

**DARKINJUNG LOCAL ABORIGINAL  
LAND COUNCIL**

Biodiversity Certification Assessment  
Report – Reeves Street, Somersby

**FINAL**

April 2020

# **DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL**

Biodiversity Certification Assessment Report –  
Reeves Street, Somersby

## **FINAL**

Prepared by  
**Umwelt (Australia) Pty Limited**  
on behalf of  
**Darkinjung Local Aboriginal Land Council**

Project Director:	Barbara Crossley
Project Manager:	Les Seddon
Technical Project Director:	Kate Connolly
Technical Project Manager:	Philippa Fagan
Report No.	4567/R01/V3
Date:	April 2020



### **Newcastle**

75 York Street  
Teralba NSW 2284

Ph. 02 4950 5322

[www.umwelt.com.au](http://www.umwelt.com.au)



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

# Executive Summary



Darkinjung Local Aboriginal Land Council (Darkinjung) is seeking to lodge a planning proposal for the rezoning and subdivision of Lot 481 DP 1184693 Reeves Street, Somersby NSW, for the purposes of an environmental living housing development.

The Development Footprint is located along Reeves Street Somersby, NSW in the Central Coast Local Government Area. The Development Footprint covers an area of approximately 16.6 hectares and is surrounded by a mosaic of intact native vegetation, rural landholdings and the Pacific Motorway.

This Biodiversity Certification Assessment Report (BCAR) has been prepared by Umwelt (Australia) Pty Limited (Umwelt) on behalf of Darkinjung to assess the potential biodiversity impacts of the proposed development in accordance with the Biodiversity Assessment Method (BAM).

Surveys of the Development Footprint identified three Plant Community Types (PCTs) (in varying conditions) and native fauna habitats, including:

- 3.2 ha of PCT1641 Dwarf Apple Scribbly Gum Heathy Low Woodland on Sandstone Ranges of the Central Coast (Good Condition)
- 9.9 ha of PCT1642 Scribbly Gum – Red Bloodwood – Old Man Banksia Heathy Woodland of Southern Central Coast (Good Condition)
- 0.6 ha of PCT1642 Scribbly Gum – Red Bloodwood – Old Man Banksia Heathy Woodland of Southern Central Coast (Moderate Condition) *Pinus radiata* variant

- 2.9 ha of PCT 1699 Heath- leaved Banksia – Coral Fern Wet Heath on Sandstone Ranges of the Lower Central Coast (Good Condition).

Following the application of avoidance and mitigation measures, the BCAR identified the following biodiversity credits required to offset the impacts of the Project:

- 76 ecosystem credits for PCT1641 Dwarf Apple Scribbly Gum heathy low woodland on sandstone ranges of the Central Coast
- 277 ecosystem credits for PCT1642 Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast
- 41 ecosystem credits for PCT 1699 Heath- leaved Banksia – Coral Fern wet heath on sandstone ranges of the lower Central Coast
- 471 species credits for eastern pygmy possum (*Cercartetus nanus*), 554 species credits for large-eared pied- bat (*Chalinolobus dwyeri*), 201 species credits for giant burrowing frog (*Heleioporus australiacus*), 471 species credits for spreading guinea flower (*Hibbertia procumbens*), 47 species credits for southern myotis (*Myotis Macropus*), 356 species credits for squirrel glider and 187 species credits for red- crowned toadlet (*Pseudophryne australis*).

Darkinjung is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the unavoidable loss of biodiversity values as a result of the Project as required under the *Biodiversity Conservation Act 2016*. This will be undertaken using one or more of the following options:

- The establishment and retirement of credits within a Stewardship site.
- Securing required credits through the open credit market and/or
- Payments to the Biodiversity Conservation Fund.



# Glossary

BCAR	Biodiversity Certification Assessment Report
BAM	Biodiversity Assessment Methodology
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
CEEC	Critically Endangered Ecological Community
Development Footprint	The total impact zone associated with the project
DAWE	Commonwealth Department of Agriculture, Water and Environment
DNG	Derived Native Grasslands
Ecosystem credit	A measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site and the gain in biodiversity values at an offset site.
EEC	Endangered Ecological Community
EP	Endangered Population
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
GDEs	Groundwater-dependent Ecosystems
GIS	Geographical Information System
IBRA	Interim Biogeographic Regionalisation for Australia (Version 7)
LGA	Local Government Area
MGA	Map Grid of Australia
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
PMST	Protected Matters Search Tool
Species credit	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection database.
Strahler Stream Order	Classification system that gives a waterway an 'order' according to the number of tributaries associated with it.
TEC	Threatened Ecological Community
TBDC	Threatened Biodiversity Data Collection
VIS	Vegetation Information System

### 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
1	Ryan Parsons	4 June 2019		
2	Kate Connolly	23 April 2020	Les Seddon	23 April 2020
3	Kate Connolly	28 April 2020	Les Seddon	28 April 2020

# Table of Contents

## Executive Summary

<b>Glossary</b>	<b>iii</b>
<b>1 Introduction</b>	<b>1</b>
1.1 Development Footprint Information	5
1.2 Local Ecological Context	5
1.3 Key Resources, Policies and Documents	6
1.4 Report Preparation	6
<b>2 Methods</b>	<b>7</b>
2.1 Landscape Features and Site Context	7
2.2 Native Vegetation Assessment	7
2.2.1 Literature and Database Review	7
2.2.2 Floristic and Vegetation Integrity Survey	7
2.2.3 Targeted and Meandering Transects	11
2.2.4 Digital Aerial Photograph Interpretation	11
2.2.5 Plant Identification and Nomenclature Standards	11
2.2.6 Vegetation Mapping	12
2.2.7 Threatened Ecological Community Delineation Techniques	14
2.2.8 Plant Community Type (PCT) Allocation	14
2.3 Threatened Species	14
2.3.1 Literature and Database Review	14
2.3.2 Ecosystem-credit Species	15
2.3.3 Species-credit Species	15
2.3.4 Weather Conditions and Limitations	18
<b>3 Results</b>	<b>20</b>
3.1 Landscape Value	20
3.2 Native Vegetation within the Development Footprint	20
3.2.1 Plant Community Types and Vegetation Zones	20
3.2.2 Exotic Vegetation	27
3.2.3 Threatened Ecological Communities	28
3.2.4 Vegetation Integrity Score	28
3.3 Threatened Species within the Development Footprint	28
3.3.1 Ecosystem-credit Species	28
3.3.2 Species-credit Species	30
3.3.3 Species- Credit Species Habitat Polygons and Biodiversity Risk Weighting	33

<b>4</b>	<b>Avoidance and Minimisation of Impacts</b>	<b>36</b>
4.1	Avoidance of Important Biodiversity Features	36
4.2	Minimisation Measures	36
4.2.1	Tree Felling Procedure	37
4.3	Summary of Measures	38
<b>5</b>	<b>Assessment of Impacts</b>	<b>40</b>
5.1	Impacts on Native Vegetation and Habitat	40
5.1.1	Direct Impacts	40
5.1.2	Indirect Impacts	41
5.2	Prescribed Impacts	42
5.2.1	Uncertain Prescribed Impacts	43
5.3	Biodiversity Corridor Functionality and Connectivity	43
5.4	Serious and Irreversible Impacts	46
<b>6</b>	<b>Biodiversity Credit Impact Summary</b>	<b>47</b>
6.1	Impacts Not Requiring Assessment	47
6.2	Impacts Not Requiring Offset	47
6.3	Impacts Requiring Offset	47
<b>7</b>	<b>Biodiversity Credit Report</b>	<b>49</b>
<b>8</b>	<b>Preliminary Biodiversity Offset Strategy</b>	<b>50</b>
<b>9</b>	<b>References</b>	<b>51</b>

## Figures

Figure 1.1	Planning proposal structure plan (Urbis 2019)	1
Figure 1.2	Locality Plan	3
Figure 1.3	Development Footprint	4
Figure 2.1	Landscape Features	9
Figure 2.2	Survey Effort	13
Figure 3.1	Plant Community Types in the Development Footprint	22
Figure 3.2	Threatened Species	29
Figure 3.3	Species-Credits Species Polygons	35
Figure 5.1	Proposal site in Relation to Central Coast Regional Plan 2036 Biodiversity Corridors (NSW Government 2016)	45

## Plates

Plate 3.1	Giant burrowing frog recorded within the Development Footprint	32
Plate 3.2	Red-crowned toadlet recorded within the Development Footprint	33

# Tables

Table 1.1	Development Footprint Location in the Landscape	5
Table 1.2	Accredited BAM Assessors and their Role on this Project	6
Table 2.1	Adequacy of Floristic and Vegetation Integrity Survey in the Development Footprint	10
Table 2.2	Species credit species survey methodology and timing	15
Table 2.3	Weather Conditions for Surveys	18
Table 3.1	Landscape Features in the Development Footprint	20
Table 3.2	Vegetation Zone Vegetation Integrity Scores	28
Table 3.3	Species-credit Species within the Development Footprint	30
Table 3.4	Species-credit Species Polygons	33
Table 4.1	Avoidance and Minimisation Measures	39
Table 5.1	Direct Impacts of the Project on Biodiversity Features	40
Table 6.1	Impacts Requiring Offset	48

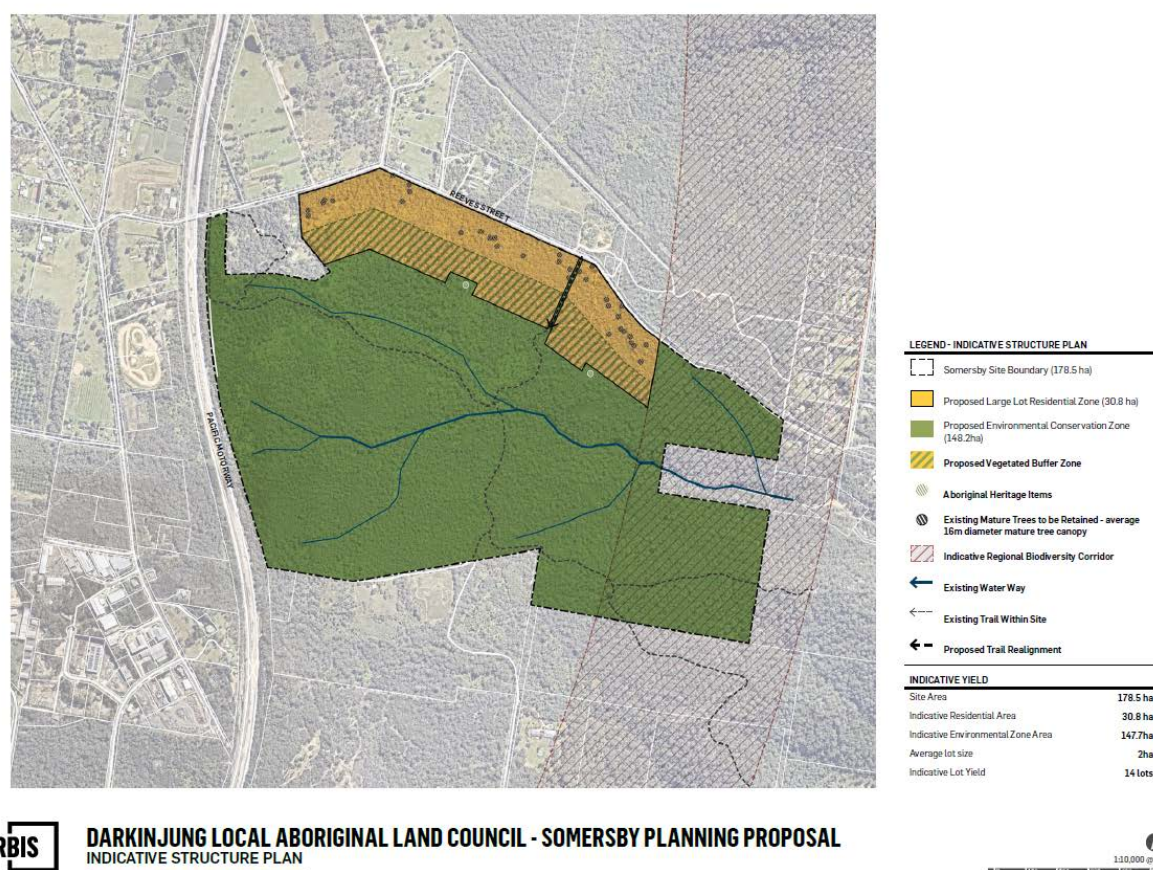
# Appendices

Appendix A	Predicted Threatened Species (Ecosystem Credit)
Appendix B	Predicted Threatened Species (Species Credit) and Survey Methods
Appendix C	Flora Species List
Appendix D	Vegetation Integrity Data
Appendix E	Biodiversity Credit Report



# 1 Introduction

Darkinjung Local Aboriginal Land Council (Darkinjung) is seeking a rezoning and subdivision of a site located at Lot 481 DP 1184693 Reeves Street, Somersby NSW, for the purposes of a residential housing development, as shown in **Figure 1.1**. This will involve the subdivision of the site into 14 residential housing lots, and the development of necessary ancillary infrastructure such as sewerage and stormwater management. As the proposed subdivision is linear and occurs along the frontage of Reeves Street, no internal roads are proposed.



**URBIS** DARKINJUNG LOCAL ABORIGINAL LAND COUNCIL - SOMERSBY PLANNING PROPOSAL  
INDICATIVE STRUCTURE PLAN

**Figure 1.1** Planning proposal structure plan (Urbis 2019)

The Development Footprint is located along Reeves Street Somersby, NSW (refer to **Figure 1.2** and **Figure 1.3**) in the Central Coast Local Government Area (LGA). The Development Footprint covers an area of approximately 16.6 hectares (ha) and is surrounded by a mosaic of intact native vegetation, rural landholdings and the Pacific Motorway to the west. The Development Footprint was revised following the Regional Planning Proposal's Rezoning Review Request decision and has been strategically located outside the indicative regional biodiversity corridor identified in the Central Coast Regional Plan 2036 (NSW Government 2016) (refer **Figure 1.1** and **Section 5.3**).

This Biodiversity Certification Assessment Report (BCAR) has been prepared by Umwelt (Australia) Pty Limited (Umwelt) to assess the potential biodiversity impacts of the residential subdivision in accordance with the Biodiversity Assessment Method (BAM) and the *Biodiversity Conservation Act 2016* (BC Act). It provides the findings of the biodiversity assessment of the proposed rezoning and residential subdivision. It addresses the specific requirements of the BAM (OEH 2017a).

Under the BC Act, options exist for the assessment and approval of biodiversity offsetting arrangements including standard biodiversity certification, strategic biodiversity certification or offsetting at the development application stage. Darkinjung LALC is yet to determine the method to be applied in this case. A BCAR framework has been used to assess biodiversity impacts and quantify potential offset obligations as part of the supporting information for the planning proposal.





Image Source: Nearmap (2019); Open Street Map (2019) Data source: NSW LPI (2019)



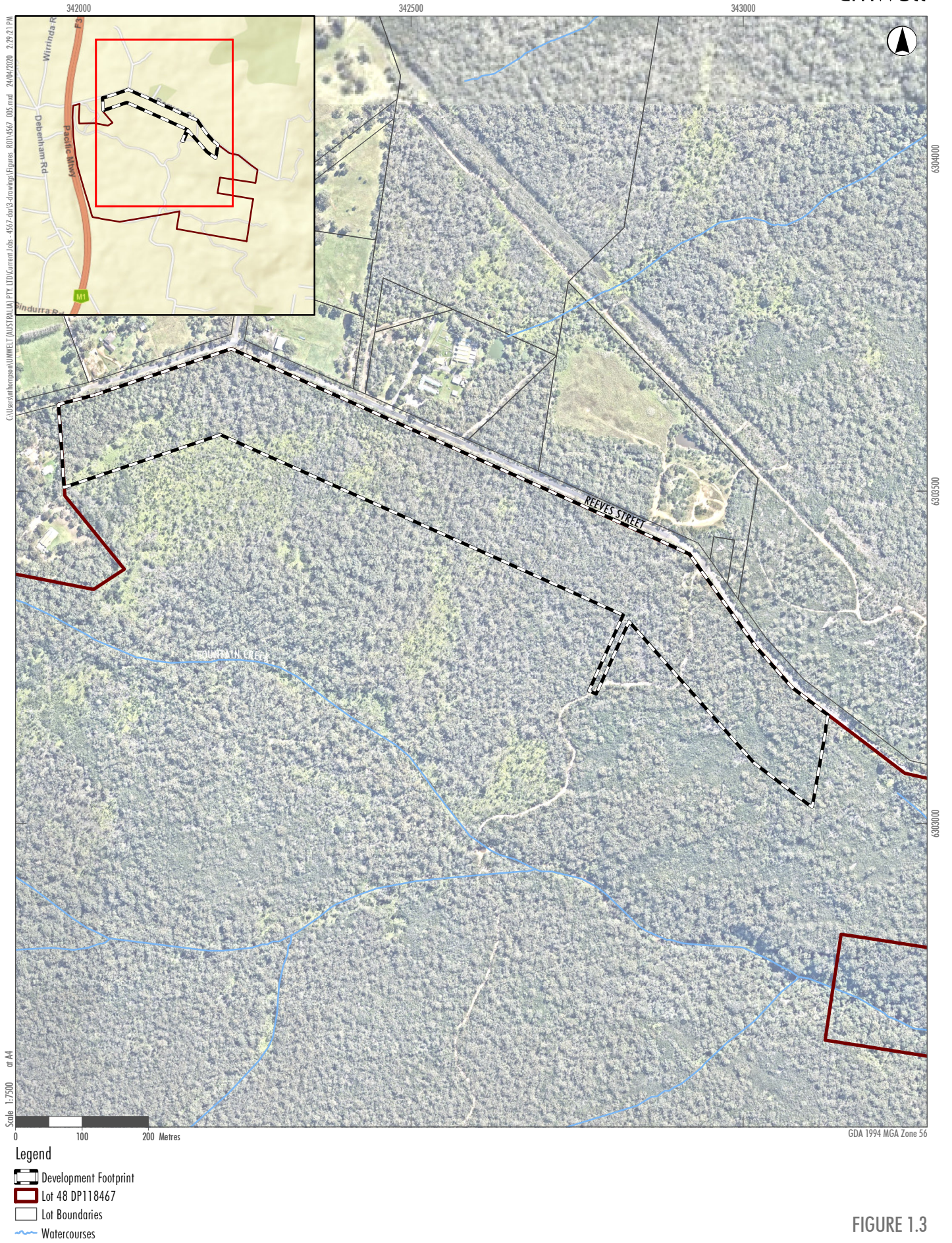


FIGURE 1.3

Development Footprint



## 1.1 Development Footprint Information

The Development Footprint will be subjected to a range of disturbances as described in **Section 1.1** and **Section 5.0**.

The Development Footprint contains remnant vegetation adjacent to existing disturbances such as rural-residential land and major roadways. Intact vegetation is generally in moderate to good condition. Some areas, such as along roads, contain small outbreaks of exotic plant species and disturbances such as rubbish.

**Table 1.1 Development Footprint Location in the Landscape**

Development Footprint Location in the Landscape	
IBRA Bioregion	Sydney Basin
IBRA Subregion	Pittwater
Mitchell Landscape	Somersby Plateau
LGA	Central Coast
Development Footprint Size	16.6 hectares
Assessment Type	Site-based
Lot and DP	Lot 481 DP 1184693

## 1.2 Local Ecological Context

The Development Footprint is located in the Central Coast region (refer to **Figure 1.3**). The locality is occupied by rural landscapes, residential areas and industrial areas, with substantial intact vegetation extending to the north and south of the site. The M1 Pacific Motorway is located immediately to the west of the site providing transport routes northward and southward along the NSW coast, however it also contributes to vegetation fragmentation and barriers to fauna movement.

The development footprint is located adjacent to an indicative biodiversity corridor identified in the Central Coast Regional Plan 2036 (NSW DPE 2016) as connecting the central national parks and state reserves. This is part of a broader biodiversity corridor network that links to the Great Dividing Range, Hawkesbury River, Kuring-gai Chase National Park and Watagans National Park. The location of the development footprint has been carefully placed to ensure the width of this corridor is largely unaffected by the proposal.

The wider Central Coast is particularly biodiverse and contains a variety of flora, fauna species and ecosystems primarily due to high vegetation cover, the presence of major estuarine systems and proximity to coastlines. A key Threatened Ecological Community (TEC) known to occur in the locality is *Coastal Upland Swamp in the Sydney Basin Bioregion* listed as an EEC under both the BC Act and Commonwealth *Environment Protection and Biodiversity Conservation Act* (EPBC Act).

Where there is suitable habitat, a range of threatened flora species are known to occur in the wider locality including *Darwinia glaucophylla* and Biconvex paperbark (*Melaleuca biconvexa*) listed as vulnerable under the BC Act, and Somersby mintbush (*Prostanthera junonis*), tranquillity mintbush (*Prostanthera askania*) and spreading guinea flower (*Hibbertia procumbens*) listed as endangered under the BC Act (DPIE 2020a).

Records of threatened fauna species occur around the locality, including within the intact vegetated areas to the south of the site, and within Strickland State Forest to the north. Records include red-crowned toadlet (*Pseudophryne australis*), giant burrowing frog (*Heleioporus australiacus*), eastern pygmy possum



(*Cercartetus nanus*), powerful owl (*Ninox strenua*), squirrel glider (*Petaurus norfolcensis*) and southern myotis (*Myotis Macropus*), all listed as vulnerable under the BC Act.

### 1.3 Key Resources, Policies and Documents

The following key resources, policies and documents were used during the preparation of this BCAR:

- Biodiversity Assessment Method Order 2017 (OEH 2017a)
- Biodiversity Assessment Method Operational Manual (Stage 1) (OEH 2018a)
- Biodiversity Assessment Method Operational Manual (Stage 2) (DPIE 2019)
- Biodiversity Assessment Method Calculator (Version 8), accessed March 2019 to April 2020.
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities –Working Draft (DEC 2004)
- BioNet Atlas of NSW Wildlife database and mapping tool (DPIE 2020a), accessed April 2020
- Threatened Biodiversity Data Collection (TBDC) (DPIE 2020b), accessed April 2020
- Vegetation Information System (VIS) Classification Database (DPIE 2020c), accessed April 2020
- NSW Guide to Surveying Threatened Plants (OEH 2016)
- Department of Agriculture Water and Environment (DAWE) Protected Matters Search Tool, accessed April 2020.

### 1.4 Report Preparation

This BCAR was prepared by Philippa Fagan (Senior Ecologist), with review and technical direction from Kate Connolly (Principal Ecologist). Field surveys were undertaken by a range of suitably qualified and experienced ecologists.

**Table 1.2** below outlines the details of the Accredited BAM Assessors involved in the survey, calculations and reporting for the project.

**Table 1.2 Accredited BAM Assessors and their Role on this Project**

Name	Assessor ID	Role
Kate Connolly <i>Principal Ecologist</i>	BAAS17005	Review and technical direction
Philippa Fagan <i>Senior Ecologist</i>	BAAS18117	BCAR preparation Field Surveys

## 2 Methods

### 2.1 Landscape Features and Site Context

Landscape features such as IBRA bioregions, IBRA subregions and NSW Mitchell Landscape regions, native vegetation extent within a 1500m buffer area, cleared areas, rivers, streams, wetlands and connectivity features were identified within the Development Footprint (where appropriate) in accordance with Section 4.2 of the BAM (OEH 2017a) (refer to **Figure 2.1**).

The 'Site Context' of the Development Footprint is calculated by assessing the native vegetation cover and patch size within the Development Footprint in accordance with Section 4.3 of the BAM (OEH 2017a).

### 2.2 Native Vegetation Assessment

#### 2.2.1 Literature and Database Review

A review of previous documents and reports relevant to the project was undertaken. The information obtained was used to inform survey design and was also used to assist in the assessment of potentially occurring threatened and migratory species, endangered populations (EPs) and TECs.

Relevant documents included:

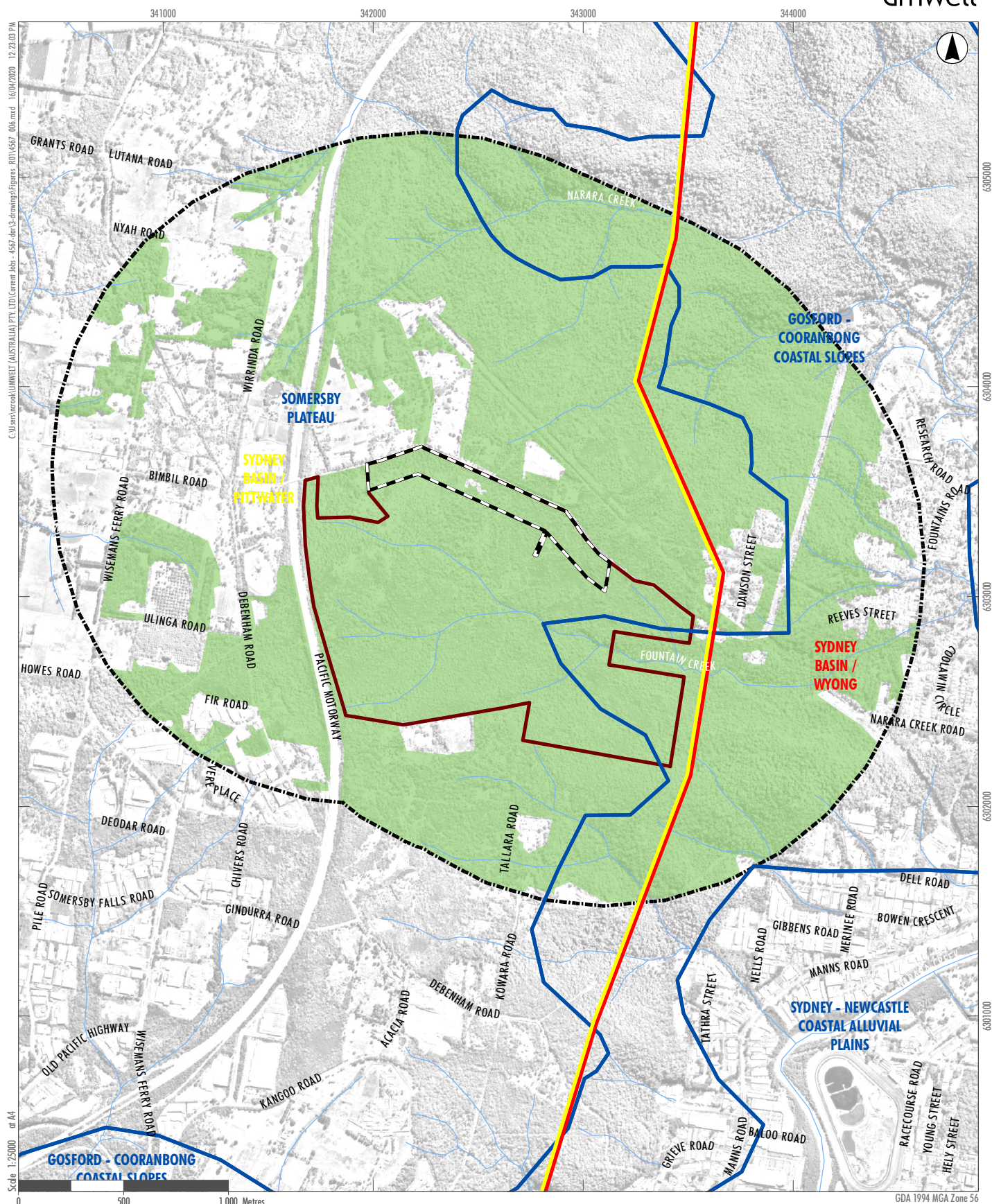
- Discussion Paper Informing the Preparation of a Planning Proposal for Rezoning – Property: Reeves Road, Somersby Lot 481 DP 1184693 (ADW Johnson Pty Ltd, February 2018)
- Vegetation Mapping of Gosford LGA (Bell 2009)
- Threatened Biodiversity Data Collection (DPIE 2020b) reporting for known/predicted threatened communities in the Pittwater IBRA subregion
- VIS Classification Database (DPIE 2020c), accessed April 2020
- DAWE Protected Matters Search Tool for known/predicted EPBC Act-listed TECs, accessed April 2020.

#### 2.2.2 Floristic and Vegetation Integrity Survey

Floristic and vegetation integrity surveys were undertaken over the following survey periods (refer to **Figure 2.2**):

- **Winter 2018:**
  - 27 to 29 August 2018 (undertaken as part of the Central Coast BioCertification Project)
- **Spring 2018:**
  - 31 October 2018 (undertaken as part of the Central Coast BioCertification Project)
- **Summer 2019:**
  - 22 and 23 January 2019 (undertaken as part of the Central Coast BioCertification Project)

- **Autumn 2019:**
  - 27 March 2019
  - 2 and 4 April 2019
- **Summer 2019:**
  - 27 and 28 November 2019, (undertaken as part of the Central Coast BioCertification Project) and
- **Autumn 2020:**
  - 24 and 25 March 2020.



- Legend
- Lot 48 DP118467
  - Mitchell Landscape Boundaries
  - 1500m Site Buffer
  - Native Vegetation Mapping
  - IBRA Region / Sub Region**
  - Sydney Basin / Pittwater
  - Sydney Basin / Wyong

**FIGURE 2.1**  
**Landscape Features**



A total of nine BAM plots and twelve rapid vegetation assessments were conducted within the Development Footprint during the surveys undertaken for this assessment (refer to **Figure 2.2**). Floristic and vegetation integrity data was collected in accordance with minimum requirements under the BAM (OEH 2017a).

**Table 2.1** outlines the floristic survey effort in the Development Footprint.

**Table 2.1 Adequacy of Floristic and Vegetation Integrity Survey in the Development Footprint**

Veg. Zone	Plant Community Type (PCT) <i>Condition Class</i>	Area in the Development Footprint (ha)	Number of Floristic and Vegetation Integrity Plots	
			Required	Completed
1	1641 – Dwarf Apple – Scribbly Gum heathy low woodland on sandstone ranges of the Central Coast <i>Good Condition</i>	3.2	2	2*
2	1642 – Scribbly Gum – Red Bloodwood _ Old Man Banksia heathy woodland of southern Central Coast <i>Good Condition</i>	9.9	3	4
3	1642 – Scribbly Gum – Red Bloodwood _ Old Man Banksia heathy woodland of southern Central Coast – <i>Pinus radiata</i> variant <i>Moderate Condition</i>	0.61	1	1
4	1699 – Heath- leaved Banksia – Coral Fern wet heath on sandstone ranges of the lower Central Coast <i>Good Condition</i>	2.9	2	2
<b>TOTAL</b>		<b>16.6</b>	<b>7</b>	<b>9</b>

\*One of these floristic plots is situated outside of the Development Footprint due to a boundary change during the project's progression (see **Figure 2.2**)

At each floristic and vegetation integrity plot, data was recorded according to Section 5 of the BAM (OEH 2017a). This involved setting out 20 x 50 m, 20 x 20 m and 1 x 1m plots. The location of each plot was recorded using a hand-held GPS with accuracy of  $\pm 5$  m. The Map Grid of Australia (MGA) coordinate system was used.

At each plot/transect, roughly 45 to 60 minutes was spent searching for all vascular flora species present within the 20 x 20 m plot. Searches of each 20 x 20 m plot were generally undertaken through parallel transects from one side of the plot to another. Most effort was spent on examining the groundcover, which usually supported well over half of the species present, however the composition of any shrub, mid-storey, canopy and emergent layers were also thoroughly examined.

For each flora species recorded in the plot, the following data was collected in accordance with Table 2 of the BAM (OEH 2017a):

- stratum/layer in which the species occurs
- growth form
- scientific name and common name
- cover and
- abundance.



At each vegetation integrity plot the following attributes were recorded in accordance with the BAM (OEI 2017a) to determine the condition of the vegetation zone:

- **Composition** - native plant species richness by growth form (within the 20 x 20 m plot)
- **Structure** – estimate foliage cover of native and exotic species by growth form (within the 20 x 20 m plot)
- **Function** (within the 20 x 50 m plot) including number of large trees, presence or otherwise of tree stem size classes, presence or otherwise of canopy species regeneration, length of fallen logs, percentage cover for litter (recorded from five 1 x 1 m plots), number of trees with hollows and high threat exotic cover.

## 2.2.3 Targeted and Meandering Transects

Targeted transects for threatened floristic species were conducted during the months of August, October and January, targeting the flowering periods of prospective threatened species. Transects were walked by two ecologists in parallel traverses ten metres apart in suitable habitat, during which the vegetation was continually searched for threatened species. Further details on the timing of these transects is provided in **Section 2.3**. Opportunistic records of threatened species were also recorded during vegetation integrity surveys in March, April, November 2019 and March 2020.

Meandering transects were walked across much of the Development Footprint particularly during fauna habitat assessments or targeted fauna surveys. Opportunistic sampling of vegetation was undertaken along these transects, particularly searches for threatened or otherwise significant species, endangered populations and TECs. Meandering transects enable floristic sampling across a much larger area than plot-based survey, especially where the number of plots is limited. Records along transects supplemented floristic sampling carried out in plots, however, the data collected are in the form of presence records, rather than semi-quantitative cover abundance scores.

Meandering transects provided invaluable information on spatial patterns of vegetation that informed vegetation community mapping of the Development Footprint.

## 2.2.4 Digital Aerial Photograph Interpretation

Digital imagery (aerial photographs) of the Development Footprint was viewed prior to and after vegetation survey to identify spatial patterns in vegetation, land use and landscape features. These informed field survey design and implementation, ecological assessment and vegetation community mapping of the Development Footprint.

Vegetation communities in the Development Footprint were mapped on-screen overlaying high-resolution aerial photographs (Nearmap, March 2019). Mapping was undertaken using the Manifold System 8.0 GIS and ESRI ArcMaps 10.6.

## 2.2.5 Plant Identification and Nomenclature Standards

All vascular plants recorded or collected within plots and on targeted or meandering transects were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002). Where known, changes to nomenclature and classification have been incorporated into the results. Updated taxonomy has been derived from PlantNET (Botanic Gardens Trust 2020).

Common names used follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

## **2.2.6 Vegetation Mapping**

Vegetation mapping was undertaken using best-practice techniques to delineate vegetation communities across the Development Footprint. Vegetation mapping involved the following key steps:

- preliminary review of digital airborne imagery to explore vegetation distribution patterns as dictated by change in canopy texture, tone and colour, as well as topography
- predicting the distribution of particular vegetation communities based on understanding the distribution of PCTs (DPIE 2020c)
- ground-truthing of the vegetation map based on survey effort
- revision 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.

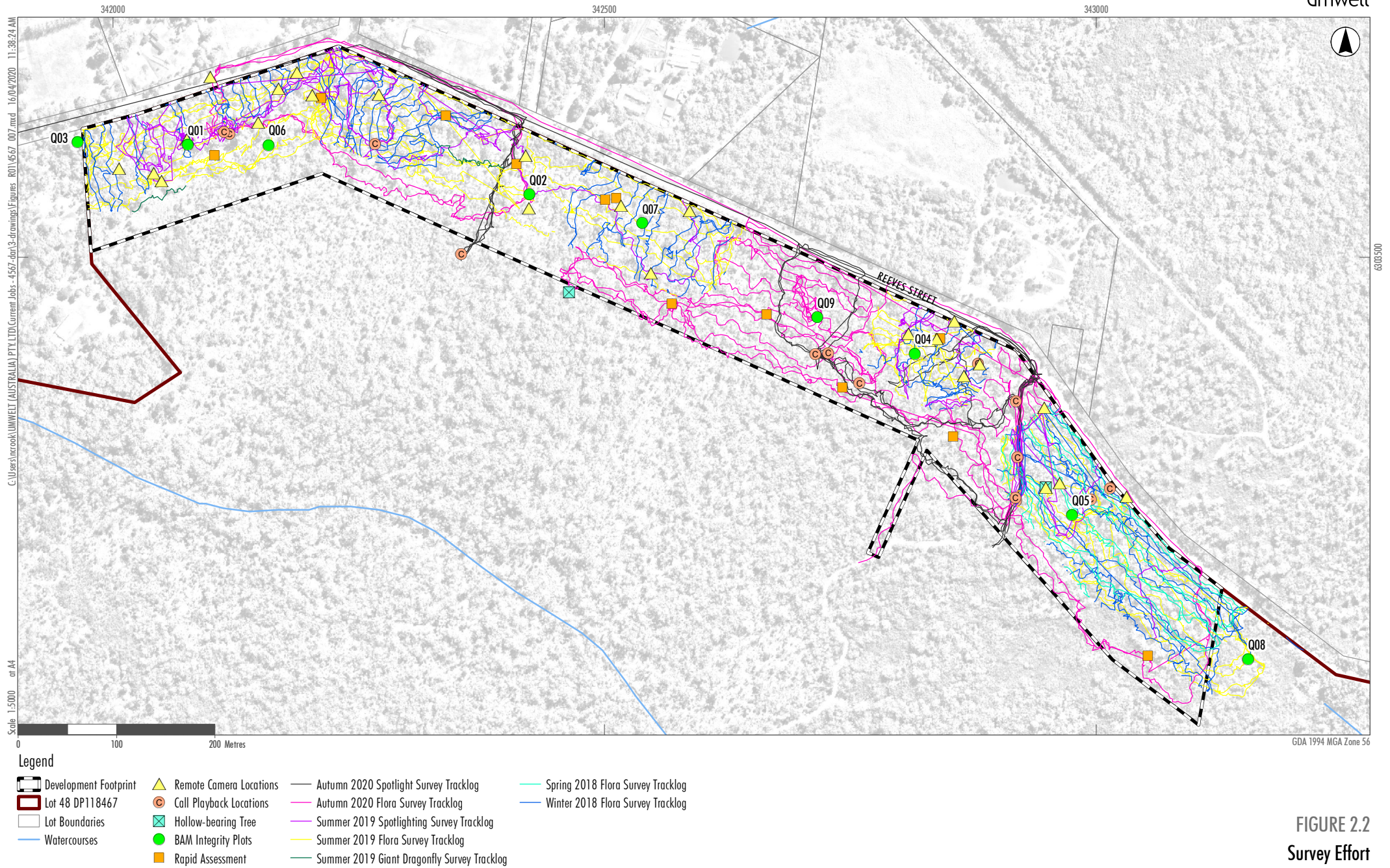


FIGURE 2.2  
Survey Effort

## 2.2.7 Threatened Ecological Community Delineation Techniques

Where applicable, vegetation communities identified in the Development Footprint were compared to TECs listed under the Commonwealth EPBC Act and NSW BC Act. An assessment of similarity with the NSW Scientific Committee Final Determinations was undertaken, as well as the Commonwealth Threatened Species Scientific Committee Listing and Conservation Advice. The following approach was used:

- full-floristic plot assessments and meandering surveys to determine floristic composition and structure of each ecological community
- comparison with published species lists, including lists of ‘important species’ as identified on the listing advice provided by the NSW Scientific Committee and/or Commonwealth Threatened Species Scientific Committee
- comparison with habitat descriptions and distributions for listed TECs
- assessment using guidelines and recovery plans published by the Commonwealth Department of Environment and Energy (DoEE) and the NSW OEH
- comparison with other assessments of TECs in the region.

## 2.2.8 Plant Community Type (PCT) Allocation

Each of the vegetation communities described within the Development Footprint were aligned with an equivalent PCT as detailed in the VIS Classification Database (DPIE 2020c). For each vegetation community described in the Development Footprint, the dominant and characteristic species were entered into the online plant community identification tab and an initial list of PCTs was generated. The profiles for each of the possible PCTs were then interrogated and the most appropriate match assigned based on floristic, structure, soil, landform and distribution details.

Further detail regarding this allocation for individual PCTs is outlined in **Section 3.2.1**.

## 2.3 Threatened Species

### 2.3.1 Literature and Database Review

A review of previous documents and reports relevant to the project was undertaken. This included ecological reports, previous ecological surveys undertaken in the vicinity of the Development Footprint and also relevant ecological database searches. The information obtained was used to inform survey design where required and was also used to assist in the assessment of potentially occurring ecosystem-credit and species-credit species. Relevant documents and resources included:

- BioNet Atlas of NSW Wildlife database and mapping tool (DPIE 2020a), accessed March 2020
- Threatened Biodiversity Data Collection (DPIE 2020b) for known/predicted threatened species in the Pittwater IBRA subregion, accessed March 2020
- PlantNET (Botanic Gardens Trust 2019) database search for threatened plants within a 10 km radius of the site, accessed March 2020
- DAWE Protected Matters Search Tool (DAWE 2019) for known/predicted EPBC Act-listed species, accessed April 2020.



A preliminary assessment using the TBDC was undertaken which provided a list of species-credit species that might require survey and the suitable survey periods for each species. The results of these database searches, literature review and TBDC review were used to design the appropriate survey requirements for species-credit species.

### 2.3.2 Ecosystem-credit Species

Ecosystem-credit species are those threatened species that can be predicted by vegetation surrogates and landscape features. Ecosystem-credit species are not required to be specifically targeted during field surveys, however an assessment of the suitability of habitat in the Development Footprint is undertaken to determine the species presence or otherwise in the vegetation zones identified.

**Appendix A** outlines the ecosystem credit species predicted by the BAM calculator or identified in the literature review.

### 2.3.3 Species-credit Species

Targeted and opportunistic surveys and walking transects for species-credit species were undertaken across the Development Footprint (refer to **Figure 2.2**). **Table 2.2** below outlines the dates, methods and species targeted during the surveys.

**Table 2.2 Species credit species survey methodology and timing**

Survey Date	Method	Species Targeted
27 and 28 August 2018	Spotlighting and call playback	barking owl ( <i>Ninox connivens</i> ) masked owl ( <i>Tyto novaehollandiae</i> ) powerful owl ( <i>Ninox strenua</i> ) sooty owl ( <i>Tyto tenebricosa</i> )
	Habitat assessments (evidence of breeding)	white- bellied sea- eagle ( <i>Haliaeetus leucogaster</i> ) little eagle ( <i>Hieraaetus morphnoides</i> ) square- tailed kite ( <i>Lophoictinia isura</i> ) eastern osprey ( <i>Pandion cristatus</i> )
	Targeted threatened species transects Habitat assessments	rough doubletail ( <i>Diuris praecox</i> ) broad- headed snake ( <i>Hoplocephalus bungaroides</i> )
31 October 2018	Targeted threatened species transects across part of the development footprint.	variable midge orchid ( <i>Genoplesium insigne</i> ) spreading guinea flower ( <i>Hibbertia procumbens</i> ) Somersby mintbush ( <i>Prostanthera junonis</i> ) eastern underground orchid ( <i>Rhizanthella slateri</i> ) black eyed Susan ( <i>Tetradlea juncea</i> ) <i>Tetradlea glandulosa</i>



Survey Date	Method	Species Targeted
22 and 23 January 2019	Targeted threatened species transects	giant dragonfly ( <i>Petalura gigantea</i> )
	Targeted threatened species transects	Bynoes wattle ( <i>Acacia bynoeana</i> ) Charmhaven apple ( <i>Angophora inopina</i> ) thick- leaf star- hair ( <i>Astrotricha crassifolia</i> ) <i>Baloskion longipes</i> netted bottlebrush ( <i>Callistemon linearifolius</i> ) leafless tongue orchid ( <i>Cryptostylis hunteriana</i> ) <i>Darwinia glaucophylla</i> Camfield's stringybark ( <i>Eucalyptus camfieldii</i> ) Bauers midge orchid ( <i>Genoplesium bauera</i> ) small- flowered grevillea ( <i>Grevillea parviflora</i> subsp. <i>Parviflora</i> ) <i>Grevillea shiressii</i> Groves paperbark ( <i>Melaleuca groveana</i> ) hairy geebung ( <i>Persoonia hirsuta</i> )
25 – 28 March 2019	Nocturnal searches	bush stone- curlew ( <i>Burhinus grallarius</i> )
	Call- playback Gang cockatoo and glossy black- cockatoo survey (breeding habitat assessment) Koala SAT tests Microbat breeding habitat assessment	gang- gang cockatoo ( <i>Callocephalon fimbriatum</i> ) glossy black- cockatoo ( <i>Calyptorhynchus lathamii</i> ) large- eared pied- bat ( <i>Chalinolobus dwyeri</i> ) giant burrowing frog ( <i>Heleioporus australiacus</i> ) green and golden bell frog ( <i>Litoria aurea</i> ) green- thighed frog ( <i>Litoria brevipalmata</i> ) giant barred frog ( <i>Mixophyes iteratus</i> ) pale- headed snake ( <i>Hoplocephalus bitorquatus</i> ) little bentwing- bat ( <i>Miniopterus australis</i> ) eastern bentwing- bat ( <i>Miniopterus schreibersii oceanensis</i> ) southern myotis ( <i>Myotis Macropus</i> ) koala ( <i>Phascolarctos cinereus</i> ) red- crowned toadlet ( <i>pseudophryne australis</i> ) grey- headed flying- fox ( <i>Pteropus poliocephalus</i> ) eastern cave bat ( <i>Vespadelus troughtoni</i> )
25 March – 6 May 2019	Remote camera	eastern pygmy possum ( <i>Cercartetus nanus</i> ) parma wallaby ( <i>Macropus parma</i> ) squirrel glider ( <i>Petaurus norfolcensis</i> )

Survey Date	Method	Species Targeted
1 – 4 April 2019	BAM floristic surveys	NA
6 – 8 May 2019	Nocturnal searches Hollow bearing tree analysis Call- playback Stag watching Gang gang cockatoo and glossy black-cockatoo survey (breeding habitat assessment)	gang- gang cockatoo ( <i>Callocephalon fimbriatum</i> ) glossy black- cockatoo ( <i>Calyptorhynchus lathami</i> ) powerful owl ( <i>Ninox strenua</i> ) barking owl ( <i>Ninox connivens</i> ) masked owl ( <i>Tyto novaehollandiae</i> ) sooty owl ( <i>Tyto tenebricosa</i> )
27 and 28 November 2019	Targeted threatened species transects	Bynoes wattle ( <i>Acacia bynoeana</i> ) netted bottlebrush ( <i>Callistemon linearifolius</i> ) Camfield's stringybark ( <i>Eucalyptus camfieldii</i> ) hairy geebung ( <i>Persoonia hirsuta</i> ) spreading guinea flower ( <i>Hibbertia procumbens</i> ) Somersby mintbush ( <i>Prostanthera junonis</i> )
24 – 25 March 2020	Nocturnal searches Call- playback Gang- gang cockatoo and glossy black-cockatoo survey (breeding habitat assessment) Forest-owl tree hollow searches BAM floristic surveys Targeted threatened species transects	eastern pygmy possum ( <i>Cercartetus nanus</i> ) parma wallaby ( <i>Macropus parma</i> ) squirrel glider ( <i>Petaurus norfolcensis</i> ) greater glider ( <i>Petauroides volans</i> ) brush- tailed phascogale ( <i>Phascogale tapoatafa</i> ) pale- headed snake ( <i>Hoplocephalus bitorquatus</i> ) koala ( <i>Phascolarctos cinereus</i> ) green and golden bell frog ( <i>Litoria aurea</i> ) green- thighed frog ( <i>Litoria brevipalmata</i> ) giant barred frog ( <i>Mixophyes iteratus</i> ) red- crowned toadlet ( <i>pseudophryne australis</i> ) giant burrowing frog ( <i>Heleioporus australiacus</i> ) bush stone- curlew ( <i>Burhinus grallarius</i> ) Bynoes wattle ( <i>Acacia bynoeana</i> ) netted bottlebrush ( <i>Callistemon linearifolius</i> ) Camfield's stringybark ( <i>Eucalyptus camfieldii</i> ) hairy geebung ( <i>Persoonia hirsuta</i> )

Species-credit surveys considered the following survey guidelines:

- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft* (DEC 2004)
- *NSW Guide to Surveying Threatened Plants* (OEH 2016)
- *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (DECC 2009)
- *Draft Survey Guidelines for Australia's Threatened Orchids* (DoE 2013).

**Appendix B** outlines the species-credit species predicted by the BAM calculator or identified in the literature review and the targeted survey effort undertaken in accordance with BAM survey requirements.

**Appendix B** also notes where species-credit species were not considered to require further survey in accordance with Section 6.4 (Step 3) of the BAM (OEH 2017).

## 2.3.4 Weather Conditions and Limitations

**Table 2.3** below outlines the weather conditions for the surveys. Data is derived from the Central Coast weather station in Gosford (061425) from the Bureau of Meteorology (2020).

**Table 2.3 Weather Conditions for Surveys**

Date	Daily Data			Monthly Data		
	Min-Max Temp.	Rainfall (mm)	Relative Humidity (%)	Min-Max Temp (mean)	Rainfall (total) (mm)	Relative Humidity (mean) (%)
27 August 2018	9.9-14.0	1.8	87	6.4-19.0	8.3	16
28 August 2018	9.1-14.6	0	51			
31 October 2018	16.1-26.0	0	70	13.6-21.7	8.3	95
22 January 2019	21.1-31.1	0	75.4	20.7-30.3	1.9	73
23 January 2019	20.6-31.6	0	71			
25 March 2019	20.0-25.5	4.4	81	17.7-26.6	23.0	65
26 March 2019	16.0-25.9	3	48.5			
27 March 2019	13.9-23.9	0	64			
28 March 2019	14.6-26.8	0	72			
29 March 2019	16.1-27.3	0	71			
2 April 2019	16.8-32.4	0	63	15.8-25.7	2.4	65
4 April 2019	19.1-24.7	0.2	0.2			
6 May 2019	13.8-20.4	0	54	10.5-22.2	0.6	63
7 May 2019	6.6-23.5	0	48			
8 May 2019	8.9-21.4	0	43			
27 November 2019	10.1-22	11.2	41	14.2-26.6	21.8	53
28 November 2019	11.7-25.8	0	62			

Date	Daily Data			Monthly Data		
	Min-Max Temp.	Rainfall (mm)	Relative Humidity (%)	Min-Max Temp (mean)	Rainfall (total) (mm)	Relative Humidity (mean) (%)
24 March 2020	15.6-22.1	10.8	90	16.2-24.8	178.8	78
25 March 2020	15.3-23.1	1.6	84			

## 3 Results

### 3.1 Landscape Value

The buffer area contains a range of landscape features typical of the landscapes around the Central Coast region. These landscape features are outlined in relation to the Development Footprint in **Table 3.1** below.

**Table 3.1 Landscape Features in the Development Footprint**

Landscape Features	
IBRA Bioregion	Sydney Basin
IBRA Subregion	Pittwater
Mitchell Landscape	Somersby Plateau
Rivers, Streams, Estuaries	No wetlands or Strahler streams (Strahler 1952) in the Development Footprint
Wetlands (within, adjacent to and downstream)	<i>Coastal Upland Swamp in the Sydney Basin Bioregion</i> EEC occurs both within the Development Footprint and to the south of the Development Footprint over an extensive area.
Native Vegetation Cover	865 hectares in the 1500m buffer area (75%)
Areas of Geological Significance or Soil Hazard Features	None identified
Areas of Outstanding Biodiversity Value	None identified
Cleared Areas	None within the Development Footprint
Connectivity Features	<p>The site is part of extensive native vegetation extending to the north and south, which provides connectivity and enables transfer of genetic material for both flora and fauna in the locality. The Development Footprint is located adjacent to the corridor identified in the Central Coast Regional Plan 2036 (NSW Government 2016) as connecting the Central National Parks and State Forests.</p> <p>Not identified within a Priority Investment Area (OEH 2017c).</p> <p>Not identified as an important flyway for migratory species.</p>

### 3.2 Native Vegetation within the Development Footprint

#### 3.2.1 Plant Community Types and Vegetation Zones

Surveys of the Development Footprint identified three Plant Community Types (PCTs) across two condition classes, (refer to **Figure 3.1**) including:

- Zone 1 PCT1641 Dwarf Apple Scribbly Gum heathy low woodland on sandstone ranges of the Central Coast (Good Condition)
- Zone 2 PCT1642 Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast (Good Condition)

- Zone 3 PCT1642 Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast (Moderate Condition) (*Pinus radiata* variant)
- Zone 4 PCT 1699 Heath- leaved Banksia – Coral Fern wet heath on sandstone ranges of the lower Central Coast (Good Condition)

A description of the vegetation zones is outlined below and a flora species list is included in **Appendix C**.



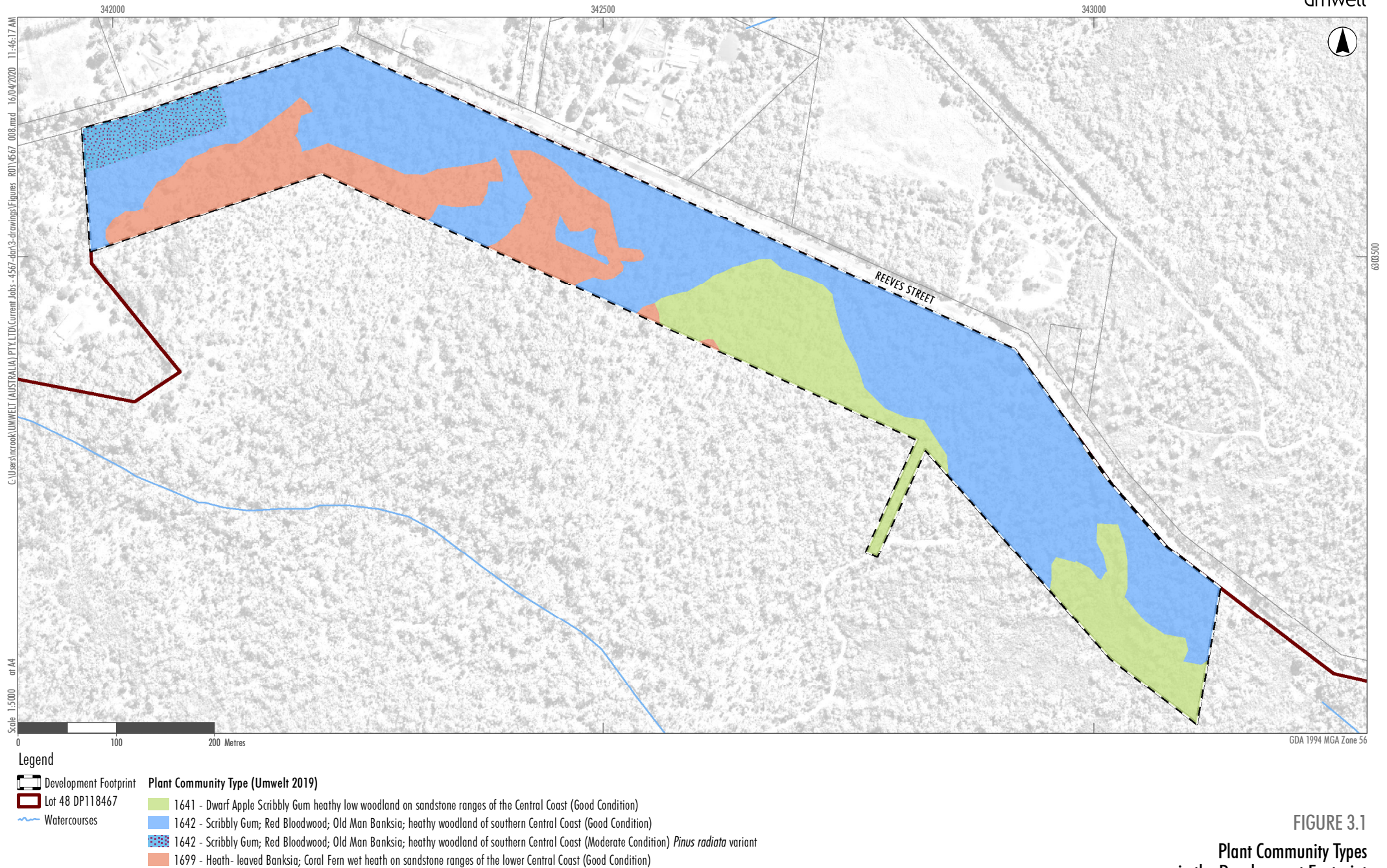



FIGURE 3.1  
Plant Community Types  
in the Development Footprint




## Zone 1 – PCT 1641 Dwarf Apple – Scribbly Gum heathy low woodland on sandstones ranges of the Central Coast (Good Condition)

PCT Name	Dwarf Apple – Scribbly Gum heathy low woodland on sandstones ranges of the Central Coast	
Condition	Good	
Formation	Heathlands	
Class	Sydney Coastal Heaths	
Percent cleared	44.00	
Area in Development Footprint (ha)	3.2	
Patch Size Class (ha)	>101	
Location	Occurs in the eastern and central portion of the Development Footprint (refer to <b>Figure 3.1</b> ).	
Canopy Description	Sparse canopy dominated by dwarf apple ( <i>Angophora hispida</i> ) with the occasional scribbly gum ( <i>Eucalyptus haematoma</i> ) occurring, likely due to the proximity to PCT 1642.	
Mid-storey/Shrub Layer Description	A very dense mid- storey/shrub layer dominated by fern- leaved banksia ( <i>Banksia oblongifolia</i> ) and heath- leaved banksia ( <i>Banksia ericifolia</i> ), flaky- barked tea- tree ( <i>Leptospermum trinervium</i> ), fringed baeckea ( <i>Baeckea diosmifolia</i> ), tick bush ( <i>Kunzea ambigua</i> ), conesticks ( <i>Isopogon anemonifolius</i> ), mountain devils ( <i>Lambertia formosa</i> ) drumsticks ( <i>Petrophile pulchella</i> ) and tantoon ( <i>Leptospermum polygalifolium</i> ).	
Ground Cover Description	This vegetation zone is characterised by a fairly dense ground layer of sedges, grasses and herbs. The dominant species included <i>Cyathochaeta diandra</i> , oat speargrass ( <i>Anisopogon avenaceus</i> ), <i>Lepyrodia scariosa</i> , lesser flannel flower ( <i>Actinotus minor</i> ) and <i>Lepidosperma laterale</i> . Less dominant grasses were also present, including wiry panic ( <i>Entolasia stricta</i> ) and bordered panic ( <i>Entolasia marginata</i> ).	
PCT Allocation	Vegetation Zone 1 was aligned with PCT1641 as it supports a number of the species identified for the PCT as listed on the VIS Classification Database (DPIE 2020c). The canopy is dominated by dwarf apple ( <i>Angophora hispida</i> ) and scribbly gum ( <i>Eucalyptus haemastoma</i> ) which are the only two diagnostic species listed as occurring in the canopy. Further, the mid-stratum contains 100% of the species listed on the VIS Classification Database (DPIE 2020c), with the ground stratum containing 5 of 7 (71%) of the listed diagnostic species. Furthermore, the vegetation description for this community is very close to what is occurring on site, being an <i>Angophora</i> dominated heath, occurring on dissected sandstone hills of the Central Coast. PCT1641 was therefore determined to be the best overall fit in terms of diagnostic species and the community’s location in the landscape.	
BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.	
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.	




## Zone 2 – PCT 1642 Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast (Good Condition)

PCT Name	Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast	
Condition	Good	
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)	
Class	Sydney Coastal Dry Sclerophyll Forests	
Percent cleared	30.00	
Area in Development Footprint (ha)	9.9	
Patch Size Class (ha)	>101	
Location	Occurs at the top of the slope across the majority of the Development Footprint (refer to <b>Figure 3.1</b> ).	
Canopy Description	Mid-dense canopy dominated by scribbly gum ( <i>Eucalyptus haemastoma</i> ), red bloodwood ( <i>Corymbia gummifera</i> ) and silvertop ash ( <i>Eucalyptus sieberi</i> ). Scattered occurrences of Sydney red gum ( <i>Angophora costata</i> ) and blue-leaved stringybark ( <i>Eucalyptus agglomerata</i> ).	
Mid-storey/Shrub Layer Description	A fairly dense mid-storey/shrub layer containing an array of species including tautoon ( <i>Leptospermum polygalifolium</i> ), conesticks ( <i>Petrophile pulchella</i> ), sweet wattle ( <i>Acacia suaveolens</i> ), heath- leaved banksia ( <i>Banksia ericifolia</i> ), broad- leaved geebung ( <i>Persoonia levis</i> ), narrow- leaved geebung ( <i>Persoonia linearis</i> ), old man banksia ( <i>Banksia serrata</i> ), grey spider flower ( <i>Grevillea buxifolia</i> ), tick bush ( <i>Kunzea ambigua</i> ) and native currant ( <i>Leptomeria acida</i> ).	
Ground Cover Description	This vegetation zone is characterised by a diverse and fairly dense ground layer of ferns, sedges and sub-shrubs. Dominant species include <i>Platysace linearifolia</i> , lesser flannel flower ( <i>Actinotus minor</i> ), <i>Xanthorrhoea media</i> , oat speargrass ( <i>Anisopogon avenaceus</i> ), fishbones ( <i>Lomandra obliqua</i> ) and screw fern ( <i>Lindsaea linearis</i> ).	
PCT Allocation	Vegetation Zone 2 was aligned with PCT1642 as it supports a high number of the diagnostic species and stratum specifics identified for the PCT as listed on the VIS Classification Database (DPIE 2020c). Its canopy contains all four species listed, comprising <i>E. haemastoma</i> , <i>C. gummifera</i> , <i>E. sieberi</i> and <i>A. costata</i> , as well as containing all of the seven diagnostic mid- storey species listed. The ground stratum further contains 75% of the species listed on the VIS Classification Database (OEH 2017c). PCT1642 was therefore determined to be the best overall fit in terms of diagnostic species and the community’s location in the landscape.	


<b>PCT Name</b>	<b>Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast</b>
<b>Condition</b>	<b>Good</b>
<b>BC Act Status</b>	This vegetation zone is not consistent with any TEC listed under the BC Act. The VIS Classification Database (DPIE 2020c) lists PCT 1642 as aligning in part with Kincumber Scribbly Gum Forest in the Sydney Basin Bioregion CEEC listed under the BC Act. However, the vegetation on site is not considered to be consistent with this CEEC, due to a lack of floristic similarity. The majority of the characteristic canopy species, comprising <i>Eucalyptus piperita</i> , <i>Eucalyptus racemosa</i> , <i>Eucalyptus acmenoides</i> , <i>Eucalyptus pilularis</i> , <i>Eucalyptus resinifera</i> and <i>Syncarpia glomulifera</i> , are not present within this vegetation zone (NSW Scientific Committee 2011). The only Eucalypts listed for the CEEC that are present on site are <i>Angophora costata</i> (in very low numbers) and <i>Corymbia gummifera</i> . Additionally, the community is listed as occurring south of Kincumber, while the Development Footprint occurs to the north of Kincumber (NSW Scientific Committee 2011).
<b>EPBC Act Status</b>	This vegetation zone is not consistent with any TEC listed under the EPBC Act.

### Zone 3 – PCT 1642 Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast (Moderate Condition - *Pinus radiata* variant)

PCT Name	Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast	
Condition	Moderate – <i>Pinus radiata</i> variant	
Formation	Dry Sclerophyll Forests (Shrubby sub-formation)	
Class	Sydney Coastal Dry Sclerophyll Forests	
Percent cleared	30.00	
Area in Development Footprint (ha)	0.61	
Patch Size Class (ha)	>101	
Location	Occurs at the top of the slope in the western corner of the study area (refer to <b>Figure 3.1</b> ).	
Canopy Description	The canopy is the same as for Vegetation Zone 2, however in addition to the presence of scribbly gum ( <i>Eucalyptus haemastoma</i> ), red bloodwood ( <i>Corymbia gummifera</i> ) and silvertop ash ( <i>Eucalyptus sieberi</i> ), the area is dominated by large Radiata Pine ( <i>Pinus radiata</i> ). There is also black she oak ( <i>Allocasuarina littoralis</i> ) present.	
Mid-storey/Shrub Layer Description	A fairly dense mid-storey/shrub layer containing an array of species including tantoon ( <i>Leptospermum polygalifolium</i> ), conesticks ( <i>Petrophile pulchella</i> ), <i>Sannantha pluriflora</i> , heath-leaved banksia ( <i>Banksia ericifolia</i> ), narrow- leaved geebung ( <i>Persoonia linearis</i> ), spiny bossiaea ( <i>Bossiaea obcordata</i> ) pink spider flower ( <i>Grevillea sericea</i> ), tick bush ( <i>Kunzea ambigua</i> ) and sweet wattle ( <i>Acacia suaveolens</i> ).	

PCT Name	Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast
Condition	Moderate – <i>Pinus radiata</i> variant
Ground Cover Description	This vegetation zone was characterised by a diverse and fairly dense ground layer of ferns, sedges and sub-shrubs. Dominant species include oat speargrass ( <i>Anisopogon avenaceus</i> ), wiry panic ( <i>Entolasia stricta</i> ), <i>Lepyrodia scariosa</i> , <i>Lepidosperma concavum</i> and many- flowered mat-rush ( <i>Lomandra multiflora</i> ). Other species present include <i>Platysace linearifolia</i> , common maidenhair ( <i>Adiantum aethiopicum</i> ) and hairy apple ( <i>Billardiera scandens</i> ).
PCT Allocation	Vegetation Zone 3 was aligned with PCT1642 as it is surrounded by vegetation zone 2, which aligns with this PCT, however vegetation zone 3 is dominated by the exotic species <i>Pinus radiata</i> , likely due to edge effects from the adjacent roadside.
BC Act Status	This vegetation zone is not consistent with any TEC listed under the BC Act.
EPBC Act Status	This vegetation zone is not consistent with any TEC listed under the EPBC Act.

#### Zone 4 – PCT 1699 Heath- leaved Banksia – Coral Fern wet heath on sandstone ranges of the lower Central Coast (Good Condition)

PCT Name	Heath- leaved Banksia – Coral Fern wet heath on sandstone ranges of the lower Central Coast	
Condition	Good	
Formation	Freshwater Wetlands	
Class	Coastal Heath Swamps	
Percent cleared	0.00	
Area in Development Footprint (ha)	2.9	
Patch Size Class (ha)	>101	
Location	Occurs on the poorly draining lower areas along the southern boundary (refer to <b>Figure 3.1</b> ).	
Canopy Description	Canopy species are generally absent, with occasional scattered scribbly gum ( <i>Eucalyptus haemastoma</i> ).	
Mid-storey/Shrub Layer Description	A relatively open midstorey/shrub layer of heath- leaved banksia ( <i>Banksia ericifolia</i> ) is present, with occasional tantoon ( <i>Leptospermum polygalifolium</i> ), mountain devils ( <i>Lambertia formosa</i> ) and conesticks ( <i>Petrophile pulchella</i> ).	
Ground Cover Description	This vegetation zone was characterised by a dense ground layer of pouched coral fern ( <i>Gleichenia dicarpa</i> ), with other sedges, forbs and grasses such as wiry panic ( <i>Entolasia stricta</i> ), lesser flannel flower ( <i>Actinotus minor</i> ), spreading rope- rush ( <i>Empodisma minus</i> ), red- fruit saw-sedge ( <i>Gahnia sieberiana</i> ) and swamp selaginella ( <i>Selaginella uliginosa</i> ).	



PCT Name	Heath- leaved Banksia – Coral Fern wet heath on sandstone ranges of the lower Central Coast
Condition	Good
PCT Allocation	Vegetation Zone 4 was aligned with PCT1699 as it supports a number of the species identified for the PCT as listed on the VIS Classification Database (DPIE 2020c). It is dominated by heath-leaved banksia ( <i>Banksia ericifolia</i> ) and tantoon ( <i>Leptospermum polygalifolium</i> ) which are two of the four positive diagnostic species occurring in the mid stratum/shrub layer. Further, the shrub and ground layers contain five of eight (62%) species listed on the VIS Classification Database (DPIE 2020c), with the ground stratum containing the diagnostic species pouched coral fern ( <i>Gleichenia dicarpa</i> ) at almost 100% coverage, which is diagnostic for this PCT. PCT1699 was determined to be the best overall fit in terms of diagnostic species and the community's location in the landscape, given that this PCT is described as a Banksia dominated wet heath occurring on dissected Hawkesbury sandstone from Peats Ridge to Mooney Creek, which accurately describes the vegetation in the Development Footprint.
BC Act Status	This vegetation zone is consistent with <i>Coastal Upland Swamp in the Sydney Basin Bioregion</i> EEC listed under the BC Act. The vegetation within the Development Footprint has been found to be consistent with the EEC due to the floristic similarity found on site and the position in the landscape on poorly draining/waterlogged soils. In particular, a dominance of species such as <i>Banksia ericifolia</i> , <i>Baumea</i> sp., <i>Selaginella uliginosa</i> , <i>Empodisma minus</i> and <i>Gahnia sieberiana</i> , and an almost complete coverage of <i>Gleichenia dicarpa</i> in the ground layer, closely aligns to the description of this EEC (NSW Scientific Committee 2012). Other characteristic species recorded include <i>Lindsaea linearis</i> , <i>Entolasia stricta</i> , <i>Lepyrodia scariosa</i> , <i>Xyris</i> sp., <i>Cassytha glabella</i> , <i>Hakea teretifolia</i> and <i>Petrophile pulchella</i> . The absence of any tree species in the canopy is also a conforming feature of this EEC and matches that which was found within the Development Footprint. The vegetation in the Development Footprint is also found on the Somersby Plateau, which conforms to the landscape described in the NSW Final Determination (NSW Scientific Committee 2012). Finally, many species found within the Coastal Upland Swamp EEC are absent from the surrounding vegetation communities (NSW Scientific Committee 2012), which is particularly true for the vegetation within the Development Footprint which is starkly different from the surrounding vegetation, largely due to the dominance of the <i>Gleichenia dicarpa</i> which forms large colonies around swamps.
EPBC Act Status	This vegetation zone is also consistent with the <i>Coastal Upland Swamps in the Sydney Basin Bioregion</i> EEC under the EPBC Act. As per the assessment above according to the BC Act status, this vegetation zone within the Development Footprint is consistent with the EEC under the EPBC Act due to the floristic similarity found on site and the position in the landscape on poorly draining/waterlogged soils (DoE 2014). Characteristic species included in the EPBC conservation advice for this community have been extracted from the NSW final determination, therefore the NSW and Commonwealth listings share the same list of characteristic species.

### 3.2.2 Exotic Vegetation

The Development Footprint contains very few exotic species, and no areas have been mapped as exotic vegetation. Some areas adjacent to Reeves Street contain large specimens of radiata pine (*Pinus radiata*). A number of weeds present in the Development Footprint are classed as High Threat Weed species under the BAM, including blackberry (*Rubus anglocandicans*), pampas grass (*Cortaderia selloana*) and lantana (*Lantana camara*), and are identified in the flora species list in **Appendix C**.

### 3.2.3 Threatened Ecological Communities

Vegetation Zone 4 – PCT1699 Heath- leaved Banksia – Coral Fern wet heath on sandstone ranges of the lower Central Coast (Good Condition) is considered to conform to the following TECs:

- *Coastal Upland Swamp in the Sydney Basin Bioregion EEC* listed under the BC Act
- *Coastal Upland Swamps in the Sydney Basin Bioregion EEC* listed under the EPBC Act.

### 3.2.4 Vegetation Integrity Score

**Table 3.2** below details the vegetation integrity scores for each of the vegetation zones in the Development Footprint. The vegetation integrity data for each of the vegetation zones is provided in **Appendix D**.

**Table 3.2 Vegetation Zone Vegetation Integrity Scores**

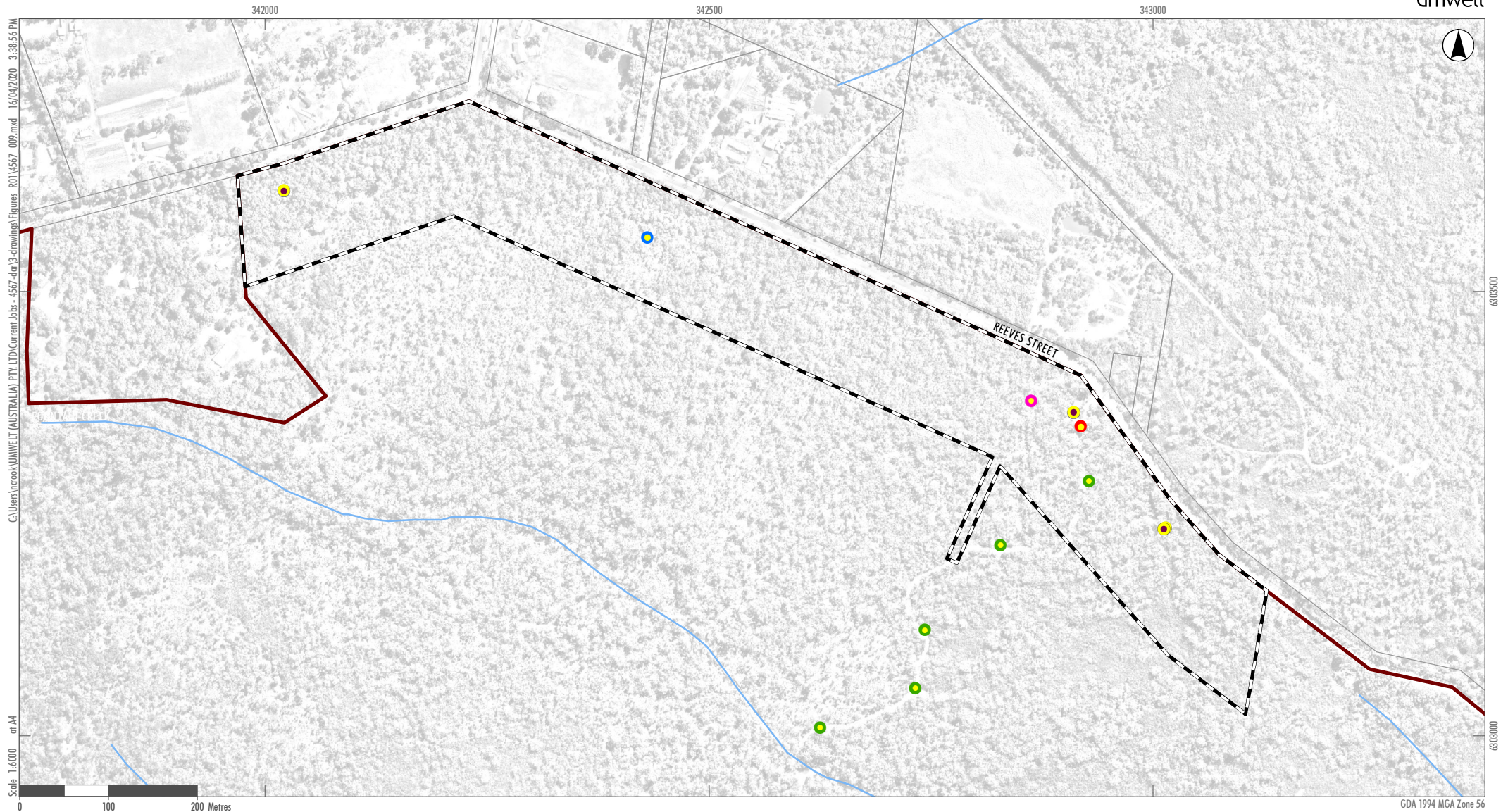
Veg Zone	PCT Name	Composition	Structure	Function	Current Vegetation Integrity Score
1	1641 Dwarf Apple – Scribbly Gum heathy low woodland on sandstone ranges of the Central Coast <i>Good Condition</i>	97.0	50.3	52.7	<b>63.6</b>
2	1642 Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast <i>Good Condition</i>	90.7	58.4	70.0	<b>71.9</b>
3	1642 Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast <i>Moderate Condition – Pinus radiata variant</i>	81.2	20.8	48.7	<b>43.5</b>
4	1699 Heath- leaved Banksia – Coral Fern wet heath on sandstone ranges of the lower Central Coast <i>Good Condition</i>	73.8	11.0	-	<b>28.5</b>

## 3.3 Threatened Species within the Development Footprint

### 3.3.1 Ecosystem-credit Species

A list of the ecosystem-credit species predicted to occur by the BAM Calculator and/or the literature review within the Development Footprint is provided in **Appendix A**. Threatened species records are shown on **Figure 3.2**.





### Legend

- Development Footprint
  - Lot 48 DP118467
  - Lot Boundaries
  - Watercourses
- Threatened Species Recorded During Surveys**
- Red-crowned Toadlet
  - Glossy-black Cockatoo (heard)
  - Giant Burrowing Frog
  - Squirrel Glider
  - Hibbertia procumbens*

FIGURE 3.2  
Threatened Species



### 3.3.2 Species-credit Species

A list of the species-credit species predicted to occur by the BAM Calculator and/or the literature review and a discussion on their inclusion or exclusion from the calculator assessment is provided in **Appendix B**. Species-credit species recorded or assumed present are shown in **Table 3.3** below and further information on the surveys undertaken for these species is provided in **Appendix B**.

**Table 3.3 Species-credit Species within the Development Footprint**

Species	BC Act	EPBC Act	Species Presence	Justification
eastern pygmy possum <i>Cercartetus nanus</i>	V	-	Yes (assumed present)	Species not detected, however this species is difficult to detect and a high number (40) of records exist within 10 km of the Development Footprint. 27 of these records have been submitted since 1 January 2009. This species is associated with PCTs 1641 and 1642 according to the TBDC (DPIE 2020b). The species polygon has been aligned with the extent of these PCTs occurring in the Development Footprint.
large-eared pied-bat <i>Chalinolobus dwyeri</i>	V	V	Yes (assumed present)	This species is considered to occur where there are potential roosts located within 2 km of associated PCTs. Potential roosts are caves, scarps, cliffs, rock overhangs and disused mines (DPIE 2020b), and these features are highly likely to occur within 2 km of the Development Site, particularly to the north. As it is not possible to survey within 2 km of the Development Footprint for any possible roosts, and as PCT 1642 is associated with this species according to the TBDC (DPIE 2020b), the species has been assumed to occur on site. The species polygon has been aligned with PCT 1642. There are two records of this species in the locality.

Species	BC Act	EPBC Act	Species Presence	Justification
giant burrowing frog <i>Heleioporus australiacus</i>	V	V	Yes (surveyed)	The species was heard and observed during spotlighting surveys within the Development Footprint in March 2020 (see <b>Plate 3.1</b> ). The species reportedly travels up to 300 m from breeding habitats (DPIE 2020b). A 300 m buffer has been assumed around each point that this species was detected, and is consistent with the justification for the method used for red-crowned toadlet (see below). This species was recorded on the access track adjacent to flowing and pooling water along this track immediately after rain. A further six individuals were detected along the access track outside of the Development Footprint, with the 300 m buffer for some of these individuals overlapping with the Development Footprint. Refer to <b>Figure 3.3</b> for the species polygon for this species.
spreading guinea flower <i>Hibbertia procumbens</i>	E	-	Yes (surveyed)	Four individuals detected within Development Footprint. Refer to <b>Figure 3.3</b> for the species polygon for this species. This species has been aligned with suitable PCTs according to the TBDC (DPIE 2020b).
southern myotis <i>Myotis macropus</i>	V	-	Yes (assumed present)	This species is considered to occur where there are waterbodies (> 3m) within 200 m of hollow-bearing trees in associated PCTs. There are dams located within 200 m from the Development Footprint, across Reeves Street, and PCTs 1641 and 1642 are associated with this species. There are 10 records of this species in the locality.
squirrel glider <i>Petaurus norfolcensis</i>	V	-	Yes (surveyed)	The species was observed during spotlighting surveys in March 2020. Refer to <b>Figure 3.3</b> for the species polygon for this species. This species has been aligned with suitable PCTs according to the TBDC (DPIE 2020b).

Species	BC Act	EPBC Act	Species Presence	Justification
red- crowned toadlet <i>Pseudophryne australis</i>	V	-	Yes (surveyed)	The species was heard and observed during spotlighting surveys within the Development Footprint in May 2019 (see <b>Plate 3.2</b> ). Published information regarding the dispersal ability of this species is scarce, however advice from the BCD suggests that a buffer of 300 m around confirmed habitat would be suitable as a habitat polygon. This was confirmed via a query to the Land Management and Biodiversity Conservation (LMBC) Contact Centre and subsequent phone call from the LMBC in May 2019, who advised a 300 m buffer around the observation would be appropriate. Therefore, a 300 m buffer has been assumed around the location at which this species was recorded. This species was recorded in an artificial drainage line adjacent to an existing track where water pooling would occur, and extensive leaf litter and reeds were present at the time of survey. Refer to <b>Figure 3.3</b> for the species polygon for this species.



**Plate 3.1** Giant burrowing frog recorded within the Development Footprint

© Umwelt, 2020



**Plate 3.2** Red-crowned toadlet recorded within the Development Footprint

© Umwelt, 2020

### 3.3.3 Species- Credit Species Habitat Polygons and Biodiversity Risk Weighting

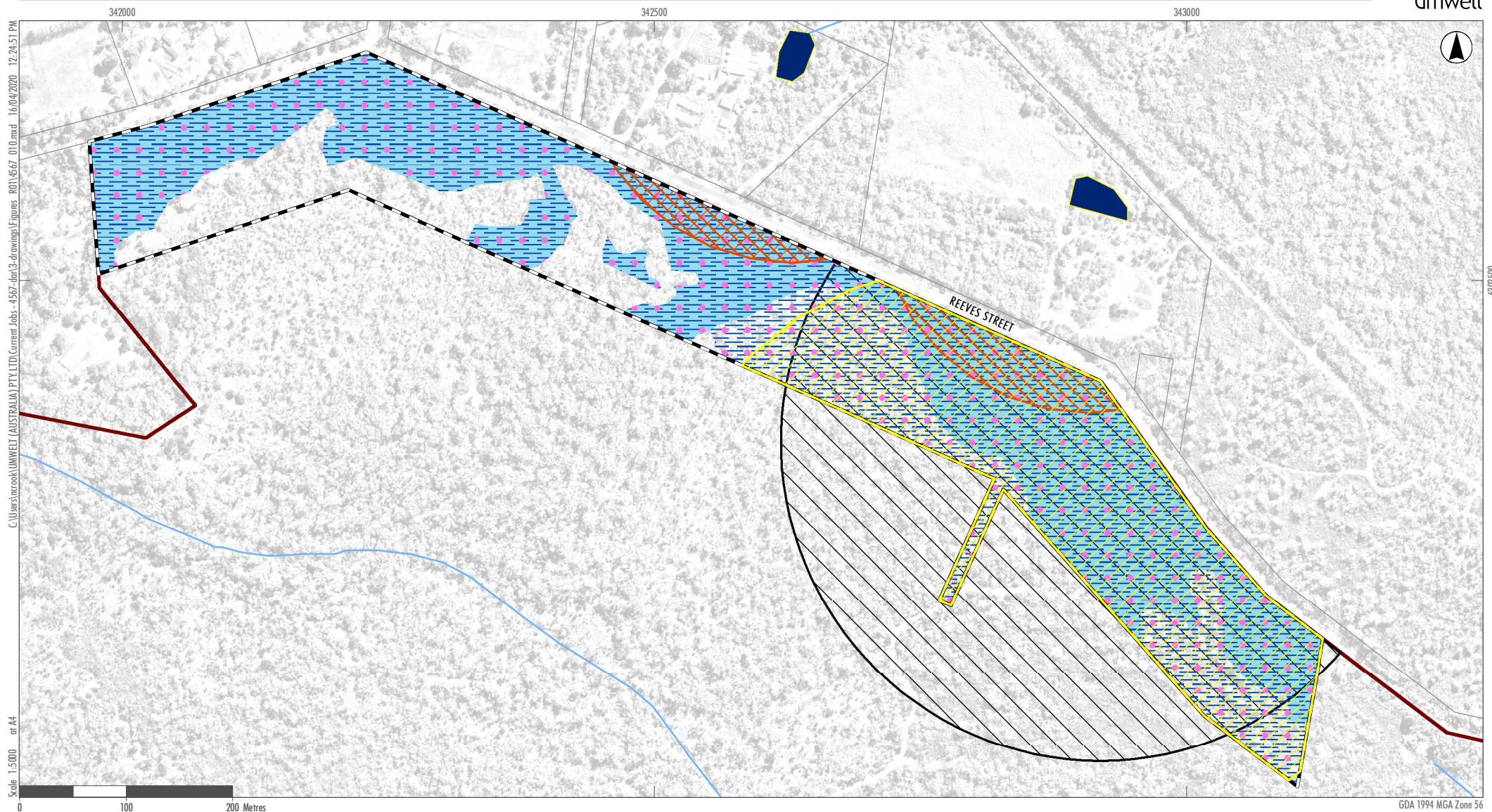
Species habitat polygons have been prepared for the species outlined in **Table 3.4** below. Polygons are shown on **Figure 3.3**.

**Table 3.4** Species-credit Species Polygons

Species	Biodiversity Risk Weighting	Species Habitat Polygon Area (ha)	Species Habitat Polygon Description
eastern pygmy possum <i>Cercartetus nanus</i>	2	9.5	All areas of Vegetation Zone 1, 2 and 3 (1641 Good, and 1642 Good and 1642 Moderate) (refer <b>Figure 3.3</b> ).
large- eared pied- bat <i>Chalinolobus dwyeri</i>	3	8.4	All areas of vegetation zone 1 (PCT 1642) (Development Footprint is assumed to be within 2 km of roosting habitat) (refer <b>Figure 3.3</b> ).
giant burrowing frog <i>Heleioporus australiacus</i>	1.5	7.8	300 m buffer from where the species was recorded (including areas of PCTs 1641 (2.4 ha) and 1642 (4.9 ha) and 1699 (0.009 ha) good condition) (refer <b>Figure 3.3</b> ).

Species	Biodiversity Risk Weighting	Species Habitat Polygon Area (ha)	Species Habitat Polygon Description
spreading guinea flower <i>Hibbertia procumbens</i>	2	9.5	All areas of Vegetation Zone 1, 2 and 3 (1641 Good, and 1642 Good and 1642 Moderate) (refer <b>Figure 3.3</b> ).
southern myotis <i>Myotis macropus</i>	2	1.3	Any part of vegetation zone 1 and 3 (PCT 1641 and 1642 Good) that are situated within a 200 m buffer from nearby dams (refer <b>Figure 3.3</b> ).
squirrel glider <i>Petaurus norfolcensis</i>	2	8.4	All areas of vegetation zone 1 (PCT 1642) (refer <b>Figure 3.3</b> ).
red- crowned toadlet <i>Pseudophryne australis</i>	1.5	7.2	300 m buffer from where the species was recorded (including areas of vegetation zone 1 and 3 (PCTs 1641 (2.3 ha) and 1642 Good (4.9 ha)) (refer <b>Figure 3.3</b> ).





### Legend

- |   |  |                                     |
|---|--|-------------------------------------|
| Development Footprint   | Red-crowned Toadlet (300m Buffer around Observation) | <i>Hibbertia procumbens</i> Habitat |
| Lot 48 DP118467   | Southern Myotis Foraging Habitat Buffer              |                                     |
| Lot Boundaries  | Southern Myotis Foraging Habitat                     |                                     |
| Watercourses  | Large-Eared Pied Bat and Squirrel Glider Habitat     |                                     |
| Giant Burrowing Frog Habitat (300m Buffer around Observation) | Eastern Pygmy Possum Habitat                         |                                     |

FIGURE 3.3  
Species-Credits Species  
Polygons



## 4 Avoidance and Minimisation of Impacts

### 4.1 Avoidance of Important Biodiversity Features

Darkinjung have sought to avoid and minimise the potential impacts on the ecological values of the project primarily through the selection of the location of the disturbance area. The Development Footprint has been located immediately adjacent to Reeves Street, in areas more likely to be already subject to edge effects and indirect impacts from surrounding development. The intact and high quality bushland to the south of the Development Footprint will remain intact.

Following the Regional Planning Proposal's Rezoning Review Request decision, the Development Footprint was modified to locate the impacts of the project outside the indicatively mapped regional biodiversity corridor, as identified in the Central Coast Regional Plan 2036 (NSW DPE 2016). As a result, the location of the development footprint has been carefully placed to ensure the width of this corridor is largely unaffected by the proposal. The width of intact vegetation north and south of Reeves Road will not be reduced to less than 500 metres which is consistent with the broad guidance for regional corridors as applied in Scotts (2003) and DECC (2007) (refer to **Section 5.3** for more detail).

Darkinjung has also sought to specifically avoid impacts to the mapped areas of *Coastal Uplands Swamp EEC* in the northwest of the Development Footprint. The Development Footprint currently shows the worse-case scenario for impact and it is intended that the actual disturbance from the project will be reduced at the detailed design stage prepared for the development application. Where possible, building envelopes and wastewater management areas will be placed in areas to reduce direct impacts on this BC Act and EPBC Act listed community.

In addition, the Biodiversity Values (BV) Map identifies land with high biodiversity value that is particularly sensitive to impacts from development and clearing. No areas of high biodiversity values are identified on the BV Map within the Development Footprint. An area of protected riparian land, associated with Fountain Creek, occurs to the south of the Development Footprint. This feature has been entirely avoided and is intended to form part of the offsetting strategy for the project.

Prescribed impacts set out in the BAM (OEH 2017a) have been avoided by the project. Further detail on the assessment of prescribed impacts is outlined in **Section 5.2**.

### 4.2 Minimisation Measures

Darkinjung has committed to the design and implementation of a comprehensive biodiversity impact minimisation strategy to mitigate the unavoidable impacts of the project. The following specific control measures are considered to be integral to the minimisation of impacts on the biodiversity features of the Development Footprint and surrounds. Control measures include:

- demarcation of approved clearance boundaries
- weed management
- fencing and access control
- bushfire management
- pre-clearance and tree felling procedures.

## 4.2.1 Tree Felling Procedure

The supervision of all trees and vegetation removal works is to be completed by a suitably qualified and experienced ecologist. If an unanticipated ecological issue is encountered, further advice is to be sought on the most appropriate measures to ensure minimal impact on fauna species, particularly threatened species. Prior to the commencement of felling activities, a local veterinarian and/or qualified wildlife carer will be identified and their contact details kept on hand, in the case their assistance is needed for injured wildlife. All personnel who are involved in the capture/handling/housing and/or transport of native fauna species (injured or uninjured) must be appropriately licensed under the requirements of the NSW Animal Ethics Committee.

The following sections document the steps required to be completed as part of the tree felling process.

No more than two weeks prior to tree felling habitat trees, the following activities will be undertaken:

- Remove non-habitat trees/vegetation less than 3m in height, as close to the habitat tree felling date as possible (less than one week) in order to create disturbance to discourage fauna usage of the habitat trees.
- In the event that threatened fauna are identified, provide a minimum 48 hour window for any threatened fauna species to vacate hollows or nests.

On the day of felling of habitat trees, the following activities will be undertaken:

- Complete a visual inspection of the area to be cleared for fauna species and nests that may have become active since pre-clearing surveys.
- Shake the habitat tree (with heavy machinery) for at least 30 seconds or as appropriate prior to felling to encourage fauna to abandon the tree.
- Ensure that habitat trees are lowered away from adjoining retained habitats.
- Lower the habitat tree as gently as possible with heavy machinery, noting in some situations (i.e. steep slopes) manual felling by chainsaw may be appropriate.
- Inspect all hollows and canopy of felled trees for remaining or injured fauna.
- Capture any displaced or injured fauna. Unharmful fauna are to be released into nearby secure habitats on the same day. Injured fauna are to be triaged immediately, humanely euthanized if required, or taken to a veterinarian or local volunteer wildlife carer group for further attention if required.
- Felled trees are to be rolled where appropriate so that the number of hollows blocked against the ground is minimised.
- In the event that threatened fauna are identified, provide a minimum 48 hour window for any threatened fauna species to vacate hollows or nests.

Each of these control measures will contribute to the maintenance of habitat quality adjacent to the Development Footprint outside existing approved disturbance.

## 4.3 Summary of Measures

**Table 4.1** below outlines the avoidance and minimisation measures proposed for the project including the timing, action, outcome and responsibility of these measures.



**Table 4.1 Avoidance and Minimisation Measures**

Measure	Timing	Responsibility	Proposed Techniques	Outcome
Preliminary ecological site inspection	Pre-project design	N/A	N/A	<ul style="list-style-type: none"> <li>Preliminary assessment of areas of avoidance to inform project design.</li> </ul>
Location and design of facilities in existing disturbed areas.	Project design	N/A	N/A	<ul style="list-style-type: none"> <li>Focus impacts on areas of low biodiversity value.</li> </ul>
Pre-clearance Surveys and Tree Felling Procedure	Prior to clearance and during clearance activities	Site Manager	<ul style="list-style-type: none"> <li>Pre-clearance surveys and felling procedures as described above.</li> </ul>	<ul style="list-style-type: none"> <li>Minimisation of impacts to resident fauna species within the Development Footprint.</li> </ul>
Demarcation of approved clearance boundaries	Prior to clearance and during clearance activities	Site Manager	<ul style="list-style-type: none"> <li>Establish construction fencing or marking tape around areas not proposed for clearance.</li> </ul>	<ul style="list-style-type: none"> <li>Minimisation of unnecessary impacts to surrounding vegetation and habitats.</li> </ul>
Weed management	Construction and operation	Site Manager	<ul style="list-style-type: none"> <li>Chemical and physical removal of invasive and high- threat weed species in accordance with the <i>NSW Weed Control Handbook</i> (DPI 2018).</li> </ul>	<ul style="list-style-type: none"> <li>Minimisation of environmental and noxious weeds in the Development Footprint.</li> <li>Minimisation of weed spread from and into the wider locality.</li> </ul>

# 5 Assessment of Impacts

## 5.1 Impacts on Native Vegetation and Habitat

### 5.1.1 Direct Impacts

The development of the project will result in direct impacts on biodiversity values. Direct impacts include the loss of vegetation and fauna habitats as a result of clearance works and subsequent impacts from residential housing. The Development Footprint contains a range of habitat features (such as hollow-bearing trees, fallen logs and threatened flora species habitat) and species-credit species have been identified to occur within the Development Footprint.

**Table 5.1** below outlines the maximum direct impacts on native vegetation, which totals approximately 16.6 hectares. This assumes that the entire development footprint will be cleared as a result of the rezoning and subsequent development of the site. Further refinement of impact areas and building envelopes will be undertaken following the rezoning process to further minimise direct impacts to biodiversity.

**Table 5.1 Direct Impacts of the Project on Biodiversity Features**

Species	Area within the Development Footprint (ha)
<b>Plant Community Type</b>	
PCT1641 Dwarf Apple Scribbly Gum heathy low woodland on sandstone ranges of the Central Coast <i>Good Condition</i>	3.2
PCT1642 Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast <i>Good Condition</i>	9.9
PCT1642 Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast <i>Pinus radiata</i> variant <i>Moderate Condition</i>	0.61
PCT 1699 Heath- leaved Banksia – Coral Fern wet heath on sandstone ranges of the lower Central Coast <i>Good Condition</i>	2.9
<b>Species-credit Species Habitats</b>	
eastern pygmy possum – <i>Cercartetus nanus</i>	13.71
large-eared pied-bat – <i>Chalinolobus dwyeri</i>	10.51
giant burrowing frog – <i>heleioporus australiacus</i>	7.8
spreading guinea flower - <i>Hibbertia procumbens</i>	13.71
southern myotis – <i>Myotis macropus</i>	1.3
squirrel glider – <i>Petaurus norfolcensis</i>	9.9
red- crowned toadlet – <i>Pseudophryne australis</i>	7.2

## 5.1.2 Indirect Impacts

The project is not expected to result in any substantial indirect impacts on the biodiversity values of surrounding lands. No substantial indirect impacts are expected to occur in relation to connectivity, corridors, habitat fragmentation or light emissions beyond minimal encroachment from the Development Footprint. However, some minor indirect impacts associated with water runoff and altered water flows, noise, dust and weeds may occur during the subsequent development of the Development Footprint. These are discussed below.

No indirect impact zones have been identified for this project.

### 5.1.2.1 Noise Impacts

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 suitability of areas of suitable habitat.

In regard to potential impacts on biodiversity, noise disturbance is likely to be highest during construction of the project. Upon completion, noise levels are likely to be similar to those already experienced in the area from the nearby Pacific Motorway and residences. Noise from proposed residences is not expected to be of any level of significance in relation to threatened species, populations and communities.

### 5.1.2.2 Dust Impacts

Dust emissions have the potential to adversely impact native species during ground disturbance works and construction. Potential impacts include dust covering vegetation, which thereby potentially reduces vegetation health and growth. This subsequently impacts upon native fauna species. The design of the project will include measures to minimise the potential for adverse dust impacts. Dust impacts will also only be present during the construction phase of the project and will therefore be a temporary disturbance to the vegetation and habitats adjacent to the Development Footprint.

### 5.1.2.3 Weed Impacts

Weed species could be inadvertently brought into the Development Footprint with imported materials, on equipment, or could invade naturally through removal of native vegetation and establishment of gardens. The presence of weed species within the Development Footprint has the potential to decrease the value of extant vegetation to native species. Mitigation measures outlined in **Section 4.0** will be implemented to minimise the potential for weed encroachment into areas surrounding the Development Footprint.

There is unlikely to be any substantial change to impacts from weeds. Any additional impacts resulting from weeds are not expected to be of any level of significance in relation to threatened species, populations and communities.

### 5.1.2.4 Surface and Groundwater Impacts

The *Coastal Uplands Swamp EEC* occurring within and surrounding the Development Footprint is likely to be particularly susceptible to any changes in surface and groundwater flows. A formal assessment of the surface and groundwater impacts associated with the project will be undertaken at the development application stage and following the refinement of building envelopes and final impact areas. The assessment will provide confirmation that indirect impacts on *Coastal Uplands Swamp EEC* outside of the

assessed disturbance footprint will be avoided as well as establish how the worst case impacts on the *Coastal Uplands Swamp EEC* within the disturbance footprint currently assessed can be reduced. This is acknowledged by Darkinjung and will be specifically assessed as part of the development application stage and any necessary refinement of the BCAR.

## 5.2 Prescribed Impacts

No impacts are predicted to threatened species' or communities' habitat associated with karst, caves, cliffs and other geological features of significance or human-made structures as these do not occur within or adjacent to the Development Footprint. However, small rocky areas and crevices do occur within the Development Footprint, which can be considered a prescribed impact. These areas are relatively small, considering the larger area of surrounding habitat.

No areas of non- native vegetation exist within the development footprint. The small area of PCT 1642 (moderate) has been mapped separately from the areas of PCT 1642 (good) due to the dominance radiata pine (*Pinus radiata*) in the canopy, however the vegetation community is otherwise predominantly native. This area is habitat for spreading guinea flower (*Hibbertia procumbens*) and has been mapped as such. This very minor area of habitat is not considered important to the local or regional existence of the spreading guinea flower, given that only one individual was detected within this area during surveys.

Important connectivity and movement habitat is unlikely to be substantially impacted by the project, however removal of the vegetation will be a long-term and permanent impact. The corridor of native vegetation that encompasses the Development Footprint is approximately 3.5 km wide and extends north and south for an extensive distance. The Development Footprint is located within the corridor identified in the Central Coast Regional Plan 2036 (NSW Government 2016) as connecting the Central National Parks and State Forests. The project proposes to impact a relatively minor proportion of this area of native vegetation (approximately 1.5 km long). The corridor itself will remain the same size overall, and minor impacts to connectivity will occur (refer to **Figure 2.1**).

Only those threatened fauna species that are not particularly mobile are likely to be impacted by the proposal. Similarly, threatened flora species and threatened ecological communities rely on connectivity for the exchange of genetic material. Therefore, impacts to connectivity limit the diversity within any given gene pool. However, considering the small area of connectivity to be removed, and given that the retained vegetation will remain completely surrounded by native vegetation, impacts to genetic exchange are not anticipated such that these threatened species or communities would cease to exist in the locality.

The project will not result in severing any major fauna movement habitat which would result in the loss of connectivity in the wider landscape or movement important for threatened species to maintain their life cycle.

No impacts on water quality or hydrological processes that sustain threatened species and threatened ecological communities are likely to occur. While a mapped creek occurs to the south of the Development Footprint, no waterbodies exist within the Development Footprint. Additionally, a drainage line that appears to be man- made and where the red- crowned toadlet (*Pseudophryne australis*) was detected, is situated immediately adjacent to the Development Footprint, but is not proposed to be impacted. No direct impacts to the hydrological processes of this drainage line are anticipated to occur as part of the proposed activity. Should any indirect impacts occur, these are expected to be short- term in duration and persist only during the construction phase of the project. These should also be minimal provided appropriate erosion and sediment controls are in place.



As outlined in **Section 5.1.2.4** above, specialist studies will be conducted to confirm whether alterations to hydrological processes will occur. In particular, future development will be designed to ensure that there is no indirect impact to downstream upland swamp communities or hydrological processes within the local area. A decrease in any available groundwater or surface water seepage could potentially have negative impacts upon the longevity and extent of the EEC, including in the wider area to the south of the Development Footprint.

Access to the Development Footprint will occur via Reeves Street. As the Development Footprint occurs immediately adjacent to Reeves Street, it is unlikely that any threatened species or animals that are part of a TEC would be adversely impacted by the increase in vehicle movement in or near to the Development Footprint. As the proposed activity would result in an increase in residences on Reeves Street, an increase in local vehicle movement is anticipated. However, the anticipated increase is not at such a scale that the increase in vehicle strikes would be significant to the decline of any threatened species.

The impacts of wind turbines are not applicable to this project.

### 5.2.1 Uncertain Prescribed Impacts

Uncertain impacts are those that are unable to be reliably predicted during the assessment process or are infrequent in nature. These usually refer to impacts associated with caves, cliffs, mine subsidence and wind turbine strikes and increased vehicle strikes. Indirect impacts associated with the interruption of ecosystem processes are also complex and difficult to quantify.

The project is unlikely to result in any uncertain prescribed impacts.

## 5.3 Biodiversity Corridor Functionality and Connectivity

The development footprint is located adjacent to an indicative biodiversity corridor identified in the Central Coast Regional Plan 2036 (NSW DPE 2016) as Corridor 2 connecting the central national parks and state forests (refer **Figure 5.1**). This is part of a broader biodiversity corridor network that links to the Great Dividing Range, Hawkesbury River, Ku-ring-gai Chase National Park and Watagans National Park.

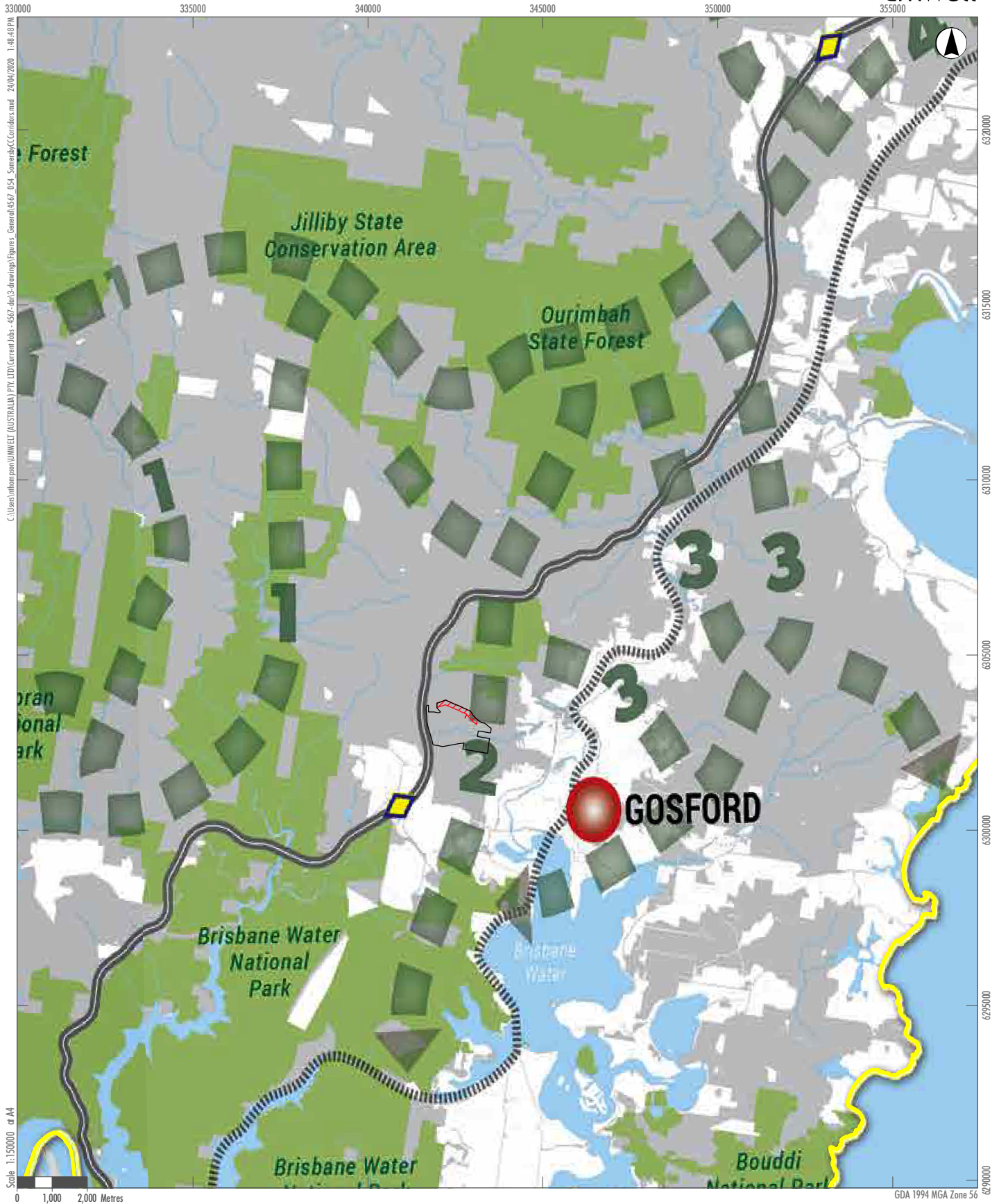
A 'wildlife corridor' generally describes a strip of vegetation that differs from the surrounding vegetation and connects otherwise separate areas of habitat (Gleeson and Gleeson 2012). Corridors may include large expanses of intact native landscapes, river systems and floodplains, networks of habitat patches or scattered paddock trees. Connectivity is a critical function of wildlife corridors. These corridors may help to reduce or moderate some of the adverse effects of habitat fragmentation by facilitating dispersal of individuals between substantive patches of remaining habitat. Corridors are not necessarily continuous, as currently fragmented or cleared areas can also contribute to overall landscape connectivity (Scotts 2003).

The key local corridor relevant to the development site is the majority intact vegetation associated with Corridor 2 on the eastern side of the M1 Motorway running in a north-south direction (refer to **Figure 5.1**). Existing fragmentation is evident in the immediate locality associated with vegetation cleared on the northern side of Reeves Road and scattered housing along Dawson Street to the east of the development footprint.

As outlined in **Section 4.1**, following the Regional Planning Proposal's Rezoning Review Request decision, the Development Footprint was modified to locate the impacts of the project outside the indicatively mapped regional biodiversity corridor, as identified in the Central Coast Regional Plan 2036 (NSW DPE 2016). As a result, the location of the development footprint has been carefully placed to ensure the proposal maintains a functional corridor that provides connectivity for species found in the area.

The proposed development has been designed to avoid impacts on the functionality of the connectivity and biodiversity corridors in the locality and region. As a result of the placement of the development footprint, existing connectivity values between the north and south will be retained and the functionality of corridors will be preserved through the appropriate siting of the proposed development.

The development of this planning proposal is unlikely to result in any substantial cumulative impacts in relation to regional connectivity and the collective development of other Darkinjung proposed developments in the Central Coast LGA. The development footprint proposed represents a relatively small area in a regional context and the proposal is not likely to sever or affect the functionality of any important regional biodiversity corridors.



#### Legend

- Proposed Development Footprint
- Lot 48 DP118467
- Central Coast Local Government Area

- ▶ Inter-regional Road and Interchange

#### Biodiversity Corridor

- ▶ 1 - Linking to Mountains and National Parks to the West
- ▶ 2 - Connecting the Central National Parks & State Forests
- ▶ 3 - Linking Coastal Hills with valleys and Foreshores
- ▶ 4 - Connecting the Coast to the Foothills and Providing an Inter-Regional Landscape Break

FIGURE 5.1

Proposal Site in Relation to  
Central Coast Regional Plan 2036 Biodiversity  
Corridors (NSW Government 2016)

## 5.4 Serious and Irreversible Impacts

Under the BC Act, a determination of whether an impact is serious and irreversible must be made in accordance with the principles prescribed in the BC Regulation. The principles have been designed to capture those impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in New South Wales. These are impacts that:

- 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
- 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
- impact on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution, or
- impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

None of the PCTs or species-credit species that generate biodiversity credits for the project are nominated as candidate SAI entities in the Threatened Biodiversity Data Collection (TBDC). (note: the large-eared pied-bat is listed as an SAI for confirmed breeding habitat only, which does not occur in the Development Footprint). The predicted species outlined in **Appendix B**, the candidate SAI entities are listed for breeding habitat components only (e.g. cave and cliff line habitat for cave-roosting microbat species), contain distributional restrictions (i.e. SAI for south of the Sydney Basin Bioregion only) or the species do not occur in the Development Footprint (i.e. flora species).

No species or ecological communities listed as SAI entities are likely to occur within the Development Footprint and no further assessment of SAI is required.



## 6 Biodiversity Credit Impact Summary

### 6.1 Impacts Not Requiring Assessment

Under the BAM, impacts to areas of land without native vegetation do not require further assessment. The Development Footprint does not contain any areas of exotic vegetation or areas that have been previously cleared.

### 6.2 Impacts Not Requiring Offset

Impacts on native vegetation not requiring offsets under the BAM include native vegetation that has a vegetation integrity score of less than 20 (where it is not associated with ecosystem-credit species habitat or a TEC), less than 17 (where it is associated with ecosystem-credit habitat or a TEC) or less than 15 (where it is representative of a EEC or CEEC).

As all native vegetation recorded within the Development Footprint has a higher vegetation integrity score than the required thresholds, there are no areas of native vegetation impact not requiring offset.

### 6.3 Impacts Requiring Offset

Three PCTs and seven species-credit species are considered to require offsetting in accordance with the BAM (OEH 2017a). **Table 6.1** summarises this outcome.

**Table 6.1 Impacts Requiring Offset**

Veg Zone	PCT/Species-credit	Vegetation Integrity Score			Area (ha)	Credits Required
		Current	Future	Change		
1	PCT1641 Dwarf Apple Scribbly Gum heathy low woodland on sandstone ranges of the Central Coast <i>Good Condition</i>	63.6	0	-63.6	3.2	76
2	PCT1642 Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast <i>Good Condition</i>	71.9	0	-71.9	9.9	267
3	PCT1642 Scribbly Gum – Red Bloodwood – Old Man Banksia heathy woodland of southern Central Coast <i>Pinus radiata</i> variant <i>Moderate Condition</i>	43.5	0	-43.5	0.61	10
4	PCT 1699 Heath- leaved Banksia – Coral Fern wet heath on sandstone ranges of the lower Central Coast <i>Good Condition</i>	28.5	0	-28.5	2.9	41
-	eastern pygmy possum <i>Cercartetus nanus</i>	-	-	-	13.7	471
-	large- eared pied- bat <i>Chalinolobus dwyeri</i>	-	-	-	10.5	554
-	giant burrowing frog <i>Heleioporus australiacus</i>	-	-	-	7.8	201
-	spreading guinea flower <i>Hibbertia procumbens</i>	-	-	-	13.7	471
-	southern myotis <i>Myotis macropus</i>	-	-	-	1.3	47
-	squirrel glider <i>Petaurus norfolcensis</i>	-	-	-	9.9	356
-	red- crowned toadlet <i>Pseudophryne australis</i>	-	-	-	7.2	187

## 7 Biodiversity Credit Report

A full Biodiversity Credit Report is included in **Appendix E**.

## 8 Preliminary Biodiversity Offset Strategy

The Darkinjung- owned lands located at Reeves Street Somersby are much larger than the assessed Development Footprint. The remainder of Lot 481 DP 1184693 is located immediately south of the Development Footprint and comprises over 172 hectares. Based on a high-level habitat suitability assessment, including a review of previously recorded threatened species (DPIE 2020a), and in conjunction with previous ecological studies (Conacher Consulting 2015), the remainder of Lot 481 DP 1184693 will likely generate the required credits to offset the impacts of the project if it was to be established as a Biodiversity Stewardship site.

The southern portion of the lot is proposed to be rezoned to E2 Environmental Conservation for the purposes of the planning proposal, and as the E2 zoning is not intended to be an existing conservation obligation under the BAM, the calculation of credits for this land will be determined using the existing land zone (i.e. RU2).

Darkinjung is committed to delivering a Biodiversity Offset Strategy that appropriately compensates for the unavoidable loss of biodiversity values as a result of the project under the BC Act 2016 and *Biodiversity Conservation Regulation 2017*. Firstly, Darkinjung has, where possible, altered the project to avoid and minimise biodiversity impacts in the project planning stage, and a range of impact mitigation strategies are proposed to mitigate the impact on ecological values (refer to **Section 4.0**) prior to the consideration of offsetting requirements.

Fulfilling offset requirements under the BC Act can be undertaken using one or a combination of the following offset strategies:

- In-perpetuity conservation through the establishment of a Stewardship site achieved and the retirement of credits.
- Securing required credits through the open credit market and/or
- Payments to the Biodiversity Conservation Fund.



## 9 References

- ADW Johnson (2018). Discussion Paper Informing the Preparation of a Planning Proposal for Rezoning – Property: Reeves Road, Somersby Lot 481 DP 1184693
- Bell, S.A.J. (2009) The natural vegetation of the Gosford Local Government Area, Central Coast, New South Wales, Final Report to Gosford City Council.
- Birds in Backyards (2018). *Gang- gang Cockatoo Basic Information* [online] found at: <<http://www.birdsinbackyards.net/species/Callocephalon-fimbriatum>> accessed May 2019.
- Botanic Gardens Trust, (2020) *PlantNET* – The Plant Information Network System of Botanic Gardens Trust, Sydney, Australia (version 2.0). <<http://plantnet.rbgsyd.nsw.gov.au>> accessed April 2020.
- Bureau of Meteorology (BOM) (2020). *Climate Data Online* [online] available at: <http://www.bom.gov.au/climate/data/?ref=fttr> accessed April 2020.
- Conacher Consulting Pty Ltd, (2015) Ecological Investigation Report, Lot 481 DP 1184693 & Lot 483 DP 1149939, Somersby.
- Cronquist, A, (1981) An Integrated System of Classification of Flowering Plants. Columbia University Press, New York.
- Department of Environment and Climate Change (DECC) (2009) *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians*.
- Department of Environment and Conservation (DEC) (2004) *Threatened Species Survey and Assessment: Guidelines for development and activities (working draft)*, November 2004.
- Department of Planning, Industry and Environment (DPIE) (2020a) BioNet Atlas of NSW Wildlife, accessed March 2020.
- Department of Planning, Industry and Environment (DPIE) (OEI) (2018a) Biodiversity Assessment Method Operational Manual (Stage 2), September 2019.
- Department of Planning, Industry and Environment (DPIE) (2020b) Threatened Biodiversity Data Collection (TBDC), accessed March 2020
- Department of Planning, Industry and Environment (DPIE) (2020c) Vegetation Information System (VIS) accessed April 2020.
- Department of the Environment (DoE) (2014) *Conservation Advice (including listing advice) for Coastal Upland Swamps in the Sydney Basin Bioregion*. Canberra: Department of the Environment.
- Department of the Environment (DoEE) (2013). *Draft Survey Guidelines for Australia's Threatened Orchids*.
- Department of Agriculture, Water and Environment (DAWE) (2020) Protected Matters Search Tool <http://www.environment.gov.au/webgis-framework/apps/pmst/pmst.jsf>
- Harden, G, J, editor, (1992) *Flora of New South Wales. Volume 3*. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Harden, G, J, editor, (1993) *Flora of New South Wales. Volume 4*. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

Harden, G, J, editor, (2000) *Flora of New South Wales. Volume 1*. 2<sup>nd</sup> edition. New South Wales University Press and Royal Botanic Gardens, Sydney.

Harden, G, J, editor, (2002) *Flora of New South Wales. Volume 2*. Revised edition. Royal Botanic Gardens Sydney & New South Wales University Press, Sydney.

NSW Government (2016) Central Coast Regional Plan 2036

NSW Scientific Committee (2011) *Kincumber Scribbly Gum Forest in the Sydney Basin Bioregion – critically endangered ecological community listing – final determination*

NSW Scientific Committee (2012) *Coastal Upland Swamps Sydney Basin Bioregion – endangered ecological community listing – final determination*

Office of Environment and Heritage (OEH) (2016) NSW Guide to Surveying Threatened Plants, February 2016

Office of Environment and Heritage (OEH) (2017a) Biodiversity Assessment Method, August 2017.

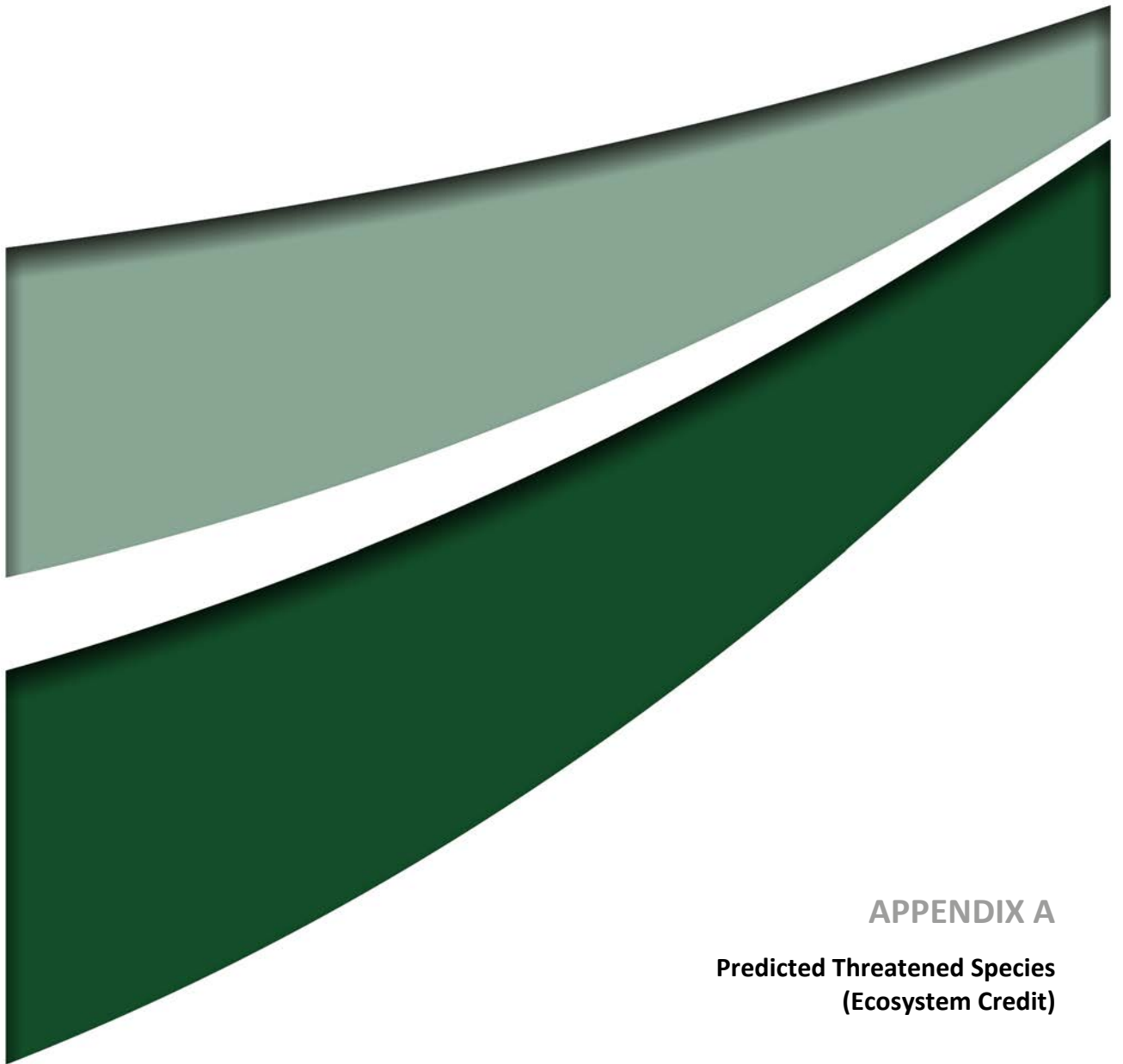
Office of Environment and Heritage (OEH) (2017b) *Guidance to Assist a Decision-Maker to Determine a Serious and Irreversible Impact*, August 2017.

Office of Environment and Heritage (OEH) (2017c) Identifying priority investment areas - Supplementary information to the Draft Biodiversity Conservation Investment Strategy 2017-2037, November 2017.

Office of Environment and Heritage (OEH) (2018a) Biodiversity Assessment Method Operational Manual (Stage 1), May 2018.

Office of Environment and Heritage (OEH) (2018b). *'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method*.

Strahler, A. N., (1952) Hypsometric (area-altitude) analysis of erosional topography, *Geological Society of America Bulletin* 63 (11): 1117-1142.



## APPENDIX A

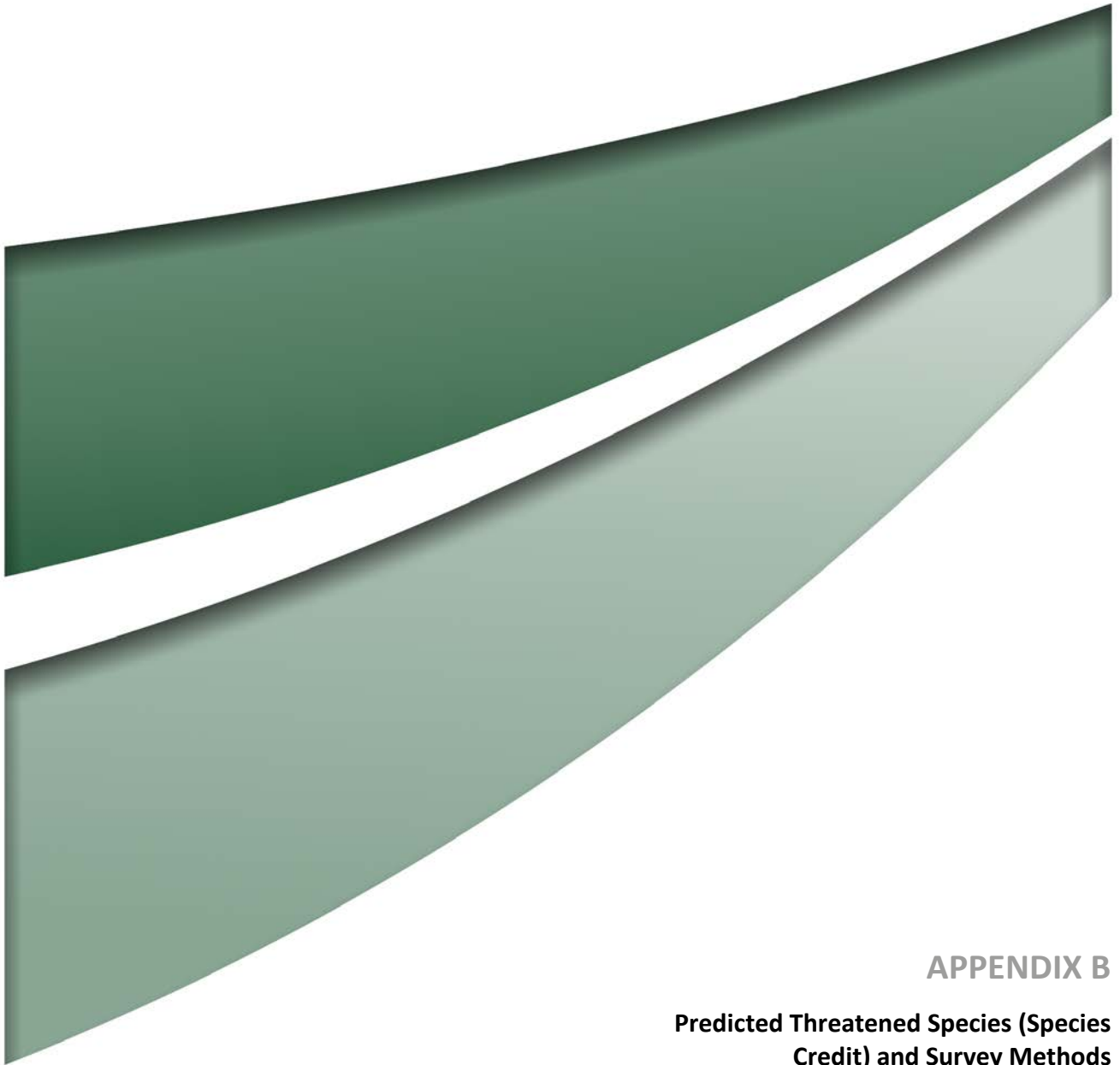
**Predicted Threatened Species  
(Ecosystem Credit)**

## Predicted Threatened Species (Ecosystem Credit)

Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint
gang-gang cockatoo (foraging) <i>Callocephalon fimbriatum</i>	V	-	Moderate	-
glossy black-cockatoo (foraging) <i>Calyptrorhynchus lathamii</i>	V	-	High	Presence of <i>Allocasuarina</i> and <i>casuarina</i> species.
brown treecreeper (eastern subspecies) <i>Climacteris picumnus victoriae</i>	V	-	High	-
varied sittella <i>Daphoenositta chrysoptera</i>	V	-	Moderate	-
spotted-tailed quoll <i>Dasyurus maculatus</i>	V	E	High	-
eastern false pipistrelle <i>Falsistrellus tasmaniensis</i>	V	-	High	-
little lorikeet <i>Glossopsitta pusilla</i>	V	-	High	-
white-bellied sea-eagle (foraging) <i>Haliaeetus leucogaster</i>	V	-	High	Within 1km of a river, lake, large dam or creek, wetlands and coastlines.
little eagle (foraging) <i>Hieraaetus morphnoides</i>	V	-	Moderate	-
broad-headed snake (foraging) <i>Hoplocephalus bungaroides</i>	E	V	High	-
golden-tipped bat <i>Kerivoula papuensis</i>	V	-	High	-
swift parrot (foraging) <i>Lathamus discolor</i>	E	CE	Moderate	Availability of nectar resources
square-tailed kite (foraging) <i>Lophoictinia isura</i>	V	-	Moderate	-
black-chinned honeyeater (eastern subspecies) <i>Melithreptus gularis</i>	V	-	Moderate	-
little bentwing-bat (foraging) <i>Miniopterus australis</i>	V	-	High	-
large bent-winged bat (foraging) <i>Miniopterus orianae oceanensis</i>	V	-	High	-
eastern coastal free-tailed bat <i>Mormopterus norfolkensis</i>	V	-	High	-



Species	BC Act	EPBC Act	Sensitivity to Gain	Habitat Constraint
turquoise parrot <i>Neophema pulchella</i>	V	-	High	-
barking owl (foraging) <i>Ninox connivens</i>	V	-	High	-
powerful owl (foraging) <i>Ninox strenua</i>	V	-	High	-
eastern osprey (foraging) <i>Pandion cristatus</i>	V	-	Moderate	-
yellow-bellied glider <i>Petaurus australis</i>	V	-	High	Hollow-bearing trees with hollows greater than 25cm diameter.
scarlet robin <i>Petroica boodang</i>	V	-	Moderate	-
koala (foraging) <i>Phascolarctos cinereus</i>	V	V	High	-
long-nosed potoroo <i>Potorous tridactylus</i>	V	V	High	Dense shrub layer or alternatively high canopy cover exceeding 70% (i.e. to capture populations inhabiting wet sclerophyll and rainforest).
eastern chestnut mouse <i>Pseudomys gracilicaudatus</i>	V	-	High	-
grey-headed flying-fox (foraging) <i>Pteropus poliocephalus</i>	V	V	High	-
yellow-bellied sheath-tail-bat <i>Saccolaimus flaviventris</i>	V	-	High	-
greater broad-nosed bat <i>Scoteanax rueppellii</i>	V	-	High	-
eastern grass owl <i>Tyto longmembris</i>	V	-	Moderate	-
masked owl (foraging) <i>Tyto novaehollandiae</i>	V	-	High	-
sooty owl (foraging) <i>Tyto tenebricosa</i>	V	-	Moderate	-



## APPENDIX B

**Predicted Threatened Species (Species  
Credit) and Survey Methods**

## Predicted Threatened Species (Species Credit) and Survey Methods

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
<b>FLORA SPECIES</b>						
Bynoes wattle <i>Acacia bynoeana</i>	E	V	Sept-Mar	-	No	<b>Species not detected.</b> Threatened flora searches and walking transects targeting this species were undertaken in October 2018, January 2019 and March 2020, in suitable habitat over 4.5 days. Opportunistic observations were completed throughout all Umwelt survey periods.
thick-leaf star-hair <i>Astrotricha crassifolia</i>	V	V	All year	-	Yes	<b>Species not detected.</b> Threatened flora searches and walking transects targeting this species were undertaken in August, October 2018, January 2019 and March 2020, in suitable habitat over 6.5 days. Opportunistic observations were completed throughout all Umwelt survey periods.
dense cord- rush <i>Baloskion longipes</i>	V	V	All year	-	No	<b>Species not detected.</b> Threatened flora searches and walking transects targeting this species were undertaken in August, October 2018, January 2019 and March 2020, in suitable habitat over 6.5 days. Opportunistic observations were completed throughout all Umwelt survey periods.
netted bottle brush <i>Callistemon linearifolius</i>	V	-	Sept-Mar	-	No	<b>Species not detected.</b> Threatened flora searches and walking transects targeting this species were undertaken in October 2018, January 2019 and March 2020, in suitable habitat over 4.5 days. Opportunistic observations were completed throughout all Umwelt survey periods.
leafless tongue orchid <i>Cryptostylis hunteriana</i>	V	V	Nov-Feb	-	No	<b>Species not detected.</b> Targeted searches and walking transects were undertaken during January 2019 in suitable habitat over 2 days. Opportunistic observations were completed throughout all Umwelt survey periods.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
<i>Darwinia glaucophylla</i>	V	-	All year	-	No	<b>Species not detected.</b> Threatened flora searches and walking transects targeting this species were undertaken in August, October 2018, January 2019 and March 2020 in suitable habitat over 6.5 days. Opportunistic observations were completed throughout all Umwelt survey periods.
camfield's stringybark <i>Eucalyptus camfieldii</i>	V	V	All year	-	No	<b>Species not detected.</b> Threatened flora searches and walking transects targeting this species were undertaken in August, October 2018, January 2019 and March 2020, in suitable habitat over 6.5 days. Opportunistic observations were completed throughout all Umwelt survey periods.
small-flower grevillea <i>Grevillea parviflora</i> subsp. <i>parviflora</i>	V	V	All year	-	No	<b>Species not detected.</b> Threatened flora searches and walking transects targeting this species were undertaken in August, October 2018, January 2019 and March 2020, in suitable habitat over 6.5 days. Opportunistic observations were completed throughout all Umwelt survey periods.
<i>Grevillea shiressii</i>	V	V	All year	-	Yes	<b>Species not detected.</b> Threatened flora searches and walking transects targeting this species were undertaken in August, October 2018, January 2019 and March 2020, in suitable habitat over 6.5 days. Opportunistic observations were completed throughout all Umwelt survey periods.
spreading guinea flower <i>Hibbertia procumbens</i>	E	-	Dec-Mar	-	No	<b>Species present.</b> 4 individuals detected across the study area. Species habitat polygon mapped in <b>Figure 3.3</b> .
biconvex paperbark <i>Melaleuca biconvexa</i>	V	V	All year	-	No	<b>Species not present.</b> No habitat present for this species within the Development Footprint. Threatened flora searches and walking transects were undertaken in August and October 2018, January 2019 and March 2020, in suitable habitat over 6.5 days. Opportunistic observations were completed throughout all Umwelt survey periods.



Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
Groves paperbark <i>Melaleuca groveana</i>	V	-	All year	-	No	<b>Species not detected.</b> Threatened flora searches and walking transects targeting this species were undertaken in August, October 2018 and January 2019, and March 2020, in suitable habitat over 6.5 days. Opportunistic observations were completed throughout all Umwelt survey periods.
Hairy geebung <i>Persoonia hirsuta</i>	E	E	Dec-May	-	No	<b>Species not detected.</b> Threatened flora searches and walking transects targeting this species were undertaken in January 2019 and March 2020 in suitable habitat over 4 days. Opportunistic observations were completed throughout all Umwelt survey periods.
tranquility mintbush <i>Prostanthera askania</i>	E	E	Sept-Dec	-	No	<b>Species not present.</b> No habitat present for this species within the Development Footprint. Threatened flora searches and walking transects were undertaken in October 2018 in suitable habitat over 2 days. Opportunistic observations were completed throughout all Umwelt survey periods.
Somersby mintbush <i>Prostanthera junonis</i>	E	E	Oct-Nov	-	No	<b>Species not detected.</b> Threatened flora searches and walking transects were undertaken during October 2018 and November 2019 in suitable habitat over 2.5 days. However, only part of the site was covered during these surveys. Further surveys recommended. Opportunistic observations were completed throughout all Umwelt survey periods.
scrub turpentine <i>Rhodamnia rubescens</i>	CE	-	All year	-	Yes	<b>Species not present.</b> Habitat within the Development Footprint is unsuitable for this species. Threatened flora searches and walking transects were undertaken in August, October 2018, January 2019 and March 2020, in suitable habitat over 6.5 days. Opportunistic observations were completed throughout all Umwelt survey periods.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
magenta lilly pilly <i>Syzygium paniculatum</i>	E	V	All year	-	No	<b>Species not present.</b> Habitat within the Development Footprint is unsuitable for this species. Threatened flora searches and walking transects were undertaken in August, October 2018, January 2019 and March 2020, in suitable habitat over 6.5 days. Opportunistic observations were completed throughout all Umwelt survey periods.
<i>Tetratheca glandulosa</i>	V	-	Jul-Nov	-	No	<b>Species not detected.</b> Threatened flora searches and walking transects targeting this species were undertaken in August and October 2018, and November 2019 in suitable habitat over 4.5 days. Opportunistic observations were completed throughout all Umwelt survey periods.
<b>FAUNA SPECIES</b>						
regent honeyeater (breeding) <i>Anthochaera phrygia</i>	CE	CE	Sep-Dec	-	Yes	<b>Important habitat not present.</b> Important areas mapping provided by DPIE shows no important areas for this species within the Development Footprint (accessed April 2020). No further assessment necessary.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
bush stone-curlew <i>Burhinus grallarius</i>	E	-	All year	Fallen/standing dead timber including logs.	No	<p><b>Species not detected.</b> Habitat on site is marginal for this species. Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 25 March 2019 to 6 May 2019 (43 nights). At each site, a remote camera was mounted on a tree trunk and positioned towards a bait station containing peanut butter, honey and oats. Cameras were set to take three photos in quick succession when movement was detected.</p> <p>Nocturnal spotlighting searches were undertaken in March and May 2019 over six nights in suitable habitat areas between sunset and midnight using 30 watt hand-held spotlights and head torches. Call- playback was also undertaken for this species over three consecutive nights during March 2019 and two consecutive nights during March 2020. This involved playing the call of the species for five minutes, followed by a listening period of five minutes. Opportunistic observations were completed throughout all Umwelt survey periods and this species was not flushed during flora transects.</p>
gang-gang cockatoo (breeding) <i>Callocephalon fimbriatum</i>	V	-	Oct-Jan	Eucalypt tree species with hollows greater than 9cm diameter.	No	<p><b>No suitable breeding habitat present.</b> This species breeds in very tall, old- growth forests in mountain regions (DPIE 2020b). Habitat assessments and targeted searches were conducted in March and May 2019, and March 2020 over 4 days to identify potential breeding habitat available for the species across the Development Footprint. Suitable tree species containing hollows greater than 9 cm were recorded and inspected for occupants. Opportunistic observations were completed throughout all Umwelt survey periods.</p>

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
glossy black-cockatoo (breeding) <i>Calyptorhynchus lathami</i>	V	-	Mar-Aug	Living or dead trees with hollows greater than 15cm diameter, and greater than 5m above ground.	No	<b>Species present however no evidence of breeding detected.</b> One individual was heard calling off site in March 2019. Habitat assessments and targeted searches were conducted in March and May 2019, and March 2020 over 4 days to identify potential breeding habitat available for the species across the Development Footprint. Suitable tree species containing hollows greater than 15 cm were recorded and inspected for occupants. Opportunistic observations were completed throughout all Umwelt survey periods.
eastern pygmy possum <i>Cercartetus nanus</i>	V	-	Oct-Mar	-	No	<b>Assumed Present.</b> Species not detected, however, this species is highly cryptic and a high number (40) of records exist within 10 km of the Development Footprint. 27 of these records have been submitted since 1 January 2009. This species is associated with PCTs 1641 and 1642 according to the TBDC (DPIE 2020b). Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 25 March 2019 to 6 May 2019 (43 nights). At each site, a remote camera was mounted on a tree trunk and positioned towards a bait station containing peanut butter, honey and oats. Cameras were set to take three photos in quick succession when movement was detected. Nocturnal spotlighting searches were undertaken in March and May 2019, and March 2020 over 10 nights in suitable habitat areas between sunset and midnight using 30 watt hand-held spotlights and head torches.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
<p>large-eared pied bat</p> <p><i>Chalinolobus dwyeri</i></p>	V	V	Sept-Mar	<p>Land within 2km of rocky areas containing cliffs, caves, overhangs, escarpments, outcrops, or crevices.</p> <p>Land within 2km of old mines or tunnels.</p>	Yes	<p><b>Breeding and roosting habitat not present, however species assumed present.</b> Habitat assessments for suitable breeding habitat for this species (caves, scarps, rocky areas, overhangs, crevices, cliffs, escarpments or old mines) was conducted opportunistically during all survey periods in 2018 and 2019. While there are some rocky areas, these areas do not contain crevices or caves that would be utilised by this species for breeding or roosting. All of these areas were checked for the presence of bats and none were detected.</p> <p>This species is considered to occur where there are potential roosts located within 2 km of associated PCTs. As it is not possible to survey all land within 2 km of the Development Footprint for possible roosts, this species has been assumed to occur on site. The species polygon has been aligned with PCT 1642 according to the TBDC (DPIE 2020b).</p>
<p>white-bellied sea-eagle (breeding)</p> <p><i>Haliaeetus leucogaster</i></p>	V	-	Jul-Dec	<p>Living or dead mature trees within suitable vegetation within 1km of rivers, lakes, large dams or creeks, wetlands and coastlines.</p>	No	<p><b>No suitable breeding habitat present.</b> This species requires very tall, dead or alive, trees suitable for a very large stick nest. Habitat assessments and targeted searches were conducted in August and October 2018 over 2.5 days to identify potential breeding habitat available for the species across the Development Footprint. Suitable tree species were inspected for large stick nests and/or evidence of breeding pairs.</p> <p>Targeted searches during March and May 2019 (6 days in total) for any evidence of large stick nests (active or inactive) was also carried out during other surveys.</p> <p>Opportunistic observations for large stick nests were completed throughout all Umwelt survey periods, none of which were detected.</p>



Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
giant burrowing frog <i>Heleioporus australiacus</i>	V	V	Sept-May	-	No	<p><b>Species detected.</b> One individual detected in the development footprint in March 2020, with a further six individuals detected south of the development footprint.</p> <p>Targeted searches and spotlighting conducted in March and May 2019, and March 2020 over ten nights in areas of suitable habitat.</p> <p>Call- playback was undertaken for this species over three consecutive nights during March 2019. This involved playing the call of the species for five minutes, followed by a listening period of five minutes.</p>
little eagle (breeding) <i>Hieraaetus morphnoides</i>	V	-	Aug-Oct	Nest trees; live (occasionally dead) large old trees within vegetation.	No	<p><b>No suitable breeding habitat present.</b> This species requires very tall, dead or alive, trees suitable for large stick nests.</p> <p>Habitat assessments and targeted searches were conducted in August and October 2018 over 2.5 days to identify potential breeding habitat available for the species across the Development Footprint. Suitable tree species were inspected for large stick nests and/or evidence of breeding pairs.</p> <p>Targeted searches during March and May 2019 (6 days in total) for any evidence of large stick nests (active or inactive) was also carried out during other surveys.</p> <p>Opportunistic observations for very large stick nests were completed throughout all Umwelt survey periods. None were detected.</p>
pale-headed snake <i>Hoplocephalus bitorquatus</i>	V	-	Nov-Mar	Within 500m of moderate to good vegetation.	No	<p><b>Species not detected.</b> Targeted searches and walking transects were undertaken during March 2019 and March 2020 in suitable habitat over 5 days. Nocturnal spotlighting was also conducted over three consecutive nights in March 2019 and two consecutive nights in March 2020. Opportunistic observations were completed throughout all Umwelt survey periods.</p>

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
broad-headed snake (breeding) <i>Hoplocephalus bungaroides</i>	E	V	Aug-Sept	Including escarpments, outcrops and pagodas within the Sydney Sandstone geologies	Yes	<b>Species not detected.</b> Targeted searches and walking transects were undertaken during August 2018 in suitable habitat over 2 days. Opportunistic observations were completed throughout all Umwelt survey periods.
swift parrot <i>Lathamus discolor</i> (important habitat)	E	CE	May-Aug	-	Yes	<b>Important habitat not present.</b> Consultation with BAM support (Denise Wallace - Subject Matter Expert on 9 March 2020) who advised that the potential development area will not trigger the important habitat map for the swift parrot and the species can therefore be assessed as part of ecosystem credit requirements. As such there is no need to undertake targeted surveys for this species.
green and golden bell frog <i>Litoria aurea</i>	E	V	Nov-Mar	Semi-permanent/ephemeral wet areas, within 1km of swamps or waterbodies.	No	<b>Species not present.</b> Targeted searches and spotlighting conducted in March 2019 and March 2020 over five nights in areas of suitable habitat. Call-playback was also undertaken for this species over three consecutive nights during March 2019 and two consecutive nights in March 2020. This involved playing the call of the species for five minutes, followed by a listening period of five minutes. Opportunistic observations were completed throughout all Umwelt survey periods.
green-thighed frog <i>Litoria brevipalmata</i>	V	-	Oct-Mar	-	No	<b>Species not present.</b> Targeted searches and spotlighting conducted in March 2019 and March 2020 over five nights in areas of suitable habitat. Call-playback was also undertaken for this species over three consecutive nights during March 2019 and two consecutive nights in March 2020. This involved playing the call of the species for five minutes, followed by a listening period of five minutes. Opportunistic observations were completed throughout all Umwelt survey periods.

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
square-tailed kite (breeding) <i>Lophoictinia isura</i>	V	-	Sept-Jan	Nest trees.	No	<p><b>No suitable breeding habitat present.</b> This species requires very tall, dead or alive, trees suitable for large stick nest.</p> <p>Habitat assessments and targeted searches were conducted in October 2018 and January 2019 over 2.5 days to identify potential breeding habitat available for the species across the Development Footprint. Suitable tree species were inspected for large stick nests and/or evidence of breeding pairs.</p> <p>Targeted searches during March and May 2019 (6 days in total) for any evidence of large stick nests (active or inactive) was also carried out during other surveys.</p> <p>Opportunistic observations for very large stick nests were completed throughout all Umwelt survey periods. None were detected.</p>
parma wallaby <i>Macropus parma</i>	V	-	All year	-	No	<p><b>Species not detected.</b> Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 25 March 2019 to 6 May 2019 (43 nights). At each site, a remote camera was mounted approximately one metre above the ground on a tree trunk and positioned towards a bait station containing peanut butter, honey and oats. Cameras were set to take three photos in quick succession when movement was detected.</p> <p>Nocturnal spotlighting searches were also undertaken in March and May 2019, and March 2020 over eight nights in suitable habitat areas between sunset and midnight using 30 watt hand-held spotlights and head torches.</p>
little bent-winged bat (breeding) <i>Miniopterus australis</i>	V	-	Dec-Feb	Caves, tunnels, mine, culverts or other structures known or suspected to be used for breeding.	Yes	<p><b>Breeding habitat not present.</b> Habitat assessments for suitable breeding habitat for this species (caves, scarps, rocky areas, overhangs, crevices, cliffs, escarpments or old mines) was conducted opportunistically during all survey periods in 2018, 2019 and 2020. While there are some rocky areas, these areas do not contain crevices or caves that would be utilised by this species for breeding. All of these areas were checked for the presence of bats and none were detected.</p>

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
large bent-winged bat (breeding) <i>Miniopterus orianae oceanensis</i>	V	-	Nov-Feb	Caves, tunnels, mines, culverts or other structures known or suspected to be used for breeding.	Yes	<b>Breeding habitat not present.</b> Habitat assessments for suitable breeding habitat for this species (caves, scarps, rocky areas, overhangs, crevices, cliffs, escarpments or old mines) was conducted opportunistically during all survey periods in 2018, 2019 and 2020. While there are some rocky areas, these areas do not contain crevices or caves that would be utilised by this species for breeding. All of these areas were checked for the presence of bats and none were detected.
giant barred frog <i>Mixophyes iteratus</i>	E	E	Oct-Mar	Land within 50m of semi-permanent and permanent drainages	No	<b>Species not present.</b> Targeted searches and spotlighting conducted in March 2019 and March 2020 over five nights in areas of suitable habitat. Call- playback was also undertaken for this species over three consecutive nights during March 2019 and two consecutive nights in March 2020. This involved playing the call of the species for five minutes, followed by a listening period of five minutes. Opportunistic observations were completed throughout all Umwelt survey periods.
southern myotis <i>Myotis macropus</i>	V	-	Nov-Mar	Hollow-bearing trees, bridges, caves or artificial structures, within 200m of riparian zone.  Within 500m of foraging habitat.	No	<b>Species assumed present.</b> This species is considered to occur where there are waterbodies (> 3m) within 200 m of hollow-bearing trees in associated PCTs. There are dams located within 200 m from the Development Footprint, across Reeves Street, and PCTs 1641 and 1642 are associated with this species according to the TBDC (DPIE 2020b). Species polygon mapped in <b>Figure 3.3.</b>

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
<b>barking owl (breeding)</b> <i>Ninox connivens</i>	V	-	May-Dec	Living or dead trees with hollows greater than 20cm diameter and greater than 4m above the ground.	No	<p><b>Species not detected.</b></p> <p>Habitat assessments were conducted in March and May 2019, and March 2020 over 4 days to identify potential habitat available for the species across the Development Footprint. Suitable living trees and stags were recorded and inspected for any evidence of occupation (e.g. pellets, whitewash, noise). One suitable nesting tree (containing a hollow larger than 20 cm) was stagwatched at dusk during May 2019. Nothing was observed entering or exiting the hollow and no evidence of breeding or occupation (e.g. pellets, whitewash etc.) was observed.</p> <p>Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. The surveys were undertaken over six nights in March and May 2019.</p> <p>Call- playback was also undertaken for this species over two consecutive nights in August 2018, and three consecutive nights during May 2019. This involved playing the call of the species for five minutes, followed by a listening period of five minutes.</p> <p>Opportunistic observations were completed throughout all Umwelt survey periods.</p>



Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
powerful owl (breeding) <i>Ninox strenua</i>	V	-	May-Aug	Living or dead trees with hollow greater than 20cm diameter.	No	<p><b>Species not detected.</b></p> <p>Habitat assessments were conducted in March and May 2019, and March 2020 over 4 days to identify potential habitat available for the species across the Development Footprint. Suitable living trees and stags were recorded and inspected for any evidence of occupation (e.g. pellets, whitewash, noise). One suitable nesting tree (containing a hollow larger than 20 cm) was stagwatched at dusk during May 2019. Nothing was observed entering or exiting the hollow and no evidence of breeding or occupation (e.g. pellets, whitewash etc.) was observed.</p> <p>Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. The surveys were undertaken over six nights in March and May 2019.</p> <p>Call- playback was also undertaken for this species over two consecutive nights in August 2018, and three consecutive nights during May 2019. This involved playing the call of the species for five minutes, followed by a listening period of five minutes</p> <p>Opportunistic observations were completed throughout all Umwelt survey periods.</p>

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
eastern osprey (breeding) <i>Pandion cristatus</i>	V	-	Apr-Nov	Living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting.	No	<p><b>No suitable breeding habitat present.</b> This species requires very tall, dead or alive, trees suitable for a very large stick nest. Habitat assessments and targeted searches were conducted in August, October 2018 and March 2019 over 5.5 days to identify potential breeding habitat available for the species across the Development Footprint. Suitable tree species were inspected for large stick nests and/or evidence of breeding pairs.</p> <p>Targeted searches during March and May 2019 (6 days in total) for any evidence of large stick nests (active or inactive) was also carried out during other surveys.</p> <p>Opportunistic observations for very large stick nests were completed throughout all Umwelt survey periods. None were detected.</p>
Giant dragonfly <i>Petalura gigantea</i>	E	-	Dec-Jan	Within 500m of swamps	Yes	<p><b>Species not detected.</b></p> <p>Habitat assessments and targeted searches conducted in January 2019 over 2 days within and adjacent to suitable swamp habitats.</p> <p>Opportunistic observations were completed throughout all Umwelt survey periods.</p>

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
squirrel glider <i>Petaurus norfolcensis</i>	V	-	All year	-	No	<p><b>Species detected.</b></p> <p>This species was observed during spotlighting in March 2020. While this species is difficult to visually distinguish from the non-threatened sugar glider (<i>Petaurus breviceps</i>), both Umwelt ecologists agreed in the field that the tail, which is a defining feature, looked far more like that pertaining to squirrel gliders. Photos were also shared amongst Umwelt ecologists and the agreed consensus was squirrel glider.</p> <p>Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 25 March 2019 to 6 May 2019 (43 nights). At each site, a remote camera was mounted approximately one metre above the ground on a tree trunk and positioned towards a bait station containing peanut butter, honey and oats. Cameras were set to take three photos in quick succession when movement was detected.</p> <p>Nocturnal spotlighting searches were undertaken in March and May 2019, and March 2020 over eight nights in suitable habitat areas between sunset and midnight using 30 watt hand-held spotlights and head torches. Call- playback was also undertaken for this species over three consecutive nights during March 2019, and two consecutive nights in March 2020. This involved playing the call of the species for five minutes, followed by a listening period of five minutes. Opportunistic observations were completed throughout all Umwelt survey periods.</p>

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
koala (breeding) <i>Phascolarctos cinereus</i>	V	V	All year	-	No	<p><b>Species not detected.</b></p> <p>Bushnell Trophy Cam HD cameras were installed at 10 locations within the Development Footprint from 25 March 2019 to 6 May 2019 (43 nights). At each site, a remote camera was mounted on a tree trunk and positioned towards a bait station containing peanut butter, honey and oats. Cameras were set to take three photos in quick succession when movement was detected.</p> <p>Three Spot Assessment Techniques (SAT) searches were undertaken in the woodland vegetation across the Development Footprint during March 2019. This involves searching underneath suitable trees (at least 30 trees) for Koala scats.</p> <p>Nocturnal spotlighting searches were undertaken in March and May 2019, and March 2020 over eight nights in suitable habitat areas between sunset and midnight using 30 watt hand-held spotlights and head torches. Call- playback was also undertaken for this species over three consecutive nights during March 2019, and two consecutive nights in March 2020. This involved playing the call of the species for five minutes, followed by a listening period of five minutes. Opportunistic observations were completed throughout all Umwelt survey periods.</p>
red-crowned toadlet <i>Pseudophryne australis</i>	V	-	All year	-	No	<p><b>Species detected.</b> Species heard calling in an artificial drainage line during March and May 2019, within the Development Footprint. Species was captured during the May 2019 surveys.</p> <p>Call- playback was also undertaken for this species over three consecutive nights during March 2019. This involved playing the call of the species for five minutes, followed by a listening period of five minutes. The call-response from this species was also recorded.</p>

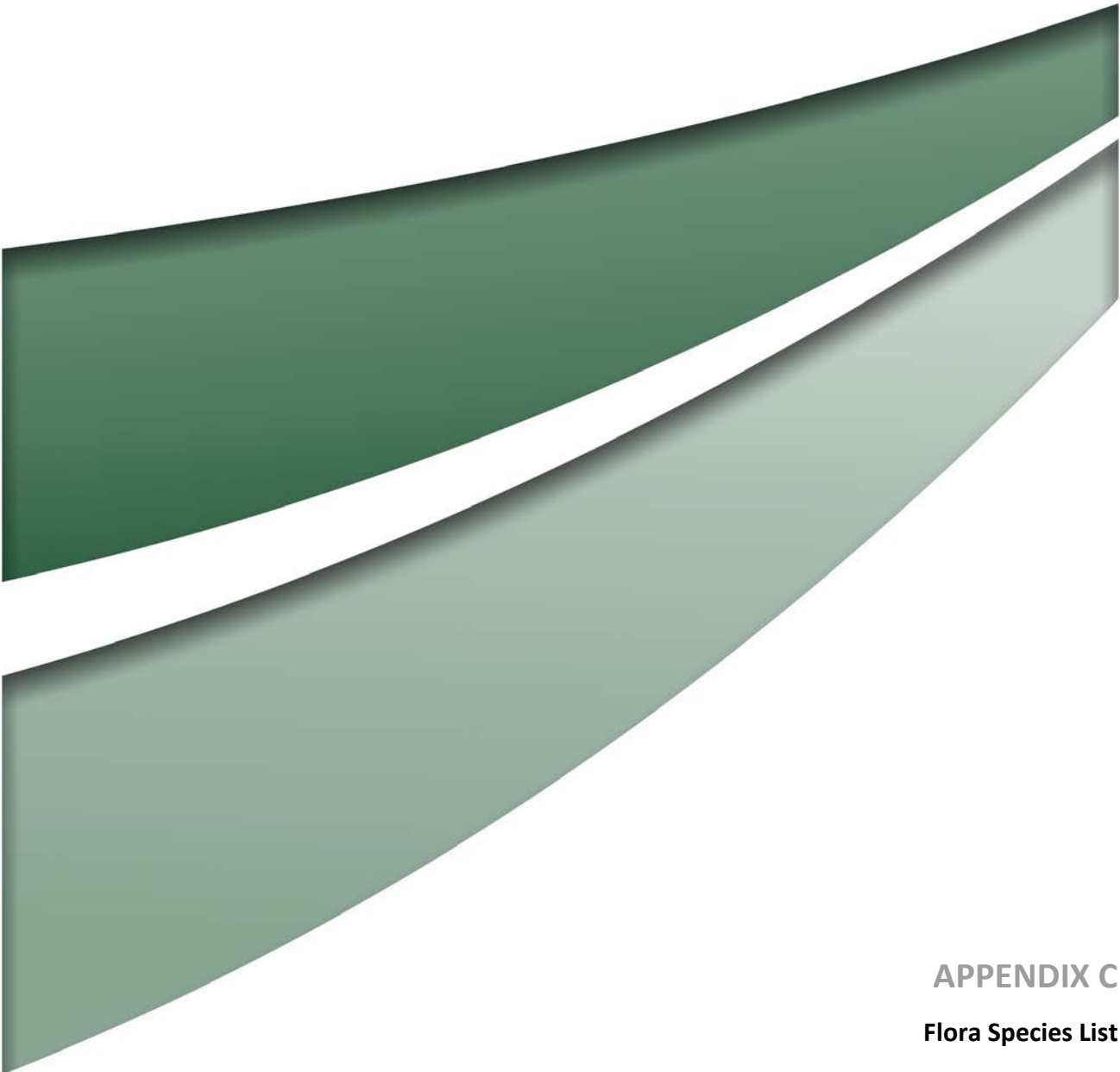
Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
grey-headed flying-fox (breeding camps) <i>Pteropus poliocephalus</i>	V	V	Oct-Dec	Breeding camps.	No	<b>No camps detected.</b> Individual foraging flying- foxes detected. However, the entire Development Footprint was traversed during targeted searches for threatened flora and fauna species in August and October 2018, and January 2019, and March 2020. Opportunistic observations were completed throughout all Umwelt survey periods and no flying- fox camps were detected. Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. The surveys were undertaken over six nights in March and May 2019, and two nights in March 2020. Individuals of this species were detected, though no camps detected.
red-backed button-quail <i>Turnix maculosus</i>	V	-	All year	-	No	<b>Species not detected.</b> Threatened species searches and walking transects were undertaken in August and October 2018, January 2019 and March 2020, in suitable habitat over 6.5 days. It is likely that this species would be flushed during these transects. Opportunistic observations were completed throughout all Umwelt survey periods.



Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
masked owl (breeding) <i>Tyto novaehollandiae</i>	V	-	May-Aug	Living or dead trees with hollows greater than 20cm diameter.	No	<p><b>Species not detected.</b></p> <p>Habitat assessments were conducted in March and May 2019, and March 2020 over 4 days to identify potential habitat available for the species across the Development Footprint. Suitable living trees and stags were recorded and inspected for any evidence of occupation (e.g. pellets, whitewash, noise). One suitable nesting tree (containing a hollow larger than 20 cm) was stagwatched at dusk during May 2019. Nothing was observed entering or exiting the hollow and no evidence of breeding or occupation (e.g. pellets, whitewash etc.) was observed.</p> <p>Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. The surveys were undertaken over six nights in March and May 2019.</p> <p>Call- playback was also undertaken for this species over two consecutive nights in August 2018, and three consecutive nights during May 2019. This involved playing the call of the species for five minutes, followed by a listening period of five minutes</p> <p>Opportunistic observations were completed throughout all Umwelt survey periods.</p>

Species	BC Act	EPBC Act	Survey Period	Habitat Constraint	SAIL Entity	Survey Method
sooty owl (breeding) <i>Tyto tenebricosa</i>	V	-	Apr-Aug	Caves/hollow- bearing trees	Yes	<p><b>Species not detected.</b></p> <p>Habitat assessments were conducted in March and May 2019, and March 2020 over 4 days to identify potential habitat available for the species across the Development Footprint. Suitable living trees and stags were recorded and inspected for any evidence of occupation (e.g. pellets, whitewash, noise). One suitable nesting tree (containing a hollow larger than 20 cm) was stagwatched at dusk during May 2019. Nothing was observed entering or exiting the hollow and no evidence of breeding or occupation (e.g. pellets, whitewash etc.) was observed.</p> <p>Nocturnal spotlighting searches were undertaken in suitable habitat areas between sunset and midnight using 30 watt Lightforce hand-held spotlights and head torches. The surveys were undertaken over six nights in March and May 2019.</p> <p>Call-playback was also undertaken for this species over two consecutive nights in August 2018, and three consecutive nights during May 2019. This involved playing the call of the species for five minutes, followed by a listening period of five minutes.</p> <p>Opportunistic observations were completed throughout all Umwelt survey periods.</p>
eastern cave bat <i>Vespadelus troughtoni</i>	V	-	Nov-Jan	Caves or 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.	Yes	<p><b>Breeding habitat and associated PCTs not present.</b> Habitat assessments for suitable breeding habitat for this species (caves, scarps, rocky areas, overhangs, crevices, cliffs, escarpments or old mines) was conducted opportunistically during all survey periods in 2018 and 2019. While there are some rocky areas, these areas do not contain crevices or caves that would be utilised by this species. All of these areas were checked for the presence of bats and none were detected. Species is also not associated with any of the PCTs found on site (OEH, 2020b).</p>

^ Survey period derived from resources other than TBDC.



## APPENDIX C

### Flora Species List

## Flora Species List

The following list was developed from the floristic plot rapid transect surveys of the Development Footprint. It includes all species of vascular plants observed during these surveys. It is acknowledged that the list is not comprehensive, as not all species are readily detected at any one time of the year. Many species flower only during restricted periods of the year, and some flower only once in several years. In the absence of flowering material, many of these species cannot be identified, or even detected.

Names of classes and families follow a modified Cronquist (1981) System.

Any species that could not be identified to the lowest taxonomic level are denoted in the following manner:

sp. specimens that are identified to genus level only.

The following abbreviations or symbols are used in the list:

AA denotes abundance rating according to BAM

PC cover measure according to BAM

asterisk (\*) denotes species non-native species

double asterisk (\*\*) denotes High Threat Weed species under the BAM

subsp.                      subspecies and

var.                      variety.

All vascular plants recorded or collected were identified using keys and nomenclature in Harden (1992, 1993, 2000 and 2002). Where known, changes to nomenclature and classification have been incorporated into the results, as derived from PlantNET (Botanic Gardens Trust 2019), the on-line plant name database maintained by the National Herbarium of New South Wales.

Common names used follow Harden (1992, 1993, 2000 and 2002) where available, and draw on other sources such as local names where these references do not provide a common name.

Scientific Name	Common Name	Zone 1 PCT 1641				Zone 2 PCT 1642 (good)								Zone 3 PCT 1642 (moderate)		Zone 4 PCT 1699			
		Q08		Q09		Q01		Q04		Q05		Q07		Q03		Q02		Q06	
		AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC
Coniferopsida - Pines																			
<i>Pinus radiata</i>	radiata pine**					2	5							15	35				
Filicopsida - Ferns																			
<i>Adiantum aethiopicum</i>	common maidenhair													25	0.1				
<i>Gleichenia dicarpa</i>	pouched coral fern					10	0.1									1000	35	3000	95
<i>Lindsaea linearis</i>	screw fern			0.1	10	20	0.1					20	0.1					50	0.1
<i>Lindsaea</i> sp.										100	0.1								
<i>Pteridium esculentum</i>	bracken					20	0.2											10	0.1
<i>Schizaea bifida</i>	forked comb fern	100	0.1	0.1	10														
<i>Selaginella uliginosa</i>	swamp selaginella	75	0.1											75	0.1	1	0.1		
Magnoliopsida - Lilidae (Monocots)																			
<i>Anisopogon avenaceus</i>	oat speargrass	1000	5	5	200	100	20	2000	45	1000	5	1000	40	500	0.5				
<i>Baloskion pallens</i>		1000	0.5																
<i>Baumea</i> sp.																		500	0.5
<i>Caustis flexuosa</i>	curly wig			0.1	5			100	0.1										
<i>Caustis</i> sp.										1000	0.5	10	0.1						
<i>Cryptostylis erecta</i>	tartan tongue orchid			0.1	10											10	0.1		
<i>Cryptostylis</i> sp.						10	0.1												
<i>Cryptostylis subulata</i>	large tongue orchid							10	0.1	10	0.1	3	0.1	50	0.1				



Scientific Name	Common Name	Zone 1 PCT 1641				Zone 2 PCT 1642 (good)								Zone 3 PCT 1642 (moderate)		Zone 4 PCT 1699			
		Q08		Q09		Q01		Q04		Q05		Q07		Q03		Q02		Q06	
		AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC
<i>Cyathochaeta diandra</i>		1000	5	0.2	100			1000	5			500	10						
<i>Dianella revoluta</i>	blueberry lily	10	0.1	0.1	1	5	0.1			100	0.1	1	0.1	25	0.1				
<i>Empodisma minus</i>		200	0.2															20	0.1
<i>Entolasia marginata</i>	bordered panic	1000	5	0.1	10	100	1	50	0.1			20	0.1						
<i>Entolasia stricta</i>	wiry panic	1000	5	0.3	1000			1000	5	1000	5	20	0.1	1000	1	1000	0.5	1000	0.5
<i>Gahnia sieberiana</i>	red-fruit saw-sedge																	5	0.5
<i>Imperata cylindrica</i>	blady grass					5	0.1							100	0.1				
<i>Lepidosperma concavum</i>														250	0.2	1000	0.5		
<i>Lepidosperma laterale</i>	variable sword-sedge									1000	0.5	100	0.2						
<i>Lepidosperma urophorum</i>																1000	0.5		
<i>Leptocarpus tenax</i>				60	3000														
<i>Lepyrodia scariosa</i>		1000	5			10	0.1	1000	10			200	5	1000	0.5	1000	5	1000	0.5
<i>Lepyrodia</i> sp.						10	0.1			500	0.2								
<i>Lomandra cylindrica</i>						1	0.1												
<i>Lomandra filiformis</i>				0.1	5			50	0.1			5	0.1						
<i>Lomandra glauca</i>	pale mat-rush											10	0.1						
<i>Lomandra longifolia</i>	spiny-headed mat-rush													100	0.1				
<i>Lomandra multiflora</i> subsp. multiflora	many-flowered mat-rush	200	0.2							1000	0.5			250	0.5			200	0.2

Scientific Name	Common Name	Zone 1 PCT 1641				Zone 2 PCT 1642 (good)								Zone 3 PCT 1642 (moderate)		Zone 4 PCT 1699			
		Q08		Q09		Q01		Q04		Q05		Q07		Q03		Q02		Q06	
		AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC
<i>Lomandra obliqua</i>		25	0.1			10	0.1			250	0.2	10	0.1						
<i>Patersonia sericea</i>	silky purple-flag	1000	0.5	0.2	50	5	0.1	50	0.5	10	0.1	2	0.1	1000	0.5	20	0.1		
<i>Schoenus apogon</i>	fluke bogrush			0.2	50			200	0.2										
<i>Smilax australis</i>	lawyer vine					2	0.1												
<i>Xanthorrhoea media</i>		30	1	0.2	10	5	0.5	10	0.2	10	1								
<i>Xyris gracilis</i>				0.1	10											1000	0.5		
Magnoliopsida - Magnoliidae (Dicots)																			
<i>Acacia linifolia</i>	white wattle									2	0.2			5	0.5	15	0.1		
<i>Acacia longifolia</i> subsp. <i>longifolia</i>	Sydney golden wattle							1	0.1			1	0.1			3	0.5		
<i>Acacia myrtifolia</i>	red-stemmed wattle									25	0.1			25	0.1				
<i>Acacia oxycedrus</i>	spike wattle			0.1	2	1	0.1									10	0.5		
<i>Acacia suaveolens</i>	sweet wattle	40	0.5	1	10	10	0.5	3	0.1	20	0.2	10	0.1	5	0.5	1	0.1	1	0.1
<i>Acacia terminalis</i>	sunshine wattle			0.1	5					5	0.2								
<i>Acacia ulicifolia</i>	prickly Moses											1	0.1						
<i>Actinotus minor</i>	lesser flannel flower	200	0.5			20	0.1			100	0.1	20	0.1			5	0.1		
<i>Ageratina adenophora</i>	crofton weed**													15	0.1				
<i>Allocasuarina littoralis</i>	black she-oak													35	20				
<i>Angophora hispida</i>	dwarf apple	50	5	5	10			8	0.1			2	0.1						
<i>Baeckea diosmifolia</i>	fringed baeckea	30	0.2					100	0.5			10	0.1						

Scientific Name	Common Name	Zone 1 PCT 1641				Zone 2 PCT 1642 (good)								Zone 3 PCT 1642 (moderate)		Zone 4 PCT 1699			
		Q08		Q09		Q01		Q04		Q05		Q07		Q03		Q02		Q06	
		AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC
<i>Banksia ericifolia</i>	heath-leaved banksia	70	35	5	10	3	0.1	15	10	30	5	12	2	10	0.1	30	2	50	40
<i>Banksia oblongifolia</i>	fern-leaved banksia	20	1					2	5	30	7								
<i>Banksia serrata</i>	old-man banksia			0.1	2	2	5												
<i>Bauera rubioides</i>	river rose	25	0.1			20	0.1							35	0.5				
<i>Billardiera scandens</i>	hairy apple berry			0.1	10	5	0.1	3	0.1	75	0.1	2	0.1	50	0.1				
<i>Boronia ledifolia</i>	Sydney boronia							5	0.1							1	0.1		
<i>Bossiaea ensata</i>	sword bossiaea	35	0.5	0.1	10			10	0.1	5	0.1	1	0.1	1	0.1				
<i>Bossiaea heterophylla</i>	variable bossiaea					10	0.1	10	0.1			3	0.1	5	0.1				
<i>Bossiaea obcordata</i>	spiny bossiaea					5	0.1			35	0.5			50	0.5				
<i>Cassytha glabella</i>		50	0.1	0.1	10			1	0.1			5	0.1			50	0.1	50	0.1
<i>Cissus hypoglauca</i>	giant water vine															1	0.1		
<i>Corymbia gummifera</i>	red bloodwood					8	15			10	10	4	1						
<i>Dampiera stricta</i>				0.1	10			5	0.1	20	0.1	5	0.1	30	0.1				
<i>Darwinia fascicularis</i>		20	0.2													1	0.1	3	0.2
<i>Dillwynia floribunda</i>								100	1										
<i>Dillwynia retorta</i>				0.1	2			10	0.1										
<i>Elaeocarpus reticulatus</i>	blueberry ash							1	0.1										
<i>Epacris pulchella</i>	wallum heath	150	0.5			5	0.1			30	0.2	5	0.1	25	0.1				
<i>Eucalyptus agglomerata</i>	blue-leaved stringybark					1	20	1	1	10	10	1	0.3						

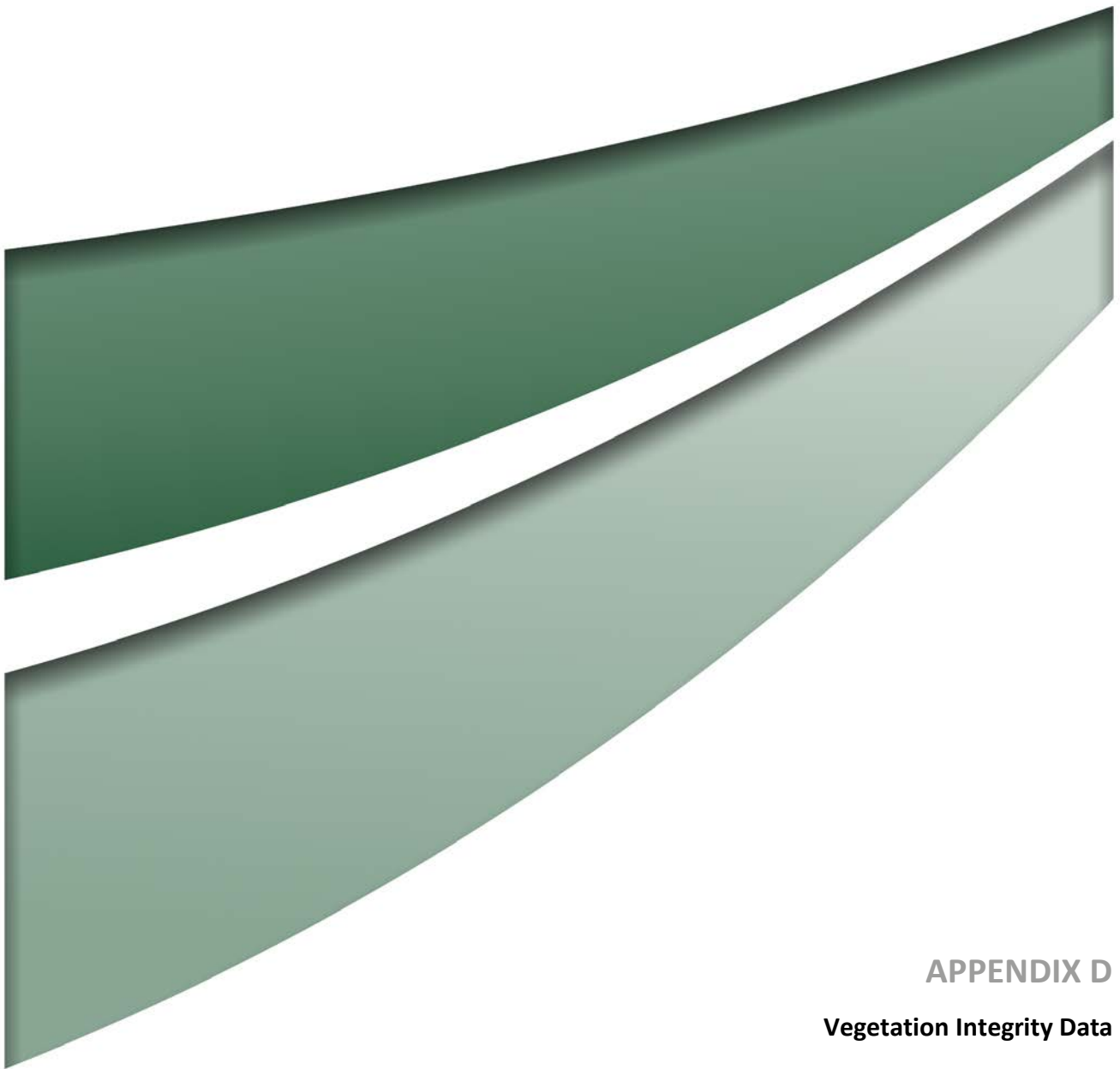
Scientific Name	Common Name	Zone 1 PCT 1641				Zone 2 PCT 1642 (good)								Zone 3 PCT 1642 (moderate)		Zone 4 PCT 1699			
		Q08		Q09		Q01		Q04		Q05		Q07		Q03		Q02		Q06	
		AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC
<i>Eucalyptus haemastoma</i>	broad-leaved scribbly gum	0	0.5	20	6	7	20	5	20			12	20			2	5		
<i>Eustrephus latifolius</i>	wombat berry			0.1	1														
<i>Glochidion ferdinandi</i>	cheese tree													0	1				
<i>Gompholobium glabratum</i>	dainty wedge pea	25	0.1									5	0.1						
<i>Gompholobium latifolium</i>	golden glory pea			0.1	10			5	0.1	10	0.1								
<i>Gonocarpus teucrioides</i>	germander raspwort	25	0.1																
<i>Goodenia</i> sp.								10	0.1										
<i>Grevillea buxifolia</i>	grey spider flower	50	0.5			5	0.1	5	0.1	5	0.1					5	0.1		
<i>Grevillea sericea</i> subsp. <i>sericea</i>										10	0.5	2	0.1	15	0.2				
<i>Hakea dactyloides</i>	finger hakea	1	0.1					1	0.1	1	0.1	2	0.1						
<i>Hakea gibbosa</i>				0.3	6					2	0.5	1	0.1	5	0.5				
<i>Hakea teretifolia</i>	needlebush	50	2							5	0.2							3	0.5
<i>Hibbertia acicularis</i>		40	0.1					20	0.1			2	0.1						
<i>Hibbertia aspera</i>	rough guinea flower	70	0.5	0.1	5	5	0.1	1	0.1	35	0.1	5	0.1						
<i>Hibbertia linearis</i>								2	0.1										
<i>Hibbertia obtusifolia</i>	hoary guinea flower	30	0.2	0.1	2			3	0.1	20	0.1								
<i>Hovea linearis</i>						5	0.1			20	0.1			75	0.1				
<i>Isopogon anemonifolius</i>	broad-leaf drumsticks					10	1	5	0.1	50	0.2	1	0.1	25	0.1				

Scientific Name	Common Name	Zone 1 PCT 1641				Zone 2 PCT 1642 (good)								Zone 3 PCT 1642 (moderate)		Zone 4 PCT 1699			
		Q08		Q09		Q01		Q04		Q05		Q07		Q03		Q02		Q06	
		AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC
<i>Kunzea ambigua</i>	tick bush					1	0.2			10	0.5			10	0.5	20	0.5		
<i>Kunzea capitata</i>		50	1																
<i>Lambertia formosa</i>	mountain devil			0.1	1	5	0.5			20	0.5	5	0.1			15	0.1		
<i>Leptomeria acida</i>	sour currant bush					3	0.1	1	0.1	3	0.1								
<i>Leptospermum arachnoides</i>				0.1	10							1	0.1						
<i>Leptospermum polygalifolium</i>		100	5			10	7			15	0.2	10	0.3	30	5			15	0.5
<i>Leptospermum trinervium</i>	slender tea-tree	30	2	10	20			15	10	15	5	20	2						
<i>Leucopogon ericoides</i>	pink beard-heath									5	0.1								
<i>Leucopogon juniperinus</i>	prickly beard-heath					2	0.1												
<i>Lobelia purpurascens</i>				0.1	5														
<i>Lomatia silaifolia</i>	crinkle bush			0.1	1	5	0.5			10	0.1	1	0.1	10	0.1				
<i>Mirbelia rubiifolia</i>	heathy mirbelia	10	0.1																
<i>Morinda jasminoides</i>						1	0.2												
<i>Parsonsia</i> sp.										5	5								
<i>Parsonsia straminea</i>	common silkpod					5	0.5			10	0.1	2	0.1	50	0.1	30	0.1	1	0.1
<i>Persoonia levis</i>	broad-leaved geebung	3	0.1	0.1	5			1	0.1	8	2	2	0.2			1	0.1		
<i>Persoonia linearis</i>	narrow-leaved geebung					5	1			20	0.5			4	0.5				
<i>Petrophile pulchella</i>	conesticks	100	1	0.1	10	20	0.5	10	1	50	0.2	11	0.5	35	0.5	50	0.1		



Scientific Name	Common Name	Zone 1 PCT 1641				Zone 2 PCT 1642 (good)								Zone 3 PCT 1642 (moderate)		Zone 4 PCT 1699			
		Q08		Q09		Q01		Q04		Q05		Q07		Q03		Q02		Q06	
		AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC	AA	PC
<i>Philotheca hispidula</i>		50	0.1	0.1	10			200	2	100	0.2	3	0.1						
<i>Philotheca salsolifolia</i>		50	0.5													1	0.1		
<i>Phyllanthus hirtellus</i>	thyme spurge									25	0.1			10	0.1				
<i>Platysace linearifolia</i>		50	0.1	5	1000	50	5	100	0.2	75	0.1			10	0.1				
<i>Polyscias sambucifolia</i>	elderberry panax					10	1												
<i>Pultenaea paleacea</i>	chaffy bush-pea											5	0.1						
<i>Pultenaea rosmarinifolia</i>		50	0.1	0.1	1					10	0.1								
<i>Ranunculus</i> sp.														10	0.1				
<i>Sannantha pluriflora</i>						1	1							1	5	50	1	5	2
<i>Styphelia tubiflora</i>	red five-corner									40	0.1								
<i>Tetradlea thymifolia</i>	black-eyed susan									5	0.1								
<i>Trachymene incisa</i>				0.1	2														
<i>Trochocarpa laurina</i>	tree heath															2	0.1		
<i>Woollsia pungens</i>						10	0.1												
<i>Xanthosia tridentata</i>	rock xanthosia	30	0.1	0.1	2														
<i>Xylomelum pyriforme</i>	woody pear			0.1	1	5	0.1	1	0.1	20	0.1	5	0.1						

\*\*High threat weed



## APPENDIX D

### Vegetation Integrity Data

## Vegetation Integrity Data

The following vegetation integrity data was collected from surveys of the Development Footprint. It includes the composition, structure and function attributes that are recorded in each BAM plot. This data is assessed against benchmark data for PCTs and entered into the BAM Calculator to assess the condition of each PCT in the Development Footprint.

The following abbreviations are used in the table below:

Tr	Tree (growth form)
Sh	Shrub (growth form)
Gr	Grass (growth form)
Fb	Forb (growth form)
Fn	Fern (growth form)
Ot	Other (growth form)

	COMPOSITION						STRUCTURE						FUNCTION										
	Tr	Sh	Gr	Fb	Fn	Ot	Tr	Sh	Gr	Fb	Fn	Ot	Regen  >5	Stem Classes (cm)					No. Large Trees	No. Hollow Trees	Litter (%)	Fallen Logs (m)	High Threat Weeds
														5-10	10-20	20-30	30-50	50-80					
Q01	4	23	7	5	3	6	60	19.4	21.5	0.5	0.4	1.5	1	1	1	1	1	0	1	1	73	84	5
Q02	3	13	5	3	2	3	5.2	5.3	7	0.3	35.1	0.3	1	1	1	1	0	0	0	0	11	240	0
Q03	3	20	7	6	2	2	21.5	15.1	2.9	1	0.2	0.2	1	1	1	1	1	1	0	0	84.0	13	35.1
Q04	3	26	8	4	0	3	21.1	31.5	65.5	0.8	0	0.4	1	1	1	1	1	0	0	1	51.0	39	0
Q05	3	34	7	6	1	4	20.2	25.2	11.9	0.6	0.1	6.2	1	1	1	1	1	1	1	1	76.0	24	0
Q06	0	6	6	0	3	2	0	43.3	2.3	0	95.2	0.2	1	1	1	0	0	0	0	0	17.0	60	0
Q07	4	25	10	5	1	3	21.4	7	55.8	0.5	0.1	0.3	1	1	1	1	1	1	1	1	37.0	170	0
Q08	2	25	9	5	2	2	5.5	51.5	26	1.3	0.2	1.1	1	1	1	1	1	1	0	1	14.0	3	0
Q09	3	20	11	6	2	3	25.1	22.9	65.4	0.7	0.2	0.3	1	1	1	1	1	0	0	0	49.0	10	0



## APPENDIX E

### Biodiversity Credit Report

## Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00015277/BAAS18117/19/00015278	Somserby BCAR	26/11/2019
Assessor Name	Report Created	BAM Data version *
Ryan Parsons	16/04/2020	22
Assessor Number	BAM Case Status	Date Finalised
BAAS17048	Open	To be finalised
Assessment Revision	Assessment Type	
0	Biocertification	

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

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAI	Ecosystem credits
<b>Dwarf Apple - Scribbly Gum heathy low woodland on sandstone ranges of the Central Coast</b>								
1	1641_good	63.6	3.2	0.25	High Sensitivity to Potential Gain	1.50		76
							<b>Subtotal</b>	<b>76</b>



# BAM Credit Summary Report

Heath-leaved Banksia - Coral Fern wet heath on sandstone ranges of the lower Central Coast							
4	1699_good	28.5	2.9	0.25	High Sensitivity to Potential Gain	2.00	41
						<b>Subtotal</b>	<b>41</b>
Scribbly Gum - Red Bloodwood - Old Man Banksia heathy woodland of southern Central Coast							
2	1642_good	71.9	9.9	0.25	High Sensitivity to Potential Gain	1.50	267
3	1642_moderate	43.5	0.6	0.25	High Sensitivity to Potential Gain	1.50	10
						<b>Subtotal</b>	<b>277</b>
						<b>Total</b>	<b>394</b>

## Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAI	Species credits
<b><i>Cercartetus nanus</i> / Eastern Pygmy-possum ( Fauna )</b>						
1641_good	63.6	3.2	0.25	2	False	102
1642_good	71.9	9.9	0.25	2	False	356
1642_moderate	43.5	0.61	0.25	2	False	13
					<b>Subtotal</b>	<b>471</b>
<b><i>Chalinolobus dwyeri</i> / Large-eared Pied Bat ( Fauna )</b>						
1642_good	71.9	9.9	0.25	3	True	534
1642_moderate	43.5	0.61	0.25	3	True	20
					<b>Subtotal</b>	<b>554</b>

## BAM Credit Summary Report

<b><i>Heleioporus australiacus / Giant Burrowing Frog ( Fauna )</i></b>							
1699_good	28.5	0.01	0.25	1.5	False		0
1641_good	63.6	2.9	0.25	1.5	False		69
1642_good	71.9	4.9	0.25	1.5	False		132
						<b>Subtotal</b>	<b>201</b>
<b><i>Hibbertia procumbens / Spreading Guinea Flower ( Flora )</i></b>							
1641_good	63.6	3.2	0.25	2	False		102
1642_good	71.9	9.9	0.25	2	False		356
1642_moderate	43.5	0.61	0.25	2	False		13
						<b>Subtotal</b>	<b>471</b>
<b><i>Myotis macropus / Southern Myotis ( Fauna )</i></b>							
1642_good	71.9	1.3	0.25	2	False		47
						<b>Subtotal</b>	<b>47</b>
<b><i>Petaurus norfolcensis / Squirrel Glider ( Fauna )</i></b>							
1642_good	71.9	9.9	0.25	2	False		356
						<b>Subtotal</b>	<b>356</b>
<b><i>Pseudophryne australis / Red-crowned Toadlet ( Fauna )</i></b>							
1641_good	63.6	2.3	0.25	1.5	False		55
1642_good	71.9	4.9	0.25	1.5	False		132
						<b>Subtotal</b>	<b>187</b>

