Appendix M – Terrestrial ecology impact assessment

NEWSTAN MINE EXTENSION PROJECT

Biodiversity Development Assessment Report



141842
Newstan Mine Extension Project
1
22 March 2020

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Document status

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Approval for issue

Arne Bishop  22 May 2020

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STAGE 1 – BIODIVERSITY ASSESSMENT

1 INTRODUCTION TO STAGE 1 – BIODIVERSITY ASSESSMENT

RPS Australia East Pty (RPS) has been engaged by Centennial Coal Company Limited (Centennial) to undertake a Biodiversity Development Assessment Report (BDAR) for a State Significant Development to allow for mining within the Newstan Extension of Mining Area (shown in **Figure 1)**.

Newstan Colliery is an existing underground coal mine located in the Lake Macquarie Local Government Area (LGA), approximately 25 kilometres south west of Newcastle and 140 kilometres north of Sydney, NSW. It is owned and operated by Centennial Newstan Pty Ltd (Centennial Newstan).

Mining operations at Newstan Colliery began in 1887 and upon the introduction of the NSW *Environmental Planning and Assessment Act* 1979 (EP&A Act) operated pursuant to continuing use rights in accordance with Part 4, Division 10 of the EP&A Act (continuing use rights).

Newstan Colliery has at various times mined the upper coal seams (Great Northern and Fassifern seams) and lower coal seams (West Borehole, Borehole, Young Wallsend and Yard seams) and produced both semi-soft coking coal and thermal coal for the domestic and export markets. In the lower seams, workings to date have been concentrated to the west of the seam split, which is a defining geological feature of the mine. Mining has historically been undertaken using a combination of bord and pillar and longwall mining.

In August 2014, the underground operations at Newstan Colliery were placed onto care and maintenance due to poor market conditions. In recent years, Centennial Newstan has commenced feasibility investigations into the recommencement of mining at Newstan Colliery. The most recent modification to DA 73-11-98 in January 2019, permits first workings mining within the West Borehole seam in the southern portion of the Newstan Colliery mining lease area. The first workings aim to improve Centennial Newstan's understanding of the geology within the West Borehole seam, including the presence, throw and strike of a major fault zone projected from the historic Newstan workings.

Centennial Newstan is now seeking approval for the continuation of mining within the West Borehole seam. The Newstan Mine Extension Project (the Project) proposes to extract up to 25.9 million tonnes (Mt) over a fifteen-year period at a maximum production rate of 4 million tonnes per annum (Mtpa) of Run of Mine (ROM) coal. Bord and pillar mining is proposed using continuous miner methods that will include areas of first workings, partial extraction and total extraction. A mix of metallurgical and thermal coal is proposed to be extracted. ROM coal will be delivered to the Newstan Colliery Surface Site via a series of existing underground conveyors. Once the coal reaches the Newstan Colliery Surface Site it will be handled in accordance with the approved operations for the Northern Coal Logistics Project (SSD-5145), managed by Centennial Coal's Northern Coal Services business unit.

Other key features of the Project include:

- Utilisation of the Newstan Colliery Surface Site to provide parking, bathhouse, administration and workshop facilities for the underground workforce. A small number of administrative, maintenance and monitoring personnel will also be located at Awaba Colliery Surface Site.
- Transportation of personnel and materials to and from the underground mining area via the existing men and materials drift at Newstan Colliery Surface Site.
- Continued operation of the two existing ventilation fans at Newstan Colliery Surface Site and the installation and operation of three new ventilation fans at the existing ventilation shaft at Awaba Colliery Surface Site.

- In-seam gas drainage, with gas transferred to a new gas flaring facility to be located within the existing disturbance footprint of Awaba Colliery Surface Site.
- Extraction of underground water via the existing Fassifern Pump Station at Newstan Colliery Surface Site and ongoing groundwater management in accordance with Centennial Coal's Northern Operations Water Management Plan.

The project is aligned with the broader Centennial Coal business strategy in that it facilitates the development of a new semi-soft coking coal product stream and a thermal coal product for both the domestic and export markets. The project will enable supply of export coal products while meeting contractual coal supplies to the domestic markets. Over time, the project can potentially replace the coal product currently supplied to the domestic market by other Centennial operations as these other resources become depleted. This will ensure ongoing security of supply for domestic electricity generation.

If approved, the project will allow for the optimisation of resource recovery from Newstan Colliery while providing ongoing direct and indirect employment opportunities. In addition, the project will provide a number of positive flow-on effects to the local, regional and state economies through additional wages and royalties.

1.1 Biodiversity Assessment Approach

The following section outlines the legislative context and approach to assessments contained within this BDAR and the associated Biodiversity Inventory Report (BIR; Appendix A).

1.1.1 Biodiversity Assessment Methodology

The Biodiversity Assessment Methodology (BAM) requires the assessment to be prepared by an accredited assessor. The BAM is also applied to identify reasonable measures and strategies that can be taken to avoid and minimise impacts on biodiversity.

Using the BAM plot data gathered in the field and other GIS information, the BAM Credit Calculator has been populated and "run". Outputs generated from the initial run constitute the interim credit report from the BAM Credit Calculator relating to the impact site, clearly identifying the 'Ecosystem Credits' and the 'Species Credits' required to be retired to meet "no net loss", plus any other matters requiring consultation with the Biodiversity Conservation Division (BCD) of the Department of Planning, Industry and Environment (DPIE).

The field data and subsequent BAM credit calculations for the development site are typically utilised to produce the BDAR. Ultimately, reporting is required to be conducted for the formal project application in accordance with the BAM requirements, being:

Stage 1 – Biodiversity Assessment;

Stage 2 – Impact Assessment (biodiversity values); and

Stage 3 – Improving Biodiversity Values.

At this stage, the field surveys and BDAR production have been conducted in line with the BAM requirements for Stages 1 & 2 only. Due to the uncertain nature of the potential impacts (as described in Stage 2) the overall credit liability is not yet known. Credit liability is proposed to addressed at a later date in one of two ways; 1. Paying into the Biodiversity Conservation Trust (BCT) fund or 2. Setting up a

Stewardship Site via BAM Stage 3 – Improving Biodiversity Values (Biodiversity Stewardship Site Assessment Report; BSAR).

1.1.2 Biodiversity Inventory Report (Appendix A)

The primary purpose of the Biodiversity Inventory Report (BIR) is to document the biodiversity values of the study area, thus serve as a primary resource document for the BDAR. In addition, the BIR serves a dual purpose for assessing other regulatory matters not relevant to the prescribed content of a BDAR (i.e. Appendix 10 of the BAM). As such, the BIR is presented in a separate document suitable for standalone use to address relevant State Environmental Planning Policies (SEPPs); Matters of National Environmental Significance (MNES); and the NSW State Groundwater Dependant Ecosystems Policy. The following documents and guidelines were considered when preparing the BIR:

- Threatened Species Assessment Guidelines (OEH 2016);
- NSW State Groundwater Dependent Ecosystem Policy (DLWC 2002);
- Risk Assessment Guidelines for Groundwater Dependent Ecosystems (DPIOW 2012);
- State Environmental Planning Policy No. 44 – Koala Habitat Protection (now repealed and replaced by the SEPP (Koala Habitat Protection) 2019;
- State Environmental Planning Policy (Coastal Management) 2018; and
- Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (DoE 2013).

The BIR also has regard for survey methodologies prescribed in various State and Commonwealth guidelines where deemed relevant to the project.

1.1.3 Biodiversity Development Assessment Report

This BDAR includes, but is not be limited to:

- Review of previous ecological investigations undertaken in proximity to the Project;
- Mapping of Plant Community Types (PCTs) impacted by the Project;
- Mapping of habitat used by ‘Candidate Species’ that is likely to be impacted by the Project;
- Identification of impact avoidance, minimisation, mitigation and management measures as required;
- Calculation and collation of a credit ledger for Ecosystem and Species Credit Species impacted by the Project; and
- Reporting of the above and other relevant assessment matters specified in the BAM.

1.2 Project Area Particulars

Locality:	Newstan Colliery, Fassifern NSW	
LGA:	Lake Macquarie City Council (LMCC)	
Lot/DP:	LOT99	DP755218
	LOT100	DP755218
	LOT1	DP585142

LOT7322	DP1166295
LOT11	DP1050120
LOT51	DP840671
LOT7321	DP1166295
LOT1	DP1109558
LOT7320	DP1166295
LOT10	DP239629
LOT8	DP239629
LOT153	DP755207
LOT216	DP755207
LOT101	DP755218
LOT214	DP755207
LOT54	DP755218
LOT102	DP755218
LOT215	DP755207
LOT1	DP582126
LOT65	DP1126625
LOT462	DP1138964
LOT463	DP1138964
LOT7305	DP1149082
LOT7304	DP1149082
LOT7309	DP1164559
LOT7336	DP1170023
LOT110	DP755207
LOT213	DP755207
LOT5	DP239629
LOT9	DP239629
LOT6	DP239629
LOT212	DP755207
LOT211	DP840670
LOT20	DP734860
LOT21	DP734860

LOT20	DP840668
LOT1	DP737496
LOT1	DP817425
LOT100	DP828283
LOT50	DP840671
LOT101	DP828283
LOT7306	DP1164232
LOT1	DP1191308

The Project Application Area (**Figure 1**) extends under seven portions of road reserve and an unsurveyed land parcel.

Project Application Area:	The Project encompasses three distinct areas (Newstan Colliery, the proposed Extension of Mining Area, and Awaba Colliery) with the existing Newstan Colliery Holding Boundary forming the Project Application Area (**Figure 1**).
Study Area:	The area where ecological surveys were undertaken which includes all proposed mining and surface works (**Figure 1**).
Extension of Mining Area	The area under which bord-and-pillar mining operations are proposed.
Boundaries:	Eraring Power Station to the south; Awaba township to the north and Environmental Conservation Areas to the east and west. Scattered rural residential premises are also located to the west.
Buffer Area	Buffer Area: Area within 1,500 m of the outside edge of Potential Application Area
Zoning:	The following zoning exists withing the Extension of Mining Area: E2 (Environmental Conservation); SP1 (Mining); SP2 (Electricity Generating Works; Railway Corridor).
Current Land Use:	Southern Reject Emplacement Area (SREA), Clean Water Diversion Drain (CWDD) the Final Pollution Control Dam (FPCD), coal preparation plant, coal handling plant, dedicated haul road, and Eraring Power station, Crown Land, LMCC Offset and Awaba infrastructure.
Topography:	Rolling low hills with numerous, primarily ephemeral drainage lines. Slope gradients generally 10–25% and local relief 20–80 m. Some southerly facing slopes have slope gradients >25%. Rock outcrop is absent.

Regional Sydney Basin
Sub Region
Wyong

WAKEFIELD
FREEMANS WATERHOLE
RYHOPE
AWABA
MYUNA BAY



Legend

- Extension of Mining
- Project Application
- Study Area
- 1500m Buffer
- Biodiversity Values
- Biodiversity Values added in the last 90 days
- NSW IBRA Subregion
- Land Subject To Inundation
- Swamp-Wet
- Tracks and Roads
- Power Lines
- Railway
- Drainage

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500 250 0 500 1,000 1,500 2,000 m
SCALE: 1:54,566 AT A3 SIZE

TITLE : FIGURE 1: PROJECT AREA LOCATION

LOCATION : NEWSTAN

DATUM: GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **3/02/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Joe.May)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\BDAR Figures\141842 BDAR Figure 1 PA Location_A A3L 20200129.mxd

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1.3 The Proposal

Centennial Newstan is seeking approval for the continuation of mining within the West Borehole seam. The Newstan Mine Extension Project proposes to extract up to 25.9 million tonnes (Mt) over a fifteen-year period at a maximum production rate of 4 million tonnes per annum (Mtpa) of Run of Mine (ROM) coal. Bord and pillar mining is proposed using continuous miner methods that will include areas of first workings, partial extraction and total extraction. A mix of metallurgical and thermal coal is proposed to be extracted. ROM coal will be delivered to the Newstan Colliery Surface Site via a series of existing underground conveyors. Once the coal reaches the Newstan Colliery Surface Site it will be handled in accordance with the approved operations for the Northern Coal Logistics Project (SSD-5145), managed by Centennial Coal's Northern Coal Services business unit.

Other key features of the project include:

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- Transportation of personnel and materials to and from the underground mining area via the existing men and materials drift at Newstan Colliery Surface Site.
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- In-seam gas drainage, with gas transferred to a new gas flaring facility to be located within the existing disturbance footprint of Awaba Colliery Surface Site.
- Extraction of underground water via the existing Fassifern Pump Station at Newstan Colliery Surface Site and ongoing groundwater management in accordance with Centennial Coal's Northern Operations Water Management Plan.

1.4 Information Sources used in this Assessment

- Department of Energy and Environment Australian Government's Species Profiles and Threats (SPRAT) database (http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl);
- Department of Energy and Environment EPBC Act Protected Matters Search Tool (http://www.environment.gov.au/epbc/protected-matters-search-tool; Accessed August 2018);
- Office of Environment and Heritage Threatened Species Profiles (http://www.environment.nsw.gov.au/threatenedspeciesapp/; Accessed September 2018);
- Interim Biogeographical Regionalisation for Australia (IBRA) and IBRA sub-regions (http://www.environment.gov.au/land/nrs/science/ibra);
- DPI profiles of threatened species, populations and ecological communities;
- OEH VIS Mapping (http://www.environment.nsw.gov.au/research/VISmap.htm);
- NSW Biodiversity Values Map (https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap; Accessed August 2018); and
- State of NSW (2017). Biodiversity Assessment Method.

1.5 Staff Qualifications

This report was written by Joe May (Accredited BAM Assessor - BAAS18060) and was reviewed and issued for approval by Lauren Eather (Accredited BAM Assessor – BAAS18061) and Arne Bishop (Accredited BAM Assessor – BAAS17065). Field work was undertaken by the following ecological consultants:

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- Janene Devereux
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- Shelomi Doyle
- Daniel Watts
- Rhys Corrigan
- Duncan Scott-Lawson
- Zachariah Cotter
- Daniel Creevey
- Tristam Richardson
- Kieran Marshall
- Jessica Sharp
- Diane Warman
- Joe Gibbs
- Alan Midgley
- Tara Boreham
- Michael Collins-Levy

2 LANDSCAPE FEATURES

2.1 IBRA Bioregions and Subregions

The Project Application Area is within the Sydney Basin Bioregion and Wyong Subregion.

2.2 NSW Landscape Regions and Area

The Project Application Area is within the Gosford-Cooranbong Coastal Slopes Mitchell Landscape (NPWS 2003).

2.3 Study Area

The Study Area is approximately 1,440.26 ha. The area of native vegetation within this area is approximately 1,036.27 ha.

2.4 Native Vegetation

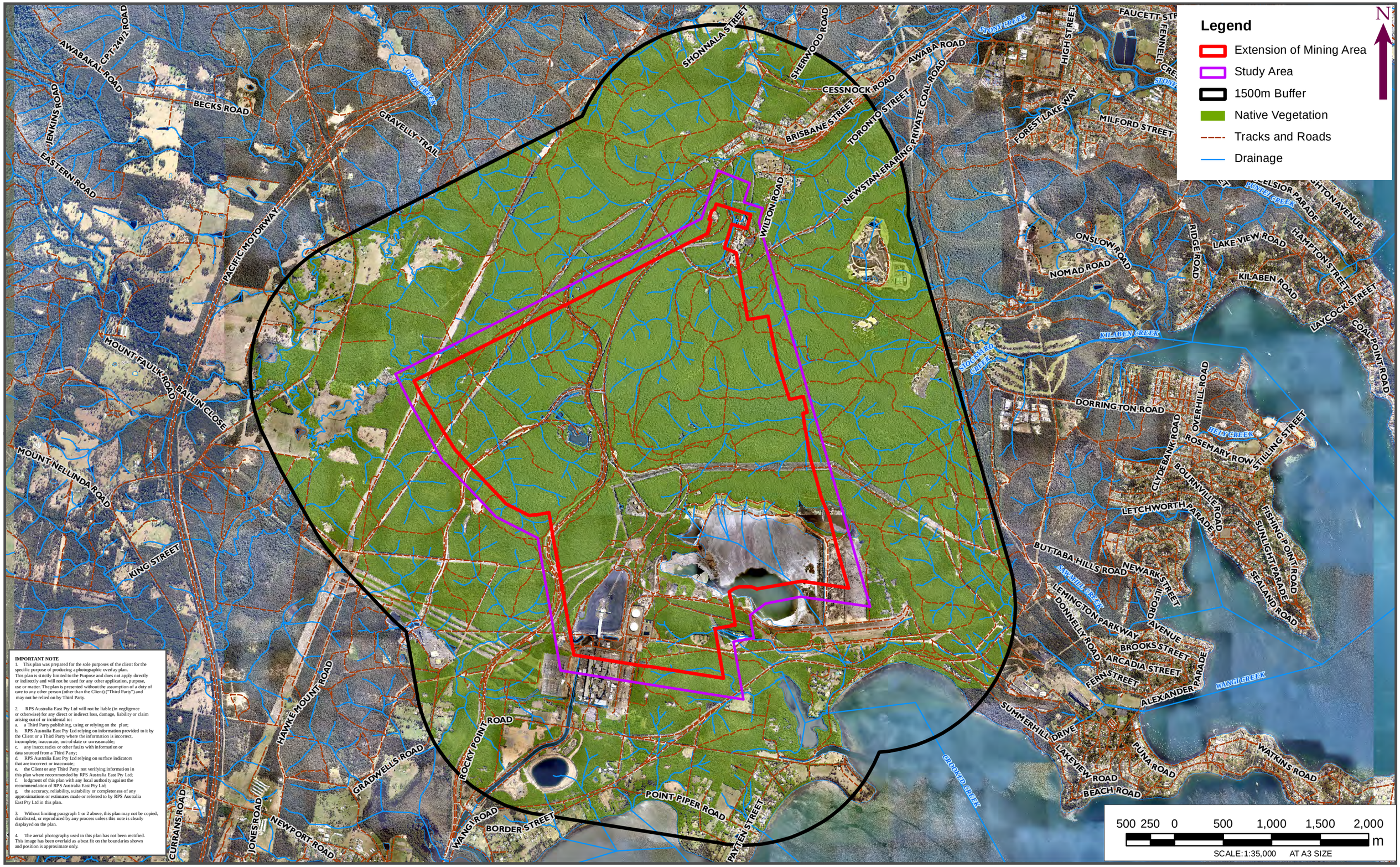
Approximately 3,266.07 ha of vegetation occurs within the 1,500 m Buffer (70.7% of the buffer area), according to Lake Macquarie Vegetation Mapping (Bell and Driscoll 2015). Native vegetation within this Buffer Area is shown in **Figure 2**.

2.5 Cleared Areas

Within the Buffer Area, vegetation clearing has occurred associated with mining activities, power generation, ash dam disposal activities, transport (i.e. public roads and rail), agriculture (e.g. poultry farms, horse stables and livestock), past forestry activity, low-density residential housing and powerline easements. Approximately 29.29 % ha (1,353.35 of 4,619.42 ha) of the 1,500 m Buffer is cleared.

Within the Study Area, clearing has been due to:

- Southern Reject Emplacement Area)
- Clean Water Diversion Drain
- Final Pollution Control Dam
- Coal preparation plant
- Coal handling plant
- Dis-used quarry
- Newstan-Eraring haul road
- Eraring Power station and ash dam
- Unsealed access tracks
- Clearing
- by past forestry
- Transmission line easements



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   e. the Client or any Third Party not verifying information in this plan where recommended by RPS Australia East Pty Ltd;
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TITLE : FIGURE 2: NATIVE VEGETATION WITHIN BUFFER AREA

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\BDAR Figures\141842 BDAR Figure 2 Native Veg_A A3L 20200131.mxd

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2.6 Rivers and Streams

The Study Area drains via Stoney Creek (1st to 3rd order), Kilaben Creek (1st to 2nd order), Stockyard Creek (1st to 3rd order), Lords Creeks (1st to 4th order) and Crooked Creek (1st to 2nd order). These tributaries ultimately drain into Lake Macquarie, which is at its nearest point, approximately 1km southwest of the Study Area.

2.7 Wetlands

There was 0.23 ha of Freshwater Wetlands on Coastal Floodplains identified within the Study Area as PCT 1737.

2.8 Connectivity Features

Vegetation mapping and inspection of recent aerial photography indicates considerable clearing of vegetation within the locality. The native vegetation patch size associated with the Study Area is approximately 1,036.16 ha, which extends into tracts of bushland to the east and north. This vegetation tract incorporates part of the Awaba State Forest and Sugarloaf State Conservation Area. The M1 Pacific Motorway and Main Northern Railway corridor present a potential barrier for fauna moving west. Primarily housing development prevents a barrier to connectivity to Lake Macquarie.

2.9 Areas of Geological Significance and Soil Hazard Features

The site is typical of Gosford - Cooranbong Coastal Slopes Landscape with rolling hills of Triassic Narrabeen sandstones. There are no karst, caves, crevices, cliffs or other areas of geological significance.

Soil landscape units present are Awaba (aw) and Doyalson (do). These soil units are prone to erosion (**Table 1**). Soil types within the Study Area are provided in **Figure 3**.

Table 1 Soil Landscape Units

Soil Landscape	Formative Process	Composition	Hazard
Awaba (aw)	Erosional	• Gravelly brown loam • Gravelly hard setting bleached sandy loam to sandy clay loam • Gravelly earthy bright yellowish-brown sandy clay loam • Gravelly grey clay • Well-structured sticky plastic clay	• Erosion hazard • Steep slopes (localised) • Mass movement hazard (localised) • Mine subsidence district • Rock outcrop (localised) • High run-on (localised) • Shallow soil (localised) • Moderate foundation hazard • High foundation hazard (localised)
Doyalson (do)	Erosional	• Brown loose loamy sand	• Erosion hazard

Soil Landscape	Formative Process	Composition	Hazard
		• Hard setting bleached yellowish brown clayey sand • Earthy bright yellowish-brown sandy clay loam • Earthy light grey clay • Strongly pedal clay	• Seasonal waterlogging (localised) • High run-on (foot slopes) • Mine subsidence district • Foundation hazard (localised)

2.10 Areas of Outstanding Biodiversity Value

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

2.11 Site Context Components

2.11.1 Method of BAM Assessment

The BAM streamline assessment method does not apply to this BDAR. Hence, a Development Assessment Case for a Major Development was applied within the BAM calculator (BAM-C).

2.11.2 Percentage of Native Vegetation Cover

The overall vegetation cover within the Buffer Area (i.e. within 1500 m of the perimeter of the Extension of Mining Area) was determined using aerial photographs and local vegetation mapping (Bell and Driscoll 2015).

As per Section 2.4, the total cover of native vegetation within the buffer area is 70.7% (**Figure 2**).

Legend

- Extension of Mining Area
- Study Area
- 1500m Buffer
- Tracks and Roads
- Drainage

Soils by Code and Name

- aw - AWABA
- awa - AWABA variant a
- do - DOYALSON
- ts - TACOMA SWAMP
- wa - WARNERS BAY
- wn - WATAGAN
- wy - WYONG
- xx - DISTURBED TERRAIN
- WATER - WATER

N

500 250 0 500 1,000 1,500 2,000 m

SCALE:1:35,000 AT A3 SIZE

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TITLE : FIGURE 3: SOIL UNITS WITHIN BUFFER AREA

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\BDAR Figures\141842 BDAR Figure 3 Soil Units_A A3L 20200131.mxd

CLIENT: **CENTENNIAL COAL**

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3 NATIVE VEGETATION

3.1 Native Plant Species

Approximately 340 flora species were detected within the BAM plots; 322 native and 18 exotic species. Of these, six were threatened plants listed under the *Biodiversity Conservation Act* 2016 (BC Act) or *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act), including:

- *Acacia bynoeana* (BC Act: Endangered, EPBC Act: Vulnerable)
- *Angophora inopina* (BC Act: Vulnerable, EPBC Act: Vulnerable)
- *Corybas dowlingii (*BC Act: Endangered*)*
- *Genoplesium insigne* (BC Act: Critically Endangered, EPBC Act: Critically Endangered)
- *Grevillea parviflora* subsp. *parviflora* (BC Act: Vulnerable, EPBC Act: Vulnerable)
- *Tetratheca juncea* (BC Act: Vulnerable, EPBC Act: Vulnerable)

For a full list of species see **Appendix C.2**.

3.2 High Threat Weeds

A list of high threat weed species (as determined by the Biodiversity Conservation Division {BCD}) detected within the Study Area during surveys is provided in **Table 2**.

Table 2 High Threat Weeds detected within the Study Area and their management requirements

Scientific Name	Common Name	BAM High Threat Weed	Weed of National Significance (WONS)	Duty under *Biosecurity Act* (2015)
Ageratina riparia	Mistflower	Yes	No	
Axonopus fissifolius	Narrow-leafed Carpet Grass	Yes	No	
Cinnamomum camphora	Camphor Laurel	Yes	No	
Ehrharta erecta	Panic Veldtgrass	Yes	No	
Lantana camara	Lantana	Yes	Yes	General Biosecurity Duty Must not be imported into the State or sold
Ligustrum sinense	Small-leaved Privet	Yes	No	
Ochna serrulata	Mickey Mouse Plant	Yes	No	
Rubus fruiticosus sp. agg	Blackberry	Yes	Yes	General Biosecurity Duty Prohibitions on dealings – must not be imported into the State or sold. Regional Recommended Measure for the Hunter region - The plant should not be bought,

Scientific Name	Common Name	BAM High Threat Weed	Weed of National Significance (WONS)	Duty under *Biosecurity Act* (2015)
				sold, grown, carried or released into the environment. Land managers should mitigate the risk of the plant being introduced to their land. Land managers should mitigate spread from their land. Land managers to reduce impacts from the plant on priority assets.
Senna pendula		Yes	No	

Other common environmental weeds comprised the following species:

- *Cirsium vulgare* (Spear Thistle);
- *Conyza spp.* (Fleabane);
- *Hypochaeris radicata* (Catsear);
- *Melinis repens* (Red Natal Grass);
- *Pyllanthus tenellus* (Hen and Chicken);
- *Senna pendula var. glabrata*;
- *Setaria parviflora*;
- *Solanum mauritanium* (Wild Tobacco Bush); and
- *Solanum nigrum* (Black-berry Nightshade).

3.3 Plant Community Types (PCTs)

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

3.3.1 Method for Assessing PCTs

3.3.1.1 Review of existing information

The Lake Macquarie Vegetation Community Mapping (Bell and Driscoll 2015) was used as the basis for a preliminary analysis of vegetation patterns within the Study Area. This mapping was updated following re-interpretation of mapped vegetation boundaries using the latest aerial photography (i.e. Google™ 2019) prior to survey stratification. PCTs were assigned to Bell and Driscoll (2015) using the conversion table by Bell (2016a). Updates also included the assigning of notional condition classes. Preliminary PCTs were assigned to areas of relatively homogenous land cover (i.e. vegetation zones). Additional revisions were performed following the completion of field surveys (i.e. revision of boundaries and condition classes). PCT extent was calculated in a GIS to determine the number of BAM plots required and stratification of other survey methods.

The vegetation condition of defined PCTs were classified as good, moderate, derived or poor based on the definitions provided in **Table 3**. Vegetation condition was then used to delineate vegetation zones, and subsequently stratify sampling, as required by the BAM (State of NSW 2017).

Table 3 Classification of vegetation condition classes

Vegetation Condition	Definition
Good	Vegetation community generally resembles pre-European levels of condition structure and overall integrity. Vegetation is resilient to weed invasion due to dominance of native species within the ground, shrub and canopy layers.
Moderate	Native canopy present. The understorey is dominated by natives (>50% native cover). Vegetation condition is below benchmark value but above that defined for poor condition.
Derived	Native vegetation in a structurally modified state, exemplified by an unnatural dominance of species in a non-characteristic stratum combined with the absence of characteristic species in the dominant strata (i.e. native grasslands derived from grassy woodlands, native shrublands derived from dry sclerophyll forests).
Poor	Understorey dominated by exotic species (i.e. >50% exotic cover). Native shrub layer has been replaced by weeds. These areas have: • A vegetation integrity score <15 where the PCT is representative of an endangered or critically endangered ecological community; or • A vegetation zone has a vegetation integrity score <17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community; or • A vegetation zone has a vegetation integrity score <20 where the PCT is not representative of a Threatened Ecological Community (TEC) or associated with threatened species habitat. Based on the vegetation integrity score for this vegetation group, assessment of native vegetation is not required beyond Section 5.4 of the BAM (State of NSW 2017).

3.3.1.2 Floristic survey

Prior to allocating the BAM plot location and replication requirements, Rapid Data Points (RDPs) were collected across the Study Area to ground truth the Bell and Driscoll (2015) vegetation mapping. At each RDP point, species composition in the vicinity was recorded, focusing on the dominant species in each stratum (e.g. canopy, mid, shrub and ground layer) that assist in aligning the vegetation with the PCTs. Following confirmation of the PCT extent, GIS was used to determine the required survey effort (i.e. BAM plots).

Thirty-nine flora plots were carried out in accordance with the BAM to assess the composition, structure and function components of vegetation integrity following RDP surveys (**Appendix A**). The locations of these BAM plots were situated to achieve maximum coverage of the vegetation within the Study Area (**Figure 4**).

The following attributes were measured in each plot:

- One standard 20 x 20 m plot, to assess the composition and structure attributes, including trees, shrubs, grasses, forbs, ferns and other growth forms;
- One standard 20 x 50 m plot (1,000 m^2) to assess the function attributes: number of large trees
- (i.e. >50 cm DBH), stem size class, tree regeneration, length of fallen logs, high threat exotic vegetation cover and hollow-bearing trees; and

- Five 1 m^2 sub-plots to assess average litter cover for the plots.

Mapping by Bell and Driscoll (2015) was generally consistent with the RDP and BAM plot results, requiring only minor amendments to boundaries of the vegetation mapping following ground-truthing.

3.3.2 PCTs identified within the Study Area

Nine PCTs were identified within the Study Area:

- PCT 1598 Forest Red Gum grassy open forest on floodplains of the lower Hunter
- PCT 1588 Grey Ironbark – Broad-leaved Mahogany – Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast
- PCT 1619 Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands
- PCT 1627 Smooth-barked Apple – Turpentine – Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast
- PCT 1636 Scribbly Gum – Red Bloodwood – Angophora inopina heathy woodland on lowlands on the Central Coast
- PCT 1638 Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast
- PCT 1716 – Prickly-leaved Paperbark forest on the coastal lowlands of the Central Coast and Lower North Coast
- PCT 1718 – Swamp Mahogany – Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast
- PCT 1737 – Typha rushland

A description of these PCTs, and justification for their selection, are provided in **Tables 4 to 12**. Further information regarding these PCTs, including photographs, is found in **Appendix A**. PCTs and BAM plot locations are displayed on **Figure 4**.

Legend

- Extension of Mining Area
- Surface Disturbance Areas
- Study Area
- BAM Plot
- Tracks and Roads

Plant Community Type

- 1588 - Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast
- 1598 - Forest Red Gum grassy open forest on floodplains of the lower Hunter
- 1619 - Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
- 1627 - Smooth-barked Apple - Turpentine - Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast
- 1636 - Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast
- 1638 - Smooth-barked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast
- 1716 - Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast
- 1718 - Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast
- 1737 - Typha rushland

N

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OLNEY STREET

NEWSTAN-ERARING PRIVATE COAL R

NEWSTAN-ERARING PRIVATE COAL ROAD

HAWKE MOUNT ROAD

SIMPSON ROAD

JUNCTION ROAD

CONSTRUCTION ROAD

BUTTABA HILLS ROAD

WANGI ROAD

DONNELLY ROAD

WANGI POINT ROAD

500 250 0 500 1,000 1,500 2,000 m

SCALE:1:22,000 AT A3 SIZE

TITLE : FIGURE 4: BAM PLOT LOCATION AND VEGETATION MAPPING

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **21/05/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): C A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\BDAR Figures\141842 BDAR Figure 4 BAM plots Veg_C A3L 20200521.mxd

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Table 4 Description of PCT 1588 within the Study Area

Grey Ironbark – Broad-leaved Mahogany – Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast		
Vegetation Formation	Hunter-Macleay Dry Sclerophyll Forests	
Vegetation Class	Dry Sclerophyll Forests (Shrub/grass sub-formation)	
Vegetation Type	PCT ID	1588
	Common Community Name	Grey Ironbark – Broad-leaved Mahogany – Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast
Condition	Moderate	
Approximate extent within the Study Area	30.23 ha	
BAM Plot no.	3, 5, 15 and 27.	
Species relied upon for PCT identification	*Corymbia maculata*	3, 5, 15 and 27.
	Eucalyptus umbra	3, 5, 15 and 27.
	Corymbia gummifera	3 and 5.
Other consistent diagnostic features	*Imperata cylindrica*	3, 5, 15 and 27.
	Pseuderanthemum variable	3, 5, 15 and 27.
	Themeda triandra	3, 5, 15 and 27.
	Entolasia stricta	3, 5, 15 and 27.
TEC Status	Not Listed	
Estimate of percentage cleared	56	
Notes	None	

Table 5 Description of PCT 1598 within the Study Area

Forest Red Gum grassy open forest on floodplains of the lower Hunter		
Vegetation Formation	Forested Wetlands	
Vegetation Class	Coastal Floodplain Wetlands	
Vegetation Type	PCT ID	1598
	Common Community Name	Forest Red Gum grassy open forest on floodplains of the lower Hunter
Condition	Moderate	
Approximate extent within the Study Area	0.11 ha	
BAM Plot no.	No BAM plots was undertaken in this community due to land access issues and the small size of the area. In the absence of BAM plots, benchmark conditions were adopted for this community. This is addressed in Section 4.2.1.2 of the BIR.	

Forest Red Gum grassy open forest on floodplains of the lower Hunter	
Species relied upon for PCT identification	*Eucalyptus tereticornis*
	Eucalyptus punctata
	Angophora floribunda
Other consistent diagnostic features	
TEC Status	Hunter Lowland Redgum Forest in the Sydney Basin and NSW North Coast Bioregions (Endangered under the BC Act)
Estimate of percentage cleared	73
Notes	None

Table 6 Description of PCT 1619 within the Study Area

Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands		
Vegetation Formation	Sydney Coastal Dry Sclerophyll Forests	
Vegetation Class	Dry Sclerophyll Forests (Shrubby sub-formation)	
Vegetation Type	PCT ID	1619
	Common Community Name	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands
Condition	Moderate	
Approximate extent within the Study Area	421.2 ha	
BAM Plot no.	2, 8, 10, 12, 13, 16, 17, 19, 24, 28, 30 and 40.	
Species relied upon for PCT identification	*Angophora costata*	Plots 2,8,13,16,17,19,24 and 28.
	Eucalyptus piperita	Plots 2,8,13,16,17,19 and 24.
	Eucalyptus capitellata	Plots 2,8,13 and 24.
	Eucalyptus gummifera	Plots 2,8,12,13,19 and 28.
Other consistent diagnostic features	*Entolasia stricta 2, 8, 10, 12, 13, 16, 17, 19, 24, 28, 30 and 40.* *Lomandra obliqua 2, 10, 12, 13, 16, 24, 28, 30 and 40.*	
TEC Status	Not Listed	
Estimate of percentage cleared	28	
Notes	None	

Table 7 Description of PCT 1627 within the Study Area

Smooth-barked Apple – Turpentine – Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast	
Vegetation Formation	Sydney Coastal Dry Sclerophyll Forests
Vegetation Class	Dry Sclerophyll Forests (Shrubby sub-formation)

Smooth-barked Apple – Turpentine – Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast		
Vegetation Type	PCT ID	1627
	Common Community Name	Smooth-barked Apple – Turpentine – Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast
Condition	Moderate	
Approximate extent within the Study Area	108.81 ha	
BAM Plot no.	4, 6, 9, 21, 22 and 34.	
Species relied upon for PCT identification	*Angophora costata*	Plots 4, 6, 9, 21, 22 and 34.
	Eucalytpus piperita	Plots 9, 21 and 22.
	Melaleuca linarifolia	Plots 4, 6, 9, 21, 22 and 34.
	Pteridium esculentum	Plots 4, 6, 9, 21, 22 and 34.
Other consistent diagnostic features	Calochlaena dubia	Plots 6, 9, 21, 22 and 34.
	Callicoma serratifolia	Plots 6, 9, 21, 22 and 34.
	Pteridium esculentum	Plots 4, 6, 9, 21, 22 and 34.
TEC Status	Not Listed	
Estimate of percentage cleared	1	
Notes	None	

Table 8 Description of PCT 1636 within the Study Area

Scribbly Gum – Red Bloodwood – Angophora inopina heathy woodland on lowlands of the Central Coast		
Vegetation Formation	Sydney Coastal Dry Sclerophyll Forests	
Vegetation Class	Dry Sclerophyll Forests (Shrubby sub-formation)	
Vegetation Type	PCT ID	1636
	Common Community Name	Scribbly Gum – Red Bloodwood – Angophora inopina heathy woodland on lowlands of the Central Coast
Condition	Moderate	
Approximate extent within the Study Area	408.1 ha	
BAM Plot no.	1, 7, 10, 11, 14, 18, 20, 36, 37 and 41.	
Species relied upon for PCT identification	*Angophora costata*	1, 11, 14, 18, 20, 36, 37 and 41.
	Eucalyptus haemastoma	1, 7, 10, 11, 14, 18, 20, 36, 37 and 41.
	Eucalyptus capitellata	1, 7, 10, 11, 20, 36 and 41.
	Allocasuarina littoralis	1, 7, 10, 11, 14, 18, 20, 36, 37 and 41.
Other consistent diagnostic features	*Dillwynia retorta*	1, 7, 10, 11, 14, 18, 20, 36, 37 and 41.
	Entolasia stricta	1, 7, 10, 11, 14, 18, 20, 36, 37 and 41.
	Lambertia formosa	1, 7, 10, 11, 14, 18, 20, 36, 37 and 41.
TEC Status	Not Listed	
Estimate of percentage cleared	30	
Notes	None	

Table 9 Description of PCT 1638 within the Study Area

Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast		
Vegetation Formation	Dry Sclerophyll Forests (Shrubby sub-formation)	
Vegetation Class	Sydney Coastal Dry Sclerophyll Forests	
Vegetation Type	PCT ID	1638
	Common Community Name	Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast
Condition	Moderate	
Approximate extent within the Study Area	46.82 ha	
BAM Plot no.	35, 38 and 39	
Species relied upon for PCT identification	*Angophora costata*	35, 38 and 39.
	Corymbia gummifera	35, 38 and 39.
	Eucalyptus haemastoma	35, 38 and 39.

Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast		
	Allocasuarina littoralis	35, 38 and 39.
	Glochidion ferdinandi	35, 38 and 39.
Other consistent diagnostic features	*Lepidosperma laterale*	35, 38 and 39.
	Lomandra obliqua	35, 38 and 39.
	Parsonsia straminea	35, 38 and 39.
	Phyllanthus hirtellus	35, 38 and 39.
TEC Status	Not Listed	
Estimate of percentage cleared	50	
Notes	None	

Table 10 Description of PCT 1716 within the Study Area

Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast		
Vegetation Formation	Coastal Swamp Forests	
Vegetation Class	Forested Wetlands	
Vegetation Type	PCT ID	1716
	Common Community Name	Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast
Condition	Moderate	
Approximate extent within the Study Area	5.0 ha	
BAM Plot no.	31, 32 and 33.	
Species relied upon for PCT identification	*Angophora costata*	31, 32 and 33.
	Eucalyptus resinifera	31, 32 and 33.
	Eucalyptus globoidea	31, 32 and 33.
	Gahnia clarkei	31, 32 and 33.
Other consistent diagnostic features	*Aristida vagans*	31, 32 and 33.
	Dianella caerulea var. producta	31, 32 and 33.
	Entolasia stricta	31, 32 and 33.
TEC Status	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered under the BC Act)	
Estimate of percentage cleared	66	
Notes	None	

Table 11 Description of PCT 1718 within the Study Area

Swamp Mahogany – Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast		
Vegetation Formation	Forested Wetlands	
Vegetation Class	Coastal Swamp Forests	
Vegetation Type	PCT ID	1718
	Common Community Name	Swamp Mahogany – Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast
Condition	Moderate	
Approximate extent within the Study Area	15.77 ha	
BAM Plot no.	23, 25, 26 and 29.	
Species relied upon for PCT identification	*Eucalyptus robusta*	23, 25, 26 and 29.
	Eucalyptys piperita	23 and 25.
	Glochidion ferdinandi	23, 25, 26 and 29.
	Melaleuca linifolia	23, 25, 26 and 29.
Other consistent diagnostic features	*Adiantum aethiopicum*	23, 25, 26 and 29.
	Pratia purpurascens	23, 25, 26 and 29.
TEC Status	Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered under the BC Act)	
Estimate of percentage cleared	74	
Notes	None	

Table 12 Description of PCT 1737 within the Study Area

Typha rushland		
Vegetation Formation	Freshwater Wetlands	
Vegetation Class	Coastal Freshwater Lagoons	
Vegetation Type	PCT ID	1737
	Common Community Name	Typha rushland
Condition	Moderate	
Approximate extent within the Study Area	0.23 ha	
BAM Plot no.	No plot conducted. Benchmark conditions assumed.	
Species relied upon for PCT identification	*Typha orientalis* was seen to occur throughout this area in an RDP photograph.	
TEC Status	Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (Endangered under the BC Act)	

Typha rushland	
Estimate of percentage cleared	70
Notes	None

3.3.3 Patch size

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

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

3.3.4 Vegetation Integrity Score

The vegetation integrity score (VIS) for each vegetation zone is presented in **Table 13.**

Table 13 Current vegetation integrity score for the vegetation zones

Vegetation Zone Name	Plant Community Type	Condition	Composition	Structure	Function	Vegetation Integrity Score
Zone 1_PCT 1588_Moderate	PCT 1588	Moderate	86	7.7	50.7	32.2
Zone 2_PCT 1619_Moderate	PCT 1619	Moderate	70.7	49.4	51.9	56.6
Zone 3_PCT 1627_Moderate	PCT 1627	Moderate	60.1	24.9	62.3	45.3
Zone 4_PCT 1636_Moderate	PCT 1636	Moderate	77.2	50.8	59	61.4
Zone 5_PCT 1638_Moderate	PCT 1638	Moderate	74.8	60.1	71.5	68.5
Zone 6_PCT 1716_Moderate	PCT 1716	Moderate	99.2	44.1	63.5	65.2
Zone 7_PCT 1718_Moderate	PCT 1718	Moderate	90.9	97.5	51.1	76.8
Zone 8_PCT 1737_Good	PCT 1737	Good	100	100	NA	100

4 THREATENED SPECIES

4.1 Fauna Habitat Assessment

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

- habitat trees (including large hollow-bearing trees);
- flowering shrubs and feed tree species, including winter flowering species.
- sandstone rocky outcrops, including rock crevices; and
- 1st, 2nd and 3rd order streams via Stoney Creek (1st to 3rd order), Kilaben Creek (1st to 2nd order), Stockyard Creek (1st to 3rd order), Lords Creeks (1st to 4th order) and Crooked Creek (1st to 2nd order). These tributaries ultimately drain into Lake Macquarie, which is at its nearest point, approximately 1 km southwest of the Project Application Area.

4.2 Ecosystem Credit Species Assessment

The following ecosystem credit species were assigned by the BAM calculator as being associated with the PCTs present within the Study Area (**Table 14**). Of these ecosystem credit species, the following were detected within the Study Area:

- Brown Treecreeper (*Climacteris picumnus victoriae*);
- Gang-gang Cockatoo (*Callocephalon fimbriatum*), Glossy-black Cockatoo (*Calyptorhynchus lathami*);Little Lorikeet (*Glossopsitta pusilla*);
- Masked Owl (*Tyto novaehollandiae*);
- Powerful Owl (*Ninox strenua*);
- Varied Sittella (*Daphoenositta chrysoptera*);
- White-bellied Sea Eagle (*Haliaeetus leucogaster*);
- Dusky Woodswallow (*Artamus cyanopterus*);
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*);
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*); and
- Little Bent-winged Bat (*Miniopterus australis*).

Table 14 Ecosystem Credit Species

Ecosystem credit species	Vegetation type(s)	Sensitivity to gain class	BC Act Listing	EPBC Act Listing	Recorded on-site
Anseranas semipalmata Magpie Goose	1737	Moderate Sensitivity to Potential Gain	Vulnerable	Not listed	No
Anthochaera phrygia Regent Honeyeater (Foraging)	1718	High Sensitivity to Potential Gain	Critically Endangered	Critically Endangered	No
Artamus cyanopterus Dusky Woodswallow	1588, 1619, 1627, 1636, 1638, 1716 and 1718	Moderate sensitivity to gain class	Vulnerable	Not listed	Yes
Botaurus poiciloptilus Australasian Bittern	1737	Moderate Sensitivity to Potential Gain	Endangered	Endangered	No
Calidris ferruginea Curlew Sandpiper (Foraging)	1737	High Sensitivity to Potential Gain	Endangered	Critically Endangered	No
Calidris tenuirostris Great Knot (Foraging)	1737	High Sensitivity to Potential Gain	Vulnerable	Critically Endangered	No
Callocephalon fimbriatum Gang-gang Cockatoo (Foraging)	1619, 1627 and 1636	Moderate Sensitivity to Potential Gain	Vulnerable	Not listed	No
Calyptorhynchus lathami Glossy Black-Cockatoo (Foraging)	1619, 1627 and 1636	High Sensitivity to Potential Gain	Vulnerable	Not listed	Yes
Chthonicola sagittata Speckled Warbler	1588, 1619, 1627, 1636 and 1638	High Sensitivity to Potential Gain	Vulnerable	Not listed	No
Circus assimilis Spotted Harrier	1737	Moderate Sensitivity to Potential Gain	Vulnerable	Not listed	No
Climacteris picumnus victoriae Brown Treecreeper (eastern subspecies)	1588, 1619, 1627, 1636 and 1638	High Sensitivity to Potential Gain	Vulnerable	Not listed	Yes
Daphoenositta chrysoptera Varied Sittella	1588, 1619, 1627, 1636, 1638, 1716 and 1718	Moderate Sensitivity to Potential Gain	Vulnerable	Not listed	Yes
Dasyurus maculatus Spotted-tailed Quoll	1588, 1619, 1627, 1636, 1638, 1716 and 1718	High Sensitivity to Potential Gain	Vulnerable	Endangered	No
Ephippiorhynchus asiaticus Black-necked Stork	1737	Moderate Sensitivity to Potential Gain	Endangered	Not listed	No
Epthianura albifrons White-fronted Chat	1737	Moderate Sensitivity to Potential Gain	Vulnerable	Not listed	No

Ecosystem credit species	Vegetation type(s)	Sensitivity to gain class	BC Act Listing	EPBC Act Listing	Recorded on-site
Glossopsitta pusilla Little Lorikeet	1588, 1619, 1627, 1636, 1638, 1716 and 1718	High Sensitivity to Potential Gain	Vulnerable	Not listed	Yes
Grantiella picta Painted Honeyeater	1619, 1627 and 1636	Moderate Sensitivity to Potential Gain	Vulnerable	Vulnerable	No
Haliaeetus leucogaster White-bellied Sea-Eagle (Foraging)	1588, 1619, 1627, 1636, 1638, 1716 and 1718 and 1737	High Sensitivity to Potential Gain	Vulnerable	Vulnerable	Yes
Hieraaetus morphnoides Little Eagle (Foraging)	1619, 1627, 1636, 1716, 1718 and 1737	Moderate Sensitivity to Potential Gain	Vulnerable	Vulnerable	No
Irediparra gallinacea Comb-crested Jacana	1737	Moderate Sensitivity to Potential Gain	Vulnerable	Vulnerable	No
Ixobrychus flavicollis Black Bittern	1716, 1718 and 1737	Moderate Sensitivity to Potential Gain	Vulnerable	Vulnerable	No
Lathamus discolor Swift Parrot (Foraging)	1619, 1627, 1636, 1716 and 1718	Moderate Sensitivity to Potential Gain	Endangered	Critically Endangered	No
Limicola falcinellus Broad-billed Sandpiper (Foraging)	1737	High Sensitivity to Potential Gain	Vulnerable	Not listed	No
Limosa limosa Black-tailed Godwit (Foraging)	1737	High Sensitivity to Potential Gain	Vulnerable	Not listed	No
Lophoictinia isura Square-tailed Kite (Foraging)	1618, 1627 and 1636	Moderate Sensitivity to Potential Gain	Vulnerable	Not listed	No
Micronomus norfolkensis Eastern Coastal Free-tailed Bat	1619, 1627, 1636, 1716 and 1718	High Sensitivity to Potential Gain	Vulnerable	Not listed	Yes
Miniopterus australis Little Bent-winged Bat (Foraging)	1619, 1627, 1636, 1716 and 1718	High Sensitivity to Potential Gain	Vulnerable	Not listed	Yes
Miniopterus orianae oceanensis Large Bent-winged Bat (Foraging)	1619, 1627, 1636, 1716 and 1718	High Sensitivity to Potential Gain	Vulnerable	Not listed	Yes
Neophema pulchella Turquoise Parrot	1588, 1619, 1627, 1636 and 1638	High Sensitivity to Potential Gain	Vulnerable	Not listed	No
Ninox strenua Powerful Owl (Foraging)	1619, 1627 and 1636	High Sensitivity to Potential Gain	Vulnerable	Not listed	Yes

Ecosystem credit species	Vegetation type(s)	Sensitivity to gain class	BC Act Listing	EPBC Act Listing	Recorded on-site
Oxyura australis Blue-billed Duck	1737	Moderate Sensitivity to Potential Gain	Vulnerable	Not listed	No
Pandion cristatus Eastern Osprey (Foraging)	1619, 1636, 1716, 1718 and 1737	Moderate Sensitivity to Potential Gain	Vulnerable	Not listed	Yes
Petroica boodang Scarlet Robin	1619, 1627 and 1636	Moderate Sensitivity to Potential Gain	Vulnerable	Not listed	No
Phascolarctos cinereus Koala (Foraging)	1619, 1627, 1636 and 1718	High Sensitivity to Potential Gain	Vulnerable	Vulnerable	No
Phoniscus papuensis Golden-tipped Bat	1619, 1627, 1636, 1716 and 1718	High Sensitivity to Potential Gain	Vulnerable	Not listed	No
Pomatostomus temporalis temporalis Grey-crowned Babbler (eastern subspecies)	1619, 1627 and 1636	Moderate Sensitivity to Potential Gain	Vulnerable	Not listed	No
Pteropus poliocephalus Grey-headed Flying-fox (Foraging)	1619, 1627, 1636, 1716 and 1718	High Sensitivity to Potential Gain	Vulnerable	Not listed	Yes
Rostratula australis Australian Painted Snipe	1737	Moderate Sensitivity to Potential Gain	Endangered	Endangered	No
Saccolaimus flaviventris Yellow-bellied Sheathtail-bat	1619, 1627, 1636, 1716 and 1718	High Sensitivity to Potential Gain	Vulnerable	Not listed	No
Scoteanax rueppellii Greater Broad-nosed Bat	1588, 1619, 1627, 1636, 1638, 1716 and 1718	High Sensitivity to Potential Gain	Vulnerable	Not listed	Yes
Stagonopleura guttata Diamond Firetail	1627	Moderate Sensitivity to Potential Gain	Vulnerable	Not listed	No
Stictonetta naevosa Freckled Duck	1737	Moderate Sensitivity to Potential Gain	Vulnerable	Not listed	No
Tyto novaehollandiae Masked Owl (Foraging)	1619, 1627 and 1636	High Sensitivity to Potential Gain	Vulnerable	Not listed	Yes
Xenus cinereus Terek Sandpiper (Foraging)	1737	High Sensitivity to Potential Gain	Vulnerable	Not listed	No

4.2.1 Species excluded from Assessment

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

4.3 Species Credit Species

The species credit species predicted to occur within the Study Area are presented in **Table 15**.

Table 15 Candidate species credit species requiring assessment

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on site	Included or excluded	Reason for inclusion or exclusion
Acacia bynoeana Bynoe's Wattle	Endangered	Vulnerable	None	High Sensitivity to Potential Gain	Preferred habitat available such as open, sometimes slightly disturbed sites like as trail margins and edges of roadside spoil mounds. Associated overstorey species such as Red Bloodwood and Scribbly Gum present on-site	Included	Habitat components on site
Angophora inopina Charmhaven Apple	Vulnerable	Vulnerable	None	High Sensitivity to Potential Gain	*Eucalyptus haemastoma–Corymbia gummifera–Angophora inopina* woodland/forest present on-site	Included	Habitat components on site
Anthochaera phrygia Regent Honeyeater (Breeding)	Critically Endangered	Critically Endangered	None	High Sensitivity to Potential Gain	Flowering Swamp Mahogany was located on-site which is known to be suitable foraging habitat for Regent Honeyeaters	Included	Habitat components on site
Astrotricha crassifolia Thick-leaf Star-hair	Vulnerable	Vulnerable	None	Very High Sensitivity to Potential Gain	Specific habitat requirements unknown, however Dry Sclerophyll Woodland on Sandstone is present on site which is known to be a preferred habitat type for the species	Included	Habitat components on site
Burhinus grallarius Bush Stone-curlew	Endangered	Not Listed	None	High Sensitivity to Potential Gain	Fallen/standing dead timber including logs	Included	Habitat components on site
Caladenia tessellata Thick Lip Spider Orchid	Endangered	Vulnerable	None	Moderate Sensitivity to Potential Gain	Generally found in grassy sclerophyll woodland on clay loam or sandy soils which is present on-site	Included	Habitat components on site

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on site	Included or excluded	Reason for inclusion or exclusion
Calidris ferruginea Curlew Sandpiper (Breeding)	Endangered	Critically Endangered	None	High Sensitivity to Potential Gain	None	Excluded	Habitat components not on site
Calidris tenuirostris Great Knot (Breeding)	Vulnerable	Critically Endangered	Within 5 km of the coast and tidal influenced water bodies	High Sensitivity to Potential Gain	None	Excluded	Habitat components not on site
Callistemon linearifolius Netted Bottle Brush	Vulnerable	Not Listed	None	Moderate Sensitivity to Potential Gain	Dry sclerophyll forest present on-site	Included	Habitat components on site
Callocephalon fimbriatum Gang-gang Cockatoo (Breeding)	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Hollow bearing trees Eucalypt tree species with hollows greater than 9 cm diameter	Included	Habitat components on site
Calyptorhynchus lathami Glossy Black-Cockatoo (Breeding)	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Hollow bearing trees Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground	Included	Habitat components on site
Cercartetus nanus Eastern Pygmy-possum	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Tree hollows, rotten stumps, holes in the ground, abandoned nests and banksia for foraging are all present on-site	Included	Habitat components on site
Chalinolobus dwyeri Large-eared Pied Bat	Vulnerable	Vulnerable	None	Very High Sensitivity to Potential Gain	Cliffs Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels	Included	Habitat components on site

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on site	Included or excluded	Reason for inclusion or exclusion
Corunastylis sp. Charmhaven	Critically Endangered	Critically Endangered	Only known from the Gorokan - Charmhaven area	High Sensitivity to Potential Gain	It occurs within low woodland to heathland with a shrubby understorey and ground layer. Dominants include Black She-oak (*Allocasuarina littoralis*), Prickly Tea-tree (*Leptospermum juniperinum*), Prickly-leaved Paperbark (*Melaleuca nodosa*) and Narrow-leaved Bottlebrush (*Callistemon linearis*). These features are present on-site	Included	Habitat components on site
Crinia tinnula Wallum Froglet	Vulnerable	Not Listed	None	Moderate Sensitivity to Potential Gain	Sedgelands and wet heathlands presence on-site	Included	Habitat components on site
Cryptostylis hunteriana Leafless Tongue Orchid	Vulnerable	Vulnerable	None	Moderate Sensitivity to Potential Gain	Populations have been recorded in woodland dominated by Scribbly Gum (*Eucalyptus haemastoma*), Brown Stringybark (*Eucalyptus capitellata*), Red Bloodwood (*Corymbia gummifera*) and also associated with Large Tongue Orchid (*C. subulata*), These features all occur on-site	Included	Habitat components on site
Cynanchum elegans White-flowered Wax Plant	Endangered	Endangered	None	High Sensitivity to Potential Gain		Included	Habitat components on site
Darwinia glaucophylla	Vulnerable	Not Listed	None	Moderate Sensitivity to Potential Gain	Rocky areas rocky platforms or within 100m	Included	Habitat components on site
Diuris bracteata	Endangered (Presumed extinct)	Presumed extinct	None	High Sensitivity to Potential Gain	Specific habitat requirements unknown	Included	Habitat components on site
Diuris praecox Rough Doubletail	Vulnerable	Vulnerable	None	Moderate Sensitivity to Potential Gain	Grows on hills and slopes of near-coastal districts in open forests which have a grassy to dense understory	Included	Habitat components on site

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on site	Included or excluded	Reason for inclusion or exclusion
Eucalyptus camfieldii *Camfield's Stringybark*	Vulnerable	Vulnerable	None	High Sensitivity to Potential Gain	Associated species *E. capitellata* Brown Stringybark and *E. haemastoma* Scribbly Gum are present on-site in addition to shallow sandy soils overlying Hawkesbury sandstone	Included	Habitat components on site
Eucalyptus oblonga - endangered population	Endangered Population	Not Listed	None	High Sensitivity to Potential Gain	None	Excluded	Site not at Bateau Bay, Forresters Beach or Tumbi Umbi thus individuals found cannot be part of the listed 'Endangered Population.'
Eucalyptus parramattensis subsp. decadens	Vulnerable	Vulnerable	Northern section of sub-region, associated with poorly drained sand deposits within 10kms radius of Kurri Kurri	High Sensitivity to Potential Gain	It occurs in dry sclerophyll woodland with dry heath understory which is present on-site	Included	Habitat components on site
Eucalyptus parramattensis subsp. parramattensis - endangered population	Endangered Population	Not Listed	None	High Sensitivity to Potential Gain	The endangered population occurs on sandy alluvium within a floodplain community which also supports *Eucalyptus robusta* (Swamp mahogany), *E. tereticornis* (Forest Red Gum), *E. gummifera* (Sydney Bloodwood) as well as Melaleuca (Paperbark) species. These features are present on-site	Included	Habitat components on site
Genoplesium insignis Variable Midge Orchid	Critically Endangered	Critically Endangered	None	High Sensitivity to Potential Gain	Appears to be associated with PCT 1636 Scribbly Gum – Red Bloodwood – *Angophora inopina* which is present on-site	Included	Habitat components on site

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on site	Included or excluded	Reason for inclusion or exclusion
Grevillea parviflora subsp. parviflora Small-flower Grevillea	Vulnerable	Vulnerable	None	High Sensitivity to Potential Gain	Shrubby woodland and open forest including *Corymbia maculata Angophora costata* open forest	Included	Habitat components on site
Haliaeetus leucogaster White-bellied Sea-Eagle (Breeding)	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines	Included	Habitat components on site
Hibbertia procumbens Spreading Guinea Flower	Endangered	Not Listed	West of Morisset	High Sensitivity to Potential Gain	None	Excluded	Site not west of Morisset
Hieraaetus morphnoides Little Eagle (Breeding)	Vulnerable	Not Listed	None	Moderate Sensitivity to Potential Gain	Nest trees - live (occasionally dead) large old trees within vegetation)	Included	Habitat components on site
Hoplocephalus bitorquatus Pale-headed Snake	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Hollow-bearing trees Dry eucalypt forest Loose bark Logs and dead branches	Included	Habitat components on site
Lathamus discolor Swift Parrot (Breeding)	Endangered	Critically Endangered	None	Moderate Sensitivity to Potential Gain	Flowering Swamp Mahogany was located on-site which is known to be suitable foraging habitat for Regent Honeyeaters	Included	Habitat components on site
Limicola falcinellus Broad-billed Sandpiper (Breeding)	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	None	Excluded	Habitat components not on site

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on site	Included or excluded	Reason for inclusion or exclusion
Limosa limosa Black-tailed Godwit (Breeding)	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	None	Excluded	Habitat components not on site
Litoria aurea Green and Golden Bell Frog	Endangered	Vulnerable	None	High Sensitivity to Potential Gain	Semi-permanent/ephemeral wet areas Within 1km of wet areas/Swamps Within 1km of swamp/Waterbodies Within 1km of waterbody	Included	Habitat components on site
Litoria brevipalmata Green-thighed Frog	Vulnerable	Not Listed	None	Moderate Sensitivity to Potential Gain	Eucalypt forest, heath, temporary pools and flooded areas occur on-site	Included	Habitat components on site
Litoria littlejohni Littlejohn's Tree Frog	Vulnerable	Vulnerable	None	High Sensitivity to Potential Gain	Wet and dry sclerophyll forest present on-site with dams and semi-permanent water	Included	Habitat components on site
Lophoictinia isura Square-tailed Kite (Breeding)	Vulnerable	Not Listed	None	Moderate Sensitivity to Potential Gain	Nest trees	Included	Habitat components on site
Maundia triglochinoides	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Riparian areas/drainage lines, water ponding, man-made dams and drainage channels up to 1 m deep/Semi-permanent/ephemeral wet areas/Swamps Shallow swamps up to 1 m deep/Waterbodies Shallow waterbodies up to 1 m deep	Included	Habitat components on site
Melaleuca biconvexa Biconvex Paperbark	Vulnerable	Vulnerable	None	High Sensitivity to Potential Gain	Grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. These habitat components are available on-site	Included	Habitat components on site

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on site	Included or excluded	Reason for inclusion or exclusion
Melaleuca groveana Grove's Paperbark	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Dry shrubby open forest and woodland	Included	Habitat components on site
Miniopterus australis Little Bent-winged Bat (Breeding)	Vulnerable	Not Listed	None	Very High Sensitivity to Potential Gain	Caves Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave' observation type code 'E nest-roost' with numbers of individuals >500 or from the scientific literature	Included	Habitat components on site
Miniopterus orianae oceanensis Large Bent-winged Bat (Breeding)	Vulnerable	Not Listed	None	Very High Sensitivity to Potential Gain	Caves Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave " observation type code "E nest-roost " with numbers of individuals >500	Included	Habitat components on site
Mixophyes iteratus Giant Barred Frog	Endangered	Endangered	None	Moderate Sensitivity to Potential Gain	Land within 50 m of semi-permanent and permanent drainages	Included	Habitat components on site
Myotis macropus Southern Myotis	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Hollow bearing trees Within 200 m of riparian zone/Other Bridges, caves or artificial structures within 200 m of riparian zone/Waterbodies This include rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200 m of the site	Included	Habitat components on site

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on site	Included or excluded	Reason for inclusion or exclusion
Nettapus coromandelianus Cotton Pygmy-Goose		Not Listed	None	Moderate Sensitivity to Potential Gain	Waterbodies Deep permanent fresh waters on floodplains with floating and submergent vegetation	Included	Habitat components on site
Ninox strenua Powerful Owl (Breeding)	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Hollow bearing trees Living or dead trees with hollow greater than 20 cm diameter	Included	Habitat components on site
Pandion cristatus Eastern Osprey (Breeding)	Vulnerable	Not Listed	None	Moderate Sensitivity to Potential Gain	Presence of stick-nests in living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting)	Included	Habitat components on site
Persicaria elatior Tall Knotweed	Vulnerable	Vulnerable	None	High Sensitivity to Potential Gain	Semi-permanent/ephemeral wet areas or within 50 m/Swamps or within 50 m/Waterbodies including Wetlands, or within 50 m	Included	Habitat components on site
Petalura gigantea Giant Dragonfly	Endangered	Not Listed	None	Very High Sensitivity to Potential Gain	None	Excluded	Habitat components not on site
Petaurus norfolcensis Squirrel Glider	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Hollow-bearing trees Eucalypt woodland	Included	Habitat components on site
Phascogale tapoatafa Brush-tailed Phascogale	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Hollow bearing trees	Included	Habitat components on site
Phascolarctos cinereus Koala	Vulnerable	Vulnerable	None	High Sensitivity to Potential Gain	Areas identified via survey as important habitat (see comments))	Included	Habitat components on site

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on site	Included or excluded	Reason for inclusion or exclusion
(Breeding)							
Planigale maculata Common Planigale	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Hollow logs, rocks, bark and eucalypt forest	Included	Habitat components on site
Prostanthera askania Tranquility Mintbush	Endangered	Endangered	None	High Sensitivity to Potential Gain	Eucalypt forest Hollow-bearing trees	Included	Habitat components on site
Prostanthera junonis Somersby Mintbush	Endangered	Endangered	None	High Sensitivity to Potential Gain	None	Included	This species is restricted to the Somersby Plateau
Pseudophryne australis Red-crowned Toadlet	Vulnerable	Not Listed	None	Moderate Sensitivity to Potential Gain	Periodically wet drainage lines below sandstone ridges Rocks Dense vegetation Thick piles of leaf litter	Included	Habitat components on site
Pteropus poliocephalus Grey-headed Flying-fox (Breeding)	Vulnerable	Vulnerable	None	High Sensitivity to Potential Gain	Breeding camps	Included	Habitat components on site
Rutidosis heterogama Heath Wrinklewort	Vulnerable	Vulnerable	None	High Sensitivity to Potential Gain	Heath on sandy soils Moist areas in open forest Disturbed roadsides	Included	Habitat components on site
Senna acclinis Rainforest Cassia	Endangered	Not Listed	None	High Sensitivity to Potential Gain	Dry rainforest margins	Included	Habitat components on site

Species Credit Species	BC Act	EPBC Act	Habitat components and geographic restrictions	Sensitivity to gain class	Habitat components on site	Included or excluded	Reason for inclusion or exclusion
Tetratheca glandulosa	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	None	Included	This species is associated with shale-sandstone transition habitat where shale-cappings occur over sandstone. This does not occur on-site
Tetratheca juncea Black-eyed Susan	Vulnerable	Vulnerable	None	High Sensitivity to Potential Gain	The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape	Included	Habitat components on site
Turnix maculosus Red-backed Buttonquail	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Dense grass Sedgeland Creeks and wetlands	Included	Habitat components on site
Tyto novaehollandiae Masked Owl (Breeding)	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	Hollow bearing trees Living or dead trees with hollows greater than 20cm diameter	Included	Habitat components on site
Uperoleia mahonyi Mahony's Toadlet	Endangered	Not Listed	None	High Sensitivity to Potential Gain	Dams Creeks Acid paperbark swamps	Included	Habitat components on site
Xenus cinereus Terek Sandpiper (Breeding)	Vulnerable	Not Listed	None	High Sensitivity to Potential Gain	None	Excluded	Habitat components not on site
Zannichellia palustris	Endangered	Not Listed	None	High Sensitivity to Potential Gain	Waterbodies Freshwater or slightly brackish estuarine areas (10%))	Included	Habitat components on site

4.3.1 Exclusions based on Habitat

The following species were excluded from assessment due to an absence of habitat components on site:

- *Calidris ferruginea* (Curlew Sandpiper): No intertidal mudflat present within the Study Area;
- *Calidris tenuirostris* (Great Knot): No intertidal mudflat present within the Study Area;
- *Eucalyptus oblonga*: Study Area not at Bateau Bay, Forresters Beach or Tumbi Umbi;
- *Hibbertia procumbens* (Spreading Guinea Flower): Study Area not west of Morisset;
- *Limicola falcinellus* (Broad-billed Sandpiper): No intertidal mudflat present within the Study Area;
- *Limosa limosa* (Black-tailed Godwit): No intertidal mudflat present within the Study Area;
- *Petalura gigantea* (Giant Dragonfly): There are no swamps within 500 m of the Study Area; and
- *Petrogale penicillata* (Brush-tailed Rock-wallaby): Land was outside the required 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliff lines.

4.3.2 Candidate species requiring confirmation of presence or absence

Table 16 Summary of species credit species surveyed within the Study Area

Species Credit Species	Biodiversity risk weighting	Survey Time	Assumed to occur/survey /expert report	Present on site?	Species polygon area or count
Acacia bynoeana Bynoe's Wattle	High	September to February	Surveyed in January 2019	Yes	Count: 36 (**Figure 6**)
Angophora inopina Charmhaven Apple	High	Year-round	Surveyed in January 2019	Yes	Count: 24 (**Figure 7**)
Anthochaera phrygia Regent Honeyeater (Breeding)	Very High	September to December	Surveyed in September 2019	No	Area
Astrotricha crassifolia Thick-leaf Star-hair	Very High	Year-round	Surveyed in January 2019	No	Area
Burhinus grallarius Bush Stone-curlew	High	Year-round	Surveyed in January 2019	No	Area
Caladenia tessellata Thick Lip Spider Orchid	Very High	No BAM specified survey timing	Surveyed in October 2019	No	Area
Calidris ferruginea Curlew Sandpiper (Breeding)	Very High	No BAM specified survey timing	Surveyed in January 2019	No	Area
Calidris tenuirostris Great Knot (Breeding)	Very High	September to March	Surveyed in January 2019	No	Area
Callistemon linearifolius Netted Bottle Brush	Moderate	September to March	Surveyed in January 2019	No	Area

Species Credit Species	Biodiversity risk weighting	Survey Time	Assumed to occur/survey /expert report	Present on site?	Species polygon area or count
Callocephalon fimbriatum Gang-gang Cockatoo (Breeding)	High	October to January	Surveyed in January and October 2019	No	Area
Calyptorhynchus lathami Glossy Black-Cockatoo (Breeding)	High	March to August	Surveyed in June 2019	Yes	Area (**Figure 13**)
Cercartetus nanus Eastern Pygmy-possum	High	October to March	Surveyed in October 2019	No	Area
Chalinolobus dwyeri Large-eared Pied Bat	Very High	September to March	Surveyed in January 2019	No	Area
Corunastylis sp. Charmhaven	Very High	November to January	Surveyed in January 2019	No	Area
Corybas dowlingii Red-hooded Orchid	High	June - July	Surveyed in June 2019	Yes	Count (modelled): 327,954 (**Figure 8**)
Crinia tinnula Wallum Froglet	Moderate	Year-round	Surveyed in June 2019	No	Area
Cryptostylis hunteriana Leafless Tongue Orchid	Moderate	November to February	Surveyed in January 2019	No	Area
Cynanchum elegans White-flowered Wax Plant	High	Year-round	Surveyed in January 2019	No	Area
Darwinia glaucophylla	Moderate	Year-round	Surveyed in January 2019	No	Area
Diuris bracteata	Very High	August to December	Surveyed in August 2019	No	Area
Diuris praecox Rough Doubletail	Moderate	July to August	Surveyed in August 2019	No	Area
Eucalyptus camfieldii *Camfield's Stringybark*	High	Year-round	Surveyed in June 2019	No	Count
Eucalyptus oblonga - endangered population	High	Year-round	Surveyed in June 2019	No	Count
Eucalyptus parramattensis subsp. decadens	High	Year-round	Surveyed in June 2019	No	Count
Eucalyptus parramattensis subsp. parramattensis - endangered population	High	Year-round	Surveyed in June 2019	No	Area
Genoplesium insigne Variable Midge Orchid	Very High	September to October	Surveyed in October 2019	Yes	Count: 88 (**Figure 9**)
Grevillea parviflora subsp. parviflora Small-flower Grevillea	High	Year-round	Surveyed in January 2019	Yes	Count: 4,273 (**Figure 10**)

Species Credit Species	Biodiversity risk weighting	Survey Time	Assumed to occur/survey /expert report	Present on site?	Species polygon area or count
Haliaeetus leucogaster White-bellied Sea-Eagle (Breeding)	High	July to December	Surveyed in August 2019	Yes	Area (Figure 15)
Hibbertia procumbens Spreading Guinea Flower	High	December to March	Surveyed in January 2019	No	Area
Hieraaetus morphnoides Little Eagle (Breeding)	Moderate	August to October	Surveyed in August 2019	No	Area
Hoplocephalus bitorquatus Pale-headed Snake	High	November to March	Surveyed in January 2019	No	Area
Hoplocephalus stephensii Stephens banded Snake	High	October to March	Surveyed January and October 2019		Area **(Figure 17**)
Lathamus discolor Swift Parrot (Breeding)	Very High	May to August	Surveyed in June 2019	No	Area
Limicola falcinellus Broad-billed Sandpiper (Breeding)	High	November to February	Surveyed in January 2019	No	Area
Limosa limosa Black-tailed Godwit (Breeding)	High	November to March	Surveyed in January 2019	No	Area
Litoria aurea Green and Golden Bell Frog	High	November to March	Surveyed in January 2019	No	Area
Litoria brevipalmata Green-thighed Frog	Moderate	October to March	Not surveyed	Yes (assumed)	Area (**Figure 12**)
Litoria littlejohni Littlejohn's Tree Frog	High	July to November	Surveyed in October 2019	No	Area
Lophoictinia isura Square-tailed Kite (Breeding)	Moderate	September to January	Surveyed in October 2019	No	Area
Maundia triglochinoides	High	November to March	Surveyed in January 2019	No	Area
Melaleuca biconvexa Biconvex Paperbark	High	Year-round	Surveyed in June 2019	No	Count
Melaleuca groveana Grove's Paperbark	High	Year-round	Surveyed in June 2019	No	Count
Miniopterus australis Little Bent-winged Bat (Breeding)	Very High	December to February	Surveyed in January 2019	Yes	Area (**Figure 18**)

Species Credit Species	Biodiversity risk weighting	Survey Time	Assumed to occur/survey /expert report	Present on site?	Species polygon area or count
Miniopterus orianae oceanensis Large Bent-winged Bat (Breeding)	Very High	November to February	Surveyed in January 2019	Yes	Area (**Figure 19**)
Mixophyes iteratus Giant Barred Frog	High	October to March	Surveyed in January 2019	No	Area
Myotis macropus Southern Myotis	High	November to March	Surveyed in January 2019	No	Area
Nettapus coromandelianus Cotton Pygmy-Goose	High	Year-round	Surveyed in June 2019	No	Area
Ninox strenua Powerful Owl (Breeding)	High	May to August	Surveyed in June 2019	Yes	Area (**Figure 14**)
Pandion cristatus Eastern Osprey (Breeding)	Moderate	April to November	Surveyed in June 2019	Yes, however, no optimal breeding habitat is present.	Area
Persicaria elatior Tall Knotweed	High	December to May	Surveyed in January 2019	No	Area
Petalura gigantea Giant Dragonfly	Very High	December to January	Surveyed in January 2019	No	Area
Petaurus norfolcensis Squirrel Glider	High	Year-round	Surveyed in October 2019	Yes	Area (**Figure 16**)
Phascogale tapoatafa Brush-tailed Phascogale	High	Year-round	Surveyed in August 2019	No	Area
Phascolarctos cinereus Koala (Breeding)	High	Year-round	Surveyed in October 2019	No	Area
Planigale maculata Common Planigale	High	Year-round	Surveyed in October 2019	No	Area
Prostanthera askania Tranquility Mintbush	High	September to December	Surveyed in October 2019	No	Area
Prostanthera junonis Somersby Mintbush	High	September to November	Surveyed in October 2019	No	Area
Pseudophryne australis Red-crowned Toadlet	Moderate	Year-round	Surveyed in January 2019	No	Area
Pteropus poliocephalus Grey-headed Flying-fox (Breeding)	High	October to December	Surveyed in October 2019	Yes	Area
Rutidosis heterogama Heath Wrinklewort	High	Year-round	Surveyed in January 2019	No	Area

Species Credit Species	Biodiversity risk weighting	Survey Time	Assumed to occur/survey /expert report	Present on site?	Species polygon area or count
Senna acclinis Rainforest Cassia	High	Year-round	Surveyed in January, June and October 2019	No	Count
Tetratheca glandulosa	High	August to November	Surveyed in October 2019	No	Area
Tetratheca juncea Black-eyed Susan	High	September to October	Surveyed in October 2018	Yes	Count (modelled): 47,910 (**Figure 11**)
Turnix maculosus Red-backed Buttonquail	High	Year-round	Surveyed in October 2019		Area
Tyto novaehollandiae Masked Owl (Breeding)	High	May to August	Surveyed in June 2019	Yes	Area
Uperoleia mahonyi Mahony's Toadlet	High	January to March	Surveyed in January 2019	No	Area
Xenus cinereus Terek Sandpiper (Breeding)	High	Year-round	Surveyed in January 2019	No	Area
Zannichellia palustris	High	October to January	Surveyed in June 2019	No	Area

4.3.3 Modelling Green-thighed Frog Distribution

As there was no rainfall event in the appropriate season (October 2018 – January 2019; DPIE 2019) that reached the calling trigger for the Green-thighed Frog (i.e. >75 mm in a 24 hour period or >150 mm in 72 hours; DPIE 2019; BOM 2019), no adequate presence or absence surveys could be conducted for this species. As such, for the purpose of the BIR, it was assumed that this species would be present within PCTs it is known to associate with.

For this frog species, the definition of suitable habitat was provided for a transmission line upgrade project (SSD-5144 Mod 7) at Mandalong, NSW (approximately 8 km southwest of the Project Application Area) by Dr Michael Mahony (2018), an expert for the Green-thighed Frog formally recognised by NSW DPIE for this project. Mahony's definition stated:

"In the southern part of its range, Green-thighed Frogs usually breed in water bodies that are located within or near areas of wetter forest types. These sites are usually depressions with a leafy/shrubby substrate (Lemckert et. al., 2006; Ledlin 1997), and adjacent to forests the pools may be in open flooded areas with sedges and tussock grasses. The breeding sites are predominantly ephemeral pools (35 of 37 sites {95%} of the sites studied by Lemckert et. al., 2006) partly or wholly within rainforest or wet sclerophyll forest (26 out of 31 sites = 84%) (Lemckert et. al., 2006). There are two records of calling from around permanent, artificial ponds and three records wholly within dry sclerophyll forest, one from swamp forest behind a beach (around 100 m from the sea) and another from coastal forest. The two records from permanent water bodies are associated with dry forests (Murphy and Turbill 1999)."

Based on these known habitat requirements for the Green-thighed Frog within the Central Coast/Hunter region, Mahony (2018) assessed the suitability of major vegetation communities within the LMCC as habitat for the Green-thighed Frog. **Table 17** summarises the finding of his assessment and relates this to the areas of potential Green-thighed Frog habitat within the Study Area.

Table 17 Suitability of major vegetation communities for *L. brevipalmata* breeding (adopted from Mahony 2018)

Community	MU	Equivalent PCT1	Suitable *L. brevipalmata* habitat	Suitable Habitat in Project Area (ha)
Alluvial Tall Moist Forest	5	1568	Yes	0
Buttonderry Footslopes Forest	30a	1619	No	0
Coastal Foothills Spotted Gum - Ironbark Forest	15	1588	Yes	30.23
Coastal Plains Scribbly Gum Woodland	31	1636	No	0
Coastal Wet Gully Forest	1	1573	Yes	0
Hinterland Spotted Gum - Red Ironbark Forest	17o	1590	Yes	0
Hunter Valley Moist Spotted Gum - Ironbark Forest	12c	1588	Yes	As above
Jilliby Spotted Gum-Ferguson's Ironbark-Mahogany Forest	15n	1588	Yes	As above

1 MUs were converted to PCTs in accordance with Bell (2016).

In addition to PCT 1588, habitat suitability for the Green-thighed Frog was also considered for PCTs within the Study Area that were not assessed by Mahony (2018). PCTs 1638, 1627, 1716, 1718 and 1737 were also considered to provide potential habitat for the Green-thighed Frog within the Study Area.

As such, Green-thighed Frog habitat is assumed to encompass PCT 1588 (as identified by Mahony 2018; **Table 17**), as well as PCTs 1638, 1627, 1716, 1718 and 1737. In total, the potential habitat for the Green-thighed Frog was determined to be 206.86 ha. A species polygon encompassing this potential Green-thighed Frog habitat is presented in **Figure 12**.

Habitat assessment for the Green-thighed Frog was deliberately conservative by over-representing the occurrence of potential habitat use by the Green-thighed Frog, as this species is rare, and its distribution is highly heterogenous in the Central Coast/Hunter Regions (Mahony 2018).

4.3.4 Modelling *Tetratheca juncea* Distribution

Rather than individually marking all clumps of *Tetratheca juncea* (Black-eyed Susan), the distribution of this species across the Study Area was predicted based on the well-established ecology of this species.

The distribution of *T. juncea* was predicted by firstly identifying the PCTs present within the Study Area that this species is known to occur. The vegetation communities offering suitable habitat for *T. juncea* within the Study Area were adopted from Driscoll (2003), which analysed 400 records of *T. juncea* across the Lower Hunter and Central Coast. In total, Driscoll (2003) identified 16 vegetation communities that this species may associate with in this region – six of which were found to occur within the Study Area. To

allow consistency with the BAM, the vegetation mapping units identified by Driscoll (2003) as suitable *T. juncea* habitat were converted to PCTs in accordance with Bell (2016a).

The number of clumps within the Study Area was then predicted by multiplying the area of suitable habitat for *T. juncea* by the median density of this species. The median density of *T. juncea* clumps was adopted from Driscoll (2013), who studied the density of *T. juncea* across 12 locations on the Central Coast where *T. juncea* occurs at 47.83 clumps per ha.

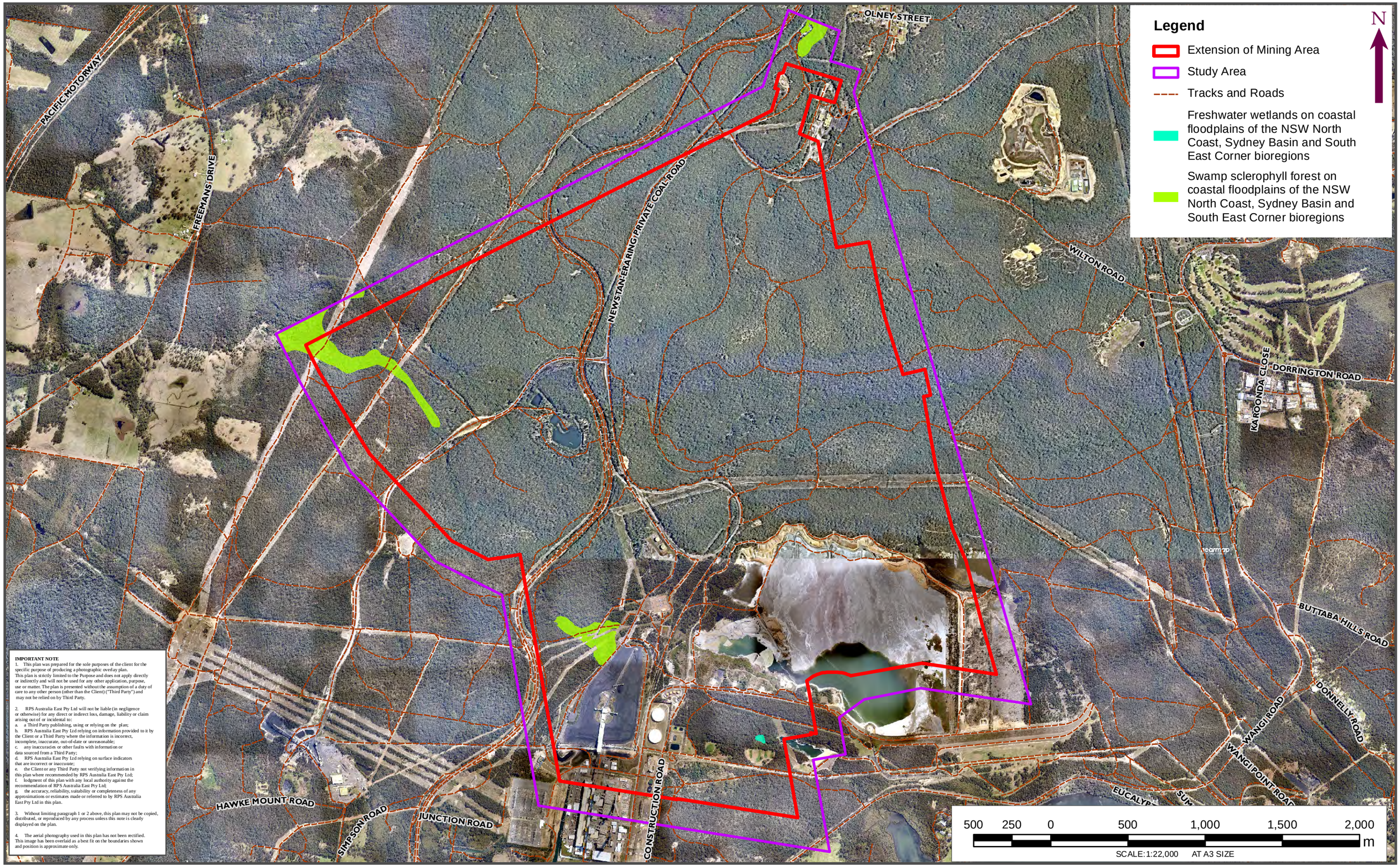
In total, it was predicted that 47,910 clumps of *T. juncea* occur in the Study Area. **Table 17** details the suitable vegetation communities present in the Study Area and predicted number of clumps present. A species polygon encompassing potential *T. juncea* habitat is presented in **Figure 11**.

Table 18 Predicted distribution and number of T. juncea clumps

PCT	BioNet listed	Area (ha)	Assumed total clumps[1]
1619	Yes	424.06	20,283
1636	Yes	418.27	20,006
1588	No	30.23	1,446
1716	No	5.00	239
1627	Yes	108.35	5,182
1718	No	15.77	754
Total		**1,001.68**	**47,910**

1. Median density of *T. juncea* clumps was adopted from Driscoll (2013).

Using this list of vegetation communities was considered a more conservative approach to assuming presence based on PCT associations listed by BioNet (DPIE 2019). For instance, PCTs 1588 and 1718 were identified as potential *T. juncea* habitat by Driscoll (2003) but are not listed as associated vegetation types in BioNet (DPIE 2019). Moreover, the median density of *T. juncea* within the Study Area is likely to be far less than that modelled here due to spatial heterogeneity of this species. For instance, it was noted that densities of *T. juncea* were far higher in riparian areas and on south-facing slopes, relative to other aspects as indicated in **Appendix A**.



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TITLE : FIGURE 5: THREATENED ECOLOGICAL COMMUNITIES

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

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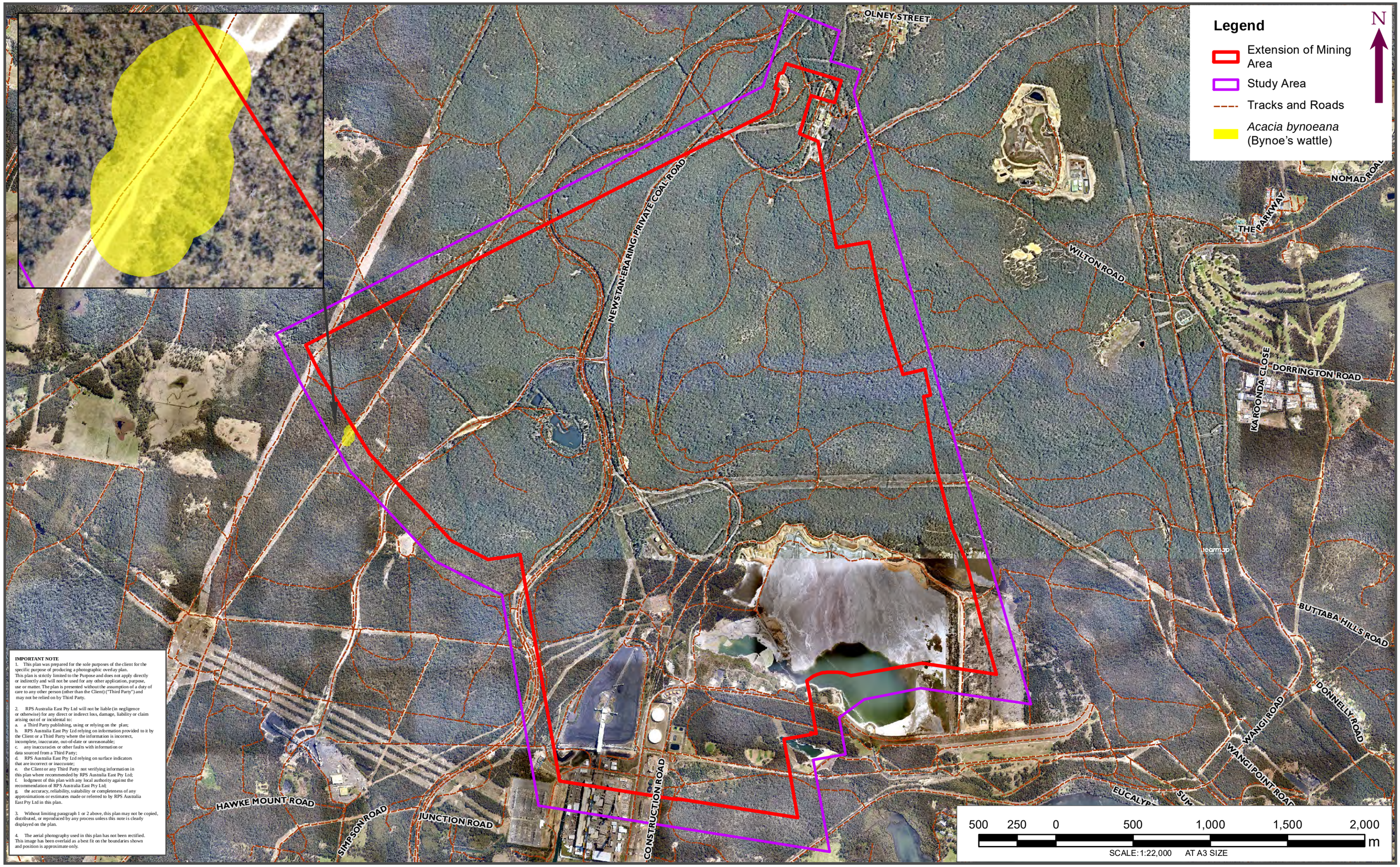
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TITLE : FIGURE 6: THREATENED SPECIES POLYGON: *ACACIA BYNOEANA* (BYNOE'S WATTLE)

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

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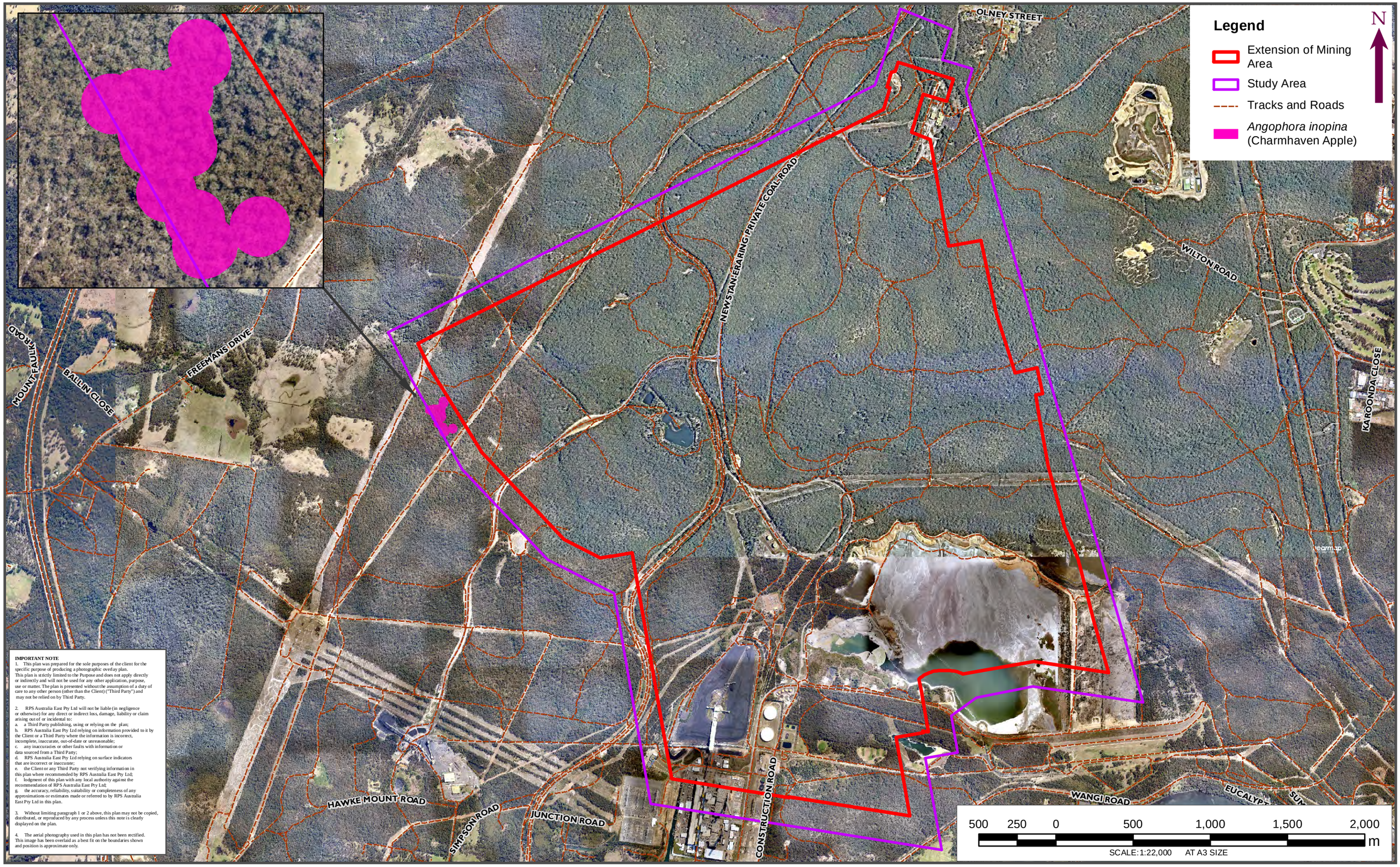
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TITLE : FIGURE 7: THREATENED SPECIES POLYGON: *ANGOPHORA INOPINA* (CHARMHAVEN APPLE)

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

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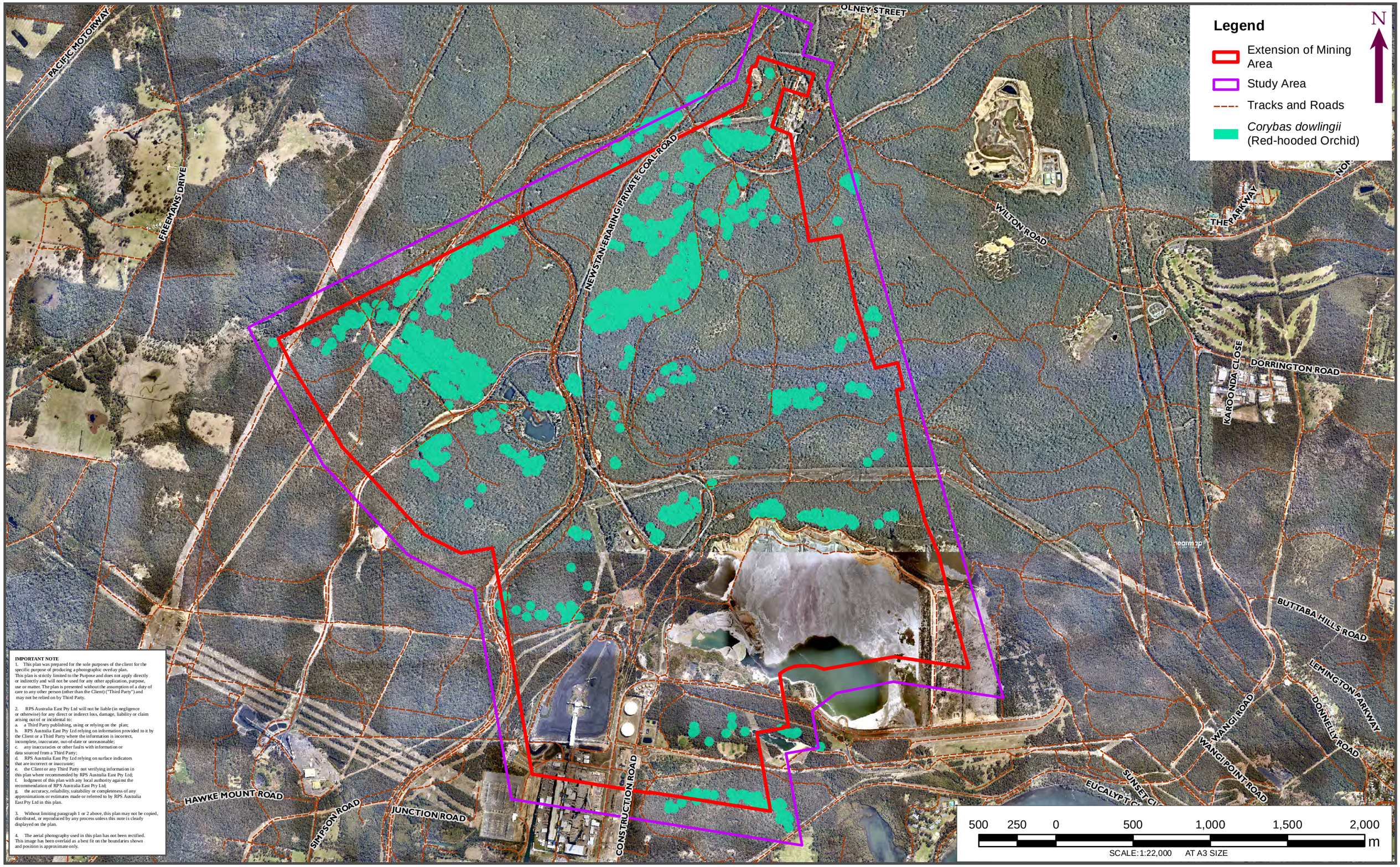
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TITLE : FIGURE 8: THREATENED SPECIES POLYGON: *CORYBAS DOWLINGII* (RED-HOODED ORCHID)

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

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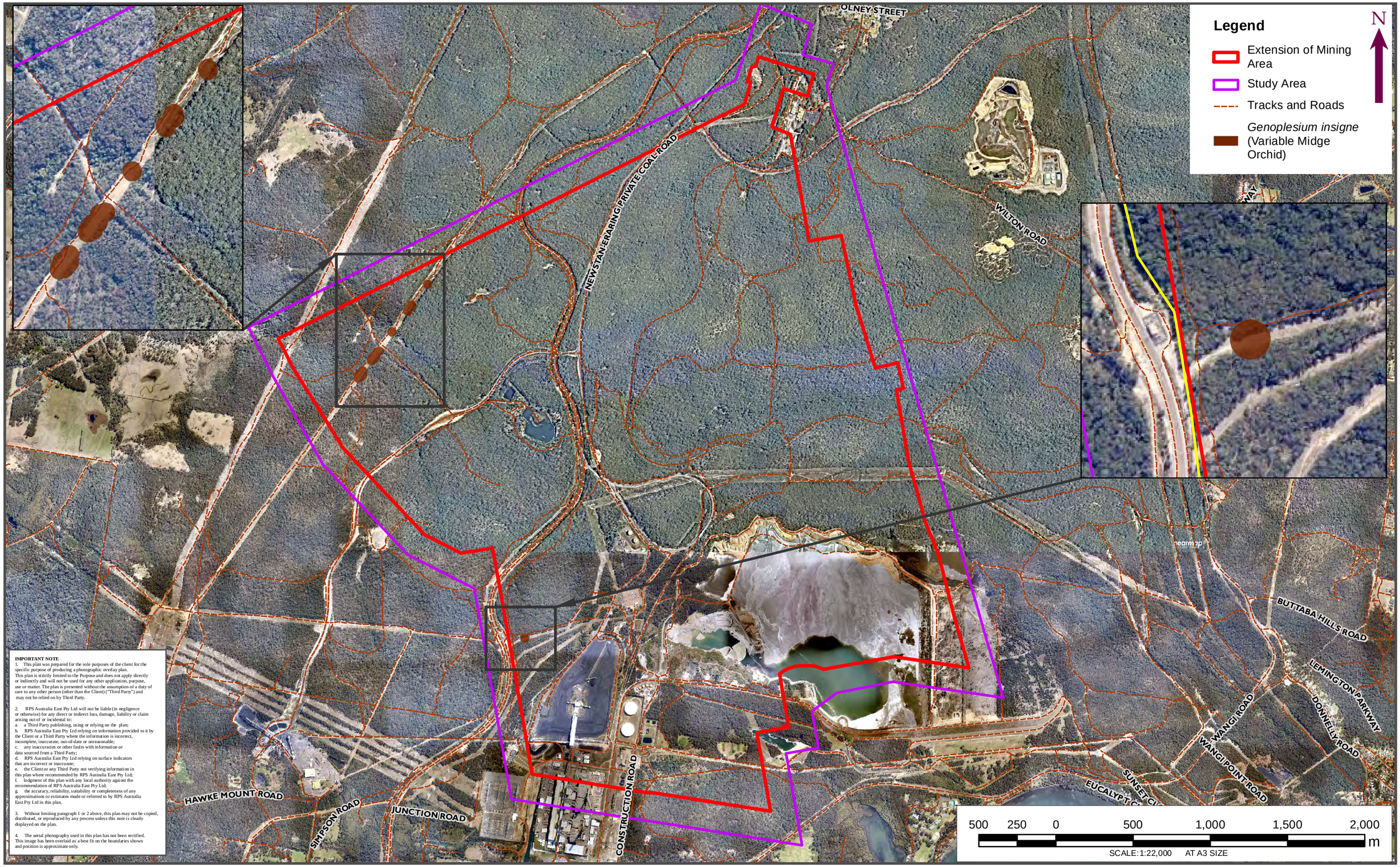
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TITLE : FIGURE 9: THREATENED SPECIES POLYGON: *GENOPLESIUM INSIGNE* (VARIABLE MIDGE ORCHID)

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

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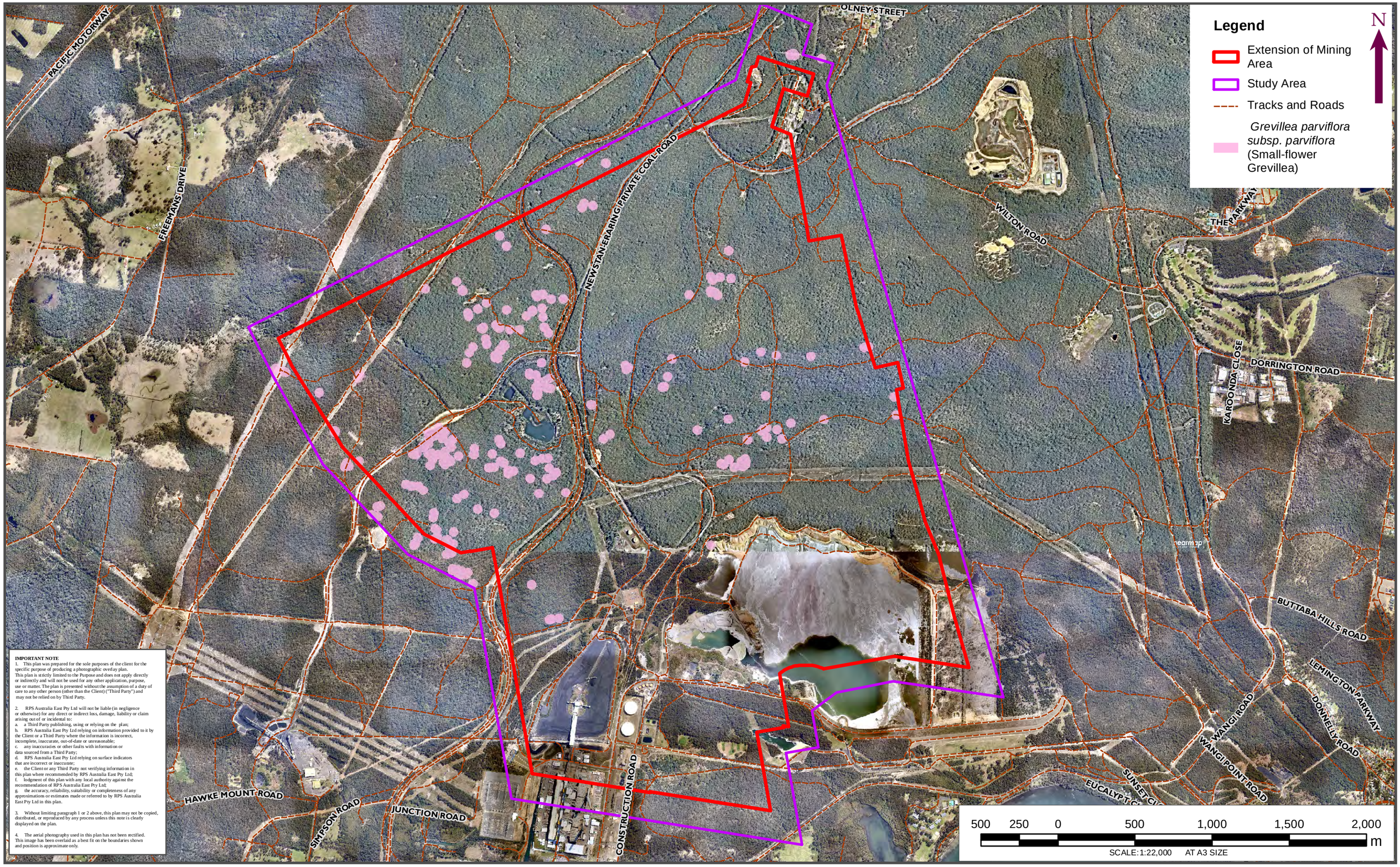
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TITLE : FIGURE 10: THREATENED SPECIES POLYGON: *GREVILLEA PARVIFLORA SUBSP. PARVIFLORA* (SMALL-FLOWER GREVILLEA)

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

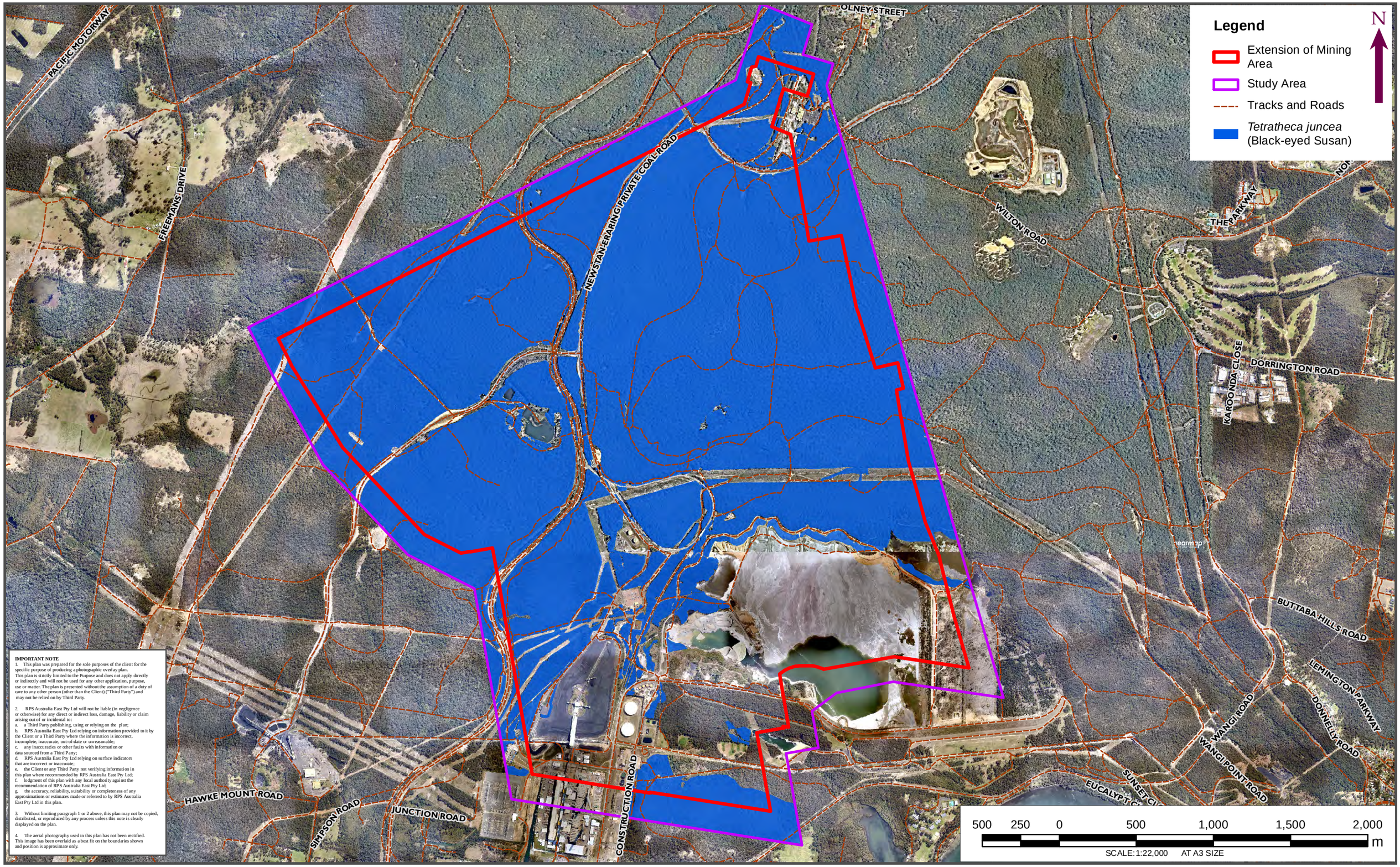
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TITLE : FIGURE 11: THREATENED SPECIES POLYGON: *TETRATHECA JUNCEA* (BLACK-EYED SUSAN)

LOCATION : NEWSTAN

DATUM: GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

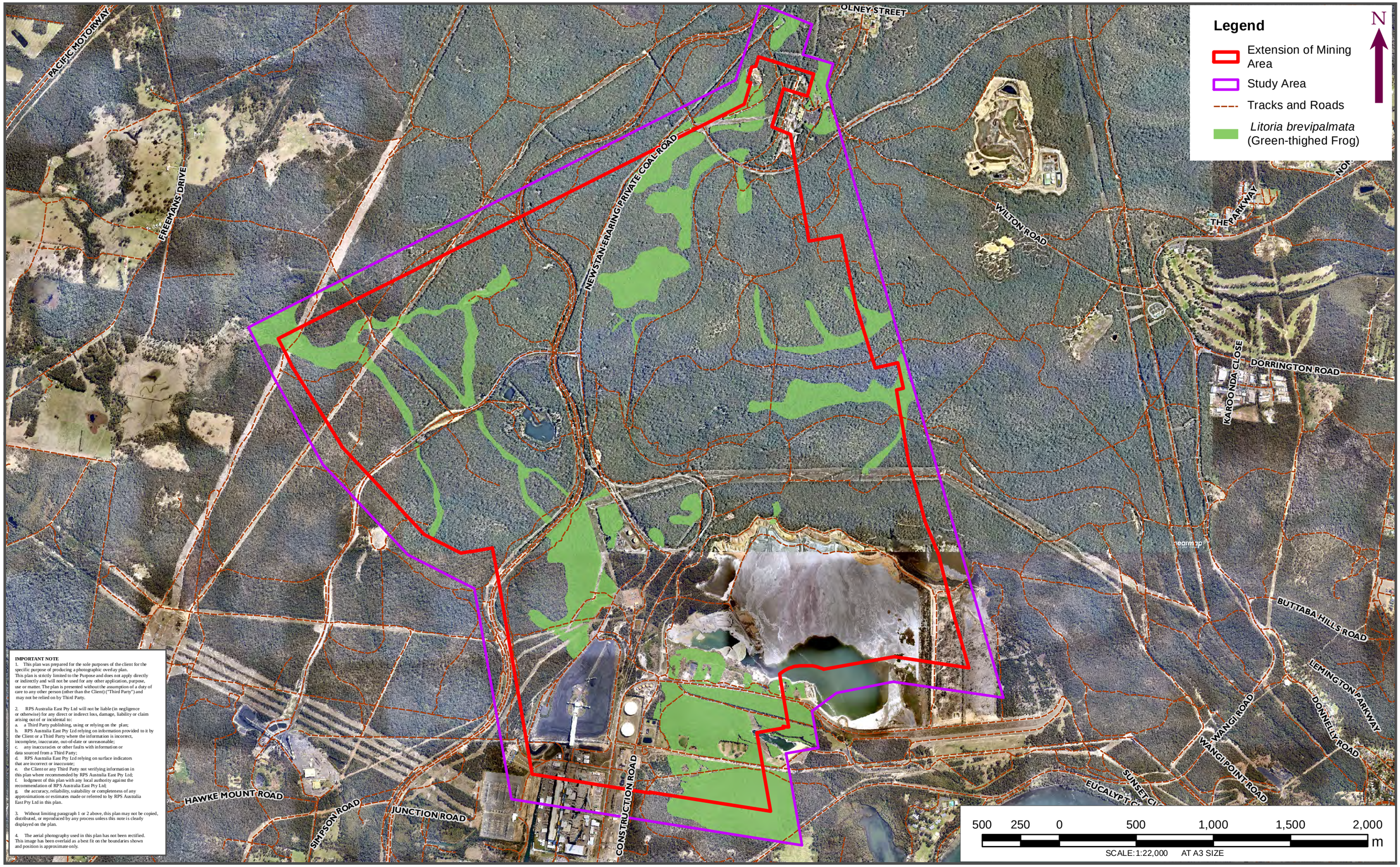
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TITLE : FIGURE 12: THREATENED SPECIES POLYGON: *LITORIA BREVIPALMATA* (GREEN-THIGHED FROG)

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

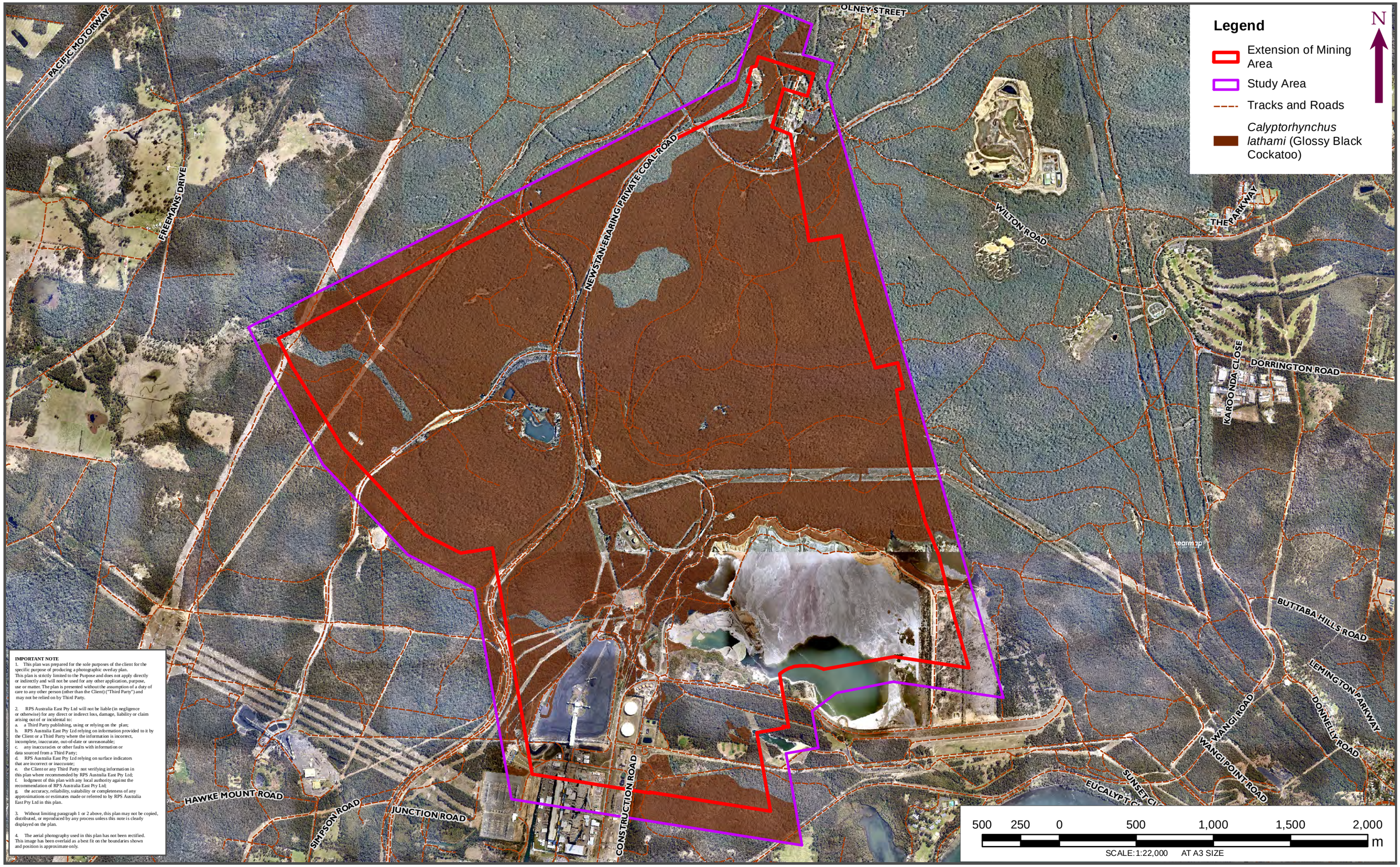
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TITLE : FIGURE 13: THREATENED SPECIES POLYGON: *CALYPTORHYNCHUS LATHAMI* (GLOSSY BLACK COCKATOO)

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

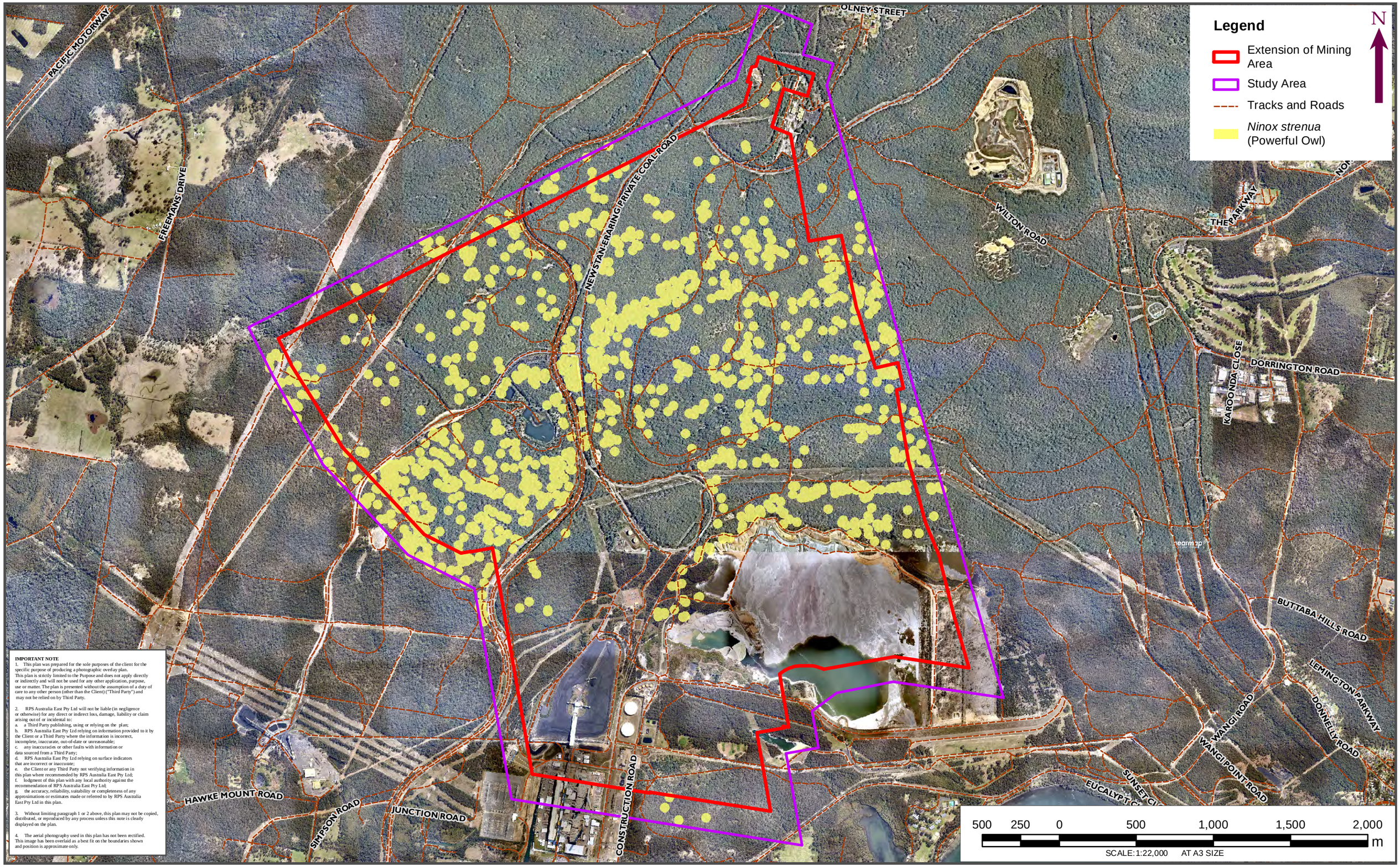
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TITLE : FIGURE 14: THREATENED SPECIES POLYGON: *NINOX STRENUA* (POWERFUL OWL)

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

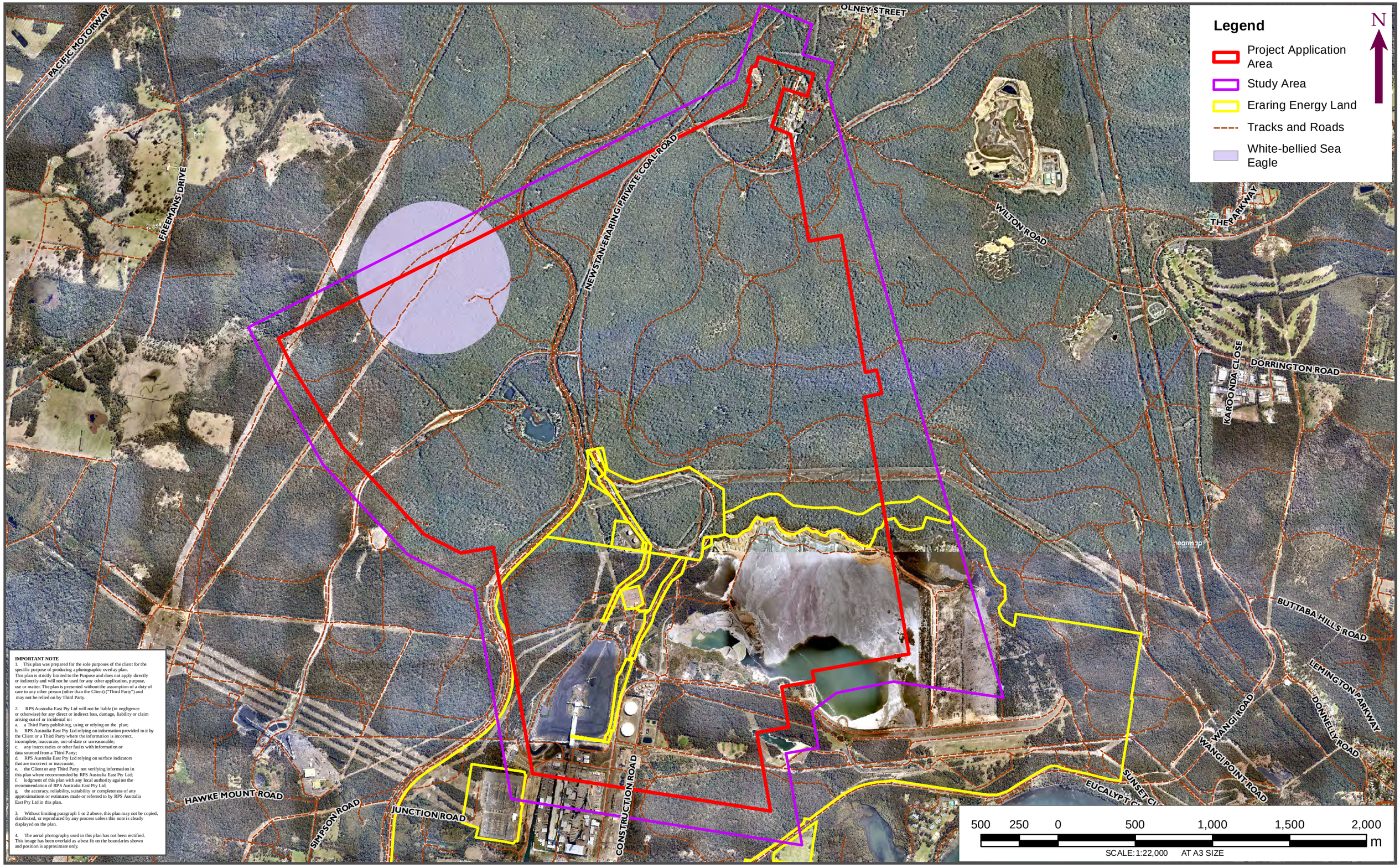
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TITLE : FIGURE 15: THREATENED SPECIES POLYGON: (WHITE-BELLIED SEA EAGLE)

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **14/11/2019**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

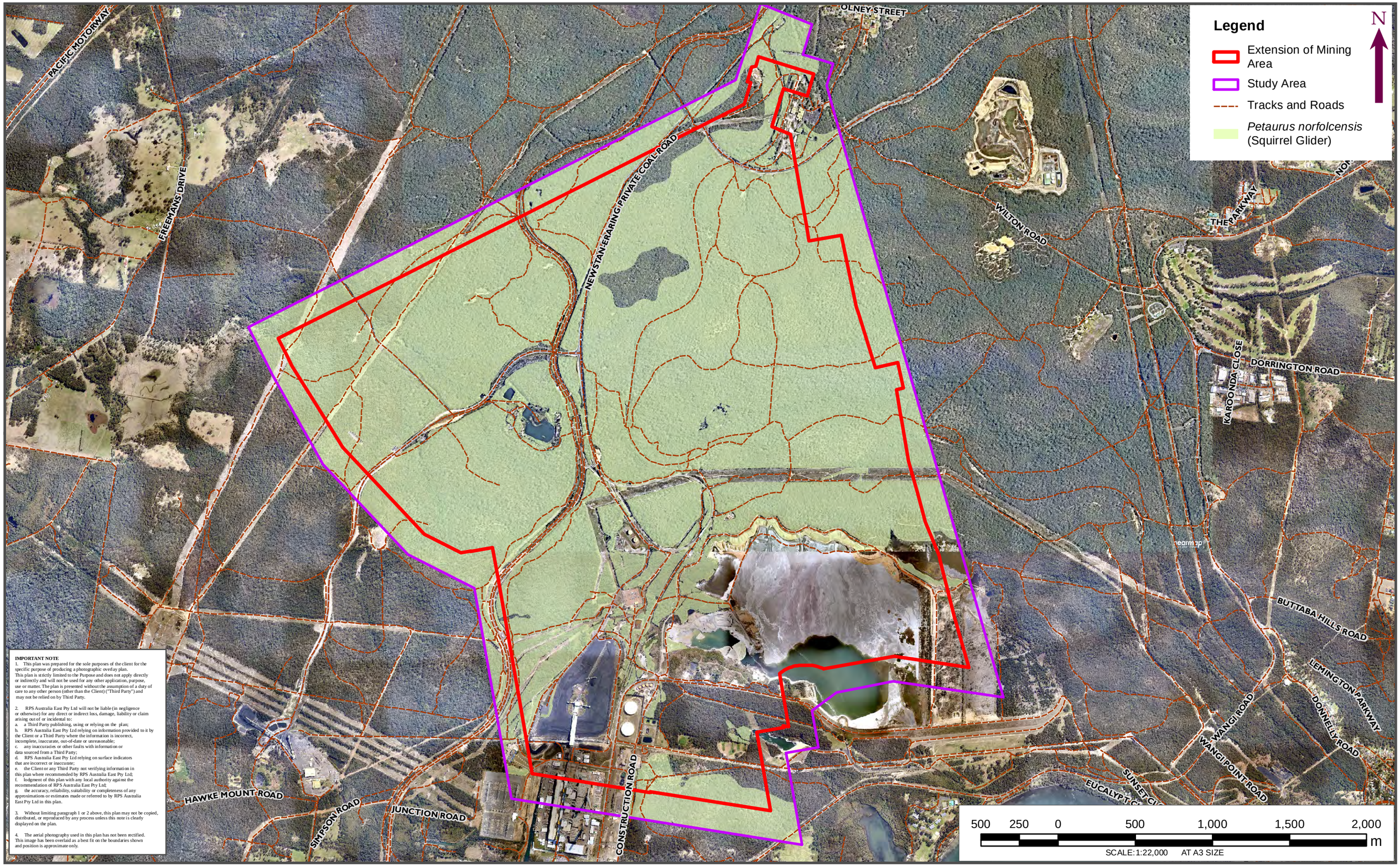
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TITLE : FIGURE 16: THREATENED SPECIES POLYGON: *PETAURUS NORFOLCENSIS* (SQUIRREL GLIDER)

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

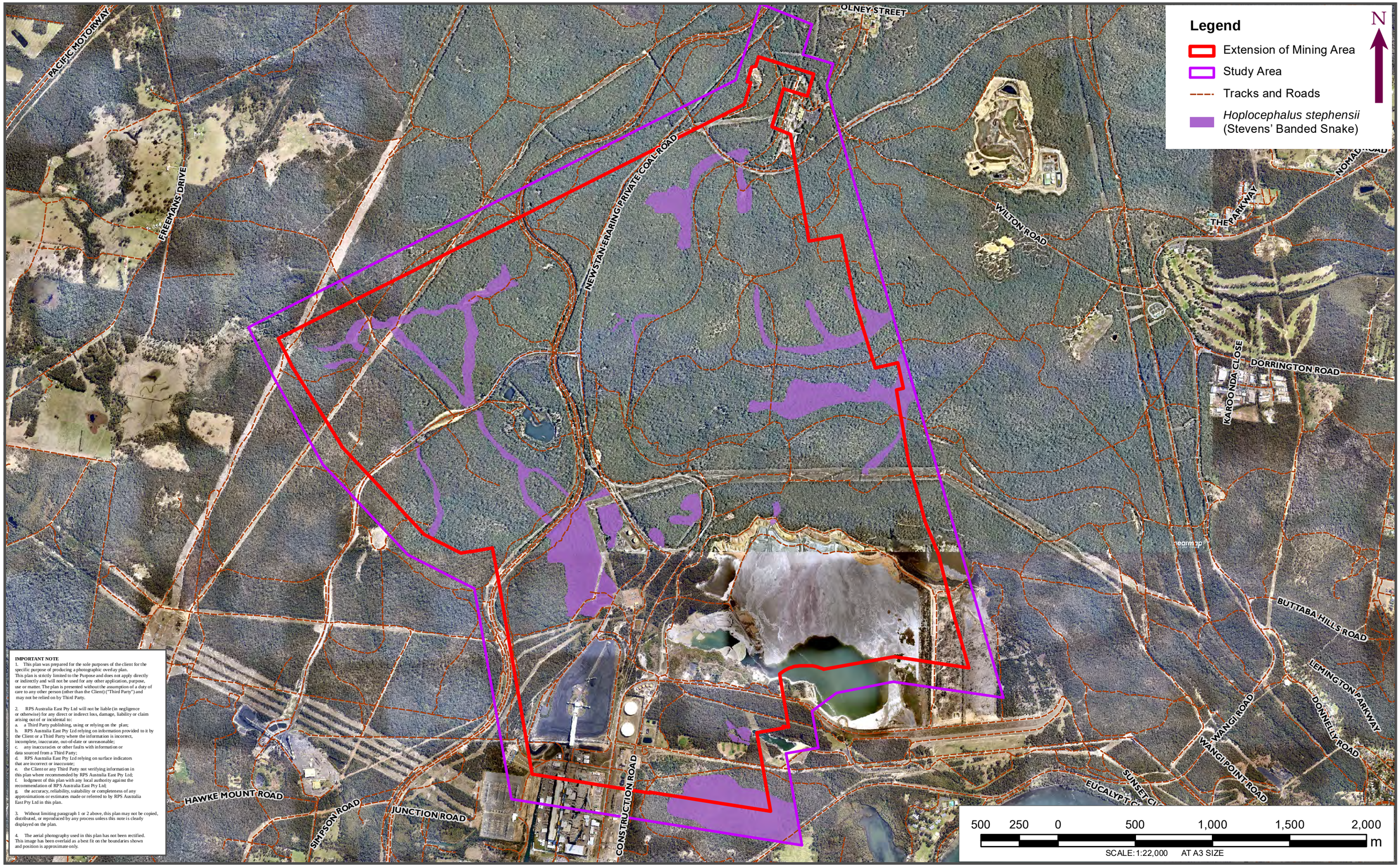
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TITLE : FIGURE 17: THREATENED SPECIES POLYGON: *HOPLOCEPHALUS STEPHENSII* (STEVENS' BANDED SNAKE)

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

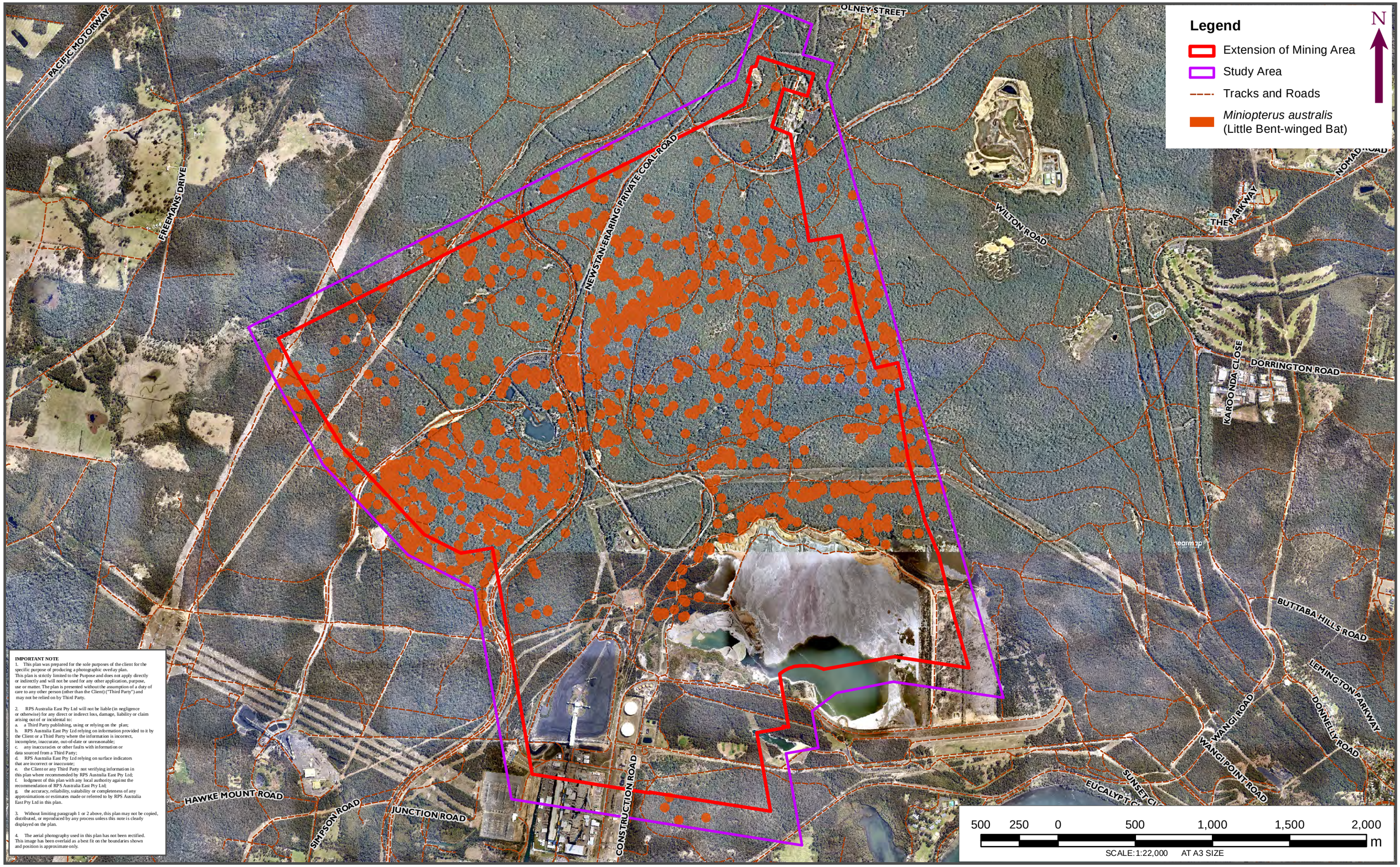
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TITLE : FIGURE 18: THREATENED SPECIES POLYGON: *MINIOPTERUS AUSTRALIS* (LITTLE BENT-WINGED BAT)

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

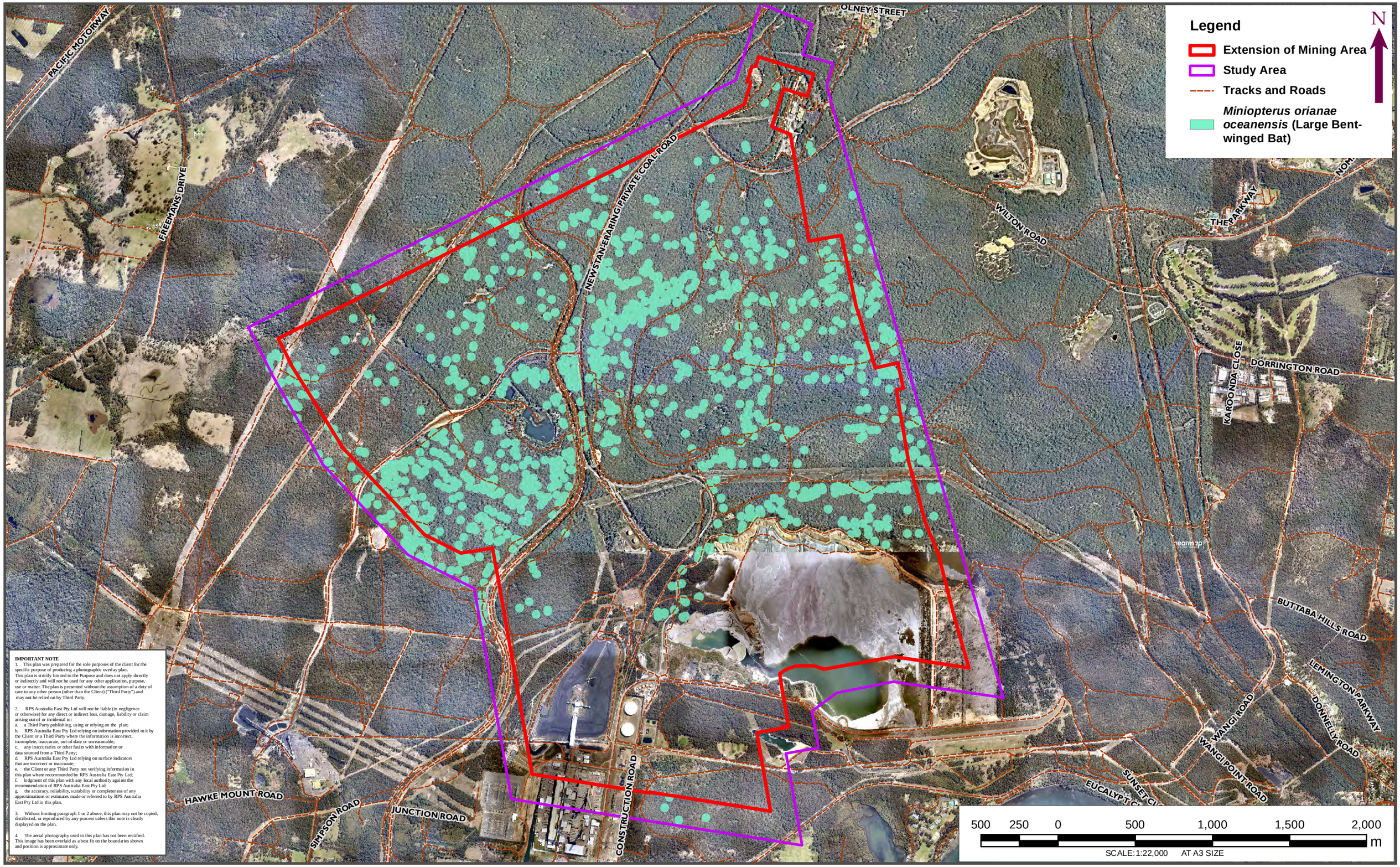
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TITLE : FIGURE 19: THREATENED SPECIES POLYGON: *MINIOPTERUS ORIANAE OCEANENSIS* (LARGE BENT-WINGED BAT)

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\BDAR Figures\141842 BDAR Figure 19 Th Species Moo A A3L 20200131.mxd

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JOB REF: **PR141842**

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4.3.5 Prescribed Biodiversity Values

With reference to Section 6.7 of the BAM, the Study Area does not contain the following Prescribed Biodiversity Values:

- Karst, caves, crevices or cliffs; and
- The proposed development is not a wind farm.

The following Prescribed Biodiversity Values were identified on site:

- Occurrence of rock: Scattered rocks occur in varying densities throughout the Study Area, with the highest densities occurring near ridgetops and along riparian zones. These provide potential habitat for *Hoplocephalus stephensii*;
- Human made structures and non-native vegetation: Human made structures in the Study Area include the Southern Reject Emplacement Area, Clean Water Diversion Drain, the Final Pollution Control Dam, coal preparation plant, coal handling plant, dedicated haul road, and Eraring Power station; and
- Hydrological processes that sustain and interact with the rivers, streams and wetlands: The Study Area drains via Stoney Creek (1st to 3rd order), Kilaben Creek (1st to 2nd order), Stockyard Creek (1st to 3rd order), Lords Creeks (1st to 4th order) and Crooked Creek (1st to 2nd order). These tributaries ultimately drain into Lake Macquarie, which is at its nearest point, approximately 1 km southwest of the Study Area.

STAGE 2 – IMPACT ASSESSMENT

5 INTRODUCTION TO STAGE 2 – IMPACT ASSESSMENT

5.1 Avoiding and Minimising Impacts on Native Vegetation and Habitat during project planning

5.1.1 Designing a project to avoid and minimise impacts on native vegetation and habitat

The proposed Project design involves both bord-and-pillar underground mining and the construction of associated ancillary facilities. During the design phase consideration was afforded to the important biodiversity values of the Study Area, which assisted in the decision-making process for the development locations. Discussion on 'zoning' of bords and how they are designed to avoid and minimise impacts is made in Section 5.1.1.1.

Construction of ancillary facilities has been designed to utilise areas of existing disturbance rather than clearing native vegetation where possible. Approximately 0.32 ha of native vegetation will be cleared for the ancillary facilities. This includes approximately 0.15 ha of Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions endangered ecological community (EEC; as listed under BC act) (**Figure 20**). See Section 6.1 for further discussion on direct impacts.

5.1.1.1 Mine Plan refinements

Bord-and-pillar mining is used rather than longwall mining in areas containing sensitive environmental habitats within the Study Area. In this instance, the previous Awaba workings mean that there is the potential for interactions between new mine working and old mine workings, which could result in compounded subsidence impacts. Bord-and-pillar mining extracts coal from the ground whilst leaving pillars of coal behind to support the roof. This minimises the potential for subsidence when compared to longwall mining, which removes 'walls' of coal at a time, leaving the roof to collapse afterwards. By adopting the bord-and-pillar mining process, the level of impacts to biodiversity are likely to be less than other more impactful mining processes with the intention of avoiding and/or minimising significant impacts. The proposed bord and pillar design for the Project is displayed in **Figure 20**.

The long history of mining at the Newstan and Awaba Collieries, and the associated environmental monitoring and management activities that have been undertaken over many years, has provided Centennial Newstan with a large amount of baseline information to help guide the development of the project. Centennial Newstan has also undertaken extensive detailed project-specific geological, engineering, environmental, financial and other technical investigations over several years to develop and refine the project.

The potential impacts of the project have been minimised by maximising the use of existing surface infrastructure and equipment, developing a low-impact and flexible mine design, minimising surface disturbance for gas drainage and greenhouse gas abatement, and proposing a complementary suite of mitigation measures and management strategies to be implemented during construction, operation, and closure. The combination of first workings only, partial extraction, and total extraction using bord and pillar mining methods has been adopted to minimise subsidence impacts to sensitive built and natural surface features and to mitigate multi-seam subsidence impacts associated with the Awaba workings in the

overlying Great Northern seam. Conservative buffers have been adopted in the mine design to minimise subsidence impact risks to overlying infrastructure such as the Main Northern Railway, Eraring Power Station and Eraring Ash Dam and sensitive surface water features such Stockyard Creek, Kilaben Creek, and Stony Creek. There is also inherent flexibility in the proposed bord and pillar mining method as it provides Centennial Newstan with the ability to vary mining activities as required in response to unforeseen geological or environmental constraints. The combination of first workings, partial and total extraction has been adopted to mitigate impacts on sensitive surface features.

Total extraction, where all pillars in a panel are removed, is proposed to the south of the existing Awaba workings in areas that have not been subject to mining previously (i.e. single-seam conditions) and in some areas beneath the existing workings (multi-seam conditions) where sensitive surface features are not present. The total extraction in the multi-seam areas will provide the additional benefit of reducing the long-term liability of pillar failure in the overlying Awaba workings in the Great Northern seam.

The proposed partial extraction will mine three of the four rows of pillars, leaving a spine pillar (i.e. one row of pillars) within each panel. This spine pillar will reduce the maximum mining span to 86 m, which will reduce subsidence effects. Partial extraction is proposed under the Ulan Rail Loop and under the sections of an existing 132 kV transmission line that are subject to multi-seam conditions.

The development of first workings only (i.e. no secondary extraction) will occur beneath certain sensitive surface features in both single-seam and multi-seam conditions. This includes under second and third order streams, the Main Northern Railway, a 132 kV substation, the Eraring Power Station, and the Eraring Ash Dam wall. The Awaba Biodiversity Conservation Area, on Lot 463 DP 1138964, is located within the Extension of Mining Area. Potential impacts to this offset area have been considered by proposing first workings only within the 2nd and 3rd order watercourses within this area. Extraction of the coal resource is proposed outside these watercourses in accordance with the mine plan.

With the presence of the overlying Awaba mine workings and larger than previously encountered volume of gas within the West Borehole seam and overlying seams, which will be released by the mining process, this mining system allows for greater control of subsidence, particularly with regard to minimising multi-seam subsidence, improved gas management, and superior flexibility to deal with geological anomalies and environmental constraints.

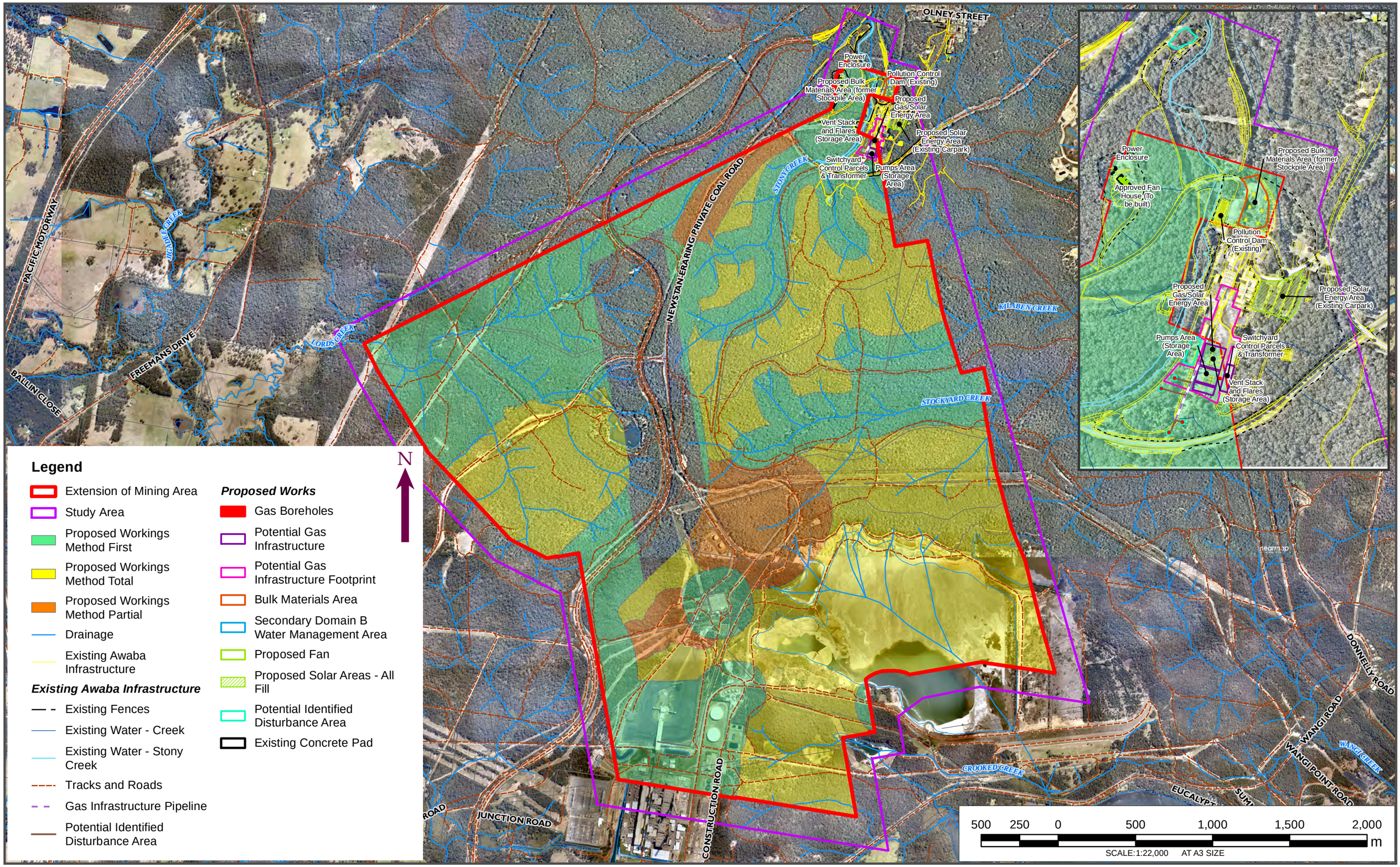
Centennial Newstan proposes to use in-seam gas drainage methods to manage gas within the Extension of Mining Area. This method will involve undertaking horizontal directional drilling between 15 m and 20 m above the West Borehole seam following the orientation of the panels and roadways within the Extension of Mining Area. Gas captured during the in-seam drainage system will be transferred to a gas flaring facility located at the Awaba Colliery Surface Site via underground pipelines. This approach minimises surface disturbance and associated environmental impacts whilst also providing a safe and cost-effective solution to managing gas emissions in line with current industry practice.

5.1.1.2 Ancillary facilities

Ancillary facilities have been carefully designed to avoid impacts on biodiversity by:

- Selecting previously disturbed areas primarily void of native vegetation in which to construct parking, the bath house and administration and workshop facilities;
- Utilising an existing ventilation shaft on which to construct the proposed three fans to be situated at Awaba Colliery Surface Site;

- Transportation of personnel and materials to and from the underground mining area via the existing men and materials drift at Newstan Colliery Surface Site;
- Utilising existing disturbed areas primarily void of native vegetation to install a new gas flaring facility; and
- Extraction of underground water through the existing Fassifern Pump Station at Newstan Colliery Surface Site to avoid the need to construct an additional pump station.



Legend

- Extension of Mining Area
- Study Area
- Proposed Workings Method First
- Proposed Workings Method Total
- Proposed Workings Method Partial
- Drainage
- Existing Awaba Infrastructure

Existing Awaba Infrastructure

- Existing Fences
- Existing Water - Creek
- Existing Water - Stony Creek
- Tracks and Roads
- Gas Infrastructure Pipeline
- Potential Identified Disturbance Area

Proposed Works

- Gas Boreholes
- Potential Gas Infrastructure
- Potential Gas Infrastructure Footprint
- Bulk Materials Area
- Secondary Domain B Water Management Area
- Proposed Fan
- Proposed Solar Areas - All Fill
- Potential Identified Disturbance Area
- Existing Concrete Pad

N

TITLE : FIGURE 20: FINAL PROJECT FOOTPRINT

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **16/03/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): B A3 (james.hugo)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\BDAR Figures\141842 BDAR Figure 20 Final Project Footprint B A3L 20200316.mxd

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5.2 Avoiding and minimising Prescribed Biodiversity Impacts during project planning

The BC Regulation (clause 6.1) identifies actions that are prescribed as impacts to be assessed under the Biodiversity Offsets Scheme.

5.2.1 Proposed disturbance area design

The proposed disturbance area has been designed to avoid impacts to state and federally listed flora species and will not impact on any federally listed EECs (see **Figure 4**).

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

Large rocks and steep slopes will be avoided by surface infrastructure but are predicted to experience surface cracking and rock fracturing to some extent (MSEC 2019). Surface cracking on steep slopes located above the northern ends of the proposed extension of mining area is predicted to be typically between 100 mm and 200 mm, with more isolated cracking widths greater than 200 mm (MSEC 2019). Cracks and plug failures could occur with widths in the order of 1 m or greater (MSEC 2019). Fracturing is also predicted to occur underneath rock outcrops; however, no outcrops have been identified within the Study Area.

Minimal surface cracking on steep slopes is not likely to have significant impacts on biodiversity as most species occupying these habitats can avoid those cracks. If the cracks are large enough and occur in habitats designated as suitable for the Stephen's Banded Snake (*Hoplocephalus stephensii*) (**Figure 17**), there is a low likelihood of fauna mortality. Whilst isolated incidents may occur to an individual, it is not likely to create a significant impact to a local population of a threatened species.

Where small rocks are disturbed by surface infrastructure, they will be relocated in adjacent bushland to retain their habitat value for any rock-associated threatened species. This may include the candidate threatened species Stephens' Banded Snake (**Figure 17**). Based on the small number and size of rocks predicted to be disturbed, when compared to the abundance of rock and rock outcrops in the local area, it is expected that the Project is unlikely to be significant for the local and bioregional persistence of the suite of any threatened species or community likely to use such habitat.

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

Increased ponding has the potential to occur along sections of Stockyard and Crooked Creeks and with depths of up to 0.3 m and lengths of up to 200 m (MSEC 2019). Ponding could also occur along other streams within the Study Area, immediately upstream of the barrier pillars and around the perimeter of the proposed mining area, or where natural ponding already exists (MSEC 2019).

Hydraulic modelling produced by EMM (2020) shows that an additional 1.6 ha of remnant ponding may be experienced under subsided conditions.

In addition to ponding, the Project has the potential to lead to cracking and sinkholes along riparian zones as a result of subsidence. This can lead to changed waterflow conditions or impacts to terrestrial vegetation.

Subsidence may impact the timing, magnitude and total volume of flow within watercourses (EMM 2020). Changes in catchment hydrology may result from the following mechanisms;

- Flattening of the landform, leading to slower catchment response and attenuation of flow (i.e. reduced and delayed peak flow);
- Steepening of the landform, leading to quicker catchment response and reduced attenuation of flow); and
- Changes in surface storage within flow paths or undrained depressions in the catchment resulting in increased or decreased ponding of water.

Species and ecological communities potentially subject to the impacts from ponding include those that were recorded or predicted to occur within riparian areas. Those include:

- Swamp Sclerophyll Forest on Coastal Floodplains (**Figure 5**);
- Freshwater Wetlands on Coastal Floodplains (**Figure 5**);
- *Corybas dowlingii* (Red-helmet Orchid) (**Figure 8**);
- *Grevillea parviflora subsp. parviflora* (Small-flowered Grevillea) (**Figure 10**);
- *Tetratheca juncea* (Black-eyed Susan) (**Figure 11**); and
- *Litoria brevipalmata* (Green-thighed Frog) (**Figure 12**).

Ponding has the potential to either enhance or to be detrimental to the species and ecological communities listed above. The abovementioned potential impacts are proposed to be verified via a Biodiversity Management Plan (BMP); refer to Section 8.1) to determine the actual credit liabilities that are incurred post mining.

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

No additional access tracks are proposed to be constructed as part of the Project; however, vehicle presence and movement is likely to increase. The risk of vehicle strike on threatened species is assessed in **Table 19**.

Table 19 Assessment of impacts of vehicle strike on threatened fauna

Species	Likelihood of strike	Predicted impacts
Calyptorhynchus lathami (Glossy Black Cockatoo)	**Low** – species generally flies near canopy.	Unlikely to be struck by vehicles
Ninox strenua (Powerful Owl)	**Low** – species forages at night, when vehicular movements associated with this Project will be highly irregular.	Unlikely to be struck by vehicles
Litoria brevipalmata (Green-thighed Frog)	**Low** – species is nocturnal and is associated with riparian zones which are not aligned with access tracks.	Unlikely to be struck by vehicles
Tyto novaehollandiae (Masked Owl)	**Low** – species forages at night, when vehicular movements associated with this Project will be highly irregular.	Unlikely to be struck by vehicles

Species	Likelihood of strike	Predicted impacts
Miniopterus schreibersii oceanensis (Eastern Bentwing-Bat)	**Low** – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
Scoteanax rueppellii (Greater Broad-nosed Bat)	**Low** – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
Pandion cristatus (Eastern Osprey)	**Low** – species generally flies near canopy.	Unlikely to be struck by vehicles
Haliaeetus leucogaster (White-bellied Sea Eagle)	**Low** – species generally flies near canopy.	Unlikely to be struck by vehicles
Glossopsitta pusilla (Little Lorikeet)	**Low** – species generally flies near canopy.	Unlikely to be struck by vehicles
Miniopterus australis (Little Bentwing-bat)	**Low** – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
Micronumus norfolkensis (East Coast Free-tailed Bat)	**Low** – species is nocturnal and generally flies near canopy.	Unlikely to be struck by vehicles
Daphnoenositta chrysoptera (Varied Sittella)	**Moderate** – species forages diurnally potentially along access tracks. .	Potential to be struck by vehicles
Petaurus norfolcensis (Squirrel Glider)	**Low** – species is nocturnal and requires vegetation to glide between trees and is unlikely to be moving across the path of a vehicle.	Unlikely to be struck by vehicles

6 IMPACTS UNABLE TO BE AVOIDED

6.1 Direct Impacts

Direct impacts will be incurred through the proposed installation of infrastructure at Awaba; including a secondary domain B water management area, sediment control dam, gas boreholes and associated pipeline (see **Figure 22**). The native vegetation that would be cleared as a result of this infrastructure is shown in **Table 20**.

Table 20 Proposed clearing of native vegetation PCT types and associated areas

PCT number	PCT	Area to be cleared (ha)*
1588	Grey Ironbark – Broad-leaved Mahogany – Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	0.06
1619	Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands	0.12
1718	Swamp Mahogany – Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast	0.15
	Total	0.32

*The total area to be cleared adds up to approximately 0.32 when the decimal places are increased.

Other direct impacts are avoided by limiting surface infrastructure to pre-disturbed areas, including:

- Utilisation of the Newstan Colliery Surface Site to provide parking, bathhouse, administration and workshop facilities for the underground workforce. A small number of administrative, maintenance and monitoring personnel will also be located at Awaba Colliery Surface Site;
- Transportation of personnel and materials to and from the underground mining area via the existing men and materials drift at Newstan Colliery Surface Site;
- Utilising an existing ventilation shaft on which to construct the proposed three fans to be situated at Awaba Colliery Surface Site;
- In-seam gas drainage, with gas transferred to a new gas flaring facility to be located within the existing disturbance footprint of Awaba Colliery Surface Site; and
- Extraction of underground water via the existing Fassifern Pump Station at Newstan Colliery Surface Site and ongoing groundwater management in accordance with Centennial Coal's Northern Operations Water Management Plan.

6.2 Indirect Impacts

Indirect impacts that need to be considered are listed in Section 9.1.4.2 of BAM. Given the nature of the Project, the following impacts were considered not applicable:

- Inadvertent impacts on adjacent habitat or vegetation;
- Reduced viability of adjacent habitat due to edge effects;
- Reduced viability of adjacent habitat due to noise, dust or light spill;

- Transport of weeds and pathogens from the site to adjacent vegetation;
- Increased risk of starvation, exposure and loss of shade or shelter;
- Loss of breeding habitats;
- Trampling of threatened flora species;
- Inhibition of nitrogen fixation and increased soil salinity;
- Fertiliser drift;
- Rubbish dumping;
- Wood collection;
- Bush rock removal and disturbance;
- Increase in predatory species populations;
- Increase in pest animal populations;
- Increased risk of fire; and
- Disturbance to specialist breeding and foraging habitat, e.g. beach nesting for shorebirds.

6.3 Adaptive Management Strategy

In accordance with Section 9.4.2 of BAM, an adaptive management plan is required where impacts are uncertain.

The Project has the potential to lead to impacts to threatened plants and ecological communities from cracking, sinkholes, plug-failures and ponding. In order to effectively quantify the mining related impacts to the threatened flora and ecological communities, an area-based assessment will be undertaken with reference to the species polygons in **Figures 5** to **11**.

In the case of impacts occurring, adaptive management will occur via the review of monitoring programs and investigation of causation to ensure any future impacts can be readily identified and predicted. Where impacts are identified, they will be offset in accordance with state and federal policies. These monitoring measures and Trigger Action Response Plans (TARPs) will be detailed within the Biodiversity Management Plan (BMP) prepared as part of the Extraction Plan process post consent. The TARP contained within the BMP will contain a framework for adaptive management, which should include; mitigation, remediation and changes to the mine design.

7 SERIOUS AND IRREVERSIBLE IMPACTS

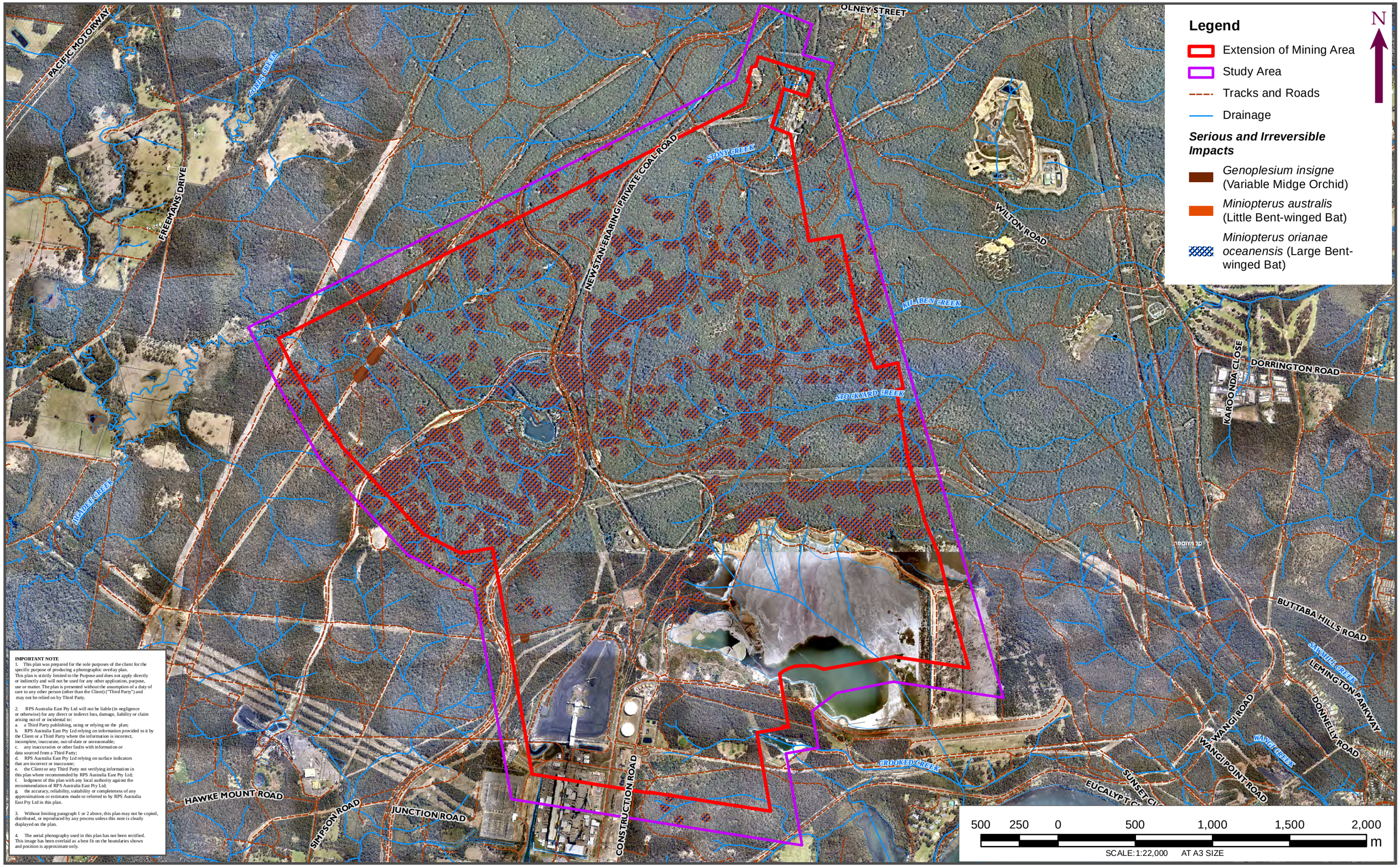
According to the Guidance to assist a decision-maker to determine a serious and irreversible impact (State of NSW and DPIE 2019), a Serious and Irreversible Impact (SAII) may occur when the following entities are impacted:

- Species or ecological community currently in a rapid rate of decline; or
- Species or ecological communities with very small population size.

Notably, one potential SAII species was recorded on site; *Genoplesium insigne* (Variable Midge Orchid).

Eighty-eight individuals *Genoplesium insigne* were detected during targeted surveys within the power line easement to the north west of the Study Area. This species is also associated with PCT 1619 and 1636, and therefore has additional potential habitat of 902.9 ha within the Study Area. A BMP will aim to determine whether mining has an impact on this species.

The additional impact assessment provisions for threatened species listed in Appendix B of OEH (2019) have not been directly addressed in this BDAR due to the outcomes of the Assessments of Significance detailed in the appended BIR (**Appendix A**).



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TITLE : FIGURE 21: SERIOUS AND IRREVERSIBLE IMPACTS

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

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8 REQUIREMENT TO OFFSET

8.1 Impacts Requiring an Offset

8.1.1 Bord-and-Pillar Mining

Extensive flora and fauna surveys have been undertaken for the Project in line with the BAM, resulting in a comprehensive baseline dataset which can be utilised to inform the initial commencement of individual monitoring programs. In order to determine the occurrence of mining related impacts on threatened species or ecological communities, it is proposed that LIDAR could be utilised to detect the potential impacts of the Project (i.e. sinkholes, cracking and plug-failures).

If impacts are detected, the extent of those impacts will be quantified by comparison to the baseline dataset. Where insufficient baseline data is available, presence of threatened species will be assumed if they are considered to be likely to occur and potentially impacted.

Following potential impacts, an offset liability report will be prepared to both quantify the impacts and outline the offset strategy that will be adopted to address those impacts. The offset liability report will be prepared with reference to the BAM and provided within three months of any impacts being identified.

8.1.2 Infrastructure

As aforementioned, approximately 0.32 ha of native vegetation will be cleared for ancillary facilities. This includes an area approximately 0.15 ha of PCT 1718 which is commensurate with Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC. All impacts listed in **Table 21** will be offset in accordance with the NSW Biodiversity Offsets Scheme (BOS).

Table 21 Proposed infrastructure associated with the clearing of native vegetation (PCTs) and associated offset liabilities.

PCT	Area to be cleared (ha)	BAM calculator adjustment*	Credit liability
1588 – Grey Ironbark – Broad-leaved Mahogany – Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	0.06	0.1	3
1619 – Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands	0.12	0.1	5
1718 – Swamp Mahogany – Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast	0.15	0.2	8

*The BAM calculator automatically rounds input <0.1 ha to the nearest 0.1 ha.

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Legend

- Extension of Mining Area
- Study Area
- Tracks and Roads

Existing Awaba Infrastructure

- Existing Awaba Infrastructure
- Existing Water - Stony Creek
- Gas Infrastructure Pipeline
- Potential Identified Disturbance Area
- Drainage
- Uncertain Impacts

N

OLNEY STREET
FREEMANS DRIVE
ZORAS CREEK
NEWSTAN-ERARING PRIVATE COAL ROAD
STONY CREEK
WILTON ROAD
KILABEN CREEK
STOCKYARD CREEK
JACADE CREEK
HAWKE MOUNT ROAD
CONSTRUCTION ROAD
CROOKED CREEK

500 250 0 500 1,000 1,500 2,000 m

SCALE: 1:22,000 AT A3 SIZE

TITLE : FIGURE 22: IMPACTS REQUIRING OFFSET

LOCATION : NEWSTAN

DATUM: GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **21/05/2020**

PURPOSE: **BDAR**

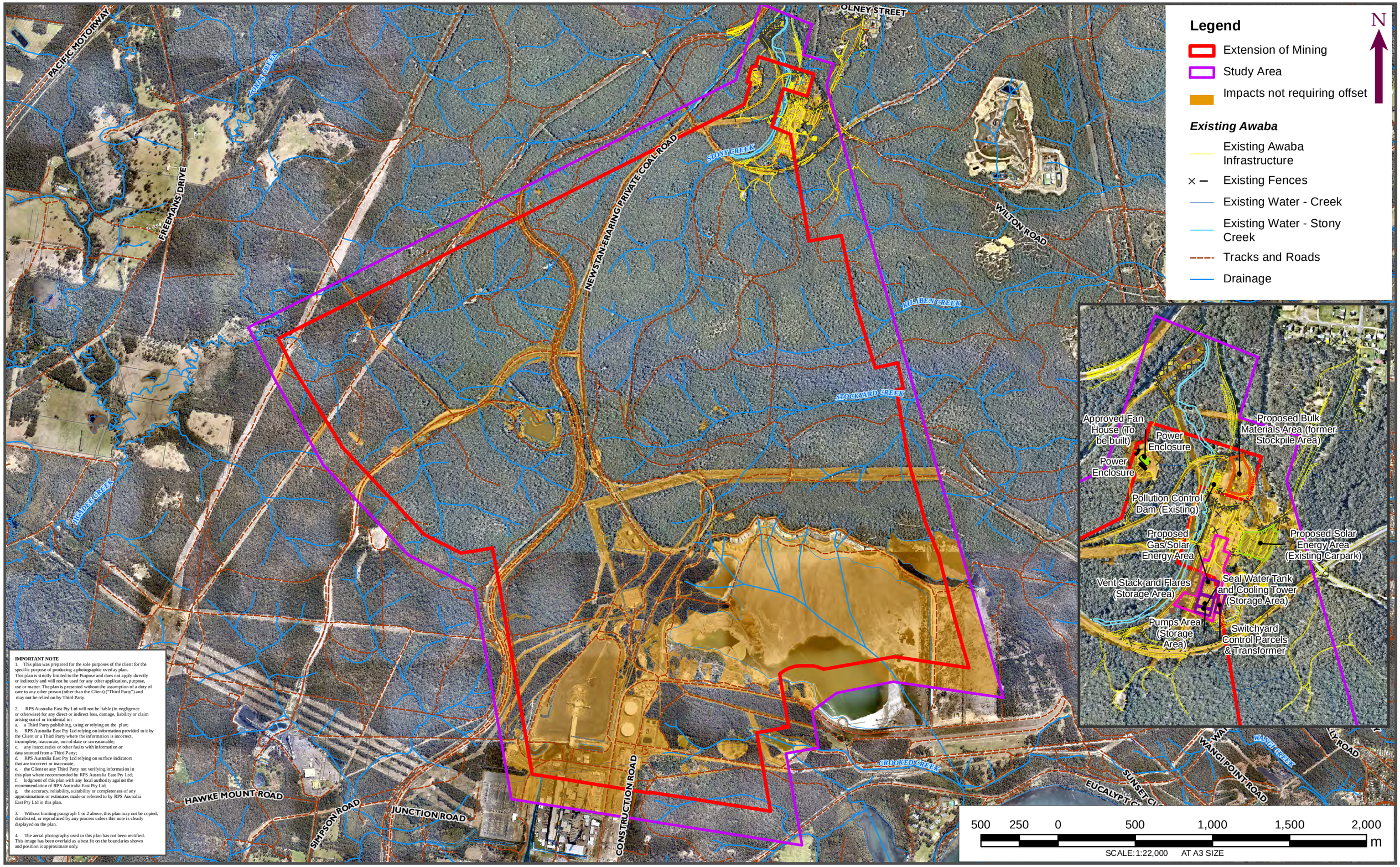
VERSION (PLAN BY): C A3 (Natalie.Wood)

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TITLE : FIGURE 23: IMPACTS NOT REQUIRING OFFSET

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **31/01/2020**

PURPOSE: **BDAR**

VERSION (PLAN BY): A A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\BDAR Figures\141842 BDAR Figure 23 Impacts not requiring offset A A3L 20200131.mxd

CLIENT: **CENTENNIAL COAL**

JOB REF: **PR141842**

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9 CONCLUSION

RPS was engaged by Centennial Newstan to prepare this BDAR for the Newstan Extension. This report was prepared to assess the impacts of the Project on biodiversity values to meet the requirements of BAM.

This BDAR addresses Stage 1 (Biodiversity Assessment) and Stage 2 (Impact Assessment) of the BAM.

In accordance with the objectives of the Biodiversity Offset Scheme, the use of Bord-and-Pillar mining design was proposed to avoid and minimise impacts on biodiversity values.

Maps have been provided in compliance with BAM, including the layout of the proposed project footprint in relation to biodiversity values.

The majority of the potential impacts related to this Project are indirect subsidence related impacts such as; cracking, sinkholes and plug-hole failures. In order to accurately determine the credit liability incurred by the Project, a robust BMP will aim to identify potential impacts to threatened species and ecological communities. If potential impacts are identified, an offset liability report will be produced within 3 months in line with the BAM (and EPBC requirements if no bilateral agreement is in place) and it will contain a proposed offset strategy.

Approximately 0.32 ha of native vegetation will be cleared for ancillary facilities. This includes an area approximately 0.15 ha of PCT 1718 which is commensurate with Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC. The credit liability associated with this loss of native vegetation has been calculated in **Table 21**.

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Appendix A

Biodiversity Inventory Report

NEWSTAN MINE EXTENSION PROJECT

Biodiversity Inventory Report



Newstan Mine Extension Project
Newstan Mine Extension Project
V2
22 March 2020

rpsgroup.com

Document status

Version	Purpose of document	Authored by	Reviewed by	Approved by	Review date
1	Draft for Client Review	Joe May	Hayden Beck and Arne Bishop	Arne Bishop	05/12/2019
2	Second Client review	Joe May	Arne Bishop	Arne Bishop	10/02/2020
3	Final for submission	Joe May	Arne Bishop	Arne Bishop	22/05/2020

Approval for issue

Arne Bishop  22 March 2020

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SUMMARY

Context

RPS Australia East Pty Ltd (RPS) was engaged by Centennial Newstan to prepare a Biodiversity Inventory Report (BIR) for the proposed Newstan Mine Extension Project (hereafter referred to as the 'Project'). The BIR identifies and describes biodiversity values present within the Study Area as supporting documentation for the Biodiversity Development Assessment Report (BDAR). Specifically, the purpose of this BIR is to describe the biodiversity values of the Study Area as a basis for assessing the impacts of the Project on threatened biodiversity listed under the *Biodiversity Conservation Act* 2016 (BC Act) and *Environment Protection and Biodiversity Conservation Act* 1999 (EPBC Act).

Methods

Biodiversity values were explored and quantified through field surveys undertaken over 2018 and 2019, and four seasons (i.e. spring, summer, autumn and winter) in accordance with the Biodiversity Assessment Method (BAM). Threatened species surveys focused on threatened entities listed under the BC Act and EPBC Act [i.e. Matters of National Environmental Significance (MNES)]. Vegetation communities were also mapped and surveyed in accordance with BAM.

Key Results – Plant Community Types

Nine Plant Community Types (PCTs) were identified within the Study Area. Three of these PCTs were commensurate with NSW listed endangered ecological community (EEC) listings, but not commensurate to any EPBC listed communities

Key Results – Flora

Six threatened flora species were recorded within the Study Area. These threatened species were *Acacia bynoeana* (listed as endangered under BC Act and EPBC Act); *Corybas dowlingii* (listed as vulnerable under BC Act), *Grevillea parviflora var. parviflora* (listed as vulnerable under BC Act and EPBC Act), *Genoplesium insigne* (listed as critically endangered under BC Act and EPBC Act) and *Tetratheca juncea* (listed as vulnerable under BC Act and EPBC Act). Due to the high density of *T. juncea* within the Study Area, the average density for assessment purposes.

Key Results – Fauna

Eleven threatened fauna species listed as vulnerable under the BC Act were recorded within the Study Area. These species were the Squirrel Glider (*Petaurus norfolcensis*); Grey-headed Flying-fox (*Pteropus poliocephalus*); Eastern Freetail-bat (*Mormopterus norfolkensis*); Little Bentwing-bat (*Miniopterus australis*); Eastern Bentwing-bat (*Miniopterus schreibersii oceanesis*); Greater Broad-nosed Bat (*Scoteanax rueppellii*); Glossy Black-Cockatoo (*Calyptorhynchus lathami*); Little Lorikeet (*Glossopsitta pusilla*); Powerful Owl (*Ninox strenua*); Brown Treecreeper (*Climacteris picumnus victoriae*) and Varied Sittella (*Daphoenositta chrysoptera*). Of those species, the Grey-headed Flying-fox (*Pteropus poliocephalus*) is also listed as vulnerable under the EPBC Act.

A representative survey for *Litoria brevipalmata* (Green-thighed Frog) was not possible as there was no suitable rainfall event in the appropriate season [i.e. >75 mm in a 24 hour period or >150 mm in 72 hours between October – January; DPIE 2019)].As such, for the purpose of the BIR, *L. brevipalmata* was assumed present within suitable habitat. Due to the lack of survey effort for *L. brevipalmata*, the distribution and density for this species was modelled for assessment purposes.

EPBC Act Assessment

Five species of threatened flora and one species of threatened fauna were identified within the site. Those species include *Acacia bynoeana* (vulnerable under EPBC Act), *Angophora inopina* (vulnerable under EPBC Act), *Genoplesium insigne* (critically endangered under EPBC Act), Grevillea parviflora subsp. parviflora (vulnerable under EPBC Act) and Tetratheca juncea (vulnerable under EPBC Act). No TECs listed under the EPBC Act were identified in the Study Area. Assessments of Significance were performed for

Commonwealth listed threatened biodiversity recorded on-site or those with a moderate to high likelihood of occurrence.

1 INTRODUCTION

1.1 The Project

RPS Australia East Pty (RPS) has been engaged by Centennial Newstan (the proponent) to produce this Biodiversity Inventory Report (BIR) for the Newstan Mine Extension Project (SSD-10333) is seeking approval to extract approximately 25.9 million tonnes over a fifteen year period (hereafter referred to as the 'Project'). This BIR provides supporting documentation for the Biodiversity Development Assessment Report (BDAR).

Newstan Colliery is an existing underground coal mine located in the Lake Macquarie Local Government Area (LGA), approximately 25 kilometres (km) south west of Newcastle and 140 km north of Sydney, NSW. It is owned and operated by Centennial Newstan Pty Ltd (Centennial Newstan).

Mining operations at Newstan Colliery began in 1887 and upon the introduction of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) operated pursuant to continuing use rights in accordance with Part 4, Division 10 of the EP&A Act (continuing use rights).

Newstan Colliery has at various times mined the upper coal seams (Great Northern and Fassifern seams) and lower coal seams (West Borehole, Borehole, Young Wallsend and Yard seams) and produced both semi-soft coking coal and thermal coal for the domestic and export markets. In the lower seams, workings to date have been concentrated to the west of the seam split, which is a defining geological feature of the mine. Mining has been undertaken using a combination of bord-and-pillar and longwall mining.

In August 2014, the underground operations at Newstan Colliery were placed onto care and maintenance due to poor market conditions. In recent years, Centennial Newstan has commenced feasibility investigations into the recommencement of mining at Newstan Colliery. The most recent modification to DA 73-11-98 in January 2019, permits first workings mining within the West Borehole seam in the southern portion of the Newstan Colliery mining lease area. The first workings aim to improve Centennial Newstan's understanding of the geology within the West Borehole seam, including the presence, throw and strike of a major fault zone projected from the historic Newstan workings.

Centennial Newstan is now seeking approval for the continuation of mining within the West Borehole seam. The Newstan Mine Extension Project proposes to extract up to 25.9 million tonnes (Mt) over a fifteen-year period at a maximum production rate of 4 million tonnes per annum (Mtpa) of Run of Mine (ROM) coal. Bord-and-pillar mining is proposed using continuous miner methods that will include areas of first workings, partial extraction and total extraction. A mix of metallurgical and thermal coal is proposed to be extracted. ROM coal will be delivered to the Newstan Colliery Surface Site via a series of existing underground conveyors. Once the coal reaches the Newstan Colliery Surface Site it will be handled in accordance with the approved operations for the Northern Coal Logistics Project (SSD-5145), managed by Centennial Coal's Northern Coal Services business unit.

Other key features of the Project include:

- Utilisation of the Newstan Colliery Surface Site to provide parking, bathhouse, administration and workshop facilities for the underground workforce. A small number of administrative, maintenance and monitoring personnel will also be located at Awaba Colliery Surface Site;
- Transportation of personnel and materials to and from the underground mining area via the existing men and materials drift at Newstan Colliery Surface Site;
- Continued operation of the three existing ventilation fans at Newstan Colliery Surface Site and the installation and operation of two new ventilation fans at the existing ventilation shaft at Awaba Colliery Surface Site;
- In-seam gas drainage, with gas transferred to a new gas flaring facility to be located within the existing disturbance footprint of Awaba Colliery Surface Site; and

- Extraction of underground water via the existing Fassifern Pump Station at Newstan Colliery Surface Site and ongoing groundwater management in accordance with Centennial Coal's Northern Operations Water Management Plan.

The Project is aligned with the broader Centennial Coal business strategy in that it facilitates the development of a new semi-soft coking coal product stream and a thermal coal product for both the domestic and export markets. The Project will enable supply of export coal products while meeting contractual coal supplies to the domestic markets. Over time, the Project can potentially replace the coal product currently supplied to the domestic market by other Centennial operations as these other resources become depleted. This will ensure ongoing security of supply for domestic electricity generation.

If approved, the Project will allow for the optimisation of resource recovery from Newstan Colliery while providing ongoing direct and indirect employment opportunities. In addition, the Project will provide a number of positive flow-on effects to the local, regional and state economies through additional wages and royalties.

1.2 Study Area

The overall Study Area footprint is approximately 1440.26 ha. The area of native vegetation with the potential to be impacted totals 1036.27 ha. The Study Area is comprised of land owned by Centennial Pty Ltd and land owned by Origin Energy (see **Figure 1**).

Locality:	Newstan Colliery, Fassifern NSW	
LGA:	Lake Macquarie City Council (LMCC)	
Lot/DP:	LOT99	DP755218
	LOT100	DP755218
	LOT1	DP585142
	LOT7322	DP1166295
	LOT11	DP1050120
	LOT51	DP840671
	LOT7321	DP1166295
	LOT1	DP1109558
	LOT7320	DP1166295
	LOT10	DP239629
	LOT8	DP239629
	LOT153	DP755207
	LOT216	DP755207
	LOT101	DP755218
	LOT214	DP755207
	LOT54	DP755218
	LOT102	DP755218

LOT215	DP755207
LOT1	DP582126
LOT65	DP1126625
LOT462	DP1138964
LOT463	DP1138964
LOT7305	DP1149082
LOT7304	DP1149082
LOT7309	DP1164559
LOT7336	DP1170023
LOT110	DP755207
LOT213	DP755207
LOT5	DP239629
LOT9	DP239629
LOT6	DP239629
LOT212	DP755207
LOT211	DP840670
LOT20	DP734860
LOT21	DP734860
LOT20	DP840668
LOT1	DP737496
LOT1	DP817425
LOT100	DP828283
LOT50	DP840671
LOT101	DP828283
LOT7306	DP1164232
LOT1	DP1191308

1.3 Purpose of BIR

The purpose of this BIR is to describe the biodiversity values of the Study Area as a basis for assessing the impacts of the Project on threatened biodiversity listed under the *Biodiversity Conservation Act 2016* (BC Act) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The preparation of this BIR has taken into consideration the information requirements for the following matters:

- Section 6.12 of the BC Act (i.e. Biodiversity Development Assessment Report; BDAR, which this BIR is appended to); and

- *Significant Impact Guidelines* 1.1 – Matters of National Environmental Significance (DoE 2013), specifically for listings under Section 18 and 18A of the EPBC Act.

In relation to the above, the BIR is focused on evaluating the likelihood of occurrence and incidence of threatened biodiversity (i.e. threatened species, populations and ecological communities) listed under the BC Act and/or EPBC Act using methods and guidance specified in the Biodiversity Assessment Methodology (BAM) and the Project brief. In addition to providing technical information for the preparation of the BDAR, the BIR also contains an assessment of the Projects impact on relevant Matters of National Environmental Significance (MNES) listed under the EPBC Act. MNES relevant to this report are those listed under Section 18 and 18A of the EPBC Act (i.e. threatened species and ecological communities) and relevant State Environmental Planning Policies (SEPPs).

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

- NSW State Groundwater Dependant Ecosystem Policy;

- Risk Assessment Guidelines for Groundwater Dependant Ecosystems;

- SEPP No. 44 – Koala Habitat Protection;

- SEPP (Koala Habitat Protection) 2019 (repeals and replaces the SEPP no. 44 on the 1st of March 2020);

- Coastal Management SEPP 2018; and

- Significant Impact Guidelines 1.1 – Matters of National Environmental Significance (DoE 2013).

1.4 Scope of Works

The investigation scope of this BIR is to:

- Identify vascular plant species occurring within the Study Area, including any threatened species listed under the BC Act and/or EPBC Act;

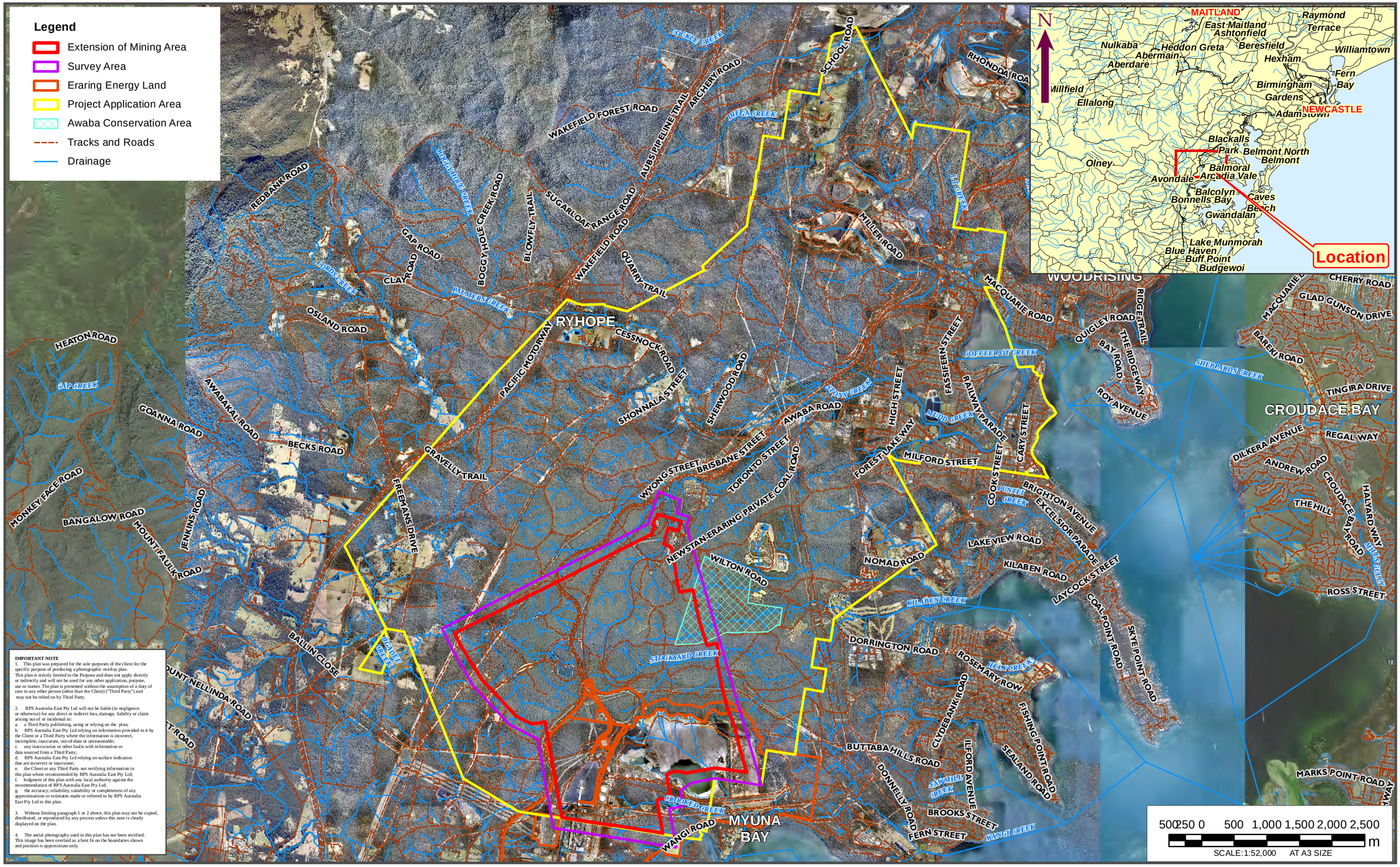
- Identify and map the extent of vegetation communities and Plant Community Types (PCTs) within the Study Area, including any threatened ecological communities (TECs) listed under the BC Act and/or EPBC Act;

- Identify any fauna species, including threatened and migratory species, and populations of their habitats, which occur within the Study Area and are known to occur in the wider locality;

- Report datasets necessary for performing computations in the online BAM Calculator;

- Assess the likely impact of the Project on threatened biodiversity listed under the EPBC Act that are relevant to the Project; and

- Consider relevance of local environmental legislation, including SEPP 44 – Koala Habitat Protection and SEPP (Koala Habitat Protection) 2019.



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TITLE : FIGURE 1: SITE LOCATION

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **10/02/2020**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): C A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\Biodiversity Inventory Report Figures\141842 Figure 1 Site Location_C A3L 20200210.mxd

CLIENT: **CENTENNIAL COAL**

JOB REF: **PR141842**

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Table 1 Study Area Description

Feature	Description
Site	The Study Area boundary is displayed in Figure 1. The site is 1440.26 ha, with 1036.27 being comprised of native vegetation.
Local Government Area	Lake Macquarie City Council Local Government Area.
Current Land Use	The land is currently comprised of a number of facilities, including; the Southern Reject Emplacement Area (SREA), Clean Water Diversion Drain (CWDD) the Final Pollution Control Dam (FPCD), coal preparation plant, coal handling plant, dedicated haul road, and Eraring Power station.
Topography	Rolling low hills with numerous, primarily ephemeral drainage lines. Slope gradients generally 10–25% and local relief 20–80 m. Some southerly facing slopes have slope gradients >25%. Rock outcrop is absent.
Hydrology	The Project Application Area drains via Stoney Creek (1st to 3rd order), Kilaben Creek (1st to 2nd order), Stockyard Creek (1st to 3rd order), Lords Creeks (1st to 4th order) and Crooked Creek (1st to 2nd order). These tributaries ultimately drain into Lake Macquarie, which is at its nearest point, approximately 1km southwest of the Project Application Area. Stony Creek constitutes a Key Fish Habitat (DPI 2007) within the site.
Vegetation	Vegetation of the Study Area falls within the Sydney Basin Bioregion and is dominated by Dry Sclerophyll Forests along the hillsides. Wet Sclerophyll Forests are within the gullies and alluvial flats.

1.5 Regulatory Context

The Project is seeking State Significant Development approval under Division 4.7 of Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The regulatory context that defines the assessment framework for the Project is outlined in **Table 2**.

Table 2 Relevant Legislation, Policy and Guidelines

Legislation, Policy and Guidelines	Jurisdiction	Comment
Environment Protection and Biodiversity Conservation Act 1999	Commonwealth	Provides lists of Matters of National Environmental Significance (MNES) such as threatened species and ecological communities (Section 18 and 18A). Outlines circumstances where a Proponent is required to refer a proposed action for assessment under the EPBC Act (i.e. Section 68).
Significant Impact Guidelines 1.1 – Matters of National Environmental Significance	Commonwealth	These Significant impact guidelines provide overarching guidance on determining whether an action is likely to have a significant impact on a MNES. Consideration of survey methods for specific MNES required where potential impacts are identified.
Biodiversity Conservation Act 2016	NSW	Provides lists of species, populations and ecological communities with a legal threatened status in NSW. Introduces the Biodiversity Offsets Scheme (BOS) and Biodiversity Assessment Method (BAM).
Biosecurity Act 2015	NSW	Prescribes the statutory requirements for managing pests, diseases, weeds and contaminants in NSW. Applies to construction activities and occupation of the Study Area.
Environmental Planning and Assessment Act 1979	NSW	This Act has effect subject to the provisions of Part 7 of the BC Act and Part 7A of the Fisheries Management Act 1994 that relate to the operation of this Act in connection with the terrestrial and aquatic environment. Biodiversity impact assessments in terrestrial settings to be performed in accordance with BAM and BOS.

Legislation, Policy and Guidelines	Jurisdiction	Comment
National Parks and Wildlife Act 1974	NSW	Requires consideration of any impacts on the conservation reserve network.
Fisheries Management Act 1994	NSW	Provides lists of species, populations and ecological communities with a legal threatened status in NSW. One of the objectives of this act is to 'conserve key fish habitats'.
Coastal Management SEPP 2018	NSW	Sets the land use planning framework for coastal management and ensures implementation of the planning objectives of the proposed Coastal Management Act in NSW. This policy repeals, replaces and consolidates SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection).
SEPP No. 44 – Koala Habitat Protection	NSW	In addressing SEPP44, there are two questions to be considered: Is the land “Potential Koala Habitat”? and; Is the land “Core Koala Habitat”?
SEPP (Koala Habitat Protection) 2019	NSW	The State Environmental Planning Policy (Koala Habitat Protection) 2019 repeals and replaces the SEPP no. 44 – Koala Habitat Protection on the 1st of March 2020. Although this assessment was written prior to the transition from SEPP no. 44, the Development Application (DA) is likely to be lodged after the 1st of March. Consequently, it has been included herewith for brevity. The primary changes which are of particular relevance to the Project with regards to the new SEPP are; the updated definition of core Koala habitat, the inclusion of two new Koala SEPP maps and an expanded list of tree species from 10 to 123.

1.6 Planning Secretary’s Environmental Assessment Requirements (SEARS)

The Planning Secretary’s Environmental Assessment Requirements (SEARs) issued for the Project under Section 4.12(8) of the Environmental Planning and Assessment Act 1979 and Schedule 2 of the Environmental Planning and Assessment Regulation 2000 specify the requirements to be addressed as outlined in **Table 3**.

Table 3 SEARS requirements addressed in this report

SEARS Biodiversity Requirement	Section Addressed
Accurate predictions of any vegetation to be cleared on site	Section 5.2
An assessment of the likely biodiversity impacts of the development, paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems, undertaken in accordance with *Biodiversity Assessment Method* and documented in a Biodiversity Development Assessment Report	Section 4.2.2 for Threatened Flora Section 4.3 for Threatened Fauna Section 5.3 for Groundwater Dependent Ecosystems
A strategy to offset any residual impacts of the development in accordance with the offset rules under the *Biodiversity Offsets Scheme*	Section 8.1 of the BDAR
An assessment on the likely impacts of Lake Macquarie City Council’s Awaba Biodiversity Conservation Area	Section 5.1

2 STAFF QUALIFICATIONS AND LICENSING

2.1 Qualifications

This report was written by Joe May (Accredited BAM Assessor – BAAS18058) and reviewed by Arne Bishop (Accredited BAM Assessor - BAAS17065). Fieldwork was undertaken by Joe May, Giorginna Xu, Rhys Corrigan, Zachariah Cotter, Shelomi Doyle, Duncan Scott-Lawson, Daniel Creevey, Tristam Richardson, Hayden Beck, Alan Midgley, Sam Des Forges, Shawn Ryan, Tara Boreham, Simon Danielson, Vanessa Walker, Jessica Sharp, Joe Gibbs, Michael Collins-Levy, Janene Devereux, Diane Warman, Daniel Watts and Kieran Marshall. Academic qualifications and professional experience of RPS the authors are documented in **Appendix A**. The additional staff involved in the fieldwork's qualifications are available upon request.

2.2 Licensing

Research was conducted under the following licences:

- NSW National Parks and Wildlife Scientific Investigation Licence S100536 (Valid 31 December 2019);
- Animal Research Authority (Trim File No: 01/1142) issued by NSW Agriculture (Valid 25 March 2022);
- Animal Care and Ethics Committee Certificate of Approval (Trim File No: 01/1142) issued by NSW Department of Primary Industries (Valid 21 March 2020); and
- Certificate of Accreditation of a Corporation as an Animal Research Establishment (Trim File No: 01/1522 & Ref No: AW2001/014) issued by NSW Agriculture (Valid 22 May 2020).

3 METHODOLOGY

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

3.1 Desktop Assessment

3.1.1 Databases

A review of relevant information was performed to gain an understanding of the biodiversity values occurring or potentially occurring within the Study Area. Information sources reviewed for a 10 km radius of the Study Area (hereafter the 'locality') included:

- BAM Calculator (BAM-C) candidate species output;
- Flora and Fauna records contained in the Department of Planning, Industry and Environment (DPIE) Wildlife Atlas of NSW; and
- Flora and Fauna records contained in the Department of the Environment and Energy (DoEE) Protected Matters Search Tool.

A preliminary Biodiversity Risk Assessment Tool (BRAT) was produced from this information to provide a framework for determining investigation methods necessary for performing adequate site investigations.

3.1.2 Spatial Datasets

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

- Lake Macquarie Native Vegetation Community Map (Bell and Driscoll 2015);
- Mitchell Landscapes (NPWS 2003a);
- IBRA region and subregion mapping (IBRA7); and
- Recent aerial imagery of the Study Area.

3.1.3 Literature

A review of relevant information was undertaken to provide an understanding of ecological values occurring or potentially occurring within the Study Area and locality (i.e. within 10km). Previous reports prepared for the Study Area have been reviewed to assess the likelihood of threatened species or ecological communities occurring within the Study Area. Information sources reviewed included:

- RPS (2018) Newstan Mod 8 Biodiversity Inventory Report; and
- RPS (2018a) Newstan Annual Flora and Fauna Monitoring Report.

A review of commercially available aerial imagery, regional mapping and literature was also undertaken to identify areas of biodiversity value in the Study Area. Information sources included:

- Aerial Photograph Interpretation (API) to prepare preliminary vegetation mapping for the Study Area;
- Bell, S. A. and Driscoll, C (2015). Vegetation Mapping Report, Lake Macquarie Local Government Area. Unpublished report to Lake Macquarie City Council. Produced by East Coast Flora Survey;
- Bell, S. A. (2016a). Conversion Lake Macquarie Native Vegetation Community Map Units to Plant Community Types (PCTs) March 2016. Accessed November 2019.

https://lakemac.com.au/page.aspx?pid=109&vid=25&fid=138&ftype=FGrp; Department of Land and Water Conservation (2002) NSW State Groundwater Dependent Ecosystem Policy;

- Eamus, D. (2009) Identifying groundwater dependent ecosystems, A guide for land and water managers. Australian Government – Land and Water Australia;
- Kleinfelder (2015) Completion Report for 2010 – 2015 Bi-annual Nest Box Monitoring Project;
- Lake Macquarie City Council (2015) Lake Macquarie Native Vegetation and Corridors Map;
- National Parks and Wildlife Service (2003b). Lower Hunter and Central Coast Regional Environment Management Strategy Vegetation Survey, Classification and Mapping; Lower Hunter and Central Coast Region (LHCCREMS);
- A review of Geographic Information System (GIS) data including (but not limited to) aerial photography, topographic maps, SEPP 14 Wetland Mapping, Soil Landscapes and Acid Sulphate Soil Potential; and
- Collective knowledge gained from extensive work in the area.

3.1.4 Likelihood of Occurrence

The list of threatened species, populations and ecological communities (collectively referred to as 'threatened entities') identified as potentially occurring was determined through a Likelihood of Occurrence (LoO; **Appendix B**). A preliminary LoO was performed prior to field surveys to guide investigation methods and effort. This was subsequently refined following the completion of field survey. The relevant criteria used in the LoO is listed below in **Table 4**.

Table 4 Likelihood of Occurrence criteria

Likelihood	Threatened Fauna	Threatened Flora
None	Broad habitat types are absent from the Study Area. Species incidence is not expected and, if present, would represent atypical habitat usage.	
Low	Broad habitat types are absent from the Study Area. Species may be an occasional transient visitor with incidence likely to be random and unrelated to known habitat needs. Species unlikely to depend on available habitat for breeding or important life cycle processes.	Broad habitat types are absent from the Study Area. Species incidence likely to be random and unrelated to known habitat needs. Species unlikely to depend on available habitat for breeding or important life cycle processes.
Moderate	Study Area habitat types broadly align with known habitat surrogates (e.g. vegetation formations). While species may occasionally occur, it is unlikely to support sedentary populations (e.g. opportunistic habitat use or use during movement/ migration). Habitat usage may be supplementary to nearby higher value habitat or associated with the use of better habitat types in a modified or degraded state.	Study Area habitat types broadly align with known habitat surrogates (e.g. vegetation formations). While species may occasionally occur, presence is likely to be uncommon and restricted due to the absence of important micro habitat needs. Habitat may be associated with nearby higher value habitat or better habitat types occurring in a modified or degraded state.
High	Habitat values generally consistent with published literature and/ or known occurrences. If present, the species is likely to depend on the identified habitat values for breeding or important life cycle processes; although, habitat importance would depend on additional factors.	
Known	The species was observed in the Study Area during the current survey.	

Note: that regardless of the outcome of the LoO, BAM Candidate species still required to be surveyed for within the prescribed timeframe. In accordance with BAM, Candidate Species may only be dismissed from requiring survey when:

- presence is assumed;

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

3.2 Flora Surveys

Flora surveys were conducted in accordance with the BAM, with the aim to identify the vegetation communities existing on site. Species detected are listed in **Appendix C**.

3.2.1 Vegetation Mapping

The Lake Macquarie Vegetation Community Mapping (Bell and Driscoll 2015) was used as the basis for a preliminary analysis of vegetation patterns within the Study Area. Bell and Driscoll (2015) mapping was updated following re-interpretation of mapped vegetation boundaries using the latest aerial photography (i.e. Google Earth™ 2019) prior to survey stratification. PCTs were assigned to Bell and Driscoll (2015) using the conversion table by Bell (2016a). Preliminary PCTs were assigned to areas of relatively homogenous land cover (i.e. vegetation zones). Additional revisions were performed following the completion of field surveys (i.e. revision of boundaries and condition classes). PCT extent was calculated in a Geographic Information System (GIS) program (ArcGIS™) to determine the number of BAM plots required and implementation of other survey methods.

3.2.1.1 Rapid Data Points (RDPs)

Rapid Data Points were undertaken across the Study Area to assist vegetation classification and refine the boundaries and distribution of PCTs. In total, 223 RDPs were undertaken. Information recorded at each RDP include:

- Dominant canopy species;
- Main associated species;
- Landscape position;
- Characteristic mid-storey species;
- Characteristic groundcover species; and
- Other diagnostic features.

Legend

- Extension of Mining Area
- Survey Area
- Eraring Energy Land

Plant Community Type

- 1588 - Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast
- 1598 - Forest Red Gum grassy open forest on floodplains of the lower Hunter
- 1619 - Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
- 1627 - Smooth-barked Apple - Turpentine - Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast
- 1636 - Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast
- 1638 - Smooth-baked Apple - Red Bloodwood - Scribbly Gum grass - shrub woodland on lowlands of the Central Coast
- 1716 - Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast
- 1718 - Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast
- 1737 - Typha rushland

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200 100 0 200 400 600 800 1,000 m

SCALE: 1:23,000 AT A3 SIZE

TITLE : FIGURE 2: VEGETATION MAPPING

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **5/02/2020**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): D A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\Biodiversity Inventory Report Figures\141842 Figure 2 Vegetation Mapping_D A3L 20200205.mxd

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3.2.2 BAM Plots

Forty-one floristic plots were undertaken in accordance with BAM to measure the vegetation integrity (i.e. composition, structure and functional components) of the sites' native vegetation cover. BAM plots were placed in locations that were representative of the vegetation zones being assessed. That is, BAM plots were placed to avoided near ecotones, tracks and other areas of disturbance.

Each plot included:

- One standard 20 x 20 m plot, to assess the composition and structure attributes, including trees, shrubs, grasses, forbs, ferns and other growth forms;
- One standard 20 x 50 m plot (1000 m^2) to assess the function attributes: number of large trees (i.e. > 50 cm DBH), stem size class, tree regeneration, length of fallen logs, high threat exotic vegetation cover and hollow-bearing trees; and
- Five 1 m^2 sub-plots to assess average litter cover for the plots.

The methods for collecting data from within a BAM plot are described in DPIE (2017). BAM plot locations are outlined in **Figure 3**.

Legend

- Extension of Mining Area
- Survey Area
- Eraring Energy Land
- BAM Plot
- Tracks and Roads

Plant Community Type

- 1588 - Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast
- 1598 - Forest Red Gum grassy open forest on floodplains of the lower Hunter
- 1619 - Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands
- 1627 - Smooth-barked Apple - Turpentine - Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast
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- 1737 - Typha rushland

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OLNEY STREET
NEWSTAN-ERARING PRIVATE COAL ROAD
WILTON ROAD
THE PARKWAY
DORRINGTON ROAD
IMMARNA ROAD
DONNELLY ROAD
WANGI ROAD
WANGI POINT ROAD
SUNSET CL
EUCALYPT
HAWKE MOUNT ROAD
SIMPSON ROAD
JUNCTION ROAD
CONSTRUCTION ROAD

SCALE: 1:22,000 AT A3 SIZE

TITLE : FIGURE 3: BAM PLOT

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **5/02/2020**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): B A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\Biodiversity Inventory Report Figures\141842 Figure 3 BAM Plots_C A3L 20200205.mxd

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3.2.3 Quality Control

To ensure the floristic data collected were reliable, all BAM plots were undertaken by experienced ecologists with an in depth understanding of native vegetation within the LMCC LGA. Where there was uncertainty identifying a species, a specimen (i.e. leaves, buds, fruit and or flowers) was collected and later identified using relevant guides and keys (including PlantNET; National Herbarium of NSW, 2018). In cases where further resolution was required, samples were sent to the National Herbarium of NSW to confirm identification.

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

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

3.2.4 Targeted Flora Surveys

Targeted flora searches were conducted with the aim of locating threatened flora species identified as Candidate Species (as identified in the BAM-C) or those not identified by the BAM-C but have a moderate or greater likelihood of occurring in the Study Area. Searches were made within potential habitat occurring within the Study Area using parallel transects (DPIE 2016a). Plant specimens of unknown or significant status were collected for later identification or lodgement with the National Herbarium of NSW. Surveys were performed with reference to methods, timing and effort specified in DPIE (2016a); the survey effort undertaken for candidate species is summarised in **Table 5**.

Table 5 Maximum distances between parallel field traverses (DPIE 2016a)

Species	Maximum distances between traverses	Threatened Species (Candidate Species and or EPBC Act Listed)
Trees, Mallee trees and tall shrubs (>6 m)	40 m	*Angophora inopina* *Eucalyptus camfieldii* *Eucalyptus oblonga* *Eucalyptus parramattensis subsp. decadens* *Eucalyptus parramattensis subsp. parramattensis* *Melaleuca biconvexa* *Melaleuca groveana*
Medium shrubs (1 to 6 m) Cycads and large ferns	20 m	*Astrosticha crassifolia* *Callistemon linearifolius* *Senna acclinis* *Syzygium paniculatum*
Sub-shrubs (<1 m)	15m	*Acacia bynoeana* *Darwinia glaucophylla* *Grevillea parviflora subsp. parviflora* *Hibbertia procumbens* *Persoonia hirsute subsp. hirsute* *Prostanthera askania* *Prostanthera junonis*
Herbs and forbs	10 m	*Pelargonium sp. Striatellum* *Rutidosis heterogama*
Ferns (<1 m) Grasses/sedges/rushes and other graminoids Orchids Epiphytes and climbers	10 m	*Calledenia tessellata* *Corybas dowlingii* *Cryptostylis hunteriana* *Cynanchum elegans* *Diuris bracteate* *Diuris praecox*

Species	Maximum distances between traverses	Threatened Species (Candidate Species and or EPBC Act Listed)
		Genoplesium insigne *Maundia triglochinoides* *Persicaria elatior* *Tetratheca glandulosa* *Tetratheca juncea* *Zannichellia palustris*

The locations of the targeted flora searches are shown in **Figures 4** to **7**.

Legend

- Extension of Mining Area
- Survey Area
- Eraring Energy Land
- January Threatened Flora Search
- January 7 to January 31 tracklog

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200 100 0 200 400 600 800 1,000 m

SCALE: 1:23,000 AT A3 SIZE

nearmap

TITLE : FIGURE 4: SUMMER THREATENED FLORA TRACKS

LOCATION : NEWSTAN

DATUM: GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **6/02/2020**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): B A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\Biodiversity Inventory Report Figures\141842 Figure 4 Summer th flora tracks B A3L 20200206.mxd

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Legend

- Extension of Mining Area
- Survey Area
- Eraring Energy Land
- *Corybas_dowlingii* Search Areas
- May 20 to June 1 Tracklog

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200 100 0 200 400 600 800 1,000 m

SCALE: 1:23,000 AT A3 SIZE

TITLE : FIGURE 5: MAY 20 TO JUNE 1 THREATENED FLORA TRACKS

LOCATION : NEWSTAN

DATUM: GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **6/02/2020**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): B A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\Biodiversity Inventory Report Figures\141842 Figure 5 May 20 to June 1 th flora tracks B A3L

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Legend

- Extension of Mining Area
- Survey Area
- Eraring Energy Land
- August Threatened Flora Search
- August 1 to August 30 Tracklog

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200 100 0 200 400 600 800 1,000 m

SCALE: 1:23,000 AT A3 SIZE

TITLE : FIGURE 6: AUGUST 1 TO AUGUST 30 THREATENED FLORA TRACKS

LOCATION : NEWSTAN

DATUM: GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **6/02/2020**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): B A3 (Natalie.Wood)

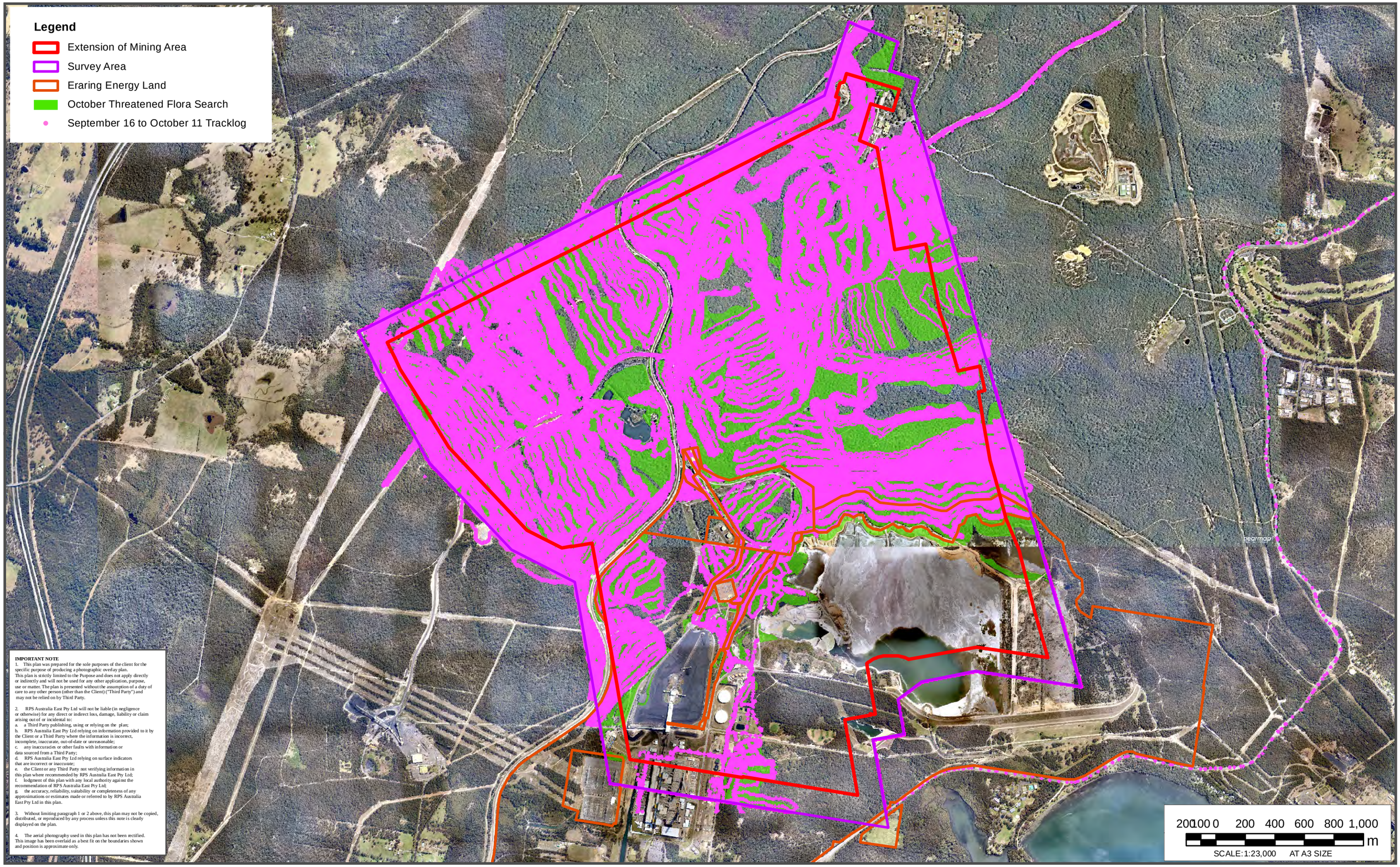
PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\Biodiversity Inventory Report Figures\141842 Figure 6 August 1 to August 30 th flora tracks B A3L

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TITLE : FIGURE 7: SEPTEMBER 16 TO OCTOBER 11 THREATENED FLORA TRACKS

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **6/02/2020**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): B A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\Biodiversity Inventory Report Figures\141842 Figure 7 September 16 to October 11 th flora tracks B

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3.3 Fauna Surveys

Field survey methods, timing and effort used in this investigation reflected the results obtained from the desktop assessment (i.e. identification of threatened fauna species listed under the BC Act and/or EPBC Act that may occur within the Study Area) and initial BAM Credit Calculator entry output. Survey techniques performed in this investigation are outlined below and included Elliot Trapping, hair Tubes, infrared cameras, spotlighting, call playback, Anabat recordings, point sampling for avifauna and opportunistic sightings. A description of these survey techniques is provided in **Sections 3.3.1** to **3.3.6**.

Vegetation stratification units, mapped to guide fauna survey effort, is shown in **Figure 8**, whilst locations of these surveys are shown in **Figure 9**. A summary of the survey timing, effort and locations is outlined in **Section 3.4**.

3.3.1 Mammal Census

3.3.1.1 Ground Trapping

Candidate Species Targeted: *Planigale maculata* (Common Planigale), *Potorous tridactylus* (Long-nosed Potoroo) and *Pseudomys novaehollandiae* (New Holland Mouse).

Terrestrial trapping was undertaken using Elliott A and Elliott B traps. Elliott traps were baited with a mixture of rolled oats, peanut butter and honey. Traps were checked within two hours of sunrise each morning, with any captures identified and released at point of capture. Traps were re-baited where necessary. The selected locations of the trap lines focused on stratification units as well as areas consisting of understorey that would provide protection for terrestrial mammal species.

Terrestrial traps targeted small terrestrial mammals, such as dasyurids (e.g. Antechinus and Dunnarts) and rodents (e.g. rats and mice). A total of eleven traplines consisting of 220 Elliott A and 220 Elliott B traps were established for five nights (i.e. 1100 Elliott A trap nights and 1100 Elliott B trap nights). Locations of those traplines were guided by stratifying the Study Area by bushland type, as per **Figure 8**. Trapline locations are displayed in **Figure 9**.

3.3.1.2 Arboreal Trapping

Candidate Species Targeted: *Petaurus norfolcensis* (Squirrel Glider); *Cercartetus nanus* (Eastern Pygmy-possum); *Phascogale tapoatafa* (Brush-tailed Phascogale) and *Petauroides Volans* (Greater Glider).

Arboreal trapping was undertaken using tree mounted Elliott B size traps. Traps were mounted on brackets set at approximately 3 m in height on trees with a diameter at breast height (DBH) greater than 30 cm. Traps were baited with rolled oats, peanut butter and honey mixture, and the tree trunks were sprayed liberally with a brown sugar and water mix each day in the late afternoon. Traps were checked early the following morning. Eleven transects of five arboreal Elliott B traps were established across the Study Area. Traps were set for five nights with reference to LMCC squirrel glider guidelines, with a total of 605 arboreal Elliott B trap nights.

3.3.1.3 Hair Funnel

Candidate Species Targeted: Planigale maculat*a* (Common Planigale); *Potorous tridactylus* (Long-nosed Potoroo); *Pseudomys novaehollandiae* (New Holland Mouse); *Petaurus norfolcensis* (Squirrel Glider); *Cercartetus nanus* (Eastern Pygmy-possum); *Phascogale tapoatafa* (Brush-tailed Phascogale) and *Petauroides Volans* (Greater Glider).

Surveys were undertaken using Hair Funnels, baited with rolled oats, peanut butter and honey. Trees in which arboreal Hair Funnels were erected were sprayed with a brown sugar and water mix. Eleven hair tube transects were deployed in combination with terrestrial traplines established for five nights each for a total of 275 arboreal and 275 terrestrial trap nights. In addition to this, a total of 11 terrestrial and 11 arboreal Hair Funnels were deployed throughout the Study Area for a total of 28 nights each (**Figure 10**). This totals 583 terrestrial and 583 arboreal Hair Funnel trap-nights.

3.3.1.4 Camera Traps

Candidate Species Targeted: *Petaurus norfolcensis* (Squirrel Glider); *Petauroides Volans* (Greater Glider); *Cercartetus nanus* (Eastern Pygmy-possum); *Phascogale tapoatafa* (Brush-tailed Phascogale); *Planigale maculata* (Common Planigale); *Macropus parma* (Parma Wallaby); *Petrogale penicillate* (Brush-tailed Rock-wallaby); *Phascolarctos cinereus* (Koala); *Varanus rosenbergi* (Rosenberg's Goanna).

Nine camera traps were deployed to sample for a combination of ground-dwelling and arboreal mammals, including small-medium mammals such as dasyurids (e.g. Antechinus and Dunnarts), rodents (e.g. rats and mice), gliders, and bandicoots. These camera traps were baited with the rolled oats mixture, as well as tinned cat food to sample for predatorial and omnivorous species.

3.3.1.5 Spotlighting

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

Spotlighting was undertaken with the use of a hand-held spotlight and head torch whilst walking and driving over the Study Area. Areas of dense bush were targeted; however, tracks were also spotlighted whilst entering and exiting the Study Area.

3.3.1.6 Nocturnal Call Playback

Candidate Species Targeted: *Petaurus norfolcensis* (Squirrel Glider) and Koala (*Phascolarctos cinereus)*.

Pre-recorded calls of Squirrel gliders, Koalas and Yellow-bellied Gliders were broadcast to elicit vocal responses or to attract these species to the Project Area. The calls were broadcast through an amplification system (loud hailer) designed to project the sound for at least 1 km under still night conditions.

As described by Kavanagh and Peake (1993) and Debus (1995), the call of each species was broadcast for at least five minutes, followed by five minutes of listening, and stationary spotlighting. Following the final broadcast and listening, the area was spotlighted on foot.

3.3.1.7 Transect surveys

Candidate Species Targeted: *Pteropus poliocephalus* (Grey-headed Flying-fox); and Koala (*Phascolarctos cinereus)*.

Potential flying fox camps were searched for on foot using transect surveys of the entire Study Area, watching for flying bats and listening for their distinctive calls. In conjunction with threatened species surveys, observations for Koala activity (individual, scratch marks, scats etc) were search for throughout the Study Area.

3.3.2 Anabat Census

Candidate Species Targeted: *Chalinolobus dwyeri* (Large-eared Pied Bat); *Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Kerivoula papuensis* (Golden-tipped Bat), *Miniopterus australis* (Little Bentwing-bat); *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat); *Mormopterus norfolkensis* (Eastern Freetail-bat); *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat); *Scoteanax rueppellii* (Greater Broad-nosed Bat);*Vespadelus troughtonii* (Eastern Cave Bat) and *Myotis micropus* (Southern Myotis).

Microbat echolocation calls were recorded using Anabat Detector units set to remotely record for the entire night (6 pm to 6 am). Survey locations had emphasis placed on areas deemed likely to provide potential foraging and flyway sites for microbats. Twelve individual units were deployed between 9 January and 12 February. Bat call analysis was undertaken by Echo Ecology (**Appendix H**). Each call sequence ('pass') was assigned to one of three categories, according to the confidence with which identification could be made, being:

- Definite - Pass identified to species level and could not be confused with another species;
- Probable - Pass identified to species level and there is a low chance of confusion with another species; or
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species.

3.3.3 Avifauna Census

3.3.3.1 Point/area Bird Census

Candidate Species Targeted: *Anseranas semipalmata* (Magpie Goose); *Anthochaera phrygia* (Regent Honeyeater); *Artamus cyanopterus* (Dusky Woodswallow); *Botaurus poiciloptilus* (Australian Bittern); *Burhinus grallarius* (Bush Stone-curlew); *Calidris tenuirostris* (Great Knot); *Callocephalon fimbriatum* (Gang-gang Cockatoo); *Calyptorhynchus lathami* (Glossy Black-Cockatoo); *Chthonicola sagittate* (Speckled Warbler); *Circus assimilis* (Spotted Harrier); *Climacteris picumnus victoriae* (Brown Treecreeper); *Daphoenositta chrysoptera* (Varied Sittella); *Dasyornis brachypterus* (Eastern Bristlebird); *Ephippiorhynchus asiaticus* (Black-necked Stork); *Epthianura albifrons* (White-fronted Chat); *Glossopsitta pusilla* (Little Lorikeet); *Grantiella picta* (Painted Honeyeater); *Haliaeetus leucogaster* (White-bellied Sea-Eagle); *Hieraaetus morphnoides* (Little Eagle); *Irediparra gallinacean* (Comb-crested Jacana); *Ixobrychus flavicollis* (Black Bittern); *Lathamus discolour* (Swift Parrot); *Limicola falcinellus* (Broad-billed Sandpiper); *Limosa limosa* (Black-tailed Godwit) and *Lophoictinia isura* (Square-tailed Kite).

Each point-based, comprised a 20-minute observation of a 0.79 ha (50 m radius) circular plot. During the 20 min period, the observer stayed at the point, watching and listening for bird activity in the surrounding 50 m. This allowed the observer to safely keep track of individual birds within the reduced area, recording the numbers of each species and the closest distance that they approached the point during the 20 min period. Surveys were conducted within 3 hours of sunrise to improve the consistency of sampling conditions across the Study Area (i.e. period of highest bird activity).

During the bird survey, any cryptic bird species that may have been missed during the point count period were noted. Birds flying through the area were not recorded unless they were regarded as making some use of that vegetation type, for example, foraging in the airspace above.

3.3.3.2 Transect Surveys

Candidate Species Targeted: *Pandion cristatus* (Eastern Osprey); *Hieraaetus morphnoides* (Little Eagle); *Haliaeetus leucogaster* (White-bellied Sea-Eagle); and *Lophoictinia isura* (Square-tailed Kite).

Breeding habitat for these candidate species were undertaken on foot using belt transects throughout the Study Area across all four seasons, in conjunction with threatened flora searches (see **Section 3.2.4**). Surveys utilised sound and visual recognition to identify species.

3.3.3.3 Nocturnal Call Playback

Candidate Species Targeted: *Tyto tenebricosa* (Sooty Owl); *Ninox strenua* (Powerful Owl); *N. connivens* (Barking Owl); and *Tyto novaehollandiae* (Masked Owl).

Pre-recorded calls of threatened Owl species with the potential to occur within the Study Area were broadcast to elicit vocal responses or to attract the species to the Study Area. The calls were broadcast through an amplification system (loud hailer) designed to project the sound for at least 1 km under still night conditions.

As described by Kavanagh and Peake (1993) and Debus (1995), the call of each species was broadcast for at least five minutes, followed by five minutes of listening and stationary spotlighting. Following the final broadcast and listening, the area was spotlighted on foot.

3.3.4 Herpetofauna Census

Candidate Species Targeted: *Crinia tinnula* (Wallum Froglet); *Heleioporus australiacus* (Giant Burrowing Frog); *Hoplocephalus bitorquatus* (Pale-headed Snake); *Hoplocephalus bungaroides* (Broad-headed Snake); *Hoplocephalus stephensii* (Stephens' Banded Snake); *Litoria aurea* (Green and Golden Bell Frog); *Litoria brevipalmata* (Green-thighed Frog); *Mixophyes balbus* (Stuttering Frog); *Mixophes iteratus* (Giant Barred Frog); *Pseudophryne australis* (Red-crowned Toadlet), *Uperoleia mahonyi* (Mahony's Toadlet) and *Varanus rosenbergi* (Rosenburg's monitor).

Herpetofauna searches were undertaken via a combination of spotlighting and opportunistic surveys.

Spotlighting was undertaken with the use of a hand-held spotlight and head torch whilst walking and driving over the Study Area. Areas of dense bush were targeted; however, tracks were also spotlighted whilst entering and exiting the Study Area.

Camera traps referred to in **Section 3.3.1.4** were used to add survey effort for the detection of *Varanus rosenbergi*, *Hoplocephalus bitorquatus* and *Hoplocephalus stephensii*.

Any herpetofauna that was opportunistically observed were recorded.

3.3.5 Secondary Indications and Incidental Observations

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

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

3.3.6 Habitat Survey

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

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

Legend

- Extension of Mining Area
- Survey Area

Straified Vegetation

- Dry Sclerophyll Forests (Shrubby sub-formation)
- Dry sclerophyll Forests (Shrub/grass sub-formation)
- Forested Wetlands
- Freshwater Wetlands
- Traplines

1 2 3 4 5 6 7 8 9 10 11

nearmap

200 100 0 200 400 600 800 1,000 m

SCALE: 1:23,000 AT A3 SIZE

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TITLE : FIGURE 8: STRATIFIED VEGETATION CLASSES

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **6/02/2020**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): B A3 (Natalie.Wood)

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Legend

- Extension of Mining Area
- Survey Area
- Traplines
- Harp Traps
- HairTraps
- Nest Box's
- Camera Traps
- Bird Census
- Anabats

Straified Vegetation

- Dry Sclerophyll Forests (Shrubby sub-formation)
- Dry sclerophyll Forests (Shrub/grass sub-formation)
- Forested Wetlands
- Freshwater Wetlands

N

1 2 3 4 5 6 7 8 9 10 11

nearmap

200 100 0 200 400 600 800 1,000 m

SCALE: 1:22,000 AT A3 SIZE

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TITLE : FIGURE 9: FAUNA SURVEY METHODS AND EFFORT

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **6/02/2020**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): B A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\Biodiversity Inventory Report Figures\141842 Figure 10 Fauna survey methods B A3L 20200206.mxd

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3.4 Survey Details

3.4.1 Survey Effort

The survey effort expended as part of this investigation is outlined in **Table 6**.

Table 6 Survey Effort

Method	Survey Effort
Rapid data points (RDPs)	223 RDPs were undertaken throughout the Study Area in order to ground truth Lake Macquarie vegetation mapping and determine the PCT types and extents.
BAM plots	41 BAM plots were undertaken throughout the Project Area.
Targeted flora transects	Transects undertaken in accordance with DPIE (2016a). Full Study Area surveys were completed on four separate occasions so that survey timings were in line with those recommended by the BAM. Those periods included January 7 to January 31, May 20 to June 14, August 1 to August 30 and September 16 to October 11. Further details are provided in **Section 3.4.1.1**.
Camera traps	Nine camera traps were deployed during January and September 2019.
Anabats	12 Anabats were deployed in the Study Area during January and February of 2019.
Harp traps	Two harp traps we deployed for one week from the 7 – 11 October 2019.
Terrestrial Elliot A and B traps and Arboreal Elliot B traps	Eleven traplines were deployed across the site in line with the recommendations of DECC (2004) and the Lake Macquarie Squirrel Glider Guidelines (2015). Each trapline contained 20 terrestrial B, 20 terrestrial A and five Arboreal B Elliot traps which were deployed over five nights. This totals 1100 Elliot A trap-nights, 1100 terrestrial B Elliot traps-nights and 275 arboreal B trap nights. Six traplines were deployed and checked between 16 – 21 of September and five traplines from 23 – 28 September.
Terrestrial and Arboreal hair tube traps	Five arboreal and five terrestrial hair-tubes were placed with each of the 11 trap-lines for five nights each. In addition, 11 arboreal and 11 terrestrial hair-tubes were placed out for a total of 28 nights. This totals 671 arboreal trap-nights and 671 terrestrial trap-nights. The 30 arboreal and 30 terrestrial hairtubes were deployed between 16 – 21 September and 25 arboreal and 25 terrestrial hair-tubes were deployed between 23 – 28 September. 11 arboreal and 11 terrestrial hair tubes were deployed between August 25 and October 1.
Nest-boxes	Eighteen nest-boxes were deployed at a height of approximately 1.5m for a period of 34 nights. Between August 25 and October 1.
Bird census	Seventeen bird census plots were undertaken throughout the Study Area between 14 – 18 January and 10 14 June.
Herpetofauna search	Six separate occasions to target threatened fauna via either random meandering transects on foot or along tracks by car. Surveys were conducted on 20 – 21 March, 16 – 17 June and 19 – 20 September.
Spotlighting	Six separate occasions to target threatened fauna via either random meandering transects on foot or along tracks by car. Surveys were conducted on 20 – 21 March, 16 – 17 June and 19 – 20 September.
Call playback	Six separate occasions to target threatened fauna. Surveys were conducted on 20 – 21 March, 16 – 17 June and 19 – 20 September.
General fauna / Opportunistic surveys	Study Area was thoroughly surveyed using parallel transects from January 7 to January 31, May 20 to June 14, August 1 to August 30 and September 16 to October 11. Opportunistic surveys of threatened and non-threatened fauna were undertaken in collaboration with those transects.

3.4.1.1 Flora

Targeted flora surveys were undertaken over 85 days; from January 7 to January 31; May 20 to June 14; August 1 to August 20; and September 16 to October 11, 2019. BAM flora plots were undertaken over nine days; on June 5, 7, 8 and 13 in 2018; November 15 and 16 in 2018; April 16 in 2014; May 13 and 14; November 14, 2019.

- PCT 1588 Grey Ironbark – Broad-leaved Mahogany – Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast;
- PCT 1598 Forest Red Gum grassy open forest on floodplains of the lower Hunter;
- PCT 1619 Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands;
- PCT 1627 Smooth-barked Apple – Turpentine – Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast;
- PCT 1636 Scribbly Gum – Red Bloodwood – Angophora inopina heathy woodland on lowlands on the Central Coast;
- PCT 1638 Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast;
- PCT 1716 – Prickly-leaved Paperbark forest on the coastal lowlands of the Central Coast and Lower North Coast;
- PCT 1718 – Swamp Mahogany – Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast; and
- PCT 1737 – Typha rushland.

Cleared areas within the existing easement and managed areas, which lack on overstory due to routine maintenance trimming, were also surveyed.

3.5 Dates and Weather Conditions

Weather conditions for days surveys were undertaken is provided in **Table 7**. Weather information was accessed from Cooranbong (station numbers 061012) at Latitude 33.09° S, Longitude 151.46° E, and 10 m ASL elevation. Data was also supplemented with a nearby station (061014). The weather station is approximately 4 km to the south-west of the Study Area.

Table 7 Weather conditions during survey periods

Date	Day	Temp (Min °C)	Temp (Max °C)	Rain (mm)
January 2019				
7	Mo	18.4	25.1	10.2
8	Tu	18.4	29.4	1.2
9	We	19.3	34	0
10	Th	22	25.3	0
11	Fr	19.9	28.4	0
14	Mo	21	28.5	0
15	Tu	18.5	31.3	0
16	We	19.8	33.6	0
17	Th	20.1	32.1	0
18	Fr	19.8	32.8	0

Date	Day	Temp (Min °C)	Temp (Max °C)	Rain (mm)
21	Mo	21	27.4	21.2
22	Tu	20.8	30.8	0.2
23	We	19.8	33.9	0
24	Th	22.3	28.8	0
25	Fr	20.7	32.1	0
28	Mo	22.9	28.4	1
29	Tu	19.6	31.6	0
30	We	21.2	32.6	0
31	Th	21.3	37.3	0
May/June 2019				
20	Mo	6.6	23.7	0
21	Tu	7.5	26.5	0
22	We	8.5	24.8	0
23	Th	9.7	24	0
24	Fr	7.5	25.7	0
27	Mo	3.1	19.9	0
28	Tu	4.9	17.8	1.4
29	We	9.1	19.4	0
30	Th	6.2	17.3	0
31	Fr	4.8	19.9	0
3	Mo	9.9	19.7	0.6
4	Tu	6.6	13.5	7.2
5	We	9	15.8	12.6
6	Th	3.3	18.9	0
7	Fr	6.8	18.2	0.4
10	Mo	6	23.2	0.2
11	Tu	6.6	24	0
12	We	5.1	23.3	0
13	Th	10.2	25.4	0.2
14	Fr	4.5	17.9	0
August 2019				
1	Th	8.5	19.3	2.4
2	Fr	4.1	17.2	0.2
5	Mo	4.5	19.3	0
6	Tu	-0.4	21.3	0
7	We	-0.8	23.4	0
8	Th	4.2	23.3	0.4
9	Fr	6.7	18.1	0
10	Sa	7.9	15.3	0
11	Su	7.8	15	0
12	Mo	7.4	18.4	0.4
13	Tu	-0.4	18.9	0
14	We	-0.6	18.9	0.2
15	Th		21.8	0.2
16	Fr		25.2	0
19	Mo	9.7	17.3	0

Date	Day	Temp (Min °C)	Temp (Max °C)	Rain (mm)
20	Tu	5.2	21.9	0
21	We	3.5	22.5	0
22	Th	12.7	21.7	0
23	Fr	7.8	18.8	0
26	Mo	12.6	18.9	0
27	Tu	10.5	19.5	0.6
28	We	5.8	21.8	0
29	Th	5.2	16.1	0.2
30	Fr	10.5	13.5	43.6
September/October 2019				
16	Mo	3.7	28.6	0.2
17	Tu	9.4	16.8	4
18	We	9.5	20.2	35.8
19	Th	13.8	20.6	16.2
20	Fr	10.3	22.1	2.2
21	Sa	11.6	26	0
23	Mo	10	22.8	0
24	Tu	3.4	20.2	0
25	We	5.2	21.4	0
26	Th	8.1	20.8	0
27	Fr	10.4	26.6	0
28	Sa	7.2	20.5	0
30	Mo	11.4	19	0.2
1	Tu	9.4	20.1	4.2
2	We	5.5	24	0.2
3	Th	7.2	27.9	0
4	Fr	9.1	33.8	0
5	Sa	15.9	18.9	1.2
8	Tu	15.2	26.2	0
9	We	9.1	18.9	1.6
10	Th	8	19.5	0.2
11	Fr	9.1	18.9	0.6

Source: Bureau of meteorology: http://www.bom.gov.au/climate/dwo/IDCJDW2159.latest.shtml

3.6 Limitations

Limitations associated with this Assessment are presented in **Section 3.6.1**. The limitations have been considered specifically in relation to threatened species assessments, results and conclusions.

3.6.1 Data Availability and Accuracy

The collated threatened flora and fauna species records provided by NSW Atlas of Wildlife Database for the region are known to vary in accuracy and reliability. Traditionally, this is due to the reliability of information provided to the NSW Atlas of Wildlife Database for collation and/or the need to protect specific threatened species locations. For the purposes of this report this information has been considered to have an accuracy of ± 1 km, however for some threatened species, records may be denatured by up to 2 km.

Threatened flora and fauna records within the region were predominantly sourced from the NSW Atlas of Wildlife Database (DPIE 2018a) and an EPBC Protected Matters Search (DoEE 2018). Similar limitations are known to exist with regards to these data sources and their accuracy.

Data recorded by RPS during the survey period, has been gathered with a Trimble Differential GPS unit, which is capable of sub-metre accuracy following post processing.

4 RESULTS

4.1 Desktop Assessment

4.1.1 Database Interrogation – Species

Database search results (DPIE 2019a; DoEE 2019) identified 24 threatened flora and 65 threatened fauna species with the potential to occur within the locality (i.e. 10 km radius of the Study Area). A comprehensive list of threatened species, including their habitat types, is provided in **Appendix B**. A summary of the threatened species with a moderate or greater likelihood of occurrence based on DPIE database search, literature review (**Section 3.1.2**), EPBC Protected Matters Search and BAM-C is provided in **Table 8**.

Table 8 Threatened Species with 'Moderate of Greater likelihood of occurrence

Scientific Name (Common Name)	Common Name	BC Act	EPBC Act
Acacia bynoeana	Bynoe's Wattle	E	V
Angophora inopina		V	V
Anthochaera phrygia	Regent Honeyeater	CE	E, M
Artamus cyanopterus	Dusky Woodswallow	V	-
Botaurus poiciloptilus	Australasian Bittern	E	E
Caladenia tessellata	Thick-lip Spider Orchid	E	V
Callistemon linearifolius		V	-
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-
Cercartetus nanus	Eastern Pygmy-possum	V	-
Chalinolobus dwyeri	Large-eared Pied Bat	V	V
Chthonicola sagittata	Speckled Warbler	V	-
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	-
Crinia tinnula	Wallum Froglet	V	-
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V
Cynanchum elegans	White-flowered Wax Plant	E	E
Daphoenositta chrysoptera	Varied Sittella	V	-
Dasyurus maculatus	Spotted-tailed Quoll	V	E
Diuris bracteata		E	Extinct
Diuris praecox	Rough Doubletail	V	V
Ephippiorhynchus asiaticus	Black-necked Stork	E	-
Epthianura albifrons	White-fronted Chat	V	-
Eucalyptus camfieldii		V	V
Eucalyptus oblonga		EP	-
Eucalyptus parramattensis subsp. decadens		V	V
Eucalyptus parramattensis subsp. parramattensis		EP	-
Falsistrellus tasmaniensiS	Eastern False Pipistrelle	V	-
Genoplesium insigne	Variable Midge Orchid	E	-
Glossopsitta pusilla	Little Lorikeet	V	-
Grantiella picta	Painted Honeyeater	V	-
Grevillea parviflora subsp. parviflora	Small-flowered Grevillea	V	V
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	M

Scientific Name (Common Name)	Common Name	BC Act	EPBC Act
Heleioporus australiacus	Giant Burrowing Frog	V	V
Hibbertia procumbens	Spreading Guinea Flower	E	-
Hieraaetus morphnoides	Little Eagle	V	-
Hoplocephalus bitorquatus	Pale-headed Snake	V	-
Hoplocephalus stephensii	Stephens' Banded Snake	V	-
Irediparra gallinacea	Comb-crested Jacana	V	-
Ixobrychus flavicollis	Black Bittern	V	-
Lathamus discolor	Swift Parrot	E	CE
Litoria aurea	Green and Golden Bell Frog	E	V
Litoria brevipalmata	Green-thighed Frog	V	-
Litoria littlejohni	Littlejohn's Tree Frog	V	V
Lophoictinia isura	Square-tailed Kite	V	-
Macropus parma	Parma Wallaby	V	-
Maundia triglochinoides		V	-
Melaleuca biconvexa	Biconvex Paperbark	V	V
Mormopterus norfolkensis	Eastern Freetail-bat	V	-
Microtis angusii	Angus's Onion Orchid	E	E
Miniopterus australis	Little Bentwing-bat	V	-
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V	-
Mixophyes iteratus	Giant Barred Frog	E	E
Myotis macropus	Southern Myotis	V	-
Neophema pulchella	Turquoise Parrot	V	-
Nettapus coromandelianus	Cotton Pygmy-goose	E	-
Ninox connivens	Barking Owl	V	-
Ninox strenua	Powerful Owl	V	-
Pandion cristatus	Osprey	V	-
Persicaria elatior		V	V
Petalura gigantea	Giant Dragonfly	E	-
Petauroides volans	Greater Glider	-	V
Petaurus australis	Yellow-bellied Glider	V	-
Petaurus norfolcensis	Squirrel Glider	V	-
Petroica boodang	Scarlet Robin	V	-
Phascogale tapoatafa	Brush-tailed Phascogale	V	-
Phascolarctos cinereus	Koala	V	V
Planigale maculata	Common Planigale	V	-
Potorous tridactylus	Long-nosed Potoroo	V	V
Prostanthera askania		E	E
Prostanthera junonis		E	E
Pseudomys novaehollandiae	New Holland Mouse	-	V
Pseudophryne australis	Red-crowned Toadlet	V	-
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Ptilinopus regina	Rose-crowned Fruit-dove	V	-
Rhodamnia rubescens	Scrub Turpentine	CE	-
Rostratula australis	Australian Painted Snipe	E	E, M
Rutidosis heterogama		V	V
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-

Scientific Name (Common Name)	Common Name	BC Act	EPBC Act
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-
Senna acclinis		E	-
Syzygium paniculatum	Magenta Lilly Pilly	E	V
Tetratheca glandulosa	Tetratheca glandulosa	V	V
Tetratheca juncea	Black-eyed Susan	V	V
Thesium australe	Austral Toadflax	V	V
Turnix maculosus	Red-backed Button-quail	V	-
Tyto novaehollandiae	Masked Owl	V	-
Tyto tenebricosa	Sooty Owl	V	-
Uperoleia mahonyi	Mahony's Toadlet	CE	CE
Vespadelus troughtoni	Eastern Cave Bat	V	-

Key: V: Vulnerable; E: Endangered; CE: Critically Endangered; -: Not Listed

4.1.2 Resources

- Department of Energy and Environment Australian Government's Species Profiles and Threats (SPRAT) database (http://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl);
- Department of Energy and Environment EPBC Act Protected Matters Search Tool (http://www.environment.gov.au/epbc/protected-matters-search-tool; Accessed December 2018);
- Office of Environment and Heritage Threatened Species Profiles (http://www.environment.nsw.gov.au/threatenedspeciesapp/; Accessed December 2018);
- Interim Biogeographical Regionalisation for Australia (IBRA) and IBRA sub-regions (http://www.environment.gov.au/land/nrs/science/ibra);
- DPI profiles of threatened species, populations and ecological communities;
- DPIE VIS Mapping (http://www.environment.nsw.gov.au/research/VISmap.htm);
- NSW Biodiversity Values Map (https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BVMap; Accessed August 2018); and
- State of NSW (2017). Biodiversity Assessment Method.

4.1.3 Spatial Datasets

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

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

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

The Study Area is highly connected to bushland to the south, west and north. The largest of these is the Wollomi State Forest to the west. This vegetation is largely intact. The M1 Pacific Motorway and rail corridor present a potential barrier for fauna moving west towards Wollemi State Forest.

The Study Area is predominantly vegetated. The Study Area provides a variety of internal habitat linkages along creeks, gullies and ridgelines, and as such is mapped as a corridor of remnant native vegetation or corridor of partially cleared remnant native vegetation within the Lake Macquarie Native Vegetation and Corridors Map (LMCC 2015). Where clearing of native vegetation has occurred, the reason of this disturbance has been public and private roads, unsealed access tracks, clearing by past forestry, Awaba Colliery and Eraring Power Station.

4.1.4 Literature

A review of vegetation mapping by Bell and Driscoll (2015) for the Study Area was undertaken. This vegetation mapping identified five Vegetation Mapping Units (MUs) within the Study Area.

4.1.5 Candidate Species Survey Matrix – BAM Calculator

Sub-bioregion, landscape and regional vegetation mapping outlined in **Section 3.1.3** was entered in the NSW BAM-C to produce a survey matrix for State listed threatened species identified as having a likelihood of occurrence within the Study Area.

Species and appropriate survey periods (i.e. grey shading) is provided in **Table 9**. Survey adequacy has also been assessed in terms of the survey timing and methods used, as described in **Section 3**.

Table 9 Candidate Species List

Species Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Acacia bynoeana (Bynoe's Wattle)	x											
Angophora inopina	x											
Astrotricha crassifolia	x											
Caladenia tessellata (Thick-lip Spider Orchid)												
Callistemon linearifolius	x											
Cryptostylis hunteriana (Leafless Tongue-orchid)	x											
Cynanchum elegans (White-flowered Wax Plant)	x											
Darwinia glaucophylla	x											
Diuris bracteata								x				
Diuris praecox (Rough Doubletail)								x				
Eucalyptus camfieldii						x						
Eucalyptus oblonga						x						
Eucalyptus parramattensis subsp. decadens						x						
Eucalyptus parramattensis subsp. parramattensis						x						
Genoplesium insignis (Variable Midge Orchid)										x		

Species Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Grevillea parviflora subsp. parviflora (Small-flowered Grevillea)	x											
Hibbertia procumbens (Spreading Guinea Flower)	x											
Maundia triglochinoides	x											
Melaleuca biconvexa (Biconvex Paperbark)						x						
Melaleuca groveana						x						
Persicaria elatior	x											
Prostanthera askania										x		
Prostanthera junonis										x		
Rutidosis heterogama	x											
Senna acclinis	x											
Tetratheca glandulosa										x		
Tetratheca juncea (Black-eyed Susan)										x		
Zannichellia palustris (Zannichellia palustris)						x						
Anthochaera Phrygia (Regent Honeyeater)									x			
Burhinus grallarius (Bush Stone-curlew)										x		
Calidris ferruginea (Curlew Sandpiper)	x											
Calidris tenuirostris (Great Knot)										x		
Callocephalon fimbriatum (Gang-gang Cockatoo)	x											
Calyptorhynchus lathami (Glossy Black-Cockatoo)						x						
Cercartetus nanus (Eastern Pygmy-possum)										x		
Chalinolobus dwyeri (Large-eared Pied Bat)	x											
Crinia tinnula (Wallum Froglet)							x					
Haliaeetus leucogaster (White-bellied Sea-Eagle)								x				
Heleioporus australiacus (Giant Burrowing Frog)										x		
Hieraaetus morphnoides (Little Eagle)								x				
Hoplocephalus bitorquatus (Pale-headed Snake)	x											
Hoplocephalus bungaroides (Broad-headed Snake)								x				
Lathamus discolour (Swift Parrot)						x						
Limicola falcinellus												

Species Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(Broad-billed Sandpiper)												
Limosa (Black-tailed Godwit)	x											
Litoria aurea (Green and Golden Bell Frog)											x	
Litoria brevipalmata (Green-thighed Frog)												
Lophoictinia isura (Square-tailed Kite)										x		
Macropus parma (Parma Wallaby)						x						
Miniopterus australis (Little Bentwing-bat)	x											
Miniopterus schreibersii oceanensis (Eastern Bentwing-bat)	x											
Mixophyes balbus (Stuttering Frog)	x											
Mixophyes iteratus (Giant Barred Frog)	x											
Myotis Macropus (Southern Myotis)	x											
Nettapus coromandelianus (Cotton Pygmy-goose)						x						
Ninox strenua (Powerful Owl)						x						
Pandion cristatus (Osprey)						x						
Petalura gigantea (Giant Dragonfly)	x											
Petaurus norfolcensis (Squirrel Glider)										x		
Petrogale penicillate (Brush-tailed Rock-wallaby)								x				
Phascogale tapoatafa (Brush-tailed Phascogale)								x				
Phascolarctos cinereus (Koala)										x		
Planigale maculata (Common Planigale)										x		
Pseudophryne australis (Red-crowned Toadlet)	x											
Pteropus poliocephalus (Grey-headed Flying-fox)										x		
Turnix maculosus (Red-backed Button-quail)										x		
Tyto novaehollandiae (Masked Owl)						x						
Uperoleia mahonyi (Mahony's Toadlet)										x		
Vespadelus troughtoni	x											

Species Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(Eastern Cave Bat)												
Xenus cinereus (Terek Sandpiper)	x											

4.2 Flora

4.2.1 Plant Community Types (PCTs)

Ground truthing of the Study Area identified nine PCTs. In total, there is an estimated area of 1,036.16 ha of native vegetation cover in the Study Area. The composition of the PCTs compiling this native vegetation is listed below in **Table 10**.

Table 10 PCTs within the Study Area

PCT	Area (ha)	No. BAM Plots undertaken	BAM Plots required
PCT 1588 Grey Ironbark – Broad-leaved Mahogany – Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast;	30.23	4	4
PCT 1598 Forest Red Gum grassy open forest on floodplains of the Lower Hunter;	0.11	0[1]	0
PCT 1619 Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands;	421.2	9	7
PCT 1627 Smooth-barked Apple – Turpentine – Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast;	108.81	8	6
PCT 1636 Scribbly Gum – Red Bloodwood – Angophora inopina heathy woodland on lowlands on the Central Coast;	408.1	10	7
PCT 1638 Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast	46.82	3	3
PCT 1716 Prickly-leaved Paperbark forest on the coastal lowlands of the Central Coast and Lower North Coast;	5	3	3
PCT 1718 Swamp Mahogany – Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast	15.77	4	3
PCT 1737 Typha rushland	0.23	0[2]	1
Total	**1036.27**	**41**	**34**

[1]No BAM plot was undertaken in Forest Red Gum grassy open forest on floodplains of the lower Hunter, due to land access issues and the small size of the area. Benchmark conditions were adopted for this community. This is addressed in Section 4.2.1.2.

[2]No BAM plot was undertaken in Typha rushland due to access restrictions. Benchmark conditions were adopted for this community. This is addressed in **Section 4.2.1.8**.

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

Description: Open forests characterised by *Eucalyptus paniculata*. The understorey is typically shrubby with sparse climbers. The ground layer is characteristically grassy with various graminoids and forbs. Coastal lowlands of the Central Coast mainly on sandstones.

BAM Plot Number: 3, 5, 15 and 27.

Diagnostic upper stratum species: *Eucalyptus umbra* (Plots 3, 5, 15 and 27).

Diagnostic middle stratum species: *Breynia oblongifolia* (Large Mock-olive; Plot 15); *Dodonaea triquetra* (Large-leaf Hop-bush; Plots 5 and 15); *Eustrephus latifolius* (Wombat Berry; Plots 3, 5 and 15); *Pandorea pandorana* (Wonga Vine; Plots 3,5,15 and 27).

Diagnostic ground stratum species: *Themeda triandra* (Kangaroo Grass: Plots 3, 5,15 and 27); *Imperata cylindrica* (Blady Grass; Plots 3, 5,15 and 27); *Dianella caerulea* (Blue Flax-lily; Plots 3, 5,15 and 27); *Lomandra longifolia* (Spiny-headed Mat-rush; Plots 5 and 15); *Pratia purpurescens* (Whiteroot; Plot 5) and *Glycine clandestine* (Twining glycine; Plots 3, 5, 15 and 27).

Classification: This vegetation community can correspond with 'Endangered - Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion', which is BC Act listed. However, as the site is outside of the North Coast Bioregion, it does not correspond with this EEC.



Plate 1 Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast

4.2.1.2 PCT 1598 Forest Red Gum grassy open forest on floodplains of the Lower Hunter

Description: Open forests with a canopy dominated by Eucalyptus tereticornis. The mid-storey consists of an open shrub layer. The ground layer is dominated by grasses with sparse graminoids and forbs. Open forests with a canopy dominated by Eucalyptus tereticornis. The mid-storey consists of an open shrub layer. The ground layer is dominated by grasses with sparse graminoids and forbs.

BAM Plot Number: No BAM plots were undertaken due to land access restrictions.

Diagnostic upper stratum species: *Eucalyptus tereticornis, Eucalyptus punctata*

Diagnostic middle stratum species: *Breynia oblongifolia (*Coffee Bush*), Leucopogon juniperinus (*Prickly Beard-heath*), Daviesia ulicifolia (*Gorse Bitter Pea*), Persoonia linearis (*Narrow-leaved Geebung*) and Jacksonia scoparia (*Dogwood*).*

Diagnostic ground stratum species: *Microlaena stipoides* (Weeping Grass), *Cymbopogon refractus* (Barbed Wire Grass), *Imperata cylindrica* (Blady Grass), *Pratia purpurascens* (Whiteroot), *Cheilanthes sieberi* (Rock Fern), *Lomandra multiflora* (Many-flowered Mat-rush) *and Pomax umbellate* (Pomax).

Classification: This vegetation community can correspond with Hunter Lowland Redgum Forest in the Sydney Basin and New South Wales North Coast Bioregions, listed as 'Endangered' under the BC Act.

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

Description: Open forests with a canopy dominated by *Angophora costata* and *Corymbia gummifera*. The mid-storey is typically shrubby and commonly includes grass trees and scrambling climbers. The ground layer is typically dominated by grasses along with graminoids and scattered forbs. Coastal lowlands and low ranges of the lower North Coast and Central Coast; mainly on sandy substrates.

BAM Plot Number: 2, 8, 12, 13, 16, 19, 24, 28 and 30.

Diagnostic upper stratum species: *Angophora costata* (Smooth-barked Apple; Plots 2,8,13,16 and 24); *Corymbia gummifera* (Red Bloodwood; Plots 2,8,12,13 and 28); *Eucalyptus capitellata* (Brown Stringybark; Plots 2,8,13,24 and 30).

Diagnostic middle stratum species: *Banksia spinulosa* (Hairpin Banksia; Plots 2 and 8); *Allocasuarina littoralis* (Black She-Oak; Plots 2, 24,28 and 30); *Leptospermum polygalifolium* (Tantoon; Plots 8 and 16); *Persoonia levis* (Broad-leaved Geebung; Plots 12 and 24); *Persoonia linearis* (Narrow-leaved Geebung; Plots 2,24 and 28); *Billardiera scandens* (Hairy Apple Berry; Plots 2,12,13, 16, 24 and 30).

Diagnostic ground stratum species: *Themeda triandra* (Kangaroo Grass: Plots 2, 12,16,24,28 and 30); *Aristata vagans* (Threeawn Speargrass; Plots 12 and 16); *Dianella caerulea* (Blue Flax-lily; Plots 8, 12 and 16);

Lepidosperma laterale (Variable Sword-sedge; Plots 2, 8, 12, 13,28 and 30); *Lomandra obliqua* (Plots 2,12,13,16,24,28 and 30) and *Goodenia heterophylla* (Variable Leaved Goodenia; Plots12 and 30).

Classification: This vegetation community does not correspond with any BC Act and/or EPBC Act listed TEC.



Plate 2 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands

4.2.1.4 PCT 1627 Smooth-barked Apple – Turpentine – Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast

Description: Open Forests to Woodlands with a generally well developed and distinctly two-layered mid-stratum. The ground cover is characterised by graminoids; sub-shrubs and forbs. Sandstone ranges of the Central Coast hinterland from Wisemans Ferry to Pearl Beach and north to about Wyong Creek, including Dharug National Park. Elevation is 50 to 300m.

BAM Plot Number: 4, 6, 9, 17, 21, 22 and 34

Diagnostic upper stratum species: *Angophora costata* (smooth-barked apple; Plots 4,6,17,21,22 and 34); *Eucalyptus piperita* (Sydney Peppermint; Plots 4,6,9, 17,21 and 34); and *Corymbia gummifera* (Red Bloodwood; Plot 9).

Diagnostic middle stratum species: *Persoonia linearis* (Narrow-leaved Geebung; Plots 6 and 34)

Diagnostic ground stratum species: *Dianella caerulea* (Blue-flax Lilly; Plots 4,6,9 and 17); *Lomandra longifolia* (Plot 17); *Lepidosperma laterale* (Variable sword-edge; Plot 9)

Classification: This vegetation community does not correspond with any BC Act and/or EPBC Act listed TEC.



Plate 3 **Smooth-barked Apple – Turpentine – Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast**

4.2.1.5 PCT 1636 Scribbly Gum – Red Bloodwood – Angophora inopina heathy woodland on lowlands of the Central Coast

Description: Eucalypt dominated Woodlands with a shrubby mid-stratum and a graminoid ground cover. This community occurs on coastal lowlands from northern Tuggerah Lake to the northern end of Lake Macquarie. The substrate is sandstone with moist sandy soils. Elevation is usually under 100m.

BAM Plot Number: 1, 7, 10, 11, 14, 18, 20, 36 and 37.

Diagnostic upper stratum species: *Eucalyptus haemastoma* (Broad-leaved Scribbly Gum; Plots 1,7,10,11,14,36 and 37); *Corymbia gummifera* (Red Bloodwood; Plots 1,7,10,11,36 and 37).

Diagnostic middle stratum species: *Banksia oblongifolia* (Fern-leaved Banksia; Plot 10); *Leptospermum trinervium* (Slender Tea-tree; Plots 1,7,10,11, 14,36 and 37); *Lambertia formosa* (Mountain Devil; Plots 1,7,10,11,14,20,36 and 37); *Xanthorrhoea* spp. (A grass tree; Plots 1,7,10,11,14,20,36 and 37) and *Hakea dactyloides* (Finger Hakea; Plot 10).

Diagnostic ground stratum species: *Epacris pulchella* (Wallum Heath; Plots 1 and 7); *Ptilothrix deusta* (Plots 1,7,10,11,14,36 and 37); *Lomandra obliqua* (Plots 1,7,10,14,20,36 and 37); and *Themeda triandra* (Kangaroo Grass: Plots 1,14,36 and 37).

Classification: This vegetation community does not correspond with any BC Act and/or EPBC Act listed TEC.



Plate 4 **Smooth-barked Apple – Turpentine – Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast**

4.2.1.6 PCT 1638 – Scribbly Gum – Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast

Description: Dry sclerophyll forest with a canopy characterised by Angophora, Eucalyptus and Corymbia. The mid-stratum is typically comprised of low shrubs. This community has been previously recorded in the local government area of Gosford within the Sydney Basin Bioregion and may occur elsewhere in the Bioregion.

BAM Plot Number: 35, 38 and 39.

Diagnostic upper stratum species: *Angophora costata* (Plot 35, 38 and 39), *Corymbia gummifera* (Plot 35, 38 and 39), *and Eucalyptus haemastoma* (Plot 35, 38 and 39).

Diagnostic middle stratum species: *Allocasuarina littoralis* (Plot 35, 38 and 39).

Classification: This vegetation community does not correspond with any BC Act and/or EPBC Act listed TEC.



Plate 5 **Scribbly Gum – Smooth-barked Apple – Red Bloodwood shrubby forest of the Lower Hunter, Sydney Basin Bioregion**

4.2.1.7 PCT 1716 Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast

Description: Characterised by dense thickets of paperbarks (*Melaleuca nodosa*, *Melaleuca sieberi*) with stunted emergent eucalypts such as *Eucalyptus resinifera*, *Eucalyptus paniculata* or *Angophora costata*. Understorey vegetation is often limited, although clumps of *Gahnia clarkei* and *Baumea juncea* are typical. Grasses, such as *Microlaena stipoides var. stipoides*, are common.

BAM Plot Number: 31, 32 and 33.

Diagnostic upper stratum species: *Angophora costata* (Plot 31, 32 and 33);

Eucalyptus resinifera (Plot 31, 32 and 33); and

Diagnostic middle stratum species: *Melaleuca nodosa* (Plot 31, 32 and 33) and *Melaleuca sieberi* (Plot 31 and 32)

Diagnostic ground stratum species: *Imperata cylindrica* and *Microlaena stipoides* (Plot 32, 32 and 33).

Classification: This vegetation community is commensurate with 'Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions' EEC under the BC Act.



Plate 6 Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast

4.2.1.8 4PCT 1718 Swamp Mahogany – Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast

Description: Typified by the presence of *Eucalyptus robusta* in the canopy and may occur with a range of associates including *Melaleuca linariifolia*, *Melaleuca sieberi*, *Eucalyptus resinifera*, and *Eucalyptus tereticornis*. The understorey is variable, often with a dense shrub layer of species such as *Acacia longifolia*, *Omalanthus nutans*, *Leptospermum juniperinum*, *Melaleuca thymifolia* and *Pultenaea villosa*, and the sedges *Gahnia clarkei*, *Chorizandra cymbaria* and *Baloskion tetraphyllous subsp. meiostachyus*.

BAM Plot Number: 23, 25, 26 and 29.

Diagnostic upper stratum species: *Eucalyptus robusta* (Plot 23, 25, 26 and 29).

Diagnostic middle stratum species: *Melaleuca linarifolia* (Plot 23, 25, 26 and 29) and *Glochidion ferdinandi* (Plot 23, 25, 26 and 29).

Diagnostic ground stratum species: *Lomandra longifolia* (Plot 23 and 25) and *Gahnia clarkei* (Plot 23 and 27).

Classification: This vegetation community does not correspond with any BC Act and/or EPBC Act listed TEC.



Plate 7 Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast

4.2.1.9 PCT 1737 Typha rushland

Description: *Typha orientalis* dominates these areas almost exclusively.

BAM Plot Number: **No plot undertaken. Assuming benchmark condition.**

Diagnostic upper stratum species: *Melaleuca quinquenervia* (Taken from Bionet)

Diagnostic middle stratum species: N/A

Diagnostic ground stratum species: *Typha orientalis, Persicaria strigose, Cladium procerum* and *Cynadon dactylon*.

Classification: This vegetation community does not correspond with any BC Act and/or EPBC Act listed TEC.



Plate 8 Typha rushland

4.2.2 Threatened Flora

The threatened flora species detected within the Study Area during targeted surveys are shown in **Table 11**. Locations of threatened plants detected during field surveys are shown in **Figure 10**.

Table 11 Threatened flora occurring within the Study Area

Scientific Name	BC Act listing	EPBC Act listing	Count
Acacia bynoeana	E	V	36
Angophora inopina	V	V	24
Corybas dowlingii	E	-	327,954
Genoplesium insigne	CE	CE	88
Grevillea parviflora subsp. parviflora	V	V	4,273
Tetratheca juncea	V	V	47,910

4.2.3 Modelling *Tetratheca juncea* Distribution

Rather than individually marking all clumps of *Tetratheca juncea* (Black-eyed Susan), the distribution of this species across the Study Area was predicted based on the well-established ecology of this species.

The distribution of *T. juncea* was predicted by firstly identifying the PCTs present within the Study Area that this species is known to occur. The vegetation communities offering suitable habitat for *T. juncea* within this Project were adopted from Driscoll (2003), which analysed 400 records of *T. juncea* across the Lower Hunter and Central Coast. In total, Driscoll (2003) identified 16 vegetation communities that this species may associate with in this region – six of which were found to occur within the Study Area. To allow consistency with BAM, the vegetation mapping units identified by Driscoll (2003) as suitable *T. juncea* habitat were converted to PCTs in accordance with Driscoll (2016).

The number of clumps within the Study Area was then predicted by multiplying the area of suitable habitat for *T. juncea* (see above) by the median density of this species. The median density of *T. juncea* clumps was adopted from Driscoll (2013), who studied the density of *T. juncea* across 12 locations on the Central Coast where species occurs; 47.83 clumps per ha.

In total, it was predicted that 47,910 clumps of *T. juncea* occur in the Study Area. **Table 12** details the suitable vegetation communities present in the Study Area and predicted number of clumps present. A species polygon encompassing this potential *T. juncea* habitat is presented in the BDAR.

Table 12 Predicted distribution and number of *T. juncea* clumps

Plant Community Description (LHCCREMS)	Mapping Unit (LHCCREMS)	PCT equivalent[1]	BioNet listed	Area (ha)	Assumed total clumps[2]
Coastal Plains Smooth-barked Apple Woodland	30	1619	Yes	424.06	20,283
Coastal Plains Scribbly Gum Woodland	31	1636	Yes	418.27	20,006
Coastal Foothills Spotted Gum-Ironbark Forest	15	1588	No	30.23	1,446
Wyong Paperbark Swamp Forest	43	1716	No	5.00	239
Coastal Sheltered Apple-Peppermint Forest	11	1627	Yes	108.35	5,182
Swamp Mahogany-Paperbark Forest	37	1718	No	15.77	754
Total					**47,910**

1. MUs were converted to PCTs in accordance with Driscoll (2016). 2. Median density of T. juncea clumps was adopted from Driscoll (2013).

Using this list of vegetation communities was considered a more conservative approach to assuming presence based on PCT associations listed by BioNet (DPIE 2019). For instance, PCTs 1588 and 1718 were identified as potential *T. juncea* habitat by Driscoll (2003) but are not listed as associated vegetation types in BioNet (DPIE 2019). Moreover, the median density of *T. juncea* within the Study Area is likely to be far less than that modelled here due to spatial heterogeneity of this species. For instance, it was noted that densities of *T. juncea* were far higher in riparian areas and on south-facing slopes, which only comprised only in select areas within the Study Area.

4.2.4 Weeds

A list of weeds detected during surveys is provided in **Table 13**. The Study Area is subject to the *Greater Sydney Region Strategic Weed Management Plan 2017 – 2022*.

Table 13 Weeds detected within the Study Area and their management requirements

Scientific Name	Common Name	BAM High Threat Weed	Weed of National Significance	Duty under Biosecurity Act (2015)
Ageratina riparia	Mistflower	Yes	No	No prescribed Biosecurity Duty
Andropogon virginicus	Whiskey Grass	No	No	No prescribed Biosecurity Duty
Asparagus aethiopicus	Asparagus Fern	No	No	No prescribed Biosecurity Duty
Axonopus fissifolius	Narrow-leafed Carpet Grass	Yes	No	No prescribed Biosecurity Duty
Cirisium vulgare	Spear Thistle	No	No	No prescribed Biosecurity Duty
Ehrharta erecta	Panic veldtgrass	No	No	No prescribed Biosecurity Duty
Hydrocotyle spp	Water Pennywort	No	No	General Biosecurity Duty As Above
Hypochaeris radicata	Catsear	No	No	No prescribed Biosecurity Duty
Lantana camara	Lantana	No	No	General Biosecurity Duty As Above
Ligustrum sinense	Small-leafed Privet	No	No	General Biosecurity Duty As Above
Melinis repens	Red Natal Grass	No	No	No prescribed Biosecurity Duty
Ochna serrulate	Mickey Mouse Plant	Yes	No	No prescribed Biosecurity Duty
Plantago lanceolata	Lamb's Tongue	No	No	No prescribed Biosecurity Duty
Pyllanthus tenellus	Hen and Chicken	No	No	No prescribed Biosecurity Duty
Richardia brasiliensis	Mexican Clover	No	No	No prescribed Biosecurity Duty
Rubus fruticosus sp. agg.	Blackberry	No	No	General Biosecurity Duty As Above Regional Recommended Measure The plant should not be bought, sold, grown, carried or released into the environment. Land managers should mitigate the risk of the plant being introduced to their land. Land managers should mitigate spread from their land. Land managers to reduce impacts from the plant on priority assets.
Senna pendula var. glabrata	Cassia	No	No	General Biosecurity Duty
Setaria parviflora	Marsh Bristlegrass	No	No	As Above
Sida rhombifolia	Paddy's Lucerne	No	No	General Biosecurity Duty
Solanum mauritanium	Wild Tobacco Bush	No	No	No prescribed Biosecurity Duty
Solanum nigrum	Black-berry Nightshade	No	No	No prescribed Biosecurity Duty
Syagrus romanzoffiana	Cocos Palm	No	No	No prescribed Biosecurity Duty
Taraxacum officinale	Common Dandelion	No	No	No prescribed Biodiversity Duty

Scientific Name	Common Name	BAM High Threat Weed	Weed of National Significance	Duty under Biosecurity Act (2015)
Verbena bonariensis	Purple Top	No	No	General Biosecurity Duty

Legend

- Extension of Mining Area
- Survey Area

Threatened Flora

- Acacia bynoeana
- Angophora inopina
- Genoplesium insigne
- Grevillea parviflora subsp. parviflora
- Tetratheca juncea
- Corybas dowlingii

N

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nearmap

200 100 0 200 400 600 800 1,000 m

SCALE: 1:22,000 AT A3 SIZE

TITLE : FIGURE 10: TOTAL THREATENED FLORA

LOCATION : NEWSTAN

DATUM: GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **6/02/2020**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): C A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\Biodiversity Inventory Report Figures\141842 Figure 8 Th Flora C A3L 20200206.mxd

CLIENT: **CENTENNIAL COAL**

JOB REF: **PR141842**

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4.3 Fauna

4.3.1 Mammal Census

Across all field sampling methods, fourteen species of mammals were detected; 16 native and three introduced species. Of these, the Squirrel Glider (*Petaurus norfolcensis*) is listed as vulnerable under the BC Act.

Introduced mammals detected during the survey were *Vulpes vulpes* (Fox); *Rattus rattus* (Black Rat) and *Lepus capensis* (Brown Hare).



Plate 9 Camera trap detection: Glider (identified as *Petaurus spp.*)



Plate 10 Camera trap detection: Fox

4.3.2 Microbat Census

Ten species of Microbat were positively identified from the Anabat recordings (**Appendix H**; ECHO Ecology and Surveying 2019) and a further two species were identified as part of bi-annual nest box monitoring for the Cooranbong Haul Road Offset Project (Kleinfelder 2015). Of these species, the following threatened microbats were identified:

- *Miniopterus australis* (Little Bentwing-bat; BC Act: Vulnerable; EPBC Act: Not Listed; Ecosystem and Species Credit Species);
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat; BC Act: Vulnerable; EPBC Act: Not Listed; Ecosystem and Species Credit Species);
- *Micronumus norfolkensis* (East coast Free-tailed Bat; BC Act: Vulnerable; EPBC Act: Not Listed; (Ecosystem Credit Species); and
- *Scoteanax rueppellii* (Greater Broad-nosed Bat; BC Act: Vulnerable; EPBC Act: Not Listed).

Locations of threatened bats detected during field surveys are shown in **Figure 11**.

4.3.3 Avifauna Census

A total of 120 species of birds were observed during the avifauna census and by opportunity (**Appendix B**). Of these, the following threatened birds were detected:

- *Calyptorhynchus lathami* (Glossy Black Cockatoo; BC Act: Endangered; EPBC Act: Not Listed; BAM Candidate Species);
- *Ninox strenua* (Powerful Owl; BC Act: Vulnerable; EPBC Act: Not Listed; BAM Candidate Species);
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle; BC Act: Vulnerable; EPBC Act: Not listed; BAM Candidate Species);
- *Glossopsitta pusilla* (Little Lorikeet; BC Act: Vulnerable; EPBC Act; Not listed; BAM Candidate Species); and
- *Daphnoenositta chrysoptera* (Varied Sittella; BC Act: Vulnerable; EPBC Act; Not listed; BAM Candidate Species).

Locations of threatened birds detected during field surveys are shown in **Figure 11**.

4.3.4 Herpetofauna Census

Seven species of reptile were detected opportunistically within the Study Area. Reptiles encountered include: *Pseudonaja textilis* (Eastern Brown Snake); *Demansia psammophis* (Yellow-faced Whip Snake); *Varanus varius* (Lace Monitor); *Physignathus lesueurii* (Eastern Water Dragon); *Amphibolurus muricatus* (Jacky Lizard); *Dendrelaphis punctulatus* (Green Tree Snake); *Tiliqua scincoides* (Eastern Bluetongue); and *Eulamprus quoyii* (Eastern Water-skink).

The following frogs were detected during targeted spotlighting: *Adelotus brevis* (Tusked Frog); *Crinia signifera* (Common Eastern Froglet); *Limnodynastes peronii* (Brown-striped Frog); *Limnodynastes tasmaniensis* (Spotted Grass Frog); *Pseudophryne coriacea* (Red-backed Toadlet); *Uperoleia fusca* (Dusky Toadlet); *Litoria dentata* (Bleating Tree Frog); *Litoria fallax* (Eastern Dwarf Tree Frog); *Litoria latopalmata* (Broad-palmed Frog); *Litoria peronii* (Peron's Tree Frog); and *Litoria verreauxii* (Verreaux's Frog).

None of the frogs or reptiles identified within the Study Area were listed as threatened under either the BC Act or EPBC Act.

Legend

- Newstan Extension_Proposed Workings Extents
- Eco Offset Study Boundary
- Eraring Energy Land

Threatened Fauna

- Brown Treecreeper
- Dusky Woodswallow
- Gang-gang Cockatoo
- Glossy-b Cockatoo
- Little Lorikeet
- Masked Owl
- Powerful Owl
- Varied Sitella
- White-bellied Sea Eagle
- Eastern Coastal Free-tailed Bat
- Greater Broad-nosed Bat
- Large Bent-winged Bat
- Little Bent-winged Bat

N

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200 100 0 200 400 600 800 1,000 m

SCALE: 1:23,000 AT A3 SIZE

TITLE : FIGURE 11: TOTAL THREATENED FAUNA

LOCATION : NEWSTAN

DATUM:GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **13/11/2019**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): A A3 (Natalie.Wood)

PATH: S:\Centennial\All Jobs\141842 Newstan Extension Ecology Assessment\10 - Drafting\Arcgis Map Documents\Eco\Biodiversity Inventory Report Figures\141842 Figure 12 Th Fauna A A3L 20191113.mxd

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4.3.5 Modelling *L. brevipalmata* Distribution

As there was no rainfall event in the appropriate season (October 2018 – January 2019; DPIE 2019) that reached the calling trigger for *L. brevipalmata* (i.e. >75 mm in a 24 hour period or >150 mm in 72 hours; DPIE 2019; BOM 2019), no adequate presence or absence surveys could be conducted for this species. As such, for the purpose of the BIR, it was assumed that this species would be present within PCTs it is known to associate with.

For this frog species, the definition of suitable habitat was reviewed for a transmission line project at Mandalong, NSW (approximately 8 km southwest of the Study Area) by Dr Michael Mahony (2018), an expert for *L. brevipalmata* formally recognised by NSW DPIE for this project:

"In the southern part of its range, GTFs usually breed in water bodies that are located within or near areas of wetter forest types. These sites are usually depressions with a leafy/shrubby substrate (Lemckert et. al., 2006; Ledlin 1997), and adjacent to forests the pools may be in open flooded areas with sedges and tussock grasses. The breeding sites are predominantly ephemeral pools (35 of 37 sites {95%} of the sites studied by Lemckert et. al., 2006) partly or wholly within rainforest or wet sclerophyll forest (26 out of 31 sites = 84%) (Lemckert et. al., 2006). There are two records of calling from around permanent, artificial ponds and three records wholly within dry sclerophyll forest, one from swamp forest behind a beach (around 100 m from the sea) and another from coastal forest. The two records from permanent water bodies are associated with dry forests (Murphy and Turbill 1999)."

Based on these known habitat requirements for *L. brevipalmata* within the Central Coast/Hunter region, Mahony (2018) assessed the suitability of major vegetation communities within the LMCC as habitat for GTFs. **Table 14** summarises the finding of his assessment and relates this to the areas of potential *L. brevipalmata* within the Study Area.

Table 14 Suitability of major vegetation communities for *L. brevipalmata* breeding (adopted from Mahony 2018)

Community	MU	Equivalent PCT1	Suitable *L. brevipalmata* habitat	Suitable Habitat in Study Area (ha)
Alluvial Tall Moist Forest	5	1568	Yes	0
Buttonderry Footslopes Forest	30a	1619	No	0
Coastal Foothills Spotted Gum - Ironbark Forest	15	1588	Yes	30.23
Coastal Plains Scribbly Gum Woodland	31	1636	No	0
Coastal Wet Gully Forest	1	1573	Yes	0
Hinterland Spotted Gum - Red Ironbark Forest	17o	1590	Yes	0
Hunter Valley Moist Spotted Gum - Ironbark Forest	12c	1588	Yes	As above
Jilliby Spotted Gum-Ferguson's Ironbark-Mahogany Forest	15n	1588	Yes	As above

1 MUs were converted to PCTs in accordance with Bell (2016).

In addition to PCT 1588, habitat suitability for *L. brevipalmata* was also considered for PCTs within the Study Area that were not assessed by Mahoney (2018). Of the PCTs that *L. brevipalmata* may associate with according to NSW BioNet (DPIE 2019), PCTs 1638, 1627, 1716, 1718 and 1737 may also provide habitat for *L. brevipalmata* within the Study Area.

As such, *L. brevipalmata* habitat is assumed to encompass PCT 1588 (as identified by Mahony 2018; **Table 14**), as well as PCTs 1638, 1627, 1716, 1718 and 1737. In total, the potential habitat for *L. brevipalmata* was

determined to be 206.51 ha. A species polygon encompassing this potential *L. brevipalmata* habitat is presented in the BDAR.

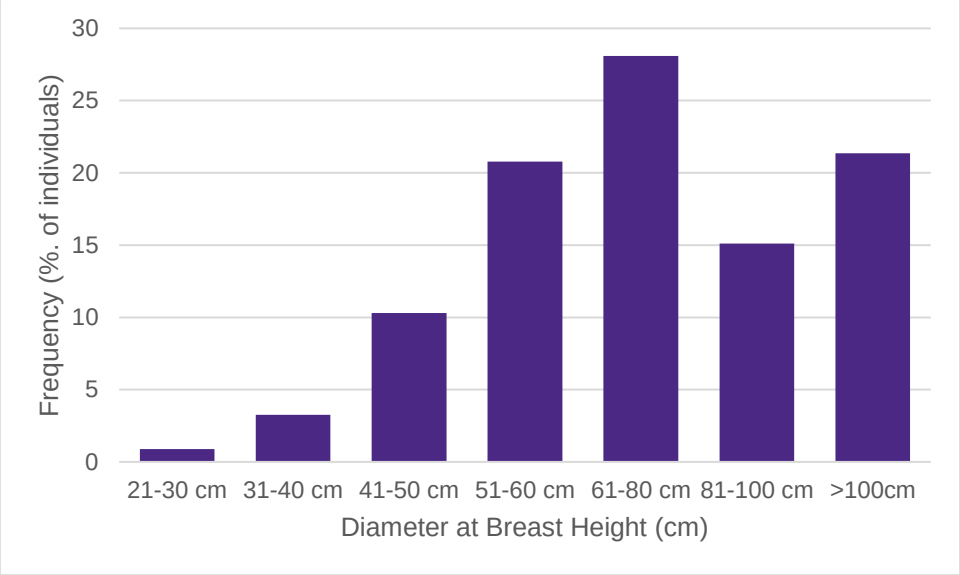
This approach deliberately took a conservative approach by potentially over-representing the occurrence of potential habitat use by *L. brevipalmata*, as this species is rare, and its distribution is highly heterogenous in the Central Coast/Hunter Regions (Mahony 2018).

No threatened reptiles or amphibians were detected during targeted or opportunistic surveys.

4.3.6 Habitat Values

Habitat detected for habitat specialists included sandstone rock (typically < 1m diameter) and 1257 hollow-bearing trees (HBTs). Locations of these HBTs are provided in **Figure 12**. HBTs within the Study Area were predominantly *Angophora costata, Corymbia maculata, Eucalyptus racemose, Eucalyptus haemastoma* and *Eucalyptus piperita*.

The size frequency distribution of a subsection of these trees is included in **Graph 1** (n = 337 HBTs), revealing most (28.1%) HBTs were 61 to 80 cm DBH.



Graph 1 Size frequency distribution of hollow-bearing trees

Legend

- Extension of Mining Area
- Survey Area
- Hollow Bearing Trees

N

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SCALE: 1:23,000 AT A3 SIZE

TITLE : FIGURE 12: HOLLOW BEARING TREES (HBTS)

LOCATION : NEWSTAN

DATUM: GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **6/02/2020**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): B A3 (Natalie.Wood)

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5 IMPACT ASSESSMENT

This section addresses regulatory matters not relevant to the prescribed content of the BDAR.

5.1 Assessment on the likely impacts of Lake Macquarie City Council's Awaba Biodiversity Conservation Area

A draft management plan has been produced (RPS 2020) and adaptive management plan as per Section 6.3 of the BDAR, it will be adopted for this area in order to verify any potential impacts to the Awaba Conservation Area (**Figure 1**). Potential impacts to this offset area have been considered by proposing first workings only within the 2nd and 3rd order watercourses within this area to minimise impacts.

5.2 Direct Impact

The Project will utilise the existing surface facilities at the Newstan and Awaba Collieries. All surface coal handling and transportation operations undertaken at Newstan Colliery will be undertaken in accordance with the existing approved operations for the Northern Coal Logistics Project.

To ensure an efficient and safe operation, the Project will require minimal construction of new and upgraded surface facilities at Awaba Colliery Surface Site (disturbance of approximately 0.32 ha of previously disturbed land). Key works will include drilling and construction of services and gas drainage boreholes, enlargement of the existing Pollution Control Dam, and construction of the gas flaring facility and ventilation fan site.

Approximately 0.32ha of native vegetation will be cleared for ancillary facilities. This includes an area approximately 0.15 ha of PCT 1718 which is commensurate with Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC, as outlined in **Table 15**.

Table 15 Proposed infrastructure associated with the clearing of native vegetation (PCTs)

PCT	Area to be cleared*
1588 – Grey Ironbark – Broad-leaved Mahogany – Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast	0.06 ha
1619 – Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands	0.12ha
1718 – Swamp Mahogany – Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast	0.15 ha
Total	0.32 ha

*The total area to be cleared adds up to approximately 0.32 when the decimal places are increased.

5.3 NSW State Groundwater Dependent Ecosystems

The potential for Groundwater Dependent Ecosystems was explored using the Groundwater Dependent Ecosystems Atlas (GDE Atlas). The GDE Atlas was developed as a national dataset of Australian GDEs to inform groundwater planning and management (BOM 2019).

A map of likely groundwater dependent ecosystems for the Study Area was generated according to the National Groundwater Dependent Ecosystems (GDE) Atlas (Commonwealth of Australia, 2019) (**Figure 13**).

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

Lake Macquarie, Muddy Lake and Whiteheads Lagoon are mapped as potential aquatic GDEs.

PCTs near these creeks that have a moderate or greater potential to be a GDE include:

- PCT 1588 Grey Ironbark – Broad-leaved Mahogany – Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast;
- PCT 1598 Forest Red Gum grassy open forest on floodplains of the lower Hunter;
- PCT 1619 Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands;
- PCT 1627 Smooth-barked Apple - Turpentine - Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast;
- PCT 1636 Scribbly Gum - Red Bloodwood - Angophora inopina heathy woodland on lowlands of the Central Coast;
- PCT 1638 Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast;
- PCT 1716 Prickly-leaved Paperbark forest on coastal lowlands of the Central Coast and Lower North Coast;
- PCT 1718 Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast; and
- PCT 1737 Typha rushland.

The Project has potential to impact upon the above nine PCTs through subsidence, however the location and extent of these impacts are uncertain given the potential interactions with existing workings in the Great North Seam (MSEC 2019).

5.4 Adaptive Management

The majority of the potential impacts related to this Project are indirect subsidence related impacts such as; cracking, sinkholes and plug-hole failures. In the case of impacts occurring, adaptive management will occur via the review of monitoring programs and investigation of causation to ensure any future impacts can be readily identified and predicted. Where impacts are identified, they will be offset in accordance with state and federal policies. These monitoring measures and Trigger Action Response Plans (TARPs) will be detailed within the Biodiversity Management Plan (BMP) prepared as part of the Extraction Plan process post consent. The TARP contained within the BMP will contain a framework for adaptive management, which should include; mitigation, remediation and changes to the mine design.

Legend

- Extension of Mining Area
- Survey Area

Terrestrial GDE

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

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SCALE: 1:23,000 AT A3 SIZE

TITLE : FIGURE 13: GROUNDWATER DEPENDENT ECOSYSTEMS

LOCATION : NEWSTAN

DATUM: GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **6/02/2020**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): B A3 (Natalie.Wood)

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5.5 State Environmental Planning Policy No.44 – Koala Habitat Protection

An assessment of koala habitat under SEPP 44 is provided below. In addressing SEPP44, there are two questions to be considered:

1. Is the land "Potential Koala Habitat"?

   'Potential Koala Habitat' is defined in SEPP 44 as, "...an area of native vegetation where trees of the type listed in Schedule 2 (Koala feed tree species) constitute at least 15% of the total number of trees in the upper or lower strata of the tree component"; and

2. Is the land "Core Koala Habitat"?

   "Core Koala habitat" is defined as an area of land with a resident population of koalas, evidenced by attributes such as breeding females (females with young), recent sightings and historical records of a Koala population."

Some of the site presents 'Potential Koala Habitat' due to the presence of primary feed trees *Eucalyptus microcorys* (Tallowwood) and *Eucalyptus robusta* (Swamp Mahogany). Of the 41 floristic plots across the site, these feed trees occurred in five plots (four plots had a cover over 15%). However, the Study Area is not considered 'Core Koala habitat' due to a low levels of Koala activity.

There have been no reported sightings of Koalas within the proposed Study Area (DPIE, 2018a), with the closest and most recent reported sightings made in 2012 within the Pacific Motorway corridor, approximately 600 m to the east. Given the low levels of Koala activity evidenced within the Study Area, the Study Area is not considered to constitute 'Core Koala Habitat' as defined under SEPP 44, and hence no further provisions of this policy apply to the Project.

5.6 State Environmental Planning Policy (Koala Habitat Protection) 2019

The State Environmental Planning Policy (Koala Habitat Protection) 2019 repeals and replaces the SEPP no. 44 – Koala Habitat Protection on the 1st of March 2020. Although this assessment was written prior to the transition from SEPP no. 44, the Development Application (DA) is likely to be lodged after the 1st of March. Consequently, it has been included herewith for brevity. The primary changes which are of particular relevance to the Project with regards to the new SEPP are: the updated definition of core Koala habitat; the inclusion of two new Koala SEPP maps; and an expanded list of feed tree species listed in schedule 2 from 10 to 123 species.

The updated definition of core Koala Habitat is provided below.

Core koala habitat means—

(a) an area of land where koalas are present, or

(b) an area of land—

(i) which has been assessed by a suitably qualified and experienced person in accordance with the Guideline as being highly suitable koala habitat, and

(ii) where koalas have been recorded as being present in the previous 18 years.

There are no records of Koala's within the Study Area and Koala's were not recorded during surveys within the Study Area. However, there are three records within relatively close proximity to the Study Area in contiguous adjoining native vegetation. The new Koala Habitat Protection Guideline was not publicly available at the time of writing this assessment, however, as there are no records of the Koala within the Study Area, it is not considered to constitute core Koala habitat.

5.7 Coastal Management State Environmental Planning Policy 2018

5.7.1 Division 3; Coastal Environment Area

5.7.1.1 Section 13; Development on land within the coastal environment area

The SEPP Map identifies an area of 'Coastal Environment Area' that occurs within the extension of mining area and Study Area (**Figure 14**) and as such, it has been addressed in this section.

(1) Development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following—

(a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,

A detailed assessment of the potential impacts to ecological values present within the Study Area has been made within this report. A BMP and a TARP have been proposed as mitigation measures including adaptive management to ensure that any potential impacts are identified and minimised or avoided. Furthermore, the assessments contained within this report and the associated BDAR do not anticipate any significant impacts. As this is a terrestrial ecology report, assessments on biophysical and hydrological integrity have not been included.

(b) coastal environmental values and natural coastal processes,

No coastal environmental values or natural coastal processes are likely to be affected by the Project

(c) the water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,

No sensitive coastal lakes identified in Schedule 1 are likely to be impacted by the Project.

(d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms

No Marine vegetation, undeveloped land or rock platforms are present within the Study Area, thus require assessment. Native flora and fauna have been comprehensively investigated within this report. No threatened flora, fauna or ecological community are considered likely to be impacted within the area identified as 'Coastal Environmental Area' (**Figure 14**).

(e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,

This report is focussed on terrestrial ecology and therefore not this question is not relevant

(f) Aboriginal cultural heritage, practices and places,

This is a terrestrial ecological assessment and is therefore not relevant to Aboriginal cultural heritage matters

(g) the use of the surf zone.

The Project is not likely to impact on any surf zone.

Legend

- Extension of Mining Area
- Survey Area
- Eraring Energy Land
- Tracks and Roads
- Coastal Wetlands
- Coastal Environment Area Map
- Proximity Area for Coastal Wetlands

OLNEY STREET

PACIFIC MOTORWAY

NEWSTAN ERARING PRIVATE COAL ROAD

FREEMANS DRIVE

BALLIN CLOSE

DORRINGTON ROAD

IMMARNA ROAD

HAWKE T ROAD

SIMPSON ROAD

JUNCTION ROAD

CONSTRUCTION ROAD

EUCALYPT

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SCALE: 1:22,000 AT A3 SIZE

TITLE : FIGURE 14: COASTAL MANAGEMENT SEPP

LOCATION : NEWSTAN

DATUM: GDA 1994

PROJECTION: GDA 1994 MGA Zone 56

DATE : **5/02/2020**

PURPOSE: **ECOLOGY**

VERSION (PLAN BY): A A3 (Natalie.Wood)

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5.7.2 Division 1; Coastal Wetlands and Littoral Rainforest Area

5.7.2.1 Section 11; Development on land in proximity to coastal wetlands or littoral rainforest

The SEPP Mapping has identified 'Land in proximity to coastal wetlands or littoral rainforest' which occurs within the Study Area (**Figure 14**) and as such, it has been addressed in this section.

(1) Development consent must not be granted to development on land identified as "proximity area for coastal wetlands" or "proximity area for littoral rainforest" on the Coastal Wetlands and Littoral Rainforests Area Map unless the consent authority is satisfied that the proposed development will not significantly impact on—

(a) the biophysical, hydrological or ecological integrity of the adjacent coastal wetland or littoral rainforest, or

A detailed assessment of the ecological values within the Study Area has been made within this report. A BMP and a TARP have been proposed as mitigation measures including adaptive management to ensure that any potential impacts are identified and minimised or avoided. Furthermore, the assessments contained within this report and the associated BDAR do not anticipate any significant impacts. As this is a terrestrial ecology report, assessments on biophysical and hydrological integrity have not been included.

(b) the quantity and quality of surface and ground water flows to and from the adjacent coastal wetland or littoral rainforest.

This report relates to terrestrial ecology and thus does not assess ground water or surface water flows.

5.8 Environmental Protection and Biodiversity Conservation Act 1999

5.8.1 EPBC Act Migratory Species

27 nationally listed migratory terrestrial and wetland species were recorded on the DoEE online database or are considered to have potential habitat available within 10 km of the Study Area (**Table 16**). The proposed works are unlikely to impact on any area considered to be 'important habitat' for these migratory species or impact a significant proportion of a migratory population.

Table 16 Migratory birds listed under the EPBC Act

Scientific Name	Common Name
Cuculus optatus	Oriental Cuckoo, Horsfield's Cuckoo
Hirundapus caudacutus	White-throated Needletail
Monarcha melanopsis	Black-faced Monarch
Monarcha trivirgatus	Spectacled Monarch
Motacilla flava	Yellow Wagtail
Myiagra cyanoleuca	Satin Flycatcher
Rhipidura rufifrons	Rufous Fantail
Actitis hypoleucos	Common Sandpiper
Arenaria interpres	Ruddy Turnstone
Calidris acuminata	Sharp-tailed Sandpiper
Calidris canutus	Red Knot, Knot
Calidris ferruginea	Curlew Sandpiper
Calidris melanotos	Pectoral Sandpiper
Calidris ruficollis	Red-necked Stint
Charadrius bicinctus	Double-banded Plover

Scientific Name	Common Name
Charadrius leschenaultii	Greater Sand Plover, Large Sand Plover
Charadrius mongolus	Lesser Sand Plover, Mongolian Plover
Gallinago hardwickii	Latham's Snipe, Japanese Snipe
Limicola falcinellus	Broad-billed Sandpiper
Limosa lapponica	Bar-tailed Godwit
Numenius madagascariensis	Eastern Curlew, Far Eastern Curlew
Numenius phaeopus	Whimbrel
Pandion haliaetus	Osprey
Pluvialis fulva	Pacific Golden Plover
Tringa brevipes	Grey-tailed Tattler
Tringa nebularia	Common Greenshank, Greenshank
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank

5.8.2 EPBC Listed Threatened Species

Sixty-seven nationally threatened species have been recorded or may occur within 10 km of the Study Area. Through the LoO, only 36 of these species are deemed as having a moderate or greater likelihood of occurring within the Study Area. These species are listed in **Table 17**.

Table 17 EPBC Act Listed Threatened Species

Scientific Name	Common Name	EPBC Act
Acacia bynoeana	Bynoe's Wattle	V
Angophora inopina	Charmhaven Apple	V
Anthochaera phrygia	Regent Honeyeater	E, M
Botaurus poiciloptilus	Australasian Bittern	E
Caladenia tessellata	Thick-lip Spider Orchid	V
Chalinolobus dwyeri	Large-eared Pied Bat	V
Cryptostylis hunteriana	Leafless Tongue-orchid	V
Cynanchum elegans	White-flowered Wax Plant	E
Dasyurus maculatus	Spotted-tailed Quoll	E
Diuris praecox	Rough Doubletail	V
Eucalyptus camfieldii	Camfield's Stringybark	V
Eucalyptus parramattensis subsp. decadens	Earp's Gum	V
Grevillea parviflora subsp. parviflora	Small-flowered Grevillea	V
Haliaeetus leucogaster	White-bellied Sea-Eagle	M
Heleioporus australiacus	Giant Burrowing Frog	V
Lathamus discolor	Swift Parrot	CE
Litoria aurea	Green and Golden Bell Frog	V
Litoria littlejohni	Littlejohn's Tree Frog	V
Melaleuca biconvexa	Biconvex Paperbark	V
Microtis angusii	Angus's Onion Orchid	E
Mixophyes iteratus	Giant Barred Frog	E
Persicaria elatior	Tall Knotweed	V
Petauroides volans	Greater Glider	V
Phascolarctos cinereus	Koala	V

Scientific Name	Common Name	EPBC Act
Potorous tridactylus	Long-nosed Potoroo	V
Prostanthera askania	Tranquility Mintbush	E
Prostanthera junonis	Somersby Mintbush	E
Pseudomys novaehollandiae	New Holland Mouse	V
Pteropus poliocephalus	Grey-headed Flying-fox	V
Rostratula australis	Australian Painted Snipe	E, M
Rutidosis heterogama	Heath Wrinklewort	V
Syzygium paniculatum	Magenta Lilly Pilly	V
Tetratheca glandulosa	Tetratheca glandulosa	V
Tetratheca juncea	Black-eyed Susan	V
Thesium australe	Austral Toadflax	V
Uperoleia mahonyi	Mahony's Toadlet	CE

Threatened species identified as having a moderate or greater likelihood of occurring within the Study Area were subjected to an Assessment of Significance under the EPBC Act *Significant Impact Guidelines 1.1* (DoE 2013; **Appendix C**).

5.8.3 Commonwealth Referral Guidelines for the Koala

An analysis was performed for the area subject to development in accordance with the referral guidelines for the Koala (DoE 2014). Results are provided in **Table 18**.

Table 18 EPBC Act Referral Guidelines for Koala

Attribute	Coast	Score
Koala occurrence	Evidence of one or more koalas within the last 2 years. Score (+ 2)	0
	Evidence of one or more koalas within 2 km of the edge of the impact area within the last 5 years. Score (+ 1)	+1
	None of the above. Score (0)	
Vegetation composition	Has forest or woodland with 2 or more known koala food tree species, OR	+2
	1 food tree species that alone accounts for >50% of the vegetation in the relevant strata. Score (+ 2)	
	Has forest or woodland with only 1 species of known koala food tree present. Score (+ 1)	
Habitat connectivity	None of the above. Score (0)	+2
	Area is part of a contiguous landscape ≥ 500 ha. Score (+ 2)	
	Area is part of a contiguous landscape < 500 ha, but ≥ 300 ha. Score (+ 1)	
Key existing threats	None of the above. Score (0)	0
	Little or no evidence of koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence. Areas which score 0 for koala occurrence and have no dog or vehicle threat present. Score (+ 2)	
	Evidence of infrequent or irregular koala mortality from vehicle strike or dog attack at present in areas that score 1 or 2 for koala occurrence, OR Areas which score 0 for koala occurrence and are likely to have some degree dog or vehicle threat present. Score (+ 1)	
Recovery value	Evidence of frequent or regular koala mortality from vehicle strike or dog attack in the Study Area at present, OR Areas which score 0 for koala occurrence and have a significant dog or vehicle threat present. Score (0)	0
	Habitat is likely to be important for achieving the interim recovery objectives for the relevant context. Score (+2)	

	Uncertain whether the habitat is important for achieving the interim recovery objectives for the relevant context. Score (+1)	
Total		**5**

A score of 5 out of a maximum of 10 was calculated for the Study Area. Based on this score, the Study Area contains habitat critical to the survival of the koala. However, since the Project is proposing to clear ≤ 2 ha of habitat containing koala feed trees, and a referral for the Project is not recommended under the referral guidelines (DoE 2014).

5.8.4 Threatened Ecological Communities

Two threatened ecological communities (TECs) were identified within the Study Area. These TECs were:

- 20.77 ha of Swamp sclerophyll forest on coastal floodplains of the NSW North Coast| Sydney Basin and South East Corner bioregions (PCT 1716 and 1718); and
- 0.23 ha of Freshwater wetlands on coastal floodplains of the NSW North Coast| Sydney Basin and South East Corner bioregions (PCT 1737).

5.8.5 EPBC Referral

Based on the potential for the Project to have a significant impact on threatened species referred to in **Section 5.5.2**, a referral under the EPBC Act was submitted to Department of Environment and Energy.

The EPBC referral decision indicates that there is likely to be a significant impact on the following matters protected by the EPBC Act:

- Listed threatened species and communities; and
- A water resource, in relation to coal seam gas development and large coal mining developments.

Based on the information available in the referral, it was determined that the proposed action is likely to have a significant impact on the following matters of national environmental significance:

- Black-eyed Susan (Tetratheca juncea) – Vulnerable; and
- Water resources: the proposed action is likely to result in changes to groundwater and surface water.

It was determined that the proposal had the potential to significantly impact on the species listed in **Table 19** at the time of referral pending further information. Specifically, it stated that '*…additional species surveys and refined project footprint should be used during the NSW accredited assessment to further analyse the likely significance of the impacts of the proposed action on the below species. If, following this further assessment, significant impacts on these species are still considered likely, an analysis should be undertaken on avoidance, mitigation and offset measures for these species*.'

Table 19 Threatened Species requiring further consideration

Guild	Species
Mammals	• Spotted-tailed Quoll (Dasyurus maculatus maculatus (SE mainland population)) – Endangered • Greater Glider (Petauroides Volans) – Vulnerable • Grey-headed Flying-fox (Pteropus poliocephalus) – Vulnerable • Large-eared Pied Bat (Chalinolobus dwyeri) – Vulnerable • Koala (Phascolarctos cinereus) Vulnerable
Birds	• Swift Parrot (Lathamus discolour) – Critically Endangered • Regent Honeyeater (Anthochaera phrygia) – Critically Endangered • Curlew Sandpiper (Calidris ferrunginea) – Critically endangered • Eastern Curlew, Far Eastern Curlew (Numenius madagascariensis) – Critically Endangered • Red Know, Know (Calidris canutus) – Endangered • Australian Painted Snipe (Rostratula australis) – Endangered • Australasian Bittern (Botaurus poiciloptilus) – Endangered

	• White-throated Needletail (Hirundapus caudacutus) - Vulnerable
Frogs	• Giant Barred Frog (Mixophyes iteratus) – Endangered • Green and Golden Bell Frog (Litoria aurea) – Vulnerable • Stuttering Frog (Mixophyes balbus) – Vulnerable • Littlejohn's Tree Frog, Heath Frog (Litoria littlejohni) - Vulnerable
Flora	• Wyong Midge Orchis 1, Variable Midge Orchid (Corunastylis insignis) – Critically Endangered • White-flowered Wax Plant (Cynanchum elegans) – Endangered • Biconvex Paperbark (Melaleuca biconvexa) – Vulnerable • Leafless Tongue-orchid (Cryptostylis hunteriana) – Vulnerable • Bynoe's Wattle, Tiny Wattle (Acacia bynoeana) – Vulnerable • Small-flower Grevillea (Grevillea parviflora subsp. Parviflora) – Vulnerable • Magenta Lilly Pilly (Syzygium paniculatum) – Vulnerable • Heath Wrinklewort (Rutidosis heterogama) – Vulnerable • Charmhaven Apple (Angophora inopina) - Vulnerable

The initial referral was lodged prior to the completion of threatened species surveys (to inform the SEARs) and subsequent survey efforts have revealed additional information as to the likelihood of significant impacts. **Appendix E** provides an EPBC Assessment of Significance with regard to potential for significant impacts on *Tetratheca juncea* and determined those impacts to be low. Furthermore, additional assessments of the species listed in **Table 19** determined that significant impacts were unlikely.

Even though significant impacts to the *Tetratheca juncea* and those species listed in **Table 19** have been deemed unlikely, a detailed BMP has been proposed to determine whether any impacts occur. Furthermore, the proposed BMP and associated TARP may include adaptive management such as; mitigation, remediation and changes to the mine design.

6 CONCLUSION AND RECOMMENDATIONS

This BIR provides the results from ecological surveys required to assess the potential impact on biodiversity values arising from mining within the West Borehole seam and associated surface infrastructure. This report also assesses matters not addressed in the BDAR, including relevant SEPPs.

The majority of the potential impacts related to this Project are indirect subsidence related impacts such as; cracking, sinkholes and plug-hole failures. In order to accurately determine the credit liability incurred by the Project, a robust BMP will aim to identify potential impacts to threatened species and ecological communities. If potential impacts are identified, an offset liability report will be produced within 3 months in line with the BAM (and EPBC requirements if no bilateral agreement is in place) and it will contain a proposed offset strategy.

Approximately 0.32 ha of native vegetation will be cleared for ancillary facilities. This includes an area approximately 0.15 ha of PCT 1718 which is commensurate with Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions EEC under the BC Act. This community is not commensurate with an EEC listed under the EPBC Act.

6.1 State Requirements (BC Act)

Nine PCTs were located within the Study Area:

- PCT 1588 Grey Ironbark – Broad-leaved Mahogany – Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast;
- PCT 1598 Forest Red Gum grassy open forest on floodplains of the Lower Hunter;
- PCT 1619 Smooth-barked Apple – Red Bloodwood – Brown Stringybark – Hairpin Banksia heathy open forest of coastal lowlands;
- PCT 1627 Smooth-barked Apple – Turpentine – Sydney Peppermint heathy woodland on sandstone ranges of the Central Coast;
- PCT 1636 Scribbly Gum – Red Bloodwood – *Angophora inopina* heathy woodland on lowlands on the Central Coast;
- PCT 1638 Smooth-barked Apple – Red Bloodwood – Scribbly Gum grass – shrub woodland on lowlands of the Central Coast;
- PCT 1716 – Prickly-leaved Paperbark forest on the coastal lowlands of the Central Coast and Lower North Coast;
- PCT 1718 – Swamp Mahogany – Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast; and
- PCT 1737 – Typha rushland.

Two BC Act listed TECs were located within the Study Area:

- Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions (listed as endangered); and
- Freshwater Wetlands on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions (listed as endangered).

The following Species Credit Species were detected within the Study Area:

- *Acacia bynoeana* (Bynoe's Wattle; BC Act: Endangered; EPBC Act: Vulnerable);

- *Angophora inopina* (Charmhaven Appl; BC Act: Vulnerable; EPBC Act: Vulnerable);
- *Corybas dowlingii* (Red Helmet Orchid; BC Act: Endangered; EPBC Act: Not Listed);
- *Genoplesium insigne* (Variable Midge Orchid; BC Act: Critically Endangered; EPBC Act: Critically Endangered);
- *Grevillea parviflora subsp*. *parviflora* (Small Flower Grevillea; BC Act: Vulnerable; EPBC Act: Vulnerable);
- *Tetratheca juncea* (Black-eyed Susan; BC Act: Endangered; EPBC Act: Vulnerable);
- *Calyptorhynchus lathami* (Glossy Black Cockatoo; BC Act: Endangered; EPBC Act: Not Listed);
- *Ninox strenua* (Powerful Owl; BC Act: Vulnerable; EPBC Act: Not Listed);
- *Litoria brevipalmata* (Green-thighed Frog; BC Act: Vulnerable; EPBC Act: Not Listed);
- *Tyto novaehollandiae* (Masked Owl; BC Act: Vulnerable; EPBC Act: Not listed);
- *Miniopterus australis* (Little Bentwing-bat; BC Act: Vulnerable; EPBC Act: Not Listed; Ecosystem and Species Credit Species);
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat; BC Act: Vulnerable; EPBC Act: Not Listed; Ecosystem and Species Credit Species);
- *Scoteanax rueppellii* (Greater Broad-nosed Bat; BC Act: Vulnerable; EPBC Act: Not Listed);
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle; BC Act: Vulnerable; EPBC Act; Not listed);

The following Ecosystem Credit Species were detected within the Study Area:

- *Miniopterus australis* (Little Bentwing-bat; BC Act: Vulnerable; EPBC Act: Not Listed);
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing-bat; BC Act: Vulnerable; EPBC Act: Not Listed);
- *Micronumus norfolkensis* (East coast Free-tailed Bat; BC Act: Vulnerable; EPBC Act: Not Listed);
- *Scoteanax rueppellii* (Greater Broad-nosed Bat; BC Act: Vulnerable; EPBC Act: Not Listed);
- *Calyptorhynchus lathami* (Glossy Black Cockatoo; BC Act: Endangered; EPBC Act: Not Listed; BAM Candidate Species);
- *Ninox strenua* (Powerful Owl; BC Act: Vulnerable; EPBC Act: Not Listed; BAM Candidate Species);
- *Tyto novaehollandiae* (Masked Owl; BC Act: Vulnerable; EPBC Act: Not listed);
- *Haliaeetus leucogaster* (White-bellied Sea-Eagle; BC Act: Vulnerable; EPBC Act: Not listed; BAM Candidate Species);
- *Glossopsitta pusilla* (Little Lorikeet; BC Act: Vulnerable; EPBC Act; Not listed; BAM Candidate Species);
- *Daphnoenositta chrysoptera* (Varied Sittella; BC Act: Vulnerable; EPBC Act; Not listed; BAM Candidate Species); and
- *Petaurus norfolcensis* (Squirrel Glider; BC Act: Vulnerable; EPBC Act; Not listed; BAM Candidate Species).

6.2 State Environmental Planning Policies

SEPP 44: The Study Area is not considered 'Core Koala habitat' due to a low levels of Koala activity. Similarly, the Study Area was considered not to constitute core koala habitat under the SEPP (Koala Habitat Protection) 2019; and

Coastal Management SEPP: The Coastal Management SEPP was triggered twice because as illustrated in **Figure 14,** there is an area of 'Land in proximity to coastal wetlands or littoral rainforest' within the Study Area and there is an area identified as a 'Coastal Environment Area' within the Extension of Mining Area and Study Area.

6.3 NSW State Groundwater Dependent Ecosystems

The Project has potential to impact upon the above nine PCTs (see section 6.1) with a moderate or greater potential to be a GDE.

6.4 Commonwealth Requirements (EPBC Act)

Five threatened flora species were identified within the Study Area. Based on the potential for the Project to have a significant impact on EPBC listed threatened species, a referral under the EPBC Act was submitted to DoEE. The referral summarised that without absolute certainty of the impacts of the Project. In the case of impacts occurring, adaptive management will occur via the review of monitoring programs and investigation of causes to ensure any future impacts can be readily identified and predicted. Where impacts are identified, they will be offset in accordance with state and federal policies. These monitoring measures and TARPs will be detailed within the BMP prepared as part of the Extraction Plan process post consent.

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Appendix A

Staff Qualifications



Arne Bishop

Service Line Leader – Terrestrial & Aquatic Ecology

Role at RPS

Service Line Leader – Terrestrial & Aquatic Ecology

Location

Newcastle, NSW, Australia

Qualifications

Bachelor of Environmental Science, University of Canberra, 2009

Bachelor of Landscape Architecture, University of Canberra, 2009

Cert IV Horticulture (Landscape), Canberra Institute of Technology, 2003

Cert II Australian Land Conservation and Restoration, Conservation Volunteers Australia, 2001

Memberships

Ecological Consultants Association, Royal Zoological Society NSW

Why Arne for this role

Arne has over 18 years' experience in the ecology sector, subsequently gaining an extensive knowledge of exotic and endemic NSW flora, fauna, ecological communities and migratory species. He conducts ecological impact assessments and monitoring programs on a daily basis.

Arne is accredited under the Biodiversity Assessment Methodology (BAM). He has conducted BioBanking assessments for State Significant Infrastructure, State Significant Developments, and smaller developments, as well as EPBC offset calculations

Relevant projects

Harman Zone Substation Ecological Constraints Report, Department of Defence, 2018-2019.

Arne project managed the development of an Ecological Constraints Report for the construction of a substation and associated easement at HMAS Harman, ACT, which is Commonwealth Land owned by the Department of Defence (DoD). In doing so, Arne managed the production of an Impact Assessment to determine the relevant constraints of the project and advised DoD of the pathways to consent based on his sound knowledge of the relevant statutory requirements, policies and standards of the Commonwealth.

Flora and Fauna Assessment at Belconnen Naval Transmitting Station Department of Defence, 2007-2008

Flora and Fauna Assessment for a proposed housing sub-division, Lawson ACT. This project was completed with a former employer. Tasks included targeted surveys for; Grassland Earless Dragon (*Tympanocryptis pinguicolla*), Striped Legless Lizard (*Delma impar*), Golden Sun Moth (*Synemon plana*), Perunga Grasshopper (*Perunga ochracea*) and Natural Temperate Grassland, Endangered Ecological Community (EEC) Mapping. Mitigation measures were included in the associated report to ensure the protection of potentially occurring threatened species during and after construction activities.

Flora and Fauna monitoring at Majura Firing Range, Department of Defence, 2004-2008.

Flora and Fauna monitoring for a military firing range, Majura ACT. This project was completed with a former employer. Tasks included targeted surveys for; Grassland Earless Dragon, Striped Legless Lizard, Golden Sun Moth, Perunga Grasshopper, Button Wrinklewort (*Rutidosis leptorhyncoides*) and Natural Temperate Grassland, Endangered Ecological Community (EEC) Mapping. Management and mitigation measures were included in the associated reports to ensure the protection of threatened species and the EEC.

Relevant projects

Springvale Blue Mountains Water Skink (BMWS) Monitoring and Research Program, Centennial Coal, 2015-2018

Designed and part implemented a multi-year research and monitoring program for the nationally endangered Blue Mountains Water Skink. Roles have included ecological field surveys and associated monitoring report preparation for Springvale underground mine on the Newnes Plateau.

Western Region Biodiversity Offset Strategy, Centennial Coal, 2014-2018

Preparation of a biodiversity offset strategy for multiple approved coal mining operations in the NSW 'Western Coal Fields' near Lithgow. Involved a post hoc assessment of Project impacts and comparable offsets using the repealed Framework for Biodiversity Offsets (Major Projects) and Part 7A of the Threatened Species Conservation Act 1995. Demonstrated a suitable offset strategy for approved projects by gaining approval through the NSW Department of Planning and Environment and Office of Environment and Heritage.

NBN Projects, 2015-2017

Biodiversity due diligence analysis to identify the presence of 'areas of environmental significance'. All projects have involved the identification and development of impact avoidance solutions for 'areas of environmental significance' such as SEPP 14 coastal wetlands, SEPP 26 Littoral Rainforest, SEPP 44 Koala Habitat, threatened biodiversity (species, populations and ecological communities) listed under the *Threatened Species Conservation Act 1995* and/ or *Environment Protection and Biodiversity Conservation Act 1999*.

Finley Solar Farm EIS, ESCO, 2017

Arne was involved in RPS' preparation of an Environmental Impact Statement (EIS) for the Finley Solar Farm Project. The Finley Solar Farm would produce 170MW over 500 hectares of land. Numerous RPS service lines worked together to prepare the document. To date RPS have successfully liaised with the NSW Department of Planning and Environment, as well as the client, to progress the project smoothly in line with the desired outcomes.

Bells Line of Road Corridor – Chifley Rd Upgrade, RMS, 2016

Conducted targeted threatened species field surveys and assisted in the preparation of a biodiversity assessment for the proposed Chifley Road upgrade located on the Bells Line of Road between Bell and Scenic Hill.

Springvale Coal (Newnes Plateau Shrub Swamp EEC), 2015-2018

Performed complex seasonal and annual monitoring programs for this State and Commonwealth listed threatened ecological community. Monitoring includes flora based repeated measures sampling within a BACI monitoring design and Soil Adjusted Normalised Vegetation Index (SANDVI) analysis of remotely sensed imagery (7cm resolution RGBI imagery) over four seasons.

Newcastle Urban Transformation and Transport Program, UrbanGrowth NSW C/- Elton Consulting, 2015

Arne was involved in the provision of a Flora and Fauna Assessment to inform the rezoning of surplus corridor lands for the Project. The proposed zoning amendments applying to the rail corridor land will form part of the delivery of urban transformation, comprising a package of transport, built form and public domain improvements in and around the rail corridor lands.

Gunnedah Basin, Santos, 2013-2015

Conducted multiple projects over approximately two years. These projects included; ecological works for Santos within the Gunnedah Basin covering gas exploration and provision of infrastructure, including, gas pipelines and access tracks. Works included field survey, preparation of advice, impact assessments, EPBC referrals, preparation and implementation of well lease rehabilitation plans, liaison and negotiations with regulators and agencies.

Springvale Coal, Centennial Coal, 2013-2015

Preparation and implementation of Biodiversity Management Plans (BMP) and Swamp Monitoring Programs (SMP) as subplans of Longwall Extractions Plans for the Springvale Coal Extension Project. BMPs and SMPs are reviewed by the Independent Monitoring Panel and State/ Commonwealth regulators prior to the approval of secondary coal extraction. Works involved the synthesis of a growing knowledge base on best practice monitoring and management of endangered upland peat swamps listed on State and Commonwealth legislation.

Mandalong Coal, Centennial Coal, 2016

Preparation and implementation of a BMP as a subplan for Extractions Plans prepared for longwalls 25-31 of the Mandalong Coal Project. BMPs are reviewed by the relevant State regulator prior to the approval of secondary coal extraction.

Northern Coal Logistics Project, Centennial Coal, 2014

Preparation of a BioBanking compliant assessment for the Northern Coal Logistics Project including assessment of complimentary biodiversity offset

sites for inclusion in the biodiversity offset strategy for the Project.

Angus Place and Springvale Extension Projects, Centennial Coal, 2012-2014

Ecological surveys were undertaken over a period of 1.5 years to aid in the production of a Flora and Fauna Report for both the Angus Place and Springvale underground mines. The project role included flora and fauna field surveys and assistance with associated reporting. Conducted notional BioBanking calculations for Springvale Extension Project to quantify biodiversity impacts and potential offset requirements. Arne has also produced Biodiversity Management Plans (BMP) for the above sites. The BMPs outlined areas of ecological importance and ecological issues on site with associated management actions and monitoring requirements in line with the Development Approval. The BMP refined the existing flora and fauna monitoring program which continues to be implemented and by Arne and his team.

Huntlee Ecological works, LWP Property Group, 2015

Undertook Ecology works to inform Major Project Approval and negotiations under the EPBC Act for the new Hunter Valley town at Huntlee. This project involved critically endangered species, offsets and presentations to stakeholder groups.

Westmead Hospital Upgrade, Price Waterhouse Coopers and Johnstaff, 2013

Ecological surveys and reporting. Ecological opportunities and constraints were assessed in relation to the relevant state and federal legislation to inform the concept design. Later a REF was produced using the relevant information from the flora and fauna field surveys, assessments and reporting.

Reticulated Water, Sewer and Recycled Water (Glossodia, Huntlee new town and Cooranbong), Flow Systems, 2013-2016

Arne was involved in the biodiversity assessments for a number of REF's. This enabled licences to be sought by the client for the provision of reticulated water, sewer and recycled water across large urban release areas in accordance with the *Water Industry Competition Act 2006*. Conducted notional BioBanking calculations to quantify biodiversity impacts and potential offset requirements.

Lower Hunter Lands subdivision, Coal and Allied, 2011

Preparation of a detailed Part 3A ecological inventory and impact assessment for a proposed residential subdivision including extensive flora, fauna and habitat surveys over approximately 3,800 hectares. Ongoing liaison, negotiations and presentations were made to authorities and community forums. The project involved significant offsets that helped to secure regional corridors and conservation initiatives long sought after in the region.



Dr Hayden Beck

hayden.beck@rpsgroup.com.au

Senior Ecologist

Qualifications:	BSc (Mar Sc); BEnvSc (Hons); MSc (Res); PhD BAM Accredited Assessor (BAAS19000)
Memberships:	Ecological Consultants Association of NSW (Practicing Member)

Locations:	Newcastle, NSW, Australia	**Project role:**	Senior Ecologist

Overview

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

Being a Biodiversity Assessment Method Accredited Assessor, Hayden has considerable experience preparing Biodiversity Development Assessment Reports (BDAR) and Biodiversity Stewardship Site Agreement Reports (BSSAR) assessments under the new NSW *Biodiversity Conservation Act* 2016.

[Areas of expertise]

- Flora and Fauna Impact Assessments
- Aquatic Ecology
- Water quality monitoring and assessment
- Marine Ecology

[Sectors]

- Mining
- Oil and Gas
- State Government
- Local Government
- Housing

Experience

Water Quality Officer – NSW Department of Environment, 2009

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

Annual Monitoring for LW22-24a Mandalong Coal Mine, Centennial Coal, 2019

Hayden organised repeat monitoring for three sensitive ecological communities, aquatic ecology using AusRivAS as well as frog surveys, to gauge the potential impact of longwall mining. This survey effort involved six RPS ecologists and involved surveys across a vast area to achieve representative sampling of both predicted impact and control locations. Hayden used his in-depth understanding of statistical analyses to determine if and how these ecosystems have responded to this underground mining, whilst referring to site specific Biodiversity Management Plans to determine if a response is required.

Characterisation of Stormwater pollution in Sydney Harbour, Marrickville, City of Sydney and Leichhardt Councils, 2011

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

Drainage upgrades to Old Pacific Highway, Mooney Mooney to Kariong, Roads and Maritime Services, 2017

Hayden prepared project REF and a Biodiversity Assessment for RMS, including ISEPP consultation to numerous government authorities. He undertook extensive ecological surveys across 24 sites to determine the impact associated with upgrades of aging culverts that transverse the Old Pacific Highway. This project required close and clear communication with the client as the scope for drainage upgrades varied across the site.

Drainage Upgrades to M1, Mt Pleasant, Roads and Maritime Services, 2016

Hayden prepared a project REF and a Biodiversity Assessment for RMS, including ISEPP consultation to numerous government authorities. He assisted extensive ecological surveys on the Illawarra Escarpment to determine the impact associated with improving drainage and installation of a water retention basin (and associated infrastructure), adjacent to the M1.

Temperate Highland Peat Swamp (THPSS) Monitoring for Springvale Mine, Centennial Coal, 2019

Hayden assists and manages field teams to undertake a diverse suite of seasonal and annual monitoring programs throughout the Newnes Plateau in the Blue Mountains, NSW.

Basalt Quarry at North Star, SMK Consultants, 2017

Hayden assisted the preparation of a Biodiversity Development Assessment Report for a Basalt Quarry, planned to facilitate construction of an inland rail line. This project targeted surveys for several threatened flora and fauna species, as well as determining offset requirements for the threatened Semi-evergreen Vine Thicket Endangered Ecological Community. This study adopted the BAM.

Concrete Batch Plant at Bushells Ridge, Advision, 2017

Hayden prepared a Flora and Fauna impact assessment for the proposed establishment of a concrete batch plant, to facilitate widening of the M1. This project targeted surveys for several threatened flora and fauna species, some of which were found onsite. This study involved use of survey techniques adopted by the BAM. Due to the presence of critically endangered orchids, the project involved in-depth liaison with Council and the Client to devise a strategy to avoid these rare plants.

Widening of Golden Highway, Castlereagh Junction to Dunedoo, Roads and Maritime Services, 2018

Hayden prepared two specialist Biodiversity Assessments and two project Review of Environmental Factors (REF) for a major upgrade of the Golden highway. This project, undertaken for NSW Roads and Maritime (RMS) and Essential Energy, included assessing the impacts to Endangered Ecological Communities resulting from widening of the road pavement and relocation of Electrical Reticulation.



Joe May

Ecologist

Role at RPS
Ecologist

Location
Newcastle, NSW, Australia

Qualifications
Master of Environmental Management

Bachelor of Environmental Science & Management

Accredited BAM Assessor

Memberships
The Ecological Consultants Association of NSW (ECA)

Environment Institute of Australia & New Zealand (EIANZ)

Royal Zoological Society of NSW (RZSNSW)

Birdlife Australia

Why Joe for this role

Joe is an accredited Biodiversity Assessment Method (BAM) Assessor with over 6 years' experience as an ecological consultant.

Joe has been an Ecologist with RPS since 2014 and has experience in the preparation of a variety of report types, including but not limited to:

- Review of Environmental Factors Biodiversity Monitoring Reports;
- Due Diligence Reporting;
- Thresholds Assessments;
- Vegetation Management Plans;
- Biodiversity Management Plans;
- Biodiversity Assessment Development Reports (BDAR); and
- Biodiversity Stewardship Site Assessment Reports (BSSAR).

The preparation of these report types requires understanding of the relevant local, state and federal legislation and policies pertaining to each.

In addition to having skills in report writing and legislation, Joe is accomplished with the following field skills:

- Fauna identification; including birds, reptiles, amphibians and mammals; and
- Flora identification; including plants, vegetation community mapping and the identification of state and federally listed endangered ecological communities.

Relevant projects

NBN Thresholds Assessments, NBN, 2015-2019

Preparation of biodiversity assessments for multiple greenfield NBN cabling installations from Maxville to Moruya (14 sites). Biodiversity constraints were identified and managed within tight assessment timeframes to meet NBN delivery objectives.

Western Region Biodiversity Offset Strategy, Centennial Coal, 2018

Conducted biometric plots, vegetation mapping and targeted flora and fauna surveys for multiple approved coal mining operations in the NSW 'Western Coal Fields' near Lithgow.

Bulga Mine Annual Fauna Monitoring, Glencore, 2015-2019

Joe has been involved in an annual monitoring program that spans two operations and involves seasonal bird surveys, habitat assessments and the full spectrum of fauna monitoring methodologies targeting threatened species as well as comprising an overall species list, and providing technical input and annual report writing.

Springvale Coal, Centennial Coal, 2018

Preparation and implementation of Biodiversity Management Plans (BMP) and Swamp Monitoring Programs (SMP) as subplans of Longwall Extractions Plans for the Springvale Coal Extension Project. BMPs and SMPs are reviewed by the Independent Monitoring Panel and State/ Commonwealth regulators prior to the approval of secondary coal extraction. Works involved the synthesis of a growing knowledge base on best practice monitoring and management of endangered upland peat swamps listed on State and Commonwealth legislation.

Mandalong Offset Assessments, Centennial Coal Mandalong, 2018

Field surveys for a range of flora and fauna assessments, including threatened species searches, nocturnal and amphibian surveys for the proposed Mandalong Offset sites.

Charbon Compensatory Habitat Assessment, Centennial Coal Charbon, 2016 to 2018

Field surveys for annual monitoring of floristics and bird life across Charbons' northern and southern Compensatory Habitat Management Areas.

Lidsdale Biodiversity Development Assessment, Centennial Coal, 2018 to 2019

Flora and fauna field surveys for the preparation of a Biodiversity Development Assessment Report.

Bulga to Broke, Singleton Council, 2019

Impact assessment for the proposed Bulga to Broke Pipeline, with floristics, threatened species searches and vegetation community determinations

Nest Box Monitoring Program, Rose Group, 2012-2019

Conduct biannual monitoring of over 500 nest boxes to comply with Conditions of Consent for residential development at Gwandalan. Prepare annual compliance reports for various approvals.

Neubeck Open Cut Coal Mine, Centennial Coal, 2012-2014

Flora and fauna field surveys were undertaken for the proposed Neubeck open cut coal mine. Surveys involved targeted threatened species surveys, vegetation mapping, flora and fauna identification and habitat mapping.

Huntlee Ecological works, LWP Property Group, 2015

Undertook Ecology works to inform Major Project Approval and negotiations under the EPBC Act for the new Hunter Valley town at Huntlee.

Springvale Blue Mountains Water Skink (BMWS) Monitoring and Research Program, Centennial Coal, 2015-2018

Participated in field research for a multi-year research and monitoring program for the nationally endangered Blue Mountains Water Skink. Roles have included ecological field surveys data management.

Appendix B

Likelihood of Occurrence

Scientific Name (Common Name)	TSC Act	EPBC Act	Habitat	Likelihood of Occurrence
Acacia bynoeana (Bynoe's Wattle)	E	V	Grows mainly in heath and dry sclerophyll forest in sandy soils. Mainly south of Dora Creek-Morisset area to Berrima and the Illawarra region, west to the Blue Mountains, also recorded from near Kurri Kurri in the Hunter Valley and from Morton National Park.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species not recently observed in the locality (NSW BioNet records).
Angophora inopina	V	V	Endemic to the Central Coast region of NSW. The known northern limit is near Karuah where a disjunct population occurs; to the south populations extend from Toronto to Charmhaven with the main population occurring between Charmhaven and Morisset. Occurs most frequently in red bloodwood – scribbly gum woodland, wet heath, red mahogany – paperbark sedge woodland and stringybark – red bloodwood forest.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species not recently observed in the locality (NSW BioNet records).
Anthochaera Phrygia (Regent Honeyeater)	CE	E, M	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. The distribution of the species has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some year's flocks converge on flowering coastal woodlands and forests.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Artamus cyanopterus cyanopterus (Dusky Woodswallow)	V	-	The Dusky Woodswallow is widespread in eastern, southern and southwestern Australia. In New South Wales it is widespread from coast to inland, including the western slopes of the Great Dividing Range and farther west. It is sparsely scattered in, or largely absent from, much of the Upper Western region. The Dusky Woodswallow is often reported in woodlands and dry open sclerophyll forests, usually dominated by eucalypts, including mallee associations. It has also been recorded in shrublands and heathlands and various modified habitats, including regenerating forests; very occasionally in moist forests or rainforests. At sites where Dusky Woodswallows are recorded the understorey is typically open with sparse eucalypt saplings, acacias and other shrubs, including heath. The ground cover may consist of grasses, sedges or open ground, often with coarse woody debris (Higgins and Peter 2002). Birds are also often observed in farmland, usually at the edges of forest or woodland or in roadside remnants or wind breaks with dead timber.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Asterolasia elegans	E	E	Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also, likely to occur in the western part of Gosford local government area. Known from only seven populations, only one of which is wholly within a conservation reserve. Occurs on Hawkesbury sandstone in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known ‘area of occurrence’ but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
Astrotricha crassifolia	V	V	Occurs near Patonga (Gosford LGA), and in Royal NP and on the Woronora Plateau (Sutherland and Campbelltown LGAs). There is also a record from near Glen Davis (Lithgow LGA). Also, in Victoria. Occurs in dry sclerophyll woodland on sandstone.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known ‘area of occurrence’ but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
Botaurus poiciloptilus (Australasian Bittern)	E	E	The Australasian Bitterns is widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes and spike rushes.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known ‘area of occurrence’ but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).

Scientific Name (Common Name)	TSC Act	EPBC Act	Habitat	Likelihood of Occurrence
Burhinus grallarius (Bush Stone-curlew)	E	-	The Bush Stone-curlew is found throughout Australia except for the central southern coast and inland, the far south-east corner, and Tasmania. Only in northern Australia is it still common however and, in the south-east, it is either rare or extinct throughout its former range. Inhabits open forests and woodlands with a sparse grassy ground layer and fallen timber. Largely nocturnal, being especially active on moonlit nights.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known ‘area of occurrence’ but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Caladenia tessellata (Thick-lip Spider Orchid)	E	V	The Tessellated Spider Orchid is found in grassy sclerophyll woodland on clay loam or sandy soils, though the population near Braidwood is in low woodland with stony soil. Known from the Sydney area (old records), Wyong, Ulladulla and Braidwood in NSW. Populations in Kiama and Queanbeyan are presumed extinct.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known ‘area of occurrence’ but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Calidris canutus (Red Knot)	-	E	The Red Knot is common in all the main suitable habitats around the coast of Australia. Very large numbers are regularly recorded in north-west Australia, with 80 Mile Beach and Roebuck Bay being particular strongholds. The only places it is not found in significant numbers are the northern part of the Great Australian Bight in South Australia and Western Australia, and along much of the NSW coast, where wader habitat is rather scarce (excluding the Hunter Estuary). It is widespread along the coast south of Townsville and along the coasts of NSW and Victoria. In Australasia the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known ‘area of occurrence’ but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Calidris ferruginea (Curlew Sandpiper)	E	-	The Curlew Sandpiper is distributed around most of the coastline of Australia. It occurs along the entire coast of NSW, particularly in the Hunter Estuary, and sometimes in freshwater wetlands in the Murray-Darling Basin. It generally occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts. It also occurs in non-tidal swamps, lakes and lagoons on the coast and sometimes the inland	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known ‘area of occurrence’ but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Calidris tenuirostris (Great Knot)	V	-	In NSW, the species has been recorded at scattered sites along the coast to about Narooma. It has also been observed inland at Tullakool, Armidale, Gilgandra and Griffith. Occurs within sheltered, coastal habitats containing large, intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons. Often recorded on sandy beaches with mudflats nearby, sandy spits and islets and sometimes on exposed reefs or rock platforms.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known ‘area of occurrence’ but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Callistemon linearifolius	V	-	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. Recorded in 2000 at Coalcliff in the northern Illawarra. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Grows in dry sclerophyll forest on the coast and adjacent ranges.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).

Scientific Name (Common Name)	TSC Act	EPBC Act	Habitat	Likelihood of Occurrence
Callocephalon fimbriatum (Gang-gang Cockatoo)	V	-	In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. Also occur in subalpine snow gum woodland and occasionally in temperate or regenerating forest. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, particularly in box-ironbark assemblages, or in dry forest in coastal areas. It requires tree hollows in which to breed.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Calyptorhynchus lathami (Glossy Black-Cockatoo)	V	-	Inhabits forest with low nutrients, characteristically with key Allocasuarina spp. Tends to prefer drier forest types with a middle stratum of Allocasuarina below Eucalyptus or Angophora. Often confined to remnant patches in hills and gullies. Breed in hollows stumps or limbs, either living or dead. Endangered population in the Riverina.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).
Caretta caretta (Loggerhead Turtle)	E	-	Loggerhead turtles have a worldwide tropical and subtropical distribution. In Australia, they occur in coral reefs, bays and estuaries in tropical and warm temperate waters off the coast of Queensland, Northern Territory, Western Australia and New South Wales.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Cercartetus nanus (Eastern Pygmy-possum)	V	-	Inhabits rainforest through to sclerophyll forest and tree heath. Banksias and myrtaceous shrubs and trees are a favoured food source. Will often nest in tree hollows but can also construct its own nest. Because of its small size it is able to utilise a range of hollow sizes including very small hollows. Individuals will use a number of different hollows and an individual has been recorded using up to 9 nest sites within a 0.5ha area over a 5 month period.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Chalinolobus dwyeri (Large-eared Pied Bat)	V	V	Located in a variety of drier habitats, including the dry sclerophyll forests and woodlands to the east and west of the Great Dividing Range. Can also be found on the edges of rainforests and in wet sclerophyll forests. This species roosts in caves and mines in groups of between 3 and 37 individuals.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
Charadrius leschenaultia (Greater Sand-plover)	V	-	Occur on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons. Non-breeding in Australia.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Charadrius mongolus (Lesser Sand-plover)	V	-	Inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops. Non-breeding in Australia.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).

Scientific Name (Common Name)	TSC Act	EPBC Act	Habitat	Likelihood of Occurrence
Chelonia mydas (Green Turtle)	V	V	Green turtles occur in seaweed-rich coral reefs and inshore seagrass pastures in tropical and subtropical areas of the Indo-Pacific region.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Chthonicola sagittata (Speckled Warbler)	V	-	The Speckled Warbler lives in a wide range of eucalypt dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Climacteris picumnus victoriae [Brown Treecreeper (eastern subspecies)]	V	-	Found in eucalypt woodlands (including box-gum woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and river red gum forest bordering wetlands with an open understorey of acacias, saltbush, lignum, cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
Crinia tinnula (Wallum Froglet)	V	-	Wallum Froglets are found in acid paperbark swamps and sedge swamps of the coastal 'wallum' country. Their tadpoles are adapted to acid conditions and may be outcompeted by the Common Froglet. Males call from the base of vegetation in and around the breeding site and are almost impossible to locate. Calling occurs from Autumn to Spring, being most strongly associated with flooding following rainfall. Its range extends from SE QLD to the Kurnell Peninsular of Sydney.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Cryptostylis hunteriana (Leafless Tongue-orchid)	V	V	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland. The larger populations typically occur in woodland dominated by Scribbly Gum (Eucalyptus sclerophylla), Silvertop Ash (E. sieberi), Red Bloodwood (Corymbia gummifera) and Black Sheoak (Allocasuarina littoralis); appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (C. subulata) and the Tartan Tongue Orchid (C. erecta).	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Cynanchum elegans (White-flowered Wax Plant)	E	E	Recorded from rainforest gullies scrub and scree slopes from the Gloucester district to the Wollongong area and inland to Mt Dangar.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Daphoenositta chrysoptera (Varied Sittella)	V	-	Inhabits wide variety of dry eucalypt forests and woodlands, usually with either shrubby under storey or grassy ground cover or both, in all climatic zones of Australia. Usually in areas with rough-barked trees, such as stringybarks or ironbarks, but also in paperbarks or mature Eucalypts with hollows.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).
Darwinia glaucophylla	V	-	Known from approximately 15 sites, several within or near to Brisbane Waters NP and one within Popran NP. Grows in sandy heath, scrub and woodlands often associated with sandstone rock platforms or near hanging swamps and friable sandstone shallow soils.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).

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Dasyornis brachypterus (Eastern Bristlebird)	E	E	Found in coastal woodlands, dense scrub and heathlands, particularly where it borders taller woodlands.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Dasyurus maculatus (Spotted-tailed Quoll)	V	E	Spotted-tailed Quoll are found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Queensland. Only in Tasmania is it still considered common. Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Diomedea antipodensis (Antipodean Albatross)	V	V	The species ranges across the southern Pacific Ocean, east to the coast of Chile and west to eastern Australia. The Antipodean Albatross breeds biennially in colonies on ridges, slopes and plateaus of isolated subantarctic islands, usually in vegetation such as grass tussocks. This species regularly occurs in small numbers off the NSW south coast from Green Cape to Newcastle during winter where they feed on cuttlefish.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Diomedea antipodensis gibsoni (Gibson's Albatross)	V	-	The species is regularly encountered on trans-Tasman shipping routes and at seas off Sydney, and regularly occurs off the NSW coast usually between Green Cape and Newcastle. This species is known only to breed on the Adams, Disappointment and Auckland Islands in the subantarctic Auckland Island group. Potential forage in NSW waters during the winter is considered significant for the species.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Diomedea epomophora (Southern Royal Albatross)	V	V	Breeding occurs on Adams, Enderby and Auckland Islands (Auckland Islands group), Campbell Island, and on Taiaroa Head (Otago Peninsula, South Island), New Zealand. This otherwise pelagic species is most commonly recorded in New Zealand and South American waters in the non-breeding season, but may circumnavigate all the way around the Southern Ocean	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Diomedea exulans (Wandering Albatross)	E	-	The Wandering Albatross is marine, pelagic and aerial.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Diomedea sanfordi (Northern Royal Albatross)	E	E	Marine, subtropical to sub-Antarctic oceans; occasionally further south into the Antarctic.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Diuris bracteata	E	Extinct	Dry sclerophyll woodland and forest with a predominantly grassy understorey.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).

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Diuris praecox (Rough Doubletail)	V	V	Occurs between Ourimbah and Nelson Bay. Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Ephippiorhynchus asiaticus (Black-necked Stork)	E	-	Mainly found on shallow, permanent, freshwater terrestrial wetlands, and surrounding marginal vegetation, including swamps, floodplains, watercourses and billabongs, freshwater meadows, wet heathland, farm dams and shallow floodwaters, as well as extending into adjacent grasslands, paddocks and open savannah woodlands. They also forage within or around estuaries and along intertidal shorelines, such as saltmarshes, mudflats and sandflats, and mangrove vegetation.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Epthianura albifrons (White-fronted Chat)	V	-	Low vegetation in salty coastal and inland areas and crops. Runs along ground and is found in local flocks in Winter.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Eucalyptus camfieldii	V	V	Restricted distribution in a narrow band with the most northerly records in the Raymond Terrace Area south to Waterfall. Localised and scattered distribution includes sites at Norah Head (Tuggerah Lakes), Peats Ridge, Mt Colah, Elvina Bay Trail (West Head), Terrey Hills, Killara, North Head, Menai, Wattamolla and a few other sites in Royal National Park. Poor coastal country in shallow sandy soils overlying Hawkesbury sandstone. Coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Eucalyptus oblonga	EP	-	The disjunct outlier population at Bateau Bay, Forresters Beach and Tumbi Umbi includes occurrences on the Patonga Claystone Formation and derived soils, corresponding to the Woodburys Bridge Soil Landscape. Normally found on in dry open forest with infertile sandy soils on sandstone. The population at Bateau Bay occurs on coastal sands.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Eucalyptus parramattensis subsp. decadens	V	V	Generally, occupies deep, low-nutrient sands, often those subject to periodic inundation or where water tables are relatively high. It occurs in dry sclerophyll woodland with dry heath understorey. It also occurs as an emergent in dry or wet heathland. Often where this species occurs, it is a community dominant.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Eucalyptus parramattensis subsp. Parramattensis (Eucalyptus parramattensis C. Hall. subsp. parramattensis in Wyong and Lake Macquarie local government areas)	EP	-	Occurs within Wyong in the Porter's Creek and the Wallarah Creek catchments, on sandy alluvium within a floodplain community which also supports swamp mahogany, forest red gum, red bloodwood as well as paperbarks.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).

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Falsistrellus tasmaniensis (Eastern False Pipistrelle)	V	-	Inhabit sclerophyll forests, preferring wet habitats where trees are more than 20 m high. Two observations have been made of roosts in stem holes of living eucalypts. There is debate about whether or not this species moves to lower altitudes during winter, or whether they remain sedentary but enter torpor. This species also appears to be highly mobile and records showing movements of up to 12 km between roosting and foraging sites.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
Fregetta grallaria (White-bellied Storm-Petrel)	-	V	The White-bellied Storm-Petrel occurs across sub-tropical and tropical waters in the Tasman Sea, Coral Sea and, possibly, the central Pacific Ocean. In the non-breeding season, it reaches and forages over near-shore waters along the continental shelf of mainland Australia. It breeds, in Australian territory, on offshore islets and rocks in the Lord Howe Island group. It nests in crevices between large volcanic rocks, and in burrows excavated in banks. Breeding colonies are often situated along dykes.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Genoplesium insignis (Variable Midge Orchid)	E	-	Grows in patches of kangaroo grass amongst shrubs and sedges in heathland and forest. Associated vegetation at Chain Valley Bay is described as dry sclerophyll woodland dominated by scribbly gum, red bloodwood, smooth-barked apple and black she-oak.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species not recently observed in the locality (NSW BioNet records).
Glossopsitta pusilla (Little Lorikeet)	V	-	Distributed in forests and woodlands from the coast to the western slopes of the Great Dividing Range in NSW, extending westwards to the vicinity of Albury, Parkes, Dubbo and Narrabri. Mostly occur in dry, open eucalypt forests and woodlands. They feed primarily on nectar and pollen in the tree canopy. Nest hollows are located at heights of between 2 m and 15 m, mostly in living, smooth-barked eucalypts. Most breeding records come from the western slopes.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).
Grantiella picta (Painted Honeyeater)	V	-	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits boree, brigalow and box-gum woodlands and box-ironbark forests.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Grevillea parviflora subsp. Parviflora (Small-flowered Grevillea)	V	V	Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest. Found over a range of altitudes from flat, low-lying areas to upper slopes and ridge crests. Often occurs in open, slightly disturbed sites such as along tracks.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).
Haematopus longirostris (Pied Oystercatcher)	E	-	The Pied Oystercatcher inhabits marine littoral habitats, including islands. It occupies muddy, sandy, stony or rocky estuaries, inlets and beaches, particularly intertidal mudflats and sandbanks in large marine bays.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Haliaeetus leucogaster (White-bellied Sea-Eagle)	V	M	Inhabits coastal and near coastal areas, building large stick nests, and feeding mostly on marine and estuarine fish and aquatic fauna.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).

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Heleioporus australiacus (Giant Burrowing Frog)	V	V	The Giant Burrowing Frog has been recorded breeding in a range of water bodies associated with more sandy environments of the coast and adjacent ranges from the Sydney Basin south the eastern Victoria. It breeds in hanging swamps, perennial non-flooding creeks and occasionally permanent pools, but permanent water must be present to allow its large tadpoles time to reach metamorphosis.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Hibbertia procumbens (Spreading Guinea Flower)	E	-	Within NSW, known from several locations only on the Central Coast in the Gosford and Wyong LGAs. These populations are at Bumble Hill near Yarramalong in Wyong LGA; Kulnura, Strickland State Forest, Mangrove Mountain, Somersby, Calga/Mt White and Peats Ridge in the Gosford LGA; and near Mogo Creek to the west of Mangrove Creek Dam. Majority of known populations occur within heath banksia scrub on skeletal sandy soils. May also be found associated with upland swamps on sandy deposits.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Hieraaetus morphnoides (Little Eagle)	V	-	Most abundant in lightly timbered areas with open areas nearby. Often recorded foraging in grasslands, crops, treeless dune fields, and recently logged areas. May nest in farmland, woodland and forest in tall trees.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Hoplocephalus bitorquatus (Pale-headed Snake)	V	-	The Pale-Headed Snake has a patchy distribution from north-east Queensland to north-east NSW. In NSW it occurs from the coast to the western side of the Great Divide as far south as Tuggerah and out to the western plains. It is found mainly in dry eucalypt forests and woodlands, cypress woodland and occasionally in rainforest or moist eucalypt forest where it favours streamside areas, particularly in drier habitats. They shelter during under loose bark or in hollows and have a preference for frogs as prey, although lizards and small mammals are also taken. This species breeds and shelters in hollows in live and dead trees and in and under fallen timber. It is best detected from mid-spring to mid-autumn and is mostly nocturnal.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Hoplocephalus bungaroides (Broad-headed Snake)	E	V	Occurs almost exclusively in association with communities occurring on Triassic sandstone within the Sydney Basin. Typically found among exposed sandstone outcrops with vegetation types ranging from woodland to heath. Within these habitats they spend most of the year sheltering in and under rock crevices and exfoliating rock. However, some individuals will migrate to tree hollows to find shelter during hotter parts of summer.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Hoplocephalus stephensii (Stephens' Banded Snake)	V	-	The Stephens Banded Snake is found through the coast and adjacent ranges of NSW from the Central Coast northwards and into SE Queensland. It is most commonly found living in wet sclerophyll and rainforest areas but can be found in taller dry forest areas and even in some areas of dry forest where there is significant rock outcropping. They spend the majority of the time in treetops, either in large hollows or in dense vegetation, coming to the gound for forage for a range of vertebrates.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Not recently observed in the locality (NSW BioNet records).
Irediparra gallinacean (Comb-crested Jacana)	V	-	Inhabits permanent wetlands with a good surface cover of floating vegetation, especially water-lilies.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).

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Ixobrychus flavicollis (Black Bittern)	V	-	Usually found on coastal plains below 200 m. Often found along timbered watercourses, in wetlands with fringing trees and shrub vegetation. The sites where they occur are characterized by dense waterside vegetation.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Lathamus discolour (Swift Parrot)	E	CE	The Swift Parrot occurs in woodlands and forests of NSW from May to August, where it feeds on eucalypt nectar, pollen and associated insects. The Swift Parrot is dependent on flowering resources across a wide range of habitats in its wintering grounds in NSW. This species is migratory, breeding in Tasmania and also nomadic, moving about in response to changing food availability.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
Limicola falcinellus (Broad-billed Sandpiper)	V	-	Broad-billed Sandpipers favour sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs as feeding and roosting habitat. Occasionally, individuals may be recorded in sewage farms or within shallow freshwater lagoons. Broad-billed Sandpipers roost on banks on sheltered sand, shell or shingle beaches.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Limosa lapponica (Bar-tailed Godwit)	-	M	Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. It is rarely found on inland wetlands or in areas of short grass, such as farmland, paddocks and airstrips, although it is commonly recorded in paddocks at some locations overseas.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Limosa (Black-tailed Godwit)	V	-	Primarily a coastal species. Usually found in sheltered bays, estuaries and lagoons with large intertidal mudflats and-or sandflats. Further inland, it can also be found on mudflats and in water less than 10 cm deep, around muddy lakes and swamps.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Litoria aurea (Green and Golden Bell Frog)	E	V	Inhabits a very wide range of water bodies including marshes, dams and streams, particularly those containing emergent vegetation such as bullrushes or spikerushes. It also inhabits numerous types of man-made water bodies including quarries and sand extraction sites. Optimum habitat includes water-bodies that are un-shaded, free of predatory fish such as Plague Minnow, have a grassy area nearby and diurnal sheltering sites available.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Litoria brevipalmata (Green-thighed Frog)	V	-	This species is distributed from south-east Queensland to the NSW Central Coast. It occurs in a range of habitat types including rainforest, moist eucalypt forest, dry eucalypt forest and heath, but is most closely associated with wetter forest types in the southern part of its range. Calling and breeding is highly correlated with heavy rainfalls that lead to the formation of large ephemeral pools in a range of sites, but always in association with some native vegetation. Calling occurring only for one or two nights at a time anywhere between September and May.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).

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Litoria littlejohni (Littlejohn's Tree Frog)	V	V	Occurs in wet and dry sclerophyll forests and heathland associated with sandstone outcrops between 280 and 1000 m on the eastern slopes of the Great Dividing Range from the Central Coast down into Victoria. Individuals have been collected from a wide range of water bodies that includes semi-permanent dams, permanent ponds, temporary pools and permanent streams, with calling occurring from fringing vegeation or on the banks. Individuals have been observed sheltering under rocks on high exposed ridges during summer and within deep leaf litter adjacent to the breeding site. Calling occurs in all months of the year, often in association with heavy rains. The tadpoles are distinctive, being large and very dark in colouration.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Lophoictinia isura (Square-tailed Kite)	V	-	Typically inhabits coastal forested and wooded lands of tropical and temperate Australia. In NSW it is often associated with ridge and gully forests dominated by Eucalyptus longifolia, Corymbia maculata, E. elata or E. smithii. Individuals appear to occupy large hunting ranges of more than 100km2. They require large living trees for breeding, particularly near water with surrounding woodland -forest close by for foraging habitat. Nest sites are generally located along or near watercourses, in a tree fork or on large horizontal limbs.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Macronectes giganteus (Southern Giant Petrel)	E	E	The Southern Giant Petrel has a circumpolar pelagic range from Antarctica to approximately 20 S and is a common visitor off the coast of NSW. Over summer, the species nests in small colonies amongst open vegetation on antarctic and subantarctic islands, including Macquarie and Heard Islands and in Australian Antarctic territory.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Macronectes halli (Northern Giant-petrel)	V	V	Breeding in Australian territory is limited to Macquarie Island and occurs during spring and summer.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Macropus parma (Parma Wallaby)	V	-	Once occurred from north-eastern NSW to the Bega area in the southeast. Their range is now confined to the coast and ranges of central and northern NSW from the Gosford district to the Queensland border. Preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Maundia triglochinoides	V	-	Grows in swamps, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients. Flowering occurs during warmer months. Diaspore is the seed and root tubers, which are probably dispersed by water.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Melaleuca biconvexa (Biconvex Paperbark)	V	V	Grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects. Scattered and dispersed populations found in the Jervis Bay area in the south and the Gosford-Wyong area in the north.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).

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Melaleuca groveana	V	-	Grows in heath and shrubland, often in exposed sites, at high elevations, on rocky outcrops and cliffs. It also occurs in dry woodlands.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
Mormopterus norfolkensis (Eastern Freetail-bat)	V	-	Most records are from dry eucalypt forests and woodlands to the east of the Great Dividing Range. Appears to roost in trees, but little is known of this species' habits.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).
Microtis angusii (Angus's Onion Orchid)	E	E	It is not easy to define the preferred natural habitat of this orchid as the Ingleside location is highly disturbed. The dominant species occurring on the site are introduced weeds Coolatai grass and Acacia saligna. The Ingleside population occurs on soils that have been modified but were originally those of the restricted ridgetop lateritic soils in the Duffys forest - Terrey Hills - Ingleside and Belrose areas. These soils support a specific and distinct vegetation type, the Duffys forest Vegetation Community which is listed as an EEC under the TSC Act and ranges from open forest to low open forest and rarely woodland.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Miniopterus australis (Little Bentwing-bat)	V	-	Coastal north-eastern NSW and eastern Queensland. Little Bent-wing Bat is an insectivorous bat that roost in caves, in old mines, in tunnels, under bridges, or in similar structures. They breed in large aggregations in a small number of known caves and may travel 100s km from feeding home ranges to breeding sites. Little Bent-wing Bat has a preference for moist eucalypt forest, rainforest or dense coastal banksia scrub where it forages below the canopy for insects.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).
Miniopterus schreibersii oceanensis (Eastern Bentwing-bat)	V	-	Eastern Bent-wing Bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Not recently observed in the locality (NSW BioNet records).
Mixophyes iteratus (Giant Barred Frog)	E	E	This species is found along larger streams of the coast and adjacent ranges of NSW and SE QLD. It inhabits rainforest and wet sclerophyll forest but is also found within cleared farmland where fringing vegetation is retained, including lantana beds. Many sites where the Giant Barred Frog is known to occur are the lower reaches of streams which have been affected by major disturbances such as clearing, timber harvesting and urban development in their headwaters.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Myotis Macropus (Southern Myotis)	V	-	The Large-footed Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. Generally, roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
Natator depressus (Flatback Turtle)	V	V	Found only in the waters around Australia, Papua New Guinea and Timor, hence it is also known as the Australian flatback	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Neophema pulchella (Turquoise Parrot)	V	-	The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area.

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			of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust.	The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Nettapus coromandelianus (Cotton Pygmy-goose)	E	-	Freshwater lakes, lagoons, swamps and dams, particularly those vegetated with waterlilies and other floating and submerged aquatic vegetation.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Ninox connivens (Barking Owl)	V	-	Generally found in open forests, woodlands, swamp woodlands and dense scrub. Can also be found in the foothills and timber along watercourses in otherwise open country.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Ninox strenua (Powerful Owl)	V	-	Occupies wet and dry eucalypt forests and rainforests. Can occupy both un-logged and lightly logged forests as well as undisturbed forests where it usually roosts on the limbs of dense trees in gully areas. It is most commonly recorded within red turpentine in tall open forests and black she-oak within open forests. Large mature trees with hollows at least 0.5 m deep are required for nesting. Tree hollows are particularly important for the Powerful Owl because a large proportion of the diet is made up of hollow-dependent arboreal marsupials. Nest trees for this species are usually emergent with a diameter at breast height of at least 100 cm.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).
Numenius madagascariensis (Eastern Curlew)	-	CE	The Eastern curlew spends its breeding season in northeastern Asia, including Siberia to Kamchatka, and Mongolia. Its breeding habitat is composed of marshy and swampy wetlands and lakeshores. Most individuals winter in coastal Australia, with a few heading to South Korea, Thailand, Philippines and New Zealand, where they stay at estuaries, beaches, and salt marshes. It uses its long, decurved bill to probe for invertebrates in the mud. It may feed in solitary, but it generally congregates in large flocks to migrate or roost. Its call is a sharp, clear whistle, cuuue-reee, often repeated.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Pachyptila turtur subantarctica (Fairy Prion)	V	V	The fairy prion is the smallest prion and it measures between 23 and 28 cm (9.1–11.0 in) long. [2] Its plumage is blue-grey on its upperparts, and white underneath. They have a dark "M" on their upperparts extending to their wingtips, and their tail is wedge-shaped with a dark tip. They have a blue bill and feet. The diet consists mainly of planktonic crustaceans and other tiny sea animals, which they feed at night from the water's surface. They breed colonially and prefer small islands. The nest is situated in soil, hidden by vegetation and is dug with the bill or feet, or it is in a hollow in a crevice. When coming back to their nest at night, they will coo softly and listen for their mate. The fairy prion is found throughout oceans and coastal areas in the Southern Hemisphere. Their colonies can be found on Chatham, Snares and Antipodes Islands of New Zealand, Bass Strait Islands of Australia, Falkland Islands, Marion Island, the Crozet Islands and Macquarie Island. Outside of the breeding season, the fairy prion is most often found feeding over deep waters, far from shore. During stormy weather it may come towards coastal habitats. It breeds on oceanic islands, where it nests in crevices on cliffs and rock falls or in burrows in soil, although it may also nest in scrub, herblands, tussock or pasture.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Pandion cristatus (Osprey)	V	-	Ospreys are found right around the Australian coastline, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Not recently observed in the locality (NSW BioNet records).
Pelargonium sp. Striatellum (Omeo's Stork's-bill)	0	E	Flowering occurs from October to March. Occurs in habitat usually located just above the high water level of irregularly inundated or ephemeral lakes. During dry periods, the species is	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be

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			known to colonise exposed lake beds. The species is known to form clonal colonies by rhizomatous propagation.	located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
Persicaria elatior	V	V	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Persoonia hirsuta (Hairy Geebung)	E	E	Distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. A large area of occurrence, but occurs in small populations, increasing the species's fragmentation in the landscape. Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. Usually present as isolated individuals or very small populations. Probably killed by fire (as other Persoonia spp. are) but will regenerate from seed.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
Petalura gigantea (Giant Dragonfly)	E	-	The Giant Dragonfly is found along the east coast of NSW from the Victorian border to northern NSW. It is not found west of the Great Dividing Range. There are known occurrences in the Blue Mountains and Southern Highlands, in the Clarence River catchment, and on a few coastal swamps from north of Coffs Harbour to Nadgee in the south. Live in permanent swamps and bogs with some free water and open vegetation. Adults emerge from late October and are short-lived, surviving for one summer after emergence.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Petauroides Volans (Greater Glider)	-	V	The Greater Glider occurs in eucalypt forests and woodlands. Utilise tree hollows	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Petaurus australis (Yellow-bellied Glider)	V	-	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Petaurus norfolcensis (Squirrel Glider)	V	-	Generally, occurs in dry sclerophyll forests and woodlands but is absent from dense coastal ranges in the southern part of its range. Requires abundant hollow bearing trees and a mix of eucalypts, banksias and acacias. There is only limited information available on den tree use by Squirrel gliders, but it has been observed using both living and dead trees as well as hollow stumps. Within a suitable vegetation community at least one species should flower heavily in winter and one species of eucalypt should be smooth barked. Endangered population in the Wagga Wagga LGA.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).
Petrogale penicillata (Brush-tailed Rock-wallaby)	E	V	Found in rocky areas in a wide variety of habitats including rainforest gullies, wet and dry sclerophyll forest, open woodland and rocky outcrops in semi-arid country. Commonly sites have a northerly aspect with numerous ledges, caves and crevices.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of

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				supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Petroica boodang (Scarlet Robin)	V	-	The Scarlet Robin is found from SE Queensland to SE South Australia and also in Tasmania and SW Western Australia. In NSW, it occurs from the coast to the inland slopes. The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Phascogale tapoatafa (Brush-tailed Phascogale)	V	-	The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occassional records west ot the divide. Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Phascolarctos cinereus (Koala)	V	V	Inhabits eucalypt forests and woodlands. The suitability of these forests for habitation depends on the size and species of trees present, soil nutrients, climate and rainfall.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
Phoebetria fusca (Sooty Albatross)	V	-	In Australian waters, this species is generally recorded in winter off the south coast from Tasmania to Western Australia, while there are occasional sightings off the NSW coast, north of Grafton. This pelagic or ocean-going species inhabits subantarctic and subtropical marine waters, spending the majority of its time at sea, and rarely occurs in continental shelf waters.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Planigale maculata (Common Planigale)	V	-	Common Planigales inhabit rainforest, eucalypt forest, heathland, marshland, grassland and rocky areas where there is surface cover, and usually close to water. The female builds a nest lined with grass, eucalypt leaves or shredded bark.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Potorous tridactylus tridactylus (Long-nosed Potoroo)	V	V	Inhabits coastal heath and wet and dry sclerophyll forests. Generally found in areas with rainfall greater than 760 mm. Requires relatively thick ground cover where the soil is light and sandy.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Prostanthera askania	E	E	Occurs adjacent to drainage lines on flat to moderately steep slopes formed on Narrabeen sandstone, and in moist sclerophyll forest and warm temperate rainforest communities. These communities are generally tall forests with a mesic understorey. Appears in some locations to propagate vegetatively by stem-layering where prostrate branches take root where they remain in contact with the soil.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Prostanthera junonis	E	E	The species is restricted to the Somersby Plateau. It occurs on both the Somersby and Sydney Town soil landscapes on gently undulating country over weathered Hawkesbury sandstone within open forest-low woodland-open scrub. It occurs in both disturbed and undisturbed sites.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially

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				have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Pseudomys novaehollandiae (New Holland Mouse)	-	V	The New Holland Mouse currently has a disjunct, fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Across the species' range the New Holland Mouse is known to inhabit open heathlands, open woodlands with a heathland understorey, and vegetated sand dunes.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Pseudophryne australis (Red-crowned Toadlet)	V	-	Occurs on wetter ridge tops and upper slopes of sandstone formations on which the predominant vegetation is dry open forests and heaths. This species typically breeds within small ephemeral creeks that feed into larger semi-perennial streams. After raining these creeks are characterised by a series of shallow pools lined by dense grasses, ferns and low shrubs and usually contain leaf litter for shelter. Eggs are terrestrial and laid under litter, vegetation or rocks where the tadpoles inside will reach a relatively late stage of development before waiting for flooding waters before hatching will occur.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Pterodroma leucoptera leucoptera (Gould's Petrel)	V	E	Pelagic marine species, spending much of its time foraging at sea and coming ashore only to breed. The Australian subspecies breeds and roosts on two islands off NSW, Cabbage Tree and Boondelbah Islands, and the at-sea distribution is poorly known.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Pterodroma neglecta neglecta (Kermadec Petrel)	V	V	Pelagic seabird that occurs in tropical, subtropical and temperate waters of the Pacific Ocean. It breeds on islands, atolls and islets in the southern Pacific Ocean. Breeding habitat in Australia includes Balls Pyramid and Phillip Island.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Pteropus poliocephalus (Grey-headed Flying-fox)	V	V	This species is a canopy-feeding frugivore and nectarivore of rainforests, open forests, woodlands, melaleuca swamps and banksia woodlands. Bats commute daily to foraging areas, usually within 15 km of the day roost although some individuals may travel up to 70 km.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).
Pterostylis gibbosa (Illawarra Greenhood)	E	E	Grows in open forest or woodland, on flat or gently sloping land with poor drainage. Known from a small number of populations in the Hunter region (Milbrodale), the Illawarra region (Albion Park and Yallah) and the Shoalhaven region (near Nowra).	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
Ptilinopus regina (Rose-crowned Fruit-dove)	V	-	Coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Rhizanthella slateri	V, EP (Great Lakes)	E	Habitat requirements are poorly understood, and no particular vegetation type has been associated with the species, although it is known to occur in sclerophyll forest.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch

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				size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).
Rhodamnia rubescens (Scrub Turpentine)	CE	-	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Rostratula australis (Australian Painted Snipe)	E	E, M	In NSW, this species has been recorded at the Paroo wetlands, Lake Cowell, Macquarie Marshes and Hexham Swamp. Most common in the Murray-Darling Basin. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known ‘area of occurrence’ but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Rutidosis heterogama	V	V	Grows in heath on sandy soils and moist areas in open forest and has been recorded along disturbed roadsides.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat)	V	-	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
Scoteanax rueppellii (Greater Broad-nosed Bat)	V	-	Prefer moist gullies in mature coastal forests and rainforests, between the Great Dividing Range and the coast. They are only found at low altitudes below 500 m. In dense environments they utilise natural and human-made opening in the forest for flight paths. Creeks and small rivers are favoured foraging habitat. This species roosts in hollow tree trunks and branches.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).
Senna acclinis	E	-	Grows in or on the edges of subtropical and dry rainforest.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known ‘area of occurrence’ but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Syzygium paniculatum (Magenta Lilly Pilly)	E	V	Found only in NSW, in a narrow, linear coastal strip from Bulahdelah to Conjola State forest. On the south coast the species occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral rainforest. On the central coast it occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known ‘area of occurrence’ but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
Tetratheca glandulosa (Tetratheca glandulosa)	V	V	Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gymea, Lambert and Faulconbridge. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone bench. Soils are generally shallow, consisting of a yellow, clayey-sandy loam. Stony lateritic fragments are also common in the soil profile on many of these	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known ‘area of occurrence’ but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be

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			ridgetops. Vegetation structure varies from heaths and scrub to woodlands-open woodlands, and open forest.	influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Tetratheca juncea (Black-eyed Susan)	V	V	Confined to the northern portion of the Sydney Basin bioregion and the southern portion of the North Coast bioregion in the local government areas of Wyong, Lake Macquarie, Newcastle, Port Stephens, Great Lakes and Cessnock. It is usually found in low open forest-woodland with a mixed shrub understorey and grassy groundcover. The majority of populations occur on low nutrient soils associated with the Awaba Soil Landscape. Cryptic species that requires survey in September-October.	Known. Species observed and habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is located within known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Habitat occupancy is likely to be associated with important life cycle processes; however, the reliance on this habitat would depend on additional factors (e.g. size and extent of local population, effect of KTPs). Species recently observed in the locality (NSW BioNet records).
Thalassarche bulleri (Pacific Albatross)	V	V	Inhabits tropical to sub-Antarctic waters, shelf edge and pelagic, preferring warmer waters, of south seas where currents from the north make it warmer.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Thalassarche bulleri platei (Northern Buller's Albatross)	0	V	Marine, pelagic species that occurs in subtropical and subantarctic waters of the South Pacific Ocean. In Australia, the species occurs over inshore, offshore and pelagic waters (Blaber 1986; Carter 1977; Rogers 1969) and off the coast of south-east Tasmania. Prefers waters of the East Australia Current where sea surface-temperatures are greater than 16.5 °C.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Thalassarche cauta cauta (Shy Albatross)	V	V	The Shy Albatross is a marine species occurring in subantarctic and subtropical waters, reaching the tropics in the cool Humboldt Current off South America.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Thalassarche cauta steadi (Black-browed Albatross)	V	V	The Black-browed Albatross has a circumpolar range over the southern oceans and are seen off the southern Australian coast mainly during winter. Inhabits antarctic, subantarctic, subtropical marine and coastal waters over upwellings and boundaries of currents.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Thalassarche impavida (Campbell Albatross)	-	V	While most of its time is spent at sea, the Campbell albatross returns to land to breed, nesting on ledges and steep slopes which are covered with short grasses, tussocks and mud.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Thalassarche melanophris (Black-browed Albatross)	-	V	Uses wide range of marine habitats from inshore shallows, bays and channels to the edge of the continental shelf and beyond to pelagic ocean environs.	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Thalassarche salvini (Salvin's Albatross)	-	V	Breeds on just a few small barren and rocky islands, and otherwise occupies the open oceans	None. Species specific habitat types (i.e. important habitat features) and known vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are absent from the investigation area. The investigation area is also likely located outside the species known 'area of occurrence' and may also occur outside the species 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Species incidence is not expected and, if detected, would likely represent atypical occurrence (e.g. incidence linked with transient activity). Presence unlikely associated with habitat occupancy involving important lifecycle processes.
Thesium austral (Austral Toadflax)	V	V	Grows in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of

Scientific Name (Common Name)	TSC Act	EPBC Act	Habitat	Likelihood of Occurrence
			Asia. Occurs in grassland or grassy woodland. Grows on kangaroo grass tussocks but has also been recorded within the exotic coolatai grass.	occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species not recently observed in the locality (NSW BioNet records).
Turnix maculosus (Red-backed Button-quail)	V	-	Red-backed Button-quail inhabit grasslands, open and savannah woodlands with grassy ground layer, pastures and crops of warm temperate areas, typically only in regions subject to annual summer rainfall greater than 400 mm. In NSW, said to occur in grasslands, heath and crops. Said to prefer sites close to water, especially when breeding. Observations of populations in other parts of its range suggest the species prefers sites near water, including grasslands and sedgelands near creeks, swamps and springs, and wetlands.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Tyto novaehollandiae (Masked Owl)	V	-	Inhabits a diverse range of wooded habitat that provide tall or dense mature trees with hollows suitable for nesting and roosting. Mostly recorded in open forest and woodlands adjacent to cleared lands. Nest in hollows, in trunks and in near vertical spouts or large trees, usually living but sometimes dead. Nest hollows are usually located within dense forests or woodlands. Masked owls' prey upon hollow-dependent arboreal marsupials, but terrestrial mammals make up the largest proportion of the diet.	High. Habitat values within the investigation area are generally consistent with descriptions provided in the BCD TSPD. Habitat is likely to be located within the known 'extent of occurrence' and 'area of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are unlikely to adversely influence the capacity of the species to occupy the habitat. Pre-existing and active KTPs are unlikely to be substantially influencing species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
Tyto tenebricosa (Sooty Owl)	V	-	Often found in tall old-growth forests, including temperate and subtropical rainforests. In NSW mostly found on escarpments with a mean altitude less than 500 metres. Nests and roosts in hollows of tall emergent trees, mainly eucalypts often located in gullies. Nests have been located in trees 125 to 161 centimetres in diameter.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Uperoleia mahonyi (Mahony's Toadlet)	CE	CE	0	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Not recently observed in the locality (NSW BioNet records).
Vespadelus troughtoni (Eastern Cave Bat)	V	-	The Eastern Cave Bat is found in a broad band on both sides of the Great Dividing Range from Cape York to Kempsey, with records from the New England Tablelands and the upper north coast of NSW. The western limit appears to be the Warrumbungle Range, and there is a single record from southern NSW, east of the ACT. A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs; has been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals.	Moderate. Species specific (i.e. important habitat features) and vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) occur within the investigation area. The investigation area may or may not be located within the species known 'area of occurrence' but is within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality may be influencing the capacity for habitat occupancy. Pre-existing and active KTPs may potentially have a negative influence on species incidence and/ or habitat occupancy. Species recently observed in the locality (NSW BioNet records).
Xenus cinereus (Terek Sandpiper)	V	-	The Terek Sandpiper mostly forages in the open, on soft wet intertidal mudflats or in sheltered estuaries, embayments, harbours or lagoons.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Not recently observed in the locality (NSW BioNet records).
Zannichellia palustris (Zannichellia palustris)	E	-	Grows in fresh or slightly saline stationary or slowly flowing water. NSW populations behave as annuals, dying back completely every summer.	Low. Vegetation classification based habitat surrogates (i.e. PCT and/ or vegetation formations) are present; however, species specific habitat types (i.e. important habitat features) are either absent, in low abundance and/ or in a disturbed state. The investigation area is likely to be located outside the species known 'area of occurrence' but may be within the known 'extent of occurrence' [i.e. standard grid size of 2x2km (IUCN 2017)]. Factors such as connectivity, patch size, habitat quantum and/ or quality are likely to be negatively influencing the likelihood of habitat occupancy. If detected, species activity is most likely low and associated with landscape

Scientific Name (Common Name)	TSC Act	EPBC Act	Habitat	Likelihood of Occurrence
				scale habitat use such as movement between areas of higher value habitat, the use of supplementary habitat or reflect the negative effects of active/ uncontrolled KTPs. Species not recently observed in the locality (NSW BioNet records).

Appendix C

Field Survey Results

C.1 Fauna Survey Results

Common Name	Scientific Name	NS	CO	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	CS	CC	AK	HS	HN	NO
Tusked Frog	*Adelotus brevis*	P																																				1
Common Eastern Froglet	*Crinia signifera*	P																															1			1		
Eastern Banjo Frog	*Limnodynastes dumerilii*	P																																				1
Brown-striped Frog	*Limnodynastes peronii*	P		1																													1			1		
Spotted Grass Frog	*Limnodynastes tasmaniensis*	P																																		1		
Red-backed Toadlet	*Pseudophryne coriacea*	P																															1			1		1
Dusky Toadlet	*Uperoleia fusca*	P																																		1		
Bleating Tree Frog	*Litoria dentata*	P																																		1		
Eastern Dwarf Tree Frog	*Litoria fallax*	P																															1			1		
Broad-palmed Frog	*Litoria latopalmata*	P																															1			1		
Peron's Tree Frog	*Litoria peronii*	P																																		1	1	
Verreaux's Frog	*Litoria verreauxii*	P																																		1		
Eastern Water-skink	*Eulamprus quoyii*	P																																		1		
Jacky Lizard	*Amphibolurus muricatus*	P																																		1		1
Eastern Water Dragon	*Physignathus lesueurii*	P																																		1		1
Lace Monitor	*Varanus varius*	P																																		1	1	1
Common Tree Snake	*Dendrelaphis punctulatus*	P																																			1	1
Yellow-faced Whip Snake	*Demansia psammophis*	P																																		1		1
Eastern Brown Snake	*Pseudonaja textilis*	P																																		1		
Unidentified Quail	*Coturnix sp.*	P																	1																			1
Pacific Black Duck	*Anas superciliosa*	P																																				1
Hardhead	*Aythya australis*	P																																				1
Australian Wood Duck	*Chenonetta jubata*	P																																				1
Black Swan	*Cygnus atratus*	P																																				1
Australasian Grebe	*Tachybaptus novaehollandiae*	P																																				1
Bar-shouldered Dove	*Geopelia humeralis*	P																																				1
Wonga Pigeon	*Leucosarcia picata*	P																																	1			1
Brown Cuckoo-Dove	*Macropygia amboinensis*	P																														1						1
Crested Pigeon	*Ocyphaps lophotes*	P																1																				1
Common Bronzewing	*Phaps chalcoptera*	P																																				1
Tawny Frogmouth	*Podargus strigoides*	P																																				1
Intermediate Egret	*Ardea intermedia*	P																																				1
White-faced Heron	*Egretta novaehollandiae*	P																																				1
Australian White Ibis	*Threskiornis molucca*	P																																				1
Whistling Kite	*Haliastur sphenurus*	P																																				1
Purple Swamphen	*Porphyrio porphyrio*	P																																				1
Sulphur-crested Cockatoo	*Cacatua galerita*	P																																				1
Little Corella	*Cacatua sanguinea*	P																1																				1
Yellow-tailed Black-Cockatoo	*Calyptorhynchus funereus*	P																																				1
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V, P,2																																				1
Australian King-Parrot	*Alisterus scapularis*	P																1																	1			1
Little Lorikeet	*Glossopsitta pusilla*	V, P																1			1														1		1	1	1
Crimson Rosella	*Platycercus elegans*	P																																				

Common Name	Scientific Name	NS	Co	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BC	SC	CA	AK	HS	SH	NO
Eastern Rosella	*Platycercus eximius*	P													1																															1
Rainbow Lorikeet	*Trichoglossus haematodus*	P																					1	1	1			1	1	1	1															1
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	P													1	1								1																						1
Pallid Cuckoo	*Cacomantis pallidus*	P																																											1
Horsfield's Bronze-Cuckoo	*Chalcites basalis*	P																																										1
Shining Bronze-Cuckoo	*Chalcites lucidus*	P																																										1
Eastern Koel	*Eudynamys orientalis*	P														1																													1
Channel-billed Cuckoo	*Scythrops novaehollandiae*	P																																										1
Southern Boobook	*Ninox novaeseelandiae*	P																																										1
Powerful Owl	*Ninox strenua*	V, P,3																																							1	1				1
Laughing Kookaburra	*Dacelo novaeguineae*	P														1																													1
Sacred Kingfisher	*Todiramphus sanctus*	P															1		1			1																							1
Rainbow Bee-eater	*Merops ornatus*	P	J																																										1
Superb Lyrebird	*Menura novaehollandiae*	P																																										1
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V, P																																										
White-throated Treecreeper	*Cormobates leucophaea*	P																					1	1	1	1	1		1	1	1	1											1
Superb Fairy-wren	*Malurus cyaneus*	P															1		1	1			1						1	1	1												1
Variegated Fairy-wren	*Malurus lamberti*	P																	1																										1
Striated Thornbill	*Acanthiza lineata*	P																						1			1	1															1
Brown Thornbill	*Acanthiza pusilla*	P													1	1									1	1																		1
White-throated Gerygone	*Gerygone albogularis*	P																							1																			1
Weebill	*Smicrornis brevirostris*	P													1		1			1																								1
Spotted Pardalote	*Pardalotus punctatus*	P													1			1	1	1			1	1	1		1				1												1
Striated Pardalote	*Pardalotus striatus*	P																																										1
Eastern Spinebill	*Acanthorhynchus tenuirostris*	P													1		1		1	1				1	1	1																	1
Red Wattlebird	*Anthochaera carunculata*	P													1																												1
Yellow-faced Honeyeater	*Lichenostomus chrysops*	P													1	1	1	1			1			1	1	1																	
White-eared Honeyeater	*Lichenostomus leucotis*	P																																										1
Noisy Miner	*Manorina melanocephala*	P																1		1																								1
Bell Miner	*Manorina melanophrys*	P														1																												
Lewin's Honeyeater	*Meliphaga lewinii*	P																1																										1
Scarlet Honeyeater	*Myzomela sanguinolenta*	P														1		1	1	1		1		1					1														1
Noisy Friarbird	*Philemon corniculatus*	P																					1			1	1		1	1	1												1
White-cheeked Honeyeater	*Phylidonyris niger*	P															1						1						1	1	1												1
Spotted Quail-thrush	*Cinclosoma punctatum*	P																																									1
Varied Sittella	*Daphoenositta chrysoptera*	V, P																																									1
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	P																																									1
Cicadabird	*Coracina tenuirostris*	P															1																											1
Golden Whistler	*Pachycephala pectoralis*	P													1	1			1		1																							1
Rufous Whistler	*Pachycephala rufiventris*	P													1	1			1			1		1	1			1	1															1
Olive-backed Oriole	*Oriolus sagittatus*	P																																									1
White-breasted Woodswallow	*Artamus leucorynchus*	P																																										1
Pied Butcherbird	*Cracticus nigrogularis*	P																		1																								1
Australian Magpie	*Cracticus tibicen*	P																																										1
Grey Butcherbird	*Cracticus torquatus*	P																							1																			

Common Name	Scientific Name	NS	CO	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	EE	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	BB	CS	CC	AK	HS	HN	O
Pied Currawong	*Strepera graculina*	P																						1															1
Grey Fantail	*Rhipidura albiscapa*	P																	1					1	1	1	1		1		1	1							1
Willie Wagtail	*Rhipidura leucophrys*	P																																					1
Rufous Fantail	*Rhipidura rufifrons*	P																	1						1	1	1												
Australian Raven	*Corvus coronoides*	P													1											1		1	1			1							1
Magpie-lark	*Grallina cyanoleuca*	P																									1												1
Black-faced Monarch	*Monarcha melanopsis*	P															1																						1
Satin Flycatcher	*Myiagra cyanoleuca*	P																						1															
Restless Flycatcher	*Myiagra inquieta*	P																																					1
Leaden Flycatcher	*Myiagra rubecula*	P																																					1
Eastern Yellow Robin	*Eopsaltria australis*	P																						1			1	1	1				1						1
Jacky Winter	*Microeca fascinans*	P															1																						1
Silvereye	*Zosterops lateralis*	P																										1		1		1						1
Welcome Swallow	*Hirundo neoxena*	P																																					1
Fairy Martin	*Petrochelidon ariel*	P																																					0
Common Myna	*Sturnus tristis**																																						1
Common Starling	*Sturnus vulgaris**																																						1
Mistletoebird	*Dicaeum hirundinaceum*	P														1						1		1															1
Red-browed Finch	*Neochmia temporalis*	P																						1	1	1	1	1											1
Short-beaked Echidna	*Tachyglossus aculeatus*	P																																					1
Yellow-footed Antechinus	*Antechinus flavipes*	P								2																													
Brown Antechinus	*Antechinus stuartii*	P			2	1	3																															1	
Northern Brown Bandicoot	*Isoodon macrourus*	P																																	1				
Long-nosed Bandicoot	*Perameles nasuta*	E2, P																						1															
Sugar Glider	*Petaurus breviceps*	P																							1													1	
Squirrel Glider	*Petaurus norfolcensis*	V, P																																				1	
Common Ringtail Possum	*Pseudocheirus peregrinus*	P																						1	1												1	
Feathertail Glider	*Acrobates pygmaeus*	P																																			1	
Common Brushtail Possum	*Trichosurus vulpecula*	P																						1											1	1		
Red-necked Wallaby	*Macropus rufogriseus*	P																						1														1
Swamp Wallaby	*Wallabia bicolor*	P																						1														
Grey-headed Flying-fox	*Pteropus poliocephalus*	V, P	V																						1													
Eastern Horseshoe-bat	*Rhinolophus megaphyllus*	P																																					
Ride's Free-tailed Bat	*Mormopterus ridei*	P																																					
Eastern Freetail-bat	*Mormopterus norfolkensis*	V, P																																					
White-striped Freetail-bat	*Austronomus australis*	P																																					
Gould's Wattled Bat	*Chalinolobus gouldii*	P																																					
Chocolate Wattled Bat	*Chalinolobus morio*	P																																					
Little Bentwing-bat	*Miniopterus australis*	V, P																																					
Eastern Bentwing-bat	*Miniopterus schreibersii oceanensis*	V, P																																					
Lesser Long-eared Bat	*Nyctophilus geoffroyi*	P																																				1	
Gould's Long-eared Bat	*Nyctophilus gouldi*	P																																				1	
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V, P																																					
Eastern Forest Bat	*Vespadelus pumilus*	P																																					
Bush Rat	*Rattus fuscipes*	P				11	18	28	3			9	2		8	4			4																			1		

| Common Name | Scientific Name | NSW Wetlands | BBBB

C.2 Flora Results

Scientific Name	Common Name	Exotic / HTE	BC Act	EPBC Act	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Acacia brownii	Heath Wattle						0.1	1	0.1	4			0.1	4																														
Acacia buxifolia	Box-leaved Wattle																																						0.1	2		
Acacia falcata	-												0.1	2																	0.1	1										
Acacia linifolia	White Wattle																0.1	2																							
Acacia longifolia	-												0.1	5					0.1	2													0.5	10			0.2	6				
Acacia parramattensis	Parramatta Wattle								0.1	3					0.2	2																										
Acacia spp.	Wattle																														0.1	1							0.1	2		
Acacia suaveolens	Sweet Wattle				0.1	1																																				
Acacia ulicifolia	Prickly Moses																														0.1	3	0.1	15								
Acianthus fornicatus	Pixie Caps																										0.1	10					0.5	200	0.1	5						
Acianthus spp.	Mosquito Orchid												0.1	30							0.1	5					0.1	35					0.1	40								
Acmena smithii	Lilly Pilly																																		5							
Adiantum aethiopicum	Common Maidenhair										0.2	20																					0.2	100	0.2	15						
Adiantum spp.																																							0.1	3		
Ageratina riparia	Mistflower	* HTE									0.1	10																														
Allocasuarina littoralis	Black She-Oak						30	14			0.2	3			0.1	3	0.2	4					0.8	12	0.3	3	0.1	4			2	6	0.1	1					8	3			0.2	2
Allocasuarina torulosa	Forest Oak				0.1	2			0.1	1											0.1	3							2	25	0.1	1			0.1	2						
Amyema spp.	Mistletoe																														0.1	1										
Angophora costata	Sydney Red Gum				0.1	2	25	6	0.1	1	0.2	2			0.3	4			2	9	2	5			0.6	2			2	1	10	2			3	3	0.5	2	15	1	35	11	30	8
Aristida vagans	Threeawn Speargrass								0.1	5			0.1	5			0.3	30									0.1	8					0.2	30	10							
Asplenium aethiopicum	Shredded Spleenwort														0.1	7																										
Austrostipa scabra	Speargrass																																				25	100	0.3	15	5	40
Austrostipa spp.	A Speargrass										0.1	15																			0.2	20										
Banksia marginata	Silver Banksia														0.2	4							0.8	4					0.1	3							5	4			30	30
Banksia oblongifolia	Fern-leaved Banksia																						0.9	7																		
Banksia paludosa																	0.1	4	0.2	8																					8	15
Banksia serrata	Old-man Banksia																								1	9																		
Banksia spinulosa	Hairpin Banksia						1.5	3											0.4	16	0.2	10			0.1	3					0.4	6										
Banksia spinulosa var. collina					0.1	1											0.2	5																								
Baumea rubiginosa																									0.1	7																		
Billardiera scandens	Hairy Apple Berry																				0.1	1	0.1	8	0.1	2	0.1	3	0.1	2					0.1	3					0.1	3		
Blechnum cartilagineum	Gristle Fern														0.1	2																			0.2	5	0.1	5						
Bossiaea obcordata	Spiny Bossiaea																								0.1	15	0.1	10	0.1	2											0.1	2		
Breynia oblongifolia	Coffee Bush										0.1	3																					0.1	2	0.1	3	0.2	6						

Scientific Name	Common Name	Exotic / HTE	BC Act	EPBC Act	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Callicoma serratifolia	Black Wattle						1	11							0.2	1					2	10																						
Callistemon salignus	Willow Bottlebrush										0.1	1																																
Calochlaena dubia	Rainbow Fern														4	40					1	30													2	20								
Carex longebrachiata																																			0.1	15								
Cassytha pubescens	Downy Dodder-laurel														0.1	5	0.1	20			0.1	10									0.1	20					8	40			0.2	50
Cassytha spp.					0.1	5																																				
Centella asiatica	Indian Pennywort										0.1	10																							0.1	10								
Ceratopetalum apetalum	Coachwood														0.1	1					1	8																						
Ceratopetalum gummiferum	Christmas Bush																																						0.1	3				
Chiloglottis spp.																																	0.1	100										
Cinnamomum camphora	Camphor Laurel	* HTE																																	0.1	5								
Clematis glycinoides var. glycinoides											0.1	20																							0.2	10								
Comesperma ericinum	Pyramid Flower				0.1	4																																				
Comesperma volubile																																					0.3	10			0.1	10		
Convolvulus erubescens	Pink Bindweed																																						25	6	30	8		
Corybas dowlingii	Red Helmet Orchid		E																														0.1	15									
Corybas spp.													0.1	10																														
Corymbia gummifera	Red Bloodwood				0.3	5	25	6	1	2			0.6	3			3	7	0.8	4	0.2	3	1	4	4	6	5	14	10	6									25	6	30	8		
Corymbia maculata	Spotted Gum								6	16			4	11													0.1	2					10	15	4	4								
Cryptostylis subulata	Large Tongue Orchid																		0.1	15			0.1	3					0.1	2	0.1	4											
Cymbopogon refractus	Barbed Wire Grass																						0.1	14																				
Cynodon dactylon	Common Couch								0.1	4																																		
Dampiera stricta					0.1	20									0.1	5			0.2	15	0.1	10			0.1	2	0.1	15	0.1	8									2	20	0.2	15	0.1	5
Daviesia ulicifolia	Gorse Bitter Pea				0.1	2							0.1	2																														
Desmodium rhytidophyllum																															0.1	5										
Desmodium varians	Slender Tick-trefoil										0.1	16	0.1	3																	0.1	3	0.1	5								
Dianella caerulea var. caerulea									0.1	4																																		
Dianella caerulea var. producta					0.1	4			0.1	15	0.1	5	0.1	8	0.1	4			0.1	5	0.1	5					0.1	10			0.1	10	0.1	5	0.1	10	0.1	15	0.1	5	0.4	15		
Dianella revoluta	Blueberry Lily																										0.1	5																
Dichelachne spp.	A Plumegrass																												0.1	10														
Dichondra repens	Kidney Weed										0.1	10																							0.1	10								

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					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Dillwynia retorta					0.1	5			0.1	1							0.1	2	0.1	10			0.1	6	0.1	3					0.1	5							0.1	3			5	30
Dillwynia spp.																									0.1	1																		
Dioscorea transversa	Native Yam														0.1	1																					0.2	30						
Dodonaea spp.	A Hopbush						0.1	3																																				
Dodonaea triquetra	Large-leaf Hop-bush												2	100	0.1	8	0.1	10	0.5	45							0.1	10					0.1	3	15	100	0.1	10						
Doryanthes excelsa	Gymea Lily										0.2	2							0.4	6					0.7	8	4	8	1	8							0.1	1			20	11		
Drosera spp.																											0.1	3																
Elaeocarpus reticulatus	Blueberry Ash														0.1	1																												
Empodisma minus															0.3	40																												
Entolasia marginata	Bordered Panic				0.1	30	2	15											0.1	8					0.1	6			0.1	10														
Entolasia stricta	Wiry Panic				0.1	20	55	100	0.1	20			0.1	35	0.1	30	2	100	0.2	65	0.2	50	1	35	0.3	40	0.1	25	0.1	20	0.2	30	0.2	60	0.1	40	0.1	20	15	100	10	100	0.5	30
Epacris microphylla	Coral Heath				0.1	5	0.1	1															0.1	12															0.1	1			0.1	15
Epacris paludosa	Swamp Heath																		0.1	7																								
Epacris pulchella	Wallum Heath				0.1	2	0.1	3									0.1	2													0.1	4												
Eragrostis brownii	Brown's Lovegrass								0.1	10																	0.1	10																
Eucalyptus acmenoides	White Mahogany																								0.3	1															10	2		
Eucalyptus capitellata	Brown Stringybark				0.1	1	7	1									0.2	1	0.3	2			0.2	1	1	2			1	2									30	6			15	2
Eucalyptus globoidea	White Stringybark																										2	3																
Eucalyptus haemastoma	Broad-leaved Scribbly Gum				0.1	1											4	5					1.1	12	3.5	5					5	2							40	15			35	7
Eucalyptus microcorys	Tallowwood																																			2	1						
Eucalyptus piperita	Sydney Peppermint						10	3	0.1	3					10	9			0.2	2	3	9							2	1					5	7	1	1			20	3		
Eucalyptus resinifera	Red Mahogany												0.3	1					0.2	2															1	1	15	4						
Eucalyptus siderophloia	Grey Ironbark												0.3	2																													
Eucalyptus spp.																																			1	2								
Eucalyptus umbra	Broad-leaved White Mahogany								4	4			0.1	1			0.4	1	0.3	2			0.2	1	0.3	1							8	7	1	4								
Eustrephus latifolius	Wombat Berry								0.1	1			0.1	2	0.1	3											0.1	1					0.1	5	0.1	5	0.1	5			0.1	2		
Gahnia aspera	Rough Saw-sedge										0.2	11			1	15					5	40							1	20							2	20						
Gahnia clarkei	Tall Saw-sedge										7	38							0.1	5																								
Gahnia spp.																					3	40																						
Geitonoplesium cymosum	Scrambling Lily														0.1	2													0.1	3											0.1	2		
Genoplesium spp.																															0.1	10												
Glochidion ferdinandii	Cheese Tree										3	12					0.2	2			0.8	8					0.1	1																

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					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Glycine clandestina	Twining glycine								0.1	3	0.1	10	0.1	4													0.1	2					0.1	4	0.1	5	0.1	10						
Glycine tabacina	Variable Glycine												0.1	3																													
Gompholobium latifolium	Golden Glory Pea												0.1	2					0.1	5	0.1	2											0.1	2					0.3	8		
Gompholobium pinnatum	Pinnate Wedge Pea				0.1	10																			0.1	6											5	20			0.1	4
Gompholobium spp.							0.1	4															0.1	5																		
Gonocarpus tetragynus	Poverty Raspwort						0.1	7							0.1	3																	0.1	5							0.1	2	0.1	1
Goodenia bellidifolia					0.1	8													0.1	3			0.1	12			0.1	8							0.1	5						
Goodenia hederacea	Ivy Goodenia																						0.1	11																		
Goodenia heterophylla																																					0.1	6				
Goodenia heterophylla subsp. eglandulosa																															0.1	2								
Goodenia heterophylla subsp. heterophylla																									0.1	6							0.1	10						
Grevillea parviflora subsp. parviflora	Small-flower Grevillea		V	V															0.1	6																				
Grevillea sericea	Pink Spider Flower						0.1	3																	0.1	2											0.1	1				
Gymnostachys anceps	Settler's Twine																																		0.2	10						
Hakea bakerana					0.1	3													0.2	6	0.1	2	0.1	2																		
Hakea bakeriana					0.1	3																																				
Hakea dactyloides	Finger Hakea																						0.1	4																	0.1	3
Hakea laevipes																	0.1	2					0.1	1													2	4				
Hardenbergia violacea	False Sarsaparilla												0.1	1																	0.1	1	0.1	5					0.1	2		
Hibbertia dentata	Twining Guinea Flower										0.1	5																														
Hibbertia empetrifolia subsp. empetrifolia																																							0.5	10	0.1	4
Hibbertia obtusifolia	Hoary Guinea Flower						0.1	3											0.1	8											0.1	1							0.2	15		
Hibbertia scandens	Climbing Guinea Flower										0.1	4	0.1	2																					0.1	5	0.1	4				
Hibbertia spp.																											0.1	10			0.1	5								
Hovea linearis																									0.1	3			0.1	2	0.1	2								
Hovea longifolia	Rusty Pods				0.1	4																									0.1	1								
Hydrocotyle laxiflora	Stinking Pennywort																																		0.1	13				
Hydrocotyle peduncularis																																	0.1	1						
Hymenosporum flavum	Native Frangipani																																		0.2	2				

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					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Hypoxis hygrometrica	Golden Weather-grass																																				0.1	2				
Imperata cylindrica	Blady Grass				0.1	30	5	28	0.1	15	0.1	20	0.2	40					0.1	14							0.1	15					0.2	40			0.1	5			35	100		
Indigofera australis	Australian Indigo																																							0.1	1		
Isopogon anemonifolius	Broad-leaf Drumsticks				0.1	5											0.1	1					0.1	6	0.2	12			0.1	1	0.2	6									0.1	1
Kennedia rubicunda	Dusky Coral Pea																																0.1	3					0.1	2		
Lagenifera stipitata	Blue Bottle-daisy																						0.1	3																		
Lagenophora stipitata	Common Lagenophora				0.1	3																					0.1	2														
Lambertia formosa	Mountain Devil				0.2	15	2	5									0.2	5	0.1	4			1	14	0.3	7			0.1	3	0.3	6							2		0.2	3
Lantana camara	Lantana	* HTE									0.1	3																							0.1	1						
Lasiopetalum spp.																													0.1	5												
Laxmannia gracilis	Slender Wire Lily																																				0.2	15				
Lepidosperma laterale	Variable Sword-sedge				0.1	10	0.8	7					0.1	1			0.2	10	0.1	5	0.1	4	0.1	6	0.1	3	0.1	5	0.1	8									0.3	5	0.1	2	10	30
Lepidosperma neesii															0.1	5															0.1	5										
Lepidosperma spp.																																	0.5	30								
Leptospermum polyanthum											0.1	2																									0.2	4				
Leptospermum polygalifolium	Tantoon														0.2	3			3	14	0.5	15			0.1	1	0.1	8					0.1	7	0.2	3						
Leptospermum polygalifolium subsp. cismontanum							10	5																																		
Leptospermum spp.	Tea-tree																		0.2	4																								
Leptospermum trinervium	Slender Tea-tree				4	25	12	18									2	10	0.4	17	0.1	4	0.7	14	0.5	10			2	15	0.2	1							30	23			3	4
Leucopogon juniperinus	Prickly Beard-heath				0.1	3																							0.1	2							0.1	3				
Leucopogon lanceolatus													0.1	1									0.1	5			0.1	2					0.1	2	0.1	2			3	6		
Leucopogon spp.	A Beard-heath				0.1	2																															0.1	3				
Lindsaea linearis	Screw Fern						2	30											0.1	15			0.1	9	0.1	6	0.1	30	0.1	15							0.1	10	0.1	10	0.1	15
Lindsaea microphylla	Lacy Wedge Fern				0.1	1	0.1	4									0.1	3											0.1	8	0.1	5										
Lomandra confertifolia	Matrush								0.1	10																	0.1	4														
Lomandra cylindrica					0.2	40																																				
Lomandra filiformis	Wattle Matt-rush								0.1	5																																
Lomandra glauca	Pale Mat-rush												0.1	4																	0.1	20			0.1	5						
Lomandra longifolia	Spiny-headed Mat-rush												0.1	2																			0.2	10	0.2	30	0.1	15				
Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush						0.1	2					0.1	5																					0.1	5			0.1	3				
Lomandra obliqua					0.1	10	2	30	0.1	20							0.1	90			0.1	3	0.1	15			0.1	8	0.1	25	0.1	15	0.1	15	0.1	10			0.2	20			0.1	15
Lomandra spp.	Mat-rush																										0.1	3					0.1	10								

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					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Lomatia silaifolia	Crinkle Bush														0.1	1									0.1	10																		
Marsdenia rostrata	Milk Vine																																		0.1	1							
Marsdenia suaveolens	Scented Marsdenia																				0.1	1																					
Maytenus silvestris	Narrow-leaved Orangebark										0.1	6					0.1	1									0.1	1									0.1	2						
Melaleuca linariifolia	Flax-leaved Paperbark										0.9	9			0.2	3					0.2	5													0.2	1	4	3						
Melaleuca Spp.																																										0.1	1
Melaleuca styphelioides	Prickly-leaved Tea Tree										0.3	3																							0.5	3	15	16						
Melichrus procumbens	Jam Tarts				0.1	3																																					
Microlaena stipoides	Weeping Grass						0.1	3							0.1	10					0.1	15											0.1	2	0.1	10	0.1	15						
Mirbelia rubiifolia	Heathy Mirbelia																																				2	40				0.2	20
Mirbelia speciosa					0.1	5													0.1	7			0.1	4	0.1	10																	
Monotoca scoparia					0.1	2																																					
Morinda jasminoides	Sweet Morinda										0.1	5																									0.1	10						
Notelaea longifolia	Large Mock-olive																				0.1	1															0.2	3						
Notelaea venosa	Veined Mock-olive																																				0.2	3						
Ochna serrulata	Mickey Mouse Plant	* HTE																																			0.1	3						
Opercularia diphylla	Stinkweed								0.1	1																							0.1	5										
Oplismenus aemulus											0.1	3																					0.1	10										
Oplismenus imbecillis																					0.1	10							0.1	5					0.1	25						
Oxalis spp.																																	0.1	1										
Pandorea pandorana	Wonga Wonga Vine												0.1	10											0.1	3	0.1	5			0.1	8	0.1	2					0.1	8			
Panicum simile	Two-colour Panic												0.1	2																													
Panicum spp.	Panicum																																0.1	5										
Parsonsia straminea	Common Silkpod										0.1	8															0.1	5			0.1	1			0.1	15						
Patersonia glabrata	Leafy Purple-flag				0.1	8													0.1	5					0.1	2	0.2	15			0.1	1			0.1	5			0.3	15		
Patersonia sericea	Silky Purple-Flag				0.1	5											0.1	5					0.1	5																	0.1	1
Persoonia levis	Broad-leaved Geebung																0.2	3							0.2	4	0.2	2			0.2	4									5	3
Persoonia linearis	Narrow-leaved Geebung						1	4	0.1	3					0.1	1	0.2	3					0.1	1							0.1	3					0.1	1	1	4				
Phyllanthus hirtellus	Thyme Spurge				0.1	2																							0.1	6	0.1	5							0.1	2		
Phyllanthus spp.																											0.1	1														
Phyllanthus tenellus	Hen and Chicken	*					0.2	11																																		
Pimelea linifolia	Slender Rice Flower																0.1	2					0.1	4													0.1	1						
Pittosporum revolutum	Rough Fruit Pittosporum																																		0.1	3							
Platysace ericoides					0.1	3																																				
Platysace linearifolia																	0.2	30																								

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					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Platysace spp.																							0.1	7																				
Poa spp.									0.1	15			0.1	10			0.1	10																									0.2	10
Podolobium ilicifolium	Prickly Shaggy Pea								0.1	3			0.1	5											0.1	2	0.1	1					0.1	3	0.1	3					0.2	10		
Polymeria calycina																															0.1	10	0.1	3								
Polyscias sambucifolia	Elderberry Panax														0.1	3					0.1	5					0.1	10													0.2	5		
Poranthera spp.																									0.1	4			0.1	3													
Pratia purpurascens	Whiteroot						0.1	11					0.1	3			0.1	3									0.2	1							0.1	1								
Prostanthera incana	Velvet Mint-bush																																		0.2	20							
Pseuderanthemum variabile	Pastel Flower				0.1	2			0.1	5			0.1	10	0.1	5			0.1	10					0.1	9	0.1	15					0.1	13	0.1	50	0.1	10	0.1	1	0.1	10		
Psychotria loniceroides	Hairy Psychotria																																		0.1	1							
Pteridium esculentum	Bracken						0.1	3			0.1	4			0.4	20			0.2	14	0.3	30			0.1	7	0.2	15	0.1	5	0.1	3			0.2	15	0.2	3			0.1	8		
Pterostylis spp.	Greenhood																																		0.1	8							
Ptilothrix deusta					0.1	15											4	100					11	200	0.8	40			0.1	15	4	100					10	50			40	200
Pultenaea canescens																																									0.1	5
Pultenaea euchila					0.1	1																																				
Pultenaea paleacea	Chaffy Bush-pea																		0.1	16																			0.1	4				
Pultenaea villosa	Hairy Bush-pea								0.1	1																							0.2	20								
Rhytidosporum procumbens																																					5	20				
Rytidosperma pallidum	Redanther Wallaby Grass; Silvertop Wallaby Grass																0.2	15					0.1	9			0.1	8															
Scaevola ramosissima	Purple Fan-flower				0.1	5			0.1	1															0.1	1							0.1	4								
Senna pendula var. glabrata		*									0.2	35																							0.1	2						
Senna spp.																							0.1	20																		
Smilax australis	Lawyer Vine																																		0.3	15						
Smilax glyciphylla	Sweet Sarsparilla						0.1	1													0.1	5																				
Smilax spp.																																	0.1	3								
Solanum nigrum	Black-berry Nightshade	*													0.1	2					0.1	4													0.1	2						
Solenogyne bellioides	Solengyne																																		0.1	5						
Stellaria spp.	Prickly Starwort																														0.1	2										
Stephania japonica	Snake vine										0.1	5																							0.1	2						
Syncarpia glomulifera	Turpentine																										0.1	4														
Telopea speciosissima	Waratah																						0.2	3	0.2	5																
Tetratheca juncea	Black-eyed Susan		V	V																																			0.1	1		

Scientific Name	Common Name	Exotic / HTE	BC Act	EPBC Act	1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Themeda triandra					0.1	20	20	20	0.2	8			3	100													0.1	30			0.3	40	0.3	30	0.1	5			0.5	15	0.2	30		
Unknown Species 1																											0.1	3																
Viola betonicifolia	Native Violet																														0.1	3										
Viola hederacea	Ivy-leaved Violet																																0.1	10								
Xanthorrhoea media																											0.1	8	0.2	8	5	20							3	6		
Xanthorrhoea spp.					0.1	2	20	17									3	20	0.2	10			0.4	16	1.2	25															40	30
Xanthosia spp.																																					5	6				

Scientific Name	Common Name	Exotic/ HTE	BC Act	EPBC Act	21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Acacia decurrens	Black Wattle								0.2	2																																			
Acacia irrorata	Green Wattle						0.2	2							10	3					0.5	2																							
Acacia longifolia									0.2	2																			0.2	5							0.1	1	0.1	1						
Acacia myrtifolia	Red-stemmed Wattle																																									0.5	5	0.1	1
Acacia spp.	Wattle																										0.1	2			0.1	2												
Acacia suaveolens	Sweet Wattle																		0.2	3																									
Acacia terminalis	Sunshine Wattle																								0.1	1																			
Acacia ulicifolia	Prickly Moses																0.1	3																											
Acianthus fornicatus	Pixie Caps																																			0.1	20								
Acianthus spp.	Mosquito Orchid																												0.1	2											0.1	100	0.1	50		
Acmena smithii	Lilly Pilly				5	4	1	5																																				
Actinotus minor	Lesser Flannel Flower																																			0.1	2								
Adiantum aethiopicum	Common Maidenhair				0.2	100	0.1	50	0.1	20			0.2	10	0.2	10					0.1	20																							
Adiantum formosum	Giant Maidenhair												0.1	1															0.1	3														
Ageratina riparia	Mistflower	* / HTE											0.1	3	0.5	30																							0.1	10				
Allocasuarina littoralis	Black She-Oak						0.1	2			2	1																					0.2	3	0.5	5	1	12	1	10	1	7	0.1	1
Allocasuarina torulosa	Forest Oak														2	4			2	4			0.5	10																				
Amperea xiphoclada																																	0.1	1								
Amyema spp.	Mistletoe										0.1	2																																
Angophora costata	Sydney Red Gum				1	1	5	1			35	15			2	1	2	1	15	1			10	2	5	7	5	3	5	4	5	5	10	5	15	2	5	2	5	2	30	5	15	18	5	3
Aristida ramosa	Purple Wiregrass																0.1	30																										
Aristida spp.	A Wiregrass																														0.1	5							0.1	1				
Aristida vagans	Threeawn Speargrass																								0.1	3	0.1	4	0.1	5													0.1	10

Scientific Name	Common Name	Exotic/ HTE	BC Act	EPBC Act	21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Arthropodium milleflorum	Pale Vanilla-lily																												0.1	5											0.1	1				
Astroloma humifusum	Native Cranberry																		0.1	1																										
Austrostipa spp.	A Speargrass																						0.5	10 0																						
Axonopus fissifolius	Narrow-leafed Carpet Grass	* / HTE																			0.1	10																								
Banksia collina																																										0.5	3		0.2	1
Banksia integrifolia	Coast Banksia																																		0.1	1										
Banksia spinulosa	Hairpin Banksia										0.2	1							1	6			5	10	0.1	2	0.1	3			0.5	7	0.1	1	0.5	5	2	10						
Bauera rubioides	River Rose																																0.1	10										
Billardiera scandens	Hairy Apple Berry										0.1	4											0.1	10			0.1	5	0.1	1	0.1	3	0.1	5	0.1	3	0.1	3	0.1	5	0.1	5	0.1	5	0.1	1
Blechnum cartilagineum	Gristle Fern						0.2	1																																						
Boronia parviflora	Swamp Boronia																																									0.1	5			
Bossiaea obcordata	Spiny Bossiaea										0.1	2																					0.1	15									0.1	10	0.2	5
Breynia oblongifolia	Coffee Bush				0.1	3	0.5	10					2	6	0.1	2					0.1	2																								
Brunoniella australis	Blue Trumpet				0.1	50	0.1	30																	0.1	5																				
Burchardia umbellata	Milkmaids																																											0.1	1
Callicoma serratifolia	Black Wattle				0.2	2	1	7	1	10					0.3	1					0.5	2																								
Calochlaena dubia	Rainbow Fern				0.2	15	5	10					3	10	0.2	8					0.5	30																								
Carex longebrachiata					0.5	15	0.2	5													0.2	10																								
Cassytha spp.																	0.1	3					0.1	10	0.1	3					0.1	10	0.1	5	0.1	10			0.1	5				
Centella asiatica	Indian Pennywort								0.1	20					0.1	10											0.1	1	0.1	2	0.1	5					0.1	2								
Cheilanthes sieberi	Rock Fern																												0.1	10														
Cinnamomum camphora	Camphor Laurel	* / HTE											0.1	1																														
Cirsium vulgare	Spear Thistle	*																			0.1	1																						
Clematis glycinoides	Headache Vine				0.1	1															0.1	1					0.1	1	0.1	2							0.1	1						
Comesperma ericinum	Pyramid Flower																																											0.1	1
Comesperma spp.																			0.1	4																								
Commelina cyanea	Native Wandering Jew				0.1	2																																						
Convolvulus erubescens	Pink Bindweed														0.1	5																												
Conyza spp.	A Fleabane	*													0.1	1					0.1	2																						
Coronidium elatum																													0.1	1														
Corybas spp.																	0.1	5					0.1	15 0							0.1	10 0			0.1	10 0	0.1	25	0.1	20 0				
Corymbia gummifera	Red Bloodwood																		15	5			15	6	0.5	1					40	5	5	7	1	1	30	6	10	6	15	15	17	10

Scientific Name	Common Name	Exotic/ HTE	BC Act	EPBC Act	21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Corymbia maculata	Spotted Gum														0.1	5	30	35															3	2					2	1						
Cryptostylis spp.																															0.1	4					0.1	2	0.1	30				
Cuscuta australis	Australian Dodder																		0.1	20																									
Cymbidium suave	Snake Orchid												0.1	1							0.1	1																							
Cymbonotus lawsonianus	Bear's Ear																		0.1	3																									
Cymbopogon refractus	Barbed Wire Grass																		1	4																									
Dampiera stricta									0.1	15													0.1	20			0.1	5	0.1	5	0.1	10	0.1	25			0.1	40						
Daviesia squarrosa																	0.1	5	0.2	10			0.1	20																			
Desmodium rhytidophyllum									0.1	2							0.1	1																									
Desmodium varians	Slender Tick-trefoil				0.1	3	0.1	5									0.1	2							0.1	5			0.1	5							0.1	5						
Dianella caerulea	Blue Flax-lily				0.1	3	0.1	5																					0.1	5	0.2	20			0.1	3	0.1	10	0.1	5			0.2	2
Dianella caerulea var. caerulea									0.1	10																																	
Dianella caerulea var. producta											0.1	3	0.1	3			0.1	5	0.1	2	0.1	2			0.1	10	0.1	5	0.1	5											0.1	5		
Dianella revoluta	Blueberry Lily																												0.1	3													
Dichondra repens	Kidney Weed				0.1	20	0.1	5	0.1	25					0.1	5											0.1	3																
Dicksonia antarctica	Soft Treefern												1	3																													
Dillwynia retorta																							0.1	2									0.1	5									6	50
Dillwynia tenuifolia																			0.1	2																							
Dioscorea transversa	Native Yam				0.1	5	0.1	10													0.1	1																						
Dipodium variegatum					0.1	1																																					
Dodonaea triquetra	Large-leaf Hop-bush				1	20	0.2	10											0.1	1																			0.2	5	50	200			
Drosera spp.																											0.1	30															
Ehretia spp.																																					0.1	2						
Ehrharta erecta	Panic Veldtgrass	* / HTE																																			0.1	2						
Entolasia marginata	Bordered Panic						0.1	10																					0.1	3													
Entolasia stricta	Wiry Panic				0.5	100			0.1	20	5	40	0.1	10	0.1	10	1	40	15	60			0.1	10	0.2	40	5		5	50	0.2	50	30		0.5	50	5	100	0.2	40	0.2	30	0.1	50	0.5	80
Epacris microphylla	Coral Heath																		0.1	3			0.2	30			0.1	3					0.1	3	0.1	3			0.1	2			0.5	100
Eragrostis brownii	Brown's Lovegrass																0.1	2	0.1	6																							
Eucalyptus capitellata	Brown Stringybark										5	1											15	15																			
Eucalyptus globoidea	White Stringybark																								10	2	5	3					1	2									
Eucalyptus haemastoma	Broad-leaved Scribbly Gum																														2	1	20	5	10	5	5	1	5	5			15	8
Eucalyptus piperita	Sydney Peppermint				25	3			10	10	25	4	10	1									2	1						30	10						25	3			25	5	25	6
Eucalyptus resinifera	Red Mahogany				10	2	5	1	5	10											2	1			5	5	1	1	5	3													

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					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Eucalyptus robusta	Swamp Mahogany								50	10			30	4	30	5					30	9																								
Eucalyptus saligna	Sydney Blue Gum						10	2																																				
Eucalyptus sparsifolia	Narrow-leaved Stringybark																5	2	5	1																								
Eucalyptus umbra	Broad-leaved White Mahogany																1	1	10	3					2	1			10	8														
Eustrephus latifolius	Wombat Berry				0.1	5			0.1	4			0.1	3	0.1	5													0.1	3			0.1	1										
Exocarpos cupressiformis	Cherry Ballart																														0.1	1											
Gahnia aspera	Rough Saw-sedge												25	60	80	50																											
Gahnia clarkei	Tall Saw-sedge				40	100	2	40	95	100											90	100			0.2	20	0.1	1	0.2	10							1	10						
Galium propinquum	Maori Bedstraw														0.1	8																											
Geitonoplesium cymosum	Scrambling Lily						0.1	5			0.1	1					0.1	2											0.1	5	0.1	5												
Genoplesium spp.											0.1	1																															
Geranium spp.															0.1	8																											
Glochidion ferdinandi	Cheese Tree								0.5	5			0.5	3	0.5	2					0.1	2			0.1	5	0.1	5	0.1	5	0.1	2	0.1	3			0.1	5	2					
Glycine clandestina	Twining glycine								0.1	15			0.1	1									0.1	2			0.1	5	0.1	2					0.1	3					0.1	5		
Glycine tabacina	Variable Glycine				0.1	1	0.1	2																							0.1	3												
Gompholobium latifolium	Golden Glory Pea										0.1	1											0.1	1																	0.2	5	0.2	6
Gompholobium pinnatum	Pinnate Wedge Pea																		0.1	2																							
Gonocarpus tetragynus	Poverty Raspwort																0.1	10					0.1	2			0.1	25			0.1	10			0.1	5	0.1	5	0.1	5				
Gonocarpus teucrioides	Germander Raspwort								0.1	5									0.1	6					0.1	20	0.1	5															
Goodenia hederacea	Ivy Goodenia																		0.1	5																							
Goodenia heterophylla																	0.1	3					0.1	1			0.1	5	0.1	5					0.1	10							
Goodenia heterophylla subsp. heterophylla											0.1	10																															
Goodenia ovata	Hop Goodenia								0.1	2											0.1	1																					
Grevillea sericea	Pink Spider Flower																		0.1	3									0.1	3			0.1	2	0.1	1					0.2	5
Gymnostachys anceps	Settler's Twine				0.5	30	0.2	3																																			
Haemodorum planifolium																													0.1	3												
Hakea bakeriana																							1	3													0.1	2						
Hardenbergia violacea	False Sarsaparilla																						0.1	1			0.1	1			0.1	1											
Hibbertia aspera	Rough Guinea Flower																						0.1	15																			
Hibbertia dentata	Twining Guinea Flower						0.5	5																																			

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					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Hibbertia empetrifolia subsp. empetrifolia											0.1	2																	0.1	2			0.1	2											0.1	25
Hibbertia obtusifolia	Hoary Guinea Flower										0.1	3																																	
Hibbertia scandens	Climbing Guinea Flower				0.3	20	0.5	10																																				
Hibbertia spp.																																					0.1	3	0.1	5				
Hibiscus spp.							0.1	2																																				
Histiopteris incisa	Bat's Wing Fern												0.2	5	0.1	4					0.1	5																							
Hovea linearis																			0.1	5			0.1	3																			0.1	2	0.1	5
Hovea longifolia	Rusty Pods										0.1	1																					1		5									
Hovea purpurea																			0.1	3																								
Hydrocotyle laxiflora	Stinking Pennywort																				0.1	10							0.1	1														
Hydrocotyle peduncularis									0.1	25																																		
Hydrocotyle tripartita	Pennywort																				0.1	2																							
Hypochaeris radicata	Catsear	*																													0.1	1												
Hypolepis muelleri	Harsh Ground Fern				0.1	2			20	10																											0.2	40						
Imperata cylindrica	Blady Grass				0.1	10	0.1	30	0.5	50	0.2	20					1	10							2	50	0.1	10	0.2	50	0.5	10							5	50			0.1	15		
Isopogon anemonifolius	Broad-leaf Drumsticks																	0	0.1	5											0			0.1	2								0.2	5
Isopogon anethifolius	Narrow-leaf Drumsticks																		0.1	2															0.1	5									
Juncus spp.	A Rush																												0.1	2														
Lagenifera stipitata	Blue Bottle-daisy																																						0.1	2				
Lagenophora stipitata	Common Lagenophora				0.1	5	0.1	10															0.1	15	0.1	25	0.2	50	0.1	40														
Lambertia formosa	Mountain Devil																						0.5	3											1	10	0.1	2						5	30
Lantana camara	Lantana	* / HTE			0.1	1	1	10							0.2	5					0.1	1					0.1	3	0.2	10			0.1	1					0.5	5	0.1	2				
Lepidosperma laterale	Variable Sword-sedge						0.1	3									0.1	10	4	20			0.2	10	0.1	1	0.1	5	0.1	2	0.1	3	2	20			3	50	0.1	3	0.1	5	0.5	15	5	36
Leptospermum polygalifolium	Tantoon				0.2	10	0.1	3	0.5	5			0.2	4													0.2	1	0.1	1	0.5	5												
Leptospermum trinervium	Slender Tea-tree										0.1	2											0.2	3			0.2	1			0.5	5			1	8	2	5					1	15
lepyrodia scariosa																											0.1	3																
Leucopogon ericoides	Pink Beard-heath																						0.1	30					0.1	2														
Leucopogon lanceolatus																															0.1	3												
Leucopogon muticus	Blunt Beard-heath																						9.5	7																				
Leucopogon spp.	A Beard-heath																																											0.2	5
Ligustrum sinense	Small-leaved Privet	* / HTE													0.1	5																												

Scientific Name	Common Name	Exotic/ HTE	BC Act	EPBC Act	21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Liliaceae spp.																			0.1	5																								
Lindsaea linearis	Screw Fern																						0.1	10			0.1	30			0.1	5					0.2	100	0.1	50	0.1	25			0.1	10
Lindsaea microphylla	Lacy Wedge Fern																		0.1	10			0.1	5			0.1	10	0.1	3			0.1	1			0.1	5			0.1	2				
Lomandra confertifolia	Matrush																1	50																												
Lomandra cylindrica											0.2	15							0.1	10			0.1	10																			0.1	100	0.1	25
Lomandra filiformis	Wattle Matt-rush																										0.1	3																		
Lomandra glauca	Pale Mat-rush																0.1	5													0.1	10	0.1	25										
Lomandra longifolia	Spiny-headed Mat-rush				3	20	1	5	0.5	5			0.5	6					1	6							0.2	5	0.2	3	0.1	3														
Lomandra multiflora subsp. multiflora	Many-flowered Mat-rush																0.1	5															0.1	5					0.1	3				
Lomandra obliqua											2	40					0.1	25	1	50			0.1	25	0.1	5	0.1	10			0.1	10	0.5	50	0.1	20	0.1	25	0.1	30	0.1	30			0.5	100
Lomandra spp.	Mat-rush																						0.1	5																						
Lomatia silaifolia	Crinkle Bush																																								0.1	2				
Maytenus silvestris	Narrow-leaved Orangebark				0.1	2	0.1	3			0.1	1																															0.1	1		
Melaleuca linariifolia	Flax-leaved Paperbark				5	4	0.2	3	25	5			50	10	40	10					20	10									0.2	1														
Melaleuca nodosa																									40	17	60	23	50	20																
Melaleuca sieberi																									1	3	1	3																		
Melaleuca styphelioides	Prickly-leaved Tea Tree				10	15	15	30							20	4																														
Melichrus procumbens	Jam Tarts																														0.1	1												
Melichrus urceolatus	Urn Heath																		0.2	6																								
Melinis repens	Red Natal Grass	*																																			0.1	2						
Microlaena stipoides	Weeping Grass				0.2	50	0.3	100							0.2	15	0.1	30							0.1	20	0.2	30	0.1	10		25			0.1	20	0.1	5	0.1	20	0.1	10		
Mirbelia rubiifolia	Heathy Mirbelia																																										0.5	100
Monotoca scoparia											0.1	3							0.1	10																								
Morinda jasminoides	Sweet Morinda				0.1	5	0.1	3					0.5	10	0.1	5																														
Myoporum spp.	Boobialla												0.1	1							0.1	1																						
Ochna serrulata	Mickey Mouse Plant	* / HTE					0.1	1																							0.1	1												
Opercularia diphylla	Stinkweed																0.1	10					0.1	3							0.1	3												
Oplismenus aemulus					0.2	15	0.1	20	0.5	20																			0.1	5							0.1	10						
Oplismenus imbecillis													0.3	30	0.2	15					0.1	50																						
Orchid spp.																							0.1	1																				
Oxalis spp.																					0.1	1			0.1	5			0.1	1														

Scientific Name	Common Name	Exotic/ HTE	BC Act	EPBC Act	21		22		23		24		25		26		27		28		29		30		31		32		33		34		35		36		37		38		39		40		41	
					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Ozothamnus spp.																													0.1	2																
Pandorea pandorana	Wonga Wonga Vine												0.1	2			0.1	3											0.1	1			0.1	1	0.1	1	0.1	3	0.1	2			0.1	2		
Panicum simile	Two-colour Panic																0.1	5	0.1	5			0.1	3	0.1	5	0.1	5	0.1	5																
Panicum spp.	Panicum																														0.1	10							0.1	3						
Parsonsia straminea	Common Silkpod								0.1	2			0.4	8							0.1	1					0.1	3	0.1	5			0.2	5					2	25	0.1	5				
Patersonia glabrata	Leafy Purple-flag										0.2	10											0.2	3													0.1	15	0.1	5	0.1	3				
Patersonia sericea	Silky Purple-Flag																												0.1	5			0.1	2									0.5	15	2	35
Persoonia laurina	Laurel Geebung																																		0.1	2									
Persoonia levis	Broad-leaved Geebung										0.1	1																																	0.5	10
Persoonia linearis	Narrow-leaved Geebung										0.1	3					0.1	5	0.1	1							0.1	1			0.5	5	0.2	5	0.2	5					0.1	2	0.1	3		
Phragmites australis	Common Reed														0.1	2					0.1	2																								
Phyllanthus hirtellus	Thyme Spurge										0.1	5					0.1	20	0.2	20			0.1	3	0.1	5	0.1	10	0.1	2	0.1	10	0.1	5	0.1	5			0.1	5	0.1	5			0.1	25
Pimelea curviflora	Rice Flower																																0.1	2												
Pimelea linifolia	Slender Rice Flower																												0.1	15															0.1	5
Pittosporum undulatum	Sweet Pittosporum												0.2	4																	0.5	3					1	10	0.5	3				
Poa sieberiana	Snowgrass																										0.1	1	0.1	5															
Poa sieberiana var. cyanophylla																															0.1	5	0.2 25											
Poa spp.																	0.1	10									0.1	10	0.1	1	0.1	5												
Podolobium aciculiferum	Needle Shaggy Pea										0.1	2											0.1	1																				
Podolobium ilicifolium	Prickly Shaggy Pea										0.1	7							0.1	1															10		0.1	2			0.1	5	0.2	5		
Polymeria calycina									0.1	5											0.1	20																						
Polyscias sambucifolia	Elderberry Panax								0.5	5			0.1	2							0.1	2							0.1	1													0.5	10		
Pomaderris spp.					0.1	1																																						
Poranthera ericifolia																							0.1	15																				
Poranthera microphylla	Small Poranthera										0.1	10					0.1	5	0.1	4																								
Pratia purpurascens	Whiteroot				0.1	3	0.1	3	0.1	20			0.1	8	0.1	5	0.1	10			0.1	1			0.1	5	0.1	10	0.1	10			0.1	30					0.1	10			0.1	25		
Pseuderanthemum variabile	Pastel Flower				0.1	20	0.1	25	0.1	20			0.1	10	0.1	5	0.1	20	0.1	10			0.1	30	0.1	40	0.1	20	0.1	20	0.1	10	0.1	5	0.1	5	0.1	5	0.1	3	0.1	3	0.1	5		
Pteridium esculentum	Bracken				0.2	5	0.2	10	0.1	20	0.1	5											0.1	5					0.1	2	0.5	10 0	20	10 0					0.1	30	0.1	5	1	15		
Pterostylis acuminata	Pointed Greenhood																0.1	50																												
Pterostylis spp.	Greenhood								0.1	10			0.1	3																															

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					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Ptilothrix deusta											0.2	15					0.1	20	2	25			1	100	0.1	50	0.1	20	0.1	10			1	100	0.5	50	2	100	0.1	1	0.1	20			0.5	50
Pultenaea paleacea	Chaffy Bush-pea										0.1	2											0.1	5			9.1	10																	1	30
Pultenaea polifolia	Dusky Bush-pea																								0.1	15									0.1	1										
Pultenaea spp.																													0.1	10															0.2	10
Pultenaea villosa	Hairy Bush-pea																0.1	2																												
Rhytidosporum procumbens																									0.1	1																				
Rubus fruticosus sp. agg.	Blackberry complex	* / HTE																																			0.1	1								
Rubus rosifolius	Rose-leaf Bramble												0.5	10	0.1	3					0.1	4																								
Rytidosperma pallidum	Redanther Wallaby Grass; Silvertop Wallaby Grass																		10	50					0.1	5													0.1	10						
Rytidosperma spp.																													0.1	3			0.1	20										
Schizaea bifida	Forked Comb Fern										0.1	2																																	0.1	11
Schoenus spp.																															0.1	3	0.1	10			0.1	1						
Senecio spp.	Groundsel, Fireweed																				0.1	5																								
Senna pendula		* / HTE													0.2	5																														
Setaria parviflora		*													0.1	5																														
Smilax spp.					0.1	3																																								
Solanum mauritianum	Wild Tobacco Bush	*													0.2	3																													
Sonchus hydrophilus	Native Sowthistle																																				0.1	2								
Stephania japonica	Snake vine				0.1	4									5	20																													
Syncarpia glomulifera	Turpentine				10	5	2	2																																					
Synoum glandulosum	Scentless Rosewood				5	1																																							
Tetratheca juncea	Black-eyed Susan		V	V																																					1	10	20	50
Thelymitra spp.																	0.1	3																												
Themeda triandra											0.2	20					0.5	50	10	30			5	50	0.1	15	0.2	40	0.2	15	0.2	20	0.1	15	0.1	15	0.1	10	0.1	15	0.1	10	0.5	2
Thysanotus tuberosus	Common Fringe-lily										0.1	4																																
Tricoryne simplex																																												1	1
Unknown Species 2																											0.1	10																		
Unknown Species 3																													0.1	5														
Unknown Species 4																					0.1	1																						
Unknown Species 5													0.1	1																														
Vernonia cinerea																									0.1	10													0.1	2						
Veronica plebeia	Trailing Speedwell				0.1	1	0.1	2																																						
Viola hederacea	Ivy-leaved Violet						0.1	5	0.1	25											0.1	5																								
Xanthorrhoea spp.											65	60							15	12			1	12	0.1	5					1	30	1	20	5	100	20	100	0.5	10	10	100				
Xanthosia pilosa	Woolly Xanthosia																						0.1	2																						

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					C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A	C	A
Xanthosia spp.																											0.1	3	0.1	2																
Zieria spp.					0.1	3																																								
Adiantum hispidulum	Rough Maidenhair						0.1	2																																						
Cinnamomum camphora	Camphor Laurel	* / HTE					0.1	1																																						
Xanthorrhoea latifolia																																									0.5	10				
Lindsaea linearis	Screw Fern																																								0.1	15				
Olearia spp.									0.1	3																																				
Cassytha glabella																																												0.1	10
Astrotricha crassifolia	Thick-leaf Star-hair		V	V																																							0.5	20
Calochilus spp.																																												0.1	5

Appendix D

EPBC Act Assessment of Significance

Assessment of Significance for vulnerable flora species

Significant Impact Criteria	*Acacia bynoeana*	*Angophora inopina*
Lead to a long-term decrease in the size of an important population of a species	**Unlikely**. Surveys of the Study Area detected 36 individuals of this species, all located toward the north west of the Study Area within and adjacent to a powerline easement. There are 30 known populations across the NSW South Western Slopes, South Eastern Highlands and Sydney Basin. After inspection of DPIE Records (2019), *Acacia bynoneana* found on site may be part of a larger population extending to the west. Based on the known extent of the local population in the area and the nature of the subsidence predicted, it is considered unlikely that the proposal would lead to a long-term decrease in the size of an important population in a regional context.	**Unlikely**. Surveys of the Study Area detected 24 individuals of this species, all located toward the north west of the Study Area within and adjacent to a powerline easement. There are known populations across NSW North Coast and the Sydney Basin. After inspection of DPIE Records (2019), *A. inopina* found on site may be part of a larger population extending to the west. Based on the known extent of the local population in the area and the nature of the subsidence predicted, it is considered unlikely that the proposal would lead to a long-term decrease in the size of an important population in a regional context.
Reduce the area of occupancy of an important population	**Unlikely**. The detected population of *A. bynoeana* is located above previous workings, which has the potential for 3,250 mm vertical subsidence. This has the possibility to reduce the habitat for the population found on site A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.. It is considerled unlikely that the proposal would reduce the area of occupancy of an important population of this species.	**Unlikely**. The detected population of *A. inopina* is located above previous workings, which has the potential for 3,250 mm vertical subsidence. This has the possibility to reduce the habitat for the population found on site. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.It is considered unlikely that the proposal would reduce the area of occupancy of an important population of this species.
Fragment an existing important population into two or more populations	**Unlikely**. As *A. bynoeana* relies on flying pollinators such as insects and birds to reproduce, the predicted subsidence is unlikely to cause an interference in reproduction between individuals. Thus, it is considered unlikely that the proposal will fragment an existing important population into two or more populations.	**Unlikely**. As *A. inopina* relies on flying pollinators such as insects and birds to reproduce, the predicted subsidence is unlikely to cause an interference in reproduction between individuals. Thus, it is considered unlikely that the proposal will fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. Critical habitat has not been declared for this species. However, inspection of DPIE Records (2019) shows a wide distribution of this species throughout the local area. Considering the suitable habitat availability in the local area, the predicted subsidence is unlikely to affect critical habitat for this species to survive.	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. Critical habitat has not been declared for this species. However, inspection of DPIE Records (2019) shows a wide distribution of this species throughout the local area. Considering the suitable habitat availability in the local area, the predicted subsidence is unlikely to affect critical habitat for this species to survive.
Disrupt the breeding cycle of an important population	**Unlikely**. Subsidence is unlikely to prohibit pollinators from accessing the flowers of *A. bynoeana*. Thus, the proposal is not likely to disrupt the breeding cycle of an important population.	**Unlikely**. Subsidence is unlikely to prohibit pollinators from accessing the flowers of *A. inopina*. Thus, the proposal is not likely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unknown**. A maximum 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature is predicted where the proposed panels mine directly beneath existing workings. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Without absolute certainty of the Project impacts, the impacts will be identified and quantified though a BMP.	**Unknown**. A maximum 3, 250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature is predicted where the proposed panels mine directly beneath existing workings. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project however this species was not. Without absolute certainty of the Project impacts, the impacts will be identified and quantified though a BMP. found in that area.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed and fungi management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed and fungi management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. Large areas of equal or better-quality habitat are available for this species within the surrounding area. Hence, it is considered unlikely that the expected potential subsidence impacts will substantially interfere with the recovery of the species.	**Unlikely**. Large areas of equal or better-quality habitat are available for this species within the surrounding area. Hence, it is considered unlikely that the expected potential subsidence impacts will substantially interfere with the recovery of the species.

Significant Impact Criteria	*Caladenia tessellata*	*Cryptostylis hunteriana*
Lead to a long-term decrease in the size of an important population of a species	**Unlikely**. Targeted surveys during the flowering period of *C. tessellata* failed to detect individuals within the Study Area. However, 22.8 ha of potential habitat occurs in the Project Area. In the absence of detection and potential impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of an important population of this species.	**Unlikely**. Targeted surveys during the flowering period of *C. hunteriana* failed to detect individuals within the Study Area. However, 993.06 ha of potential habitat occurs in the Project Area. In the absence of detection and potential impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of an important population of this species.
Reduce the area of occupancy of an important population	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project thought the species was not recorded in that area. 22.8 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Thus, it is unlikely to reduce the area of occupancy of an important population.	**Unlikely**. 993.06 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Thus, it is unlikely to reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to fragment an existing important population into two or more populations.	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. 22.8 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. Thus, it is unlikely to adversely affect habitat critical to the survival of a species.	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. 993.06 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. Thus, it is unlikely to adversely affect habitat critical to the survival of a species.

Significant Impact Criteria	*Caladenia tessellata*	*Cryptostylis hunteriana*
Disrupt the breeding cycle of an important population	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to disrupt the breeding cycle of an important population.	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. 22.8 ha of potential habitat occurs in the Study Area. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. It is unlikely to modify, destroy, remove, isolate or decrease the availability of quality habitat to the extent that the species is likely to decline.	**Unlikely**. 993.06 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. It is unlikely to modify, destroy, remove, isolate or decrease the availability of quality habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed and fungi management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed and fungi management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. 22.8 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. Thus, it is unlikely to interfere substantially with the recovery of the species.	**Unlikely**. 993.06 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. Thus, it is unlikely to interfere substantially with the recovery of the species.

Significant Impact Criteria	*Diuris praecox*	*Eucalyptus camfieldii*
Lead to a long-term decrease in the size of an important population of a species	**Unlikely**. Targeted surveys during the flowering period of *D. praecox* failed to detect individuals within the Study Area. However, 1,005.9 ha of potential habitat occurs in the Project Area. In the absence of detection and potential impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of an important population of this species.	**Unlikely**. Targeted surveys during the flowering period of *E. camfieldii* failed to detect individuals within the Study Area. However, PCTs 1649 and 1619 occur in the Project Area which may offer potential habitat for this species. In the absence of detection and potential impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of an important population of this species.
Reduce the area of occupancy of an important population	**Unlikely**. 1,005.9 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Thus, it is unlikely to reduce the area of occupancy of an important population.	**Unlikely**. No individuals were found within the Study Area. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Thus, it is unlikely to reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to fragment an existing important population into two or more populations.	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. 1,005.9 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. Thus, it is unlikely to adversely affect habitat critical to the survival of a species.	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No individuals were found within the Study Area. Thus, it is unlikely to adversely affect habitat critical to the survival of a species.
Disrupt the breeding cycle of an important population	**Unlikely**. No individuals were found within the Project Area. Thus, it is unlikely to disrupt the breeding cycle of an important population.	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. 1,005.9 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Thus, it is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unlikely**. Targeted surveys during the flowering period of *E. camfieldii* failed to detect individuals within the Project Area. However, PCTs 1649 and 1619 occur in the Study Area which may offer potential habitat for this species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys., thus the Project is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. 1,005.9 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. Thus, it is unlikely to interfere substantially with the recovery of the species.	**Unlikely**. Despite there being potential habitat on site for this species, targeted surveys failed to detect this species. As such, the Project is unlikely to substantially interfere with the recovery of this species.

Significant Impact Criteria	*Eucalyptus parramattensis* subsp. *decadens*	*Grevillea parviflora* subsp. *parviflora*
Lead to a long-term decrease in the size of an important population of a species	**Unlikely**. Targeted surveys during the flowering period *of E. parramattensis subsp. decadens* failed to detect individuals within the Study Area. However, 20.7 ha of potential habitat occurs in the Study Area. In the absence of detection and potential impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of an important population of this species.	**Unlikely**. Targeted surveys detected 4,273 individuals of *G. parviflora* subsp. *parviflora* across the Study Area. According to the *G. parviflora* subsp. *parviflora* Environmental Impact Assessment Guidelines (NPWS 2002), a population of >50 plants is considered a significant area of habitat. There are known populations across NSW North Coast and Sydney Basin. According to DPIE Records (2016), the closest known population is 8 kms from the Study Area, fragmanted by creeks and infastructure. As the natural limited dispersal of the species is ≤2 m, this seperation is significant and suggests the populations are independent to one another. The maximum predicted subsidence where the proposed panels mine directly beneath existing workings (**Figure 1)** is 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1,100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Sinkholes have the potential to form along riparian zones, with greater potential occurring in the areas that overlap existing Awaba workings (**Figure 1**). Cracking may occur to varying extents in open areas and increased ponding could occur along riparian zones. The effects of subsidence on this species is unknown and would require future monitoring. Due to the size of the population found outside of riparian zones within the Study Area, the Project is considered unlikely to lead to a long-term decrease in the size of an important population of a species.
Reduce the area of occupancy of an important population	**Unlikely**. 20.7 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Thus, it is unlikely to reduce the area of occupancy of an important population.	**Unlikely**. Surveys of detected 4,273 individuals of this species across the Study Area. As discussed above, impacts are predicted throughout various habitat types across the Study Area. The population on site is quite large, and sink holes may occur under habitat where this species occurs. This has the potenial ot harm some individuals. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Thus, it is unlikely to reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to fragment an existing important population into two or more populations.	**Potentially**. Surveys of the Project Area detected 4,273 individuals of this species across the Study Area. Due to the nature of this species seed dispersal, if cracking or pooling wider than 2m occurs between a population greater than 50 individuals, it is likely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. 20.7 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. Thus, it is unlikely to adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. Whilst surveys detected 4,273 individuals of this species across the Project Area, Critical Habitat has not been declared for this species.
Disrupt the breeding cycle of an important population	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to disrupt the breeding cycle of an important population	**Potentially**. 4,273 indiviuals are known to occur within the Study Area. If subsidence did occur in areas where this species was detected, seed dispersal, and hence the breeding cycle, of this species could be interupted due to the limited seed dispersal distance (≤2 m) of this species.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. 20.7 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Thus, it is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unlikely**. Althought this species was detected on site, the population size is quite extensive (4,273 individuals). Subsidence impacts may contribute to minor habitat modification.A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Thusit is unlikely that the impacts would cause this species to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. 20.7 ha of potential habitat occurs in the Study Area. However, no individuals were found within the Study Area. Thus, it is unlikely to interfere substantially with the recovery of the species	**Unlikely**. No recovery plan exists for this species. While some individuals may be impacted by subsidence impacts, it is not considered that the recovery of this species would be substantially interferred with as a result of the Project.

Significant Impact Criteria	*Melaleuca biconvexa*	*Persicaria elatior*
Lead to a long-term decrease in the size of an important population of a species	**Unlikely**. A total of 20.9 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Across the Sydney Basin, there are known populations of this species within five IBRA sub-regions in the Sydney Basin, with no geographic restrictions to populations within the Wyong region (OEH 2018c). On the Central Coast of NSW, there are two key areas prioritised for conservation of this species; Wyong and Lisarow (Bell 2016). The Study Area is well outside of these priority areas, whilst larger and more extensive tracts of *M. biconvexa* are located within the Mandalong	**Unlikely**. Field surveys failed to detect individuals of this species within the Study Area. However, 21 ha from PCTs 1716, 1718, and 1737 occur in the Study Area which may offer potential habitat for this species. In the absence of detection and potential impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of an important population of this species.

Significant Impact Criteria	*Melaleuca biconvexa*	*Persicaria elatior*
	Valley. Thus, this Project is unlikely to lead to a long-term decrease in the size of an important population of a species.	
Reduce the area of occupancy of an important population	**Unlikely**. A total of 20.9 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to reduce the area of occupancy of an important population. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.	**Unlikely**. A total of 21 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to reduce the area of occupancy of an important population. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.
Fragment an existing important population into two or more populations	**Unlikely**. A total of 20.9 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to fragment an existing important population into two or more populations.	**Unlikely**. A total of 21 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. A total of 20.9 ha of potential habitat occurs in the Study Area. No Critical Habitat has been declared for this species. Thus, this Project is unlikely to adversely affect habitat critical to the survival of a species.	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. A total of 21 ha of potential habitat occurs in the Study Area. No Critical Habitat has been declared for this species. Thus, this Project is unlikely to adversely affect habitat critical to the survival of a species
Disrupt the breeding cycle of an important population	**Unlikely**. A total of 20.9 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to disrupt the breeding cycle of an important population.	**Unlikely**. A total of 21 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. A total of 20.9 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Thus, this Project is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unlikely**. A total of 21 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Thus, this Project is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. A total of 20.9 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to Interfere substantially with the recovery of the species.	**Unlikely**. A total of 21 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to Interfere substantially with the recovery of the species.

Significant Impact Criteria	*Rutidosis heterogama*	*Syzygium paniculatum*
Lead to a long-term decrease in the size of an important population of a species	**Unlikely**. Field surveys failed to detect individuals of this species within the Study Area. However, 938.11 ha from PCTs 1619, 1627, and 1636 occur in the Study Area which may offer potential habitat for this species. Consequently, the Project is unlikely to lead to a long-term decrease in the size of an important population of a species.	**Unlikely**. Field surveys failed to detect individuals of this species within the Study Area. However, a total of 20.7 ha of potential habitat occurs in the Study Area. Consequently, the Project is unlikely to lead to a long-term decrease in the size of an important population of a species
Reduce the area of occupancy of an important population	**Unlikely**. A total of 938.11 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Thus, the Project is unlikely to reduce the area of occupancy of an important population.	**Unlikely**. A total of 20.7 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted surveys for this species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Thus, the Project is unlikely to reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	**Unlikely**. A total of 938.11 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, the Project is unlikely to fragment an existing important population into two or more populations.	**Unlikely**. A total of 20.7 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted surveys for this species Thus, the Project is unlikely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. A total of 938.11 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, the Project is unlikely to adversely affect habitat critical to the survival of a species.	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. A total of 20.7 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted surveys for this species. Thus, the Project is unlikely to adversely affect habitat critical to the survival of a species.
Disrupt the breeding cycle of an important population	**Unlikely**. A total of 938.11 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, the Project is unlikely to disrupt the breeding cycle of an important population.	**Unlikely**. A total of 20.7 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted surveys for this species. Thus, the Project is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. A total of 938.11 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Thus, the Project is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unlikely**. A total of 20.7 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted surveys for this species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Thus, the Project is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

Significant Impact Criteria	*Rutidosis heterogama*	*Syzygium paniculatum*
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. A total of 938.11 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to interfere substantially with the recovery of the species.	**Unlikely**. A total of 20.7 ha of potential habitat occurs in the Study Area. However, 0 individuals were detected during targeted surveys for this species. Thus, this Project is unlikely to interfere substantially with the recovery of the species.

Significant Impact Criteria	*Tetratheca juncea*	*Thesium australe*
Lead to a long-term decrease in the size of an important population of a species	**Unlikely**. 47,910 individuals of this species have been modelled as occurring within the Study Area (see **Section 4.3.3** of main report). PCTs in which this species is known to occur are not likely to experience subsidence related impacts such that the associated habitat values would be adversely impacted. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (**Figure 1**) is 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1,100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Sinkholes have the potential to form along riparian zones, with greater potential occurring in the areas that overlap existing Awaba workings (**Figure 1**). Cracking may occur to varying extents in open areas and increased ponding could occur along riparian zones. The certain impacts of subsidence on this species is unknown and would require future monitoring. In consideration to the size of the population within the Study Area, and the habitat in which this species occurs not being likely to be adversely impacted by subsidence, it is unlikely that the Project would lead to a long-term decrease in the size of an important population of *T. juncea*.	**Unlikely**. A total of 94.4 ha of potential habitat occurs in the Study Area. However, no individuals of this species were detected during targeted surveys for this species. In the absence of detection and potential impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of an important population of this species.
Reduce the area of occupancy of an important population	**Unlikely**. 47,910 individuals of this species have been modelled as occurring within the Study Area. PCTs in which this species is known to occur are not likely to experience subsidence related impacts such that the associated habitat values would be adversely impacted. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys, therefore it will not reduce its area. Whilst some areas of habitat may be impacted by potential sink holes and cracks, the Project is unlikely to reduce the area of occupancy of an important population for this species.	**Unlikely**. A total of 94.4 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Thus, this Project is unlikely to reduce the area of occupancy of an important population.
Fragment an existing important population into two or more populations	**Unlikely**. 47,910 individuals of this species have been modelled as occurring within the Study Area. Whilst some areas of habitat may be impacted by potential sink holes and cracks, the Project is unlikely to cause fragmentation of an existing population.	**Unlikely**. A total of 94.4 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No Critical Habitat has been declared for this species. Thus, this Project is unlikely to adversely affect habitat critical to the survival of a species.	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. A total of 94.4 ha of potential habitat occurs in the Study Area. No Critical Habitat has been declared for this species. Thus, this Project is unlikely to adversely affect habitat critical to the survival of a species.
Disrupt the breeding cycle of an important population	**Unlikely**. 47,910 individuals of this species have been modelled as occurring within the Study Area. The vast number of individuals within the Project Area will likely retain the ability to breed normally despite the predicted subsidence impacts to associated habitats. Therefore, it is unlikely that the Project will disrupt the breeding cycle of an important population.	**Unlikely**. A total of 94.4 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. 47,910 individuals of this species have been modelled as occurring within the Study Area. Whilst some areas of habitat may be impacted by potential sink holes and cracks. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Thus, the Project is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unlikely**. A total of 94.4 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Thus, this Project is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed and fungi management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed and fungi management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. The recovery of this species is unlikely to be substantially interfered with as a result of the Project given the vast numbers of this species modelled within the Study Area and the subsidence impacts predicted for PCTs in which this species occurs.	**Unlikely**. A total of 94.4 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to Interfere substantially with the recovery of the species.

Assessment of Significance for vulnerable fauna species

Significant Impact Criteria	Large-eared Pied bat	Painted Honeyeater
Lead to a long-term decrease in the size of an important population of a species	**Unlikely**. No individuals of this species were detected during targeted survey efforts. However, lack of detection does not provide definitive evidence that the species does not occur within the Study Area. DPIE records identify this species on site in 2016, and the Study Area supports suitable forgaing and roosting habitat for this species. Thus, at present, the occurrence of this species on site is possible. However, as this species utilises forest canopy for hunting and old mine workings and caves for roosting, it is unlikely the nature of this project will lead to a long-term decrease in the size of an important population of this species as these habitat values are not likely to be substantially impacted by subsidence.	**Unlikely**. No individuals of this species were detected during targeted survey efforts , however, 1,048.4 ha of potential habitat is present within the Study Area. However, as the species was not detected, the Project is unlikely to lead to a long-term decrease in the size of an important population of a species.
Reduce the area of occupancy of an important population	**Unlikely**. As no individuals were detected during surveys and the potential habitat occupied this species is not likely to be substantially impacted by subsidence impacts, it is unlikely that the area of occupancy would be reduced for this species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to reduce the area of occupancy of an important population. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.
Fragment an existing important population into two or more populations	**Unlikely**. This is a highly mobile species and no individuals were detected during surveys. The potential habitat occupied by this species is not likely to be substantially impacted by subsidence impacts and therefore it is unlikely that an existing important population would be fragmented as a result of the Project.	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Potentially**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No individuals of this species were detected during targeted survey efforts, however suitable habtiat occurs on site for foraging and roosting. Whilst the habitat on site has not been declared as critical habitat, there are areas suitable for roosts which according to the National Recovery Plan (DERM 2011) should be considered as critical habtiat for this species. Subsequently, if subsidence impacts did affect roosting habitat sof this species, it counc constitue an adverse affect to critical habitat for the Large-eared Pied Bat.	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No individuals were found within the Study Area and no habitat has been delareda s critical habitat for this species. Thus, it is unlikely to adversely affect habitat critical to the survival of a species.
Disrupt the breeding cycle of an important population	**Potentially**. No individuals of this species were detected during targeted survey efforts, however if this species was utilising old mining shafts to breed, and they were impacted by subisdence, this could disrupt the breeding cycel of this species.	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. Whilst this species was not detected on site, suitable habtiat is present. If subsidence impacts did impact upon potential habitat for this species, it is unlikely that it would be significant enough to modify, destroy, remove or isolate it such that this species declined. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.	**Unlikely**. No indiviudals were detected during surveys. In the absence of detection and potential impacts being primarily subsidence related, the Project is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. No individuals of this species were detected during targeted survey efforts, however suitable habtiat is available on site. If subsidence impacts affected potential habitat for this species, it is unlikel that it would be significant enough to interfere subtantially with the recovery of this species.	**Unlikely**. Despite there being potential habitat on site for this species, targeted surveys failed to detect this speices. As such, the Project is unlikely to substantially interfere with the recovery of this species.

Significant Impact Criteria	Giant Burrowing Frog	Green and Golden Bell Frog
Lead to a long-term decrease in the size of an important population of a species	**Unlikely**. No individuals of this species were detected during targeted survey efforts. However, 516.91 ha of suitable suitable habitat occurs in PCT's 1627 and 1636. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (**Figure 1**) is 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1,100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Sinkholes have the potential to form along riparian zones, with greater potential occurring in the areas that overlap existing Awaba workings (**Figure 1**). Cracking may occur to varying extents in open areas and increased ponding could occur along riparian zones. The certain impacts of subsidence on this species is unknown and would require future monitoring.	**Unlikely**. No individuals of this species were detected during targeted survey efforts. However, suitable habitat ocurs on site in marshes, dams and streams with suitable vegetative resources. DPIE Records identify the species within 5 kms of the Study Area in 2015. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Sinkholes have the potential to form along riparian zones, with greater potential occurring in the areas that overlap existing Awaba workings (**Figure 1**). Cracking may occur to varying extents in open areas and increased ponding could occur along riparian zones. The certain impacts of subsidence on this species is unknown and would require future monitoring. Whilst impacts from subsidence are not listed as a main threat to this species, changes to hydrology and reduction in water quality, which can be caused by subsidence, are threats to this species (Department of the

Significant Impact Criteria	Giant Burrowing Frog	Green and Golden Bell Frog
	Whilst the impacts on this species are not certain, the habitat types in which it could occur are not considered to be significantly impacted. It is unlikely that the Project would lead to a long-term decrease in the size of an important population of this species.	Environment 2014b). The exact effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the Project is unlikely to a long-term decrease in the size of an important population of this species.
Reduce the area of occupancy of an important population	**Unlikely**. A total of 516.91 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to reduce the area of occupancy of an important population. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.	**Unlikely**. No individuals of this species were detected during targeted survey efforts. Thus, this Project is unlikely to reduce the area of occupancy of an important population. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.
Fragment an existing important population into two or more populations	**Unlikely**. A total of 516.91 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, the Project is unlikely to fragment an existing important population into two or more populations.	**Unlikely**. No individuals of this species were detected during targeted survey efforts. Thus, the Project is unlikely to fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No critical habitat for this species has been declared and this species was not detected within the Study Area. Therefore, the Project is unlikely to affect habitat critical to the survival of this species.	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No critical habitat for this species has been declared and this species was not detected within the Study Area. Therefore, the Project is unlikely to affect habitat critical to the survival of this species.
Disrupt the breeding cycle of an important population	**Unlikely**. A total of 516.91 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, the Project is unlikely to disrupt the breeding cycle of an important population.	**Unlikely**. No individuals were detected during targeted field surveys for this species. Thus, the Project is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unknown**. A total of 516.91 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. A maximum 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature is predicted where the proposed panels mine directly beneath existing workings. Without absolute certainty of the Project impacts, the impacts will be identified and quantified though a BMP. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Thus, it is unlikely that the Project will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unknown**. A maximum 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature is predicted where the proposed panels mine directly beneath existing workings. Without absolute certainty of the Project impacts, the impacts will be identified and quantified though a BMP. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Thus, it is unlikely that the Project will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. A total of 516.91 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to interfere substantially with the recovery of the species.	**Unlikely**. No individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to interfere substantially with the recovery of the species.

Significant Impact Criteria	Little John's Treefrog	Grey-headed Flying-Fox
Lead to a long-term decrease in the size of an important population of a species	**Unlikely**. No individuals of this species were detected during targeted survey efforts. However, 108.81 ha of suitable suitable habitat occurs in PCT 1627. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (**Figure 1**) is 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1,100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Sinkholes have the potential to form along riparian zones, with greater potential occurring in the areas that overlap existing Awaba workings (**Figure 1**). Cracking may occur to varying extents in open areas and increased ponding could occur along riparian zones. The effects of subsidence on this species is unknown and would require future monitoring. Whilst impacts from subsidence are not listed as a main threat to this species, changes to hydrology and reduction in water quality, which can be caused by subsidence, are threats to this species (Department of the Environment 2014b). Without absolute certainty of the Project impacts, the impacts will be identified and quantified though a BMP. However, as the species was not detected, the Project is unlikely to lead to a long-term decrease in the size of an important population of a species.	**Unlikely**. This highly mobile species was detected within the Study Area during nocturnal surveys. There are known populations of this species across 13 IBRA subregions of the Sydney Basin. The Study Area is highly connected to bushland to the south and west. The largest of these is the Watagan Mountains to the west. This vegetation is largely intact and incorporates the Watagan National Park; as well as Olney and Watagan State Forests. These conservation areas provide a wide range of Eucalypt woodlands and forests, which this species may occupy. Based on the known extent of the local population in the area and the nature of the subsidence predicted, it is considered unlikely that the proposal would lead to a long-term decrease in the size of an important population in a regional context.
Reduce the area of occupancy of an important population	**Unlikely**. No individuals of this species were detected during targeted survey efforts. Thus, this Project is unlikely to reduce the area of occupancy of an important population. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.	**Unlikely**. Whilst this highly mobile species was detected within the Study Area during nocturnal surveys, it has the ability to disperse to adjacent areas of habitat, and the habitat on site is not considered to be adversely affected such that it becomes unavailable to this species for foraging. Therefore, it is considered unlikely that the proposal would reduce the area of occupancy of an important population. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.

Significant Impact Criteria	Little John's Treefrog	Grey-headed Flying-Fox
Fragment an existing important population into two or more populations	**Unlikely**. No individuals of this species were detected during targeted survey efforts. Thus, the Project is unlikely to fragment an existing important population into two or more populations.	**Unlikely**. Whilst this highly mobile species was detected within the Study Area during nocturnal surveys, it has the ability to disperse to adjacent areas of habitat, and the habitat on site is not considered to be adversely affected such that it becomes unavailable to this species for foraging. Therefore, it is considered unlikely that the proposal would fragment an existing important population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No critical habitat for this species has been declared and this species was not detected within the Study Area. Therefore, the Project is unlikely to affect habitat critical to the survival of this species.	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, though no individuals were recorded in this area. Critical forgaing does occur on site for the Grey-headed Flying Fox as per the definitions under the National Recovery Plan (DECCW 2009). This includes natural foraging habitat that is productive during winter and spring, when food bottlenecks have been identified. Predicted subsidence impacts are not likely to impact species such as *Corymbia maculata* and *Eucalyptus robusta* that fall into the critical foraging habitat category, such that they cease to exist on site. Therefore, whilst critical foraging habitat may exist, it is unlikely to be adversely affected by the Project such that this species survival is impacted.
Disrupt the breeding cycle of an important population	**Unlikely**. No individuals were detected during targeted field surveys for this species. Thus, the Project is unlikely to disrupt the breeding cycle of an important population.	**Unlikely**. Whilst this highly mobile species was detected within the Study Area during nocturnal surveys, it has the ability to disperse to adjacent areas of habitat, and the habitat on site is not considered to be adversely affected such that it becomes unavailable to this species for foraging. Therefore, it is considered unlikely that the proposal would disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unknown**. A maximum 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature is predicted where the proposed panels mine directly beneath existing workings. Without absolute certainty of the Project impacts, the impacts will be identified and quantified though a BMP. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Thus, it is unlikely that the Project will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.decline	**Unlikely**. Whilst this highly mobile species was detected within the Study Area during nocturnal surveys, it has the ability to disperse to adjacent areas of habitat, and the habitat on site is not considered to be adversely affected such that it becomes unavailable to this species for foraging. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Therefore, it is considered unlikely that the proposal would modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed and fungi management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. No individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to interfere substantially with the recovery of the species.	**Unlikely**. Whilst this species, and habitat for this species occurs on site, this species habitat should remain largely intact. Therefore, it is unlikely that the Project would interfere substantially with the recovery of this species.

Significant Impact Criteria	Greater Glider	Koala
Lead to a long-term decrease in the size of an important population of a species	**Unlikely**. No individuals were detected during surveys within the Study Area. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. The effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the Project can be assumed unlikely to lead to a long-term decrease in the size of an important population of a species	**Unlikely**. No individuals were detected within the Study Area during targeted surveys. Potential koala habitat does exist on site, where *Eucalyptus microcorys* and *E. robusta* are present. The closest record of koalas to the Study Area is near the Pacific highway, 600 m to the east. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (**Figure 1**) is 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1,100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Sinkholes have the potential to form along riparian zones, with greater potential occurring in the areas that overlap existing Awaba workings (**Figure 1**). Cracking may occur to varying extents in open areas and increased ponding could occur along riparian zones. The effects of subsidence on this species is unknown and would require future monitoring. In the absence of detection and potential impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of an important population of this species.
Reduce the area of occupancy of an important population	**Unlikely**. 0 individuals have been observed within the Study Area. However, lack of detection does not provide definitive evidence that the species does not coincide within the Study Area. The species is known to inhabit areas within the Sydney Basin. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. The effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the Project can be assumed unlikely to reduce the area of occupancy of an important population. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.	**Unlikely**. No individuals have been observed within the Study Area. However, potential koala habitat does exist on site. As no populations have been detected, and the impacts are subsidence related, it is unlikely that the Project will reduce the area of occupancy of an important population. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.

Significant Impact Criteria	Greater Glider	Koala
Fragment an existing important population into two or more populations	**Unlikely**. 0 individuals have been observed within the Study Area. However, lack of detection does not provide definitive evidence that the species does not coincide within the Study Area. The species is known to inhabit areas within the Sydney Basin. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. The effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the Project can be assumed unlikely to fragment an existing important population into two or more populations	**Unlikely**. No individuals have been observed within the Study Area. However, potential koala habitat does exist on site. As no populations have been detected, and the impacts are subsidence related, it is unlikely that the Project will fragment and existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. 0 individuals have been observed within the Study Area. However, lack of detection does not provide definitive evidence that the species does not coincide within the Study Area. The species is known to inhabit areas within the Sydney Basin. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. The effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the Project can be assumed unlikely to adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No individuals have been observed within the Study Area. However, potential koala habitat does exist on site. Subsidence impacts are unlikely to adversely affect habitat critical to the survival of the koala.
Disrupt the breeding cycle of an important population	**Unlikely**. 0 individuals have been observed within the Study Area. However, lack of detection does not provide definitive evidence that the species does not coincide within the Study Area. The species is known to inhabit areas within the Sydney Basin. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. The effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the Project can be assumed unlikely to disrupt the breeding cycle of an important population	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. 0 individuals have been observed within the Study Area. However, lack of detection does not provide definitive evidence that the species does not coincide within the Study Area. The species is known to inhabit areas within the Sydney Basin. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. The effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.. Therefore the Project can be assumed unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. No individuals have been observed within the Study Area. However, potential koala habitat does exist on site. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however this species was not found in that area..Therefore the Project unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Project Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. 0 individuals have been observed within the Study Area. However, lack of detection does not provide definitive evidence that the species does not coincide within the Study Area. The species is known to inhabit areas within the Sydney Basin. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. The effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the Project can be assumed unlikely to interfere substantially with the recovery of the species	**Unlikely**. No individuals have been observed within the Study Area. However, potential koala habitat does exist on site. Subsidence impacts are to substantially interefere with the recovery of this species.

Significant Impact Criteria	Long-nosed Potoroo	New Holland Mouse
Lead to a long-term decrease in the size of an important population of a species	**Unlikely**. No individuals were detected within the Study Area during targeted surveys. However, potential habitat does exist on site. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (**Figure 1**) is 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1,100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Sinkholes have the potential to form along riparian zones, with greater potential occurring in the areas that overlap existing Awaba workings (**Figure 1**). Cracking may occur to varying extents in open areas and increased ponding could occur along riparian zones. The effects of subsidence on this species is unknown and would require future monitoring. In the absence of detection and potential impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of an important population of this species.	**Unlikely**. No individuals were detected within the Study Area during targeted surveys. However, potential habitat does exist on site. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (**Figure 1**) is 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1,100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Sinkholes have the potential to form along riparian zones, with greater potential occurring in the areas that overlap existing Awaba workings (**Figure 1**). Cracking may occur to varying extents in open areas and increased ponding could occur along riparian zones. The effects of subsidence on this species is unknown and would require future monitoring. In the absence of detection and potential impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of an important population of this species.
Reduce the area of occupancy of an important population	**Unlikely**. No individuals have been observed within the Study Area. However, potential habitat does exist on site. As no populations have been detected, and the impacts are subsidence related, it is unlikely that the Project will reduce the area of occupancy of an important population. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.	**Unlikely**. No individuals have been observed within the Study Area. However, potential habitat does exist on site. As no populations have been detected, and the impacts are subsidence related, it is unlikely that the Project will reduce the area of occupancy of an important population. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.
Fragment an existing important population into two or more populations	**Unlikely**. No individuals have been observed within the Study Area. However, potential habitat does exist on site. As no populations have been detected, and the potential impacts are subsidence related, it is unlikely that the Project will fragment an existing population into two or more populations.	**Unlikely**. No individuals have been observed within the Study Area. However, potential habitat does exist on site. As no populations have been detected, and the potential impacts are subsidence related, it is unlikely that the Project will fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No critical habitat has been declared for this species. Therefore, the Project is unlikely to adversely affect habitat critical to the survival of this species.	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No critical habitat has been declared for this species. Therefore, the Project is unlikely to adversely affect habitat critical to the survival of this species.
Disrupt the breeding cycle of an important population	**Unlikely**. No individuals have been observed within the Study Area. However, potential habitat does exist on site. As no individuals have been detected, and the potential impacts are subsidence related, it is unlikely that the Project will disrupt the breeding cycle of an important population.	**Unlikely**. No individuals have been observed within the Study Area. However, potential habitat does exist on site. As no individuals have been detected, and the potential impacts are subsidence related, it is unlikely that the Project will disrupt the breeding cycle of an important population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. No individuals have been observed within the Study Area. However, potential habitat does exist on site. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Therefore it is unlikely that the Project will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unlikely**. No individuals have been observed within the Study Area. However, potential habitat does exist on site. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Therefore it is unlikely that the Project will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The **Project** is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The **Project** is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. No individuals have been observed within the Study Area. However, potential habitat does exist on site. Subsidence impacts are to substantially interefere with the recovery of this species.	**Unlikely**. No individuals have been observed within the Study Area. However, potential habitat does exist on site. Subsidence impacts are to substantially interefere with the recovery of this species.

Assessment of Significance for endangered flora species

Significant Impact Criteria	*Cynanchum elegans*	*Microtis angusii*
Lead to a long-term decrease in the size of a population.	**Unlikely**. Targeted surveys during the flowering period *of C. elegans* failed to detect individuals within the Study Area. However, 30.23 ha of potential habitat occurs in PCT 1598 within the Study Area. In the absence of detection and impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of a population of this species.	**Unlikely**. This species was not detected during targeted surveys within the Study Area. However, a total of 64.2 ha of potential habitat occurs in the Study Area. *Microtis angusii* is currently known from one site at Ingleside, north of Sydney and approximately 134 km south of the Newstan Extension Study Area. *Microtis angusii* is known to be associated with highly disturbed areas with no or limited native vegetation. Areas within the Study Area such as; the powerline easements, road verges and existing disturbed areas provide potential habitat for this species. In the absence of detection and impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of a population of this species.
Reduce the area of occupancy of the species	**Unlikely**. 30.23 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. Thus, it is unlikely to reduce the area of occupancy of a population. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.	**Unlikely**. 64.2 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. Thus, it is unlikely to reduce the area of occupancy of a population. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.

Significant Impact Criteria	*Cynanchum elegans*	*Microtis angusii*
Fragment an existing population into two or more populations	**Unlikely**. 30.23 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. Thus, it is unlikely to fragment an existing population into two or more poulations.	**Unlikely**. 64.2 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. Thus, it is unlikely to fragment an existing population into two or more poulations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. Critical habitat has not been declared for this species. Therefore, it is unlikely that the Project will adversely affect habitat critical to the survival of this species.	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. Critical habitat has not been declared for this species. Therefore, it is unlikely that the Project will adversely affect habitat critical to the survival of this species.
Disrupt the breeding cycle of a population	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to disrupt the breeding cycle of a population.	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to disrupt the breeding cycle of a population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. 30.23 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Thus, it is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unlikely**. 64.2 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Thus, it is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. 30.23 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. Thus, the Project is unlikely to interfere substantially with the recovery of this species.	**Unlikely**. 64.2 ha of potential habitat occurs in the Study Area. However, no individuals were detected during surveys. Thus, the Project is unlikely to interfere substantially with the recovery of this species.

Assessment of Significance for endangered fauna species

Significant Impact Criteria	Spotted-tailed Quoll	Giant Barred Frog
Lead to a long-term decrease in the size of a population.	**Unlikely**. No individuals were detected during targeted survey efforts. However, a total of 1,048.4 ha of suitable habitat for Spotted-tailed Quolls exists within open forest within the Study Area. Individual animals use hollow-bearing trees, fallen logs, small caved, and rocky outcrops for as den sites, all of which have been recorded within the Study Area. These habitat types also support suitable prey items for the Spotted-tailed Quoll such as small terrestrial mammals, possums and gliders or roosting birds. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (**Figure 1**) is 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1,100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Sinkholes have the potential to form along riparian zones, with greater potential occurring in the areas that overlap existing Awaba workings (**Figure 1**). Cracking may occur to varying extents in open areas and increased ponding could occur along riparian zones Whilst the impacts on this species are not certain, the habitat types in which it could occur are not considered to be significantly impacted. It is unlikely that the Project would lead to a long-term decrease in the size of an population.	**Unlikely**. 0 individuals of this species were detected during targeted survey efforts. However, lack of detection does not provide definitive evidence that the species does not occur within the Study Area. A total of 85.6 ha of potential habitat was identified within the Study Area. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Whilst impacts from subsidence are not listed as a main threat to this species, changes to hydrology and reduction in water quality, which can be caused by subsidence, are threats to this species (Department of the Environment 2014b). The exact effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the Project can be assumed unlikely to lead to a long-term decrease in the size of a population.
Reduce the area of occupancy of the species	**Unlikely**. A total of 1,048.4 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys. Thus, this Project is unlikely to reduce the area of occupancy. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys	**Unlikely**. 0 individuals of this species were detected during targeted survey efforts. However, lack of detection does not provide definitive evidence that the species does not occur within the Study Area. A total of 85.6 ha of potential habitat was identified within the Study Area. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Whilst impacts from subsidence are not listed as a main threat to this species, changes to hydrology and reduction in water quality, which can be caused by subsidence, are threats to this species (Department of the Environment 2014b). The exact effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the project can be assumed unlikely to lead to Reduce the area of occupancy of the species . A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.
Fragment an existing population into two or more populations	**Unlikely**. A total of 1,048.4 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, the Project is unlikely to fragment an existing population into two or more populations.	**Unlikely**. 0 individuals of this species were detected during targeted survey efforts. However, lack of detection does not provide definitive evidence that the species does not occur within the Study Area. A total of

Significant Impact Criteria	Spotted-tailed Quoll	Giant Barred Frog
		85.6 ha of potential habitat was identified within the Study Area. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Whilst impacts from subsidence are not listed as a main threat to this species, changes to hydrology and reduction in water quality, which can be caused by subsidence, are threats to this species (Department of the Environment 2014b). The exact effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the Project can be assumed unlikely to lead to fragment an existing population into two or more populations
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No critical habitat for this species has been declared and this species was not detected within the Study Area. Therefore, the Project is unlikely to affect habitat critical to the survival of this species.	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. 0 individuals of this species were detected during targeted survey efforts. However, lack of detection does not provide definitive evidence that the species does not occur within the Study Area. A total of 85.6 ha of potential habitat was identified within the Study Area. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Whilst impacts from subsidence are not listed as a main threat to this species, changes to hydrology and reduction in water quality, which can be caused by subsidence, are threats to this species (Department of the Environment 2014b). The exact effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the Project can be assumed unlikely to lead to adversely affect habitat critical to the survival of a species
Disrupt the breeding cycle of a population	**Unlikely**. A total of 1,048.4 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, the Project is unlikely to disrupt the breeding cycle of a population.	**Unlikely**. 0 individuals of this species were detected during targeted survey efforts. However, lack of detection does not provide definitive evidence that the species does not occur within the Study Area. A total of 85.6 ha of potential habitat was identified within the Study Area. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Whilst impacts from subsidence are not listed as a main threat to this species, changes to hydrology and reduction in water quality, which can be caused by subsidence, are threats to this species (Department of the Environment 2014b). The exact effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the Project can be assumed unlikely to lead to disrupt the breeding cycle of a population
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. A total of 1,048.4 ha of potential habitat occurs in the StudyArea. However, no individuals were detected during targeted field surveys for this species. Whilst this species was not detected on site, suitable habtiat is present. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Therefore it is unlikely that it would be significant enough to modify, destroy, remove or isolate it such that this species declined. extent that the species is likely to decline.	**Unlikely**. 0 individuals of this species were detected during targeted survey efforts. However, lack of detection does not provide definitive evidence that the species does not occur within the Study Area. A total of 85.6 ha of potential habitat was identified within the Study Area. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Whilst impacts from subsidence are not listed as a main threat to this species, changes to hydrology and reduction in water quality, which can be caused by subsidence, are threats to this species (Department of the Environment 2014b). The exact effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.. Therefore the Project can be assumed unlikely to lead to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.

Significant Impact Criteria	Spotted-tailed Quoll	Giant Barred Frog
Interfere substantially with the recovery of the species	**Unlikely**. A total of 1,048.4 ha of potential habitat occurs in the Study Area. However, no individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to interfere substantially with the recovery of the species.	**Unlikely**. 0 individuals of this species were detected during targeted survey efforts. However, lack of detection does not provide definitive evidence that the species does not occur within the Study Area. A total of 85.6 ha of potential habitat was identified within the Study Area. Thus, in present, the occurrence of this species on site is possible. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (Figure 1) is 3250mm vertical subsidence, 100mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Whilst impacts from subsidence are not listed as a main threat to this species, changes to hydrology and reduction in water quality, which can be caused by subsidence, are threats to this species (Department of the Environment 2014b). The exact effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the Project can be assumed unlikely to lead to interfere substantially with the recovery of the species.

Significant Impact Criteria	Australian Painted Snipe
Lead to a long-term decrease in the size of a population	**Unlikely**. No individuals of this species were detected during targeted survey efforts. However, 47.7 ha of suitable suitable habitat occurs within the Study Area including dams and other small water bodies. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (**Figure 1**) is 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1,100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Sinkholes have the potential to form along riparian zones, with greater potential occurring in the areas that overlap existing Awaba workings (**Figure 1**). Cracking may occur to varying extents in open areas and increased ponding could occur along riparian zones. The effects of subsidence on this species is unknown and would require future monitoring. According to the Conservation Advice (SEWPAC 2013) the main identified threat to this species is the loss and degradation of wetland, through drainage and the diversion of water for agriculture and reservoirs. Without absolute certainty of the Project impacts, the impacts will be identified and quantified though a BMP. However, as the species was not detected, the Project is unlikely to lead to a long-term decrease in the size of a population.
Reduce the area of occupancy of the species	**Unlikely**. No individuals of this species were detected during targeted survey efforts. Thus, this Project is unlikely to reduce the area of occupancy of the species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.
Fragment an existing population into two or more populations	**Unlikely**. No individuals of this species were detected during targeted survey efforts. Thus, the Project is unlikely to fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No critical habitat for this species has been declared and this species was not detected within the Study Area. Therefore, the Project is unlikely to affect habitat critical to the survival of this species.
Disrupt the breeding cycle of apopulation	**Unlikely**. No individuals were detected during targeted field surveys for this species. Thus, the Project is unlikely to disrupt the breeding cycle of a population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. A maximum 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature is predicted where the proposed panels mine directly beneath existing workings. Without absolute certainty of the Project impacts, the impacts will be identified and quantified though a BMP. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys., therefore it is unlikely that the Project will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. No individuals were detected during targeted field surveys for this species. Thus, this Project is unlikely to interfere substantially with the recovery of the species.

Assessment of Significance for critically endangered flora species

Significant Impact Criteria	***Genoplesium insigne* (Syn. *Corunastylis insignis*)**
Lead to a long-term decrease in the size of a population	**Unlikely**. 88 individuals of this species were detected during targeted surveys within the power line easement to the north west of the Study Area. This species is also associated with PCT 1619 and 1636, and therefore has additional potential habitat of 902.9 ha within the Study Area. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (**Figure 1**) is 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1,100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature.

Significant Impact Criteria	*Genoplesium insigne* (Syn. *Corunastylis insignis*)
	Sinkholes have the potential to form along riparian zones, with greater potential occurring in the areas that overlap existing Awaba workings (**Figure 1**). Cracking may occur to varying extents in open areas and increased ponding could occur along riparian zones The effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, the PCTs in which this species is known to occur are not likely to experience subsidence related impacts such that the associated habitat values would be adversely impacted. Thus, the Project can be considered unlikely to lead to a long-term decrease in the size of apopulation.
Reduce the area of occupancy of the species	**Unlikely**. 88 individuals of this species were detected during targeted surveys. These observations indicate that potential habitat may be associated with PCTs 1619, 1636 and power easements. A total of 902.9 ha of potential habitat occurs in the Study Area. Subsidence predictions are not likely to significantly affect habtitat in which this species occurs. Whilst sink holes and cracks could occur, these impacts are unlikely to reduce the area of occupancy of this species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.
Fragment an existing population into two or more populations	**Unlikely**. 88 individuals of this species were detected during targeted surveys. A total of 902.9 ha of known and potential habitat occurs in the Study Area. Subsidence predictions are not likely to significantly affect habtitat in which this species occurs. Whilst sink holes and cracks could occur, these impacts are unlikely to fragment an existing population into two or more populations.
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. Critical habitat has not been declared for this species. Therefore, the Project is unlikely to adversely affect critical habitat for this species.
Disrupt the breeding cycle of apopulation	**Unlikely**. Subsidence is unlikely to prohibit pollinators from accessing the flowers of *G. insigne*. Thus, the proposal is not likely to disrupt the breeding cycle of a population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unknown**. A maximum 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature is predicted where the proposed panels mine directly beneath existing workings. Without absolute certainty of the Project impacts, the impacts will be identified and quantified though a BMP. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys., therefore it is unlikely that the Project will modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. No recovery plan exists for this species. While some habitat in which this species occurs may be impacted by subsidence impacts, it is not considered that the recovery of this species would be substantially interferred with as a result of the Project.

Assessment of Significance for critically endangered fauna species

Significant Impact Criteria	Regent Honeyeater	Swift Parrot
Lead to a long-term decrease in the size of a population	**Unlikely**. No individuals were detected within the Study Area during targeted surveys. However, 38.5 ha of potential habitat does exist on site, in PCT 1718. The preferred Swamp Mahogany foraging habitat is a dominant canopy or emergent species in PCTs 1649 and 1718. The available habitat is considered foraging habitat only, because the nearest confirmed breeding habitat is located in the Cessnock LGA. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (**Figure 1**) is 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1,100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Sinkholes have the potential to form along riparian zones, with greater potential occurring in the areas that overlap existing Awaba workings (**Figure 1**). Cracking may occur to varying extents in open areas and increased ponding could occur along riparian zones. In the absence of detection and potential impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of a population of the species.	**Unlikely**. No individuals were detected within the Study Area during targeted surveys. However, 948.7 ha of potential habitat does exist on site, in PCT 1649 and 1718. The preferred Swamp Mahogany foraging habitat is a dominant canopy or emergent species in PCT 1718. The available habitat is considered foraging habitat only, as this species only breeds in Tasmania. Further foraging habitat is available throughout much of the site with Forest Redgum being a dominant in PCT 1588 and 1598 and Red Bloodwood also occurring in PCTs 1619,1636 and 1638. The maximum predicted subsidence where the proposed panels mine directly beneath existing working (**Figure 1**) is 3,250 mm vertical subsidence, 100 mm/m tilt and 3.0 km-1 sagging curvature. The maximum predicted subsidence outside the extent of the existing Awaba workings are 1,100 mm vertical subsidence, 0.45 km-1 hogging and 60 km-1 sagging curvature. Sinkholes have the potential to form along riparian zones, with greater potential occurring in the areas that overlap existing Awaba workings (**Figure 1**). Cracking may occur to varying extents in open areas and increased ponding could occur along riparian zones. In the absence of detection and potential impacts being primarily subsidence related, the Project is unlikely to lead to a long-term decrease in the size of apopulation.
Reduce the area of occupancy of the species	**Unlikely**. No individuals have been observed within the Study Area. However, 38.5 ha of potential habitat does exist on site. As no populations have been detected, and the impacts are subsidence related, it is unlikely that the Project will reduce the area of occupancy of the species. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.	**Unlikely**. No individuals have been observed within the Study Area. However, 948.7 ha of potential habitat does exist on site. As no populations have been detected, and the impacts are subsidence related, it is unlikely that the Project will reduce the area of occupancy of the speices. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.
Fragment an existing population into two or more populations	**Unlikely**. No individuals have been observed within the Study Area. However, 38.5 ha of potential habitat does exist on site. As no populations have been detected, and the impacts are subsidence related, it is unlikely that the Project will fragment an existing population into two or more populations.	**Unlikely** No individuals have been observed within the Study Area. However, 948.7 ha of potential habitat does exist on site. As no populations have been detected, and the impacts are subsidence related, it is unlikely that the Project will fragment an existing population into two or more populations.

Significant Impact Criteria	Regent Honeyeater	Swift Parrot
Adversely affect habitat critical to the survival of a species	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No individuals have been observed within the Study Area. However, 38.5 ha of potential habitat does exist on site. Subsidence impacts are unlikely to adversely affect habitat critical to the survival of this species.	**Unlikely**. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project. No individuals have been observed within the Study Area. However, 948.7 ha of potential habitat does exist on site. Subsidence impacts are unlikely to adversely affect habitat critical to the survival of this species.
Disrupt the breeding cycle of apopulation	**Unlikely**. No individuals were found within the Study Area. Thus, it is unlikely to disrupt the breeding cycle of a population.	**Unlikely**. This species breeds only in Tasmania. Thus, it is unlikely to disrupt the breeding cycle of a population.
Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	**Unlikely**. No individuals have been observed within the Study Area. However, 38.5 ha potential habitat does exist on site. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys.Therefore it is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	**Unlikely**. No individuals have been observed within the Study Area. However, 948.7 ha potential habitat does exist on site. A total of 0.32 ha of native vegetation is proposed to be cleared as part of the Project, however, this species was not identified in that area during targeted surveys., therefore it is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.	**Unlikely**. It is unlikely that the Study Area will experience an increase in invasive species due to the Project as weed management protocols would be followed during all works.
Introduce disease that may cause the species to decline	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.	**Unlikely**. The Project is unlikely to introduce a disease that may cause the species to decline.
Interfere substantially with the recovery of the species	**Unlikely**. No individuals have been observed within the Study Area. However, potential habitat does exist on site. Subsidence impacts are to substantially interefere with the recovery of this species. The effects of subsidence on this species is unknown and would require monitoring if the species was detected on site in future. However, as the species was not detected, the Project can be assumed unlikely to interfere substantially with the recovery of the species	**Unlikely**. No individuals have been observed within the Study Area. However, potential habitat does exist on site. Subsidence impacts are to substantially interefere with the recovery of this species.

Appendix E

EPBC Act Protected Matters Search

Australian Government
Department of the Environment and Energy

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

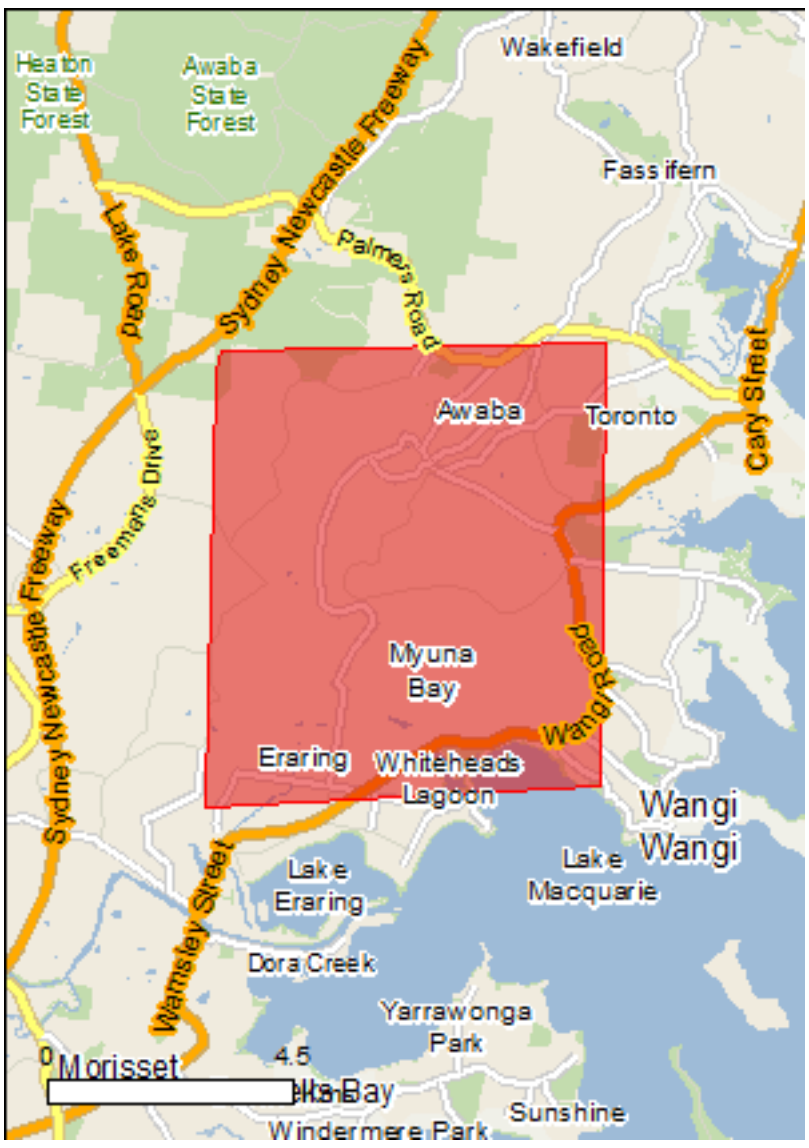
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 01/06/19 13:44:36

Summary
Details
- Matters of NES
- Other Matters Protected by the EPBC Act
- Extra Information

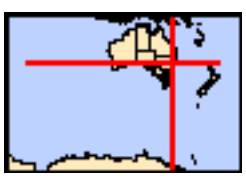
Caveat
Acknowledgements



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2010

Coordinates

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	5
Listed Threatened Species:	78
Listed Migratory Species:	67

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	4
Commonwealth Heritage Places:	None
Listed Marine Species:	89
Whales and Other Cetaceans:	14
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	10
Regional Forest Agreements:	1
Invasive Species:	49
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Hunter estuary wetlands	Within 10km of Ramsar

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Central Hunter Valley eucalypt forest and woodland	Critically Endangered	Community may occur within area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion	Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Status	Type of Presence
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat known to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limosa lapponica baueri Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Rostratula australis Australian Painted-snipe, Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta cauta Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Epinephelus daemelii Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat may occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria littlejohni Littlejohn's Tree Frog, Heath Frog [64733]	Vulnerable	Species or species habitat likely to occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mixophyes iteratus Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat known to occur within area
Mammals		
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
Potorous tridactylus tridactylus Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat known to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat known to occur within area
Angophora inopina Charmhaven Apple [64832]	Vulnerable	Species or species habitat known to occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area
Corunastylis insignis Wyong Midge Orchid 1, Variable Midge Orchid 1 [84692]	Critically Endangered	Species or species habitat known to occur within area
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat known to occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat known to occur within area
Diuris praecox Newcastle Doubletail [55086]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus camfieldii Camfield's Stringybark [15460]	Vulnerable	Species or species habitat likely to occur within area
Eucalyptus parramattensis subsp. decadens Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat likely to occur within area
Grevillea parviflora subsp. parviflora Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence within area
[Persoonia hirsuta](#) Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat may occur within area
[Pterostylis gibbosa](#) Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
[Rhizanthella slateri](#) Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
[Rutidosis heterogama](#) Heath Wrinklewort [13132]	Vulnerable	Species or species habitat known to occur within area
[Syzygium paniculatum](#) Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area
[Tetratheca juncea](#) Black-eyed Susan [21407]	Vulnerable	Species or species habitat known to occur within area
[Thesium australe](#) Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat may occur within area
Reptiles		
[Caretta caretta](#) Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
[Chelonia mydas](#) Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
[Dermochelys coriacea](#) Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
[Eretmochelys imbricata](#) Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
[Hoplocephalus bungaroides](#) Broad-headed Snake [1182]	Vulnerable	Species or species habitat likely to occur within area
[Natator depressus](#) Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
[Carcharias taurus (east coast population)](#) Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat likely to occur within area
[Carcharodon carcharias](#) White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
[Rhincodon typus](#) Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		

Name	Threatened	Type of Presence
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]		Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour known to occur within area
[Orcinus orca](#) Killer Whale, Orca [46]		Species or species habitat may occur within area
[Rhincodon typus](#) Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
[Sousa chinensis](#) Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
[Cuculus optatus](#) Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat may occur within area
[Hirundapus caudacutus](#) White-throated Needletail [682]		Species or species habitat known to occur within area
[Monarcha melanopsis](#) Black-faced Monarch [609]		Species or species habitat known to occur within area
[Monarcha trivirgatus](#) Spectacled Monarch [610]		Species or species habitat known to occur within area
[Motacilla flava](#) Yellow Wagtail [644]		Species or species habitat likely to occur within area
[Myiagra cyanoleuca](#) Satin Flycatcher [612]		Species or species habitat known to occur within area
[Rhipidura rufifrons](#) Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
[Actitis hypoleucos](#) Common Sandpiper [59309]		Species or species habitat known to occur within area
[Arenaria interpres](#) Ruddy Turnstone [872]		Species or species habitat known to occur within area
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
[Calidris canutus](#) Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat known to occur within area
[Calidris ruficollis](#) Red-necked Stint [860]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land - Australian Postal Commission
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Service Homes Corporation
Commonwealth Land - Director of War Service Homes

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		

Name	Threatened	Type of Presence
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Breeding likely to occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
Diomedea gibsoni Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]		Species or species habitat known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche sp. nov. Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Fish		
Acentronura tentaculata Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		Species or species habitat likely to occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area

Name	Status	Type of Presence
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Forestry Management Areas in Morisset	NSW
LNE Special Management Zone No1	NSW
Lake Macquarie	NSW
Munmorah	NSW
Pulbah Island	NSW
Sugarloaf	NSW
The Hunter Lakes	NSW
Tingira Heights	NSW
Wallarah	NSW
Watagans	NSW

Regional Forest Agreements	[Resource Information]

Note that all areas with completed RFAs have been included.

Name	State

Name	State
North East NSW RFA	New South Wales

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Asparagus scandens Asparagus Fern, Climbing Asparagus Fern [23255]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Cytisus scoparius Broom, English Broom, Scotch Broom, Common Broom, Scottish Broom, Spanish Broom [5934]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Nassella neesiana Chilean Needle grass [67699]		Species or species habitat likely to occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Ulex europaeus Gorse, Furze [7693]		Species or species habitat likely to occur within area

Nationally Important Wetlands	[Resource Information]
Name	State
Lake Macquarie	NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-33.00918 151.50436,-33.00659 151.50538,-33.00544 151.56856,-33.06674 151.56753,-33.06991 151.50264,-33.00918 151.50436

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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Appendix F

BAM Candidate Species

BAM Candidate Species Report

Proposal Details

Assessment Id
00013177/BAAS18060/19/00013178

Proposal Name
Newstan Extension Project BRAT Output

BAM data last updated *
30/08/2019

Assessor Name
Joe May

Report Created
31/10/2019

BAM Data version *
13

Assessor Number
BAAS18060

Assessment Type
Major Projects

BAM Case Status
Open

Assessment Revision
0

Date Finalised
To be finalised

* 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.

List of Species Requiring Survey

Name	Presence	Survey Months
Burhinus grallarius Bush Stone-curlew		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Calidris tenuirostris Great Knot		Jan Feb Mar Sep Oct Nov Dec
Crinia tinnula Wallum Froglet		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Maundia triglochinoides Maundia triglochinoides		Jan Feb Mar Nov Dec
Melaleuca biconvexa Biconvex Paperbark		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Limicola falcinellus Broad-billed Sandpiper		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Limosa limosa Black-tailed Godwit		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Litoria aurea Green and Golden Bell Frog		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Litoria brevipalmata Green-thighed Frog		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Myotis macropus Southern Myotis		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Nettapus coromandelianus Cotton Pygmy-Goose		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Haliaeetus leucogaster White-bellied Sea-Eagle		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Uperoleia mahonyi Mahony's Toadlet		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Pandion cristatus Eastern Osprey		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Persicaria elatior Tall Knotweed		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Petalura gigantea Giant Dragonfly		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Xenus cinereus Terek Sandpiper		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Zannichellia palustris Zannichellia palustris		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Turnix maculosus Red-backed Button-quail		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Hieraaetus morphnoides Little Eagle		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Calidris ferruginea Curlew Sandpiper		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Acacia bynoeana Bynoe's Wattle		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Angophora inopina Charmhaven Apple		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Astrotricha crassifolia Thick-leaf Star-hair		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Caladenia tessellata Thick Lip Spider Orchid		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Callistemon linearifolius Netted Bottle Brush		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Calyptorhynchus lathami Glossy Black-Cockatoo		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Cercartetus nanus Eastern Pygmy-possum		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Eucalyptus camfieldii Camfield's Stringybark		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Eucalyptus parramattensis subsp. decadens Eucalyptus parramattensis subsp. decadens		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Chalinolobus dwyeri Large-eared Pied Bat		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Grevillea parviflora subsp. parviflora Small-flower Grevillea		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Cryptostylis hunteriana Leafless Tongue Orchid		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Cynanchum elegans White-flowered Wax Plant		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Darwinia glaucophylla Darwinia glaucophylla		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Diuris praecox Rough Doubletail		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Genoplesium insigne Variable Midge Orchid		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Heleioporus australiacus Giant Burrowing Frog		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Hibbertia procumbens Spreading Guinea Flower		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Hoplocephalus bitorquatus Pale-headed Snake		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Hoplocephalus bungaroides Broad-headed Snake		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Macropus parma Parma Wallaby		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Lathamus discolor Swift Parrot		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Melaleuca groveana Grove's Paperbark		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Lophoictinia isura Square-tailed Kite		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Miniopterus australis Little Bentwing-bat		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Pseudophryne australis Red-crowned Toadlet		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Miniopterus schreibersii oceanensis Eastern Bentwing-bat		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

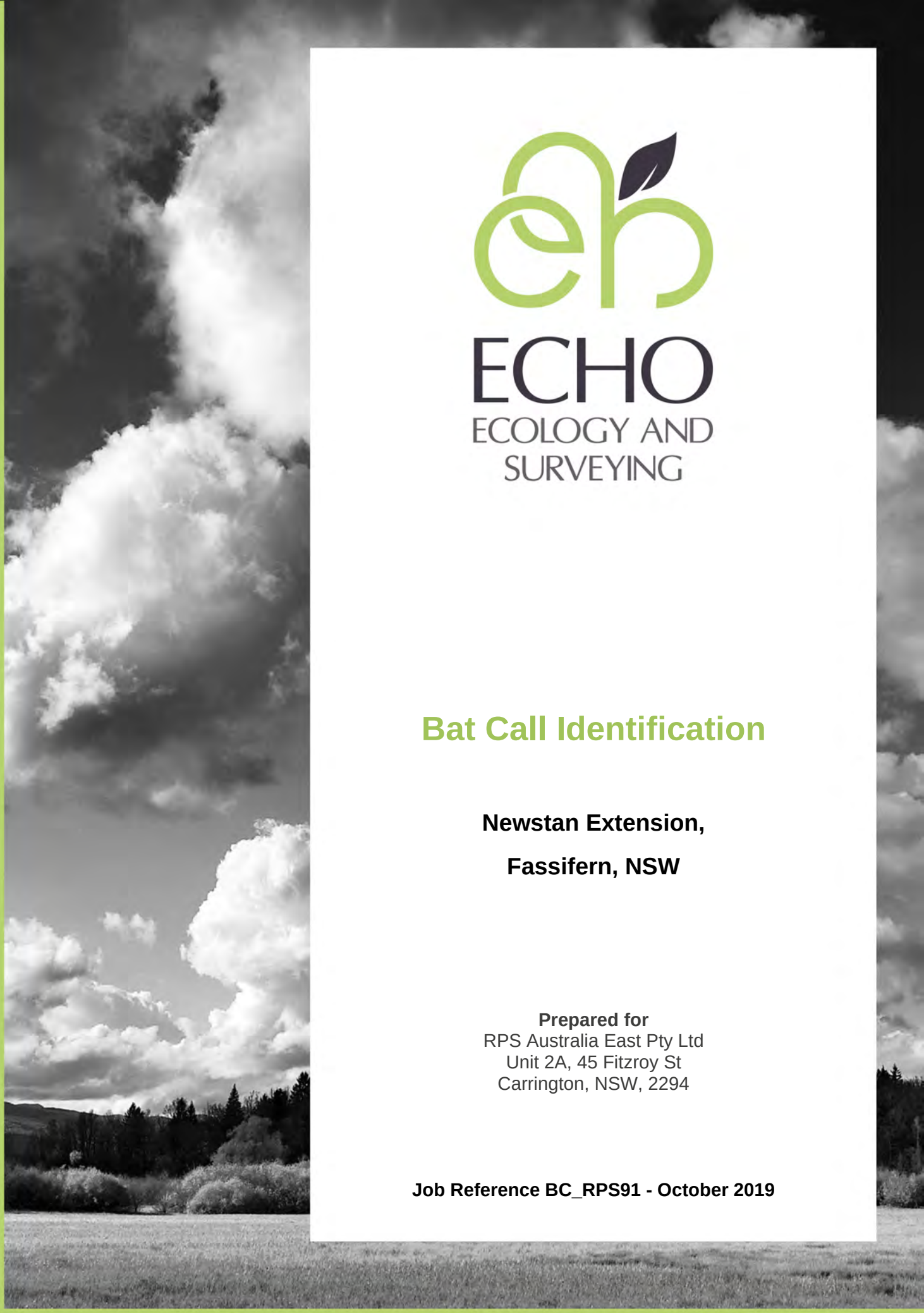
Mixophyes balbus Stuttering Frog		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Mixophyes iteratus Giant Barred Frog		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Ninox strenua Powerful Owl		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Petaurus norfolcensis Squirrel Glider		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Petrogale penicillata Brush-tailed Rock-wallaby		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Phascogale tapoatafa Brush-tailed Phascogale		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Phascolarctos cinereus Koala		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Planigale maculata Common Planigale		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Prostanthera askania Tranquility Mintbush		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Prostanthera junonis Somersby Mintbush		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Pteropus poliocephalus Grey-headed Flying-fox		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Rutidosis heterogama Heath Wrinklewort		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Senna acclinis Rainforest Cassia		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Tetratheca glandulosa Tetratheca glandulosa		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Tetratheca juncea Black-eyed Susan		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Tyto novaehollandiae Masked Owl		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Vespadelus troughtoni Eastern Cave Bat		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Anthochaera phrygia Regent Honeyeater		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Callocephalon fimbriatum Gang-gang Cockatoo		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Diuris bracteata Diuris bracteata		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Eucalyptus parramattensis subsp. parramattensis - endangered population Eucalyptus parramattensis C. Hall. subsp. parramattensis in Wyong and Lake Macquarie local government areas		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Eucalyptus oblonga - endangered population Eucalyptus oblonga population at Bateau Bay, Forresters Beach and Tumbi Umbi in the Wyong local government area		Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Appendix G

Bat Call Identification



ECHO
ECOLOGY AND
SURVEYING

Bat Call Identification

Newstan Extension,

Fassifern, NSW

Prepared for
RPS Australia East Pty Ltd
Unit 2A, 45 Fitzroy St
Carrington, NSW, 2294

Job Reference BC_RPS91 - October 2019

Echo Ecology and Surveying • PO Box 4132 Crescent Head
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This report has been prepared to document the analysis of digital ultrasonic bat echolocation calls received from a third party. The data was not collected by the author and as such no responsibility is taken for the quality of data collection or for the suitability of its subsequent use.

This report was authored by



Dr Anna McConville
PhD, B.Env.Sc.

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Figure 4-5: *Miniopterus orianae oceanensis* probable call 10

Figure 4-6: *Mormopterus norfolkensis* definite call 11

Figure 4-7: *Mormopterus ridei* definite call 11

Figure 4-8: *Rhinolophus megaphyllus* definite call 11

Figure 4-9: *Scoteanax rueppellii* probable call..... 12

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1.0 INTRODUCTION

This report has been commissioned by RPS Australia East Pty Ltd to analyse bat echolocation call data collected from Newstan, Newstan Major Extension, Fassifern, NSW. Data was provided electronically to the author. This report documents the methods involved in analysing bat call data and the results obtained only.

2.0 METHODS

2.1 Call Identification

The identification of bat echolocation calls recorded during surveys was undertaken using Anabat Insight (Titley Electronics, Version 1.9.0) software. Files from Anabat Express units (.zca) were first converted to .zc using Anabat Insight (Titley Electronics, Version 1.9.0) and a noise filter was applied (EE_Allbats.als). The identification of calls was undertaken with reference to Pennay et al. (2004) and through the comparison of recorded reference calls from the Sydney Basin. Reference calls were obtained from the NSW database and from the authors personal collection.

A list of potentially occurring echolocating bat species for the region (approximately 50 – 100 km radius) was obtained from the NSW Office of Environment and Heritage's Bionet Atlas, which holds data from a number of custodians (http://www.bionet.nsw.gov.au) and was used to constrain the identification of bat calls.

Each call sequence ('pass') was assigned to one of five categories, according to the confidence with which an identification could be made, being:

- Definite - Pass identified to species level and could not be confused with another species
- Probable - Pass identified to species level and there is a low chance of confusion with another species
- Possible - Pass identified to species level but short duration or poor quality of the pass increases the chance of confusion with another species
- Species group - Pass could not be identified to species level and could belong to one of two or more species. Occurs more frequently when passes are short or of poor quality

- Unknown - Either background ‘noise’ files or passes by bats which are too short and/or of poor quality to confidently identify.

Call sequences that were less than three pulses in length were not analysed and were assigned to ‘Unknown’ and only search phase calls were analysed. Furthermore, some species are difficult to differentiate using bat call analysis due to overlapping call frequencies and similar shape of plotted calls and in these cases calls were assigned to species groups.

The total number of passes (call sequences) per unit per night was tallied to give an index of activity.

Nomenclature follows the Australian Chiroptera taxonomic list described by Reardon et al. (2015).

The echolocation call characteristics used to differentiate species for the region and the identification potential for each species are described in Appendix A.

2.2 Log file review

We reviewed the log files for each night of recording and have summarised the detector settings, recording duration and any errors. This may be used to confirm survey effort, the use of correct detector settings and may help diagnose missing data.

2.3 Limitations

The identification of bat species from echolocation calls in many Australian regions is not straightforward. Our reference call libraries tend to be relatively small, some species vary their call frequency with region and bat behaviour may also influence call shapes and frequencies. Additional factors may add to the level of uncertainty of species identification from echolocation calls such as short call sequences, high levels of noise and missing echolocation pulses. Some species share overlapping echolocation call characteristics and some overlap so much that we are unable to differentiate between species with our current knowledge.

To assist with the interpretation of our results within this context of uncertainty, we provide a qualitative indication of the confidence of bat call identification by assigning confidence levels (Definite, Probable, Possible and Species Groups). We have also provided a list of the general identification potential for each species potentially occurring within your sample region (Appendix A). For a more complete species inventory, bat call recording should be combined with other survey methods such as trapping.

It should be noted that the activity levels recorded at different sites may not be readily able to be compared. Activity levels should not be compared among species as different species have different detectability due to factors such as call loudness, foraging strategy and call identifying features. Activity comparisons among sites are dependent on many variables which need to be carefully controlled during data collection and statistically analysed. Influential variables include wind, rain, temperature, duration of recording, season, detector and microphone sensitivity, detector placement, weather protection devices etc.

The bat call identification results presented in this report should be interpreted with these limitations in mind and in many cases trapping and habitat assessment should also be undertaken in conjunction with bat call recording.

3.0 RESULTS

A total of 21,191 call sequences were recorded, of which 3,916 call sequences were able to be analysed (ie were not 'noise' files or bat calls of short length). Of the bat calls, 1,288 call sequences (33 %) were able to be confidently identified (those classified as either definite or probable identifications) to species level (Table 3-1). Species recorded confidently within the site include:

- *Austronomus australis* (White-striped Free-tailed Bat)
- *Chalinolobus gouldii* (Gould's Wattled Bat)
- *Chalinolobus morio* (Chocolate Wattled Bat)
- *Miniopterus australis* (Little Bent-winged Bat)
- *Miniopterus orianae oceanensis* (Eastern Bent-winged Bat)
- *Mormopterus norfolkensis* (Eastern coastal Free-tailed Bat)
- *Mormopterus ridei* (Ride's Free-tailed Bat)
- *Rhinolophus megaphyllus* (Eastern Horseshoe Bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Vespadelus pumilus* (Eastern Forest Bat)

Additionally, the following bat species potentially occurred within the site, but could not be confidently identified (those calls classified as possible or as a species group):

- *Chalinolobus dwyeri* (Large-eared Pied Bat)
- *Falsistrellus tasmaniensis* (Eastern Falsistrelle)
- *Myotis macropus* (Large-footed Myotis)
- *Nyctophilus geoffroyi* (Lesser long-eared bat)
- *Nyctophilus gouldi* (Gould's long-eared bat)
- *Saccolaimus flaviventris* (Yellow-bellied Sheath-tailed Bat)
- *Scotorepens orion* (Eastern Broad-nosed Bat)

- *Vespadelus darlingtoni* (Large Forest Bat)
- *Vespadelus regulus* (Southern Forest Bat)
- *Vespadelus troughtoni* (Eastern cave bat)
- *Vespadelus vulturnus* (Little Forest Bat)

It should be noted that additional bat species may be present within the site but were not recorded by the detectors (or are difficult to identify by bat call) and habitat assessment should be used in conjunction with these results to determine the likelihood of occurrence of other bat species.

Table 3-1 below summarises the results of the bat call analysis.

3.1 Log file review

The log file review indicated that detectors were mostly set for entire nights and functioning correctly. Full details are provided in Appendix B and these should be checked against the recordings.

Table 3-1: Results of bat call analysis (number of passes per site per night)

CONFIDENCE	IDENTIFICATION	Grid 1 9/01/2019	Grid 1 10/01/2019	Grid 11/01/2019	Grid 1 12/01/2019	Grid 2 4/02/2019	Grid 2 5/02/2019	Grid 2 6/02/2019	Grid 2 7/02/2019	Grid 2 8/02/2019	Grid 2 9/02/2019	Grid 2 10/02/2019	Grid 2 11/02/2019	Grid 2 12/02/2019	Grid 3 9/01/2019	Grid 3 5/02/2019	Grid 3 6/02/2019	Grid 3 7/02/2019	Grid 3 8/02/2019	Grid 3 9/02/2019	Grid 3 10/02/2019	Grid 3 11/02/2019	Grid 3 12/02/2019	Grid 4b/5a 9/01/2019	Grid 4b/5a 10/01/2019
DEFINITE	*Austronomus australis*	-	-	2	-	250	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-
	Chalinolobus gouldii	-	2	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chalinolobus morio	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
	Miniopterus australis	2	1	3	2	-	1	1	6	4	8	1	2	-	4	-	-	-	-	-	-	-	-	-	-
	Mormopterus norfolkensis	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mormopterus ridei	-	2	-	-	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-
	Rhinolophus megaphyllus	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PROBABLE	*Austronomus australis*	-	-	-	-	13	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-
	Chalinolobus gouldii	2	2	1	-	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
	Chalinolobus morio	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
	Miniopterus australis	3	3	5	14	1	5	2	19	1	7	6	12	5	2	-	-	-	-	-	-	-	-	-	-
	Miniopterus orianae oceanensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mormopterus norfolkensis	-	-	-	-	8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Mormopterus ridei	1	3	-	-	9	-	2	1	-	1	-	-	-	-	-	2	1	-	-	1	-	-	-	-
	Rhinolophus megaphyllus	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	2	-	-	-	2	-	-	-
	Scoteanax rueppellii	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Vespadelus pumilus	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
POSSIBLE	*Austronomus australis*	-	-	1	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chalinolobus dwyeri	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
	Chalinolobus gouldii	2	1	-	-	1	-	-	-	-	-	-	-	-	1	2	-	4	2	2	1	-	-	-	-
	Miniopterus australis	1	-	-	-	-	-	6	-	-	4	3	5	7	6	-	-	-	-	-	-	-	-	-	-
	Miniopterus orianae oceanensis	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

CONFIDENCE	IDENTIFICATION	Grid 1 9/01/2019	Grid 1 10/01/2019	Grid 11/01/2019	Grid 1 12/01/2019	Grid 2 4/02/2019	Grid 2 5/02/2019	Grid 2 6/02/2019	Grid 2 7/02/2019	Grid 2 8/02/2019	Grid 2 9/02/2019	Grid 2 10/02/2019	Grid 2 11/02/2019	Grid 2 12/02/2019	Grid 3 9/01/2019	Grid 3 5/02/2019	Grid 3 6/02/2019	Grid 3 7/02/2019	Grid 3 8/02/2019	Grid 3 9/02/2019	Grid 3 10/02/2019	Grid 3 11/02/2019	Grid 3 12/02/2019	Grid 4b/5a 9/01/2019	Grid 4b/5a 10/01/2019
	Mormopterus ridei	-	-	1	-	5	-	-	-	-	1	-	2	-	-	-	-	-	-	-	1	1	-	-	-
	Saccolaimus flaviventris	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
SPECIES GROUPS	*Austronomus australis / Saccolaimus flaviventris*	-	-	-	-	4	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chalinolobus gouldii / Mormopterus norfolkensis / Mormopterus ridei	3	6	3	-	27	1	1	1	3	2	2	1	1	2	6	7	8	-	2	-	6	1	-	-
	Chalinolobus gouldii / Mormopterus ridei	5	2	9	9	64	2	5	5	-	9	1	3	1	2	2	6	5	10	5	-	-	4	3	-
	Chalinolobus gouldii / Scoteanax rueppellii	1	5	3	4	14	-	-	-	2	-	-	1	-	-	1	-	-	-	-	-	-	1	-	1
	Chalinolobus morio / Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	10	3	4	18	-	22	39	21	24	95	17	48	114	9	-	-	-	-	-	-	-	-	-	-
	Falsistrellus tasmaniensis / Scotorepens orion	6	4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Falsistrellus tasmaniensis / Scotorepens orion / Scoteanax rueppellii	95	64	1	3	30	-	-	-	-	-	-	2	-	-	3	1	1	1	-	-	-	-	-	-
	Miniopterus australis / Vespadelus pumilus	26	11	22	26	1	15	25	13	75	33	17	18	20	27	-	-	-	-	-	-	-	-	-	-
	Miniopterus orianae oceanensis / Vespadelus darlingtoni / Vespadelus regulus	1	2	2	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
	Mormopterus norfolkensis / Mormopterus ridei	-	8	-	-	18	2	1	1	-	-	2	1	-	-	-	1	-	-	-	-	-	-	-	-
	Myotis macropus / Nyctophilus geoffroyi / Nyctophilus gouldi	2	1	1	1	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
UNKNOWN	Unknown	21	32	30	28	47	44	49	46	34	81	28	61	69	22	9	11	6	6	3	6	9	6	3	6
	'Noise' files	490	487	876	449	291	300	339	223	871	197	135	261	220	227	267	357	248	888	178	231	88	570	13	13
TOTAL		**673**	**640**	**966**	**557**	**799**	**393**	**471**	**338**	**1018**	**438**	**212**	**418**	**438**	**306**	**290**	**385**	**276**	**907**	**190**	**242**	**108**	**582**	**19**	**20**

CONFIDENCE	IDENTIFICATION	Grid 7b 11/01/2019	Grid 7b 12/01/2019	Grid 7b 13/01/2019	Grid 8a 11/01/2019	Grid 8a 12/01/2019	Grid 8b 30/01/2019	Grid 8b 31/01/2019	Grid 8b 1/02/2019	Grid 8b 2/02/2019	Grid 8b 3/02/2019	Grid 9a1 31/01/2019	Grid 9a1 1/02/2019	Grid 9a1 2/02/2019	Grid 9a1 3/02/2019	Grid 9a1 4/02/2019	Grid 9a2 11/01/2019	Grid 9a2 12/01/2019	Grid 9a2 13/01/2019	Grid 10b 11/01/2019	Grid 10b 12/01/2019	Grid 10b 13/01/2019
DEFINITE	*Austronomus australis*	-	2	2	-	-	-	35	77	157	247	3	-	-	1	5	2	4	3	4	-	1
	Chalinolobus gouldii	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	2	2	-	1	-
	Chalinolobus morio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Miniopterus australis	-	3	2	-	-	-	1	-	1	2	-	-	-	-	-	4	4	4	11	25	6
	Mormopterus norfolkensis	-	-	-	-	-	-	-	-	2	1	-	-	1	-	-	-	-	-	-	-	-
	Mormopterus ridei	-	-	-	-	-	-	1	-	15	10	-	-	-	4	19	-	3	2	-	-	1
	Rhinolophus megaphyllus	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-
PROBABLE	*Austronomus australis*	-	-	-	1	-	-	5	8	9	3	1	-	-	-	-	-	-	-	-	-	-
	Chalinolobus gouldii	-	-	-	-	-	-	-	-	1	2	-	-	-	-	-	2	2	3	2	-	-
	Chalinolobus morio	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Miniopterus australis	-	7	3	1	-	-	-	-	2	1	-	-	-	-	-	-	1	2	5	7	1
	Miniopterus orianae oceanensis	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-
	Mormopterus norfolkensis	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-
	Mormopterus ridei	-	-	1	-	-	-	-	1	28	10	-	-	10	4	23	1	1	5	-	-	1
	Rhinolophus megaphyllus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Scoteanax rueppellii	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-
	Vespadelus pumilus	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
POSSIBLE	*Austronomus australis*	-	1	-	-	-	-	-	1	3	1	-	-	-	-	-	-	-	1	-	-	-
	Chalinolobus dwyeri	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Chalinolobus gouldii	-	-	1	-	-	-	-	-	1	5	-	-	-	-	-	3	6	4	1	2	-
	Miniopterus australis	-	1	3	-	1	-	-	-	-	-	-	-	-	-	-	1	1	-	-	2	2
	Miniopterus orianae oceanensis	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
	Mormopterus ridei	-	-	-	-	-	-	-	-	2	1	-	-	1	5	4	3	4	-	-	-	-

CONFIDENCE	IDENTIFICATION	Grid 7b 11/01/2019	Grid 7b 12/01/2019	Grid 7b 13/01/2019	Grid 8a 11/01/2019	Grid 8a 12/01/2019	Grid 8b 30/01/2019	Grid 8b 31/01/2019	Grid 8b 1/02/2019	Grid 8b 2/02/2019	Grid 8b 3/02/2019	Grid 9a1 31/01/2019	Grid 9a1 1/02/2019	Grid 9a1 2/02/2019	Grid 9a1 3/02/2019	Grid 9a1 4/02/2019	Grid 9a2 11/01/2019	Grid 9a2 12/01/2019	Grid 9a2 13/01/2019	Grid 10b 11/01/2019	Grid 10b 12/01/2019	Grid 10b 13/01/2019
	Saccolaimus flaviventris	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SPECIES GROUPS	*Austronomus australis / Saccolaimus flaviventris*	-	-	-	-	-	-	1	-	1	-	-	-	-	1	-	-	-	-	-	-	-
	Chalinolobus gouldii / Mormopterus norfolkensis / Mormopterus ridei	2	3	4	9	1	-	-	-	21	39	2	-	12	23	17	11	21	10	4	2	-
	Chalinolobus gouldii / Mormopterus ridei	3	5	4	32	8	-	8	3	105	56	1	-	26	15	27	28	88	28	9	8	9
	Chalinolobus gouldii / Scoteanax rueppellii	1	1	2	-	1	-	5	-	13	9	3	-	4	7	3	10	30	15	-	2	2
	Chalinolobus morio / Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	-	27	32	-	-	-	-	-	2	2	-	-	4	3	2	-	2	-	7	20	83
	Falsistrellus tasmaniensis / Scotorepens orion	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	1	3
	Falsistrellus tasmaniensis / Scotorepens orion / Scoteanax rueppellii	-	1	-	1	-	-	-	1	6	9	-	-	1	-	1	-	16	3	1	4	-
	Miniopterus australis / Vespadelus pumilus	-	29	58	2	3	-	-	1	4	1	-	-	2	5	-	-	2	3	13	9	19
	Miniopterus orianae oceanensis / Vespadelus darlingtoni / Vespadelus regulus	-	-	-	-	-	-	1	1	8	1	1	-	-	-	-	-	1	-	-	-	-
	Mormopterus norfolkensis / Mormopterus ridei	-	-	-	-	-	-	-	-	7	19	-	-	4	4	8	1	3	-	-	-	-
	Myotis macropus / Nyctophilus geoffroyi / Nyctophilus gouldi	-	1	1	-	-	-	-	-	-	-	-	-	-	1	-	-	3	1	1	1	-
	Vespadelus pumilus / Vespadelus vulturnus / Vespadelus troughtoni	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-
UNKNOWN	Unknown	1	25	45	33	24	-	26	33	43	55	10	-	15	38	50	21	73	28	19	23	45
	'Noise' files	381	923	741	25	13	2	714	382	117	182	801	115	278	254	270	90	253	232	885	450	680
TOTAL		**388**	**1030**	**899**	**104**	**51**	**2**	**797**	**508**	**550**	**659**	**822**	**115**	**360**	**365**	**429**	**178**	**521**	**346**	**966**	**558**	**853**

4.0 SAMPLE CALLS

A sample of the calls actually identified from the site for each species is given below.

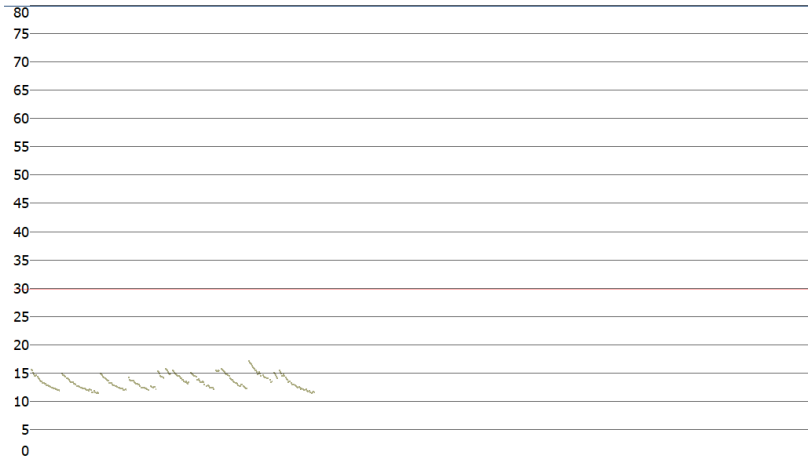


Figure 4-1: *Austronomus australis* definite call

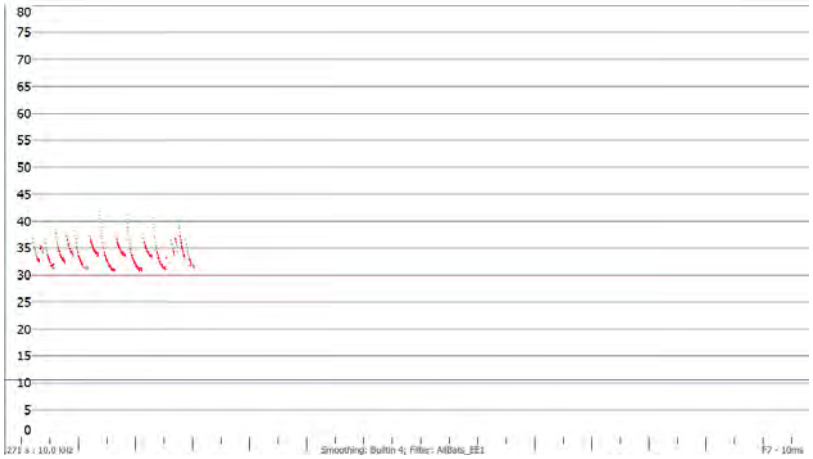


Figure 4-2: *Chalinolobus gouldii* definite call

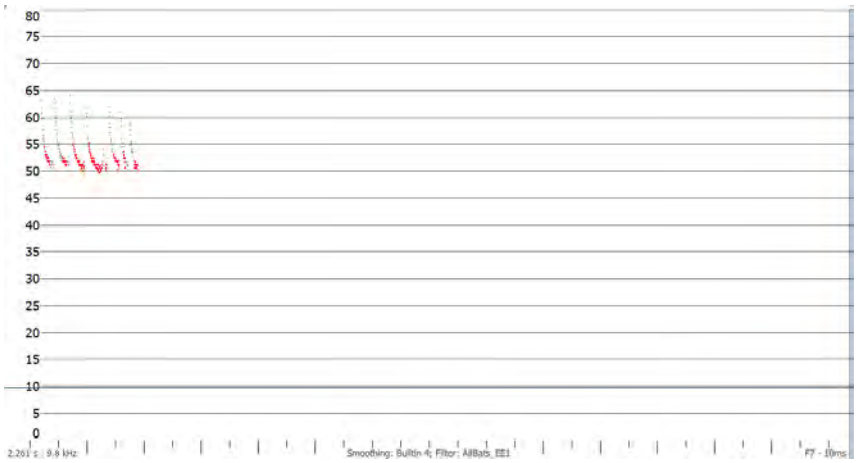


Figure 4-3: *Chalinolobus morio* definite call

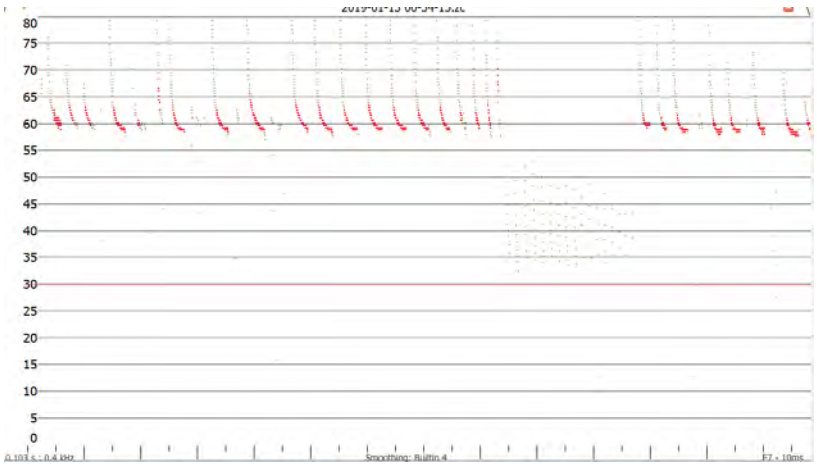


Figure 4-4: *Miniopterus australis* definite call

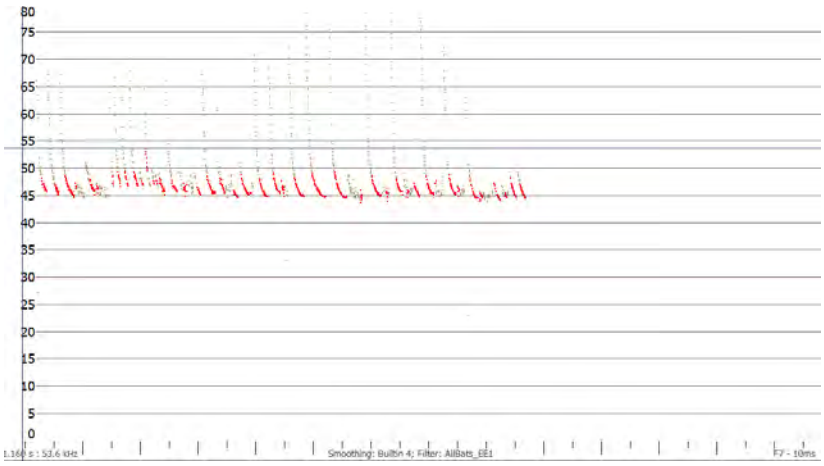


Figure 4-5: *Miniopterus orianae oceanensis* probable call



Figure 4-6: *Mormopterus norfolkensis* definite call



Figure 4-7: *Mormopterus ridei* definite call

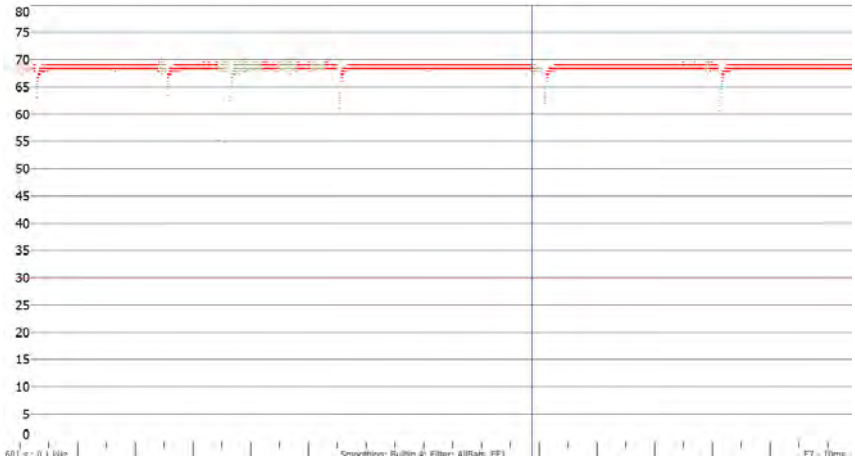


Figure 4-8: *Rhinolophus megaphyllus* definite call

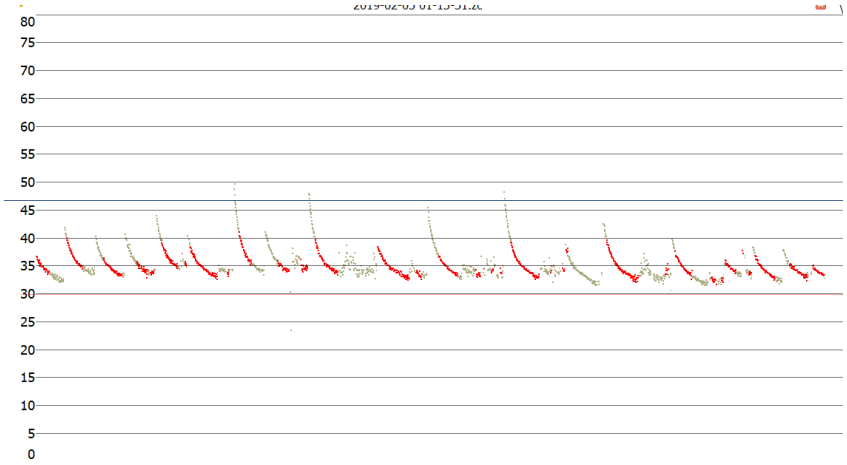


Figure 4-9: *Scoteanax rueppellii* probable call

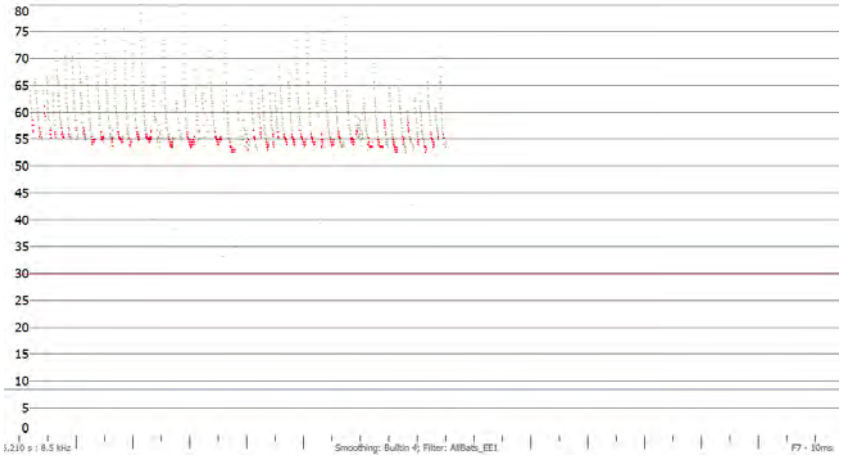


Figure 4-10: *Vespadelus pumilus* probable call

5.0 REFERENCES

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APPENDIX A SPECIES IDENTIFICATION CONFIDENCE AND CHARACTERISTICS – SYDNEY BASIN

Table A1: Identification confidence and characteristics of bat echolocation calls from the Sydney basin region

Scientific Name	Common Name	Identification Potential	Identification characteristics
Austronomus australis	White-striped Free-tailed Bat	High	Good quality calls unlikely to be confused. However, partial calls may be confused with social calls of other bat species and insects.
Chalinolobus dwyeri	Large-eared Pied Bat	High	Calls may overlap with *Saccolaimus flaviventris*. However, good quality call sequences are unlikely to be confused due to small pulse shape and alternating pulses in *Chalinolobus dwyeri*.
Chalinolobus gouldii	Gould's Wattled Bat	Mod - High	Overlaps with *Mormopterus ridei* and *Scoteanax rueppellii*. In good quality recordings, differentiated from *Mormopterus* spp. by curved pulses and from *Scoteanax rueppellii* by alternating pulse frequencies.
Chalinolobus morio	Chocolate Wattled Bat	Mod - High	Overlaps with *Vespadelus vulturnus, Vespadelus pumilus, Vespadelus troughtoni* and possibly with *Miniopterus orianae oceanensis* in some areas. Differentiated from *Vespadelus* spp. by the presence of down-sweeping tails on pulses and generally little doppler effect that is typically displayed by *Vespadelus* spp.
Falsistrellus tasmaniensis	Eastern Falsistrelle	Low	Overlaps in characteristic frequency with *Scotorepens orion* and *Scoteanax rueppellii*. *Falsistrellus tasmaniensis* is most frequently recorded from more elevated locations in the region. However, some records exist from coastal lowlands and so included it in our species groups in coastal areas as a precautionary measure. We do not distinguish *Falsistrellus tasmaniensis* from *Scotorepens orion* where they overlap in frequency due to overlapping call characteristics.

Scientific Name	Common Name	Identification Potential	Identification characteristics
Miniopterus australis	Little Bent-winged Bat	Mod – High	Overlaps in characteristic frequency with *Vespadelus pumilus*. Differentiated from *Vespadelus pumilus* by the presence of down-sweeping tails on pulses and lack of doppler effect that is typically displayed by *Vespadelus* spp.. May be identified from other species by characteristic 'stepped' feeding buzz, if feeding buzz is present.
Miniopterus orianae oceanensis	Eastern Bent-winged Bat	Low – Mod	Overlaps in characteristic frequency with *Vespadelus darlingtoni, Vespadelus regulus, Vespadelus vulturnus* and possibly with *Chalinolobus morio*. Differentiated from *Vespadelus* spp. in good quality recordings by uneven pulse spacing, generally little doppler effect that is typically displayed by *Vespadelus* spp. and in full spectrum (.WAV) recordings, the maximum pulse amplitude closer to the end of the pulse, rather than towards the middle of the pulse as found in *Vespadelus* spp. and *Chalinolobus morio*. Differentiated from *Chalinolobus morio* only where recordings are at lower characteristic frequency or in good quality recordings with uneven pulse spacing. May be identified from other species by characteristic 'stepped' feeding buzz, if feeding buzz is present.
Miniopterus orianae oceanensis	Eastern Bent-winged Bat	Low – Mod	Overlaps in characteristic frequency with *Vespadelus darlingtoni, Vespadelus regulus* and possibly with *Chalinolobus morio*. Differentiated from *Vespadelus* spp. only in good quality recordings by uneven pulse spacing and generally little doppler effect that is typically displayed by *Vespadelus* spp.. Differentiated from *Chalinolobus morio* only where recordings are at lower characteristic frequency or in good quality recordings with uneven pulse spacing.
Mormopterus ridei	Ride's Free-tailed Bat	Mod	Overlaps in characteristic frequency with *Mormopterus norfolkensis* and *Chalinolobus gouldii. Mormopterus* spp. differentiated from *Chalinolobus gouldii* in long call sequences with mostly flat pulse shapes. Differentiated from *Mormopterus norfolkensis* in long call sequences with little pulse alternation.
Mormopterus norfolkensis	Eastern coastal Free-tailed Bat	Mod	Overlaps in characteristic frequency with *Mormopterus norfolkensis, Chalinolobus gouldii* and *Scoteanax rueppellii*. *Mormopterus* spp. differentiated from *Chalinolobus gouldii* and *Scoteanax rueppellii* in long call sequences with mostly flat pulse shapes. Differentiated from *Mormopterus ridei* in long call sequences where pulses alternated, often with a downward sloping tail.

Scientific Name	Common Name	Identification Potential	Identification characteristics
Myotis macropus	Large-footed Myotis	Low - Mod	Overlaps in call features with *Nyctophilus* spp. Differentiated from *Nyctophilus* spp. in good quality call sequences with pulse intervals < 75 ms, initial slope > 400 OPS and often with a central kink and varying slopes among pulses.
Nyctophilus geoffroyi	Lesser long-eared bat	Low	Overlaps in call features with *Nyctophilus gouldi* and *Myotis macropus*. Differentiated from *Myotis macropus* by pulse intervals > 95 ms and an initial slope of < 300 OPS. However, *Nyctophilus geoffroyi* and *Nyctophilus gouldi* are unable to be differentiated from each other.
Nyctophilus gouldi	Gould's long-eared bat	Low	Overlaps in call features with *Nyctophilus geoffroyi* and *Myotis macropus*. Differentiated from *Myotis macropus* by pulse intervals > 95 ms and an initial slope of < 300 OPS. However, *Nyctophilus geoffroyi* and *Nyctophilus gouldi* are unable to be differentiated from each other.
Phoniscus papuensis	Golden-tipped Bat	Low	Has a very quiet call that is not often recorded by bat detectors.
Rhinolophus megaphyllus	Eastern Horseshoe Bat	High	Long duration, flat calls at characteristic frequency of 66 – 70kHz, unlikely to be confused with any other species.
Saccolaimus flaviventris	Yellow-bellied Sheath-tailed Bat	Mod - High	Calls may overlap with *Chalinolobus dwyeri*. However, good quality call sequences are unlikely to be confused due to *Chalinolobus dwyeri* having small pulse shape and alternating pulses. The harmonics of *Saccolaimus flaviventris* assist identification in full spectrum (.WAV) recordings. The characteristic frequency of the fundamental (first harmonic) is 10-12 kHz, the second (loudest harmonic) is 20-25kHz and the third harmonic 30-35kHz.
Scoteanax rueppellii	Greater Broad-nosed Bat	Low – Mod	Overlaps in characteristic frequency with *Chalinolobus gouldii*, *Mormopterus norfolkensis*, *Scotorepens orion* and *Falsistrellus tasmaniensis*. Differentiated from *Mormopterus* spp. in long call sequences with mostly curved pulse shapes. Differentiated from *Chalinolobus gouldii* only in long call sequences with no alternating pulse

Scientific Name	Common Name	Identification Potential	Identification characteristics
			frequencies. Differentiated from *Scotorepens orion* and *Falsistrellus tasmaniensis* by long pre-characteristic sections. Usually only identified at a probable confidence level.
Scotorepens orion	Eastern Broad-nosed Bat	Low	Overlaps in characteristic frequency with *Falsistrellus tasmaniensis* and *Scoteanax rueppellii*. *Falsistrellus tasmaniensis* is most frequently recorded from more elevated locations in the region. However, some records exist from coastal lowlands and so included it in our species groups in coastal areas as a precautionary measure. We do not distinguish *Falsistrellus tasmaniensis* from *Scotorepens orion* where they overlap in frequency due to overlapping call characteristics.
Vespadelus darlingtoni	Large Forest Bat	Low	Overlaps in characteristic frequency with *Miniopterus orianae oceanensis* and *Vespadelus regulus*. Differentiated from *Miniopterus orianae oceanensis* only in long call sequences that show even pulse spacing and doppler effect that is typically displayed by *Vespadelus* spp.. Usually unable to be differentiated from *Vespadelus regulus*.
Vespadelus pumilus	Eastern Forest Bat	Mod	Overlaps in characteristic frequency with *Chalinolobus morio, Vespadelus vulturnus, Vespadelus troughtoni* and *Miniopterus australis*. Unable to be differentiated from *Vespadelus vulturnus* and *Vespadelus troughtoni* where they overlap in characteristic frequency. Differentiated from *Chalinolobus morio* and *Miniopterus australis* at lower and higher characteristic frequencies respectively by the absence of down-sweeping tails on pulses and the presence of doppler effect that is typically displayed by *Vespadelus* spp..
Vespadelus troughtoni	Eastern cave bat	Low	Overlaps in characteristic frequency with *Chalinolobus morio, Vespadelus vulturnus* and *Vespadelus pumilus*. Differentiated from *Chalinolobus morio* in long call sequences with few down-sweeping tails on pulses and by the doppler effect that is typically displayed by *Vespadelus* spp. However, unable to be differentiated from *Vespadelus vulturnus* and *Vespadelus pumilus* in this region.
Vespadelus vulturnus	Little Forest Bat	Low	Overlaps in characteristic frequency with *Chalinolobus morio, Vespadelus troughtoni* and *Vespadelus pumilus*. Differentiated from *Chalinolobus morio* in long call sequences with few down-sweeping tails on pulses and by the doppler effect that is typically displayed by *Vespadelus* spp. Only differentiated from *Vespadelus troughtoni* and *Vespadelus pumilus* in calls with a characteristic frequency 47-48kHz.

APPENDIX B LOG FILE REVIEW

Table B1: Log file review results

Folder	Log File Name	Firmware	Set to Record	GPS	GPS	Setting Mode	Data Division	Sensitivity	Entire Night?	Errors?	Comments
Grid 1\	SN507272 2019-01-09 log.csv	V5507J	Yes	-33.03498	151.50835	Night	8	115	Yes	None	
Grid 1\	SN507272 2019-01-10 log.csv	V5507J	Yes	-33.03488	151.50835	Night	8	115	Yes	None	
Grid 1\	SN507272 2019-01-11 log.csv	V5507J	Yes			Night	8	115	Yes	None	
Grid 1\	SN507272 2019-01-12 log.csv	V5507J	Yes			Night	8	115	Yes	None	
Grid 2\	SN507239 2019-02-05 log.csv	V5507J	Yes	-33.02817	151.52010	Night	8	115	Yes	None	
Grid 2\	SN507239 2019-02-06 log.csv	V5507J	Yes	-33.02836	151.51997	Night	8	115	Yes	None	
Grid 2\	SN507239 2019-02-07 log.csv	V5507J	Yes	-33.02829	151.52004	Night	8	115	Yes	None	

Folder	Log File Name	Firmware	Set to Record	GPS	GPS	Setting Mode	Data Division	Sensitivity	Entire Night?	Errors?	Comments
Grid 2\	SN507239 2019-02-08 log.csv	V5507J	Yes	-33.02829	151.52004	Night	8	115	Yes	Buffer Overflow Warning	Excessive noise where the SD card / Anabat can't record all of the data - 8:25pm - 8:40pm
Grid 2\	SN507239 2019-02-09 log.csv	V5507J	Yes	-33.02861	151.52017	Night	8	115	Yes	None	
Grid 2\	SN507239 2019-02-10 log.csv	V5507J	Yes	-33.02829	151.52005	Night	8	115	Yes	None	
Grid 2\	SN507239 2019-02-11 log.csv	V5507J	Yes	-33.02831	151.52002	Night	8	115	Yes	None	
Grid 2\	SN507239 2019-02-12 log.csv	V5507J	Yes	-33.02842	151.51996	Night	8	115	Yes	None	
Grid 2\	SN507239 2019-02-13 log.csv	V5507J	No								
Grid 3\	SN409322 2019-01-09 log.csv	V5507J	Yes	-33.02495	151.53245	Night	8	115	Yes	None	
Grid 3\	SN507250 2019-02-05 log.csv	V5507J	Yes	-33.02542	151.53346	Night	8	115	Yes	None	
Grid 3\	SN507250 2019-02-06 log.csv	V5507J	Yes	-33.02542	151.53346	Night	8	115	Yes	None	

Folder	Log File Name	Firmware	Set to Record	GPS	GPS	Setting Mode	Data Division	Sensitivity	Entire Night?	Errors?	Comments
Grid 3\	SN507250 2019-02-07 log.csv	V5507J	Yes	-33.02542	151.53346	Night	8	115	Yes	None	
Grid 3\	SN507250 2019-02-08 log.csv	V5507J	Yes	-33.02542	151.53346	Night	8	115	Yes	None	
Grid 3\	SN507250 2019-02-09 log.csv	V5507J	Yes	-33.02542	151.53346	Night	8	115	Yes	None	
Grid 3\	SN507250 2019-02-10 log.csv	V5507J	Yes	-33.02547	151.53340	Night	8	115	Yes	None	
Grid 3\	SN507250 2019-02-11 log.csv	V5507J	Yes	-33.02530	151.53306	Night	8	115	Yes	None	
Grid 3\	SN507250 2019-02-12 log.csv	V5507J	Yes	-33.02530	151.53306	Night	8	115	Yes	None	
Grid 3\	SN507250 2019-02-13 log.csv	V5507J	No								
Grid 4b\5a	SN395661 2019-01-09 log.csv	V5507J	Yes	-33.04358	151.51225	Night	8	115	Yes	None	
Grid 4b\5a	SN395661 2019-01-10 log.csv	V5507J	Yes	-33.04351	151.51214	Night	8	115	Yes	None	
Grid 7b\	SN507191 2019-01-10 log.csv	V5507J	No	-33.05127	151.51938						

Folder	Log File Name	Firmware	Set to Record	GPS	GPS	Setting Mode	Data Division	Sensitivity	Entire Night?	Errors?	Comments
Grid 7b\	SN507191 2019-01-11 log.csv	V5507J	Yes	-33.05135	151.51924	Night	8	115	Yes	None	
Grid 7b\	SN507191 2019-01-12 log.csv	V5507J	Yes	-33.05135	151.51924	Night	8	115	Yes	None	
Grid 7b\	SN507191 2019-01-13 log.csv	V5507J	Yes	-33.05135	151.51924	Night	8	115	Yes	None	
Grid 8a\	SN395661 2019-01-11 log.csv	V5507J	Yes			Night	8	115	Yes	None	
Grid 8a\	SN395661 2019-01-12 log.csv	V5507J	Yes			Night	8	115	Yes	None	
Grid 8a\	SN395661 2019-01-13 log.csv	V5507J	Yes	-33.04936	151.52796	Night	8	115	Yes	None	
Grid 8b\	SN507239 2019-01-30 log.csv	V5507J	No	-33.04629	151.53232						
Grid 8b\	SN507239 2019-01-31 log.csv	V5507J	Yes	-33.04585	151.53230	Night	8	115	Yes	Buffer Overflow Warning	Excessive noise where the SD card / Anabat can't record all of the data - 7:59pm - 8:07pm
Grid 8b\	SN507239 2019-02-01 log.csv	V5507J	Yes	-33.04591	151.53237	Night	8	115	Yes	None	

Folder	Log File Name	Firmware	Set to Record	GPS	GPS	Setting Mode	Data Division	Sensitivity	Entire Night?	Errors?	Comments
Grid 8b\	SN507239 2019-02-02 log.csv	V5507J	Yes	-33.04591	151.53231	Night	8	115	Yes	None	
Grid 8b\	SN507239 2019-02-03 log.csv	V5507J	Yes	-33.04597	151.53233	Night	8	115	Yes	Buffer Overflow Warning	Excessive noise where the SD card / Anabat can't record all of the data - 4:49am
Grid 8b\	SN507239 2019-02-04 log.csv	V5507J	Yes	-33.04594	151.53232	Night	8	115	Yes	None	
Grid 9a1\	SN507250 2019-01-29 log.csv	V5507J	No								
Grid 9a1\	SN507250 2019-01-30 log.csv	V5507J	No								
Grid 9a1\	SN507250 2019-01-31 log.csv	V5507J	Yes	-33.04534	151.53591	Night	8	115	Yes	None	
Grid 9a1\	SN507250 2019-02-01 log.csv	V5507J	Yes	-33.04542	151.53588	Night	8	115	Yes	None	
Grid 9a1\	SN507250 2019-02-02 log.csv	V5507J	Yes	-33.04534	151.53597	Night	8	115	Yes	None	
Grid 9a1\	SN507250 2019-02-03 log.csv	V5507J	Yes	-33.04533	151.53594	Night	8	115	Yes	None	

Folder	Log File Name	Firmware	Set to Record	GPS	GPS	Setting Mode	Data Division	Sensitivity	Entire Night?	Errors?	Comments
Grid 9a1\	SN507250 2019-02-04 log.csv	V5507J	Yes	-33.04537	151.53591	Night	8	115	Yes	None	
Grid 9a2\	SN409322 2019-01-10 log.csv	V5507J	No								
Grid 9a2\	SN409322 2019-01-11 log.csv	V5507J	Yes	-33.04619	151.54084	Night	8	115	Yes	None	
Grid 9a2\	SN409322 2019-01-12 log.csv	V5507J	Yes	-33.04628	151.54092	Night	8	115	Yes	None	
Grid 9a2\	SN409322 2019-01-13 log.csv	V5507J	Yes	-33.04626	151.54083	Night	8	115	Yes	None	
Grid10 b\	SN507272 2019-01-13 log.csv	V5507J	Yes	-33.05884	151.53053	Night	8	115	Yes	None	

Appendix H

Hair Tube Analysis

TRACE ECOLOGY
Hair, Scat & Bone Analysis

Date: 12th November 2019

Att: Joe May
Ecologist
RPS Australia
RPS Australia Asia Pacific
Carrington, NSW 2294

Job Number: 2019112-1

Hair analysis

Dear Joe,

I analysed 39 hair samples and one scat sample in accordance with the methods outlined in Brunner and Coman, The Identification of Mammalian Hairs, Inkata Press, 1974 and Hair ID: An Interactive Tool for Identifying Australian Mammalian Hair, Ecobyte, 2002.

The results of the analysis are provided below in the following table.

No.	Type	ID	Trap	Species present	Confidence
1	H	29	Arboreal	*Trichosurus vulpecula*	C
2	H	18	Arboreal	Cotton	C
3	H	28	Arboreal	*Trichosurus vulpecula*	C
4	H	25	Arboreal	*Trichosurus vulpecula*	C
5	H	15	Arboreal	*Trichosurus vulpecula*	C
6	H	2	Arboreal	*Trichosurus vulpecula*	C
7	H	19	Terrestrial	*Trichosurus vulpecula*	C
8	H	Line 8, Terrestrial 4	Terrestrial	Insect material	C
9	H	Line 7, Arboreal 5	Arboreal	Cotton	C
10	H	Line 7, Terrestrial 1	Terrestrial	Insect material	C
11	H	Line 9, Arboreal 5	Arboreal	Cotton	C
12	H	Line 7, Terrestrial 2	Terrestrial	Insect material	C
13	H	Line 4, Arboreal 5	Arboreal	Human	C
14	H	Line 9, Terrestrial 3	Terrestrial	Insect material	C
15	H	Line 8, Terrestrial 5	Terrestrial	*Trichosurus vulpecula*	C
16	H	Line 4, Arboreal 4	Arboreal	Insect material	C

17	H	Line 4, Terrestrial 4	Terrestrial	Insect material	C
18	H	Line 8, Terrestrial 2	Terrestrial	Insect material	C
19	H	Line 9, Terrestrial 1	Terrestrial	Insect material	C
20	H	Line 9, Terrestrial 2	Terrestrial	Trichosurus vulpecula	C
21	H	Line 5, Terrestrial 5	Terrestrial	Plant material	C
22	H	Line 2, Terrestrial 1	Terrestrial	Plant material	C
23	H	Line 2, Arboreal 1	Arboreal	Human	C
24	H	Line 8, Trap 3		Insect material	C
25	H	Line 2, Terrestrial 2	Terrestrial	Insect material, Human	C
26	H	Line 4, Terrestrial 3	Terrestrial	Insect material	C
27	H	Line 3, Terrestrial 5	Terrestrial	*Rattus fuscipes*	C
28	H	Line 2, Arboreal 2	Arboreal	Insect material	C
29	H	Line 2, Arboreal 5	Arboreal	Human	C
30	H	Line 2, Terrestrial 4	Terrestrial	Human	C
31	H	Line 3, Terrestrial 2	Terrestrial	Human	C
32	H	Line 3, Terrestrial 3	Terrestrial	Plant material	C
33	H	Line 3, Terrestrial 4	Terrestrial	Plant material	C
34	H	Line 8, Arboreal 4	Arboreal	Insect material	C
35	H	Line 8, Arboreal 5	Arboreal	Insect material	C
36	H	Line 8, Arboreal 3	Arboreal	Insect material	C
37	H	Line 8, Arboreal 1	Arboreal	Insect material	C
38	H	Line 9, Terrestrial 4	Terrestrial	Insect material	C
39	H	Line 9, Arboreal 1	Arboreal	Human	C
40	Scat	30A	-	Likely fox scat. Contains *Trichosurus vulpecula*	C

If you have any questions about the results, please do not hesitate to contact me.

Kind regards,

Luke Foster

Trace Ecology
Mob: 0423 501 384
Email: traceecology@gmail.com

Appendix B

Credit Summary Report

BAM Credit Summary Report

Proposal Details

Assessment Id
00020388/BAAS18060/20/00020389

Proposal Name
Newstan Extension

BAM data last updated *
05/05/2020

Assessor Name
Joe May

Report Created
22/05/2020

BAM Data version *
26

Assessor Number
BAAS18060

BAM Case Status
Open

Date Finalised
To be finalised

Assessment Revision
0

Assessment Type
Major Projects

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

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

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAII	Ecosystem credits
Grey Ironbark - Broad-leaved Mahogany - Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast								
1	1588_Good	100.0	0.1	0.25	High Sensitivity to Potential Gain	1.75		3
							Subtotal	**3**

Smooth-barked Apple - Red Bloodwood - Brown Stringybark - Hairpin Banksia heathy open forest of coastal lowlands								
2	1619_Good	100.0	0.1	0.25	High Sensitivity to Potential Gain	1.50		5
							Subtotal	**5**
Swamp Mahogany - Flax-leaved Paperbark swamp forest on coastal lowlands of the Central Coast								
3	1718_Good	100.0	0.2	0.25	High Sensitivity to Potential Gain	2.00		8
							Subtotal	**8**
							Total	**16**

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAII	Species credits
Ninox strenua / Powerful Owl (Fauna)						
1588_Good	100.0	0.06	0.25	2	False	3
1619_Good	100.0	0.12	0.25	2	False	6
1718_Good	100.0	0.15	0.25	2	False	8
					Subtotal	**17**
Petaurus norfolcensis / Squirrel Glider (Fauna)						
1588_Good	100.0	0.06	0.25	2	False	3
1619_Good	100.0	0.12	0.25	2	False	6
1718_Good	100.0	0.15	0.25	2	False	8
					Subtotal	**17**

Tetratheca juncea / Black-eyed Susan (Flora)						
1588_Good	100.0	0.06	0.25	2	False	3
1619_Good	100.0	0.12	0.25	2	False	6
1718_Good	100.0	0.15	0.25	2	False	8
					Subtotal	**17**
Tyto novaehollandiae / Masked Owl (Fauna)						
1588_Good	100.0	0.06	0.25	2	False	3
1619_Good	100.0	0.12	0.25	2	False	6
1718_Good	100.0	0.15	0.25	2	False	8
					Subtotal	**17**