shape files of:	–
		☒ subject land boundary	–
		☒ assessment area (i.e. subject land and 1500 m buffer area) boundary	–
		☒ cadastral boundary of subject land	–
		☒ areas of native vegetation cover	–
		☒ landscape features	–

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
Native vegetation	**Chapter 4, Appendix A and Appendix H**	**Information**	
		☒ Identify native vegetation extent within the subject land, including cleared areas and evidence to support differences between mapped vegetation extent and aerial imagery (as described in BAM Section 4.1(1–3.) and Subsection 4.1.1)	**Section 4.1** and **Figure 4.1**
		☒ Provide justification for all parts of the subject land that do not contain native vegetation (as described in BAM Subsection 4.1.2)	**Section 4.1.2**
		☒ Review of existing information on native vegetation including references to previous vegetation maps of the subject land and assessment area (described in BAM Section 4.1(3.) and Subsection 4.1.1)	**Section 2.2.1**
		☒ Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM Section 4.2	**Section 2.2.3**
		☒ Where relevant, describe the use of more appropriate local data, provide reasons that support the use of more appropriate local data and include the written confirmation from the decision-maker that they support the use of more appropriate local data (as described in BAM Subsection 1.4.2 and Appendix A)	Not applicable
		For each PCT within the subject land, describe:	–
		☒ PCT name and ID	**Section 4.2.1, Table 4.1**
		☒ vegetation class	**Section 4.2.1, Table 4.1**
		☒ extent (ha) within subject land	**Section 4.2.1, Table 4.1**
		☒ evidence used to identify a PCT including any analyses undertaken, references/sources, existing vegetation maps (BAM Section 4.2(1–3.))	**Section 4.2.2**
		☒ plant species relied upon for identification of the PCT and relative abundance of each species	**Section 4.2.2**
		☒ if relevant, TEC status including evidence used to determine vegetation is the TEC (BAM Subsection 4.2.2(1–2.))	**Section 4.2.2, Section 4.3** and **Appendix C**
		☒ estimate of per cent cleared value of PCT (BAM Subsection 4.2.1(5.))	**Table 4.1**
		Describe the vegetation integrity assessment of the subject land, including:	–

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
		☒ identification and mapping of vegetation zones (as described in BAM Subsection 4.3.1)	Method provided in **Section 2.2**, Results provided in **Table 4.1**, **Figure 4.2** and **Section 4.2.2**
		☒ description of vegetation zones within the subject land (as described in Operational Manual Stage 1 Table 2 and Subsection 3.3.2)	**Section 4.2.2**
		☒ area (ha) of each vegetation zone	**Table 4.1**
		☒ assessment of patch size (as described in BAM Subsection 4.3.2)	**Table 4.1**
		☒ survey effort (i.e. number of vegetation integrity survey plots) as described in BAM Subsection 4.3.4(1–2.)	**Table 2.1** and **Table 4.9**
		☒ use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsection 4.3.3(5.))	**Section 4.5.3**
		Where use of more appropriate local benchmark data is proposed (as described in BAM Subsection 1.4.2, BAM Subsection 4.3.3(5.) and BAM Appendix A):	–
		☐ identify the PCT or vegetation class for which local benchmark data will be applied ☐ identify published sources of local benchmark data (if benchmarks obtained from published sources) ☐ describe methods of local benchmark data collection (if reference plots used to determine local benchmark data)	Not applicable
		☐ provide justification for use of local data rather than BioNet Vegetation Classification benchmark values	Not applicable
		☐ provide written confirmation from the decision-maker that they support the use of local benchmark data	Not applicable
		Maps and tables	
		☒ Map of native vegetation extent within the subject land at scale not greater than 1:10,000 including identification of all areas of native vegetation including areas that are ground cover only, cleared areas (as described in BAM Section 4.1(1–3.)) and all parts of the subject land that do not contain native vegetation (BAM Subsection 4.1.2)	**Figure 4.1**
		☒ Map of PCTs within the subject land (as described in BAM Section 4.2(1.))	**Figure 4.2**
		☒ Map of vegetation zones within the subject land (as described in BAM Subsection 4.3.1)	**Figure 4.2**
		☒ Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCT boundaries	**Figure 2.1**

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
		☒ Map of TEC distribution on the subject land and table of TEC listing, status and area (ha)	**Figure 4.3** and **Table 4.8**
		☒ Map of patch size locations for each native vegetation zone and table of patch size areas (as described in BAM Subsection 4.3.2)	Patch size not mapped and exceeds 100ha for all vegetation condition zones, as listed in **Table 4.9**
		Table of current vegetation integrity scores for each vegetation zone within the site and including:	–
		☒ composition condition score ☒ structure condition score ☒ function condition score ☒ presence of hollow bearing trees	**Table 4.10**
		Data	
		☒ All report maps as separate jpeg files	–
		☒ Plot field data (MS Excel format)	
		☒ Plot field datasheets	**Appendix D**
		Digital shape files of:	–
		☒ PCT boundaries within subject land	–
		☒ TEC boundaries within subject land	–
		☒ vegetation zone boundaries within subject land	–
		☒ floristic vegetation survey and vegetation integrity plot locations	–

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
Threatened species	**Chapter 5**	**Information**	
		Identify ecosystem credit species likely to occur on the subject land, including:	–
		☒ list of ecosystem credit species derived from the BAM-C (as described in BAM Subsection 5.1.1 and Section 5.2(1.))	**Table 5.1**
		☒ justification and supporting evidence for exclusion of any ecosystem credit species based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2)	**Table 5.1**
		☒ justification for addition of any ecosystem credit species to the list	**Table 5.1** / Justification for inclusion of additional Bionet Atlas species documented in **Section 2.4.2**
		Identify species credit species likely to occur on the subject land, including:	–
		☒ list of species credit species derived from the BAM-C (as described in BAM Subsection 5.1.1)	**Table 5.2** and **Table 5.3**
		☒ justification and supporting evidence for exclusions based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2)	**Table 5.2** and **Table 5.3**
		☒ justification and supporting evidence for exclusions based on degraded habitat constraints and/or microhabitats on which the species depends (as described in BAM Subsection 5.2.2)	**Table 5.2** and **Table 5.3**
		☒ justification for addition of any species credit species to the list	**Table 5.2** and **Table 5.3** / Justification for inclusion of additional Bionet Atlas species documented in **Section 2.4.2**
		From the list of candidate species credit species, identify:	–

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
		☒ species assumed present within the subject land (if relevant) (as described in BAM Subsection 5.2.4(2.a.)) ☒ species present within the subject land on the basis of being identified on an important habitat map for a species (as described in BAM Subsection 5.2.4(2.d.)) ☒ species for which targeted surveys are to be completed to determine species presence (BAM Subsection 5.2.4(2.b.)) ☒ species for which an expert report is to be used to determine species presence (BAM Subsection 5.2.4(2.c.))	**Table 5.4** and **Table 5.5**
		Present the outcomes of species credit species assessments from:	–
		☒ threatened species survey (as described in BAM Section 5.2.4)	**Section 5.2.1** (flora) and **Section 5.2.2** (fauna)
		☐ expert reports (if relevant) including justification for presence of the species and information used to make this determination (as described in BAM Subsection 5.2.4, Section 5.3, Box 3)	Not applicable
		Where survey has been undertaken include detailed information on:	–
		☒ survey method and effort (as described in BAM Section 5.3)	**Section 5.3**
		☒ justification of survey method and effort (e.g. citation of peer-reviewed literature) if approach differs from the department's taxa-specific survey guides or where no relevant guideline has been published	**Section 2.7**, **Section 2.3.4** and **Section 2.4.4.1**
		☒ timing of survey in relation to requirements in the TBDC or the department's taxa-specific survey guides. Where survey was undertaken outside these guides include justification for the timing of surveys	**Table 5.6** and **Table 5.7**
		☒ survey personnel and relevant experience	Project Team including survey personnel are listed in the preface of the report. CVs can be provided on request.
		☒ describe any limitations to surveys and how these were addressed/overcome	**Section 2.7**
		Where an expert report has been used in place of survey (as described in BAM Section 5.3, Box 3), include:	–

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
		☐ justification of the use of an expert report ☐ identify the expert, provide evidence of their expert credentials and departmental approval of expert status ☐ all requirements of Box 3 have been addressed in the expert report	Not applicable
		Where use of local data is proposed (BAM Subsection 1.4.2):	–
		☐ identify relevant species ☐ identify data to be amended ☐ identify source of information for local data, e.g. published literature, additional survey data, etc. ☐ justify use of local data in preference to VIS Classification or TBDC data	Not applicable
		☐ provide written confirmation from the decision-maker that they support the use of local data	Not applicable
		Species polygon completed for species credit species present within the subject land (assumed present or determined on the basis of survey, expert report or important habitat map) ensuring that:	–
		☒ the unit of measure for each species is documented	**Section 5.3.2**
		for species assessed by area:	–
		☒ the polygon includes the extent of suitable habitat for the target species within the subject land (as described in BAM Subsection 5.2.5)	**Section 5.3.2, Tables 5.8** to **5.11** and **Figures 5.1 to 5.4**
		☒ a description of, and evidence-based justification for, the habitat constraints, features or microhabitats used to map the species polygon including reference to information in the TBDC for that species and any buffers applied	**Section 5.3.2**
		for species assessed by counts of individuals:	–
		☒ the number of individual plants present on the subject land (as described in BAM Subsection 5.2.5(3.))	**Section 5.3.2**
		☒ the method used to derive this number (i.e. threatened species survey or expert report) and evidence-based justification for the approach taken	**Section 5.3.2**
		☒ the polygon includes all individuals located on the subject land with a buffer of 30 m around the individuals or groups of individuals on the subject land	**Section 5.3.2**
		☒ Identify the biodiversity risk weighting for each species credit species identified as present within the subject land (as described in BAM Section 5.4)	**Section 5.3.2, Tables 5.8 to 5.11**

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
		Maps and tables	
		☒ Table showing ecosystem credit species in accordance with BAM Subsection 5.1.1, and identifying:	**Table 5.1**
		☒ the ecosystem credit species removed from the list	**Table 5.1**
		☒ the sensitivity to gain class of each species	**Table 5.1**
		☒ Table detailing species credit species in accordance with BAM Section 5.2 and identifying:	**Table 5.2** and **Table 5.3**
		☒ the species credit species removed from the list of species because the species is considered vagrant, out of geographic range or the habitat or microhabitat features are not present	**Table 5.2** and **Table 5.3**
		☒ the candidate species credit species not recorded on the subject land as determined by targeted survey, expert report or important habitat map	**Table 5.4** and **Table 5.5**
		☒ Table detailing species credit species recorded or assumed as present within the subject land, habitat constraints or microhabitats associated with the species, counts of individuals (flora)/extent of suitable habitat (flora and fauna) (as described in BAM Subsection 5.2.6) and biodiversity risk weighting (BAM Section 5.4)	**Section 5.3.2, Tables 5.8** to **5.11**
		☒ Map indicating the GPS coordinates of all individuals of each species recorded within the subject land and the species polygon for each species (as described in BAM Subsection 5.2.5)	**Figures 5.1 to 5.4**
		Data	
		☒ Digital shape files of suitable habitat identified for survey for each candidate species credit species	–
		☒ Survey locations including GPS coordinates of any plots, transects, grids	
		☒ Digital shape files of each species polygon including GPS coordinates of located individuals	–
		☒ Species polygon map in jpeg format	–
		☐ Expert reports and any supporting data used to support conclusions of the expert report	Not applicable
		☐ Field datasheets detailing survey information including prevailing conditions, date, time, equipment used, etc.	Field data captured digitally

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
Prescribed impacts	**Chapter 6**	**Information**	
		Identify potential prescribed biodiversity impacts on threatened entities, including:	–
		☒ karst, caves, crevices, cliffs, rocks and other geological features of significance (as described in BAM Subsection 6.1.1) ☒ occurrences of human-made structures and non-native vegetation (as described in BAM Subsection 6.1.2) ☒ corridors or other areas of connectivity linking habitat for threatened entities (as described in BAM Subsection 6.1.3) ☒ waterbodies or any hydrological processes that sustain threatened entities (as described in BAM Subsection 6.1.4)	**Table 6.1**
		☐ protected animals that may use the proposed wind farm development site as a flyway or migration route (as described in BAM Subsection 6.1.5)	Not applicable
		☒ where the proposed development may result in vehicle strike on threatened fauna or on animals that are part of a threatened ecological community (as described in BAM Subsection 6.1.6)	**Table 6.1**
		☒ Identify a list of threatened entities that may be dependent upon or may use habitat features associated with any of the prescribed impacts	**Table 6.1**
		☒ Describe the importance of habitat features to the species including, where relevant, impacts on life cycle or movement patterns (e.g. Subsection 6.1.3)	**Table 6.1**
		Where the proposed development is for a wind farm:	–
		☐ identify a candidate list of protected animals that may use the development site as a flyway or migration route, including: resident threatened aerial species, resident raptor species and nomadic and migratory species that are likely to fly over the proposal area (as described in BAM Subsection 6.1.5)	Not applicable
		☐ provide details of targeted survey for candidate species of wind farm developments undertaken in accordance with BAM Subsection 6.1.5(2–3.)	Not applicable
		☐ predict the habitual flight paths for nomadic and migratory species likely to fly over the subject land and map the likely habitat for resident threatened aerial and raptor species (BAM Subsection 6.1.5(4.))	Not applicable

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
		Where the proposal may result in vehicle strike:	–
		☒ identify a list of threatened fauna or protected fauna species that are part of a TEC and at risk of vehicle strike due to the proposal	**Table 6.1**
		Maps and tables	
		☒ Map showing location of any prescribed impact features (i.e. karst, caves, crevices, cliffs, rocks, human-made structures, etc.)	**Figure 6.1**
		☒ Map showing location of potential vehicle strike locations	**Figure 6.1**
		☐ Maps of habitual flight paths for nomadic and migratory species likely to fly over the site and maps of likely habitat for threatened aerial species resident on the site (for wind farm developments only)	Not applicable
		Data	
		☒ Digital shape files of prescribed impact feature locations	–
		☒ Prescribed impact features map in jpeg format	–

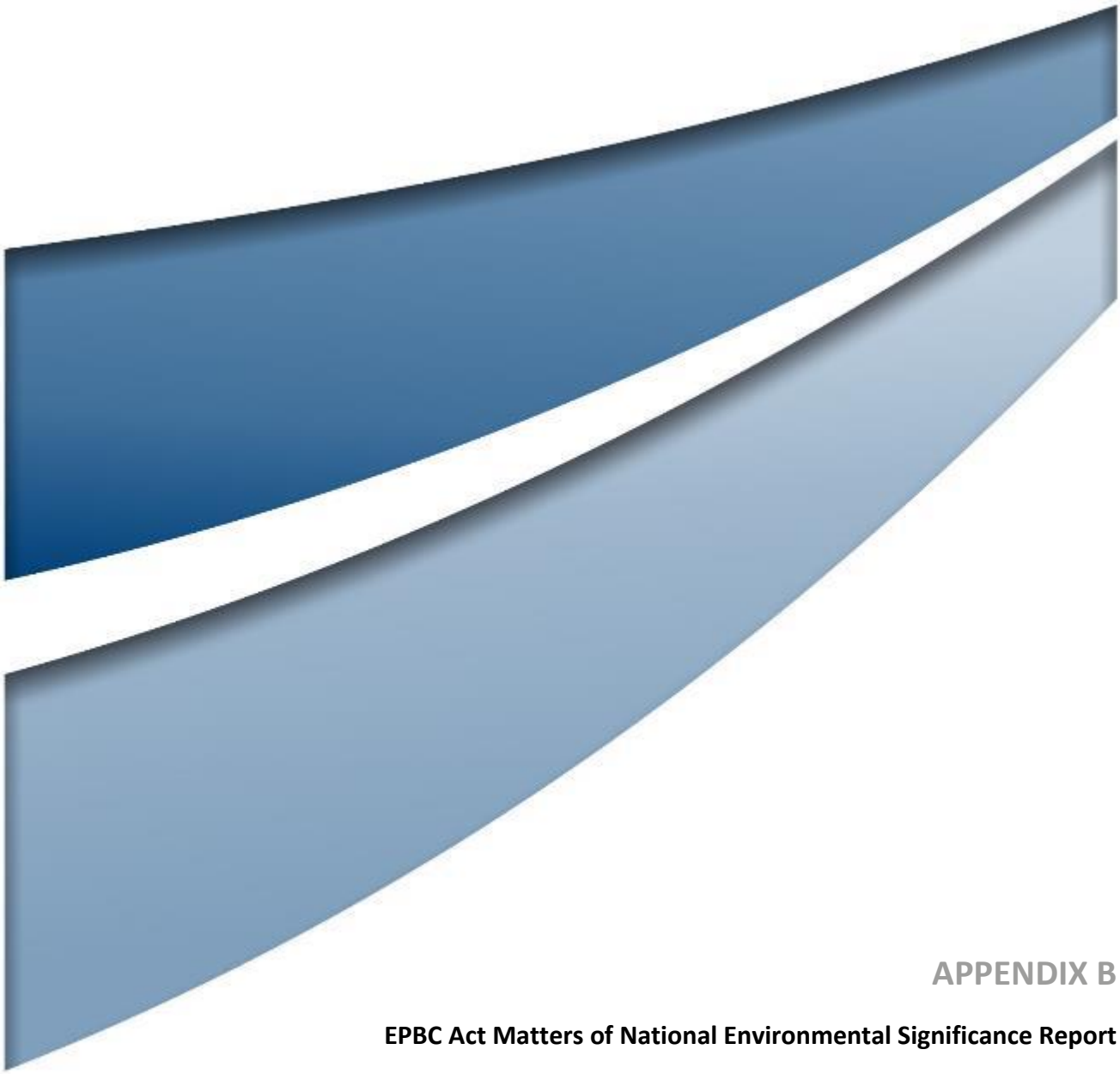
BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
Avoid and minimise impacts	**Chapter 7**	**Information**	
		Demonstration of efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the proposal location in accordance with Chapter 7, including an analysis of alternative:	–
		☒ modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology	**Section 7.1.2.6**
		☒ routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route	**Section 7.1.1.6**
		☒ alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location	**Section 7.1.1.1 to Section 7.1.1.5, Section 7.1.1.8**
		☒ alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site	**Section 7.1.1.7**
		☒ Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design (as described in BAM Sections 7.1 and 7.2)	**Section 7.1.2.1** and **Section 7.1.2.2**
		☒ Identification of any other site constraints that the proponent has considered in determining the location and design of the proposal (as described in BAM Subsection 7.2.1(3.))	**Section 7.1.2.7**
		☒ Detail measures or options considered but not implemented because they are not feasible and/or practical (e.g. due to site constraints)	**Section 7.3**
		Maps and tables	
		☒ Table of measures to be implemented to avoid and minimise the impacts of the proposal, including action, outcome, timing and responsibility	**Table 7.1**
		☒ Map of alternative footprints considered to avoid or minimise impacts on biodiversity values; and of the final proposal footprint, including construction and operation	**Figure 7.1**
		☒ Maps demonstrating indirect impact zones where applicable	**Section 8.2**
		Data	
		Digital shape files of:	–
		☒ alternative and final proposal footprint	–
		☒ direct and indirect impact zones	–
		☒ Maps in jpeg format	–

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
Assessment of impacts	**Chapter 8, Sections 8.1 and 8.2**	**Information**	
		☒ Determine the impacts on native vegetation and threatened species habitat, including a description of direct impacts of clearing of native vegetation, threatened ecological communities and threatened species habitat (as described in BAM Section 8.1)	**Section 8.1**
		Assessment of indirect impacts on vegetation and threatened species and their habitat including (as described in BAM Section 8.2):	–
		☒ description of the nature, extent, frequency, duration and timing of indirect impacts of the proposal	**Section 8.2, Table 8.3**
		☒ documenting the consequences to vegetation and threatened species and their habitat including evidence-based justifications	**Section 8.2, Table 8.3**
		☒ reporting any limitations or assumptions, etc. made during the assessment	**Section 8.2, Table 8.3**
		☒ identification of the threatened entities and their habitat likely to be affected	**Section 8.2, Table 8.3**
		Assessment of prescribed biodiversity impacts (as described in BAM Section 8.3) including:	–
		assessment of the nature, extent frequency, duration and timing of impacts on the habitat of threatened species or ecological communities associated with:	–
		☒ karst, caves, crevices, cliffs, rocks and other features of geological significance	**Section 8.3.1**
		☒ human-made structures	**Section 8.3.2**
		☒ non-native vegetation	**Section 8.3.3**
		☒ connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range	**Section 8.3.5**
		☒ movement of threatened species that maintains their life cycle	**Section 8.3.5**
		☒ water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities	**Section 8.3.6**
		☐ assessment of the impacts of wind turbine strikes on protected animals	Not applicable
		☒ assessment of the impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC	**Section 8.3.7**
		☒ evaluate the consequences of prescribed impacts	**Section 8.3**

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
		☒ describe impacts that are uncertain	**Section 8.5**
		☒ document limitations to data, assumptions and predictions	**Section 8.3.8**
		Maps and tables	
		☒ Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts	**Table 10.1**
		Data	
		N/A	–
Mitigation and management of impacts	**Chapter 8, Sections 8.4 and 8.5**	**Information**	
		Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM Sections 8.4 and 8.5 including:	–
		☒ techniques, timing, frequency and responsibility ☒ identify measures for which there is risk of failure ☒ evaluate the risk and consequence of any residual impacts	**Table 8.3, Table 8.4**
		☒ document any adaptive management strategy proposed	**Table 8.5**
		Identification of measures for mitigating impacts related to:	–
		☒ displacement of resident fauna (as described in BAM Subsection 8.4.1(2.)) ☒ indirect impacts on native vegetation and habitat (as described in BAM Subsection 8.4.1(3.)) ☒ mitigating prescribed biodiversity impacts (as described in BAM Subsection 8.4.2)	**Section 8.4**
		☒ Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM Section 8.5)	**Table 8.5**
		Maps and tables	
		☒ Table of measures to be implemented before, during and after construction to mitigate and manage impacts of the proposal, including action, outcome, timing and responsibility	**Table 8.4**
		Data	
		N/A	–

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
Impact summary	**Chapter 9**	**Information**	
		Identification and assessment of impacts on TECs and threatened species that are at risk of a serious and irreversible impacts (SAII, in accordance with BAM Section 9.1) including:	–
		☒ addressing all criteria in Subsection 9.1.1 for each TEC listed as at risk of an SAII present on the subject land	**Section 9**
		☐ for each TEC, report the extent of the TEC in NSW	Not applicable
		☒ addressing all criteria in Subsection 9.1.2 for each threatened species at risk of an SAII present on the subject land	**Section 9**
		☒ for each threatened species, report the population size in NSW	**Section 9**
		☒ documenting assumptions made and/or limitations to information ☒ documenting all sources of data, information, references used or consulted ☒ clearly justifying why any criteria could not be addressed	**Section 9**
		☒ Identification of impacts requiring offset in accordance with BAM Section 9.2	**Section 10.1** and **Table 10.1, Section 10.2** and **Table 10.2**
		☒ Identification of impacts not requiring offset in accordance with BAM Subsection 9.2.1(3.)	**Section 10.1.1 – Not applicable**
		☒ Identification of areas not requiring assessment in accordance with BAM Section 9.3	**Section 10.2**
		Maps and tables	
		☐ Map showing the extent of TECs at risk of an SAII within the subject land	Not applicable
		☐ Map showing location of threatened species at risk of an SAII within the subject land	Not applicable
		Map showing location of:	–
		☒ impacts requiring offset	**Figure 8.1**
		☐ impacts not requiring offset	Not applicable
		☐ areas not requiring assessment	Not applicable
		Data	
		Digital shape files of:	–
		☐ extent of TECs at risk of an SAII within the subject land	Not applicable
		☐ location of threatened species at risk of an SAII within the subject land	Not applicable

BDAR section	BAM ref.	BAM requirement	Reference(s) in the BDAR
		☒ boundary of impacts requiring offset	–
		☐ boundary of impacts not requiring offset	Not applicable
		☐ boundary of areas not requiring assessment	Not applicable
		☒ Maps in jpeg format	–
Impact summary	Chapter 10	**Information**	
		Ecosystem credits and species credits that measure the impact of the development on biodiversity values, including:	–
		☒ future vegetation integrity score for each vegetation zone within the subject land (Equation 25 and Equation 26 in BAM Appendix H) ☒ change in vegetation integrity score (BAM Subsection 8.1.1) ☒ number of required ecosystem credits for the direct impacts of the proposal on each vegetation zone within the subject land (BAM Subsection 10.1.2)	**Table 10.1**
		☒ biodiversity risk weighting for each	**Table 10.1 and Table 10.2**
		☐ number of required species credits for each candidate threatened species that is directly impacted on by the proposal (BAM Subsection 10.1.3)	**Table 10.2**
		Maps and tables	
		☒ Table of PCTs requiring offset and the number of ecosystem credits required	**Table 10.1**
		☒ Table of threatened species requiring offset and the number of species credits required	**Table 10.2**
		Data	
		☒ Submitted proposal in the BAM Calculator	–
Biodiversity credit report	**Chapter 10**	**Information**	
		☒ Description of credit classes for ecosystem credits and species credits at the development or clearing site or land to be biodiversity certified (BAM Section 10.2)	**Table 11.1, Table 11.2**
		☒ BAM credit report in pdf format	**Appendix F**
		Maps and tables	
		☒ Table of credit class and matching credit profile	**Table 11.1**
		Data	
		☒ BAM credit report in pdf format	**Appendix F**



APPENDIX B

EPBC Act Matters of National Environmental Significance Report

umwelt
Environmental & Social Consultants

BIODIVERSITY MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE REPORT

Stone Ridge Quarry Project

FINAL

March 2024

BIODIVERSITY MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE REPORT

Stone Ridge Quarry Project

FINAL

Prepared by
Umwelt (Australia) Pty Limited
on behalf of
Australian Resource Development Group (ARDG)

Project Director: David Holmes
Project Manager: Penelope Williams
Technical Director: Kate Connolly
Technical Manager: Jacob Manners
Report No. 4158/R08/Appendix B
Date: March 2024

umwelt
Environmental & Social Consultants

APPROVED COMPANY ISO 9001
QMS Certification Services

This report was prepared using Umwelt's ISO 9001 certified Quality Management System.

Acknowledgement of Country

Umwelt would like to acknowledge the traditional custodians of the country on which we work and pay respect to their cultural heritage, beliefs, and continuing relationship with the land. We pay our respect to the Elders – past, present, and future.

Disclaimer

This document has been prepared for the sole use of the authorised recipient and this document may not be used, copied or reproduced in whole or part for any purpose other than that for which it was supplied by Umwelt (Australia) Pty Ltd (Umwelt). No other party should rely on this document without the prior written consent of Umwelt.

Umwelt undertakes no duty, nor accepts any responsibility, to any third party who may rely upon or use this document. Umwelt assumes no liability to a third party for any inaccuracies in or omissions to that information. Where this document indicates that information has been provided by third parties, Umwelt has made no independent verification of this information except as expressly stated.

©Umwelt (Australia) Pty Ltd

Document Status

Rev No.	Reviewer		Approved for Issue	
	Name	Date	Name	Date
V1	David Holmes	15/05/2023	Penelope Williams	15/05/2023
V2	Kate Connolly	19/03/2024	David Holmes	19/03/2024

Executive Summary

Australian Resource Development Group Pty Limited (ARDG) is seeking to develop a new hard rock quarry, known as Stone Ridge Quarry (the Project), located within Wallaroo State Forest at Balickera NSW, approximately 25 kilometres (km) north of Newcastle within the Port Stephens Local Government Area (LGA).

This Biodiversity Matters of National Environmental Significance (MNES) report has been prepared to support the EPBC Act Referral relating to the Project under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), with respect to relevant ecological MNES listed under the EPBC Act. The Project in its entirety constitutes the Project.

Following an extensive desktop and literature review and multiple biodiversity surveys undertaken over many years and seasons (which included detailed vegetation mapping and threatened ecological community delineation, targeted threatened flora transect searches and species-specific fauna surveys), a range of MNES were recorded or considered to have the potential to occur and therefore be impacted by the Project.

Following Assessments of Significance undertaken in accordance with the Significant Impact Guidelines 1.1, the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions endangered ecological community, the Koala (*Phascolarctos cinereus*) and the Grey-headed Flying-fox (*Pteropus poliocephalus*) are considered likely to be significantly impacted by the Project.

ARDG has sought to avoid and minimise potential impacts on the ecological values of the Development Footprint throughout the Project planning process. This included targeted avoidance and minimisation through:

- Further reduction of the Disturbance Area over multiple iterations, including removal of the northern pit area as part of the current revised Project development footprint reducing the impact area from 79.02 ha in the EIS to a current impact area of 68.02 ha.
- Avoidance of the north-western section of the Subject land, which contains areas occupied by the Rusty Greenhood (*Pterostylis chaetophora*) and a habitat which potentially facilitates wildlife movement to the west.
- Avoidance of impacts to PCT 1716, which corresponds to the Subtropical Coastal Floodplain Forest endangered ecological community listed under the *BC Act* and Subtropical eucalypt floodplain forest and woodland listed under the *EPBC Act*.
- Alignment of the site access to the existing access track from Italia Road, to minimise impacts to the PCT 762 Cabbage Gum open forest or woodland on flats of the North Coast.
- Implementation of suitable operational management and mitigation measures such as pre-clearing surveys and fauna relocation, reuse of topsoil and habitat resources, weed, pest and pathogen management, driver code of conduct and reduced speed limit when entering and leaving the quarry, fencing and access control, erosion and sediment control and employee education. Pre-clearance surveys and clearing supervision to minimise impacts on fauna.

All residual impacts on biodiversity will be offset in accordance with the NSW Biodiversity Offsets Scheme. To meet offsets required for Commonwealth listed entities, ARDG will seek to:

- Retire biodiversity credits based on the like-for-like provisions in the Biodiversity Conservation Regulation 2017 (NSW) through the establishment of land-based (stewardship) sites or purchase of credits on the market. And/or
- Fund biodiversity conservation actions that are listed in the Ancillary rules: Biodiversity conservation actions and directly benefit the threatened entity impacted. And/or
- Pay into the Biodiversity Conservation Fund. The Biodiversity Conservation Trust is required to meet the Commonwealth offset requirement component in a like-for-like manner. This is by retiring like-for-like credits, by funding conservation actions that are listed in the *Ancillary rules: Biodiversity conservation actions* (OEH 2017) approved by the NSW Minister for Environment that directly benefit the entity impacted.

Abbreviations and Terms

Abbreviation	Definition
BAM	Biodiversity Assessment Method 2020
BC Act	NSW *Biodiversity Conservation Act 2016*
BCD	NSW Biodiversity Conservation Division
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offset Strategy
CEEC	Critically Endangered Ecological Community
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DPE	NSW Department of Planning and Environment
EPBC	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
IBRA	IBRA Interim Biogeographic Regionalisation for Australia
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NSW	New South Wales
Project	The Project in its entirety
Development Footprint	The area that is the subject of the development application
PCT	Plant Community Type
PMST	Protected Matters Search Tool
TSSC	Commonwealth Threatened Species Scientific Committee
VIS	Vegetation Information System

Table of Contents

Executive Summary i

Abbreviations and Terms iii

1.0 Introduction 1

1.1 NSW and Commonwealth Bilateral Agreement 1

1.2 EPBC Act Referral Outcome and Advice 2

2.0 Description of the Project 5

3.0 Methods for Assessing MNES 7

3.1 Desktop Literature and Database Review 7

3.2 Plant Community Surveys 8

3.2.1 Vegetation Integrity and Floristic Plot Surveys 8

3.2.2 Plant Community Type Mapping Techniques 9

3.2.3 Delineation of EPBC Act Listed Threatened Ecological Communities 9

3.3 Threatened Species Surveys 10

4.0 Survey Results 21

4.1 Plant Community Types and Threatened Ecological Communities 21

4.2 EPBC Act Threatened Ecological Community Considerations 23

4.3 Threatened Flora Species 26

4.4 Threatened Fauna Species 26

5.0 MNES Likelihood of Occurrence 28

6.0 Assessment of Impacts on MNES 42

6.1 Direct Project Impacts 42

6.2 Indirect Project Impacts 42

6.2.1 Increased Site Occupation 42

6.2.2 Impacts on Connectivity 42

6.2.3 Fugitive Light Emissions on Adjacent Habitat 43

6.2.4 Noise Impacts on Adjacent Habitats 43

6.2.5 Dust Impacts on Adjacent Habitats 43

6.2.6 Vibration Impacts 43

6.2.7 Water Impacts 44

6.2.8 Weed and Feral Animal Encroachment 44

6.2.9 Security Fencing 44

6.2.10 Increase Vehicle Movements 45

6.3 Assessments of Significance Summary for MNES 45
6.4 Assessment of 2019–2020 Bushfires 52
7.0 Avoid, Minimise, Offset 57
7.1 Avoidance 57
7.2 Impact Mitigation and Minimisation Measures 57
7.2.1 Techniques, Timing, Frequency and Responsibility of Feasible Mitigation Measures 57
7.2.2 Measures for which there is risk of failure 61
7.2.3 Risk and consequence of any residual impacts 61
7.2.4 Adaptive management strategy proposed to monitor and respond to impacts 61
7.3 Biodiversity Offset Strategy 61
7.3.1 Staged Biodiversity Offset Strategy 61
7.3.2 Details of how Biodiversity Offsets Corelate to the MNES Impacts 63
8.0 Summary 67
9.0 References 69

Figures

Figure 5.1 Biodiversity MNES Observed within the Project Area 41
Figure 7.1 Vegetation Removal and Overburden Stripping Stages 62

Tables

Table 1.1 Assessment Recommendations 3
Table 2.1 Summary of Key Aspects 5
Table 3.1 Summary of Preliminary PCT Mapping within the Development Footprint 8
Table 3.2 Surveys Targeting Species-Credit Threatened Flora Species 11
Table 3.3 Surveys Targeting Candidate and Ecosystem Credit Threatened Fauna Species 14
Table 4.1 Plant Community Types Identified within the Development Footprint 22
Table 4.2 Central Hunter Valley eucalypt forest and woodland 23
Table 4.3 Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland 24
Table 4.4 Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions 25
Table 5.1 Definitions of likelihood of occurrence 29
Table 5.2 MNES Recorded or with Potential to Occur within the Development Footprint 30

Table 5.3	Migratory Species Recorded or with Potential to Occur within the Development Footprint	38
Table 6.1	Summary of Impact Assessment for MNES	46
Table 6.2	Assessment of the 2019–2020 Bushfires on Threatened Species and Ecological Communities	53
Table 7.1	Summary of Proposed Mitigation and Management Measures for Residual Impacts (Direct, Indirect, and Prescribed)	58
Table 7.2	Implementation Details for Proposed Impact Mitigation and Management Measures	59
Table 7.3	Proposed Staged Credit Retirement Details	63
Table 7.4	Summary of Offsets for Threatened Species and Ecological Communities Listed Under the EPBC Act	65
Table 8.1	Summary of Impacts on Matters of National Environmental Significance	67
Table 10.1	Summary of TECs within the Development Footprint	B-2
Table 10.2	Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions Patch Characteristics	B-4
Table 10.3	Critically Endangered and/or Endangered Listed Species Habitat Impacts	B-5
Table 10.4	Vulnerable Listed Species Habitat Impacts	B-14

Appendices

Appendix A	Protected Matters Search Report
Appendix B	EPBC ACT Significant Impact Assessments

1.0 Introduction

Australian Resource Development Group Pty Limited (ARDG) is seeking to develop a new hard rock quarry, known as Stone Ridge Quarry (the Project), located within Wallaroo State Forest at Balickera NSW, approximately 25 kilometres (km) north of Newcastle within the Port Stephens Local Government Area (LGA) (refer to Figure 1.1 of the BDAR).

On 8 December 2022, the Project was also determined to be a Controlled Action, requiring approval under the Commonwealth *Environment Protection and Biodiversity Conservation Act* 1999 due to its potential impact on listed threatened species and ecological communities. The Project will therefore be assessed under the bilateral agreement between the Commonwealth and NSW Governments. The Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) has issued its assessment requirements which have been incorporated into the SEARs for the Project.

This Appendix consolidates the Department of Climate Change, Energy, the Environment and Water (DCCEEW) assessment requirements, as provided in the supplementary Secretary's Environmental Assessment Requirements (SEARs) for the Project, issued on 19 January 2023 as part of the controlled action determination (EPBC 2022/09368 SSD 10432).

1.1 NSW and Commonwealth Bilateral Agreement

The Bilateral Agreement made under Section 45 of the EPBC Act relating to environmental assessment between the Commonwealth of Australia and NSW was signed by both parties in 2015. This Agreement enables NSW to conduct a single environmental assessment process. When the assessment process is complete, NSW provides a report to the Australian Government assessing the likely impacts on Matters of National Environmental Significance (MNES) listed under the EPBC Act.

An Amending Agreement between the Commonwealth and NSW was entered into on 24 March 2020, which endorses the NSW Biodiversity Assessment Method (BAM) (DPIE 2020a). Offsets are required under the EPBC Act for any residual significant adverse impacts on MNES. The Assessment Bilateral Agreement applies to all NSW Projects that require EPBC Act approval to achieve streamlining benefits for Projects that use the Biodiversity Offset Strategy (BOS).

A Biodiversity Development Assessment Report (BDAR) has been prepared in accordance with the BAM, to assess the biodiversity related impacts associated with the Project. Relevant information and results obtained from site surveys associated with the BDAR preparation have been reviewed and incorporated into this report. Much of the information provided here is also included in the main body of the Stone Ridge Quarry Project BDAR, and references to the appropriate sections are provided where applicable.

1.2 EPBC Act Referral Outcome and Advice

The Department of Climate Change, Energy, the Environment and Water (DCCEEW) considers that there is likely to be a significant impact on the following threatened species and communities:

- Koala (*Phascolarctos cinereus*) (combined populations of Queensland, New South Wales and the Australian Capital Territory) – Endangered
- Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable
- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland – Endangered.

The DCCEEW also note that the following species may be significantly impacted by the Project:

- Swift Parrot (*Lathamus discolor*) – Critically Endangered
- Spotted-tail Quoll (southeastern mainland population) (*Dasyurus maculatus maculatus*) – Endangered
- Yellow-bellied Glider (south-eastern) (*Petaurus australis australis*) – Vulnerable
- New Holland Mouse (*Pseudomys novaehollandiae*) – Vulnerable
- South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) – Vulnerable.

The DCCEEW notes the following as key risks associated with the Project from the Commonwealth perspective:

- Likely and potential significant impacts to EPBC listed threatened species and ecological communities resulting from the clearing of native vegetation and terrain manipulation in the Project footprint, and the potential for indirect impacts as a result of Project activities. The Department considers the Project will clear suitable foraging or breeding habitat that is critical to the survival of these threatened species and may fragment and functionally lose the Coastal Swamp Sclerophyll Forest endangered ecological community.

The Department notes that further information is required regarding the primary patch of Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland (Coastal Swamp Sclerophyll Forest) located at the western limit of the development footprint. This information is to include the total size of this patch and an assessment of patch quality according to Table 2 in the Coastal Swamp Sclerophyll Forest Conservation Advice. The Department considers that fragmentation due to the proposed access road has the potential to leave the rest of the patch isolated and functionally lost. Further information on indirect impacts, including making the smaller remnant patches more susceptible to invasion by exotic species of weeds and pest animals, or an overabundance of native species, is required on that isolated patch. DCCEEW also require details of mitigation and offset measures if that patch is functionally lost.

The Department assessment recommendations for the Project include the insertion of the following information outlined in **Table 1.1** for each of the EPBC-listed threatened species and ecological communities impacted by the Project.

Table 1.1 Assessment Recommendations

Recommendation	DCCEEW Comment	Section where addressed in this Report	BDAR Reference
Survey results including details of the scope, timing and methodology for studies or surveys used and how they are consistent with (or justification for divergence from) published Commonwealth guidelines and policy statements.	For ecological communities, this includes any condition thresholds provided in the listing advice or approved conservation advice.	Section 2	Section 2.3.4 and Section 2.4.4
A description and quantification of habitat in the Development Footprint (including suitable breeding habitat, suitable foraging habitat, important populations and habitat critical for survival).	For the ecological communities, assessments should be targeted to determine if the vegetation patches conform to the EPBC listed threatened ecological communities.	Appendix 1 and summary provided in Section 7.3.2	Table 8.1
Information on proposed avoidance and mitigation measures to deal with the impacts of the Project, and a description of the predicted effectiveness and outcomes that the avoidance and mitigation measures will achieve.	-	Section 7.1 and Section 7.2	Section 8.4
A description of the nature, geographic extent, magnitude, timing and duration of any likely direct, indirect and consequential impacts on any relevant EPBC Act listed species and communities and listed migratory species.	It must clearly identify the location and quantify the extent of all impact areas to each relevant EPBC listed species and community.	Section 6.3	Direct impacts are documented in Section 8.1, indirect impacts are described in Section 8.2 and prescribed impacts are described in Section 8.3
Quantification of the offset liability for each species and community significantly impacted, and information on the proposed offset strategy, including discussion of the conservation benefit for each species and community, how offsets will be secured, and the timing. It is a requirement that offsets directly contribute to the ongoing viability of the specific protected matter impacted by a Project i.e. 'like-for-like'.	Like-for-like includes protection of native vegetation that is the same ecological community or habitat being impacted (preferably in the same region where the impact occurs), or funding to provide a direct benefit to the matter being impacted e.g. threat abatement, breeding and propagation programs or other relevant conservation measures.	Section 7.3	Section 10.1 and Section 11

Recommendation	DCCEEW Comment	Section where addressed in this Report	BDAR Reference
Further analysis of the impacts of the 2019–2020 bushfires on EPBC Act listed threatened species and communities should be undertaken during the assessment.	Further assessment will determine whether the remaining habitat within the Project area is of substantially greater importance to the survival of the listed threatened species following the fires and/or whether the population of the species in the area is considered an important population. This information, once obtained, can be considered when determining avoidance, mitigation and offset measures for these species.	Section 6.4	N/A

2.0 Description of the Project

ARDG is seeking to access a high quality, hard rock resource suitable for producing a wide range of quarry products for the Lower Hunter, Central Coast and northern Sydney construction material markets. The Project would produce up to 1.5 million tonnes per annum (Mtpa) of saleable quarry product with approval sought for an initial 30-year quarrying period. The conceptual layout and vegetation disturbance area (referred to in this report as the Development Footprint) for the Project is illustrated in Figure 1.3 in the BDAR.

The Development Footprint is located on land managed by Forestry Corporation of New South Wales (FCNSW). ARDG holds a Deed of Agreement (Deed) for a Forest Materials Licence (FML) with FCNSW under section 42 of the Forestry Act. The Deed was executed by ARDG and FCNSW on 1 November 2018.

The construction phase of the Project will consist of earthworks and clearing of vegetation for site preparation to enable access to target resources and development of the quarry extraction area. Construction of a weighbridge and associated administrative buildings combined with the installation of on-site processing plant and associated equipment are also required to facilitate the Project. A site access point off Italia Road would also need to be constructed. A summary of the of key aspects is provided in **Table 2.1**.

The Project is a State significant development (SSD) under the *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP) as proposed extraction will exceed 500,000 tonnes per year. A development application (DA) is required to be submitted under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

Table 2.1 Summary of Key Aspects

Aspect	Proposed for the Project
Project life	30 years.
Limits of production	Up to 1.5 Mtpa of quarry product/sales per year.
Project Area	Approximately 139 ha (including extraction, processing and stockpiling area and buffers), with a development footprint of approximately 68.02 ha.
Extraction method	Drill, blast and haul.
Material processing	Processing on site with provision for both mobile crushing and screening plant, as well as modular / fixed processing plant.
Overburden management	Overburden will be minimal and any topsoil and overburden will be stockpiled on site for use in rehabilitation.
Product	Concrete, asphalt and sealing aggregates, gabion and crushed rock, armourstone and roadbase.
Product transport	Road transport of up to 1.5 Mtpa of product via the Pacific Highway.
Site access	Single access point on Italia Road. No trucks will turn right out of the site onto Italia Road towards East Seaham. No trucks will turn right out of Italia Road onto the Pacific Highway.

Aspect	Proposed for the Project
Employment	Construction: 10 to 15 full time employees. Operation: Up to 10 full time employees, 3 to 5 part-time employees.
Hours of operation	Construction: • 7.00 am to 6.00 pm Monday to Friday • 8.00 am to 1.00 pm Saturday • No work on Sunday or public holidays. Operation: • Quarrying and processing – 7.00 am to 6.00 pm Monday to Friday, and 7.00 am to 3.00 pm Saturdays. • Truck loading, product transport and maintenance – 6.00 am to 10.00 pm Monday to Friday, and 7.00 am to 3.00 pm Saturdays. No operation on Sundays or Public Holidays apart from maintenance activities as required.
Rehabilitation and final landform	Rehabilitation will be undertaken progressively where appropriate in the context of further resources remaining available in the development footprint at the end of the planned 30-year approval life. A conceptual final landform will be prepared for the Project.

3.0 Methods for Assessing MNES

Detailed methods undertaken for the assessment of the Project is provided in in Section 2.0 of the BDAR and a summary of the survey methods as they relate to EPBC Act MNES is provided in the following sections.

The information outlined in this report is based on the results of both a desktop-based literature and database review and comprehensive biodiversity surveys undertaken over multiple years and seasons. The surveys were undertaken in accordance with the BAM. While it is acknowledged that this methodology is endorsed by the Commonwealth under the Assessment Bilateral Agreement, Umwelt has also sought to address the Commonwealth survey guidelines where relevant.

3.1 Desktop Literature and Database Review

The following key information sources containing existing ecological information related to the Project have been reviewed as part of the preparation of this assessment:

- Biodiversity Assessment Methodology 2020 (DPIE 2020a).
- NSW BioNet (incorporating the BioNet Atlas and Threatened Species Data Collection) (NSW DPE 2024a).
- Protected Matters Search Tool (PMST) (DCCEEW 2024a) for known/predicted EPBC Act-listed Threatened entities.
- National Flying Fox Monitoring Viewer (DCCEEW 2024b) <https://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf>.
- A review of Koala Habitat Assessment Criteria and Methods (Youngentob, Marsh & Skewes 2021).
- Published National Recovery Plans Listing and conservation advices and referral guidelines (where available) for Koala, Grey-headed Flying-Fox, Swift Parrot, Spotted-tailed Quoll, Yellow-Bellied Glider, New Holland Mouse, South-eastern Glossy Black Cockatoo and Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland available from the DCCEEW Species Profile and Threats (SPRAT) Database.

These reports and databases were reviewed to obtain information in relation to the Plant Community Types (PCTs), habitat constraints, microhabitats and previous site records for threatened species. A likelihood of occurrence assessment was completed for the nationally listed threatened species, migratory species and threatened ecological communities identified from the Protected Matters Search (DAWE 2024a) using the definitions provided in **Table 5.1**. The results of this assessment are provided in **Section 4.0.**

3.2 Plant Community Surveys

3.2.1 Vegetation Integrity and Floristic Plot Surveys

A stratified plot-based vegetation integrity and floristic survey of the Development Footprint was undertaken in accordance with Table 3 and Section 4.2.1 of the BAM to assess the expected environmental variation, and to address any gaps and verify the results of previous mapping and site information. A total of 18 BAM Plots were previously surveyed within the Project Area by Umwelt during 2018, however this plot data was not used for this assessment as the site was recovering from a bushfire and follow-up surveys in 2022 identified changes in the site vegetation due to regrowth. Consultation with the Biodiversity Conservation Division (BCD) Newcastle office in 2022 confirmed this approach.

An additional 20 updated BAM plots were sampled by Umwelt ecologists on the following dates:

- 12 October 2022
- 9 November 2022
- 16 November 2022.

The vegetation integrity survey of the Development Footprint was undertaken in accordance with Section 4.3.3 and Section 4.3.4 of the BAM for sampling of vegetation composition, structure and function attributes. Plots were sampled in locations to ensure that they captured attributes relevant to each vegetation zone. The locations of the plots sampled are mapped to scale and shown as BAM Plots in Figure 2.1 in the BDAR.

Plot surveys were completed prior to the refinement of the Development Footprint and therefore several plots are now situated outside of the Development Footprint boundary. This is due to the ongoing refinement of the proposed additional disturbance footprint throughout the assessment process. The surveys in these locations are considered representative of the vegetation zones within the Development Footprint. **Table 3.1** outlines the floristic plot survey effort and areas of PCT and associated condition zones identified in the preliminary mapping completed across the Development footprint.

Table 3.1 Summary of Preliminary PCT Mapping within the Development Footprint

Vegetation Condition Zone	PCT ID and Name Condition Class	Area in Development Footprint (ha)	Number of BAM Plots/Transects	
			Required (BAM 2020)	Plots Undertaken
1 PCT 762 Intact	762 - Cabbage Gum open forest or woodland on flats of the North Coast	0.33	1	2 Plots (Plot 17, Plot 22)
2 PCT 1590 - Intact	1590 - Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	39.27	4	6 Plots (Plot 8, Plot 9, Plot 10, Plot 16, Plot 20, Plot 21)
3 PCT 1618 - Intact	1618 - Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast	0.88	1	1 Plot (Plot 12B)

Vegetation Condition Zone	PCT ID and Name Condition Class	Area in Development Footprint (ha)	Number of BAM Plots/Transects	
			Required (BAM 2020)	Plots Undertaken
4 PCT 1619 - Intact (Apple Variant)	1619 - Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	18.91	3	4 Plots (Plot 11, Plot 13, Plot 15, Plot 24)
5 PCT 1619 – Intact (Apple – Ironbark Variant)	1619 - Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	8.63	3	3 Plots (Plot 12A, Plot 14, Plot 23)
Total		**68.02**	**12**	**16**

3.2.2 Plant Community Type Mapping Techniques

Native vegetation and PCT mapping was undertaken using best-practice techniques to delineate vegetation communities across the Development Footprint. Plant Community Type mapping is provided in Figure 4.2 of the BDAR. The mapping involved the following key steps:

- Review of aerial imagery to assess vegetation distribution patterns as dictated by change in canopy texture, tone and colour, as well as topography.
- Review of the modelled distribution of vegetation communities within broader scale regional based vegetation mapping prepared by Sivertsen *et al*. (2011).
- Preparation of a draft PCT map based on interpretation of digital aerial imagery.
- Field-based ground-truthing of the draft PCT mapping.
- Confirmation of vegetation community floristic delineations based on plot data.

Vegetation communities were delineated through the identification of repeating patterns of plant species assemblages in each of the identified strata. Slight variations in species composition are typical across the extent of a community and are often associated with microhabitats or ecotones with other communities.

3.2.3 Delineation of EPBC Act Listed Threatened Ecological Communities

The PCTs mapped within the Development Footprint were compared to TECs listed under the EPBC Act using the Commonwealth Threatened Species Scientific Committee (TSSC) listing and conservation advice and/or policy statements. The following approach was used:

- A list of nationally listed TECs potentially occurring within the Development Footprint was obtained through the completion of a Protected Matters Search using a 10 km buffer and review of the EPBC Act List of Ecological Communities.
- Full-floristic plot assessment, semi-quantitative rapid assessments and meandering surveys were completed initially to determine floristic composition and structure of each PCT.

- For TECs with a potential occurrence within the Development Footprint, the TEC diagnostic characteristics and condition thresholds were analysed, as identified in the listing advice provided by the TSSC for the relevant candidate TECs assessed.
- Comparison was undertaken with published species lists, including lists of 'important species' as identified on the listing advice provided by the TSSC for potentially occurring nationally listed TECs.
- Comparison with habitat descriptions and distributions for potentially occurring nationally listed TECs was made.
- Assessments were completed for the nationally listed TECs potentially occurring using any relevant guidelines and recovery plans published by the Commonwealth.

3.3 Threatened Species Surveys

Biodiversity surveys have been undertaken by Umwelt in the Development Footprint between 2017 and 2023. The locations of surveys completed for listed threatened flora species are shown in Figure 2.2 in the BDAR and the locations of surveys completed for listed threatened and migratory fauna species are shown in Figure 2.3 in the BDAR.

Surveys were undertaken for the threatened species considered to have potential to occur in the Development Footprint based on database reviews, including the EPBC Act PMST (DCCEEW 2024a) and NSW BioNet Atlas (Atlas) (NSW DPE 2024a). Surveys included species-specific surveys and on-ground searches in suitable habitat throughout the Development Footprint. Additionally, opportunistic surveys were undertaken for these species in conjunction with the plant community surveys described in **Section 3.2** of this report.

Targeted surveys for EPBC Act listed species-credit, ecosystem-credit and dual-credit species were undertaken over the dates provided in **Table 3.2** and **Table 3.3**.

Table 3.2 Surveys Targeting Species-Credit Threatened Flora Species

Species name	Listing status		Surveys Undertaken	Survey Method	Relevant Guidelines and Resources
	BC Act	EPBC Act			
Charmhaven Apple *Angophora inopina*	V	V	• 25, 26, 30, October 2017 • 8, 9, 10, 11, 12 October 2018 • 25, 26, 28 July 2022 • 12, 17, 19, 20, 25, 26, 31 October 2022 • 9,11 November 2022.	Parallel field transverses at 10-metre intervals were undertaken to target threatened flora species. This interval can be varied in response to terrain and or vegetation densities. Sampling and opportunistic observations were undertaken during all floristic and vegetation plot surveys.	Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (NSW DPIE 2020b) NSW Threatened Biodiversity Data Collection (TBDC) (NSW DPE 2024a).
White-flowered Wax Plant *Cynanchum elegans*	E	E	• 25, 26, 30, October 2017 • 8, 9, 10, 11, 12 October 2018 • 25, 26, 28 July 2022 • 12, 17, 19, 20, 25, 26, 31 October 2022 • 9,11 November 2022.	Parallel field transverses at 10-metre intervals were undertaken to target threatened flora species. This interval can be varied in response to terrain and or vegetation densities. Sampling and opportunistic observations were undertaken during all floristic and vegetation plot surveys.	Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (NSW DPIE 2020a) NSW Threatened Biodiversity Data Collection (TBDC) (NSW DPE 2024a).
Slaty Red Gum *Eucalyptus glaucina*	V	V	• 25, 26, 30, October 2017 • 8, 9, 10, 11, 12 October 2018 • 25, 26, 28 July 2022 • 12, 17, 19, 20, 25, 26, 31 October 2022 • 9,11 November 2022.	Parallel field transverses at 10-metre intervals were undertaken to target threatened flora species. This interval can be varied in response to terrain and or vegetation densities. Sampling and opportunistic observations were undertaken during all floristic and vegetation plot surveys.	Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (NSW DPIE 2020b) NSW Threatened Biodiversity Data Collection (TBDC) (NSW DPE 2024a).

Species name	Listing status		Surveys Undertaken	Survey Method	Relevant Guidelines and Resources
	BC Act	EPBC Act			
Small-flower Grevillea *Grevillea parviflora* subsp. *parviflora*	V	V	• 25, 26, 30, October 2017 • 8, 9, 10, 11, 12 October 2018 • 25, 26, 28 July 2022 • 12, 17, 19, 20, 25, 26, 31 October 2022 • 9,11 November 2022.	Parallel field transverses at 10-metre intervals were undertaken to target threatened flora species. This interval can be varied in response to terrain and or vegetation densities. Sampling and opportunistic observations were undertaken during all floristic and vegetation plot surveys.	Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (NSW DPIE 2020b) NSW Threatened Biodiversity Data Collection (TBDC) (NSW DPE 2024a).
Scrub Turpentine *Rhodamnia rubescens*	CE	CE	• 25, 26, 30, October 2017 • 8, 9, 10, 11, 12 October 2018 • 25, 26, 28 July 2022 • 12, 17, 19, 20, 25, 26, 31 October 2022 • 9,11 November 2022.	Parallel field transverses at 10-metre intervals were undertaken to target threatened flora species. This interval can be varied in response to terrain and or vegetation densities. Sampling and opportunistic observations were undertaken during all floristic and vegetation plot surveys.	Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (NSW DPIE 2020b) NSW Threatened Biodiversity Data Collection (TBDC) (NSW DPE 2024a).
Native Guava *Rhodomyrtus psidioides*	CE	CE	• 25, 26, 30, October 2017 • 8, 9, 10, 11, 12 October 2018 • 25, 26, 28 July 2022 • 12, 17, 19, 20, 25, 26, 31 October 2022 • 9,11 November 2022.	Parallel field transverses at 10-metre intervals were undertaken to target threatened flora species. This interval can be varied in response to terrain and or vegetation densities. Sampling and opportunistic observations were undertaken during all floristic and vegetation plot surveys.	Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (NSW DPIE 2020a) NSW Threatened Biodiversity Data Collection (TBDC) (NSW DPE 2024a).

Species name	Listing status		Surveys Undertaken	Survey Method	Relevant Guidelines and Resources
	BC Act	EPBC Act			
Heath Wrinklewort *Rutidosis heterogama*	V	V	• 25, 26, 30, October 2017 • 8, 9, 10, 11, 12 October 2018 • 25, 26, 28 July 2022 • 12, 17, 19, 20, 25, 26, 31 October 2022 • 9,11 November 2022.	Parallel field transverses at 10-metre intervals were undertaken to target threatened flora species. This interval can be varied in response to terrain and or vegetation densities. Sampling and opportunistic observations were undertaken during all floristic and vegetation plot surveys.	Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (NSW DPIE 2020b) NSW Threatened Biodiversity Data Collection (TBDC) (NSW DPE 2024a).
Black-eyed Susan *Tetratheca juncea*	V	V	• 25, 26, 30, October 2017 • 8, 9, 10, 11, 12 October 2018 • 25, 26, 28 July 2022 • 12, 17, 19, 20, 25, 26, 31 October 2022 • 9,11 November 2022.	Parallel field transverses at 10-metre intervals were undertaken to target threatened flora species. This interval can be varied in response to terrain and or vegetation densities. Sampling and opportunistic observations were undertaken during all floristic and vegetation plot surveys.	Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (NSW DPIE 2020b) NSW Threatened Biodiversity Data Collection (TBDC) (NSW DPE 2024a).
Austral Toadflax *Thesium australe*	V	V	• 25, 26, 30, October 2017 • 8, 9, 10, 11, 12 October 2018 • 25, 26, 28 July 2022 • 12, 17, 19, 20, 25, 26, 31 October 2022 • 9,11 November 2022.	Parallel field transverses at 10-metre intervals were undertaken to target threatened flora species. This interval can be varied in response to terrain and or vegetation densities. Sampling and opportunistic observations were undertaken during all floristic and vegetation plot surveys.	Surveying threatened plants and their habitats NSW survey guide for the Biodiversity Assessment Method (NSW DPIE 2020b) NSW Threatened Biodiversity Data Collection (TBDC) (NSW DPE 2024a).

Table 3.3 Surveys Targeting Candidate and Ecosystem Credit Threatened Fauna Species

Species Name	Listing status		Credit Type / Assessment Approach	Relevant Guidelines and Resources	Surveys Undertaken
	BC Act	EPBC Act			
Regent Honeyeater *Anthochaera phrygia*	CE	CE	This species is a dual credit entity. Foraging habitat is assessed as assumed present based on association with specific PCTs and this is offset using ecosystem credits. Important habitat is primarily mapped based on suitable habitat within buffers to known breeding locations.	The Survey Guidelines for Australia's Threatened Birds (DEWHA 2010), which specifies 20 hours over 8 days per 50 ha of habitat.	The development footprint does not contain mapped important habitat. This species was surveyed for across 17 diurnal winter bird census point based area searches completed over 4 days on 9 July 2018 (5hrs x 2 persons), 10 July (5hrs 25 min x 2 persons), 11 July 2018 (6.25 hrs x 2 persons), 12 July (4hrs x 2 persons). This species was also subject to targeted searches by 2-4 ecologists on over 16 days during which 239.5 person hours of survey were completed on 25 July 2022 (4hrs x 2 people), 26 July 2022 (7.5 hrs x 2 people), 28 July 2022 (6hrs x 2 people), 29 July 2022 (6.5hrs x 2 people), 14 September 2022 (8.5hrs x 2 people), 16 September 2022 (7.5hrs x 2 people), 17 October 2022 (8.5hrs x 2 people), 18 October 2022 (10.5hrs x 3 people), 19 October (8.5 hrs x 2 people), 25 October (8.5 hrs x 2 people), 26 October (8.5 hrs x 2 people), 31 October 2022 (4 hrs x 4 people), 1 November 2022 (3 hrs x 2 people), 2 November 2022 (4hrs x 2 people), 9 November 2022 (7.25 hrs x 2 people) and 16 November 2022 (7.75 hrs x 2 people).
South-eastern Glossy Black Cockatoo *Calyptorhynchus lathami lathami*	V	V	This species is a dual credit entity under the BAM, with foraging habitat predicted to occur based on associated PCTs and offset using ecosystem credits and breeding habitat assessed using species credits where present.	There are no specific EPBC guidelines available, the most similar species-specific requirement is for the Glossy Black Cockatoo on Kangaroo Island which requires 5hrs of area searches over one day and 20 hours of targeted searches over 4 days per 50 ha. Surveys completed considered the requirements of the BAM and the NSW Threatened Biodiversity Data	Presence of Allocasuarina sp., which is a habitat constraint for the ecosystem credit for this species were confirmed during flora surveys and habitat searches for this species. Diurnal bird surveys in accordance with Step 1 of the survey requirements were undertaken by 2 ecologists over 10 days (121 hours) on 9 July 2018 (5hrs x 2 people), 10 July 2018 (5hrs 25 min x 2 people), 11 July 2018 (6.25hrs x 2 people), 12 July 2018 (4hrs x 2 people), 25 July 2022 (4hrs x 2 people), 26 July 2022 (7.5 hrs x 2 people), 28 July 2022 (6hrs x 2 people), 29 July 2022 (6.5hrs x 2 people), 14 September 2022 (8.5hrs x 2 people) and 16 September 2022 (7.5hrs x 2 people).

Species Name	Listing status		Credit Type / Assessment Approach	Relevant Guidelines and Resources	Surveys Undertaken
	BC Act	EPBC Act			
				Collection for breeding habitat.	These surveys included diurnal census for adult birds through the Development Footprint and listening for signs of breeding such as begging chicks around potential nesting trees. Opportunistic observation surveys were also completed during orchid searches undertaken over 5 days in June 2023. No signs of breeding, including begging birds, pairs of birds or lone adult males were detected during the breeding season and therefore steps 2–4 of the survey guidelines, including mapping of hollow bearing trees suitable for breeding, are not required.
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	E	This species is a dual credit entity under the BAM, with foraging habitat predicted to occur based on associated PCTs and offset using ecosystem credits and breeding habitat assessed using species credits where present.	There are no specific EPBC guidelines available. Surveys considered the survey recommendations in the NSW Threatened Biodiversity Data Collection	Surveys were undertaken by two to three ecologists over five days (99.5 hours) on 17 October 2022 (8.5hrs x 2 people), 18 October 2022 (10.5hrs x 3 people), 19 October 2022 (8.5hrs x 2 people), 25 October 2022 (8.5hrs x 2 people) and 26 October 2022 (8.5 hrs x 2 people). These surveys included diurnal census on foot with watching and listening for signs of activity such as the presence of adult birds and begging chicks around potential nesting trees.
Large-eared pied bat *Chalinolobus dwyeri*	V	V	Species credit entity, requires targeted surveys under the BAM, has not been observed during surveys and no species credits proposed.	This species is a species credit entity which requires targeted surveys. The EPBC Act Survey Guidelines for Australia's threatened bats (DEWHA 2010b) identify that surveys should be completed during October to March. Unattended bat detectors should be left for 16 detector nights over a minimum of 4 nights per 50 ha.	For the development footprint Umwelt completed a total of 90 nights of ultrasonic call recording including 4 nights with 2 detector units during January 2018, 10 nights with 2 detector units during November to December 2022 and 76 nights with 4 detector units during January to February 2023. These ultrasonic call recording surveys were all completed during the survey periods specified in the guidelines. Extensive surveys were also completed by WSP (2023) and ELA (2021) for the Balickera Tunnel, as documented in the BDAR.
Spotted-tailed	V	E	This species is an ecosystem credit	The EPBC Act Survey Guidelines for	Camera trapping was completed with 915 trap nights achieved

Species Name	Listing status		Credit Type / Assessment Approach	Relevant Guidelines and Resources	Surveys Undertaken
	BC Act	EPBC Act			
Quoll *Dasyurus maculatus maculatus*			entity. It does not require surveys and is assessed under the BAM as reliably predicted to be present based on PCT associations.	Australia's Threatened Mammals (DSEWPac 2010) provides a general guide for spotlighting effort of 2 x 200 m transects per 5 ha spaced at least 100 m and surveyed on two nights. The EPBC Act Survey Guidelines for Australia's Threatened Mammals (DSEWPac 2010) provides a guide for camera trapping effort of 10 cameras x 14 nights per 5 ha, deployed over a 1 ha sampling area.	including 315 terrestrial trap nights with 10 cameras during 23 January to 19 March 2018 and 600 arboreal trap nights with 20 cameras during 1 November to 1 December 2022. Terrestrial cameras were mounted on the lower trunks of trees positioned at fish-based baits pegged to the ground. Arboreal cameras were mounted on trees at approximately 1.5 m height and lures consisted of a weatherproof bait cannister loosely packed with a sticky rolled oats, honey and peanut butter mixture, mounted on trees sprayed liberally with a honey-water mixture. Spotlighting surveys were completed over multiple nights spanning several years between 2018 and 2022. The surveys comprised including 7hrs 40 min of searching over 43 km completed by two people (driving and walking) over 3 nights in March 2018, 8.6 hrs of searching completed over 4 nights by 2 ecologists in July 2018, 3.5 hrs of searching over 6.8 km by two ecologists over 2 nights in August 2019, 2.5 hrs of searching over 14 km by 2 ecologists over 3 nights during November 2022 and 1hr of searching over 5.9km completed by two ecologists over 1 night in December 2022.
White-throated Needletail *Hirundapus caudacutus*	-	V	This species is an ecosystem credit entity. It does not require surveys and is assessed under the BAM as reliably predicted to be present based on PCT associations.	Present in Australia (non-breeding) from September to March, no specific survey guidelines available.	Bird census surveys were completed over 12 days (191.5 person hours) on 14 September 2022 (8.5hrs x 2 people), 16 September 2022 (7.5hrs x 2 people), 17 October 2022 (8.5hrs x 2 people), 18 October 2022 (10.5hrs x 3 people), 19 October (8.5 hrs x 2 people), 25 October (8.5 hrs x 2 people), 26 October (8.5 hrs x 2 people), 31 October 2022 (4 hrs x 4 people), 1 November 2022 (3 hrs x 2 people), 2 November 2022 (4hrs x 2 people), 9 November 2022 (7.25 hrs x 2 people) and 16 November 2022 (7.75 hrs x 2 people).
Swift Parrot	E	CE	This species is a dual credit entity.	The Survey Guidelines for Australia's	The development footprint does not contain mapped important

Species Name	Listing status		Credit Type / Assessment Approach	Relevant Guidelines and Resources	Surveys Undertaken
	BC Act	EPBC Act			
Lathamus discolor			Foraging habitat is assessed as assumed present based on association with specific PCTs and this is offset using ecosystem credits. Important habitat is mapped based on buffers to historical sightings including repeat sightings of >5 birds or one-off sightings of >40 birds, offsets for important habitat are provided with species credits, however none is mapped within the development footprint.	Threatened Birds (DEWHA 2010a), which specifies 20 hours over 8 days per 50 ha of habitat.	habitat. The species is typically present on the mainland of Australia between March and mid-October. This species was surveyed for across 17 diurnal winter bird census point based area searches completed over 4 days on 9 July 2018 (5hrs x 2 persons), 10 July (5hrs 25 min x 2 persons), 11 July 2018 (6.25 hrs x 2 persons), 12 July (4hrs x 2 persons). This species was also subject to targeted searches by 2-3 ecologists on over 9 days during which 145.5 person hours of survey were completed on 25 July 2022 (4hrs x 2 people), 26 July 2022 (7.5 hrs x 2 people), 28 July 2022 (6hrs x 2 people), 29 July 2022 (6.5hrs x 2 people), 14 September 2022 (8.5hrs x 2 people), 16 September 2022 (7.5hrs x 2 people), 17 October 2022 (8.5hrs x 2 people), 18 October 2022 (10.5hrs x 3 people), 19 October (8.5 hrs x 2 people).
Green and Golden Bell Frog *Litoria aurea*	E	V	Species credit entity, requires targeted surveys under the BAM, has not been observed during surveys and no species credits proposed.	The EPBC survey guideline for Australia's threatened frogs (DEWHA 2010c) identifies that surveys should be undertaken on warm and windless nights within one week following rainfall. The survey period is September to March and suitable survey methods include call detection, call playback and spotlighting over 4 nights (1hr per 50 m).	Spotlighting searches and call playback by Umwelt ecologists was undertaken over 4 nights on 19 March 2018 (2hrs x 2 people), 20 March 2018 (2hrs 40 min x 2 people), 22 March 2018 (3hrs x 2 people) and 28 March 2018 (2hrs x 2 people). An additional 4 replicate nights (14 person hours) of aural-visual transect surveys with call playback was completed by two Umwelt Ecologists on 1 November 2022 (2hrs x 2 people), 2 November 2022 (2 hrs x 2 people), 30 November 2022 (1.5 hrs x 2 people) and 1 December 2022 (1.5 hrs x 2 people). The survey transects were aligned to watercourses and damp areas of potential habitat within the development footprint and Project Area.

Species Name	Listing status		Credit Type / Assessment Approach	Relevant Guidelines and Resources	Surveys Undertaken
	BC Act	EPBC Act			
Koala *Phascolarctos cinereus*	E	E	Species credit entity, requires targeted surveys under the BAM, has been observed during surveys and will be offset with species credits.	Survey guidelines for Australia's threatened mammals (DSEWPC 2010) identifies general survey methods for threatened mammals, however does not provide any species specific requirements for the koala. Youngentob *et al*., (2021) discuss several survey methods including: transect and point surveys, spotlighting, trained koala detection dogs, mark-recapture, thermal detection drones, radio tracking, camera traps, faecal pellet counts, call playback passive acoustic survey, landscape nutritional quality surveys	Camera trapping was completed with 915 trap nights achieved including 315 terrestrial trap nights with 10 cameras during 23 January to 19 March 2018 and 600 arboreal trap nights with 20 cameras during 1 November to 1 December 2022. Terrestrial cameras were mounted on the lower trunks of trees positioned at fish-based baits pegged to the ground. Arboreal cameras were mounted on trees at approximately 1.5 m height and lures consisted of a weatherproof bait cannister loosely packed with a sticky rolled oats, honey and peanut butter mixture, mounted on trees sprayed liberally with a honey-water mixture. Spotlighting surveys were completed over multiple nights spanning several years between 2018 and 2022. The surveys comprised including 7hrs 40 min of searching over 43 km completed by two people (driving and walking) over 3 nights in March 2018, 8.6 hrs of searching completed over 4 nights by 2 ecologists in July 2018, 3.5 hrs of searching over 6.8 km by two ecologists over 2 nights in August 2019, 2.5 hrs of searching over 14 km by 2 ecologists over 3 nights during November 2022 and 1hr of searching over 5.9km completed by two ecologists over 1 night in December 2022.
Grey-headed Flying-Fox *Pteropus poliocephalus*	V	V	This species is a dual credit entity. The presence of foraging habitat is predicted to be present and will be offset using ecosystem credits. Species credits are required for impacts to breeding camps only and none were observed during surveys.	The Survey Guidelines for Australia's Threatened Bats (DEWHA 2010b) The primary method for determining the presence of unrecorded day roosts is to conduct field surveys. Flying foxes are recognised easily from a distance while they roost or are in flight, and have distinctive audible calls that	Diurnal habitat searches for breeding camps were completed on 17th to 19th October 2022 (27.5hrs x 2 to 3 people), 25th to 26th October 2022 (17hrs x 2 people), 31st October 2022 (3hrs x 2 people), 1st and 2nd November 2022 (7hrs x 2 people), 9th November 2022 (7.25hrs x 2 people), and 16th November 2022 (7.25hrs x 2 people). The National Flying-fox Monitoring Viewer was also reviewed (DCCEEW 2024).

Species Name	Listing status		Credit Type / Assessment Approach	Relevant Guidelines and Resources	Surveys Undertaken
	BC Act	EPBC Act			
				are heard most frequently in the early morning or under sunny conditions. Other signs include their distinctive odour and droppings. Both the ground and foliage should be examined for flying fox scats.	
Yellow-bellied Glider *Petaurus australis*	V	V	This species is an ecosystem credit entity. It does not require surveys and is assessed under the BAM as reliably predicted to be present based on PCT associations.	The EPBC Act Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2010) provides a general guide for spotlighting effort of 2 x 200 m transects per 5 ha spaced at least 100 m and surveyed on two nights. The EPBC Act Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2010) provides a guide for camera trapping effort of 10 cameras x 14 nights per 5 ha, deployed over a 1 ha sampling area.	Camera trapping was completed including 600 arboreal trap nights with 20 cameras during 1 November to 1 December 2022. Cameras were mounted on trees at approximately 1.5 m height and lures consisted of a weatherproof bait cannister loosely packed with a sticky rolled oats, honey and peanut butter mixture, mounted on trees sprayed liberally with a honey-water mixture. Spotlighting surveys were completed over multiple nights spanning several years between 2018 and 2022. The surveys comprised including 7hrs 40 min of searching over 43 km completed by two people (driving and walking) over 3 nights in March 2018, 8.6 hrs of searching completed over 4 nights by 2 ecologists in July 2018, 3.5 hrs of searching over 6.8 km by two ecologists over 2 nights in August 2019, 2.5 hrs of searching over 14 km by 2 ecologists over 3 nights during November 2022 and 1hr of searching over 5.9km completed by two ecologists over 1 night in December 2022.
New Holland Mouse *Pseudomys gracilicaudatus*	-	V	This species is an ecosystem credit entity. It does not require surveys and is assessed under the BAM as reliably predicted to be present based on PCT associations.	There are no relevant guidelines provided under the EPBC Act Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 201). Camera trapping, live trapping, hair tubes and predator pellets /	Camera trapping was completed with 315 terrestrial trap nights with 10 cameras during 23 January to 19 March 2018. Cameras were mounted on the lower trunks of trees pointed at a fish-based lure, pegged to the ground.

Species Name	Listing status		Credit Type / Assessment Approach	Relevant Guidelines and Resources	Surveys Undertaken
	BC Act	EPBC Act			
				scats, detection dogs, eDNA have been identified by the Australian Government and Tasmanian Government (Natural Resources and Environment Tasmania 2022).	
Greater Glider *Petauroides volans*	E	V	Species credit entity, requires targeted surveys under the BAM, has not been observed during surveys and no species credits proposed.	No species-specific survey guideline has been published under the EPBC Act. The Threatened Biodiversity Survey and Assessment Guidelines for Developments and Activities (DEC 2004) is the most directly relevant guide listed on the BAM Assessors webpage, which covers survey methods for non-flying mammals. Spotlighting was chosen as the most effective survey method available for this species due to its arboreal habit and leaf-based diet. Spotlighting from a vehicle is specified at 2 x 1 km tracks with a maximum speed of 5 km per hour on 2 separate nights for up to 200 ha of stratification unit. Spotlighting on foot is specified at 2 x 1 hour and 1 km up to 200 ha of stratification unit walking at 1 km per hour on 2 separate nights.	Spotlighting surveys were completed over multiple nights spanning several years between 2018 and 2022. The surveys comprised including 7hrs 40 min of searching over 43 km completed by two people (driving and walking) over 3 nights in March 2018, 8.6 hrs of searching completed over 4 nights by 2 ecologists in July 2018, 3.5 hrs of searching over 6.8 km by two ecologists over 2 nights in August 2019, 2.5 hrs of searching over 14 km by 2 ecologists over 3 nights during November 2022 and 1hr of searching over 5.9km completed by two ecologists over 1 night in December 2022.

4.0 Survey Results

4.1 Plant Community Types and Threatened Ecological Communities

The Plant Community Types (PCTs) identified in this assessment are based on the PCTs available prior to the release of the revised PCTs for eastern NSW and associated update to the BAM Calculator which occurred in February 2023. In-progress BAM-C assessments and projects with substantially progressed surveys are able to undertake this approach, in accordance with the transitional arrangements. **Table 4.1** lists all PCTs that have been observed within the Development Footprint during field surveys.

Detailed descriptions are provided for the PCTs are listed in Section 4.2.2 of the BDAR. The locations of PCTs are shown in Figure 4.2 in BDAR.

Table 4.1 Plant Community Types Identified within the Development Footprint

Current BAM-C PCT ID	PCT name	Vegetation Class	Vegetation Formation	Vegetation Condition Zone	Area within Development Footprint (ha)	EPBC TEC Associations
762	Cabbage Gum open forest or woodland on flats of the North Coast	Grassy Woodlands	Coastal Valley Grassy Woodlands	Z1 PCT 762 Intact	0.33	This PCT corresponds to the *Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions EEC* listed under the EPBC in October 2022.
1590	Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Hunter-Macleay Dry Sclerophyll Forests	Z2 PCT 1590 - Intact	39.27	This PCT does not correspond to any TECs listed under the EPBC Act. Consideration was given to the potential alignment of this PCT with the *Central Hunter Valley Eucalypt Forest and Woodland CEEC*. The presence of this CEEC was excluded based on lack of key diagnostic characteristics including lack of Permian geology and presence of high densities of *Eucalyptus fibrosa* (>2 trees per ha), a species which must be largely absent to meet the listing criteria.
1618	Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast	Dry Sclerophyll Forests (Shrubby Sub-formation)	Coastal Dune Dry Sclerophyll Forests	Z3 PCT 1618 - Intact	0.88	This PCT corresponds to the *Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions EEC* listed under the EPBC in October 2022.
1619	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	Z4 PCT 1619 - Intact (Apple Variant)	18.91	This PCT does not correspond to any TECs listed under the EPBC Act.
	Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	Z5 PCT 1619 – Intact (Apple – Ironbark Variant)	8.63	This PCT does not correspond to any TECs listed under the EPBC Act.

4.2 EPBC Act Threatened Ecological Community Considerations

Appendix C of the BDAR includes detailed analyses of EPBC Act TECs potentially occurring in the Project Area which have been replicated here for ease of reference. The following TECs listed within the EPBC Act were considered to have *potential* to occur within the project area and development footprint:

- Central Hunter Valley eucalypt forest and woodland.
- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland.
- Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions.

The following analysis of the relevant approved conservation advice and key diagnostic characteristics published by the Australian Government is provided separately for each TEC in **Table 4.2** to **Table 4.4**. It is noted that PCT 1716 Prickly-leaved Paperbark Forest on Coastal Lowlands of the Central Coast and Lower North Coast is included in the following assessments, as it is located within the project area, however has been removed from the development footprint which will be directly impacted by the Project.

Table 4.2 Central Hunter Valley eucalypt forest and woodland

Central Hunter Valley eucalypt forest and woodland- Key Diagnostic Characteristics from EPBC Act Threatened Species Scientific Committee (DoE 2015a) Approved Conservation Advice	Consideration
It occurs in the Hunter River catchment (typically called the Hunter Valley region)	The project area occurs in the Hunter River Catchment.
It typically occurs on lower hillslopes and low ridges, or valley floors in undulating country; on soils derived from Permian sedimentary rocks	Areas of drainage depressions and flats are present, however the development footprint does not occur on Permian sediments. The development footprint occurs on Carboniferous sediments of the Eagleton Volcanics and Mt Johnstone formations. The geological characteristics for this EEC are not met within the development footprint.
It does not occur on alluvial flats, river terraces, aeolian sands, Triassic sediments, or escarpments	PCTs 1590 and 1619 do not occur in the landscape positions or on the substrates specified. PCTs 762, 1618 and 1716 both occur in landscape positions associated with alluvial flats.
It is woodland or forest, with a projected canopy cover of trees of 10% or more; or with a native tree density of at least 10 native tree stems per 0.5 ha (at least 20 native tree stems/ha) that are at least one metre in height	The vegetation within the development footprint is mostly open forest.
The canopy of the ecological community is dominated by one or more of the following four eucalypt species: *Eucalyptus crebra* (Narrow-leaved Ironbark), *Corymbia maculata* (syn. *E. maculata*) (Spotted Gum), *E. dawsonii* (slaty gum) and *E. moluccana* (grey box); or a fifth species, *Allocasuarina luehmannii* (Bulloak, Buloke) dominates in combination with one or more of the above four eucalypt species, in sites previously dominated by one or more of the above four eucalypt species.	PCT 1590 contains areas dominated by *Corymbia maculata*. *Corymbia maculata* also occurs within PCT 1716 which has been removed from the development footprint following avoidance measures.

Central Hunter Valley eucalypt forest and woodland- Key Diagnostic Characteristics from EPBC Act Threatened Species Scientific Committee (DoE 2015a) Approved Conservation Advice	Consideration
Allocasuarina torulosa (Forest Oak), *Eucalyptus acmenoides* (White Mahogany) and *E. fibrosa* (red/Broad-leaved Ironbark) are largely absent from the canopy of a patch	*Allocasuarina torulosa* and *Eucalyptus fibrosa* are both present throughout PCT 1590.
A ground layer is present (although it may vary in development and composition), as a sparse to thick layer of native grasses and other native herbs and/or native shrubs	These ground layer conditions are met for the PCTs present.
Conclusion	**The Central Hunter Valley eucalypt forest and woodland is not present within the development footprint and is excluded based on lack of key diagnostic features including the geological substrate and prominent occurrence of the negative diagnostic species.**

Table 4.3 Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland

Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland - Key Diagnostic Characteristics from DAWE (2021a) Approved Conservation Advice	Consideration
Occurs on the mainland and islands near to the coast (within 20 km) from South East Queensland to south-eastern NSW specifically within these IBRA Bioregions: South Eastern Queensland (SEQ); NSW North Coast (NNC); Sydney Basin (SYB) and the Bateman sub-region of the South East Corner (SEC).	The development footprint occurs within the NSW North Coast bioregion.
Occurs in coastal catchments typically below 20m ASL, but occasionally up to 220m ASL.	Most of the development footprint is above 20m above sea level (ASL), however is entirely below 220m ASL.
Occurs on hydric soils with inundation patterns ranging from intermittent to episodic.	PCTs 762 1618 and 1716 all meet this key diagnostic requirement.
The vegetation structure varies from tall closed to open forest to woodland, to dense (closed) shrubland or scrub forest. Minimum crown cover (see footnote 5, p. 4) is at least 10%, but it is more typically in the range 50% to 70%	The vegetation within the development footprint typically meets this requirement.
From South East Queensland to the Sydney Basin Bioregion, the canopy is typically dominated or co-dominated by *Melaleuca quinquenervia* and/or *Eucalyptus robusta*. In some areas, the canopy may be locally dominated by other melaleuca species including: *M. dealbata* (SEQ bioregion) (rarely); *M. biconvexa* (mid-NSW coast to south of Sydney); *M. decora* (north of Shoalhaven), frequently with *Parsonsia straminea* climbing on the trunks of canopy species. In the SEC bioregion, *M. ericifolia* may occur as a dominant canopy or sub-canopy species.	Floristic plot analysis completed during late 2022 has identified that there are no parts of the development footprint where *Melaleuca quinquenervia* or *Eucalyptus robusta* are dominant or co-dominant. Some areas, are dominated by other melaleucas, particularly PCT 1716 which is dominated by *Melaleuca nodosa*, however no areas are dominated by *M. dealbata*, *M. biconvexa* or *M. decora*.

Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland - Key Diagnostic Characteristics from DAWE (2021a) Approved Conservation Advice	Consideration
Other tree species may occur in the canopy (or sub-canopy) in some areas, but they are not dominant across a patch, including *Casuarina glauca*, *Banksia* spp., *Callistemon salignus*, *Corymbia intermedia* (Pink Bloodwood), *E. tereticornis*, (Forest Red Gum/Queensland Blue Gum), *E. longifolia* (Woollybutt), *E. botryoides* (Southern Mahogany/Bangalay), *E. ovata* (Swamp Gum), *Livistona australis* and/or *Lophostemon* spp.	PCTs 762, 1618 ad 1716 all contain *Eucalyptus tereticornis*. This species is particularly dominant in PCT 762.
The understorey typically includes a variable ground layer, depending on the canopy cover and inundation rate/period. Tall sedges (typically *Gahnia* spp.) and/or ferns often dominate the ground layer, mixed with graminoids and other herbs, especially *Imperata cylindrica* (Blady Grass)	These understorey conditions met within PCTs 762 1618 ad 1716.
While they can occur regularly in the ground layer, the ecological community is not present if halophytic species, more typically associated with estuarine/saltmarsh areas, dominate the ground layer of a patch, for example, *Appium prostratum*, *Atriplex cinerea*, *Chenopodium glaucum*, *Rhagodia candolleanum* and *Samolus repens*.	Halophytic species were not observed.
Conclusion	**It is noted that in the referral documentation submitted for this project, the potential presence of this EEC was acknowledged. However further site based floristic plot surveys and analysis have confirmed the absence of this EEC and the presence of the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions listed under the EPBC Act.**

Table 4.4 Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions

Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions - Key Diagnostic Characteristics from DCCEEW (2022) Approved Conservation Advice	Consideration
It occurs in the New South Wales North Coast (NNC) and South Eastern Queensland (SEQ) IBRA2 bioregions, and on Curtis Island in the Brigalow Belt North IBRA Bioregion (BBN).	The development footprint occurs within the NSW North Coast bioregion.
It occurs in the catchments of the eastern watershed of the Great Dividing Range, typically in their lower reaches	The development footprint occurs within the catchment of the eastern watershed of the Great Dividing Range.
It occurs at elevations up to 250 m above sea-level (ASL), most typically below 50 m ASL.	The development footprint occurs below 250 m ASL and areas with potential to correspond with this EEC typically occur below 50 m ASL.

Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions - Key Diagnostic Characteristics from DCCEEW (2022) Approved Conservation Advice	Consideration
It occurs on alluvial landforms including river floodplains, riparian zones (e.g., along riverbanks, lake foreshores and creek lines), the floors of tributary gullies, floodplain pockets, alluvial flats, fans, terraces, and localised colluvial fans; as well as on localized depressions amongst low rises and on associated sites where water can pond.	PCTs 762, 1618 and 1716 all occur on alluvial landforms in association with riparian zones or localised depressions where water ponds.
It occurs on alluvial soils of various textures including silts, clay loams, sandy loams, gravel and cobbles	Detailed soil testing has not been undertaken PCTs 762 1618 and 1716.
It does not typically occur on soils that are primarily marine or aeolian sands, but may occur on such substrates after they have been modified by fluvial activity	The development footprint does not contain soils that are marine or aeolian sands.
It occurs as a tall closed-forest, tall open-forest, closed forest, open forest, tall woodland, or woodland (Specht 1970). The canopy has a crown cover of at least 20%	These structural requirements are satisfied for PCTs 7621618 and 1716.
It has a canopy dominated by one or a combination of Angophora, Corymbia, Eucalyptus, Lophostemon and/or Syncarpia tree species, but NOT dominated by *Eucalyptus robusta* (swamp mahogany). Other canopy tree species may be present, and in some areas rainforest trees may be prominent.	This floristic requirement is met for PCT 762 1618 and 1716.
A mid-layer (including a sub-canopy, and/or shrub-layer) may be present, sparse or absent; and fauna may be abundant or rare.	Mid layer presence/absence and fauna abundance was not utilised as a diagnostic tool in this assessment.
Conclusion	**It is considered that PCTs 762, 1618 and 1716 all correspond to the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions EEC listed under the EPBC Act.**

4.3 Threatened Flora Species

No threatened flora species listed under the EPBC Act have been observed within the Development Footprint.

4.4 Threatened Fauna Species

The following EPBC Act-listed threatened species have been recorded in the Development Footprint during the surveys undertaken for this assessment:

- Koala (*Phascolarctos cinereus*) – was recorded in baited remote camera surveys (1 location during 2018 and 2 locations during 2022) and during spotlighting surveys (1 location in 2022) (refer to Figure 5.4 in the BDAR). This species is assessed based on area of suitable habitat and its habitat is associated in the TBDC with all plant community types present.

- South-eastern Glossy Black-Cockatoo (*Calyptorhynchus lathami lathami*) – Evidence of site use for foraging by this species was detected in the form of chewed *Allocasuarina torulosa* seed cones observed during surveys completed in June 2023.
- Grey-headed Flying-fox (*Pteropus poliocephalus*) – was observed foraging within the development footprint during surveys.

No other threatened fauna species listed under the EPBC Act have been observed within the Development Footprint.

5.0 MNES Likelihood of Occurrence

A likelihood of occurrence assessment has been undertaken for Matters of National Environmental Significance in accordance with the rating definitions in **Table 5.1**.

Table 5.2 contains an assessment of the likelihood of occurrence has been completed for threatened species, TECs and wetlands of international importance listed under the EPBC Act, identified from the DCCEEW PMST (DCCEEW 2024a) as well as additional species raised by DCCEEW in their Project Assessment Notes advice.

Migratory species listed under international agreements being the Bonn Convention (Bonn), China-Australia Migratory Bird Agreement (CAMBA), Japan-Australia Migratory Bird Agreement (JAMBA) or Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA) with potential to occur in the Development Footprint have also been identified in Table 5.3 , based on the results of the Protected Matters Search (DAWE 2022a). Species which primarily inhabit marine, pelagic and estuarine environments have been omitted from the assessment due to a lack of suitable habitat. Species listed under the EPBC Act after the decision on the Referral have also been excluded from this list and are not required to be considered.

Those matters assessed as being a medium or high likelihood of occurrence in the Development Footprint are assessed further in **Section 6.0** of this Report. **Figure 5.1** shows the biodiversity MNES that have been recorded in and around the Development Footprint.

Key to abbreviations used:

- VEC – Vulnerable Ecological Community
- EEC – Endangered Ecological Community
- CEEC – Critically Endangered Ecological Community
- V – Vulnerable
- E – Endangered
- CE – Critically Endangered
- C – China-Australia Migratory Bird Agreement (CAMBA)
- J – Japan-Australia Migratory Bird Agreement (JAMBA)
- K – Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)
- B – Bonn Convention.

Table 5.1 Definitions of likelihood of occurrence

Likelihood of Occurrence	Definition
Known	Recent and reliable records of this matter exist within the Development Footprint.
High	Probable that the matter occurs in the Development Footprint, despite lack of records.
Medium	Suitable habitat is present for this matter however records of the matter are not known to occur in the immediate locality of the Development Footprint.
Low	There are no records for this matter, the matter was not recorded during targeted searches, habitat requirements are not met, or the normal distribution range of the matter does not coincide with the Development Footprint locality. Despite this, the matter may be present in rare circumstances.
Not likely	There is no potential for the matter to occur within the locality of the Action.

Table 5.2 MNES Recorded or with Potential to Occur within the Development Footprint

MNES Name	Status		PMST Notes	Likelihood to Occur within the Development Footprint	Assessment of Significance Required?
	BC Act	EPBC Act			
Wetlands of International Importance (Ramsar Wetlands)					
Hunter Estuary Wetlands	-	Ramsar	Ramsar Wetlands - within 10 km of Ramsar site	**Not likely** – Hunter Estuary Wetland Areas occur approximately 15 km to the southwest of the Development Footprint. Disturbances in the Development Footprint (including potential impacts on downstream surface water flows) are not expected to have any direct or indirect impact on the Hunter Estuary Wetlands Ramsar Site.	No
Threatened Ecological Communities					
Central Hunter Valley eucalypt forest and woodland	EEC	CEEC	Community may occur within area	**Not likely** – The Development Footprint does not occur on soils derived from Permian sedimentary rocks (Matthei 1995), therefore does not satisfy a key diagnostic feature of the vegetation community.	No
Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community	EEC	EEC	Community likely to occur within area	**Not likely** – Canopy is not dominated by coastal swamp oak C*asuarina glauca* therefore a key diagnostic feature for the community is not satisfied.	No
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	EEC	EEC	Community known to occur within area	**Not likely** – It is noted that in the referral documentation submitted for this Project, the potential presence of this EEC was acknowledged. However further site based floristic plot surveys and analysis have confirmed the absence of this EEC and the presence of the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions listed under the EPBC Act.	No
Lowland Rainforest of Subtropical Australia	EEC	CEEC	Community likely to occur within area	**Not likely** – The Development Footprint does not occur on hydric soils (Matthei 1995), therefore does not satisfy a key diagnostic feature of the vegetation community. The approved conservation advice (DSEWPaC 2011) stipulates the community is dominated or co-dominated by *Melaleuca quinquenervia* and/or *Eucalyptus robusta,* which is not consistent with the vegetation sampled within the Development Footprint.	No

MNES Name	Status		PMST Notes	Likelihood to Occur within the Development Footprint	Assessment of Significance Required?
	BC Act	EPBC Act			
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	EEC	CECC	Community likely to occur within area	**Not likely** – The Development Footprint does not occur within the Southeast Corner and Sydney Basin IBRA Bioregions, or in eastern Victoria, therefore a key diagnostic feature for the community is not satisfied.	No
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	EEC	EEC	Community likely to occur within area	**Known** – It is considered that PCTs 762 and 1618 all correspond to the EEC within the Development Footprint.	**Yes**
Threatened Flora Species					
Charmhaven Apple *Angophora inopina*	V	V	Species or species habitat known to occur within area	**Low** – This highly detectable species was not recorded within the Development Footprint despite targeted floristic surveys. Two non-contemporary records occur within the locality; the first record is situated approximately 2.3 km to the north east of the Development Footprint within Wallaroo State Forest (2000), the second record is situated approximately 4.8 km east of the Development Footprint within Wallaroo National Park (1999).	No
Hairy-joint Grass *Arthraxon hispidus*	V	V	Species may occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Trailing Woodruff *Asperula asthenes*	V	V	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Thick-lipped Spider-orchid *Caladenia tessellata*	E	V	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Dwarf Kerrawang *Commersonia prostrata*	E	E	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No

MNES Name	Status		PMST Notes	Likelihood to Occur within the Development Footprint	Assessment of Significance Required?
	BC Act	EPBC Act			
Leafless Tongue-orchid *Cryptostylis hunteriana*	V	V	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
White-flowered Wax Plant *Cynanchum elegans*	E	E	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Bluegrass *Dichanthium setosum*	V	V	Species likely to occur in buffer area only	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Newcastle Doubletail *Diuris praecox*	V	V	Species likely to occur in buffer area only	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Slaty Red Gum *Eucalyptus glaucina*	V	V	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Camfield's Stringybark *Eucalyptus camfieldii*	V	V	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Earp's Gum *Eucalyptus parramattensis* subsp. *decadens*	V	V	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Euphrasia arguta	CE	CE	Species may occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No

MNES Name	Status		PMST Notes	Likelihood to Occur within the Development Footprint	Assessment of Significance Required?
	BC Act	EPBC Act			
Small-flower Grevillea *Grevillea parviflora subsp. parviflora*	V	V	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint despite targeted floristic surveys. BioNet Atlas records show six occurrence records within the Project locality. The most proximate record (2006) is located 600 m southeast of the Development Footprint in the southern bounds of Wallaroo State Forest. The remaining records are gathered near the Pacific Highway, Karuah (Eagleton), all of which were obtained in 2005 and 2006.	No
Biconvex Paperbark *Melaleuca biconvexa*	V	V	Species may occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Knotweed *Persicaria elatior*	V	V	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
a leek-orchid *Prasophyllum* sp. Wybong (C.Phelps ORG 5269)	-	CE	Species may occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Eastern Underground Orchid *Rhizanthella slateri*	V	E	Species may occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Scrub Turpentine *Rhodamnia rubescens*	CE	CE	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no contemporary BioNet Atlas records situated within the Development Footprint or locality.	No
Native Guava *Rhodomyrtus psidioides*	CE	CE	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There is a single BioNet Atlas record (2006) within the locality, approximately 1.5 km northwest of the Development Footprint along Italia Road.	No
Magenta Lilly Pilly *Syzygium paniculatum*	E	V	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No

MNES Name	Status		PMST Notes	Likelihood to Occur within the Development Footprint	Assessment of Significance Required?
	BC Act	EPBC Act			
Black-eyed Susan *Tetratheca juncea*	V	V	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint despite targeted floristic surveys. BioNet Atlas results show no contemporary occurrence records within the locality.	No
Austral Toadflax *Thesium australe*	V	V	Species may occur in buffer area only	**Low** – Species not recorded within the Development Footprint during floristic surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Threatened Fauna Species					
Regent Honeyeater *Anthochaera phrygia*	CE	CE	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint or the surrounds during surveys. Important Areas for the Regent Honeyeater mapped under the BAM do not occur on or near the Development Footprint.	No
Australasian Bittern *Botaurus poiciloptilus*	E	E	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no contemporary BioNet Atlas records situated within the Development Footprint or locality.	No
Gang-gang Cockatoo *Callocephalon fimbriatum*	V	E	DCCEEW controlled action decision	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
South-eastern Glossy Black Cockatoo *Calyptorhynchus lathami lathami*	V	E	DCCEEW controlled action decision	**High** – Suitable habitat is present and signs of site use for foraging were observed during surveys.	Yes
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Species or species habitat known to occur within area	**Medium** – No breeding habitat occurs on the site. Balickera Tunnel occurs to the south of the Development Footprint and is known as a roost site for some threatened bat species, however the large-eared pied bat has not been recorded roosting in this location (Eco Logical 2021). The species has been previously recorded foraging in adjacent habitats near the Eagleton Quarry approximately 1.3 km to the south of the Development Footprint, however was not observed during targeted surveys for this Project.	Yes

MNES Name	Status		PMST Notes	Likelihood to Occur within the Development Footprint	Assessment of Significance Required?
	BC Act	EPBC Act			
Spotted-tailed Quoll (south-eastern mainland population) *Dasyurus maculatus maculatus*	V	E	Species or species habitat known to occur within area	**High** – Species not recorded within the Development Footprint during surveys, however several records occur throughout the locality including within Wallaroo State Forest, 400 m from the Development Footprint. The exact dates of these sightings are not specified, though the most recent record appears to be from 2004. Across the wider area the species has been captured north of the Development Footprint within Wallaroo National Park in addition to several records along the Bucketts Way (10 km from the Development Footprint).	**Yes**
Red Goshawk *Erythrotriorchis radiatus*	CE	V	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Grey Falcon *Falco hypoleucos*	E	V	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Painted Honeyeater *Grantiella picta*	V	V	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
White-throated Needletail *Hirundapus caudacutus*	-	V	Species or species habitat known to occur within area	**High**– Species not recorded within the Development Footprint during surveys. However, there are several species records (11) within the locality, though no records directly within the Development Footprint. This species is almost exclusively aerial recorded, most often above wooded areas (TSSC 2019) which occur within the Development Footprint.	Yes
Swift Parrot *Lathamus discolor*	E	CE	Species or species habitat known to occur within area	**High** – Species not recorded within the Development Footprint or the surrounds during surveys. However, the species has been recently (2020) recorded in the locality. The most recent sighting was in the eastern extent of Wallaroo National Park, approximately 4.9 km from the Development Footprint. Mapped Swift Parrot Important Habitat Areas under the BAM, do not occur on or near the Development Footprint.	Yes

MNES Name	Status		PMST Notes	Likelihood to Occur within the Development Footprint	Assessment of Significance Required?
	BC Act	EPBC Act			
Green and Golden Bell Frog *Litoria aurea*	E	V	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Stuttering Frog *Mixophyes balbus*	E	V	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Giant Barred Frog *Mixophyes iteratus*	E	V	Species may occur in buffer area only	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Parma Wallaby *Notamacropus parma*	V	V	Species or species habitat may occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	**No**
Koala *Phascolarctos cinereus*	V	E	Species or species habitat known to occur within area	**Recorded** – Species recorded within the Development Footprint during targeted surveys.	**Yes**
Yellow-bellied Glider (south-eastern) *Petaurus australis australis*	V	V	Species or species habitat known to occur within area	**Medium** – Species not recorded within the Development Footprint during surveys. There is a single occurrence record from 2005 located 1.1 km to the southwest of the Development Footprint. DCCEEW stated in their controlled action decision that this species may be significantly impacted by the Project. As such an Assessment of Significance has been prepared to address this species.	**Yes**
Long-nosed Potoroo (northern) *Potorous tridactylus tridactylus*	V	V	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No

MNES Name	Status		PMST Notes	Likelihood to Occur within the Development Footprint	Assessment of Significance Required?
	BC Act	EPBC Act			
Brush-tailed Rock-wallaby *Petrogale penicillata*	E	V	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality (NSW DPE 2024). Species habitat includes rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or clifflines which are not present within the Development Footprint.	No
Greater Glider *Petauroides volans*	-	V	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint or the surrounds during surveys and not likely to occur based on known distribution in contiguous eucalypt forests at higher elevations.	No
New Holland Mouse *Pseudomys novaehollandiae*	-	V	Species or species habitat known to occur within area	**Medium** – Species not recorded within the Development Footprint during surveys. There are six species records within the locality. These records are situated to the west of Wallaroo State Forest, and north of the Development Footprint, northwest of Wallaroo National Park. The most recent records are dated 2018, with the species recorded alongside the southern extent of Italia Road approximately 3.1 km from the Development Footprint. DCCEEW stated in their controlled action decision that this species may be significantly impacted by the Project. As such an Assessment of Significance has been prepared to address this species. Included as a precaution only as this species was included in the BAM-C automatically populated list. This species is not associated with any PCTs within the Development Footprint.	Yes
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Roosting known to occur within area	**Known**– Species recorded within the Development Footprint during nocturnal spotlighting surveys. No active camps were identified during any Umwelt survey period, however a flying-fox camp has been identified in proximity to the Development Footprint on the DAWE website (DCCEEW 2024b). Given the proximity of this record to the Development Footprint, it is recommended that further investigation be undertaken.	**Yes**

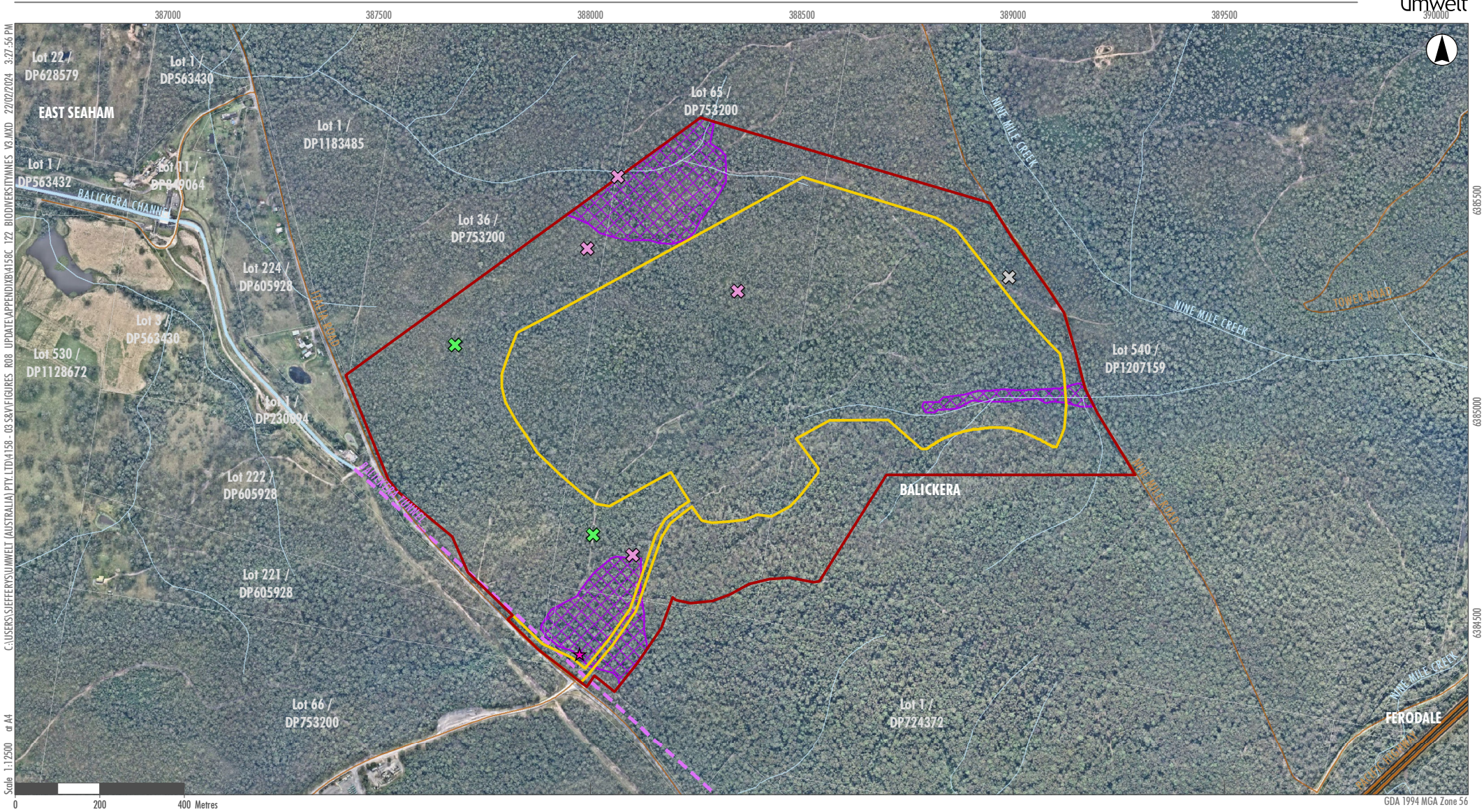
MNES Name	Status		PMST Notes	Likelihood to Occur within the Development Footprint	Assessment of Significance Required?
	BC Act	EPBC Act			
Pilotbird *Pycnoptilus floccosus*	-	V	Species may occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Australian Painted Snipe *Rostratula australis*	E	E	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Mahony's Toadlet *Uperoleia mahonyi*	E	E	Species likely to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No

Table 5.3 Migratory Species Recorded or with Potential to Occur within the Development Footprint

Species Name	EPBC – International Convention	PMST Notes	Likelihood to Occur within Development Footprint	Assessment of Significance
Fork-tailed Swift *Apus pacificus*	C, J, R	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Oriental Cuckoo *Cuculus optatus*	C, J, R	Species or species habitat may occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Latham's Snipe *Gallinago hardwickii*	B, J, R	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There is a single record from 2020 situated west of the Development Footprint along Balickera Canal near Italia Road. The Development Footprint does not contain any suitable habitat for the species, i.e. permanent or ephemeral wetlands, therefore it is considered not likely that the species would occur within the Development Footprint.	No

Species Name	EPBC – International Convention	PMST Notes	Likelihood to Occur within Development Footprint	Assessment of Significance
White-throated Needletail *Hirundapus caudacutus*	V – C, J, R	Species or species habitat known to occur within area	**High** – Species not recorded within the Development Footprint during surveys. However, there are several species records (11) within the locality, though no records directly within the Development Footprint. This species is almost exclusively aerial recorded, most often above wooded areas (TSSC 2019) which occur in the Development Footprint.	Yes / assessment completed under the vulnerable species criteria
Black-faced Monarch *Monarcha melanopsis*	B	Species or species habitat known to occur within area	**High** – Species not recorded within the Development Footprint during surveys. The species has been recorded in the locality on five occasions however, these records are non-contemporary i.e. not occurring after 1999. Suitable habitat for the species may remain within the Development Footprint and surrounds. The species is known to mainly inhabit rainforest communities (not present), though is sometimes found in nearby open eucalypt forests especially in gullies with a dense, shrubby understorey as well as in dry sclerophyll forests and woodlands, often with a patchy understorey (present) (DEH 2006a).	Yes
Yellow Wagtail *Motacilla flava*	C, J, R	Species or species habitat likely to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Satin Flycatcher *Myiagra cyanoleuca*	B	Species or species habitat known to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No
Osprey *Pandion haliaetus*	B	Species or species habitat likely to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality. Species is not likely to occur based on known distribution in mainly coastal and wetland environments and lack of suitable habitat.	No

Species Name	EPBC – International Convention	PMST Notes	Likelihood to Occur within Development Footprint	Assessment of Significance
Rufous Fantail *Rhipidura rufifrons*	B	Species or species habitat known to occur within area	**High** – Species recorded within the Development Footprint during surveys and also recorded in the locality in eight locations, with the most recent recording from 2013 located along Barleigh Ranch Way, Eagleton NSW, approximately 1.4 km southwest of the Development Footprint. Although the remaining records are non-contemporary (i.e. not within the last 10 years) it is acknowledged that suitable habitat occurs throughout the Development Footprint. In its east and south-east Australian distributions, the species inhabits wet sclerophyll forests, often in gullies dominated by eucalypts with a dense understorey (DEH 2006b).	**Yes**
Spectacled Monarch *Symposiachrus trivirgatus*	B	Species or species habitat likely to occur within area	**Low** – Species not recorded within the Development Footprint during surveys. There are no BioNet Atlas records situated within the Development Footprint or locality.	No



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Pacific Highway
- Road
- Balickera Tunnel
- Drainage Line

Vulnerable EPBC Act

- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- South-eastern Glossy Black-Cockatoo (*Calyptorhynchus lathami lathami*)

Endangered EPBC Act

- Koala (*Phascolarctos cinereus*)

Migratory EPBC Act

- Rufous Fantail (*Rhipidura rufifrons*)

EPBC TEC

- Subtropical eucalpyt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions

FIGURE 5.1

Biodiversity MNES Observed within the Project Area

Image Source: Nearmap (2022) Data source: NSW FSDF (2022), Umwelt (2023)

6.0 Assessment of Impacts on MNES

6.1 Direct Project Impacts

The Project will result in direct impacts on biodiversity values within the Development Footprint. Direct impacts include the loss of native vegetation and fauna habitats as a result of clearing works for surface infrastructure in the quarry footprints as shown in Figure 1.3 of the BDAR. For impact assessment purposes, it is assumed that all vegetation within the 68.02 ha Development Footprint will be removed.

Direct Impacts associated with the Project will result in the following impacts on MNES:

- Disturbance to a total of **68.02 hectares** of native vegetation that comprise potential habitat for MNES of which all areas are woodland/forest habitat.
- Disturbance to 1.21 hectares of Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions EEC which corresponds to PCT 762 and PCT 1618 within the development footprint.

6.2 Indirect Project Impacts

The Project is not expected to result in substantial indirect impacts or edge effects on the biodiversity values of surrounding lands, however it is acknowledged that some indirect impacts and edge effects associated with increased site occupation, connectivity and corridors, fugitive light emissions, dust, noise, vibrations, water, weeds and feral animals, security fencing, and increased vehicle movements may occur during the construction and operational phases. This is further discussed in the sections below.

6.2.1 Increased Site Occupation

Increased site occupation is anticipated to occur during the construction and operation phases of the Project. This indirect impact is considered likely to occur, with consequences likely to include reduction in habitat suitability for threatened fauna in adjoining areas.

6.2.2 Impacts on Connectivity

The Project is situated in a contiguous patch within the Wallaroo State Forest which adjoins several other areas managed for conservation include the Wallaroo National Park, Karuah National Park and Medowie State Conservation Area. Given the extent of forested areas surrounding the Development Footprint, the removal of vegetation is not likely to largely impact dispersal, migration and movement ability of fauna species across the wider landscape.

This indirect impact will occur during the staged construction, operation and once decommissioned, with consequences including reduced wildlife connectivity. Wildlife connectivity will however be maintained through retention of suitable corridor areas. Furthermore, in the long term, most of the Development Footprint will be rehabilitated with native vegetation communities that will reinstate the connectivity currently present.

6.2.3 Fugitive Light Emissions on Adjacent Habitat

Fugitive light emissions resulting from the construction and operation of the Project may result in adverse impacts on adjacent habitats and fauna species, particularly birds and bats. Potential impacts may include:

- a reduction in the navigational signal ability for some nocturnal animals
- delaying bats from emerging from roost access points and shortening the amount of time available to them for foraging.

Appropriate lighting controls to minimise impacts will be implemented as part of the Project as necessary (providing that these actions do not compromise site safety issues).

6.2.4 Noise Impacts on Adjacent Habitats

Construction and operational noise impacts have the potential to adversely impact native species. Potential impacts include:

- noise disturbing the roosting and foraging behaviour of fauna species
- noise reducing the occupancy of areas of suitable habitat.

Noise mitigation measures to minimise noise impacts will be implemented as part of the Project.

6.2.5 Dust Impacts on Adjacent Habitats

Construction and operational dust impacts have the potential to adversely impact native species during ground disturbing works, including site clearing, blasting and as a result of vehicle movements. Potential impacts include dust covering vegetation thereby potentially reducing vegetation health, growth and suitability as fauna habitat.

The design of the Project will include measures to minimise the potential for adverse dust impacts. These include:

- progressive rehabilitation and stabilisation of disturbed land
- dust suppression to reduce vehicle-generated dust emissions.

6.2.6 Vibration Impacts

Eco Logical Australia (2021) have identified that the Balickera tunnel provides habitat for microbat species, but none of which are EPBC Act listed.

It is considered that there is potential that vibration from blasting and heavy vehicle traffic may disrupt microbat roosting behaviour in the Balickera Tunnel, however the impacts of blasting on the tunnel structure have been assessed as low in the Blasting Impact Assessment, provided as Appendix 8 of EIS.

The vibration impacts are considered to have a potential to occur during the operational phase of the Project. The Blasting Impact Assessments (Enviro Strata Consulting P/L 2024) identified that no damage to the tunnel structure would result. Infrequent impacts at the highest predicted levels of 27mm/s are only expected to induce falling of accumulated dust to the floor and potentially displace small loose pieces of rock. It is considered that vibration associated with the Project is not likely to impact MNES.

6.2.7 Water Impacts

Impacts to water are considered likely to occur during construction and operation as well as ongoing following decommissioning. Water impacts from the Project are likely to include loss of existing first and second order ephemeral watercourses within the site and altered hydrology and potential sedimentation of downstream environments.

Potential impacts associated with surface water are to be managed through appropriate erosion and sediment controls and retention and treatment of runoff and intercepted water. Impacts to water quality in the downstream environment are predicted to satisfy the 'neutral or Beneficial Effect' (NorBE) requirements applicable to developments within the Grahamstown Dam catchment under NSW legislation.

6.2.8 Weed and Feral Animal Encroachment

Weed species could be inadvertently brought into the Development Footprint with imported materials or could invade into other areas naturally through removal of native vegetation. The invasion of weed species is considered a possible impact of the construction and operation of the Project as well as ongoing once decommissioned. The presence of weed species within the Development Footprint encroaching into other land has the potential to decrease the value of extant vegetation to native species, including threatened species. Mitigation measures outlined in **Section 7.2** will be implemented to minimise the potential for weed encroachment into areas surrounding the Development Footprint.

Populations of feral fauna species such as foxes, rabbits, pigs, dogs and cats can increase and quickly populate new areas without programs in place. Feral animals are already present within the development footprint. The operation and construction of the Project is considered to have a low potential for increased impacts to occur during the. Consequences of feral animal encroachment could result in a reduced habitat suitability and predation, grazing and/or trampling of threatened species. Mitigation measures outlined in **Section 7.2** will minimise the potential for feral animal spread and impacts into surrounding areas around the Development Footprints.

6.2.9 Security Fencing

Security fencing is likely to be erected during the construction and operational phases of the Project. The proposed haul road will not be fenced to limit impacts to wildlife connectivity.

6.2.10 Increase Vehicle Movements

The Project will result in the increased movement of light and heavy vehicles traveling along Italia Road, Balickera NSW, as well as some minor adjoining roads. Mortality by vehicle strike is a significant threat to Koalas and is particularly prevalent along transportation routes which occur in proximity to Koala habitat (DAWE 2022d). The potential for Koala mortalities resulting from vehicle strikes because of the Project is considered to be low and will be mitigated through implementation of a driver code of conduct which will include a reduced speed limit for trucks travelling to and from the quarry and limitation of operations to daylight hours. **Section 7.2** documents the traffic control mitigation measures proposed to minimise potential mortality by vehicle strikes.

6.3 Assessments of Significance Summary for MNES

Assessments of significance were prepared for those species identified in **Table 5.2** as present or considered to have a medium to high potential to occur within the Development Footprint, and therefore with potential to be impacted. The Commonwealth SEARs provided by DCCEEW also listed seven nationally listed threatened species (refer to **Section 1.0**) that they considered important to include in the Assessment of Significance, and these species are all considered to have a medium or higher probability of occurring within the Development Footprint and have been assessed further. There is also one endangered ecological community, Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions, listed under the EPBC Act which is considered to be present and has been assessed. These assessments of significance are provided in **Appendix B** of this Report.

The following **Table 6.1** provides a summary of the nature and quantum of impacts on the MNES considered in the Assessments of Significance.

Table 6.1 Summary of Impact Assessment for MNES

EPBC Act Entity	EPBC Act Status	Nature & Consequence of impact (direct and indirect)	Duration of impact (e.g. construction operation, life of project)	Quantum of impact	Consequence of impact at local, state and national scale	Level of impact (is an offset required?)
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	Endangered Ecological Community	**Direct Impacts:** Habitat removal within Development Footprint. **Indirect Impacts:** Fragmentation of south-western patch by access road. Project also has potential to result in reduction in quality of retained areas directly adjoining the Development Footprint due to light spill, operations noise and vibration, weed invasion and some limited and managed water and air quality impacts.	Permanent	1.21 ha of suitable habitat	Entity assessed as potentially significantly impacted under the EPBC Act. Impact is likely to be of local significance but not likely to be of consequence at regional or national scales.	Ecosystem credits using the like for like rules are required for this entity under the BAM for the residual impacts associated with the Project, the offset will consist of 47 credits, including 13 credits for PCT 762 and 34 credits for PCT 1618.
South-eastern Glossy Black Cockatoo *Calyptorhynchus lathami lathami*	Endangered	**Direct Impacts:** Clearing of suitable foraging habitat within the Development Footprint. **Indirect Impacts:** Reduced habitat suitability for directly adjoining retained areas associated with site occupation, light spill, operations noise, blasting and vibration, weed invasion and limited water and air quality impacts.	Direct impacts will be permanent, indirect impacts will be for the life of the Project.	68.02 ha of suitable foraging habitat	Entity assessed as not significantly impacted under the EPBC Act. Loss of local foraging habitat will occur, however impacts are not likely to be of significant consequence at the state or national scale.	Species credits are not required because no breeding habitat was observed. Ecosystem credits are required for foraging habitat associated with this species under the BAM. A total of 1902 ecosystem credits are required for the project including 13 credits for PCT 762, 1092 credits for PCT 1590, 34 credits for PCT 1618 and 763 credits for PCT 1619.

EPBC Act Entity	EPBC Act Status	Nature & Consequence of impact (direct and indirect)	Duration of impact (e.g. construction operation, life of project)	Quantum of impact	Consequence of impact at local, state and national scale	Level of impact (is an offset required?)
Large-eared Pied Bat *Chalinolobus dwyeri*	Vulnerable	Species not detected during surveys **Potential direct Impacts:** Clearing of suitable foraging habitat within the Development Footprint. **Potential Indirect Impacts:** Reduced habitat suitability for directly adjoining retained areas associated with site occupation, light spill, operations noise, blasting and vibration, weed invasion and limited water and air quality impacts.	Potential direct impacts will be permanent, indirect impacts will be for the life of the Project.	Species not detected during surveys. Extent of suitable habitat impacted is 68.02 ha.	Entity assessed as not significantly impacted under the EPBC Act. Impact is not likely to be of significant consequence at local, regional or national scales.	Under the NSW BAM, the Large-eared Pied-bat is a full species credit entity. This species was surveyed for and no records were found, therefore no species credits were generated. No offsetting through species credits are required.
Spotted-tailed Quoll (southeastern mainland population) *Dasyurus maculatus maculatus*	Endangered	**Direct Impacts:** Clearing of suitable foraging habitat within the Development Footprint. **Indirect Impacts:** Reduced habitat suitability for directly adjoining retained areas associated with site occupation, light spill, operations noise, blasting and vibration, weed invasion and limited water and air quality impacts.	Direct impacts will be permanent, indirect impacts will be for the life of the Project.	68.02 ha of suitable habitat	Entity assessed as not significantly impacted under the EPBC Act. Loss of suitable habitat will occur at local scale, however impacts are not likely to be of significant consequence at the state or national scale.	Ecosystem credits are required for ecosystem credit entities under the BAM. A total of 1902 ecosystem credits are required for the project including 13 credits for PCT 762, 1092 credits for PCT 1590, 34 credits for PCT 1618 and 763 credits for PCT 1619.

EPBC Act Entity	EPBC Act Status	Nature & Consequence of impact (direct and indirect)	Duration of impact (e.g. construction operation, life of project)	Quantum of impact	Consequence of impact at local, state and national scale	Level of impact (is an offset required?)
White-throated Needletail *Hirundapus caudacutus*	Vulnerable / Migratory	**Direct Impacts:** Clearing of suitable foraging habitat within the Development Footprint. **Indirect Impacts:** Reduced habitat suitability for directly adjoining retained areas associated with site occupation, light spill, operations noise, blasting and vibration, weed invasion and limited water and air quality impacts.	Direct impacts will be permanent, indirect impacts will be for the life of the Project.	68.02 ha of suitable foraging habitat	Entity assessed as not significantly impacted under the EPBC Act. Loss of suitable habitat will occur at local scale, however impacts are not likely to be of significant consequence at the state or national scale.	Ecosystem credits are required for ecosystem credit entities under the BAM. A total of 1902 ecosystem credits are required for the project including 13 credits for PCT 762, 1092 credits for PCT 1590, 34 credits for PCT 1618 and 763 credits for PCT 1619.
Swift Parrot *Lathamus discolor*	Critically Endangered	**Direct Impacts:** Clearing of suitable foraging habitat within the Development Footprint. **Indirect Impacts:** Reduced habitat suitability for directly adjoining retained areas associated with site occupation, light spill, operations noise, blasting and vibration, weed invasion and limited water and air quality impacts.	Direct impacts will be permanent, indirect impacts will be for the life of the Project.	68.02 ha of suitable foraging habitat	Entity assessed as not significantly impacted under the EPBC Act. Loss of suitable habitat will occur at local scale, however impacts are not likely to be of significant consequence at the state or national scale.	No mapped important habitat is present and species credits are not required. Ecosystem credits are required for the foraging habitat associated with this species under the BAM. A total of 1902 ecosystem credits are required for the project including 13 credits for PCT 762, 1092 credits for PCT 1590, 34 credits for PCT 1618 and 763 credits for PCT 1619.

EPBC Act Entity	EPBC Act Status	Nature & Consequence of impact (direct and indirect)	Duration of impact (e.g. construction operation, life of project)	Quantum of impact	Consequence of impact at local, state and national scale	Level of impact (is an offset required?)
Yellow-bellied Glider (south-eastern) *Petaurus australis australis*	Vulnerable	**Direct Impacts:** Clearing of suitable foraging habitat within the Development Footprint. **Indirect Impacts:** Reduced habitat suitability for directly adjoining retained areas associated with site occupation, light spill, operations noise, blasting and vibration, weed invasion and limited water and air quality impacts.	Direct impacts will be permanent, indirect impacts will be for the life of the Project.	68.02 ha of suitable habitat	Entity assessed as not significantly impacted under the EPBC Act. Loss of suitable habitat will occur at local scale, however impacts are not likely to be of significant consequence at the state or national scale.	Ecosystem credits are required for ecosystem credit entities under the BAM. A total of 1902 ecosystem credits are required for the project including 13 credits for PCT 762, 1092 credits for PCT 1590, 34 credits for PCT 1618 and 763 credits for PCT 1619.
Koala *Phascolarctos cinereus*	Endangered	**Direct Impacts:** Clearing of suitable foraging habitat within the Development Footprint. **Indirect Impacts:** Reduced habitat suitability for directly adjoining retained areas associated with site occupation, light spill, operations noise, blasting and vibration, weed invasion and limited water and air quality impacts.	Direct impacts will be permanent, indirect impacts will be for the life of the Project.	68.02 ha of suitable habitat	Entity assessed as significantly impacted under the EPBC Act. Impact is likely to be significant at the local and state level but unlikely to be of significant consequence at the national scale.	Species observed during surveys and assessed as a species credit entity under the BAM. Impacts to species will be offset through retirement of 2519 species credits, following like-for-like offsetting rules.

EPBC Act Entity	EPBC Act Status	Nature & Consequence of impact (direct and indirect)	Duration of impact (e.g. construction operation, life of project)	Quantum of impact	Consequence of impact at local, state and national scale	Level of impact (is an offset required?)
Grey-headed Flying-fox *Pteropus poliocephalus*	Vulnerable	**Direct Impacts:** Clearing of suitable foraging habitat within the Development Footprint. **Indirect Impacts:** Reduced habitat suitability for directly adjoining retained areas associated with site occupation, light spill, operations noise, blasting and vibration, weed invasion and limited water and air quality impacts.	Direct impacts will be permanent, indirect impacts will be for the life of the Project.	68.02 ha of known foraging habitat	Entity determined to be significantly impacted under the EPBC Act. Impact is likely to be of significance at the local, state and national scale as the species is considered to form a single national population.	Ecosystem credits are required for ecosystem credit entities under the BAM. A total of 1902 ecosystem credits are required for the project including 13 credits for PCT 762, 1092 credits for PCT 1590, 34 credits for PCT 1618 and 763 credits for PCT 1619.
New Holland Mouse *Pseudomys novaehollandiae*	Vulnerable	**Direct Impacts:** Clearing of suitable foraging habitat within the Development Footprint. **Indirect Impacts:** Reduced habitat suitability for directly adjoining retained areas associated with site occupation, light spill, operations noise, blasting and vibration, weed invasion and limited water and air quality impacts.	Direct impacts will be permanent, indirect impacts will be for the life of the Project.	68.02 ha of suitable foraging habitat	Entity assessed as not significantly impacted under the EPBC Act. Loss of suitable habitat will occur at local scale, however impacts are not likely to be of significant consequence at the state or national scale.	Ecosystem credits are required for ecosystem credit entities under the BAM. A total of 1902 ecosystem credits are required for the project including 13 credits for PCT 762, 1092 credits for PCT 1590, 34 credits for PCT 1618 and 763 credits for PCT 1619.

EPBC Act Entity	EPBC Act Status	Nature & Consequence of impact (direct and indirect)	Duration of impact (e.g. construction operation, life of project)	Quantum of impact	Consequence of impact at local, state and national scale	Level of impact (is an offset required?)
Rufous Fantail *Rhipidura rufifrons*	Migratory	**Direct Impacts:** Clearing of suitable foraging habitat within the Development Footprint. **Indirect Impacts:** Reduced habitat suitability for directly adjoining retained areas associated with site occupation, light spill, operations noise, blasting and vibration, weed invasion and limited water and air quality impacts.	Direct impacts will be permanent, indirect impacts will be for the life of the Project.	1.21 ha of suitable foraging habitat (PCTs 762 and 1618).	Entity assessed as not significantly impacted under the EPBC Act. Loss of suitable habitat will occur at local scale, however impacts are not likely to be of significant consequence at the state or national scale.	Species not observed during surveys and non-significant impact predicted. No offset required under EPBC Act. Impacts to species habitats will be indirectly offset through retirement of ecosystem credits.
Black-faced Monarch *Monarcha melanopsis*	Migratory	**Direct Impacts:** Clearing of suitable foraging habitat within the Development Footprint. **Indirect Impacts:** Reduced habitat suitability for directly adjoining retained areas associated with site occupation, light spill, operations noise, blasting and vibration, weed invasion and limited water and air quality impacts.	Direct impacts will be permanent, indirect impacts will be for the life of the Project.	1.21 ha of suitable foraging habitat (PCTs 762 and 1618).	Entity assessed as not significantly impacted under the EPBC Act. Loss of suitable habitat will occur at local scale, however impacts are not likely to be of significant consequence at the state or national scale.	Species not observed during surveys and non-significant impact predicted. No offset required under EPBC Act. Impacts to species habitats will be indirectly offset through retirement of ecosystem credits.

6.4 Assessment of 2019–2020 Bushfires

An assessment of the of the impacts of the 2019–2020 bushfires on EPBC Act listed threatened species and communities present or with a medium or greater potential to occur is provided in **Table 6.2**.
This assessment provides information on whether the habitat within the development footprint is of greater importance to the survival of the listed threatened species MNES following the 2019/2020 fires.

Table 6.2 Assessment of the 2019–2020 Bushfires on Threatened Species and Ecological Communities

Species Name	Listing Status		Assessment of the 2019–2020 Bushfires
	BC Act	EPBC Act	
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	E	E	• The development footprint was not burnt in the 2019–2020 bushfires, however was burnt in 2016 shortly prior to the 2019–2020 fire event. • Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, but may occur elsewhere in this bioregion. • Mega-fires, such as those experienced in the 2019–2020 fire season, can burn a significant proportion of an ecological community and the surrounding vegetation in a single event, which compounds these detrimental impacts. • It is estimated that the current extent of the ecological community as 277,000 ha; with an estimated 70% reduction from its original extent (of 937,000 ha, prior to European settlement). According to the Conservation Advice for the community (DCCEEW 2022a) almost 15% of the ecological community was burnt in 2019–20, based on the Australian Google Earth Engine Burnt Area Map (DAWE 2020). • The development footprint, including the 1.21 ha of Subtropical eucalypt floodplain forest and woodland, expected to be impacted by the Project was not burnt in the 2019–2020 bushfires. The Project Area was burnt in 2016.
South-eastern Glossy Black Cockatoo *Calyptorhynchus lathami lathami*	V	V	• The Project Area was not burnt in the 2019–2020 bushfires. • The approved conservation advice for this species identifies that a large proportion of this species range was affected by the 2019–2020 bushfires, including 10% burnt in high to very high severity fire, and a further 15% burnt in low to moderate severity fire. • This species was not recorded within the Project Area during surveys.

Species Name	Listing Status		Assessment of the 2019–2020 Bushfires
	BC Act	EPBC Act	
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	• The Project Area was not burnt in the 2019–2020 bushfires. • The Conservation Advice for this species estimates that 26.6% of the species habitat occurs within areas affected by the 2019–2020 wildfires (DAWE 2021b). The impact of these fires is yet to be thoroughly assessed. Individuals congregate to roost and raise young which places a reasonable proportion of a local population at a single locality. Most known cave roosts are in shallow caves or in the outer reaches of deeper mines or caves. As such, individuals are potentially susceptible to direct mortality from heat and smoke from fires. Mortality can be expected to be higher during high intensity fires or where fires occur on a regular basis. Mortality is potentially higher for creched young unable to escape smoke as adults may be able to. The longer-term impacts of fire frequency and intensity on the Large-eared Pied Bat are unknown. • This species was not recorded within the Project Area during surveys.
Spotted-tailed Quoll (southeastern mainland population) *Dasyurus maculatus maculatus*	V	E	• The Project Area was not burnt in the 2019–2020 bushfires. • It is considered that a large proportion of the suitable habitat for this species within NSW was burnt during the 2019–2020 bushfires, with Conservation Advice (Threatened Species Scientific Committee 2020) identifying that 29 percent of the Spotted-tailed Quoll's distribution range overlaps with the fire-affected extent. The listing status of this species under the EPBC Act was subsequently upgraded to endangered following this fire event. • This species was not recorded within the Project Area during surveys.
White-throated Needletail *Hirundapus caudacutus*	-	V / Migratory	• The Project Area was not burnt in the 2019–2020 bushfires. • There is currently no data surrounding the impacts of the 2019–2020 bushfires on this species. • This species was not recorded within the Project Area during surveys.
Swift Parrot *Lathamus discolor*	E	CE	• The Project Area was not burnt in the 2019–2020 bushfires. • The 2019/20 mega fire event that impacted the east coast of Australia represent a significant pulse impact on the quality of the habitat for the Swift Parrot. The Draft National Recovery Plan estimates that between 10-30 percent of the distribution range of the Swift Parrot was impacted to some extent, with increasing likelihood of future similar fire events as a result of climate change (DAWE 2021a). • This species was not recorded within the Project Area during surveys.

Species Name	Listing Status		Assessment of the 2019–2020 Bushfires
	BC Act	EPBC Act	
Yellow-bellied Glider (south-eastern) *Petaurus australis australis*	V	V	• The Project Area was not burnt in the 2019–2020 bushfires and this species was not observed within the Project Area during surveys. • The Conservation Advice for this species estimates that 41% of this species distribution was burnt by the 2019–2020 bushfires and was one of the reasons for the listing for this species under the EPBC Act. • This species was not recorded within the Project Area during surveys.
Koala *Phascolarctos cinereus*	E	E	• The Project Area was not burnt in the 2019–2020 bushfires. • The National Recovery Plan for the Koala (DAWE 2022b) identifies that the 2019–2020 bushfires killed, injured or affected an estimated 61,000 Koalas and burnt 3,659,625 ha (9%) of the area within which the listed Koala and its habitat are known or likely to occur. The listing status of this species under the EPBC Act was subsequently upgraded to endangered following this fire event. • This species was recorded within the Development Footprint during surveys.
New Holland Mouse *Pseudomys novaehollandiae*	-	V	• The Project Area was not burnt in the 2019–2020 bushfires. • The 2019/2020 catastrophic bushfires impacted a large area of eastern Australia with varying severity. It was estimated that over 45% of this species distribution was burnt, with a third of this area burning with high severity (DCCEEW 2024c). The New Holland Mouse is thought to shelter in burrows during fires and is a species which favours early to mid stages of vegetation succession three to five years after fire. • This species was not recorded within the Project Area during surveys.
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	• The Project Area was not burnt in the 2019–2020 bushfires. • The National Recovery Plan for this species (DAWE 2021c) identifies that although several of the impacts have not been quantified, preliminary analysis indicates that the associated impact of the fires on this species are likely to be significant in relation to foraging habitat, but only minor in relation to impacts at camp sites. • This species was observed foraging within the subject land during surveys. The National Flying Fox Monitoring Viewer (DCCEEW 2024b) identifies that there is a historical camp site within the Wallaroo State Forest within the vicinity of the subject land, however no Flying-foxes have been observed there for >10 years. The nearest active camp sites are at Moffatts Swamp and Tocal.

Species Name	Listing Status		Assessment of the 2019–2020 Bushfires
	BC Act	EPBC Act	
Rufous Fantail *Rhipidura rufifrons*	-	Migratory (Bonn)	• The Project Area was not burnt in the 2019–2020 bushfires. • There is currently no data surrounding the impacts of the 2019–2020 bushfires on this species. • This species was recorded within the Project Area during surveys.
Black-faced Monarch *Monarcha melanopsis*	-	Migratory (Bonn)	• The Project Area was not burnt in the 2019–2020 bushfires. • There is currently no data surrounding the impacts of the 2019–2020 bushfires on this species. • This species was not recorded within the Project Area during surveys.

7.0 Avoid, Minimise, Offset

The Project has been assessed using the NSW BAM which requires the application of an avoid, minimise and offset hierarchy. The Commonwealth Government supports the use of the BAM as the underpinning methodology for calculating biodiversity credit requirements under the Assessment Bilateral Agreement (further discussed in **Section 7.3**).

The following sections summarise the Project's strategy to avoid and minimise impacts on biodiversity and then offset the residual impacts associated with the Project.

7.1 Avoidance

Impact avoidance is documented in Section 7 of the BDAR. The Proponent has sought to avoid impacts to MNES by ensuring that the areas of proposed disturbance are aligned within the geological resource proposed for extraction. The Disturbance Footprint has been refined over multiple iterations to reduce areas of proposed impacts to threatened species. Impacts to native vegetation and threatened species habitats have been reduced by 60.7 ha from an initial footprint of 139.72 ha to the current Development Footprint of 68.02 ha as a result of the Project refinements. The impact avoidance areas are mapped in Figure 7.1 of the BDAR and show how the footprint has reduced between successive iterations of the development footprint from the area assessed in the scoping report (version 1), EPBC Referral (version 2), EIS (version 3) and current report (version 4).

7.2 Impact Mitigation and Minimisation Measures

7.2.1 Techniques, Timing, Frequency and Responsibility of Feasible Mitigation Measures

Impact mitigation measures for the Project are documented in detail in Section 7.4 of the main BDAR Report. The measures proposed include:

- workforce education and training
- implementation of vegetation protection zones for areas to be retained
- ecologist pre-clearance surveys and supervision of works
- erosion and sedimentation control
- weed management
- fencing, access control and fauna exclusion
- preparation and implementation of a Construction Environmental Management Plan.
- The impact mitigation measures proposed for residual impacts are also further summarised in **Table 7.1**, with implementation details provided in **Table 7.2**.

Table 7.1 Summary of Proposed Mitigation and Management Measures for Residual Impacts (Direct, Indirect, and Prescribed)

Mitigation measure	Method/technique	Timing	Frequency	Responsibility	Likely efficacy
Workforce education and training	Environmental awareness for construction and operational site workers	Construction and operation	For all new contractors and employees as part of the general site induction	Site Manager	Measure is likely to achieve intended outcome
Implementation of vegetation protection zones for areas to be retained	Temporary delineation of the Development Footprint until permanent fencing is installed.	Construction / site clearing	Prior to and during site clearing and construction Permanent fencing to remain for the life of the development	Site Manager and Project Ecologist	Measure is likely to achieve intended outcome
Ecologist pre-clearance surveys and supervision of works	Minimisation of impacts to local fauna and their habitats through identification of fauna present and management to minimise harm.	Minimisation of impacts to local fauna and their habitats through identification of fauna present and management to minimise harm.	Prior to and during site clearing	Site Manager and Project Ecologist	Measure is likely to achieve intended outcome
Erosion and sedimentation control	Installation and maintenance of appropriate erosion and sediment controls and work practices.	Prior to and during clearing works until permanent controls such as sediment basins are installed and established.	Temporary erosion and sediment controls would be installed prior to commencement of construction and permanent measures such as stormwater detention basins would be maintained for the life of the development.	Site Manager	Measure is likely to achieve intended outcome
Weed management	Targeted spraying and/or grazing to suppress weed invasion	All stages of the development	As needed	Site Manager / Project Ecologist	Measure is likely to achieve intended outcome

Mitigation measure	Method/technique	Timing	Frequency	Responsibility	Likely efficacy
Fencing, Access Control and Fauna exclusion	Installation of a permanent security fence	During operation	For the life of the development	Site Manager	Measure is likely to achieve intended outcome
Preparation and Implement of Construction Environmental Management Plan	Develop plan to adequately manage environmental impacts during construction including dam dewatering controls, fencing and access control, weed management and erosion and sediment control.	To prepared prior to the commencement of works and implemented for all construction works and for the life of the development as necessary	For the life of the development	Proponent / Site Manager	Measure is likely to achieve intended outcome
Monitoring and additional offsetting for uncertain impacts, such as changes to vegetation structure and composition resulting from groundwater drawdown, hydrological impacts and habitat suitability reduction from blasting and vibration,	Direct monitoring of vegetation and Koala and Brush-tailed Phascogale populations	Baseline surveys to be completed before commencement of works and ongoing for the life of the development.	Annual	Proponent / Project Ecologist	Measure is likely to achieve intended outcome

Implementation details for the proposed impact mitigation and management measures are provided in **Table 7.2**.

Table 7.2 Implementation Details for Proposed Impact Mitigation and Management Measures

Measure/action	Monitoring and evaluation strategy	Performance criteria	Adaptive management threshold	Adaptive management response
Workforce education and training	Completion and maintenance of a site induction register.	Induction of all construction workers.	Failure of Site manager to induct workers.	Breach to be reported in annual compliance reporting. Suspension of the relevant works until construction workers are inducted.

Measure/action	Monitoring and evaluation strategy	Performance criteria	Adaptive management threshold	Adaptive management response
Implementation of vegetation protection zones for areas to be retained	Monitoring to be undertaken by the Project Ecologist prior to commencement and monthly during construction works.	Protection of retained vegetation and habitats.	Breach of vegetation protection zones / damaged to retained habitats.	Breach to be reported in annual compliance reporting. Suspension of the relevant works until appropriate protection measures are implemented and appropriate remedial actions to remedy any adverse impacts are completed.
Ecologist pre-clearance surveys and supervision of works	Reporting on preclearance surveys and works supervision to be undertaken by Project Ecologist.	Completion of proposed works.	Completion of clearing works without project ecologist supervision.	Breaches to be reported in annual compliance reporting to DPE.
Erosion and sedimentation control	Monitoring to be undertaken in accordance with requirements of Construction Environmental Management Plan.	Temporary erosion and sediment controls to be installed prior to works. Permanent controls to be maintained for the life of the development.	Monitoring detects lack or failure of required temporary or permanent erosion and sediment controls.	Breaches to be reported in annual compliance reporting to DPE.
Weed management	Monitoring to be undertaken in accordance with requirements of Construction Environmental Management Plan.	Weed growth to be continually suppressed within the Development Footprint.	Monitoring detects increasing weed infestations which are not being suppressed.	Alternative methods or herbicides to be used to achieve success.
Fencing, Access Control and Fauna exclusion	Monitoring to be undertaken in accordance with requirements of Construction Environmental Management Plan.	Exclusion of all target fauna species.	Repair or upgrade to fencing.	Fencing design to be improved to achieve effectiveness.
Preparation and Implement of Construction Environmental Management Plan	Implementation to be supervised by Project Ecologist or suitable environmental consultant with regular reporting to DPE during construction.	Completion of all proposed environmental protection works and monitoring inspections.	Monitoring detects breach or failure to implement Construction Environmental Management Plan.	Breach to be included in annual compliance reporting to DPE.

7.2.2 Measures for which there is risk of failure

The mitigation measures for the Project require adaptive management and any failures would be addressed through monitoring and corrective actions.

7.2.3 Risk and consequence of any residual impacts

Appropriate environmental management measures will be included as part of the operations to minimise the potential for indirect and residual impacts including:

- water management systems that seek to minimise the potential for damage to flora and fauna and their habitats from erosion, sedimentation and unnatural flooding events
- noise control systems to minimise noise impacts
- dust control measures to minimise dust impacts
- lighting controls to minimise night time light impacts
- blasting controls to minimise blast overpressure and vibration impacts
- employee education and training.

7.2.4 Adaptive management strategy proposed to monitor and respond to impacts

It is considered that the potential impacts associated with the project are predictable and known. Adaptive strategies for impact mitigation measures are provided in Table 7.2. Further adaptive management strategies will be provided in the Construction Environmental Management Plan for the project.

7.3 Biodiversity Offset Strategy

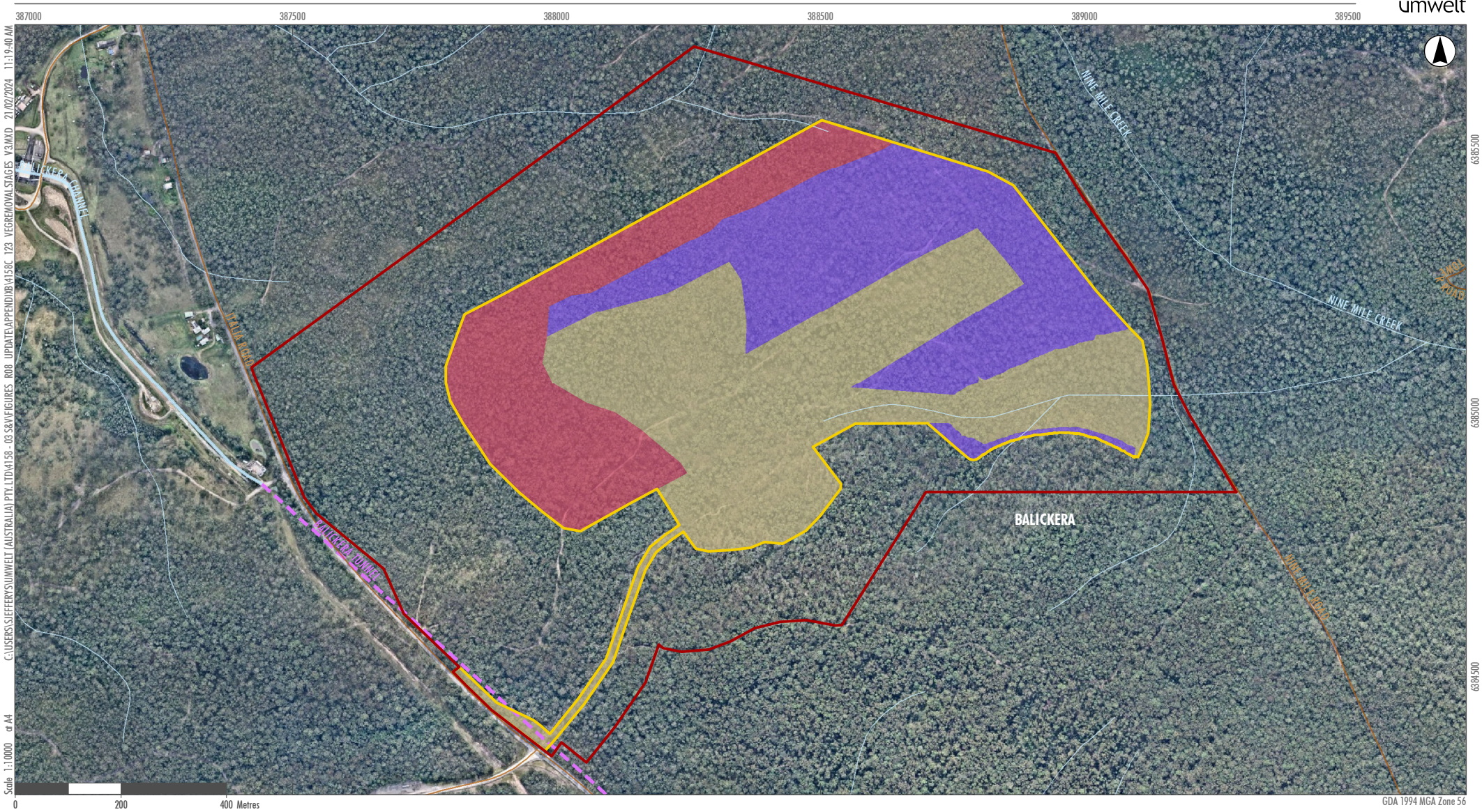
7.3.1 Staged Biodiversity Offset Strategy

The retirement of biodiversity credits is proposed to be undertaken within the following three phases, based on the vegetation removal and overburden phases mapped in **Figure 7.1**:

- Phase 1 – 38.64 ha (Stages 0–2)
- Phase 2 – 20.75 ha (Stages 3–5)
- Phase 3 – 15.63 ha (Stages 6–9).

The PCTs and threatened species that require offsetting and the proposed staged credit retirement per impact stage area is shown in **Table 7.3**. There is no proposal to fund a biodiversity conservation action or conduct ecological rehabilitation to generate biodiversity credits for the project.

The Proponent has committed to further investigate the retirement of biodiversity credits through the establishment of a Biodiversity Stewardship Site within the Wallaroo State Forest. Where credits are not generated and retired within the Wallaroo State Forest they will be purchased from the market or a payment will be made to the Biodiversity Conservation Fund. The like-for-like credit rules will be followed for nationally listed entities which require credits.



Legend

- Project Area (Subject Land)
- Disturbance Area (Development Footprint)
- Road
- Balickera Tunnel
- Drainage Line

Stage

- Phase 1 (Stages 0-2)
- Phase 2 (Stages 3-5)
- Phase 3 (Stages 6-9)

FIGURE 7.1

Vegetation Removal and Overburden Stripping Stages

Image Source: Nearmap (2022) Data source: NSW FSDF (2022)

Table 7.3 Proposed Staged Credit Retirement Details

Entity and Total Credits Required	Total Credits Required	Stage No.	Area of Impact on Entity per Stage (ha)	Credits to be retired per stage
PCT 762 Cabbage Gum open forest or woodland on flats of the North Coast	13	1	0.33	13
		2	-	-
		3	-	-
PCT 1590 Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	1092	1	11.07	308
		2	13.48	375
		3	14.72	409
PCT 1618 Smooth-barked Apple - White Stringybark - Red Mahogany - *Melaleuca sieberi* shrubby open forest on lowlands of the lower North Coast	34	1	0.88	34
		2	-	-
		3	-	-
PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	763	1	19.36	537
		2	7.27	201
		3	0.91	25
Koala (*Phascolarctos cinereus*)	2519	1	31.64	1172
		2	20.75	768
		3	15.63	579

7.3.2 Details of how Biodiversity Offsets Corelate to the MNES Impacts

The offsetting requirements for each MNES impacted by the Project are summarised in **Table 7.4**.

7.3.2.1 Species Credits

One nationally listed threatened species, the Koala, requires offsets through the provision of species credits being 2519 credits.

There is one species credit entity, Large-eared Pied-bat, which was considered to have potential to occur but was not detected during surveys. No species credits are required for the Large-eared Pied-bat under the BAM.

7.3.2.2 Ecosystem Credits

Ecosystem credits are required to offset the impacts of the Project including impacts to the following MNES entities (further detail provided in **Table 7.4**):

- Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions (associated with two PCTs which require a total of 47 credits)
- Gang-gang Cockatoo (foraging habitat)

- South-eastern Glossy Black Cockatoo (foraging habitat)
- Spotted-tailed Quoll (southeastern mainland population)
- White-throated Needletail
- Swift Parrot (foraging habitat)
- Yellow-bellied Glider (south-eastern)
- New Holland Mouse
- Grey-headed Flying-fox (foraging habitat).

7.3.2.3 Other Entities

The following EPBC Act listed migratory species are not directly covered by offsetting requirements under the BAM:

- Rufous Fantail
- Black-faced Monarch.

The above migratory species will be offset indirectly through the provision of ecosystem credits.

Table 7.4 Summary of Offsets for Threatened Species and Ecological Communities Listed Under the EPBC Act

Threatened species/community listed under EPBC Act	PCTs associated with the ecosystem credit species / ecological community (if applicable)	Area of Impact (ha)	Credits Required	Offsetting Approach
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	762, 1618	1.21	47	Offsetting using ecosystem credits for associated PCTs
South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) Foraging Habitat	762, 1590, 1618, 1619	68.02	1902 (total ecosystem credit requirement for the project)	Offsetting using ecosystem credits for associated PCTs
Spotted-tailed Quoll (Dasyurus maculatus)	762, 1590, 1618, 1619	68.02	1902 (total ecosystem credit requirement for the project)	Offsetting using ecosystem credits for associated PCTs
White-throated Needletail (*Hirundapus caudacutus*)	762, 1590, 1618, 1619	68.02	1902 (total ecosystem credit requirement for the project)	Offsetting using ecosystem credits for associated PCTs
Swift Parrot (*Lathamus discolor*) Foraging Habitat	762, 1590, 1618, 1619	68.02	1902 (total ecosystem credit requirement for the project)	Offsetting using ecosystem credits for associated PCTs
Yellow-bellied Glider (south-eastern) (Petaurus australis australis)	762, 1590, 1618, 1619	68.02	1902 (total ecosystem credit requirement for the project)	Offsetting using ecosystem credits for associated PCTs
Koala (*Phascolarctos cinereus*)	762, 1590, 1618, 1619	68.02	2,519	Offsetting like-for-like species credits
New Holland Mouse (Pseudomys novaehollandiae)	762, 1590, 1618, 1619	68.02	1902 (total ecosystem credit requirement for the project)	Offsetting using ecosystem credits for associated PCTs
Grey-headed Flying-fox (Pteropus poliocephalus)	762, 1590, 1618, 1619	68.02	1902 (total ecosystem credit requirement for the project)	Offsetting using ecosystem credits for associated PCTs

Threatened species/community listed under EPBC Act	PCTs associated with the ecosystem credit species / ecological community (if applicable)	Area of Impact (ha)	Credits Required	Offsetting Approach
Rufous Fantail (*Rhipidura rufifrons*)	N/A	68.02	No requirement although species will be indirectly offset through retirement of 1902 ecosystem credits.	Offsets not required under EPBC Act as species not significantly impacted. Indirect offsetting through retirement of ecosystem credits
Black-faced Monarch (*Monarcha melanopsis*)	N/A	68.02	No requirement although species will be indirectly offset through retirement of 1902 ecosystem credits.	Offsets not required under EPBC Act as species not significantly impacted. Indirect offsetting through retirement of ecosystem credits

8.0 Summary

The development footprint has been reduced from an area of 93.74 ha at the referral stage to a current extent of 68.02 ha. The development footprint reduction has had been undertaken to avoid and minimise impacts to biodiversity values including areas of nationally listed threatened ecological communities and habitats for nationally listed threatened species.

It is considered that the Project (in the absence of offsetting) is likely to have a significant impact on the entities identified as significantly impacted in **Table 8.1**, these include:

- Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions
- Koala (*Phascolarctos cinereus*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*).

A range of mitigation measures are proposed to reduce any potential impacts on MNES and a like-for-like biodiversity offsets will be delivered for the Project in accordance with relevant NSW and Commonwealth legislation and/or policies, as documented in **Section 7.0**. A summary of the proposed impacts on Matters of National Environmental Significance is provided in **Table 8.1**.

Table 8.1 Summary of Impacts on Matters of National Environmental Significance

MNES	Presence on site	Area of species impact	Significance of impact under EPBC Act	Offsetting approach
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	Observed	1.21 ha	Significant at local scale, not significant at regional or national scale	Ecosystem credits
South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*) Foraging Habitat	Observed	68.02	Not significant	Ecosystem credits
Large-eared Pied-bat (*Chalinolobus dwyeri*)	Not observed	Nil	Not significant	Nil
Spotted-tailed Quoll (*Dasyurus maculatus*)	Predicted (ecosystem credit species)	68.02	Not significant	Ecosystem credits
White-throated Needletail (*Hirundapus caudacutus*)	Predicted (ecosystem credit species)	68.02	Not significant	Ecosystem credits
Swift Parrot (*Lathamus discolor*) Foraging Habitat	Predicted (ecosystem credit species)	68.02	Not significant	Ecosystem credits
Yellow-bellied Glider (south-eastern) (*Petaurus australis australis*)	Predicted (ecosystem credit species)	68.02	Not significant	Ecosystem credits

MNES	Presence on site	Area of species impact	Significance of impact under EPBC Act	Offsetting approach
Koala (*Phascolarctos cinereus*)	Observed	68.02	Significant	Species credits
New Holland Mouse (*Pseudomys novaehollandiae*)	Predicted (ecosystem credit species)	68.02	Not significant	Ecosystem credits
Grey-headed Flying-fox (*Pteropus poliocephalus*)	Observed	68.02	Significant	Ecosystem credits
Rufous Fantail (*Rhipidura rufifrons*)	Observed	68.02	Not significant	Ecosystem credits
Black-faced Monarch (*Monarcha melanopsis*)	Not observed	68.02	Not significant	Ecosystem credits

9.0 References

Adams-Hosking, C., McBride, M.F., Baxter, G., Burgman, M., de Villiers, D., Kavanagh, R., Lawler, I., Lunney, D., Melzer, A., Menkhorst, P., Molsher, R., Moore, B.D., Phalen, D., Rhodes, J.R., Todd, C., Whisson, D. and McAlpine, C.A, 2016. Use of expert knowledge to elicit population trends for the Koala (Phascolarctos cinereus). Diversity and Distributions 22, 249–262.

Australian Government Department of Agriculture, Water and the Environment (DAWE) 2021c. National Recovery Plan for the Grey-headed Flying-fox Pteropus poliocephalus, Department of Agriculture, Water and the Environment, Canberra.

Australian Government Department of Agriculture, Water and the Environment (DAWE) 2022a. National Recovery Plan for Petaurus australis australis (yellow bellied glider (south-eastern)), Department of Agriculture, Water and the Environment, Canberra.

Australian Government Department of Agriculture, Water and the Environment (DAWE) 2022b. National Recovery Plan for the Koala Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory). Canberra: Department of Agriculture, Water and the Environment.

Australian Government Department of Agriculture, Water and the Environment 2021a, Conservation Advice for the Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland, Australian Government Department of Agriculture, Water and the Environment.

Australian Government Department of Agriculture, Water and the Environment 2021b, Conservation Advice for the Large-eared Pied Bat, Australian Government Department of Agriculture, Water and the Environment.

Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2022. Conservation Advice for Calyptorhynchus lathami lathami (South-eastern Glossy Black Cockatoo). Canberra: Department of Climate Change, Energy, the Environment and Water.

Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2022a, Approved Conservation Advice for the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions. Department of Climate Change, Energy, the Environment and Water.

Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2024a, Protected Matters Search Tool. Department of Climate Change, Energy, the Environment and Water.

Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2024b, National Flying-Fox Viewer. Available from: < https://www.environment.gov.au/webgis-framework/apps/ffc-wide/ffc-wide.jsf> Accessed February 2024.

Australian Government Department of Climate Change, Energy, the Environment and Water (DCCEEW) 2024c, National Recovery Plan for the Pookila (New Holland mouse), Department of Climate Change, Energy, the Environment and Water, Canberra.

Australian Government Department of Environment, Water, Heritage and the Arts (DEWHA) 2010a, Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act, Australian Government Department of Environment, Water, Heritage and the Arts.

Australian Government Department of Environment, Water, Heritage and the Arts (DEWHA) 2010b, Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act, Australian Government Department of Environment, Water, Heritage and the Arts.

Australian Government Department of Environment, Water, Heritage and the Arts (DEWHA) 2010c, Survey guidelines for Australia's threatened frogs: Guidelines for detecting frogs listed as threatened under the EPBC Act, Australian Government Department of Environment, Water, Heritage and the Arts.

Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2010, Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act, Australian Government Department of Environment, Water, Heritage and the Arts.

Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2011a, Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act, Australian Government Department of Sustainability, Environment, Water, Population and Communities.

Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) 2011b. Approved Conservation Advice for the Lowland Rainforest of Subtropical Australia. Canberra, ACT: Department of Sustainability, Environment, Water, Population and Communities.

Australian Government Department of the Environment (DoE) 2013b. Matters of National Environmental Significance. Significant Impact Guidelines 1.1. Department of the Environment.

Australian Government Department of the Environment (DoE) 2015a, Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community. Canberra: Department of the Environment.

Australian Government Department of the Environment (DoE) 2015b, Referral Guideline for management actions in grey-headed and spectacled flying-fox camps, EPBC Act Policy Statement. Canberra: Department of the Environment.

Australian Government Department of the Environment (DoE) 2018, Threat abatement plan for disease in natural ecosystems cause by Phytophthora cinnamomi, Australian Government Department of the Environment.

Australian Government Department of the Environment and Heritage (DEH) 2006a. Monarcha melanopsis in Species Profile and Threats (SPRAT) database. Canberra: Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=609

Australian Government Department of the Environment and Heritage (DEH) 2006b. Rhipidura rufifrons in Species Profile and Threats (SPRAT) database. Canberra: Available from: http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=592

Australian Government Threatened Species Scientific Committee (TSSC) 2019. Commonwealth Conservation Advice on Hirundapus caudacutus White-throated Needletail. Australian Government Threatened Species Scientific Committee.

Australian Government Threatened Species Scientific Committee 2020. Conservation Advice Dasyurus maculatus maculatus (southeastern mainland population) Spotted-tailed Quoll, south eastern mainland. Canberra: Department of Agriculture, Water and the Environment.

Colquhoun G.P., Hughes K.S., Deyssing L., Ballard J.C., Folkes C.B, Phillips G., Troedson A.L. & Fitzherbert J.A. 2021. New South Wales Seamless Geology dataset (Single Layer), version 2.1 [Digital Dataset]. Geological Survey of New South Wales, Department of Regional NSW, Maitland.

Department of the Environment (2015). Threat abatement plan for predation by feral cats. Canberra, ACT: Commonwealth of Australia. Available from: http://www.environment.gov.au/biodiversity/threatened/publications/tap/threat-abatement-plan-feral-cats. In effect under the EPBC Act from 23-Jul-2015.Department of Climate Change, Energy, the Environment and Water (2022). Conservation Advice for Calyptorhynchus lathami lathami (South-eastern Glossy Black Cockatoo). Canberra: Department of Climate Change, Energy, the Environment and Water. Available from: http://www.environment.gov.au/biodiversity/threatened/species/pubs/67036-conservation-advice-10082022.pdf. In effect under the EPBC Act from 10-Aug-2022.

Department of the Environment (DoE) 2015. Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act, Commonwealth of Australia.

Eco Logical Australia 2021. Balickera Tunnel Remediation Works - Species Impact Statement. Prepared for Hunter Water Corporation.

Matthei L.E., 1995. Soil Landscapes of the Newcastle 1:100,000 Sheet map and report, NSW Department of Land and Water Conservation, Sydney.

New South Wales National Parks and Wildlife Service (NSW NPWS) 2003. Recovery Plan for the Yellow-bellied Glider (Petaurus australis). NSW National Parks and Wildlife Service, Hurstville.

NSW Department of Environment and Conservation (DEC), 2004. Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (Working Draft), NSW Department of Environment and Conservation, Hurstville.

NSW Department of Planning and Environment (DPE) 2024, NSW BioNet (incorporating BioNet Atlas, BioNet Vegetation Database and Threatened Biodiversity Profile Data Collection) Accessed February 2024 Online: <https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/nsw-bionet>

NSW Department of Planning, Industry and Environment (DPIE) 2020a. Biodiversity Assessment Method, State of NSW and Department of Planning, Industry and Environment.

NSW Department of Planning, Industry and Environment (DPIE) 2020b, Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method, NSW Department of Planning, Industry and Environment, Parramatta.

NSW Office of Environment and Heritage 2017, Ancillary Rules: Biodiversity conservation actions published under Clause 6.5 of the Biodiversity Conservation Regulation 2017, NSW Office of Environment and Heritage Sydney.

Port Stephens Council 2002. Port Stephens Council Comprehensive Koala Plan of Management, Port Stephens Council.

Queensland Department of Environment and Resource Management 2011. National recovery plan for the large-eared pied bat Chalinolobus dwyeri. Report to the Department of Sustainability, Environment, Water, Population and Communities, Canberra.

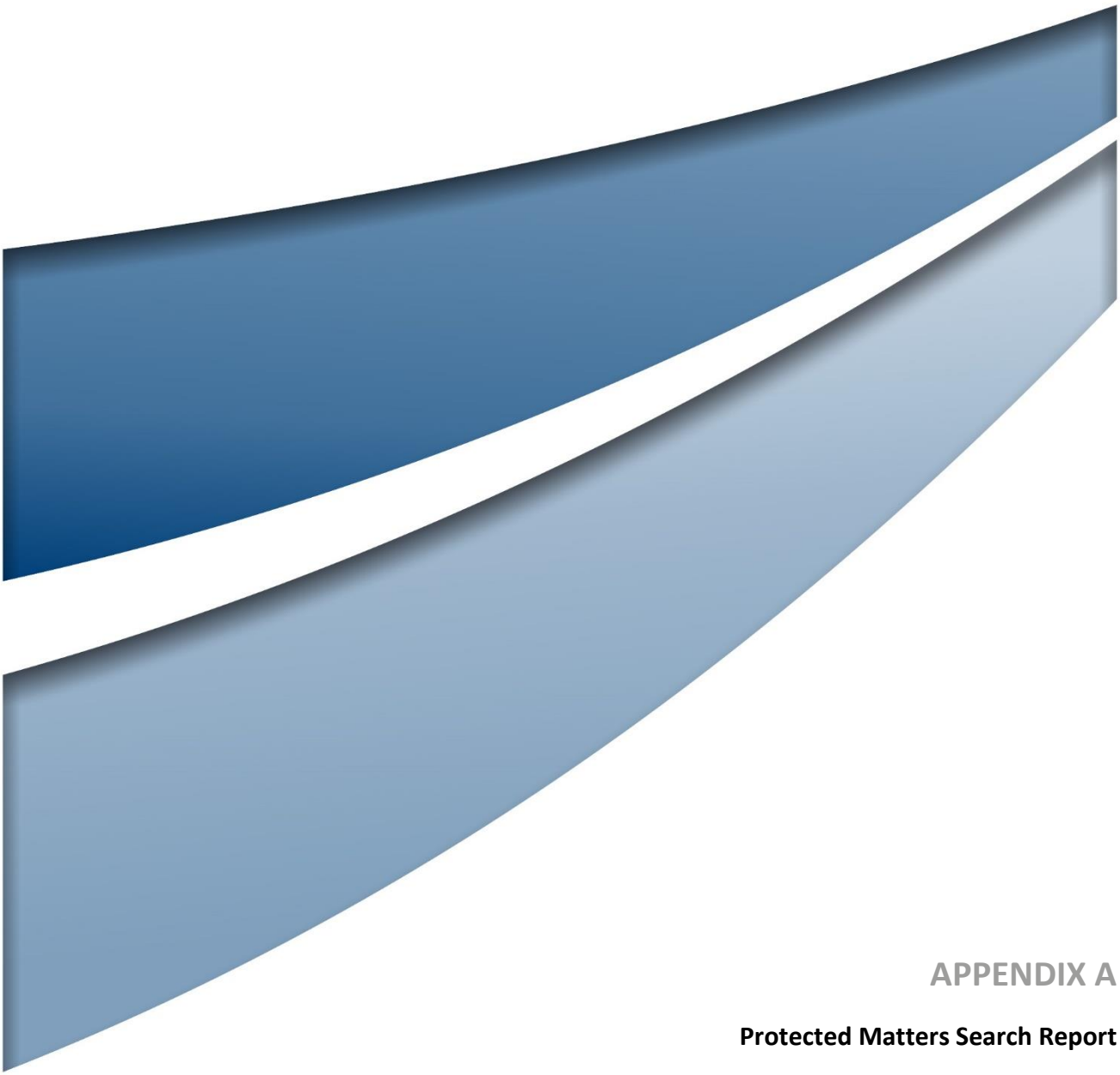
Saunders, D.L. and Tzaros, C.L. 2011. National Recovery Plan for the Swift Parrot Lathamus discolor, Birds Australia, Melbourne.

Sivertsen, D., Roff, A., Somerville, M., Thonell, J., & Denholme, B. 2011. Hunter Native Vegetation Mapping. Geodatabase Guide (Version 4). Internal Report for the Office of Environment and Heritage, Department of Premier and Cabinet, Sydney, Australia.

Victorian Department of Environment, Land, Water and Planning (DELWP) 2016. National Recovery Plan for the Spotted-tailed Quoll Dasyurus maculatus. Australian Government, Canberra. Department of Planning and Environment (DPE) 2022a. BAM Important Areas viewer, Accessed Online April 2022: https://customer.lmbc.nsw.gov.au

WSP 2023, Balickera Remediation Project – Post-construction microchiropteran bat monitoring (Draft). Prepared for Hunter Water Corporation.

Youngentob, K.N, Marsh, K.F., Skewes, J., 2021. A review of koala habitat assessment criteria and methods, report prepared for the Department of Agriculture, Water and the Environment, Canberra, November. CC BY 4.0. Melbourne.



APPENDIX A

Protected Matters Search Report

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. Please see the caveat for interpretation of information provided here.

Report created: 07-Mar-2024

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

Caveat
Acknowledgements

Summary

Matters of National Environment 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 (Ramsar	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	59
Listed Migratory Species:	19

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	26
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have

State and Territory Reserves:	3
Regional Forest Agreements:	1
Nationally Important Wetlands:	None
EPBC Act Referrals:	5
Key Ecological Features (Marine):	None
Biologically Important Areas:	None
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity	Buffer Status
Hunter estuary wetlands	Within 10km of Ramsar site	In feature area

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.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community may occur within area	In feature area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area	In feature area
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	Endangered	Community likely to occur within area	In feature area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area	In feature area
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community likely to occur within area	In feature area
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	Endangered	Community likely to occur within area	In feature area

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text	Buffer Status
BIRD			
Anthochaera phrygia			
Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area	In feature area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat likely to occur within area	In feature area
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat known to occur within area	In feature area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In feature area
Climacteris picumnus victoriae Brown Treecreeper (south-eastern) [67062]	Vulnerable	Species or species habitat known to occur within area	In feature area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat known to occur within area	In feature area
Melanodryas cucullata cucullata South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093]	Endangered	Species or species habitat likely to occur within area	In feature area
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat may occur within area	In feature area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Pycnoptilus floccosus Pilotbird [525]	Vulnerable	Species or species habitat may occur within area	In feature area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In feature area
Stagonopleura guttata Diamond Firetail [59398]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Tringa nebularia](#) Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area	In buffer area only
FROG			
[Litoria aurea](#) Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Mixophyes balbus](#) Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat may occur within area	In feature area
[Uperoleia mahonyi](#) Mahony's Toadlet [89189]	Endangered	Species or species habitat may occur within area	In feature area
MAMMAL			
[Chalinolobus dwyeri](#) Large-eared Pied Bat, Large Pied Bat [183]	Endangered	Species or species habitat known to occur within area	In feature 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	In feature area
[Notamacropus parma](#) Parma Wallaby [89289]	Vulnerable	Species or species habitat may occur within area	In feature area
[Petauroides volans](#) Greater Glider (southern and central) [254]	Endangered	Species or species habitat likely to occur within area	In feature area
[Petaurus australis australis](#) Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat known to occur within area	In feature 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]	Endangered	Species or species habitat known to occur within area	In feature area
[Potorous tridactylus tridactylus](#) Long-nosed Potoroo (northern) [66645]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Pseudomys novaehollandiae](#) New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Pteropus poliocephalus](#) Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
PLANT			
[Angophora inopina](#) Charmhaven Apple [64832]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Arthraxon hispidus](#) Hairy-joint Grass [9338]	Vulnerable	Species or species habitat may occur within area	In feature area
[Asperula asthenes](#) Trailing Woodruff [14004]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Caladenia tessellata](#) Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Commersonia prostrata](#) Dwarf Kerrawang [87152]	Endangered	Species or species habitat may occur within area	In buffer area only
[Cryptostylis hunteriana](#) Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat likely to occur within area	In feature area
[Cynanchum elegans](#) White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area	In feature area
[Dichanthium setosum](#) bluegrass [14159]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
[Diuris praecox](#) Newcastle Doubletail [55086]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Eucalyptus camfieldii Camfield's Stringybark [15460]	Vulnerable	Species or species habitat may occur within area	In feature area
Eucalyptus glaucina Slaty Red Gum [5670]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Eucalyptus parramattensis subsp. decadens Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area	In feature area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area	In feature area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area	In feature area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Prasophyllum sp. Wybong (C.Phelps ORG 5269) a leek-orchid [81964]	Critically Endangered	Species or species habitat may occur within area	In feature area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area	In feature area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
Rhodomyrtus psidioides Native Guava [19162]	Critically Endangered	Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Tetratheca juncea Black-eyed Susan [21407]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area	In feature area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In feature area
Migratory Terrestrial Species			
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In feature area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area	In feature area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area	In feature area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Symposiachrus trivirgatus as Monarcha trivirgatus](#) Spectacled Monarch [83946]		Species or species habitat likely to occur within area	In feature area
Migratory Wetlands Species			
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Calidris canutus](#) Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area	In buffer area only
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area	In feature area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat known to occur within area	In feature area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In feature area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Limosa lapponica](#) Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In buffer area only
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Tringa nebularia			
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Commonwealth Lands [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.

Commonwealth Land Name	State	Buffer Status
Unknown		
Commonwealth Land - [15655]	NSW	In buffer area only
Commonwealth Land - [15656]	NSW	In buffer area only

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In feature area
Bubulcus ibis as Ardea ibis			
Cattle Egret [66521]		Breeding likely to occur within area overfly marine area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris canutus			
Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area overfly marine area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat known to occur within area overfly marine area	In feature area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat may occur within area	In feature area
[Gallinago hardwickii](#) Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
[Haliaeetus leucogaster](#) White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In feature area
[Hirundapus caudacutus](#) White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
[Lathamus discolor](#) Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
[Limosa lapponica](#) Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In buffer area only
[Merops ornatus](#) Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In feature area
[Monarcha melanopsis](#) Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat likely to occur within area overfly marine area	In feature area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In feature area
[Neophema chrysostoma](#) Blue-winged Parrot [726]	Vulnerable	Species or species habitat may occur within area overfly marine area	In feature area
[Numenius madagascariensis](#) Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
[Pandion haliaetus](#) Osprey [952]		Species or species habitat likely to occur within area	In buffer area only
[Pterodroma cervicalis](#) White-necked Petrel [59642]		Species or species habitat may occur within area	In feature area
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In feature area
[Rostratula australis as Rostratula benghalensis (sensu lato)](#) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In feature area
[Sterna striata](#) White-fronted Tern [799]		Migration route may occur within area	In feature area
[Symposiachrus trivirgatus as Monarcha trivirgatus](#) Spectacled Monarch [83946]		Species or species habitat likely to occur within area overfly marine area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Tringa nebularia			
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area overfly marine area	In buffer area only

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Karuah	National Park	NSW	In buffer area only
Medowie	State Conservation Area	NSW	In buffer area only
Wallaroo	National Park	NSW	In buffer area only

Regional Forest Agreements	[Resource Information]

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

RFA Name	State	Buffer Status
North East NSW RFA	New South Wales	In feature area

EPBC Act Referrals				[Resource Information]
Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Seaham Quarry Project	2023/09575		Assessment	In feature area
Stone Ridge Quarry	2022/09368		Assessment	In feature area
Controlled action				
Gloucester Coal Seam Methane Gas Project	2008/4432	Controlled Action	Post-Approval	In buffer area only
Not controlled action				
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In feature area
Tomago to Tomaree Electricity Supply Upgrade	2003/1023	Not Controlled Action	Completed	In buffer area only

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

Threatened, migratory and marine species distributions have been discerned through a variety of methods. Where distributions are well known and if time permits, distributions are inferred from either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat; or modelled (MAXENT or BIOCLIM habitat modelling) using

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

Acknowledgements

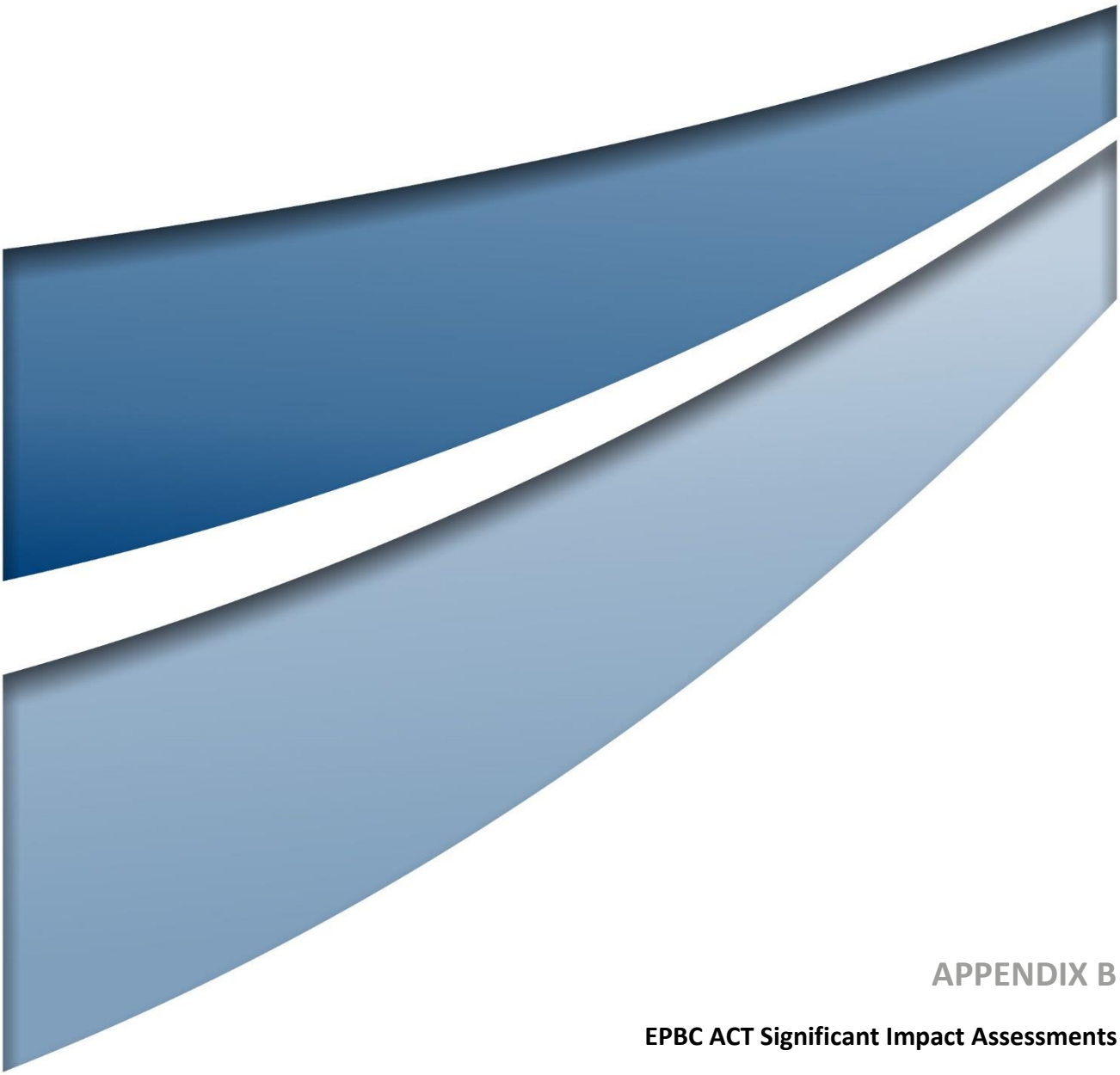
This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-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 Climate Change, Energy, the Environment and Water
GPO Box 3090
Canberra ACT 2601 Australia
+61 2 6274 1111



APPENDIX B

EPBC ACT Significant Impact Assessments

10.0 Assessments of Significance

10.1 Overview of EPBC Act Listed Entities Assessed

Significant impact assessments have been provided for the following nationally listed threatened species and ecological communities that are likely to be impacted by the Project, in accordance with the Australian Government Department of the Environment (DOE 2013) Matters of National Environmental Significance Significant Impact Guidelines 1.1 for the EPBC Act:

Threatened Ecological Communities

- Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions – Endangered.

Threatened Species

- South-eastern Glossy Black-Cockatoo (*Calyptorhynchus lathami lathami*) – Vulnerable
- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*) (SE mainland population) – Endangered
- White-throated Needletail (*Hirundapus caudacutus*) – Vulnerable
- Swift Parrot (*Lathamus discolor*)– Critically Endangered
- Yellow-bellied Glider (*Petaurus australis australis*) – Vulnerable
- Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT) – Endangered
- New Holland Mouse (*Pseudomys novaehollandiae*) – Vulnerable
- Grey-headed Flying-fox (*Pteropus poliocephalus*) – Vulnerable.

Migratory Species Listed under International Conventions

- White-throated Needletail (*Hirundapus caudacutus*) (addressed under vulnerable species assessment)
- Rufous Fantail (*Rhipidura rufifrons*)
- Black-faced Monarch (*Monarcha melanopsis*).

10.2 Threatened Ecological Communities

The endangered ecological community, Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions, is present within the Development Footprint as it is considered that PCTs 762 and 1618 all correspond to the EEC.

The extent of this EEC within the Development Footprint is provided in **Table 10.1** below and the extent of this EEC is mapped in **Figure 5.1** of the MNES Report.

Table 10.1 Summary of TECs within the Development Footprint

Corresponding TEC Name	EPBC Act Listing Status	Associated PCTs and vegetation condition zones within the Development Footprint	Area (ha)
Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions	Endangered Ecological Community Listed under the EPBC Act	PCT 762 Intact PCT 1618 Intact	1.21 ha

10.2.1 Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions

10.2.1.1 Significant Impact Assessment Criteria

The EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Department of the Environment (DOE) 2013b) significant impact criteria for critically endangered and endangered ecological communities has been addressed as follows to determine whether the Project will have, or is likely to have a significant impact on the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions EEC.

- **reduce the extent of an ecological community**

The Project will reduce the extent of the ecological community by approximately 1.21 ha. The Project is not likely to reduce the distributional extent of this community nationally.

- **fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines**

The Project will fragment a small patch of this ecological community, however, the area which is proposed to be fragmented is relatively small and occurs at the western limit of a single patch.

- **adversely affect habitat critical to the survival of an ecological community**

The area to be removed is approximately 1.21 ha in area and is considered not likely to provide habitat critical to the survival of the ecological community, due to the relatively small extent of the impact proposed. Habitat areas most critical to the survival of the ecological community are defined in the Approved Conservation Advice (DCCEEW 2022a) as patches in best condition, being class A and B. The areas of this EEC which will be impacted by the Project are categorised as Class 1A as documented in the additional TEC assessment considerations provided in **Section 10.2.1.2** .

- **modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns**

The Project is not likely to result in impacts to abiotic factors necessary for the ecological community to survive and no substantial groundwater impacts have been predicted. The area has already been impacted historically by the construction of the Balickera Tunnel and canal, which has likely resulted in altered surface water drainage patterns.

- **cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting**

Suitable mitigation measures will be implemented to ensure that the Project does not result in a substantial change in species composition to retained areas of habitat for this EEC.

- **cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:**

– assisting invasive species, that are harmful to the listed ecological community, to become established, or

– causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or

The Project is not likely to substantially reduce the quality or integrity of the retained areas of this ecological community, as appropriate management and mitigation measures will be implemented to minimise impacts to surrounding retained habitats.

- **interfere with the recovery of an ecological community.**

The Project has potential to result in impacts which may result in the following threats to this EEC (as identified in the Approved Conservation Advice):

  - land clearing
  - hydrological changes
  - fragmentation
  - weed invasion
  - diseases and pathogens.

- **Significant Impact Assessment Conclusion**

The Project will reduce the extent of this EEC and will also result in key threats recognised in the Approved Conservation Advice (DCCEEW 2022a). It is considered that the Project is likely to result in a significant impact to this community at the local scale. In the context of the regional and national scales, there would be a minor adverse cumulative impact which is considered not likely to be significant at these scales of assessment. Direct impacts associated with the Project will be offset and potential indirect impacts will be managed and mitigated.

10.2.1.2 Additional DCCEEW TEC Assessment Requirements

The following additional assessment requirements were identified by DCCEEW in relation to EPBC Act listed EECs for the Project.

- **Total Size of the Patch**

The Subtropical eucalypt floodplain forest and woodland EEC occurs as three patches, which correspond to three PCTs mapped within the Project Area and the Development Footprint. Each patch extends beyond the Project Area, however the full patch extent has not been determined by field surveys.

- **Assessment of Patch Quality in accordance with the published conservation advice**

With reference to the condition classes and thresholds contained within the Approved Conservation Advice for this EEC (DCCEEW 2022a), each patch extends outside of the Project Area and is predicted based on regional mapping, GIS and aerial imagery analysis to form a large patch size, defined as >2ha. PCT 762 and PCT 1618 are likely to meet the criteria for Class 1A habitat having a large patch size with high quality understorey and many large native trees. Within the Project Area PCT 1716, which will be retained, has a reduced large tree cover and is likely to meet the definition of Class 2A habitat, having a large patch size, with good quality understorey, large native trees and evidence of many arboreal mammals which within the Project area which are likely to occur within the patch. The characteristics of each patch are summarised in **Table 10.2**.

Table 10.2 Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions Patch Characteristics

Patch Reference	PCT Association	Project Area Extent (ha)	Development Footprint Extent (ha)	Habitat Class
1	762	4.54	0.33	1A
2*	1716	6.05	3.91	1A
3	1618	1.15	0.88	2A

** = Patch will be retained.*

- **Fragmentation of Individual Patches**

The Project will reduce the overall size of each of all three patches, however only patch 1 in the south-western section of the Project Area will be fragmented into separate areas. The area to be fragmented. Patch 3 will only be reduced by approximately 7% in area and the isolation distance between the patches will only be approximately 15 m wide.

- **Indirect impacts on fragmented areas**

There is already an informal vehicle access track intersecting this patch and the impacts will widen the existing track. The fragmented areas will continue to remain part of larger patches of contiguous vegetation to other aspects. It is expected that fragmentation impacts will be limited to increase light penetration along the road edges, weed invasion along edge areas and dust.

- **Mitigation and offset measures**

Mitigation measures are documented in Section 8.4 of the BDAR and include:

  - weed management
  - demarcation of approved Disturbance Footprint.

The like-for-like credit rules will be followed for offsetting nationally listed entities which require credits. For this EEC offsetting will be undertaken through the provision of ecosystem credits for associated PCTs.

10.3 Critically Endangered and Endangered Species

The following critically endangered or endangered species are considered in this assessment:

- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*) (SE mainland population)
- Koala (*Phascolarctos cinereus*) (combined populations of Queensland, New South Wales and the Australian Capital Territory)
- Swift Parrot (*Lathamus discolor*).

Species descriptions, in the Assessments of Significance below, are referenced from NSW and Commonwealth online threatened species profiles, unless otherwise noted. The extent and types of habitat proposed to be impacted for each species is listed in **Table 10.3**.

Table 10.3 Critically Endangered and/or Endangered Listed Species Habitat Impacts

Critically Endangered and/or Endangered MNES	Area of species impact	Type of Habitat Impacted
Spotted-tailed Quoll (*Dasyurus maculatus maculatus*) (SE mainland population)	68.02 ha	Foraging habitat
Koala (*Phascolarctos cinereus*) (combined populations of Qld, NSW and the ACT)	68.02 ha	Foraging and potential breeding and shelter habitat
Swift Parrot (*Lathamus discolor*)	68.02 ha	Foraging habitat

10.3.1 Spotted-tailed Quoll (*Dasyurus maculatus maculatus*)

A 'population of a species' is defined under the EPBC Act as an occurrence of the species in a particular area. In this case, a *population* means:

- a geographically distinct regional population, or collection of local populations, or
- a regional population, or collection of local populations, that occurs within a particular bioregion.

There are two records for the Spotted-tailed Quoll within the Wallaroo State Forest on the BioNet Atlas (NSW DPE 2024a) the dates of these sightings are listed as between 1980 and 2006. These records are the most proximate to the Development Footprint occurring 0.4 km and 0.8 km from the Development Footprint. The species has been identified in Wallaroo National Park on three occasions approximately 5.0 km north of the Development Footprint, the date range of these records is between 1990 and 2006 (NSW DPE 2024a). The closest record of this species occurred during Dan Lunney's Community Wildlife Survey in 2006 approximately 123 m southeast of the Development Footprint (NSW DPE 2024a). The species has also been recorded on several occasions along the Bucketts Way, approximately 5.0 km east of the Development Footprint, and these records fall within a similar date range as the above (1989–2004) (NSW DPE 2024a).

According to the National Recovery Plan (VDELWP 2016), the Spotted-tailed Quoll is considered to have undergone a decline of 50–90 % since colonisation with extant populations now highly fragmented and declining. Home range estimates vary considerably according to location and habitat quality; however, females have been known to occupy home ranges up to 1,515 ha and males up to 5,512 ha, and both sexes usually traverse their ranges along densely vegetated creek lines. The geographic distribution of the species is contracting, and its subpopulations are becoming increasingly fragmented.

The National Recovery Plan for the Spotted-tailed Quoll (VDELWP 2016) has identified that it is not possible to define or map habitat critical to the survival of the Spotted-tailed Quoll and identifies that all habitats within this species' current distribution that are known to be occupied are considered important.

All vegetation communities within the Disturbance Footprint as outlined are considered to provide suitable habitat for the Spotted-tailed Quoll.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population**

The Spotted-tailed Quoll has been recorded in habitat adjoining the Development Footprint in Wallaroo National Park and Wallaroo State Forest as well as vegetated areas within the locality to the west. All PCTs identified within the Development Footprint are likely to provide suitable habitat for the Spotted-tailed Quoll. The Development Footprint is not known to contain den or breeding sites for the species as none were recorded during extensive habitat surveys.

The Project is likely to remove 68.02 ha of suitable habitat for the Spotted-tailed Quoll. This species has a relatively large home range of several hundred to several thousand hectares in size (DELWP 2016).

There are larger areas of suitable habitat available for this species in the locality, including within the Wallaroo National Park (2,780 ha), the Karuah National Park (3,534 ha), the Medowie State Conservation Area (2,851 ha), the Karuah State Conservation Area (74 ha), the Medowie Nature Reserve (238 ha) and the Karuah Nature Reserve (824 ha).

The proposed reduction in habitat associated with the Project is considered not likely to result in a long-term decrease in the size of the regional population or individuals from a collection of local populations.

- **reduce the area of occupancy of the species**

The Project will result in the removal of approximately 68.02 ha of suitable foraging and movement habitat for this species.

The impacts proposed are considered to be inconsequential to any regional populations or individuals from a collection of local populations.

- **fragment an existing *population* into two or more populations**

Considering the area of suitable habitat proposed for removal and the extent of vegetated lands surrounding the Development Footprint, it is considered that the Project will not fragment an existing population into two or more populations.

- **adversely affect habitat critical to the survival of a species**

The habitat critical to the survival of the Spotted-tailed Quoll includes large patches of forest with adequate denning resources and relatively high densities of medium- sized mammalian prey (DELWP 2016). The threshold densities of these critical habitat components to support quoll populations are currently unknown, meaning that the habitat critical to the survival of the species is not possible to define (VDELWP 2016). Therefore, all habitats within the species current distribution that are known to be occupied are considered important (VDELWP 2016).

The Spotted-tailed Quoll has not been recorded within the Development Footprint despite targeted surveys, however the species is likely to use this habitat for movement and foraging.

Due to the presence of larger areas of suitable habitats surrounding the Development Footprint, it is considered that the Project will not affect habitat critical to the survival of the species at a local or regional scale.

- **disrupt the breeding cycle of a population**

The Spotted-tailed Quoll generally dens in rock shelters, small caves, hollow logs or tree hollows and utilises numerous dens within its home range, being a highly mobile species. No den sites were observed within the Development Boundary and no breeding activity was detected during surveys.

It is therefore considered that the Project is not likely to disrupt the breeding cycle of a population of the Spotted-tailed Quoll.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The Project will result in the removal of approximately 68.02 ha of suitable habitat for this species. There are larger areas of suitable habitat available for this species in the locality, including within the Wallaroo National Park (2,780 ha), the Karuah National Park (3,534 ha), the Medowie State Conservation Area (2,851 ha), the Karuah State Conservation Area (74 ha), the Medowie Nature Reserve (238 ha) and the Karuah Nature Reserve (824 ha). Therefore it is considered that the Project is not likely to modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

The Project is not expected to result in invasive species that are harmful to the Spotted-tailed Quoll becoming established in the species habitat.

- **introduce disease that may cause the species to decline**

The Project is not a type of development which is likely to introduce disease that may cause this species to decline.

- **interfere with the recovery of the species**

A National Recovery Plan for the Spotted-tailed Quoll (*Dasyurus maculatus*) (VDELWP 2016) has been prepared. The National Recovery Plan states habitat loss and modification are the greatest threats to this species and road mortality is a significant factor to the species decline. Any impacts to known habitat for the Spotted-tailed Quoll will likely contravene the objectives of the recovery plan, yet it is considered that the loss of habitat connectivity and foraging habitat associated with the Project is not likely to significantly interfere with the recovery of the species. This is due to the species large home range with ease of movement through the landscape and large areas of available habitat including significant areas under permanent conservation in national parks and conservation reserves.

Significant Impact Assessment Conclusion

The Project is **not likely** to result in a significant impact on the Spotted-tailed Quoll, given the species large home range size, the lack of detection of any records for this species within the project area and the fact that the development footprint will not fragment or reduce any suitable habitat patches below a viable size for this species.

All impacts to the Spotted-tailed Quoll will be offset with ecosystem credits required for PCTs associated with the species, as per the requirements of the BAM.

10.3.2 Koala (*Phascolarctos cinereus*)

In this case, a *population* means:

- a geographically distinct regional population, or collection of local populations; or
- a regional population, or collection of local populations, that occurs within a particular bioregion.

The koala is widely distributed across Australia and known to occur in eucalypt woodlands and forests from north-eastern Queensland, along the eastern coast of NSW, to the Eyre Peninsula in the south-east corner of South Australia. In NSW, koalas most often occur on the central and north coasts with a few populations to the west of the Great Dividing Range and are mostly found in forests and subhumid woodlands on the central and north coast, and to the west across the Western Plains and slopes, within Pilliga forest, low woodland and forested areas (TSSC 2012; Adams-Hosking et al. 2016; DAWE 2022b). The koala has been recorded within the Development Footprint and the adjoining areas of the Wallaroo State Forest and Wallaroo National Park on the BioNet Atlas (DPE 2024a). This species was also recorded by Umwelt on the site during remote camera surveys and spotlighting surveys in 2022.

The Development Footprint is situated within the Central NSW Coast Koala Management Bioregion (Youngentob *et al.*, 2021) and contains several tree species identified as locally important to the koala.

All PCTs within the Development Footprint are considered to provide suitable habitat for the koala.

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population**

The site is mapped as Marginal Habitat on the Koala Habitat Planning Map prepared by Port Stephens Council (2001). Under the BAM suitable Koala habitat is defined as habitat the species is expected to occur in or periodically use and is defined as the presence of a koala use tree species in any vegetation zone of a PCT associated with koala. Species polygons under the BAM are required to include the vegetation zone in which the species was detected and all continuous suitable habitat with the vegetation zone, which in this instance includes the entire area of the Development Footprint (DPE 2022d).

The Project will lead to a long-term decrease of approximately 68.02 ha of suitable koala habitat. The Project is not likely to result in an impact which will directly reduce the size of a population of the koala, however a population decrease may occur indirectly in association with the clearing of occupied koala habitat.

There are larger areas of suitable Koala habitat in the locality, including within the Wallaroo National Park (2,780 ha), the Karuah National Park (3,534 ha), the Medowie State Conservation Area (2,851 ha), the Karuah State Conservation Area (74 ha), the Medowie Nature Reserve (238 ha) and the Karuah Nature Reserve (824 ha).

- **reduce the area of occupancy of the species**

The Project involves the removal of 68.02 ha of known habitat for the koala. It is therefore considered that the Project is likely to reduce the area of occupancy of this species.

- **fragment an existing *population* into two or more populations**

The Development Footprint is situated in a contiguous patch of forested area which adjoins several State Forests and National Parks, most proximately, Wallaroo State Forest and Wallaroo National Park, Karuah National Park and Medowie State Conservation Area. Considering the extent of the forested area in the surrounds, the removal of vegetation is not likely to fragment an existing population into two or more populations.

- **adversely affect habitat critical to the survival of a species**

The National Recovery Plan for the Koala (DAWE 2022b) identifies that the disturbance of habitat used by koalas for feeding or resting may adversely affect habitat critical to the survival of the species. The Development Footprint contains known koala habitat and has the potential to adversely affect habitat critical to the survival of the species.

- **disrupt the breeding cycle of a *population***

No koala breeding activity has been observed within the Development Footprint and it is therefore considered that the Project is not likely to disrupt the breeding cycle of an important population of this species.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The Project will result in the loss of approximately 68.02 ha of known koala habitat. It is considered that the Project will modify, destroy or isolate or decrease the availability or quality of habitat for this species and is likely to contribute to its decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

The Project is not expected to result in invasive species that are harmful to the koala becoming established in the species habitat.

- **introduce disease that may cause the species to decline**

The koala is known to be susceptible to pathogens and parasites which have resulted in population declines, such as *Chlamydia* and the koala retrovirus.

The Project is not a type of Project which will introduce disease that may cause this species to decline.

- **interfere with the recovery of the species**

The overall goal as stated in the National Recovery Plan for the EPBC Act listed Koala (DAWE 2022c) is to stop the trend of decline in population size, by supporting resilient, connected and genetically healthy metapopulations across its range, and to increase the extent, quality and connectivity of habitat occupied. The Project involves the removal of 68.02 ha of koala habitat which will reduce the extent of habitat occupied. Direct offsets will be provided for this impact.

Significant Impact Assessment Conclusion

The Project is **likely** to have a significant impact on the koala in accordance with the criteria provided in the EPBC Act Significant Impact Guidelines.

10.3.3 Swift Parrot (*Lathamus discolor*)

In this case, a *population* means:

- a geographically distinct regional population, or collection of local populations; or
- a regional population, or collection of local populations, that occurs within a particular bioregion.

The swift parrot occurs as a single population that migrates annually from breeding grounds in Tasmania to the winter foraging grounds on the coastal plains and slope woodlands of mainland eastern Australia (Saunders and Tzaros 2011).

As the species occurs as a single population in Australia, any record of the species would constitute a population as described above. The swift parrot has not been recorded within the Development Footprint or surrounds during surveys. Several species occurrence records are situated within the locality, with the most recent record from 2020, captured in the eastern extent of Wallaroo National Park, approximately 5.1 km from the Development Footprint. The closest record of this species was recorded in 2016, 2.7 km

northwest of the Development Footprint. There have been few records of the species located within the Port Stephens LGA in the past few years with only one additional record from Medowie, NSW from 2020.

The swift parrot does not breed on mainland Australia, and as such the Development Footprint represents potential foraging habitat for this species.

The Development Footprint contains the key foraging tree species, forest red gum (*Eucalyptus tereticornis*) and Spotted Gum (*Corymbia maculata*), as recognised in the National Recovery Plan for the Swift Parrot (Saunders and Tzaros 2011).

An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of a population**

The swift parrot has not been recorded within the Development Footprint, however it has been recorded in areas in the adjoining Wallaroo National Park, Karuah National Park and in the surrounding suburbs of Karuah, Medowie and the Tilligerry Peninsula. It is likely that the species makes use of the open forest and woodland habitats of the Development Footprint, particularly during eucalypt flowering events in winter.

The Project will result in the loss of up to approximately 68.02 ha of habitat containing the key foraging resources including Spotted Gum *Corymbia maculata* and/or Forest Red Gum *Eucalyptus tereticornis* in the Development Footprint. It is considered that that scale of the impact proposed is not likely to lead to a long term decrease in the size of the swift parrot population.

- **reduce the area of occupancy of the species**

The swift parrot has not been recorded within the Development Footprint but has been occasionally recorded in the wider locality within Wallaroo National Park, Karuah National Park and various locations in the surrounding suburbs of Karuah, Medowie and the Tilligerry Peninsula. It is acknowledged that the Development Footprint does not provide any areas of Important Habitat mapped under the BAM for the swift parrot (NSW DPE 2024b). To date, these areas include areas mapped in Raymond Terrace, approximately 9 km to the southwest of the Development Footprint, areas within the Tilligerry Peninsula, approximately 20 km south-southeast of the Development Footprint, areas within North Arm Cove, approximately 20 km east of the Development Footprint and areas within Williamtown, approximately 15 km south of the Development Footprint.

The Important Habitat mapping is published to assist assessments under the NSW Biodiversity Offset Scheme to determine where credits for the species are calculated. The Important Habitat Mapping for the swift parrot does not occur within, or in lands adjoining, the Development Footprint.

The Project will result in the loss of up to approximately 68.02 ha of vegetation containing Spotted Gum or Forest Red Gum winter foraging resources for the species. The Project will result in a minor reduction in the potential area of occupancy for the swift parrot in the Development Footprint, however this is not likely to reduce the area of known occupancy in the wider locality or region.

- **fragment an existing *population* into two or more populations**

The swift parrot is a nomadic species capable of flying large distances over areas of unsuitable habitat.

It is considered that the Project is not likely to fragment the existing swift parrot population into two or more populations.

- **adversely affect habitat critical to the survival of a species**

Habitat critical to the survival of the swift parrot includes those areas of priority habitat for which the species has a high level of site fidelity or areas that possess phenological characteristics likely to be of importance to the swift parrot (Saunders and Tzaros 2011). The Development Footprint does not provide any areas of Important Habitat mapped under the BAM for the swift parrot (NSW DPE 2024b).

The swift parrot has not been recorded within the Development Footprint and has not shown site fidelity to the specific habitats of the Development Footprint, however has historically been recorded in nearby areas. The Project will not adversely affect habitat critical to the survival of the swift parrot.

- **disrupt the breeding cycle of a population**

The swift parrot breeds and nests exclusively in Tasmania and migrates to mainland Australia during the non-breeding season. There is no potential for breeding habitat to occur in the Development Footprint.

The Project is not expected to disrupt the breeding cycle of the *population* of swift parrot.

- **modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The Project will involve the removal of approximately 68.02 ha of habitat that contains key feed tree species for the swift parrot. The Development Footprint does not provide any areas of Important Habitat mapped under the BAM for the swift parrot (DPE 2024). To date, these areas include areas mapped in Raymond Terrace, approximately 9 km to the southwest of the Development Footprint, areas within the Tilligerry Peninsula, approximately 20 km south-southeast of the Development Footprint, areas within North Arm Cove, approximately 20 km east of the Development Footprint and areas within Williamtown, approximately 15 km south of the Development Footprint. It is considered not likely that the Project would modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the swift parrot would decline.

- **result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

According to the National Recovery Plan for the species (Saunders and Tzaros 2011), swift parrots are less likely to occur at known foraging sites where there is an abundance of large, aggressive nectar feeders such as noisy miner (*Manorina melanocephala*). Aggressive exclusion of birds from potential woodland and forest habitat by over-abundant noisy miners was listed as a key threatening process under the EPBC Act in May 2014.

The Project is not expected to result in an increase in additional invasive species that are harmful to the swift parrot becoming further established in this habitat.

- **introduce disease that may cause the species to decline**

The Project is a resource extraction development and is not a type of Project that is likely to introduce disease that may cause the species to decline.

- **interfere with the recovery of the species**

The Project will interfere with the Recovery Action 2 – Manage and protect Swift Parrot habitat at the landscape scale (Saunders and Tzaros 2011), given the Project will result in the loss of up to approximately 68.02 ha of habitat containing the key foraging resources. These include Spotted Gum (*Corymbia maculata*) and/or Forest Red Gum (*Eucalyptus tereticornis*) in the Development Footprint. This means that the Project will contribute to a threat identified in the National Recovery Plan.

Considering the scale of the Project, it is not likely that it will substantially interfere with the recovery of the swift parrot, given that it will only result in the removal of a relatively small amount of vegetation containing suitable foraging resources. This is due to the species large home range with ease of movement through the landscape and large areas of available habitat including significant areas under permanent conservation in national parks and conservation reserves. Thus, the interference to Recovery Action 2 – Manage and protect Swift Parrot habitat at the landscape scale (Saunders and Tzaros 2011), is considered to be marginal.

- **Significant Impact Assessment Conclusion**

The swift parrot has not been recorded within the Development Footprint, however it has been recorded in areas in the adjoining Wallaroo National Park, Karuah National Park and in the surrounding suburbs of Karuah, Medowie and the Tilligerry Peninsula. The Development Footprint does not provide any areas of Important Habitat mapped under the BAM for the Swift Parrot (NSW DPE 2024b, with the closest mapped Important Habitat occurring in Raymond Terrace, approximately 9 km to the southwest of the Development Footprint. All impacts to this species will be offset using ecosystem credits for PCTs associated with the species and therefore likely to also include key foraging resources.

It is considered that the Project is **not likely** to have a significant impact on this species.

10.4 Vulnerable Species

The following vulnerable species are considered in this assessment:

- Yellow-bellied Glider (*Petaurus australis australis*)
- Grey-headed Flying-fox (*Pteropus poliocephalus*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- New Holland Mouse (*Pseudomys novaehollandiae*)
- White-throated needletail (*Hirundapus caudacutus*)
- South-eastern Glossy Black-Cockatoo (*Calyptorhynchus lathami lathami*).

Species descriptions, in the Assessments of Significance below, are referenced from NSW and Commonwealth online threatened species profiles, unless otherwise noted. The extent and types of habitat proposed to be impacted for each species is listed in **Table 10.4**.

Table 10.4 Vulnerable Listed Species Habitat Impacts

Critically Endangered and/or Endangered MNES	Area of species impact	Type of Habitat Impacted
Yellow-bellied Glider (south-eastern) (*Petaurus australis australis*)	68.02 ha	Ecosystem species / potential foraging and den habitat
Grey-headed flying-fox (*Pteropus poliocephalus*)	68.02 ha	Ecosystem species / Foraging habitat
Large-eared Pied Bat (*Chalinolobus dwyeri*)	N/A not observed during surveys	Not observed during surveys
New Holland Mouse (*Pseudomys novaehollandiae*)	68.02 ha	Ecosystem species / Foraging and shelter habitat
White-throated needletail (*Hirundapus caudacutus*)	68.02 ha	Ecosystem species / Foraging and roost habitat
South-eastern Glossy Black Cockatoo (*Calyptorhynchus lathami lathami*)	68.02 ha	Ecosystem species / Foraging habitat but no detected breeding habitat use

10.4.1 Yellow-bellied Glider (*Petaurus australis australis*)

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal; or
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

The Development Footprint is considered to comprise up to 68.02 ha of potential foraging habitat for this species, however the Yellow-bellied Glider was not observed during surveys and the development footprint is not at the limit of this species ranges.

The yellow-bellied glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. No direct observations of the species have been recorded within 10 km of the development footprint, the closest indirect observation record being approximately 1 km south west of the development footprint.

It is therefore considered that an *important population* of the Yellow-bellied Glider is not present within the Development Footprint.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species**

Given that there is not considered to be an *important population* of the Yellow-bellied Glider present within the Development Footprint, the Project will not lead to a long-term decrease in the size of an *important population* of this species.

- **reduce the area of occupancy of an important population**

The Project will result in the loss of up to approximately 68.02 ha of potential foraging habitat for Yellow-bellied Glider. However, since the Development Footprint does not contain an *important population* of the Yellow-bellied Glider, the Project will not reduce the area of occupancy of an *important population* of this species.

- **fragment an existing important population into two or more populations**

The Development Footprint does not contain an *important population* of the Yellow-bellied Glider, therefore the Project will not result in the fragmentation of an *important population* of this species.

- **adversely affect habitat critical to the survival of a species**

The Approved Conservation Advice for this species (DAWE 2022) identifies that habitat critical to the survival of the yellow-bellied glider (south-eastern) may be broadly defined as areas containing the following attributes (noting that geographic areas containing habitat critical to survival needs to be defined by forest type on a regional basis):

  - Large contiguous areas of floristically diverse eucalypt forest, which are dominated by winter-flowering and smooth-barked eucalypts, including mature living hollow-bearing trees and sap trees.
  - Areas identified as refuges under future climate change scenarios.
  - Short or long-term post-fire refuges (i.e., unburnt habitat within or adjacent to recently burnt landscapes) that allow the species to persist, recover and recolonise burnt areas.
  - Habitat corridors required to facilitate dispersal of the subspecies between fragmented habitat patches and/or that enable recolonization or movement away from threats. yellow-bellied gliders (south-eastern) have a glide ratio (horizontal distance/height dropped) of around 2.0, and corridors spanning gaps larger than the distance gliders are likely to be able to travel should be considered critical to the survival. There is not enough evidence to define the canopy and width characteristics of appropriate corridors. In the absence of such information, a precautionary approach should be taken to maximise dispersal by considering all habitat corridors in the species' range to be habitat critical to the survival.
  - Areas in which some trees have evidence of use for sap extraction by yellow-bellied glider (south-eastern).

Based on the results of the surveys undertaken, the Development Footprint does not contain occupied habitat for this species. It is therefore considered that the Project will not adversely affect habitat critical to the survival of the Yellow-bellied Glider.

- **disrupt the breeding cycle of an *important population***

The Development Footprint does not contain an *important population* of the Yellow-bellied Glider, therefore the Project will not disrupt the breeding cycle of an important population.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

As established above, the Project will result in the loss of up to approximately 68.02 ha of suitable habitat for the Yellow-bellied Glider, however this species has not been observed during comprehensive surveys undertaken over several years. It is therefore considered that the Project will not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the Yellow-bellied Glider would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

The Project is not expected to result in invasive species that are harmful to the Yellow-bellied Glider becoming established in the species habitat.

- **introduce disease that may cause the species to decline**

No diseases that may cause the Yellow-bellied Glider to decline are likely to be introduced as a result of the Project.

- **interfere substantially with the recovery of the species**

There is a recovery plan prepared for this species which was prepared by NSW NPWS (2003) for NSW. Implementation of this recovery plan is intended to be undertaken by NSW NPWS over three years following the adoption of the plan. The threats recognised in the recovery plan include heavy logging of forests managed for timber production, clearing of forests for agriculture and urban development and wildfire.

Threats recognised for the species in the Approved Conservation Advice (DAWE 2022) include habitat loss, disturbance and modification, climate change, introduced species and fencing of agricultural land.

The Project will result in forest clearing resulting in the loss and modification of suitable habitat for this species.

Significant Impact Assessment Conclusion

The Project is **not likely** to result in a significant impact on the Yellow-bellied Glider, given the species large home range size, the lack of records for this species within the development footprint during surveys and the fact that the development footprint will not fragment or reduce any suitable habitat patches below a viable size for this species.

All impacts to the Yellow-bellied Glider will be offset with ecosystem credits required for PCTs associated with the species, as per the requirements of the BAM.

10.4.2 Grey-headed Flying-Fox (*Pteropus poliocephalus*)

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery.

This may include populations that are:

- key source populations either for breeding or dispersal; or
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

The grey-headed flying-fox was identified within the Development Footprint during nocturnal spotlighting surveys in March 2018. Additionally, a desktop search of the National Flying-fox monitoring viewer (DCCEEW 2024b has identified the presence of a historical roost site within the vicinity of the Development Footprint within Wallaroo National Park, although this has not been occupied for at least a decade.

Currently occupied camp sites for the grey-headed flying fox closest to the Development Footprint are located in Raymond Terrace approximately 13 km to the southwest and Glen William approximately 23 km to the northwest. Both camps are listed as Nationally Important Flying-fox Camps and foraging individuals recorded in the Development Footprint are likely to be from these camp sites. Equivalent camp number estimates were given for both the camp sites which are estimated to support between 16,000 and 49,999 individual grey-headed flying foxes. This data was obtained during the latest surveys in February 2022 (Raymond Terrace) and November 2021 (Glen William).

According to the Referral Guideline for Management Actions in Grey-headed and Spectacled Flying-Fox Camps (DoE 2015b) nationally important grey-headed flying-fox camps are recognised as any camps that have contained 10,000 individuals or greater in the last 10 years or have been occupied by 2,500 individuals or greater permanently or seasonally every year for the last 10 years. Therefore, the Development Footprint does not contain a nationally important grey-headed flying fox camp.

The Development Footprint is considered to comprise up to 68.02 ha of potential foraging habitat for this species but is not likely to contain significant breeding and roosting habitat necessary for maintaining genetic diversity. The Development Footprint is not near the limit of the known range of this species. Therefore, the Development Footprint is not likely to contain an *important population* of the grey-headed flying-fox.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species**

Given that there is not considered to be an *important population* of the grey-headed flying-fox present within the Development Footprint, the Project will not lead to a long-term decrease in the size of an *important population* of this species.

- **reduce the area of occupancy of an *important population***

The Project will result in the loss of up to approximately 68.02 ha of potential foraging habitat for grey-headed flying-fox. However, since the Development Footprint does not contain an *important population* of the grey-headed flying-fox, the Project will not reduce the area of occupancy of an *important population* of this species.

- **fragment an existing *important population* into two or more populations**

The Development Footprint does not contain an *important population* of the grey-headed flying-fox, therefore the Project will not result in the fragmentation of an *important population* of this species.

- **adversely affect habitat critical to the survival of a species**

According to the National Recovery Plan for the Grey-headed Flying-fox (DAWE 2021c), foraging habitat that contains important winter and spring flowering species is considered habitat critical to the survival of the species. The Development Footprint will impact approximately 68.02 ha of vegetation containing the identified winter and spring flowering species *Eucalyptus tereticornis, Eucalyptus fibrosa*, *Eucalyptus siderophloia*, *Corymbia maculata* and *Melaleuca styphelioides*. There is also a historical flying-fox camp site mapped to the north of the development footprint, BioNet Atlas records indicate that this camp was last occupied in 2000, occupation at this location has not been recorded during any surveys or in available records on the National Flying-fox Monitoring Viewer (NSW DPE 2024a; DCCEEW 2024b). Although the Project will impact habitat critical to the survival of the grey-headed flying-fox, the species' has a large home range, is highly mobile and has large areas of available habitat including significant areas under permanent conservation in national parks and conservation reserves.

- **disrupt the breeding cycle of an *important population***

An unoccupied camp was identified during surveys and was further examined using the National Flying-fox monitoring viewer (DCCEEW 2024b). The camp has been monitored across a 10-year period (2012 – present) and no individuals have been observed roosting within this period (DCCEEW 2024b). Thus, no current grey-headed flying-fox breeding populations or camps have been identified within the Development Footprint. **The Project is not expected to disrupt the breeding cycle of an *important population* of this species.**

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

As established above, the Project will result in the loss of up to approximately 68.02 ha of suitable foraging habitat for the grey-headed flying-fox. Areas of habitat will remain in Wallaroo National Park (2,780 ha), Karuah National Park (3,534 ha), Medowie State Conservation Area (2,851 ha), Karuah State Conservation Area (74 ha), Medowie Nature Reserve (238 ha) and Karuah Nature Reserve (824 ha).

There is a substantial area of high-quality remnant vegetation nearby to the Development Footprint and it is considered that the Project is not likely to modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the grey-headed flying-fox would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

The Project is not expected to result in invasive species that are harmful to the grey-headed flying-fox becoming established in the species habitat.

- **introduce disease that may cause the species to decline**

No diseases that may cause the grey-headed flying-fox to decline are likely to be introduced as a result of the Project.

- **interfere substantially with the recovery of the species**

The Project will remove 68.02 ha of foraging habitat identified in the National Recovery Plan for the Grey-headed Flying-fox (DAWE 2021) as a type of habitat critical to the survival of the species. The project therefore has potential to substantially interfere with the recovery of habitat for this species in a local and regional context.

Significant Impact Assessment Conclusion

DCCEEW have determined that the project would have a significant impact on the Grey-headed Flying-fox. The impacts to this species will be offset using ecosystem credits required for PCTs associated with the species, as per the requirements of the BAM.

10.4.3 Large-eared Pied Bat (*Chalinolobus dwyeri*)

The EPBC Act Policy Statement 1.1 Significant Impact Guidelines (Department of the Environment 2013b) identify that in the case of a vulnerable species an "important population" is one that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- key source populations either for breeding or dispersal
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

The site contains suitable foraging habitat for the Large-eared Pied Bat and this species has been recorded foraging within the locality. However, the subject population of this species has not been identified in a recovery plan, is not likely to form a key source population and is not likely to be necessary for maintaining genetic diversity. Furthermore, this species is not near the limit of its range within the site.

Therefore, it is considered that this species does not satisfy the criteria of an important population as identified by DOE (2013b).

In accordance with DOE (2013b), an action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

- **lead to a long-term decrease in the size of an important population of a species**

The species has been previously recorded in adjacent habitats near the Eagleton Quarry approximately 1.3 km to the south of the Development footprint. Through interpretation of aerial imagery, the locality of this record appears to be within foraging habitat as there are permanent pools of water within the vicinity of the record. There are no recorded roosting sites and further interpretation of aerial imagery show no presence of rocky escarpments. It is considered that an important population of the large-eared pied bat does not inhabit the site and is not likely to be impacted to the extent that a long-term decrease would occur.

- **reduce the area of occupancy of an important population**

This species has not been observed occupying the development footprint. An important population of this species is not likely to inhabit the development footprint and the Project is not likely to reduce the area of an important population of this species.

- **fragment an existing important population into two or more populations**

This species is highly mobile and capable of traversing large areas of discontinuous and unsuitable habitat. The Project is not likely to fragment a population of this species.

- **adversely affect habitat critical to the survival of a species**

The recovery plan (QDERM 2011) for this species identifies that the following should be considered critical to the survival of the species:

- maternity roosts
- sandstone cliffs and fertile wooded valley habitat within close proximity to each other.

The development footprint has not been observed to contain these habitats.

- **disrupt the breeding cycle of an important population**

The Balickera Tunnel which occurs adjacent to the southern boundary of the Development footprint provides suitable breeding habitat for this species. Extensive surveys of these tunnels by Eco Logical Australia (2021) did not identify any use by this species and the tunnel is not likely to be directly impacted by the Project. Therefore, the Project is not likely to disrupt the breeding cycle of an important population of this species.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The Development footprint contains a relatively small area of suitable foraging habitat for this species and it is considered that the Project is not likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that this species is likely to decline.

- **result in invasive species that are harmful to a threatened species becoming established in the vulnerable species' habitat**

It is considered that the Project will not result in invasive species that are harmful to this species becoming established in habitat suitable for this species. Suitable mitigation measures will be implemented to manage pest fauna species and weeds.

- **introduce disease that may cause a species to decline**

It is considered that the Project is not a type of development likely to introduce disease that may cause this species to decline.

- **interfere with the recovery of the species.**

The national recovery plan for this species, prepared by the Queensland Department of Environment and Resource Management (DERM) (2011), identifies the following specific recovery objectives:

  - Identify priority roost and maternity sites for protection.
  - Implement conservation and management strategies for priority sites.
  - Educate the community and industry to understand and participate in the conservation of the large-eared pied bat.
  - Research the large-eared pied bat to augment biological and ecological data to enable conservation management.
  - Determine the meta-population dynamics throughout the distribution of the large-eared pied bat.

It is considered that the Project is not likely to interfere with the actions required to implement the specific recovery objectives for this species.

Significant Impact Assessment Conclusion

Based on the results of this assessment, it is considered that the Project is **not likely** to result in a significant impact on the large-eared pied bat.

10.4.4 New Holland Mouse (*Pseudomys novaehollandiae*)

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal; or
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey and vegetated sand dunes. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha. The species peaks in abundance during early to mid-stages of vegetation succession typically induced by fire.

The Development Footprint is considered to comprise up to 68.02 ha of potential habitat for this species, however the New Holland Mouse was not observed during surveys. There are 4 records for this species to the south west of Italia Road and numerous sightings of this species have been made throughout the Port Stephens peninsula on the BioNet Atlas (NSW DPIE 2024a).

Given the large number of records within the region it is considered that the Development Footprint is not likely to be a key source population for breeding, dispersal or maintaining genetic diversity.
The development footprint is also not at the limit of this species range.

It is therefore considered that an *important population* of the New Holland Mouse is not present within the Development Footprint.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species**

Given that there is not considered to be an *important population* of the New Holland Mouse present within the Development Footprint, the Project will not lead to a long-term decrease in the size of an *important population* of this species.

- **reduce the area of occupancy of an *important population***

This species is not predicted under the BAM to occur in any of the PCTs present within the development footprint and suitable habitat for this species is typically characterised by the presence of open heathland, tall open forest with a grassy understorey, open woodland with a grassy or heathy understorey and vegetated sand dunes. Occupied habitats typically have sandy soils suitable for burrowing and preference has also been shown for early successional habitat (DCCEEW 2024c). Most of the development footprint, and particularly those parts at higher elevation are characterised by shallow soils which are not likely to be suitable for burrowing, with areas of potential habitat for this species being limited to areas of lower elevation and deeper soils. It is considered that any individuals which may occur in the development footprint would be not likely to form an important population and therefore the Project is not likely to reduce the area of occupancy of any important populations of the New Holland Mouse.

- **fragment an existing *important population* into two or more populations**

The Development Footprint has been designed to ensure maintenance of local wildlife connectivity and is not likely to fragment any areas of habitat for this species.

- **adversely affect habitat critical to the survival of a species**

DCCEEW (2024c) identify that habitat critical to the survival of this species includes a broad range of areas including the species' current area of occupancy, areas where the species previously occurred and patches of suitable habitat that may not be currently occupied. The criteria given for habitat critical to the survival of this species by DEECCW (2024c) is broadly defined and extensive areas of native vegetation throughout the species area of occupancy would qualify for classification as such. It is considered that the Project would adversely affect suitable habitat in an area adjacent to existing known habitat located to the west of Italia Road, however it is considered that the removal of this area of habitat would not be likely to affect the survival of the species in the immediate locality or the region due to the presence of extensive areas of suitable and known habitat.

- **disrupt the breeding cycle of an *important population***

The Development Footprint does not contain an *important population* of the New Holland Mouse, therefore the Project will not disrupt the breeding cycle of an important population.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The Project will result in the loss of up to approximately 68.02 ha of habitat, including areas potentially suitable for the New Holland Mouse, however this species has not been observed during comprehensive surveys undertaken over several years. It is therefore considered that the Project will not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the New Holland Mouse would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

As noted in the Threat Abatement Plan for Feral Cats (DPE 2015), feral cats are harmful to this species. The Project is not expected to result in invasive species (including cats), that are harmful to the New Holland Mouse becoming established in the species habitat. Other invasive species identified as threats include invasive plants, invasive rodents and predators such as foxes (DCCEEW 2024c).

- **introduce disease that may cause the species to decline**

As noted in the Threat Abatement Plan for diseases in natural ecosystems caused by *Phytophora cinnamomi* (DPE 2018), the New Holland Mouse may be affected by dieback caused by this pathogen. A pathogen management plan will be implemented for the site to mitigate against potential introduction and spread of *Phytophora cinnamomi*.

- **interfere substantially with the recovery of the species**

Current threats to this species listed in the National Recovery Plan (DCCEEW 2024c) include habitat loss and disturbance, low genetic diversity and inbreeding, altered fire regimes, climate change, invasive species and *Toxoplasma gondii* disease spread by cats.

The project will result in the loss and disturbance of suitable habitat for this species, however considering the extent of occupied habitats where this species has been recorded in the Port Stephens region it is considered that any impact to the recovery of the species are not likely to be substantial or significant.

Significant Impact Assessment Conclusion

Potentially suitable habitat for this species is present and this species has been added to the BAM-C assessment as an ecosystem credit species (predicted to occur). The development footprint contains some areas of suitable habitat for this species, particularly in areas of lower elevation on deeper soils, however the development footprint is mostly characterised by areas of shallow soils which provide suboptimal habitat for this species. There are larger areas of occupied habitat for this species present within the locality and the region including throughout the Port Stephens LGA and any impacts to this species as a result of the Project are considered **not likely to be significant impacts** in a local, regional or national context.

10.4.5 White-throated Needletail (*Hirundapus caudacutus*)

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery.

This may include populations that are:

- key source populations either for breeding or dispersal; or
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

The white-throated needletail is widespread in eastern and south-eastern Australia as part of its non-breeding territory. In eastern Australia, it is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains. The species is almost exclusively aerial, from heights of less than 1 m up to more than 1,000 m above the ground. White-throated needletails almost always forage aerially, at heights up to 'cloud level', above a wide variety of habitats ranging from heavily treed forests to open habitats, such as farmland, heathland or mudflats.

Important habitat for the species is outlined in the Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act (DoE 2015) which states that large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. They are found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces.

The white-throated needletail has not been identified within the Development Footprint during surveys. There are eleven (11) records for this species within the Development Footprint locality, though no records directly within the Development Footprint. This species is a nomadic aerial foraging species which may fly over the Development Footprint from time to time. The Development Footprint also provides a relatively small area of suitable roosting habitat for this species. It is considered that the Development Footprint does not contain a key source population, population necessary for maintaining genetic diversity or population which is near the limit of this species range. Therefore, it is considered not likely that an *important population* of white-throated needletail occurs in the Development Footprint.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an *important population* of a species**

This species is predominantly an aerial foraging species, and the Project is not likely to remove aerial foraging habitat for this species, however, it may modify the habitats present through the removal of approximately 68.02 ha of woodland and forest habitat which may be used for time to time for opportunistic roosting. The species breeds in the northern hemisphere so no breeding habitat will be impacted. The Project will impact a relatively small area of suitable habitat for this species and there are larger areas of habitat which will not be impacted by the Project within the locality. It is therefore considered that the Project will not lead to a long-term decrease in the size of an important population of the white-throated needletail.

- **reduce the area of occupancy of an *important population***

This species is predominantly an aerial foraging species, and it is considered that the removal of 94.3 ha terrestrial habitats within the site is not likely to reduce the area of occupancy of the white-throated needletail.

- **fragment an existing *important population* into two or more populations**

This species is a predominantly aerial foraging species which has rarely been recorded roosting and breeds in the northern hemisphere. The Project is not a type of development which is likely to fragment an existing important population of the white-throated needletail into two or more populations.

- **adversely affect habitat critical to the survival of a species**

This species is a predominantly aerial foraging species which has rarely been recorded roosting and breeds in the northern hemisphere. The Project will not directly impact aerial foraging habitats for this species and it is therefore considered that the Project is not likely to affect habitat critical to the survival of the species.

- **disrupt the breeding cycle of an important population**

The white-throated needletail does not breed in Australia. The Project will therefore not disrupt the breeding cycle of an *important population* of this species.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The Project will result in the loss of up to approximately 68.02 ha of terrestrial habitats for the white-throated needletail. Given the relatively small area of potential foraging habitat to be removed and the substantial areas of remnant vegetation in nearby areas including Wallaroo National Park (2,780 ha), Karuah National Park (3,534 ha), Medowie State Conservation Area (2,851 ha), Karuah State Conservation Area (74 ha), Medowie Nature Reserve (238 ha) and Karuah Nature Reserve (824 ha), the habitat within the Development Footprint is not likely to be depended upon by the species.

It is considered that the Project is not likely to modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the white-throated needletail would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

The Project is not expected to result in invasive species that are harmful to the white-throated needletail becoming established in the species habitat.

- **introduce disease that may cause the species to decline**

No diseases that may cause the white-throated needletail to decline are likely to be introduced as a result of the Project.

- **interfere substantially with the recovery of the species**

The Approved Conservation Advice (TSSC 2019) for the species includes the following conservation priorities for recovery:

  - work with governments in East Asia to minimise destruction of key breeding habitats
  - important habitats in Australia are identified and protected.

The Project is not likely to substantially interfere with the recovery of the white-throated needletail.

- **Significant Impact Assessment Conclusion**

It is considered that the Project is not likely to result in a significant impact on the white-throated needletail based on the lack of records of the species utilising the habitats within the Development Footprint and the extent of available habitat in the wider region.

10.4.6 South-eastern Glossy Black-Cockatoo (*Calyptorhynchus lathami lathami*)

In the case of a vulnerable species, an *important population* is a population that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal; or
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

South-eastern glossy black cockatoos feed almost exclusively on the seeds of sheoaks (*Allocasuarina* spp. and *Casuarina* spp.), usually relying on one or two species within a region (DCCEEW 2022). South-eastern glossy black cockatoos are hollow nesters, utilising large hollows in both living and dead eucalypt trees (DCCEEW 2022). This species was indirectly observed within the development footprint, noting the presence of crushed cones.

The Development Footprint is considered to comprise up to 68.02 ha of potential foraging habitat for this species. No signs of breeding were observed during targeted surveys and it is considered that the site is not necessary for maintaining genetic diversity given the site is surrounded by large areas of suitable habitat. The development footprint is also not at the limit of this species range.

It is therefore considered that an *important population* of the Glossy Black-Cockatoo is not present within the Development Footprint.

An action has, will have, or is likely to have a significant impact on threatened species if it does, will, or is likely to:

- **lead to a long-term decrease in the size of an important population of a species**

The Project will remove approximately 68.02 ha of native vegetation which is interspersed with areas of suitable foraging trees for this species. It is considered that there is not an *important population* of the Glossy Black-Cockatoo present within the Development Footprint, therefore the Project will not lead to a long-term decrease in the size of an *important population* of this species.

- **reduce the area of occupancy of an *important population***

The Project will remove approximately 68.02 ha of native vegetation which is interspersed with areas of suitable foraging trees for this species. The Project will remove approximately 68.02 ha of native vegetation which is interspersed with areas of suitable foraging trees for this species which is utilised occasionally. It is considered that there is not an important population of the Glossy Black-Cockatoo present within the Development Footprint and the Project will not reduce the area of occupancy of an *important population* of this species.

- **fragment an existing *important population* into two or more populations**

The Development Footprint does not contain an *important population* of the Glossy Black-Cockatoo, this species is highly mobile and the development footprint has been located to avoid isolating areas of habitat for fauna species.

- **adversely affect habitat critical to the survival of a species**

Habitat critical to the survival of this species includes foraging habitat with feed tree species relevant to the region. South-eastern glossy black cockatoos rely on nine species of sheoaks (*Allocasuarina* spp. and *Casuarina* spp.) for feeding, with species used varying depending on the region (DCCEEW 2022). In the locality, they show preference for black sheoak (*A. littoralis*) and forest sheoak (*A. torulosa*) and to a lesser extent river sheoak (*C. cunninghamiana*) and swamp sheoak (*C. glauca*) during limited times of the year (DCCEEW 2022).

Habitat critical to the survival of this species also includes breeding habitat with large nesting hollows. Trees may be living or standing dead trees (DCCEEW 2022). As a guide, potential nest hollows for the subspecies have the following traits (DCCEEW 2022):

- >8 m above ground
- located in branches >30 cm in diameter
- branch or stem no more than 45° from vertical, and
- minimum entrance diameter of >15 cm.

Based on the results of the surveys undertaken, the Development Footprint contains foraging habitat for this species however no observations of nesting individuals were made during targeted surveys. Only infrequent site use by this species was observed based on one indirect detection event over multiple years of survey. It is therefore considered that the Development Footprint does not contain habitat critical to the survival of this species.

- **disrupt the breeding cycle of an *important population***

The Development Footprint does not contain an *important population* of the Glossy Black-Cockatoo, therefore the Project will not disrupt the breeding cycle of an important population.

- **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

As established above, the Project will result in the loss of up to approximately 68.02 ha of native vegetation which is interspersed with areas of suitable foraging habitat for the Glossy Black-Cockatoo and this species has not been observed breeding within the site during comprehensive surveys undertaken over several years. It is therefore considered that the Project will not modify, destroy, remove, isolate, or decrease the availability or quality of habitat to the extent that the Glossy Black-Cockatoo would decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

The Project is not expected to result in invasive species that are harmful to the Glossy Black-Cockatoo becoming established in the species habitat.

- **introduce disease that may cause the species to decline**

No diseases that may cause the Glossy Black-Cockatoo to decline are likely to be introduced as a result of the Project.

- **interfere substantially with the recovery of the species**

Considering the scale of the Project and associated impacts proposed, it is considered not likely that the Project will interfere substantially with the recovery of this species.

Significant Impact Assessment Conclusion

The Project is considered not likely to result in a significant impact on the Glossy Black-Cockatoo.

10.5 Migratory Species Listed under International Conventions

The following migratory species are considered in this assessment:

- White-throated Needletail (*Hirundapus caudacutus*)
- Rufous Fantail (*Rhipidura rufifrons*)
- Black-faced Monarch (*Monarcha melanopsis*).

The Rufous Fantail has been observed within the development footprint during surveys. The Rufous Fantail and the Black-faced Monarch are known to occur in moist, dense habitats including wet sclerophyll and rainforest and mangroves. The dry sclerophyll forest habitats within the Development Footprint may provide movement corridors for these species. The following assessments are provided for each species.

10.5.1 White-throated Needletail (*Hirundapus caudacutus*)

An area of important habitat is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
- habitat utilised by a migratory species which is at the limit of the species range, or
- habitat within an area where the species is declining.

Important habitat for this species is defined under the Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act (DoE 2015) as '*on-breeding habitat only: Found across a range of habitats, more often over wooded areas, where it is almost exclusively aerial. Large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. Found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. Appears to have traditional roost sites.'*.

The suitable habitats within the development footprint for this species are part of larger tracts of native vegetation, however the development footprint is not likely to solely support an ecologically significant proportion of the population of this species. It is considered that the development footprint does not contain an area of important habitat for the White-throated Needletail.

The Project is considered likely to result in a significant impact on migratory species if there is a real chance or possibility that it will:

- substantially modify and/or destroy an area of important habitat for a migratory species,
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species, and/or
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.

The development footprint is considered to not contain *important habitat* for this species and therefore the Project is not likely to substantially modify or destroy important habitat for this species. Similarly, the Project will not seriously disrupt the lifecycle of an ecologically significant proportion of the population of this species; or result in an invasive species that is harmful to this species becoming established within the development footprint**.**

- Significant Impact Assessment Conclusion.

The Project is considered not likely to result in a significant impact on the White-throated Needletail.

10.5.2 Rufous Fantail (*Rhipidura rufifrons*)

An area of important habitat is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
- habitat utilised by a migratory species which is at the limit of the species range, or
- habitat within an area where the species is declining.

Important habitat for this species is defined under the Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act (DoE 2015) as '*Moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understorey. When on passage a wider range of habitats are used including dry eucalypt forests and woodlands and Brigalow shrubland's'*.

The suitable habitats within the development footprint for this species do not typically have a dense understorey, an ecologically significant proportion of the population of this species (1,100 individuals) is not likely to utilise the habitats present and the development footprint has not been identified as habitat where this species is declining.

It is considered that the development footprint does not contain an area of important habitat for the Rufous Fantail.

The Project is considered likely to result in a significant impact on migratory species if there is a real chance or possibility that it will:

- substantially modify and/or destroy an area of important habitat for a migratory species,
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species, and/or
- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.

The development footprint is considered to not contain *important habitat* for this species and therefore the Project is not likely to substantially modify or destroy important habitat for this species. Similarly, the Project will not seriously disrupt the lifecycle of an ecologically significant proportion of the population of this species; or result in an invasive species that is harmful to this species becoming established within the development footprint.

- **Significant Impact Assessment Conclusion**

The Project is considered not likely to result in a significant impact on the Rufous Fantail.

10.5.3 Black-faced Monarch

An area of important habitat is:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
- habitat utilised by a migratory species which is at the limit of the species range, or
- habitat within an area where the species is declining.

Important habitat for this species is defined under the Draft Referral Guideline for 14 Birds Listed as Migratory Species under the EPBC Act (DoE 2015) as 'Wet forest specialist, found mainly in rainforest and wet sclerophyll forest, especially in sheltered gullies and slopes with a dense understorey of ferns and/or shrubs'.

The suitable habitats within the development footprint for this species do not contain an ecologically significant proportion of the population of this species (460 individuals) is not likely to utilise the habitats present and the development footprint has not been identified as habitat where this species is declining.

It is considered that the development footprint does not contain an area of important habitat for the Black-faced Monarch.

The Project is considered likely to result in a significant impact on migratory species if there is a real chance or possibility that it will:

- substantially modify and/or destroy an area of important habitat for a migratory species,
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species, and/or

- result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species.

The development footprint is considered to not contain *important habitat* for this species and therefore the Project is not likely to substantially modify or destroy important habitat for this species. Similarly, the Project will not seriously disrupt the lifecycle of an ecologically significant proportion of the population of this species; or result in an invasive species that is harmful to this species becoming established within the development footprint**.**

- **Significant Impact Assessment Conclusion**

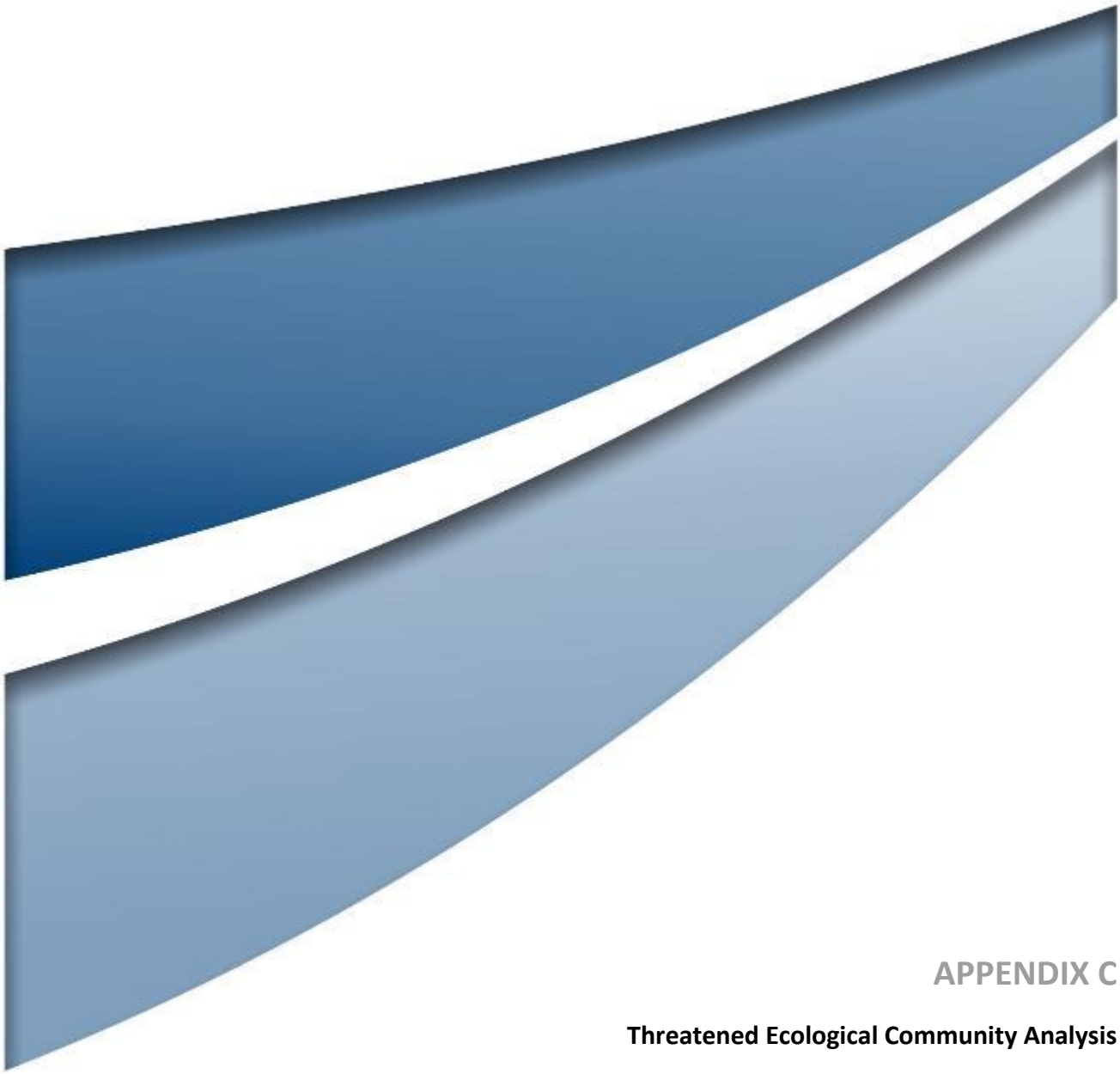
The Project is considered not likely to result in a significant impact on the Black-faced Monarch.



umwelt
Environmental & Social
Consultants

Umwelt (Australia) Pty Limited

T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au



APPENDIX C

Threatened Ecological Community Analysis

1.0 Assessment of Threatened Ecological Communities listed under the BC Act

The following threatened ecological communities (TECs) are assessed in **Tables C1.1** to **C1.8** with reference to the relevant characteristics described within the NSW Scientific Committee Final Determinations. The assessment has been undertaken to determine which TEC occur within the subject land.

Table C1.1 Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions

Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions endangered ecological community – Diagnostic Characteristics Summarised from NSW Scientific Committee (2010) Final Determination	Consideration
This EEC occurs principally on Permian sediments	The subject land does not occur on Permian sediments. The development footprint occurs on Carboniferous sediments of the Eagleton Volcanics and Mt Johnstone formations. The development footprint occurs on Carboniferous sediments of the Eagleton Volcanics and Mt Johnstone formations.
Central Hunter Grey Box – Ironbark Woodland typically forms a woodland (or open forest) dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *Brachychiton populneus* subsp. *populneus* (Kurrajong) and *Eucalyptus moluccana* (Grey Box). Other tree species may be present and occasionally dominate or co-dominate, and include *Angophora floribunda* (Rough-barked Apple) and *Callitris endlicheri* (Black Cypress Pine)	The subject land does not contain woodland or open forest dominated by *Eucalyptus crebra*, *Brachychiton populneus* subsp. populneus and *Eucalyptus moluccana*.
Central Hunter Grey Box – Ironbark Woodland has been recorded from the local government areas of Cessnock, Singleton and Muswellbrook but may occur elsewhere within the Sydney Basin Bioregion	The subject land is located within the Port Stephens LGA within the NSW North Coast Bioregion. The subject land is not within the Cessnock, Singleton or Muswellbrook LGAs.
Conclusion	**It is considered that the Central Hunter Grey Box—Ironbark Woodland in the New South Wales North Coast and Sydney Basin Bioregions EEC does not occur within the subject land.**

Table C1.2 Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions

Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions endangered ecological community - Diagnostic Characteristics Summarised from NSW Scientific Committee (2010) Final Determination	Consideration
This EEC generally occurs on Permian sediments in the Hunter Valley.	The subject land does not occur on Permian sediments. The development footprint occurs on Carboniferous sediments of the Eagleton Volcanics and Mt Johnstone formations. The geological characteristics for this EEC are not met within the subject land.
Central Hunter Ironbark - Spotted Gum - Grey Box Forest typically forms an open forest to woodland dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *Corymbia maculata* (Spotted Gum) and *Eucalyptus moluccana* (Grey Box). Other tree species may be present and occasionally dominate or co-dominate, and include *Eucalyptus fibrosa* (Broad-leaved Ironbark) and *Eucalyptus tereticornis* (Forest Red Gum)	The subject land does not contain woodland or open forest dominated by *Eucalyptus crebra*, *Corymbia maculata and Eucalyptus moluccana.* PCT 1590 is dominated by *Corymbia maculata* with the *Eucalyptus fibrosa* and/or *Eucalyptus siderophloia. Eucalyptus moluccana* and *Eucalyptus tereticornis* occur occasionally but are not dominant or co-dominant. Due to the lack of dominance by *Eucalyptus moluccana* and *Eucalyptus crebra,* it is considered that the floristic characteristics for this EEC are not met.
Central Hunter Grey Box – Ironbark Woodland has been recorded from the local government areas of Cessnock, Singleton and Muswellbrook but may occur elsewhere within the Sydney Basin Bioregion	The subject land is located within the Port Stephens LGA within the NSW North Coast Bioregion. The subject land is not within the Cessnock, Singleton or Muswellbrook LGAs. The subject land is outside of the main distribution of this EEC, which reduces the likelihood of its presence.
Conclusion	**The subject land does not contain areas which correspond with the geological or floristic characteristics and typical distribution of this EEC.** **It is considered that the Central Hunter Ironbark—Spotted Gum—Grey Box Forest in the New South Wales North Coast and Sydney Basin Bioregions endangered ecological community EEC does not occur within the subject land.**

Table C1.3 Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions

Hunter Floodplain Red Gum Woodland in the NSW North Coast and Sydney Basin Bioregions - Diagnostic Characteristics Summarised from NSW Scientific Committee (2011) Final Determination	Consideration
This EEC generally occurs on floodplains and associated floodplain rises along the Hunter River and tributaries	The subject land is within the Grahamstown Dam catchment which drains to the Hunter River.
All sites are within the NSW North Coast and Sydney Basin Bioregions	The subject land is within the NSW North Coast Bioregion
Hunter Floodplain Red Gum Woodland typically forms a tall to very tall (18-35 m) woodland. Stands on major floodplains are generally dominated by *Eucalyptus camaldulensis* (River Red Gum) in combinations with *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus melliodora* (Yellow Box) and *Angophora floribunda* (Rough-barked Apple). Within the community stands of *Casuarina cunninghamiana* subsp. *cunninghamiana* (River Oak) and *Casuarina glauca* (Swamp Oak) can form a part of this community.	The subject land does not contain woodland dominated by *Eucalyptus camaldulensis* in combinations with *Eucalyptus tereticornis*, *Eucalyptus melliodora* and *Angophora floribunda*. It is considered that the floristic requirements for this EEC are not present within the subject land.
Hunter Floodplain Red Gum Woodland has been recorded from the local government areas of Maitland, Mid-Western, Muswellbrook, Singleton, and Upper Hunter but may occur elsewhere within the NSW North Coast and Sydney Basin Bioregions	The subject land is located within the Port Stephens LGA and is not located within the main extent of occurrence of this EEC.
Conclusion	**It is considered that this EEC is not present in the subject land as the PCTs present do not match floristically with this EEC and the subject land is located outside of the recorded extent of occurrence of this EEC.**

Table C1.4 Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions

Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions - Diagnostic Characteristics Summarised from NSW Scientific Committee (2011) Final Determination	Consideration
Found on gentle slopes arising from depressions and drainage flats on Permian sediments of the Hunter Valley floor in the Sydney Basin and NSW North Coast Bioregions	Areas of drainage depressions and flats are present, however the subject land does not occur on Permian sediments. The development footprint occurs on Carboniferous sediments of the Eagleton Volcanics and Mt Johnstone formations. The geological characteristics for this EEC are not met within the subject land.
Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions has been recorded from the local government areas of Maitland, Cessnock and Port Stephens (in the Sydney Basin Bioregion) and Muswellbrook and Singleton (in the NSW North Coast Bioregion) but may occur elsewhere in these bioregions	The subject land occurs within the Port Stephens LGA.
The Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions is generally an open forest with most common canopy trees species being *Eucalyptus tereticornis* and *Eucalyptus punctata* although other frequently occurring canopy species are *Angophora costata, Corymbia maculata, Eucalyptus crebra* and *Eucalyptus moluccana*, with a number of other eucalypts being less frequently recorded	*Eucalyptus tereticornis* occurs on drainage depressions in PCTs 762, 1618 and 1716 however is typically in low densities in PCT 1618 and 1716.
Conclusion	**It is considered that this EEC is not present in the subject land as the PCTs present do not match the geological or floristic requirements for this EEC.**

Table C1.5 Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions

Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions – Additional Information and Diagnostic Characteristics Summarised from the NSW Scientific Committee (2019) Final Determination	Consideration
May occur outside the typical range of variation in the features described in Part 4 of the listing	Part 4 of the listing provides additional information about the ecological community. Part 4 of the Final Determination further identifies that this variation relates to natural variability and disturbance history. While occurrences of the community may occur outside of the typical range of features described, clear guidance is provided for exclusion of closely related map units / vegetation types which are not characteristic of the LHSGIF TEC.
Occurs in the lower Hunter Valley centered on the Cessnock-Beresfield area and approximately bounded by the towns of Paxton, Branxton, Clarence Town, Beresfield, Mt Vincent and the northern boundary of the Watagans National Park.	The development footprint occurs within the Lower Hunter Region (LGAs of Maitland, Cessnock, Port Stephens, Newcastle and Lake Macquarie), however it is located outside and to the east of the central distribution identified for this TEC. This is not a diagnostic feature and has not been relied upon in this assessment for determination of presence or absence of this TEC.
Permian substrates most commonly supporting the community belong to the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures. Permian substrates most commonly supporting the community belong to the Dalwood Group, the Maitland Group and the Greta and Tomago Coal Measures. In the area of Paterson, Seaham and Clarence Town, the community occurs on Carboniferous sediments including the Wallaringa, Mt Johnstone and Seaham formations.	The development footprint occurs on Carboniferous sediments of the Eagleton Volcanics and Mt Johnstone formations. The geological conditions for the presence of the TEC are at least partially met within the development footprint.
Strongly associated with yellow podsolic and solodic soils of the Lower Hunter soil landscapes of Aberdare, Branxton and Neath (although not restricted to these soils).	The development footprint is located on the Ten Mile Road and Ten Mile Road Variant A soil landscapes, these soil landscapes are not indicative of the presence of this EEC, however, do not conclusively rule out the presence of the TEC.

Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions – Additional Information and Diagnostic Characteristics Summarised from the NSW Scientific Committee (2019) Final Determination	Consideration
Dominated by *Corymbia maculata* and *Eucalyptus fibrosa* with *Eucalyptus punctata* occurring less frequently. Other species recorded infrequently are *Eucalyptus crebra, Eucalyptus moluccana, Eucalyptus agglomerata, Eucalyptus umbra, Corymbia gummifera, Syncarpia glomulifera, Eucalyptus globoidea, Eucalyptus paniculata subsp. paniculata, Eucalyptus sparsifolia, Angophora costata, Eucalyptus acmenoides, Eucalyptus fergusonii* subsp. *fergusonii, Eucalyptus nubila* and *Corymbia eximia* (none of these are characteristic of LHSGIF)	PCT 1590 is the only PCT present dominated by *Corymbia maculata* within all plots sampled. *Corymbia maculata* was also recorded outside of areas mapped as PCT 1590 in Plot 17 (PCT 762) and Plot 19 (PCT 1716). Plot 17 (PCT 762) has a mesic understorey and small tree layer with no ironbark species and Plot 19 contains *Eucalyptus siderophloia* as a co-dominant. Both Plots 17 and 19 are considered to not correspond to this TEC or a potentially associated PCT. For PCT 1590: - *Eucalyptus fibrosa* was observed in plots 16 and 20. - Plot 16 contained higher cover and abundance of *Eucalyptus umbra* (10% cover / 6 trees) compared to *Eucalyptus fibrosa* (5% cover / 5 trees) and also contained *Eucalyptus resinifera* at low cover and abundance (1% cover / 1 tree). - Plot 20 contained a higher cover and abundance of *Eucalyptus globoidea* (10 % cover / 15 trees) compared to *Eucalyptus fibrosa* (1% cover / 2 trees) and also contained *Eucalyptus canaliculata* (0.3% cover / 2 trees). - None of the plots sampled were dominated by both *Corymbia maculata* and *Eucalyptus fibrosa* together. Species co-occurring with *Corymbia maculata* in plots where *Eucalyptus fibrosa* was not observed include *Eucalyptus canaliculata* and *Eucalyptus globoidea* (Plot 10), *Eucalyptus siderophloia* (plots 9 and 10) and *Eucalyptus umbra* (plots 8, 9, 10 and 21). *Eucalyptus fibrosa* was not observed to be dominant in any of the plots sampled and *Eucalyptus punctata* was not recorded.

Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions – Additional Information and Diagnostic Characteristics Summarised from the NSW Scientific Committee (2019) Final Determination	Consideration
The most frequently encountered shrub species include *Acacia parvipinnula, Bursaria spinosa, Daviesia ulicifolia, Lissanthe strigosa, Melaleuca nodosa* and *Persoonia linearis*	*Acacia parvipinnula* and *Lissanthe strigosa* were not observed within the plots sampled for this PCT. *Bursaria spinosa* was observed in plots 9 and 10 with relatively low cover of 0.1% and *Persoonia linearis* was observed within five of the seven plots sampled. *Melaleuca nodosa* was observed within plot 16 with a cover of 10%. The shrub species which were observed in highest density within the plots sampled included *Melaleuca nodosa*, *Pultenaea villosa, Hakea dactyloides, Leptospermum polygalifolium, Acacia longifolia, Hibbertia aspera*. Shrub species commonly encountered across the plots sampled included *Acacia falcata, Acacia implexa, Acacia longifolia, Acacia ulicifolia, Acrotriche divaricata, Boronia ledifolia, Breynia oblongifolia, Jacksonia scoparia, Leucopogon juniperinus, Notelaea longifolia, Persoonia linearis* and *Pultenaea villosa*.
Species frequently observed in the ground stratum include *Aristida vagans, Cheilanthes sieberi, Dianella revoluta, Entolasia stricta, Glycine clandestina, Hardenbergia violacea, Lepidosperma laterale, Lomandra filiformis, Lomandra multiflora, Macrozamia flexuosa, Microlaena stipoides, Panicum simile, Phyllanthus hirtellus, Pomax umbellata* and *Themeda triandra*.	Many of the ground cover species identified as frequently observed are present, however many of these are commonly encountered within many ecological communities. The ground stratum alone is not considered to be a strong diagnostic feature of the ecological community.
The Final Determination describes map units MU 67 and MU68 of Somerville (2009) as corresponding to the LHSGIF EEC.	MU 67 is described as having a canopy strongly dominated by *Corymbia maculata* and *Eucalyptus fibrosa,* often in association with *Eucalyptus punctata* and MU 68 is described as having a canopy strongly dominated by *Eucalyptus fibrosa* in association with *Corymbia maculata.* The canopy of the vegetation assigned to PCT 1590 within the development footprint is strongly dominated by *Corymbia maculata*, however this is in association with a range of other Eucalypt species, particularly, *Eucalyptus globoidea, Eucalyptus siderophloia, Eucalyptus umbra and Eucalyptus canaliculata.* It is considered that the PCT present corresponds to MU 65 of Somerville (2009).

Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions – Additional Information and Diagnostic Characteristics Summarised from the NSW Scientific Committee (2019) Final Determination	Consideration
The following Map Units of Somerville (2009) are identified by the NSW Scientific Committee as not forming part of Lower Hunter Spotted Gum Ironbark Forest (they are contra-indicative): • Map Unit 65 • Map Unit 66 • Map Unit71 • Map UNit72 • Map Unit 73 • Map Unit75	Map unit 65 is described as occurring in areas with similar edaphic properties but receiving a higher average annual rainfall. The development footprint is located at low elevation in a coastal area, which is likely to receive on average higher annual rainfall compared to the central distributional area described for this TEC. Map unit 65 is identified as having a canopy dominated by *Corymbia maculata* in association with *Eucalyptus umbra, Eucalyptus fibrosa, Eucalyptus siderophloia* and *Allocasuarina torulosa*. It is considered that this canopy composition generally accords with the floristics of the plots sampled within PCT 1590 with the addition of other eucalyptus such as *Eucalyptus globoidea* and *Eucalyptus canaliculata.* The shrub layer of map unit 65 is identified as having a more frequent occurrence of *Acacia ulicifolia, Breynia oblongifolia, Leucopogon juniperinus and Notelaea longifolia* and a less frequent occurrence of *Grevillea montana, Grevillea parviflora subsp. parviflora, Melaleuca decora, Melaleuca nodosa* and *Pultenaea spinosa*. In relation to the ground layer a mix of species including some more frequently recorded within the LHSGIF EEC and some more frequently recorded within MU65 were observed across the plots sampled. Map Unit 66 is described as being dominated by *Eucalyptus punctata* and *Angophora floribunda*, these species were not recorded, and it is considered that this map unit does not occur within the development footprint. Map Unit 71 occurs at very low elevations and is dominated by *Corymbia maculata* and *Eucalyptus fibrosa* in association with *Eucalyptus moluccana, Eucalyptus crebra* and *Eucalyptus tereticornis*. This map unit does not correspond with any of the plots sampled here. Map Units 72 and 75 have a co-dominance of *Eucalyptus crebra* and *Corymbia maculata* with lower frequency or absence of *Eucalyptus fibrosa*. Map Unit 73 occurs at higher elevations with higher rainfall and is dominated by *Corymbia maculata, Eucalyptus crebra* and less frequently *Eucalyptus tereticornis.* These map units do not correspond with any of the plots sampled here. It is considered that PCT 1590 matches the contra-indicative Map Unit 65 of Somerville (2009), and does not match a Somerville (2009) map unit associated with the Lower Hunter Spotted Gum Ironbark Forest EEC.

Lower Hunter Spotted Gum Ironbark Forest in the Sydney Basin and NSW North Coast Bioregions – Additional Information and Diagnostic Characteristics Summarised from the NSW Scientific Committee (2019) Final Determination	Consideration
Conclusion	While it is acknowledged that the site has been influenced by historical disturbance including bushfires and logging, the current composition of the canopy and shrub stratum are aligned with Map Unit 65 of Somerville (2009). This is reflected in the composition of the canopy and shrub layers which may be related to soil properties and/or higher average annual rainfall closer to the coast, compared to the identified central distribution of this EEC. **It is considered that the vegetation within the development footprint, mapped as PCT 1590, is not consistent with the Lower Hunter Spotted Gum Ironbark Forest EEC, as described by the NSW Scientific Committee (2019).**

Table C1.6 River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions - Diagnostic Characteristics Summarised from the NSW Scientific Committee (2011) Final Determination	Consideration
Occurs within the NSW North Coast, Sydney Basin and South East Corner bioregions known from parts of the Local Government Areas of Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Eastern Capital City Regional, Eurobodalla and Bega Valley but may occur elsewhere in these bioregions	The subject land is located within the Port Stephens LGA which is within the area of occurrence of this EEC.
Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains	The subject land contains periodically inundated alluvial flats and drainage lines associated with coastal floodplains. These landforms include areas of PCT 762, 1618 and 1716.
The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees	The subject land typically contains open forest vegetation.
While the composition of the tree stratum varies considerably, the most widespread and abundant dominant trees include *Eucalyptus tereticornis* (forest red gum), *E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple). *Eucalyptus baueriana* (blue box), *E. botryoides* (bangalay) and *E. elata* (river Peppermint) may be common south from Sydney, *E. ovata* (swamp gum) occurs on the far south coast, *E. saligna* (Sydney blue gum) and E. *grandis* (flooded gum) may occur north of Sydney, while E. *benthamii* is restricted to the Hawkesbury floodplain. Other eucalypts including *Eucalyptus longifolia* (Woollybutt), *E. moluccana* (grey box) and *E. viminalis* (ribbon gum) may be present in low abundance or dominant in limited areas of the distribution. A layer of small trees may be present, including *Melaleuca decora*, *M. styphelioides* (prickly-leaved teatree), *Backhousia myrtifolia* (grey myrtle), *Melia azedarach* (white cedar), *Casuarina cunninghamiana* subsp. *cunninghamiana* (river oak) and *C. glauca* (swamp oak). The combination of features that distinguish River-Flat Eucalypt Forest on Coastal Floodplains from other endangered communities on the coastal floodplains include: its dominance by either a mixed eucalypt canopy or by a single species of eucalypt belonging to either the genus Angophora or the sections Exsertaria or Transversaria of the genus Eucalyptus (Hill 2002); the relatively low abundance or sub-dominance of	PCT 762 contains a canopy dominated by *Eucalyptus tereticornis* and a small tree layer composed of composed of *Melaleuca styphelioides, Melaleuca sieberi, Melaleuca decora, Melaleuca nodosa* and *Callistemon salignus*. It is considered that the floristics of this PCT correspond with this EEC. PCT 1618 is dominated by *Eucalyptus resinifera* in association with *Angophora costata, Eucalyptus fibrosa, Eucalyptus globoidea* and *Eucalyptus tereticornis*. *Eucalyptus resinifera* subsp*. resinifera* from the section Transversaria and *E. tereticornis* from the section Exsertaria are present. It is considered that this PCT aligns with this EEC. PCT 1716 contains a sparse eucalypt canopy composed *Eucalyptus tereticornis*, *Eucalyptus siderophloia* and *Corymbia maculata* to approximately 10m high with a dense sub-canopy of *Melaleuca nodosa*. While *E. tereticornis* belongs to the section Exsertaria, the other characteristic species present do not belong to the section Exsertaria or Transversaria. The mid storey is composed of a mix of Melaleuca species including *Melaleuca decora, Melaleuca linariifolia, Melaleuca nodosa* and *Melaleuca sieberi*. It is considered that this PCT does not align with the floristic characteristics of this EEC.

River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions - Diagnostic Characteristics Summarised from the NSW Scientific Committee (2011) Final Determination	Consideration
Casuarina and Melaleuca species; the relatively low abundance of *Eucalyptus robusta*; and the prominent groundcover of soft-leaved forbs and grasses	
Conclusion	**The River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC is present within the subject land and development footprint.** **It is considered that PCTs 762 and 1618 both correspond with this EEC.** **It is considered that the floristic characteristics of PCT 1716 do not correspond with this EEC.**

Table C1.7 Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion

Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion - Diagnostic Characteristics Summarised from the NSW Scientific Committee (2011) Final Determination	Consideration
Associated with clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains	The subject land contains periodically inundated alluvial flats and drainage lines associated with coastal floodplains. These landforms include areas of PCT 762, 1618 and 1716.
Generally occurs below 50 m, but may occur on localised river flats up to 250 m elevation in the NSW North Coast bioregion	The alluvial flats and drainage line areas within the subject land are typically below 50m elevation and the requirement for occurrence within the NSW North Coast bioregion is met.
The structure of the community may vary from tall open forests to woodlands, although partial clearing may have reduced the canopy to scattered trees.	PCT 761 and 1618 form an open forest. PCT 1716 forms an open forest to scrub with scattered trees. Areas with scattered trees have likely been subject to historical disturbances associated with logging and bushfire.
Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion is known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, but may occur elsewhere in this bioregion	The subject land occurs with the Port Stephens LGA.
Characteristic species are identified in paragraph 1 of the final determination. The most widespread and abundant dominant trees include *Eucalyptus tereticornis* (forest red gum), *E. siderophloia* (grey ironbark), *Corymbia intermedia* (pink bloodwood) and, north of the Macleay floodplain, *Lophostemon suaveolens* (swamp turpentine). Other trees may be scattered throughout at low abundance or locally common at few sites, particularly where there is an influence from lithic substrates upslope. These include *Eucalyptus moluccana* (grey box), *E. propinqua* (grey gum), *E. seeana* (narrow-leaved red gum), *Angophora subvelutina* (broad-leaved apple), *E. robusta* (swamp mahogany), *Eucalyptus resinifera* subsp. *hemilampra* (red mahogany), *E. acmenoides* (white mahogany), *Angophora woodsiana, A. paludosa* and rainforest trees such as *Ficus* spp. (figs) and *Cupaniopsis* spp (tuckeroos). A layer of small trees may be present, including *Allocasuarina torulosa* (forest oak), *Alphitonia excelsa* (red ash), *Glochidion ferdinandi* (cheese tree), *Callistemon* spp. (bottlebrushes), *Melaleuca* spp. (paperbarks) and *Casuarina glauca* (swamp oak).	*Eucalyptus tereticornis* occurs within PCT 762, 1618 and 1716 which each occur on landforms associated with coastal floodplains. *E. tereticornis* is dominant within PCT 762, however other co-occurring eucalypts are not characteristic of this EEC. *E. tereticornis* is not dominant within PCT 1618 and no other characteristic tree species for the EEC occur as dominant species there. *E. tereticornis* occurs in tandem with *Eucalyptus siderophloia* in parts of PCT 1716, which also has a strong co-occurrence of *Corymbia maculata*. The other characteristic eucalypt species described for this EEC were not observed. A layer of small trees including several of the characteristic species for this EEC occurs within PCT 762, 1618 and 1716.

Subtropical Coastal Floodplain Forest of the NSW North Coast bioregion - Diagnostic Characteristics Summarised from the NSW Scientific Committee (2011) Final Determination	Consideration
The combination of features that distinguish Subtropical Coastal Floodplain Forest from other endangered ecological communities on the coastal floodplains include: its dominance by a mixed eucalypt canopy, often with *Lophostemon suaveolens*; the presence of rainforest elements as scattered trees or understorey plants; the relatively low abundance or sub-dominance of Casuarina and Melaleuca species; the relatively low abundance of *Eucalyptus robusta*; and the prominent groundcover of soft-leaved forbs and grasses. It may occupy central or marginal parts of floodplains and sandy flats, including Pleistocene back-barrier flats (Pressey and Griffith 1992); habitats where flooding is periodic and soils are rich in silt and sand, sometimes humic, and show little influence of saline ground water.	PCT 762, 1618 and 1716 each contain a mixed eucalypt canopy. Rainforest elements as scattered trees or understorey plants are present. Melaleuca and Casuarina species are sub-dominant except for PCT 1716 where a prominent layer of *Melaleuca nodosa* occurs, presumably as a response to historical disturbance. *Eucalyptus robusta* was not observed. The ground cover is dominated by soft leaved forbs and grasses, however sedges also feature. The areas where these PCTs occur are typically drainage lines and flats on marginal parts of floodplains with no influence from likely saline ground water.
Conclusion	**It is considered that PCT 1716 corresponds to a disturbed variant of this EEC. PCTs 762 and PCT 1618 display floristic characteristics which better align with the River-flat Eucalypt Forest on Coastal Floodplains EEC.**

Table C1.8 Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions

Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions - Diagnostic Characteristics Summarised from the NSW Scientific Committee (2011) Final Determination	Consideration
Associated with humic clay loams and sandy loams, on waterlogged or periodically inundated alluvial flats and drainage lines associated with coastal floodplains	The subject land contains periodically inundated alluvial flats and drainage lines associated with coastal floodplains. These landforms include areas of PCT 762, 1618 and 1716.
Swamp Sclerophyll Forest on Coastal Floodplains generally occurs below 20 m (though sometimes up to 50 m) elevation, often on small floodplains or where the larger floodplains adjoin lithic substrates or coastal sand plains in the NSW North Coast, Sydney Basin and South East Corner bioregions	The alluvial flats and drainage line areas within the subject land are typically above 20m in elevation. The elevation of these areas is below 50m elevation and the requirement for occurrence within the NSW North Coast bioregion is met.
The structure of the community is typically open forest, although partial clearing may have reduced the canopy to scattered trees. In some areas the tree stratum is low and dense, so that the community takes on the structure of scrub. The community also includes some areas of fernland and tall reedland or sedgeland, where trees are very sparse or absent	PCTs 762, 1618 and 1716 are considered to correspond with the broad structural requirements of this EEC.
Characteristic species are identified in paragraph 1 of the final determination. The combination of features that distinguish Swamp Sclerophyll Forest on Coastal Floodplains from other endangered ecological communities on the coastal floodplains include: its relatively dense tree canopy dominated by *Eucalyptus robusta*, *Melaleuca quinquenervia* or *E. botryoides*, the relatively infrequent occurrence of other eucalypts, *Casuarina glauca* or *Lophostemon suaveolens*; the occasional presence of rainforest elements as scattered trees or understorey plants; and the prominence of large sedges and ferns in the groundcover. It generally occupies small alluvial flats and peripheral parts of floodplains where they adjoin lithic substrates or coastal sandplains. The soils are usually waterlogged, stained black or dark grey with humus, and show little influence of saline ground water.	No PCTs within the subject land contain a canopy dominated or composed of *Eucalyptus robusta, Melaleuca quinquenervia or Eucalyptus botryoides*. All PCTs present have a canopy dominated by other eucalypt species. Furthermore areas with a very sparse or absent canopy with the structural formation of fernland, tall reedland or sedgeland are not present. PCT 1716 does contain a sparse eucalypt canopy in parts with a scrub mid stratum dominated by *Melaleuca nodosa*. The canopy species *E. tereticornis* and *E. siderophloia*, which occur within PCT 1716, align with the Subtropical Coastal Floodplain Forest and not this EEC. *Melaleuca nodosa* is also a characteristic species of the Subtropical Coastal Floodplain Forest and is not listed as a characteristic species within the final determination for this EEC.
Conclusion	**It is considered that the Swamp Sclerophyll Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions EEC does not occur within the subject land.**

2.0 Assessment of Threatened Ecological Communities listed under the EPBC Act

The following TECs listed within the EPBC Act were considered to have potential to occur within the subject land:

- Central Hunter Valley eucalypt forest and woodland
- Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland
- Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions.

The following detailed analysis of the relevant approved conservation advice and key diagnostic characteristics published by the Australian Government is provided separately for each TEC in **Tables C2.1** to **2.3**.

Table C2.1 Central Hunter Valley eucalypt forest and woodland

Central Hunter Valley eucalypt forest and woodland- Key Diagnostic Characteristics from EPBC Act Threatened Species Scientific Committee (2015) Approved Conservation Advice	Consideration
It occurs in the Hunter River catchment (typically called the Hunter Valley region)	The subject land occurs in the Hunter River Catchment
It typically occurs on lower hillslopes and low ridges, or valley floors in undulating country; on soils derived from Permian sedimentary rocks	Areas of drainage depressions and flats are present, however the subject land does not occur on Permian sediments. The subject land occurs on Carboniferous sediments of the Eagleton Volcanics and Mt Johnstone formations. The geological characteristics for this EEC are not met within the subject land.
It does not occur on alluvial flats, river terraces, aeolian sands, Triassic sediments, or escarpments	PCTs 1590 and 1619 do not occur in the landscape positions or substrates specified. PCTs 762, 1618 and 1716 all occur in landscape positions associated with alluvial flats.
It is woodland or forest, with a projected canopy cover of trees of 10% or more; or with a native tree density of at least 10 native tree stems per 0.5 ha (at least 20 native tree stems/ha) that are at least one metre in height	The vegetation within the subject land is mostly open forest.
The canopy of the ecological community is dominated by one or more of the following four eucalypt species: *Eucalyptus crebra* (narrow-leaved ironbark), *Corymbia maculata* (syn. E. maculata) (spotted gum), *E. dawsonii* (slaty gum) and *E. moluccana* (grey box); or a fifth species, *Allocasuarina luehmannii* (bulloak, buloke) dominates in combination with one or more of the above four eucalypt species, in sites previously dominated by one or more of the above four eucalypt species.	PCT 1590 contains areas dominated by *Corymbia maculata*. *Corymbia maculata* also occurs within PCT 1716.
Allocasuarina torulosa (forest oak), *Eucalyptus acmenoides* (white mahogany) and *E. fibrosa* (red/broad-leaved ironbark) are largely absent from the canopy of a patch	*Allocasuarina torulosa* and *Eucalyptus fibrosa* are both present throughout PCT 1590.
A ground layer is present (although it may vary in development and composition), as a sparse to thick layer of native grasses and other native herbs and/or native shrubs	These ground layer conditions are met for the PCTs present.
Conclusion	The Central Hunter Valley eucalypt forest and woodland is not present within the subject land and is excluded based on lack of key diagnostic features including the geological substrate and prominent occurrence of the negative diagnostic species.

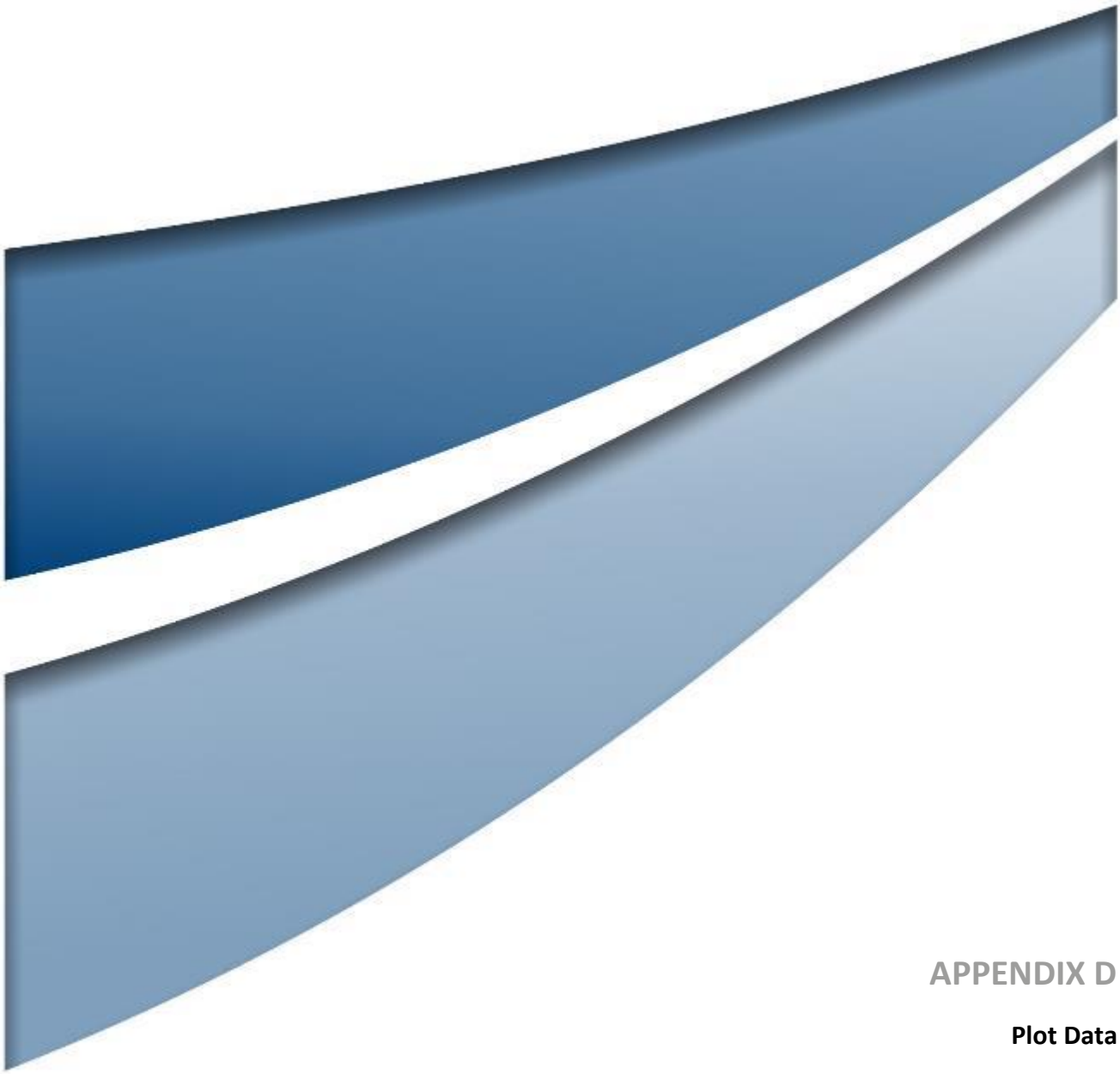
Table C2.2 Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland

Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland - Key Diagnostic Characteristics from DAWE (2021) Approved Conservation Advice	Consideration
Occurs on the mainland and islands near to the coast (within 20 km) from South East Queensland to south-eastern NSW specifically within these IBRA Bioregions: South Eastern Queensland (SEQ); NSW North Coast (NNC); Sydney Basin (SYB) and the Bateman sub-region of the South East Corner (SEC).	The subject land occurs within the NSW North Coast bioregion.
Occurs in coastal catchments typically below 20m ASL, but occasionally up to 220m ASL.	Most of the subject land is above 20m above sea level (ASL), however is entirely above 220m ASL.
Occurs on hydric soils with inundation patterns ranging from intermittent to episodic.	PCTs 762, 1618 and 1716 all meet this key diagnostic requirement.
The vegetation structure varies from tall closed to open forest to woodland, to dense (closed) shrubland or scrub forest. Minimum crown cover (see footnote 5, p. 4) is at least 10%, but it is more typically in the range 50% to 70%	The vegetation within the subject land typically meets this requirement.
From South East Queensland to the Sydney Basin Bioregion, the canopy is typically dominated or co-dominated by *Melaleuca quinquenervia* and/or *Eucalyptus robusta*. In some areas, the canopy may be locally dominated by other *melaleuca* species including: *M. dealbata* (SEQ bioregion) (rarely); *M. biconvexa* (mid-NSW coast to south of Sydney); *M. decora* (north of Shoalhaven), frequently with *Parsonsia straminea* climbing on the trunks of canopy species. In the SEC bioregion, *M. ericifolia* may occur as a dominant canopy or sub-canopy species.	Floristic plot analysis completed during late 2022 has identified that there are no parts of the subject land where *Melaleuca quinquenervia* or *Eucalyptus robusta* are dominant or co-dominant. Some areas, are dominated by other melaleucas, particularly PCT 1716 which is dominated by *Melaleuca nodosa*, however no areas are dominated by *M. dealbata*, *M. biconvexa* or *M. decora*.
Other tree species may occur in the canopy (or sub-canopy) in some areas, but they are not dominant across a patch, including *Casuarina glauca*, *Banksia* spp., *Callistemon salignus*, *Corymbia intermedia* (Pink Bloodwood), *E. tereticornis*, (Forest Red Gum/Queensland Blue Gum), *E. longifolia* (Woollybutt), *E. botryoides* (Southern Mahogany/Bangalay), *E. ovata* (Swamp Gum), *Livistona australis* and/or *Lophostemon* spp.	PCTs 762, 1618 ad 1716 all contain *Eucalyptus tereticornis*. This species is particularly dominant in PCT 762.
The understorey typically includes a variable ground layer, depending on the canopy cover and inundation rate/period. Tall sedges (typically *Gahnia* spp.) and/or ferns often dominate the ground layer, mixed with graminoids and other herbs, especially *Imperata cylindrica* (Blady Grass)	These understorey conditions met within PCTs 762, 1618 ad 1716.

Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland - Key Diagnostic Characteristics from DAWE (2021) Approved Conservation Advice	Consideration
While they can occur regularly in the ground layer, the ecological community is not present if halophytic species, more typically associated with estuarine/saltmarsh areas, dominate the ground layer of a patch, for example, *Appium prostratum, Atriplex cineria, Chenopodium glaucum, Rhagodia candolleaus* and *Samolus repens*.	Halophytic species were not observed.
Conclusion	**It is noted that in the referral documentation submitted for this project, the potential presence of this EEC was acknowledged. However further site based floristic plot surveys and analysis have confirmed the absence of this EEC and the presence of the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions listed under the *EPBC Act*.**

Table C2.3 Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions

Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions - Key Diagnostic Characteristics from DCCEEW (2022) Approved Conservation Advice	Consideration
It occurs in the New South Wales North Coast (NNC) and South Eastern Queensland (SEQ) IBRA2 bioregions, and on Curtis Island in the Brigalow Belt North IBRA Bioregion (BBN).	The subject land occurs within the NSW North Coast bioregion.
It occurs in the catchments of the eastern watershed of the Great Dividing Range, typically in their lower reaches	The subject land occurs within the catchment of the eastern watershed of the Great Dividing Range.
It occurs at elevations up to 250 m above sea-level (ASL), most typically below 50 m ASL.	The subject land occurs below 250m ASL and areas with potential to correspond with this EEC typically occur below 50m ASL.
It occurs on alluvial landforms including river floodplains, riparian zones (e.g., along riverbanks, lake foreshores and creek lines), the floors of tributary gullies, floodplain pockets, alluvial flats, fans, terraces, and localised colluvial fans; as well as on localized depressions amongst low rises and on associated sites where water can pond.	PCTs 762, 1618 and 1716 all occur on alluvial landforms in association with riparian zones or localized depressions where water ponds.
It occurs on alluvial soils of various textures including silts, clay loams, sandy loams, gravel and cobbles	Detailed soil testing has not been undertaken PCTs 762, 1618 and 1716
It does not typically occur on soils that are primarily marine or aeolian sands, but may occur on such substrates after they have been modified by fluvial activity	The subject land does not contain soils that are marine or aeolian sands.
It occurs as a tall closed-forest, tall open-forest, closed forest, open forest, tall woodland, or woodland (Specht 1970). The canopy has a crown cover of at least 20%	These structural requirements are satisfied for PCTs 762, 1618 and 1716.
It has a canopy dominated by one or a combination of Angophora, Corymbia, Eucalyptus, Lophostemon and/or Syncarpia tree species, but NOT dominated by *Eucalyptus robusta* (swamp mahogany). Other canopy tree species may be present, and in some areas rainforest trees may be prominent.	This floristic requirement is met for PCT 762, 1618 and 1716.
A mid-layer (including a sub-canopy, and/or shrub-layer) may be present, sparse or absent; and fauna may be abundant or rare.	Mid layer presence/absence and fauna abundance was not utilised as a diagnostic tool in this assessment.
Conclusion	**It is considered that PCTs 762, 1618 and 1716 all correspond to the Subtropical eucalypt floodplain forest and woodland of the New South Wales North Coast and South East Queensland bioregions EEC listed under the EPBC Act.**



APPENDIX D

Plot Data

Table D.1 Floristic Plot Data

Family Name	Scientific Name	Plot 12B		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Plot 12A		Plot 13		Plot 14		Plot 15		Plot 16		Plot 17		Plot 22		Plot 20		Plot 24		Plot 19		Plot 21		Plot 23	
		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
Trees																																			
Casuarinaceae	*Allocasuarina littoralis*					1	8			0.1	3	1	8	0.1	3	0.1	1			0.1	2															
Myrtaceae	*Angophora costata*	15	5									5	3	5	3	15	12	15	15	10	12	1	1			2	1			5	3			5	5
Myrtaceae	*Corymbia gummifera*											15	8	10	10	5	10			1	1					1	1			5	4			10	4
Myrtaceae	*Corymbia maculata*			10	5	30	20	30	20	20	25											10	8	5	1			5	10			20	20	20	10		
Myrtaceae	*Eucalyptus canaliculata*									5	4					1	1	10	10			1	1	10	2	2	1								
Myrtaceae	*Eucalyptus fibrosa*	1	1															15	20			5	5			5	2	1	2					10	3
Myrtaceae	*Eucalyptus globoidea*	1	1							1	1	5	2	5	3	5	1			15	15					1	1	10	15	5	3			10	3
Myrtaceae	*Eucalyptus piperita*											5	2																						
Myrtaceae	*Eucalyptus resinifera*	10	3											15	20	15	12			2	1	1	1												
Myrtaceae	*Eucalyptus siderophloia*			1	1			5	3	5	3																					3	1	5	3
Myrtaceae	*Eucalyptus tereticornis*	5	2	5	1																					10	8								
Myrtaceae	*Eucalyptus umbra*					1	1	8	4	10	10			1	1							10	6											5	3
Oleaceae	*Notelaea longifolia*							0.1	1					0.1	1									0.1	2	0.1	1	1	5					0.1	1
Phyllanthaceae	*Glochidion ferdinandi*	0.1	2											1	10	10	30	2	20					10	20	0.2	5	0.1	1			0	0			0.2	3
Shrubs																																			
Araliaceae	*Polyscias sambucifolia*									0.1	1			0.2	4	0.2	5																		
Dilleniaceae	*Hibbertia aspera*	0.1	2	0.5	20	5	20			0.2	10			1	50	0.1	10							0.1	1	0.5	10	2	25	0.2	10			0.2	3		
Dilleniaceae	*Hibbertia riparia*											0.1	5	0.2	20											0.1	1			1	25						
Ericaceae	*Acrotriche divaricata*	0.1	1	0.1	1	0.1	1	0.2	2	0.2	2			0.5	10			0.1	2							0.1	2	0.2	2	0.5	5	0.1	1	0.2	2	0.2	3
Ericaceae	*Epacris pulchella*											0.1	3	0.5	50					0.1	20	0.1	20							0.2	35						
Ericaceae	*Leucopogon juniperinus*			0.1	5	0.1	5			0.1	5													0.1	3	1	10					0.1	1	0.1	3		
Fabaceae (Faboideae)	*Bossiaea heterophylla*											0.1	1																						
Fabaceae (Faboideae)	*Daviesia acicularis*											0.1	3																						
Fabaceae (Faboideae)	*Dillwynia retorta*											0.1	1							1	20													3	100
Fabaceae (Faboideae)	*Gompholobium latifolium*											0.1	5																						
Fabaceae (Faboideae)	*Indigofera australis*					0.1	3																					0.7	5						
Fabaceae (Faboideae)	*Jacksonia scoparia*					0.2	3	0.2	2																			0.5	3					0.3	3	0.1	1
Fabaceae (Faboideae)	*Mirbelia rubiifolia*			0.1	10	0.1	10			0.1	5																								
Fabaceae (Faboideae)	*Platylobium formosum*									0.3	10			0.1	5					0.1	3														
Fabaceae (Faboideae)	*Pultenaea euchila*											1	20	0.1	5					0.2	10									0.5	10			0.1	2	2	100
Fabaceae (Faboideae)	*Pultenaea paleacea*											0.3	20	2	50	1	50			5	200	0.1	5			0.1	2			0.5	10						
Fabaceae (Faboideae)	*Pultenaea retusa*	0.1	1	0.1	2																														
Fabaceae (Faboideae)	*Pultenaea villosa*	0.1	1			5	10	0.2	10							2	20	5	20	1	15	10	30					0.7	3			0.3	5			10	100
Fabaceae (Mimosoideae)	*Acacia falcata*	0.1	5					0.1	1																									0.1	1
Fabaceae (Mimosoideae)	*Acacia implexa*			0.1	1	0.1	3			0.5	8																								
Fabaceae (Mimosoideae)	*Acacia irrorata*	1	10																																
Fabaceae (Mimosoideae)	*Acacia longifolia*													0.2	5									0.1	3										
Fabaceae (Mimosoideae)	*Acacia myrtifolia*											0.2	10																						
Fabaceae (Mimosoideae)	*Acacia terminalis*													0.2	5																				

Family Name	Scientific Name	Plot 12B		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Plot 12A		Plot 13		Plot 14		Plot 15		Plot 16		Plot 17		Plot 22		Plot 20		Plot 24		Plot 19		Plot 21		Plot 23	
		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
Fabaceae (Mimosoideae)	*Acacia ulicifolia*							0.2	3	0.1	1											0.3	5			0.1	2	1	5								
Myrtaceae	*Callistemon salignus*			0.2	3											1	10							5	15										
Myrtaceae	*Leptospermum polygalifolium*	1	10	0.5	6			0.5	3	0.1	3	0.2	5	30	50	30	200			10	50	5	20	0.2	2	0.5	10			25	75						
Myrtaceae	*Leptospermum trinervium*											0.2	1	5	10																				
Myrtaceae	*Melaleuca decora*	5	20					0.1	1															10	5	5	10								
Myrtaceae	*Melaleuca linariifolia*	1	10																																
Myrtaceae	*Melaleuca nodosa*	20	50	40	100									20	30							10	20			20	25					30	100		
Myrtaceae	*Melaleuca sieberi*	0.5	5											1	10	5	20			0.2	1					10	20								
Myrtaceae	*Sannantha crassa*	2	20																																
Phyllanthaceae	*Breynia oblongifolia*			0.5	20	0.1	3	0.1	1	0.1	2			0.1	2							0.1	1	10	30	0.2	5							0.3	3	0.1	3
Phyllanthaceae	*Phyllanthus hirtellus*					0.2	20	0.1	10	0.1	10	0.1	20	0.1	10			0.1	10	0.1	10	0.2	100					1	250	0.3	50	0.3	100	0.2	5	0.3	50
Pittosporaceae	*Bursaria spinosa*							0.1	1	0.1	3							0.1	3																
Pittosporaceae	*Pittosporum multiflorum*							0.1	2																			0.5	10						
Pittosporaceae	*Pittosporum revolutum*													0.1	2											0.1	2								
Proteaceae	*Banksia spinulosa*													0.2	3	0.5	6			0.5	4									0.7	10				
Proteaceae	*Banksia spinulosa var. collina*											2	5																						
Proteaceae	*Hakea dactyloides*					5	10																												
Proteaceae	*Isopogon anemonifolius*											0.1	2																						
Proteaceae	*Lambertia formosa*											1	10																						
Proteaceae	*Persoonia levis*											0.1	2																						
Proteaceae	*Persoonia linearis*			0.1	1			0.2	10	0.1	5	0.5	5	2	10	0.1	5	0.1	3			0.1	2			0.1	1	0.5	2	0.5	5			0.1	1	0.5	20
Rutaceae	*Boronia ledifolia*									0.1	6											0.1	5					0.3	100	0.1	25						
Sapindaceae	*Dodonaea triquetra*	0.1	2															5	30																
Thymelaeaceae	*Pimelea linifolia*											0.1	10									0.5	50							0.3	10				
Grass and grass-like																																			
Cyperaceae	*Bolboschoenus fluviatilis*	0.2	20																																
Cyperaceae	*Carex appressa*															1	200																		
Cyperaceae	*Carex inversa*	5	100			1	100			0.1	10			1	100			0.1	10							10	200	0.7	50					0.1	20		
Cyperaceae	*Cyathochaeta diandra*							2	100					2	50	2	200			5	100									10	1000				
Cyperaceae	*Eleocharis sphacelata*	0.1	5																																
Cyperaceae	*Lepidosperma laterale*			0.1	10	0.2	50	1	20	1	30	1	50			2	100			0.2	20	0.1	5			0.1	5	0.1	20	0.2	10	0.5	20	1	100	0.5	100
Cyperaceae	*Lepidosperma spp.*															0.5	50																		
Cyperaceae	*Ptilothrix deusta*			10	500							25	1000			35	3000	2	100	20	2000	10	1000							45	1000	0.5	50			5	500
Cyperaceae	*Schoenoplectus validus*	0.1	10																																
Cyperaceae	*Schoenus apogon*	5	1000	5	1000											1	100			2	200	5	500			5	500			3	500	0.5	100				
Juncaceae	*Juncus usitatus*															0.1	3																		
Lomandraceae	*Lomandra filiformis*					1	50	5	250	5	200	0.1	5															1	50					0.5	500		
Lomandraceae	*Lomandra longifolia*			0.1	3									0.1	3	0.2	10	0.1	5			0.2	5	0.1	5	0.1	5					1	10	3	50		
Lomandraceae	*Lomandra multiflora subsp. multiflora*			0.5	50	0.1	20	1	50	1	20									0.1	3											0.1	10				
Lomandraceae	*Lomandra obliqua*											5	500	1	100			1	100	0.2	100									1	250					10	1000
Poaceae	*Anisopogon avenaceus*											40	500																						

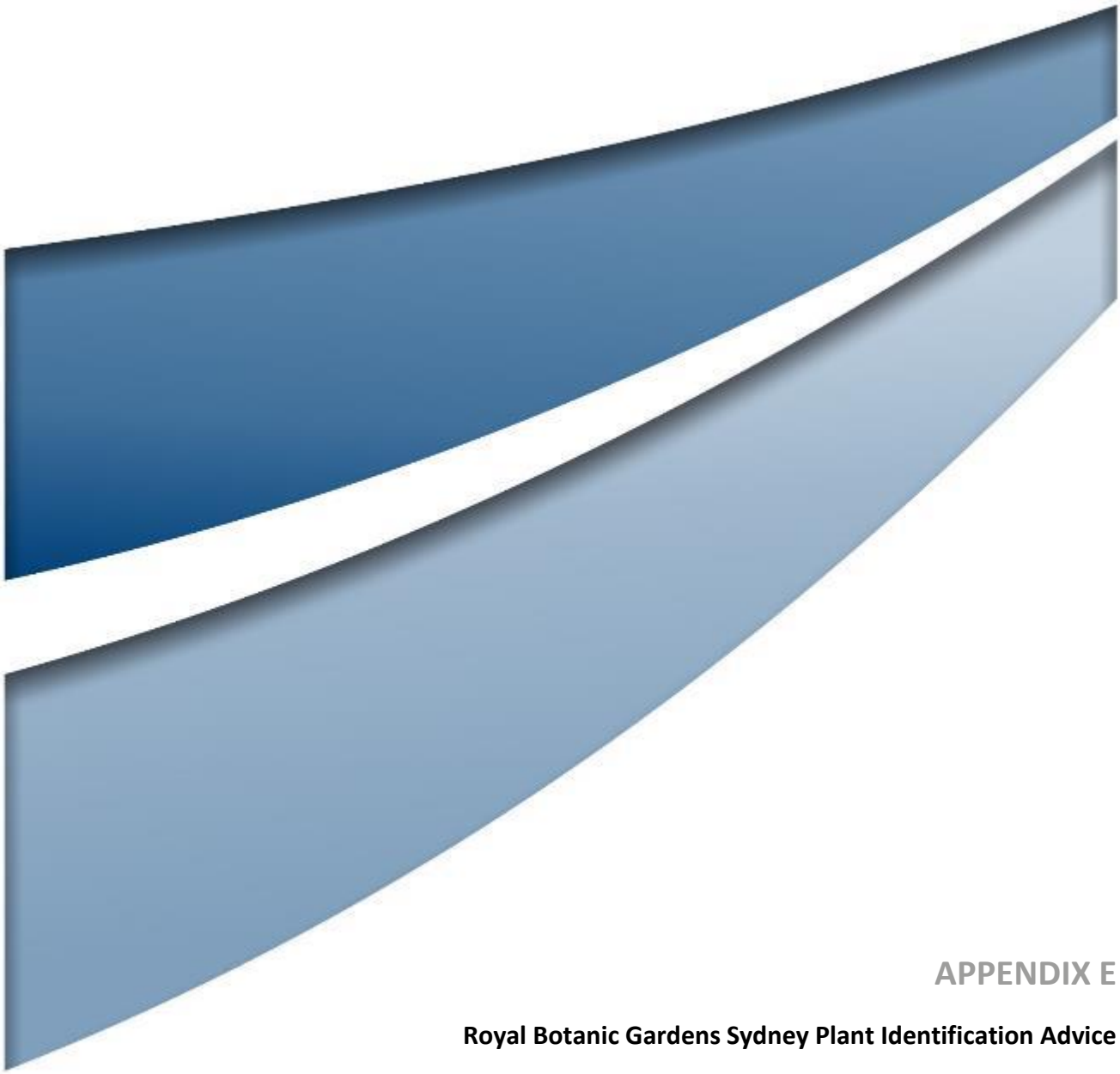
Family Name	Scientific Name	Plot 12B		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Plot 12A		Plot 13		Plot 14		Plot 15		Plot 16		Plot 17		Plot 22		Plot 20		Plot 24		Plot 19		Plot 21		Plot 23	
		C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Poaceae	*Aristida vagans*					1	50																			1	100	2	250			3	500	0.5	100	0.3	20
Poaceae	*Austrostipa spp.*	1	100	1	100									5	500																						
Poaceae	*Dichelachne crinita*			1	100	5	100	5	100	1	100			5	500			5	200			5	500					5	250								
Poaceae	*Digitaria divaricatissima*					1	50																			1	100										
Poaceae	*Echinopogon caespitosus*	5	100					0.5	20					5	500			5	500			5	500	10	500	2	200			0.5	50						
Poaceae	*Echinopogon caespitosus var. caespitosus*							1	50																												
Poaceae	*Entolasia marginata*	10	500	5	500	5	100			5	100			5	500	10	2000	5	1000			1	50	35	3000	5	500	15	1000			2	100				
Poaceae	*Entolasia stricta*	40	1000			5	100	10	500	1	50	15	500	5	500	20	1000	10	2000	15	2000	5	500			5	200			10	500	10	1000	10	1000	10	500
Poaceae	*Eragrostis spp.*			1	50																																
Poaceae	*Imperata cylindrica*	5	100					10	50	15	500			1	100	5	500	15	1000			1	50			25	1000					10	1000			3	100
Poaceae	*Microlaena stipoides var. stipoides*	10	200	5	500	5	100	1	50	5	100	5	500	5	500	1	200	5	200	20	3000	10	1000	20	1000							2	100	2	100	0.3	50
Poaceae	*Oplismenus aemulus*															1	50							20	2000	5	500	0.5	35					0.2	50		
Poaceae	*Panicum simile*	5	500	10	500	10	500	1	100					5	500			5	500	5	200	5	500							1	150	1	50	0.3	20	0.3	10
Poaceae	*Poa affinis*					10	100	20	100	5	100							10	500																		
Poaceae	*Rytidosperma caespitosum*			0.1	10																																
Poaceae	*Rytidosperma pallidum*							1	20											1	20													0.2	10	1	50
Poaceae	*Sporobolus creber*					0.5	20																														
Poaceae	*Themeda triandra*			30	1000	10	100	40	1000	5	50	5	100	25	3000	10	500	5	500	5	200	10	500			1	20	40	1000	3	500	0.1	2			5	500
Restionaceae	*Lepyrodia scariosa*													5	500																						
Forbs																																					
Acanthaceae	*Brunoniella australis*	0.1	10			0.1	10	0.1	10	0.1	10	0.1	10															0.1	50					0.1	10	0.1	20
Acanthaceae	*Pseuderanthemum variabile*					0.1	20																	1	200	0.1	10	0.3	100								
Apiaceae	*Centella asiatica*	0.1	50																					1	200			0.5	250								
Apiaceae	*Hydrocotyle laxiflora*	0.2	100					0.1	10							0.1	20					0.1	10	5	1000	0.2	500	0.1	50								
Asteraceae	*Brachyscome spathulata*									0.1	5																										
Asteraceae	*Cymbonotus lawsonianus*							0.1	10																												
Asteraceae	*Euchiton sphaericus*			0.1	10	0.1	5																														
Asteraceae	*Lagenifera stipitata*									0.1	10															0.1	10										
Asteraceae	*Sigesbeckia orientalis subsp. orientalis*					0.1	3																											0.1	1		
Asteraceae	*Vernonia cinerea*	0.1	20	0.2	50	0.1	5	0.1	5																	0.1	5	0.1	1			0.1	3	0.1	20		
Campanulaceae	*Lobelia purpurascens*	0.1	20	1	500	0.1	10	0.1	10	0.2	50			1	500	0.1	20	0.1	50	0.1	20	0.2	100	0.2	100	0.1	10	0.3	100			1	1000	1	1000	2	1000
Campanulaceae	*Wahlenbergia communis*							0.1	10	0.1	10											0.1	20					0.2	100								
Clusiaceae	*Hypericum gramineum*							0.1	5													0.1	10														
Convolvulaceae	*Dichondra repens*	0.2	100					0.2	100	0.1	50													5	500	0.1	20										
Fabaceae (Faboideae)	*Desmodium rhytidophyllum*					0.1	20	0.1	10									0.1	1			0.1	2											0.1	5	0.3	50
Fabaceae (Faboideae)	*Hovea linearis*											0.1	3																	0.1	1						
Goodeniaceae	*Brunonia australis*			0.1	20																																
Goodeniaceae	*Goodenia heterophylla*	0.1	20									0.2	100																								
Goodeniaceae	*Goodenia heterophylla subsp. heterophylla*															0.2	100	0.1	20			0.1	10													0.3	50
Goodeniaceae	*Goodenia paniculata*			0.2	100							0.1	20	0.1	20					1	200	1	100														
Haloragaceae	*Gonocarpus teucrioides*											0.1	50	0.1	20	5	1000	0.2	200	0.2	200	0.2	100			0.1	10			0.3	100	0.5	50			0.3	50

Family Name	Scientific Name	Plot 12B		Plot 7		Plot 8		Plot 9		Plot 10		Plot 11		Plot 12A		Plot 13		Plot 14		Plot 15		Plot 16		Plot 17		Plot 22		Plot 20		Plot 24		Plot 19		Plot 21		Plot 23	
		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	C	A
Haloragaceae	*Haloragis heterophylla*			5	500																											0.1	20				
Iridaceae	*Patersonia sericea*											0.5	20																	0.1	5						
Juncaginaceae	*Triglochin striata*	0.1	10																																		
Orchidaceae	*Cryptostylis subulata*															0.1	5									0.1	10										
Orchidaceae	*Microtis parviflora*							0.1	5																												
Oxalidaceae	*Oxalis perennans*													0.1	10					0.1	10																
Phormiaceae	*Dianella caerulea*	0.5	30	0.1	20	0.1	20	0.1	10	0.2	25	0.1	10	0.1	10			0.1	10	0.1	3			0.2	10												
Phormiaceae	*Dianella caerulea var. caerulea*															0.1	5																				
Rubiaceae	*Opercularia diphylla*			0.1	10	0.1	10	0.1	20	0.1	10	0.1	10	0.1	5							0.1	10														
Rubiaceae	*Pomax umbellata*							0.1	20																									0.3	50	0.1	20
Violaceae	*Hybanthus monopetalus*											0.1	20			0.1	10			0.1	5									0.2	50					0.2	50
Ferns																																					
Dennstaedtiaceae	*Pteridium esculentum*													0.2	20																					0.1	2
Lindsaeaceae	*Lindsaea linearis*													0.5	500															0.7	250						
Pteridaceae	*Cheilanthes sieberi*			0.1	10	0.1	20	0.1	50					0.1	10			0.1	20			0.1	10			0.1	10					0.2	100	0.1	50	0.1	20
Pteridaceae	*Cheilanthes sieberi subsp. sieberi*									0.1	20																										
Other Native Plants																																					
Apocynaceae	*Parsonsia straminea*	0.1	10	0.1	1	0.1	3	0.2	3																	0.1	1					0.1	3				
Bignoniaceae	*Pandorea pandorana*							0.1	5	0.1	5			0.1	5											0.1	1							0.1	1		
Convolvulaceae	*Convolvulus erubescens*	0.1	10											0.1	5	0.1	5							0.1	10									0.2	100
Fabaceae (Faboideae)	*Glycine clandestina*													0.1	5							0.1	5	0.1	10							0.1	20	0.2	20	0.1	20
Fabaceae (Faboideae)	*Glycine tabacina*					0.1	10	0.1	10			0.1	10													0.1	5	0.1	25	0.1	5	0.1	3				
Fabaceae (Faboideae)	*Hardenbergia violacea*					0.1	10	0.1	10	0.1	5	0.1	5	0.1	2			0.1	5	0.1	5					0.1	1	0.3	35	0.3	35	0.2	3	0.2	10	1	50
Lauraceae	*Cassytha glabella*	0.1	2							0.1	5			0.2	20							0.1	5			0.1	5			0.1	25						
Luzuriagaceae	*Eustrephus latifolius*			0.1	5	1	10	0.1	10					0.1	5	0.2	10					0.1	3			0.1	3	0.1	15			0.3	100	0.2	100	0.2	30
Pittosporaceae	*Billardiera scandens*					0.1	3	0.1	5	0.1	3			0.5	20	0.1	10	0.1	3			0.1	5			0.1	5	0.2	15			0.1	3	0.2	10	0.2	50
Smilacaceae	*Smilax glyciphylla*													0.1	1									0.2	5												
Xanthorrhoeaceae	*Xanthorrhoea latifolia*											5	30																								
High Threat Exotics																																					
Asteraceae	*Bidens pilosa*					0.1	3	0.1	5															0.2	20			0.1	35					0.1	1		
Asteraceae	*Senecio madagascariensis*	0.1	2	0.1	2	0.1	3	0.1	3	0.1	10			0.1	2			0.1	3					0.1	10			0.1	3			0.1	10				
Other Exotics																																					
Asteraceae	*Gamochaeta calviceps*			0.1	10																																
Asteraceae	*Sonchus oleraceus*					0.1	5	0.1	3																			0.1	1					0.1	10		
Rubiaceae	*Galium aparine*									0.1	10			0.1	20																						

Key: A = Abundance, C = Cover.

Table D.2 Vegetation Integrity Data

Plot	PCT	Area	Patch Size	Condition Class	Zone	Easting	Northing	Bearing	Composition Data						Structure Data						Function Data										
									Tree	Shrub	Grass	Forbs	Ferns	Other	Tree	Shrub	Grass	Forbs	Ferns	Other	Large Trees	Hollow trees	Litter C	Len Fallen Logs	Tree Stem 5to9 cm	Tree Stem 10to19 cm	Tree Stem 20to29 cm	TreeStem30to49 cm	Free Stem 50to79 cm	Tree Regen	High Threat Exotic
12B	1618	0.88	100	Intact	56	389039	6385037.29	250	6	13	12	9	0	3	32.1	31.1	86.4	1.5	0.0	0.3	2	0	49.0	18.0	0	1	1	1	1	1	0.1
7	1716	3.91	100	Regenerating	56	388208	6385537.58	230	3	11	13	8	1	2	16.0	42.3	68.8	6.8	0.1	0.2	0	0	44.0	12.5	1	1	1	1	0	1	0.1
8	1590	45.63	100	Intact	56	388364	6385447.29	100	3	11	14	9	1	5	32.0	16.0	54.8	0.9	0.1	1.4	0	0	85.0	53.0	1	1	1	1	0	1	0.2
9	1590	45.63	100	Intact	56	388358	6385285.69	270	4	12	14	13	1	6	43.1	2.1	98.5	1.4	0.1	0.7	0	0	52.0	60.0	1	1	1	1	0	1	0.2
10	1590	45.63	100	Intact	56	388271	6385095.38	290	6	14	11	8	1	4	41.1	2.2	44.1	1.0	0.1	0.4	1	0	52.0	104.0	1	1	1	1	1	1	0.1
11	1619	19.52	100	Intact_Apple	56	388963	6385215.2	290	5	18	8	9	0	3	31.0	6.4	96.1	1.4	0.0	5.2	2	0	74.0	25.0	1	1	1	1	1	1	0.0
12	1619	8.75	100	Intact_Ironbark	56	388074	6384746.6	65	8	19	14	6	3	8	37.2	63.5	70.1	1.5	0.8	1.3	0	0	76.0	90.0	1	1	1	1	0	1	0.1
13	1619	19.52	100	Intact_Apple	56	388517	6384985.22	65	7	9	14	7	0	3	51.1	39.9	88.8	5.7	0.0	0.4	2	1	79.0	26.0	1	1	1	1	1	1	0.0
14	1619	8.75	100	Intact_Ironbark	56	388687	6384970.28	0	4	6	13	5	1	2	42.0	10.4	68.2	0.6	0.1	0.2	1	0	95.0	65.0	1	1	1	1	1	1	0.1
15	1619	19.52	100	Intact_Apple	56	388806	6385095.3	90	5	11	11	9	0	1	28.1	18.4	73.5	1.9	0.0	0.1	1	0	88.0	70.0	1	1	1	1	1	1	0.0
16	1590	45.63	100	Intact	56	388651	6385430.1	270	6	12	13	10	1	4	28.0	26.6	57.8	2.2	0.1	0.4	0	2	81.0	39.0	1	1	1	1	0	1	0.0
17	762	0.33	100	Intact	56	388002	6384446.64	290	4	10	7	6	0	6	25.1	35.9	126.1	12.4	0.0	1.5	3	0	50.0	15.0	1	1	0	1	1	1	1.3
18	Null	45.63	100	Intact	56	387872	6385300.62	50	6	10	14	9	1	4	52.0	12.8	64.2	1.5	0.1	0.5	0	0	0.0	43.0	1	1	1	1	0	1	0.2
22	762	0.33	100	Intact	56	388043	6384627.59	120	8	14	13	11	1	8	21.3	38.0	80.2	1.3	0.1	0.9	0	0	7.4	76.0	0	1	1	1	0	0	0.1
20	1590	45.63	100	Intact	56	387841	6384961.68	90	6	10	10	16	3	7	17.4	7.4	96.3	3.5	0.5	1.1	0	0	44.0	63.0	1	1	1	1	0	1	0.5
24	1619	19.52	100	Intact_Apple	56	388497	6385080.1	58	4	12	9	9	1	4	15.7	29.8	73.7	1.7	0.7	0.8	2	0	70.0	5.0	1	1	1	1	1	1	0.0
19	1716	3.91	100	Regenerating	56	388051	6385448.11	30	2	5	13	9	1	6	23.0	30.8	31.0	3.1	0.2	0.9	0	0	95.2	49.0	1	1	1	1	0	1	0.1
21	1590	45.63	100	Intact	56	388059	6385279	70	5	12	11	8	1	5	30.8	5.6	20.8	2.8	0.1	0.9	2	1	93.0	94.0	1	1	1	1	1	1	0.2
23	1619	8.75	100	Intact_Ironbark	56	388428	6384848.02	80	6	13	14	14	2	7	35.3	20.4	37.0	4.3	0.2	2.2	4	0	90.2	49.0	1	1	1	1	1	1	0.0



APPENDIX E

Royal Botanic Gardens Sydney Plant Identification Advice

The Royal
BOTANIC GARDENS
& Domain Trust

National Herbarium of New South Wales

Ms Kate CONNOLLY
Umwelt
PO Box 838
Toronto, NSW 2283
AUSTRALIA

Enquiry No: 20341
Botanical.Is@rbgsyd.nsw.gov.au
Fax No: (02) 9251 1952
Ph. No: (02) 9231 8111
Date: 1 December 2017

Dear Ms CONNOLLY,

Thank you for your enquiry of 13-Nov-17. We are happy to provide the following information:

CL1 *Callistemon linearifolius* conf. P.G. Wilson 1 Dec 2017
CL2 *Callistemon linearifolius* conf. P.G. Wilson 1 Dec 2017
CL3 *Callistemon linearifolius* conf. P.G. Wilson 1 Dec 2017
CL4 *Callistemon linearifolius* conf. P.G. Wilson 1 Dec 2017

An invoice for $44.00 (incl. GST) will be forwarded to you separately by our finance section to cover cost of identification.

Thank you for your enquiry.

Yours sincerely

Barbara Wiecek
Identification Botanist
Botanical Information Service

The Royal Botanic Gardens & Domain Trust

National Herbarium of New South Wales

Jacob MANNERS
Umwelt
75 York Street
Teralba, NSW 2284

BIS Enquiry No: 22140
Botanical.Is@botanicgardens.nsw.gov.au
Ph. No: (02) 4631 5135
Date: 10 March 2023

Dear Jacob,

Re: Plant identification – Job 4158

Your plant specimens have been determined as the following:

1. DMTS01 - ***Corybas* sp.** - conf. A.E. Orme - 28 Feb 2023 – not retained
2. DMTS02 - ***Callistemon acuminatus* or possibly *salignus*** - det. P.G. Wilson - 7 Mar 2023 – not retained
3. DMTS03 - ***Callistemon acuminatus* or possibly *salignus*** - det. P.G. Wilson - 7 Mar 2023 - not retained
4. DMTS04 - ***Callistemon acuminatus* or possibly *salignus*** - det. P.G. Wilson - 7 Mar 2023 - not retained
5. DMTS05 - ***Callistemon acuminatus* or possibly *salignus*** - det. P.G. Wilson - 7 Mar 2023 - not retained
6. BLTS01 - ***Grevillea humilis* subsp. *humilis*** - det. A.E. Orme - 9 Mar 2023 – retained
7. BLTS02 - ***Callistemon rigidus*** - det. P.G. Wilson - 7 Mar 2023 - some of the younger leaves have characters which are *linearifolius*-like, so rather ambiguous. The presence of prominent glands on the leaves is also often associated with *C. linearifolius*. It is possible that P.G. Wilson did identify material like this (particularly if sterile) as *C. linearifolius* in the past. This specimen has been retained.
8. BLTS03 - ***Grevillea humilis* subsp. *humilis*** - det. A.E. Orme - 9 Mar 2023 - retained
9. JMG1 - ***Grevillea humilis* subsp. *humilis*** - det. A.E. Orme - 9 Mar 2023 – retained
10. JMC1 - ***Callistemon acuminatus* or possibly *salignus*** - det. P.G. Wilson - 7 Mar 2023 - not retained

An invoice for $220.00 (incl. GST) will be forwarded to you separately by our finance section to cover cost of identification.

Yours sincerely,

Andrew Orme
Identification Technical Officer
Botanical Identification Service

AUSTRALIAN INSTITUTE OF BOTANICAL SCIENCE

visit NSW Flora Online at plantnet.rbgsyd.nsw.gov.au
to help you identify the plants of New South Wales

NSW GOVERNMENT Planning, Industry & Environment

The Royal
BOTANIC GARDENS
& Domain Trust

National Herbarium of New South Wales

Jacob MANNERS
Umwelt
75 York Street
Teralba, NSW 2284
AUSTRALIA

BIS Enquiry No: 22328
Botanical.Is@botanicgardens.nsw.gov.au
Ph. No: (02) 4631 5135
Date: 20th July 2023

Dear Jacob,

Re: plant identification – *Corybas* specimens from Balickera region – Umwelt job 4158

Thank you for your enquiry of 16th June 2023. We are happy to provide the following information:

230605_1025_Cordow: *Corybas aconitiflorus* - det A.E. Orme 20th July 2023 – retained

230605_1000: *Corybas aconitiflorus* - det A.E. Orme 20th July 2023 – retained

20230607_1029_cordow_LS: *Corybas aconitiflorus* - det A.E. Orme 20th July 2023 – retained

TS_DM_Winter_01: *Corybas aconitiflorus* - det A.E. Orme 20th July 2023 – retained

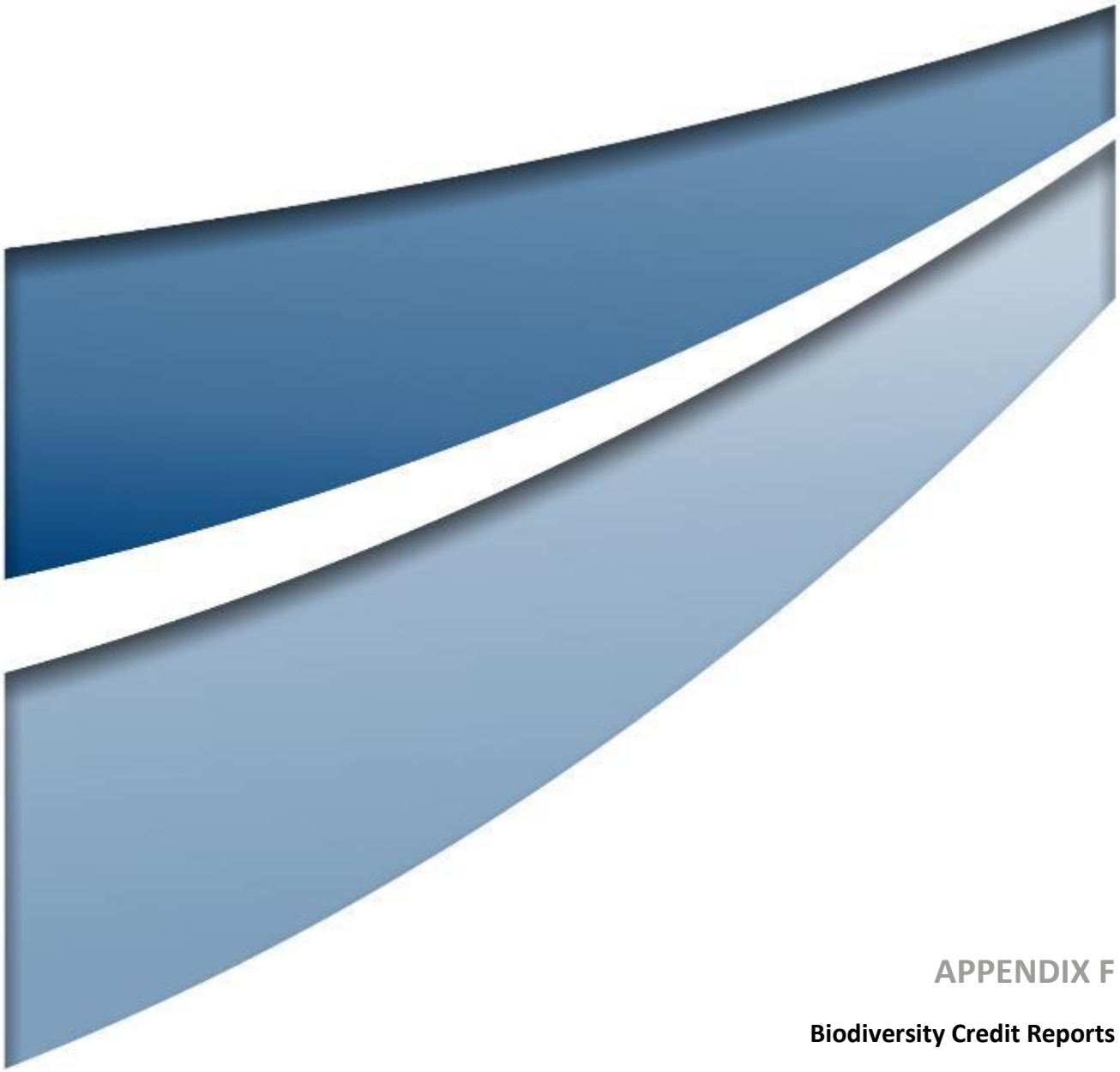
20230607_1046_Cordow_LS: *Corybas aconitiflorus* - det A.E. Orme 20th July 2023 - retained

An invoice for $75.00 (incl. GST) will be forwarded to you separately by our finance section to cover cost of identification.

Thank you for your enquiry.

Yours sincerely,

Andrew Orme
Identification Technical Officer
Botanical Identification Service



APPENDIX F

Biodiversity Credit Reports

BAM Credit Summary Report

Proposal Details

Assessment Id
00035143/BAAS17099/22/00035144

Proposal Name
Stone Ridge Quarry

BAM data last updated *
22/06/2023

Assessor Name
Jacob Manners

Report Created
13/03/2024

BAM Data version *
61

Assessor Number
BAAS17099

BAM Case Status
Finalised

Date Finalised
13/03/2024

Assessment Revision
2

Assessment Type
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)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Cabbage Gum open forest or woodland on flats of the North Coast												
5	762_Intact	Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion	78.8	78.8	0.33	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		13
											Subtotal	**13**
Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands												
3	1619_Intact_Apple	Not a TEC	70.7	70.7	18.9	PCT Cleared - 45%	High Sensitivity to Gain			1.50		502
4	1619_Intact_Ironbark	Not a TEC	80.5	80.5	8.6	PCT Cleared - 45%	High Sensitivity to Gain			1.50		261
											Subtotal	**763**

Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast												
1	1618_Intact	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	78.1	78.1	0.88	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Endangered Ecological Community	Not Listed	2.00		34
											Subtotal	**34**
Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest												
2	1590_Intact	Not a TEC	74.1	74.1	39.3	PCT Cleared - 48%	High Sensitivity to Gain			1.50		1092
											Subtotal	**1092**
											Total	**1902**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits

Petaurus norfolcensis / Squirrel Glider (Fauna)									
1618_Intact	78.1	78.1	0.88	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	34
1590_Intact	74.1	74.1	39.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	1455
1619_Intact_Apple	70.7	70.7	18.9	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	669
1619_Intact_Ironbark	80.5	80.5	8.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	348
762_Intact	78.8	78.8	0.33	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	13
								Subtotal	**2519**
Phascogale tapoatafa / Brush-tailed Phascogale (Fauna)									
1618_Intact	78.1	78.1	0.88	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	34

1590_Intact	74.1	74.1	39.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	1455
1619_Intact_Apple	70.7	70.7	18.9	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	669
1619_Intact_Ironbark	80.5	80.5	8.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	348
762_Intact	78.8	78.8	0.33	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	13
								Subtotal	**2519**
Phascolarctos cinereus / Koala (Fauna)									
1618_Intact	78.1	78.1	0.88	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	34
1590_Intact	74.1	74.1	39.3	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	1455

1619_Intact_Apple	70.7	70.7	18.9	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	669
1619_Intact_Ironbark	80.5	80.5	8.6	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	348
762_Intact	78.8	78.8	0.33	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	13
								Subtotal	**2519**

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00035143/BAAS17099/22/00035144

Proposal Name
Stone Ridge Quarry

BAM data last updated *
22/06/2023

Assessor Name
Jacob Manners

Assessor Number
BAAS17099

BAM Data version *
61

Proponent Names

Report Created
13/03/2024

BAM Case Status
Finalised

Assessment Revision
2

Assessment Type
Major Projects

Date Finalised
13/03/2024

* 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
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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

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
1618-Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.9	0	34	34
1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Not a TEC	39.3	1092	0	1092
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Not a TEC	27.5	502	261	763
762-Cabbage Gum open forest or woodland on flats of the North Coast	Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion	0.3	0	13	13

762-Cabbage Gum open forest or woodland on flats of the North Coast

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

	Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion This includes PCT's: 621, 686, 761, 762, 837, 848, 852, 971, 1062, 1091, 1092, 1106, 1215, 1227, 1230, 1333, 1588, 1594, 1598, 3067, 3102, 3420, 3428, 3574, 3984, 4002, 4003, 4005, 4032, 4033, 4036, 4042, 4045, 4046	-	762_Intact	No	13	Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 715, 904, 922, 1178, 1215, 1588, 1589, 1590, 1591, 1592, 1593, 1600, 1601, 1602, 1608, 1612, 1626, 1748, 3431, 3432, 3433, 3434, 3435, 3436, 3437, 3438, 3439, 3441, 3442, 3443, 3444, 3445, 3446, 3447	Hunter-Macleay Dry Sclerophyll Forests <50%	1590_Intact	Yes	1092	Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1618-Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 686, 828, 835, 941, 1108, 1109, 1212, 1228, 1293, 1318, 1326, 1386, 1504, 1556, 1594, 1618, 1720, 1794, 3145, 3181, 3185, 3188, 3192, 3258, 3328, 4024, 4025, 4039, 4041, 4058, 4138	-	1618_Intact	No	34	Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

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

	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1619_Intact_Apple	Yes	502	Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1619_Intact_Ironbark	No	261	Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

BAM Biodiversity Credit Report (Like for like)

Species	Vegetation Zone/s	Area / Count	Credits
Petaurus norfolcensis / Squirrel Glider	**1618_Intact, 1590_Intact, 1619_Intact_Apple, 1619_Intact_Ironbark, 762_Intact**	68.0	2519.00
Phascogale tapoatafa / Brush-tailed Phascogale	**1618_Intact, 1590_Intact, 1619_Intact_Apple, 1619_Intact_Ironbark, 762_Intact**	68.0	2519.00
Phascolarctos cinereus / Koala	**1618_Intact, 1590_Intact, 1619_Intact_Apple, 1619_Intact_Ironbark, 762_Intact**	68.0	2519.00

Credit Retirement Options

Like-for-like credit retirement options

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
Phascolarctos cinereus / Koala	Spp	IBRA subregion

	Phascolarctos cinereus / Koala	Any in NSW

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00035143/BAAS17099/22/00035144

Proposal Name
Stone Ridge Quarry

BAM data last updated *
22/06/2023

Assessor Name
Jacob Manners

Assessor Number
BAAS17099

BAM Data version *
61

Proponent Name(s)

Report Created
13/03/2024

BAM Case Status
Finalised

Assessment Revision
2

Assessment Type
Major Projects

Date Finalised
13/03/2024

* 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
Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
1618-Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.9	0	34	34.00
1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	Not a TEC	39.3	1092	0	1092.00
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	Not a TEC	27.5	502	261	763.00
762-Cabbage Gum open forest or woodland on flats of the North Coast	Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion	0.3	0	13	13.00

762-Cabbage Gum open forest or woodland on flats of the North Coast

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region

	Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion This includes PCT's: 621, 686, 761, 762, 837, 848, 852, 971, 1062, 1091, 1092, 1106, 1215, 1227, 1230, 1333, 1588, 1594, 1598, 3067, 3102, 3420, 3428, 3574, 3984, 4002, 4003, 4005, 4032, 4033, 4036, 4042, 4045, 4046	-	762_Intact	No	13	Upper Hunter,Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Grassy Woodlands	Tier 3 or higher threat status	762_Intact	No	13	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1590-Spotted Gum - Broad-leaved Mahogany - Red Ironbark shrubby open forest	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	Hunter-Macleay Dry Sclerophyll Forests This includes PCT's: 715, 904, 922, 1178, 1215, 1588, 1589, 1590, 1591, 1592, 1593, 1600, 1601, 1602, 1608, 1612, 1626, 1748, 3431, 3432, 3433, 3434, 3435, 3436, 3437, 3438, 3439, 3441, 3442, 3443, 3444, 3445, 3446, 3447	Hunter-Macleay Dry Sclerophyll Forests <50%	1590_Intact	Yes	1092	Upper Hunter,Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrub/grass sub-formation)	Tier 4 or higher threat status	1590_Intact	Yes (including artificial)	1092	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1618-Smooth-barked Apple - White Stringybark - Red Mahogany - Melaleuca sieberi shrubby open forest on lowlands of the lower North Coast	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 686, 828, 835, 941, 1108, 1109, 1212, 1228, 1293, 1318, 1326, 1386, 1504, 1556, 1594, 1618, 1720, 1794, 3145, 3181, 3185, 3188, 3192, 3258, 3328, 4024, 4025, 4039, 4041, 4058, 4138	-	1618_Intact	No	34	Upper Hunter,Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	1618_Intact	No	34	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1619-Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1619_Intact_Apple	Yes	502	Upper Hunter,Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Sydney Coastal Dry Sclerophyll Forests This includes PCT's: 1083, 1138, 1156, 1181, 1183, 1250, 1253, 1619, 1620, 1621, 1623, 1624, 1625, 1627, 1632, 1636, 1638, 1642, 1643, 1681, 1776, 1777, 1778, 1780, 1782, 1783, 1785, 1786, 1787, 3578, 3579, 3580, 3581, 3582, 3583, 3584, 3585, 3586, 3587, 3588, 3589, 3590, 3591, 3592, 3593, 3594, 3595, 3596, 3597, 3598	Sydney Coastal Dry Sclerophyll Forests <50%	1619_Intact_Ironbark	No	261	Upper Hunter,Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1619_Intact_Apple	Yes (including artificial)	502	IBRA Region: NSW North Coast, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1619_Intact_Ironbark	No	261	IBRA Region: NSW North Coast, 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
Petaurus norfolcensis / Squirrel Glider	**1618_Intact, 1590_Intact, 1619_Intact_Apple, 1619_Intact_Ironbark, 762_Intact**	68.0	2519.00
Phascogale tapoatafa / Brush-tailed Phascogale	**1618_Intact, 1590_Intact, 1619_Intact_Apple, 1619_Intact_Ironbark, 762_Intact**	68.0	2519.00
Phascolarctos cinereus / Koala	**1618_Intact, 1590_Intact, 1619_Intact_Apple, 1619_Intact_Ironbark, 762_Intact**	68.0	2519.00

Credit Retirement Options

Like-for-like options

Petaurus norfolcensis/ Squirrel Glider

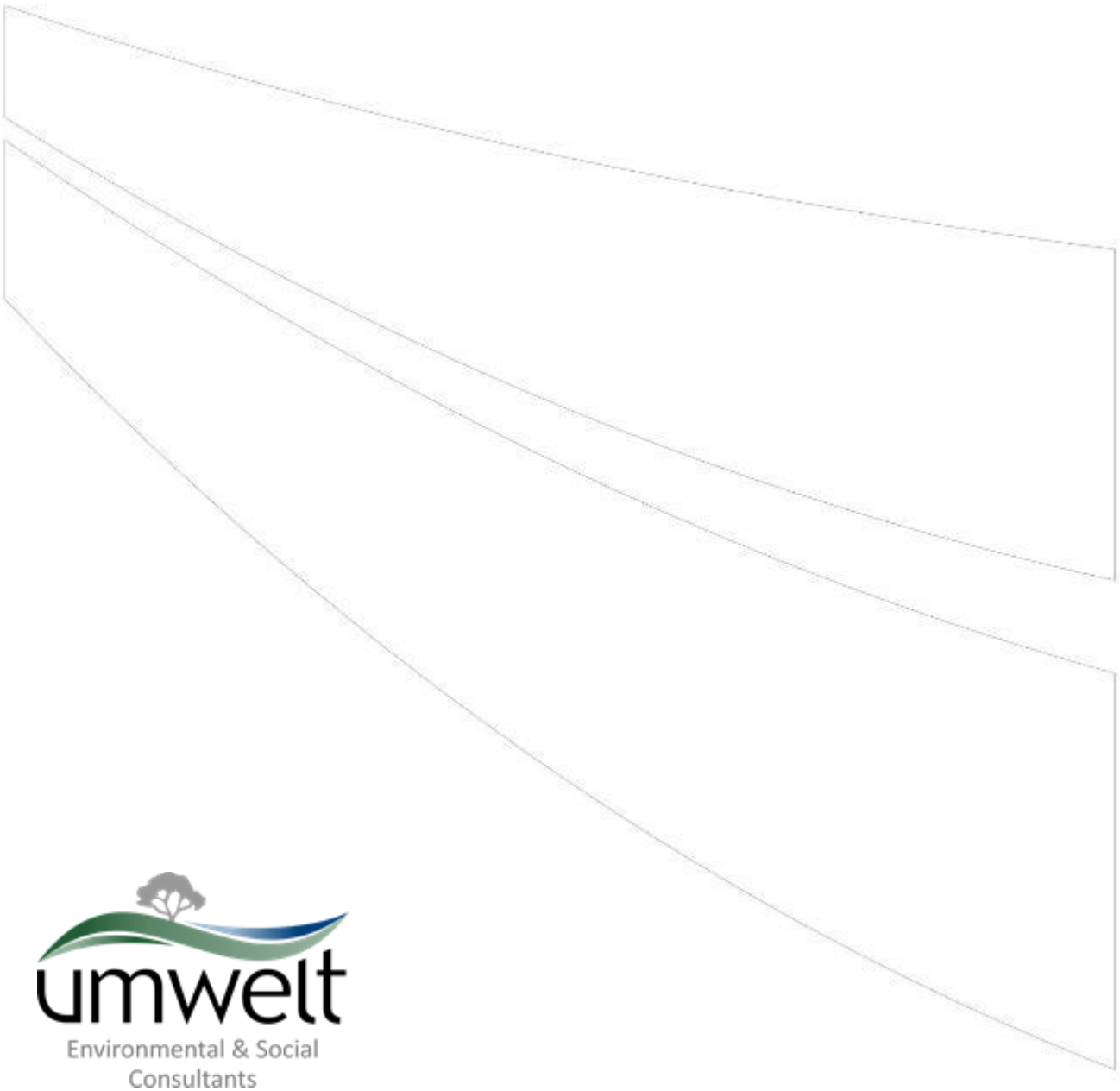
Spp	IBRA region
Petaurus norfolcensis/Squirrel Glider	Any in NSW

Variation options

Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
Fauna	Vulnerable	Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Phascogale tapoatafa/ Brush-tailed Phascogale	Spp		IBRA region
	Phascogale tapoatafa/Brush-tailed Phascogale		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Phascolarctos cinereus/ Koala	Spp		IBRA region
	Phascolarctos cinereus/Koala		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

	Fauna	Endangered	Upper Hunter, Ellerston, Hunter, Karuah Manning, Mummel Escarpment and Tomalla. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.



umwelt
Environmental & Social Consultants

Umwelt (Australia) Pty Limited

T| 1300 793 267 E| info@umwelt.com.au www.umwelt.com.au