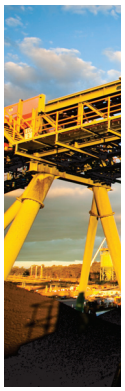

MOOLARBEN COAL COMPLEX OC3 EXTENSION PROJECT

AMENDMENT REPORT

APPENDIX C

UPDATED BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

YANCOAL
兖煤澳大利亚有限公司
MOOLARBEN COAL

Excellence in your environment

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Moolarben Coal Complex OC3 Extension Project

Biodiversity Development Assessment Report

Prepared for Moolarben Coal Operations Pty Ltd | 8 March 2024

Project number	Client	Project manager/Accredited assessor	LGA
7037	Moolarben Coal Operations Pty Ltd	Amanda Griffith (Accreditation No. BAAS19016)	Mid-Western Regional LGA

This Biodiversity Development Assessment Report has been prepared on the basis of the requirements of (and information provided under) the Biodiversity Assessment Method as certified by BAM Accredited Assessor: Amanda Griffith (BAASS19016)

Version	Author	Review	Status	Date
Draft 1	Niche: Amanda Griffith, Alex Christie, Sophia Dunn, Ryan Sébire, Premise: Sally Kirby, Isobel Colson, Michelle Lindsay	Amanda Griffith	Draft 1	25 February 2022
Draft 2	As above		Draft 2	12 August 2022
Draft 3	As above		Draft 3	30 August 2022
Draft 4	As above		Draft 4	7 September 2022
Draft 5	As above		Draft 5	16 September 2022
Final (Rev0)	As above	Amanda Griffith	Final	03 November 2022
Revision 1	Amanda Griffith, Ryan Sébire, Sophia Dunn, Mandy Melvaine	Amanda Griffith	Rev1	18 February 2024
Revision 2	Amanda Griffith, Ryan Sébire, Sophia Dunn, Mandy Melvaine	Amanda Griffith	Rev2	01 March 2024
Revision 3	Ryan Sébire, Sophia Dunn	Amanda Griffith	Rev3	07 March 2024

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Summary

The Moolarben Coal Complex is located approximately 40 kilometres (km) north of Mudgee, New South Wales (NSW). The Moolarben Coal Complex is operated by Moolarben Coal Operations Pty Ltd (MCO), a wholly owned subsidiary of Yancoal Australia Limited (Yancoal). The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities).

MCO is proposing an extension to the approved OC3 mining operations to allow for extraction of additional coal within existing mining and exploration tenements adjacent to approved operations at the Moolarben Coal Complex (the Project). Approval for the Project is being sought under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

MCO (2022a) prepared and submitted the Moolarben Coal Complex OC3 Extension Project Environmental Impact Statement (the EIS) for the Project to support the assessment process under the EP&A Act.

In response to submissions received on the EIS, MCO is proposing to amend the Project Development Footprint (including reduced run-of-mine (ROM) coal and peak annual production, and revised mine schedules and rehabilitation plan) to incorporate additional avoidance measures relative to the EIS. These changes are described in the Amendment Report. Niche Environment and Heritage Pty Ltd (Niche), in collaboration with Premise, was commissioned by MCO to prepare a Biodiversity Development Assessment Report (BDAR) for the EIS. This BDAR has now been updated to consider the amended Project and forms part of the Amendment Report. This BDAR has been prepared in accordance with the Biodiversity Assessment Method (BAM) (NSW Department of Planning, Industry and Environment [DPIE] 2020a) to describe and assess direct, indirect and prescribed impacts to ecological values, including threatened biodiversity listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Native Vegetation

The amended Development Footprint is 675.21 hectares (ha) in size, comprising 480.01 ha of native vegetation, 186.6 ha of non-native vegetation and 8.6 ha of access roads, dams and buildings. Native vegetation in the Study Area was surveyed in March 2019, March 2020, March – April and September – December 2021 and January 2022 by ELA, and additional plots were collected in July-August 2023 by Niche in accordance with the BAM (DPIE 2020a) and the BAM 2020 Operational Manual – Stage 1 (DPIE 2020b).

Most of the native woodland/forest within the Study Area (particularly the lower slopes and flat land) has been previously cleared for agriculture and habitats are fragmented. Most of the native woodland/forest remaining within the revised Development Footprint occurs around the periphery and is connected to the extensive areas of native vegetation to the south within the Munghorn Gap Nature Reserve, and along the ranges running to the east. Native woodland/forest otherwise occurs as isolated patches or scattered trees.

A total of nine Plant Community Types (PCTs) in various condition states were mapped within the Development Footprint:

- PCT 266 - *White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion* – represented by remnant woodland, derived native grassland and scattered trees.

- PCT 281 - *Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion* - represented by remnant woodland, derived native grassland and scattered trees.
- PCT 483 - *Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley* - represented by remnant forest and derived native grassland.
- PCT 1610 - *White Box - Black Cypress Pine shrubby woodland of the Western Slopes* - represented by remnant woodland and regenerating.
- PCT 1629 - *Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin* - represented by remnant forest.
- PCT 1655 - *Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin* - represented by remnant woodland.
- PCT 1656 - *Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin* - represented by remnant forest and regenerating.
- PCT 1661 - *Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin* - represented by remnant woodland.
- PCT 1711 - *Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin* - represented by remnant shrubland.

Four of the PCTs recorded in the Development Footprint align to threatened ecological communities listed under the BC Act and/or EPBC Act:

- PCTs 266, 281 and 483 mapped within the Development Footprint meet the listing criteria for *White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions* Critically Endangered Ecological Community (CEEC) listed under the BC Act and *White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC listed under the EPBC Act (Box-Gum Woodland CEEC).
- PCT 1655 meets the listing criteria for *Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion* Vulnerable Ecological Community (VEC) listed under the BC Act and seven of the eight patches recorded within the Development Footprint meet the listing criteria for *Central Hunter Valley eucalypt forest and woodland* CEEC listed under the EPBC Act (Eucalypt Forest and Woodland CEEC).

Grassland areas where exotic species were dominant were assessed and attributed to Category 1 – exempt land where justified.

Threatened Species

Targeted surveys for threatened flora species were undertaken between September and October 2021 and January 2022 via a grid and parallel transect method in accordance with the *NSW Surveying Threatened Plants and Their Habitats: NSW Survey Guide for The Biodiversity Assessment Method* (DPIE 2020c). One threatened flora species, Cotoneaster Pomaderris (*Pomaderris cotoneaster*), listed as Endangered under both the BC Act and EPBC Act, was recorded in the Study Area.

A fauna habitat assessment was undertaken between January 2021 and March 2022 in accordance with Section 5.2.2 of the BAM (DPIE 2020a) to determine the presence of habitat constraints and the condition of micro-habitats. Subsequent targeted survey included: camera trapping; diurnal and nocturnal habitat searches; spotlighting; harp trapping; Anabat detectors; Pitfall, Elliot and funnel trapping; systematic scat surveys and opportunistic recordings of non-target threatened species.

During the surveys, a total of 22 fauna species listed as threatened under the BC Act were recorded within the Study Area, of which five are also listed as threatened under the EPBC Act.

Measures to Avoid, Minimise, Mitigate and Manage Impacts

Measures to avoid and minimise impacts on biodiversity values have been assessed. Some of the key measures that have been adopted include:

- Refinement of the Project design to reduce impacts to native vegetation, flora and fauna habitat through: locating infrastructure areas immediately adjacent to open cut mining areas; preferentially locating disturbance in Category 1 – exempt land or where the vegetation/habitat is in the poorest condition [e.g. low quality derived native grassland]).
- Avoidance of all direct disturbance to mapped rocky habitat including a 100 metre (m) buffer (i.e. caves, crevices, cliffs, rocks) for the Broad-headed Snake, Eastern Cave Bat and Large-eared Pied Bat.
- Implementation of blast criterion of 50 millimetres per second (mm/s) at nearest rocky habitat features to minimise potential indirect vibration impacts to habitat for the Broad-headed Snake, Eastern Cave Bat and Large-eared Pied Bat.
- Avoidance/minimisation of vegetation clearance within riparian habitat associated with Moolarben Creek and Murdering Creek to retain habitat and connectivity for threatened species and ecological communities, and minimise adverse impacts on waterbodies, water quality and hydrological processes.
- Minimise impacts on the Box-Gum Woodland CEEC through retention of Box-Gum Woodland CEEC within the riparian corridor of Moolarben and Murdering Creeks and avoidance of relatively high-quality Box-Gum Woodland remnants in the south-east of the Project.
- Avoidance of Rocky habitat for the Pink-tailed Legless Lizard adjacent to where the species was recorded in the south-west of the Study Area.
- Progressive back-filling and rehabilitation of open cut pits to ensure on-going replacement of habitat/resources and minimising the time between loss and replacement of resources.
- Establishment of 100 m setback from boundary of Munghorn Gap Nature Reserve.

Measures to mitigate and manage impacts on biodiversity values have also been assessed. Some of the key measures to mitigate and manage impacts include:

- Establishment of the Habitat Enhancement Area to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened ecological communities and threatened species habitat within the riparian zone of Moolarben Creek and Murdering Creek (outside of the Development Footprint).
- Implementation of a Vegetation Clearance Protocol.
- Progressive rehabilitation and revegetation of disturbed areas following completion of active mining operations.
- Establishment of a surface rock trial site to assess if introducing new surface rock during mine rehabilitation can restore rocky habitat for the Pink-tailed Legless Lizard.
- Weed and pathogen management with a focus on vehicle/machinery hygiene control to prevent spread of weeds and pathogens, as well as physical and/or chemical weed removal/control.
- Pest animal control with a focus on pest species known to impact native flora and fauna, specifically feral cat, wild dog, feral pig, feral goat, wild rabbit, red fox, fallow deer and feral birds.
- Implementation of Noisy Miner monitoring and management program prior to and during Regent Honeyeater breeding season (June to January).
- Bushfire management to manage and reduce bushfire risk.

- Fencing of *Pomaderris cotoneaster* plants adjacent to the Development Footprint.
- Minimising light spill within adjacent woodland areas in the Munghorn Gap Nature Reserve, as far as practicable through by directing lighting into the site.
- Implementation of speed limits on all vehicles using internal mine roads and access tracks and training of personnel (contractors, visitors, and other representatives) to minimise interactions with native fauna.

Impacts on Native Vegetation and Habitats

After implementation of impact avoidance and minimisation measures, the Project would result in the direct loss of native vegetation (480.01 ha) in the Development Footprint. Of the native vegetation to be cleared, 366.9 ha is derived native grassland, 93.64 ha is remnant woodland/forest/shrubland, 17.2 ha is regenerating Woodland/Forest, 2.18 ha is scattered trees, and 0.09 ha is planted native vegetation.

The above vegetation groups that would be cleared provide habitat resources for a range of fauna. The Project has the potential to impact surface rocky habitat (Pink-tailed Legless Lizard). No mapped rocky habitat (habitat for Large-eared Pied Bat, Eastern Cave Bat and Broad-headed Snake) would be directly impacted by the Project; including vegetation within a 100 m buffer of mapped rocky habitat, considered breeding habitat for these threatened bat species. Some creek crossings are proposed but these are unlikely to materially impact water habitat resources.

Potential indirect impacts to native vegetation adjacent to the Development Footprint have been assessed. These indirect impacts would be mitigated, managed and monitored through implementation of weed and feral/pest animal management, sediment and erosion control, Noisy Miner monitoring and management and ongoing dust monitoring.

Impacts on Threatened Biodiversity

Some of the native vegetation that would be cleared equates to the following threatened ecological communities: 401.12 ha of Box-Gum Woodland CEEC listed under the BC and EPBC Act (comprising 34.22 ha of woodland and 366.9 ha of derived native grassland), 16.1 ha of *Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion* VEC listed under the BC Act, of which 15.5 ha conforms to Eucalypt Forest and Woodland CEEC listed under the EPBC Act.

The native vegetation to be cleared would result in the loss of habitat for 12 ecosystem credit fauna species recorded in the Study Area. Four of the dual credit species (Masked Owl, Little Eagle, Powerful Owl and Large Bent-winged Bat) were also regarded as ecosystem species for the Project due to the absence of breeding habitat in the Development Footprint. Unavoidable impacts of habitat clearance for these species would be offset with ecosystem credits.

There are six threatened fauna species that require species credits for the Project:

- Pink-tailed Legless Lizard (*Aprasia parapulchella*) (Vulnerable, BC Act and EPBC Act)
- Regent Honeyeater (*Anthochaera phrygia*) (Critically Endangered, BC Act and EPBC Act) – species not recorded but is considered likely to use habitat in the Development Footprint based on the presence of Important Habitat Mapping for the species within the Development Footprint
- Large-eared Pied Bat (*Chalinolobus dwyeri*) (Vulnerable, BC Act and Endangered, EPBC Act)
- Eastern Cave Bat (*Vespadelus troughtoni*) (Vulnerable, BC Act)
- Squirrel Glider (*Petaurus norfolcensis*) (Vulnerable, BC Act).
- Koala (*Phascolarctos cinereus*) (Endangered, BC Act and EPBC Act)

Prescribed impacts relevant to the Project have been assessed and include potential impact to surface rocky habitat (Pink-tailed Legless Lizard). No mapped rocky habitat (for Large-eared Pied Bat, Eastern Cave Bat and Broad-headed Snake) would be directly impacted by the Project.

Potential indirect impacts to adjacent areas of CEEC and/or threatened species habitat would be mitigated, managed and monitored through implementation of a Vegetation Clearance Protocol, weed and feral/pest animal management, sediment and erosion control, Noisy Miner monitoring and management and ongoing dust monitoring.

Serious and Irreversible Impacts (SAII)

Six entities at risk of SAII were relevant to this assessment: Box-Gum Woodland CEEC, Broad-headed Snake, Large-eared Pied Bat, Eastern Cave Bat, Swift Parrot and the Regent Honeyeater. Information required for consideration of SAII for each species is provided in this BDAR. This BDAR describes how impacts on SAII entities would be avoided, minimised, mitigated, offset and subject to additional appropriate measures.

Impacts to Matters of National Environmental Significance (MNES)

The Project is considered likely to have a significant impact on five MNES listed under the EPBC Act: Box-Gum Woodland CEEC, Pink-tailed Legless Lizard, Regent Honeyeater, Koala and Large-eared Pied Bat. The Project is not likely to have a significant impact on the Eucalypt Forest and Woodland CEEC, *Pomaderris cotoneaster,* Swift Parrot or Broad-headed Snake.

This BDAR describes the proposed avoidance and mitigation measures to manage the relevant impacts. Unavoidable impacts to these species would be offset under the BC Act.

Biodiversity Requiring Offset under the Biodiversity Offsets Scheme

Ecosystem and species credits required to offset unavoidable impacts to native vegetation and threatened biodiversity are detailed below. Biodiversity offsets would be provided for direct impacts to two threatened ecological communities, one threatened flora and six threatened fauna species (Tables ES-1 and ES-2). Offsets for prescribed impacts to Pink-tailed Legless Lizard habitat within Category-1 exempt land have also been provided. Other potential prescribed or indirect impacts have been avoided, minimised or mitigated, and would not require ecosystem or species credits.

Table ES-1 Impacts that require an offset – ecosystem credits

PCT name	Associated Threatened Ecological Community	Impact area (ha)	Number of ecosystem credits required
PCT 266 White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Box-Gum Woodland CEEC	35.3	1,091
PCT 281 Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Box-Gum Woodland CEEC	365.78	8,517
PCT 483 Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	Box-Gum Woodland CEEC	0.04	2

PCT name	Associated Threatened Ecological Community	Impact area (ha)	Number of ecosystem credits required
PCT 1610 White Box - Black Cypress Pine shrubby woodland of the Western Slopes	-	28.2	526
PCT 1629 Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	-	5.5	116
PCT 1655 Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion VEC	16.19*^	372
PCT 1656 Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin	-	17.8	336
PCT 1661 Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	-	3.7	84
PCT 1711 Tantoon - *Lepyrodia leptocaulis* shrubland on sandstone drainage lines of the Sydney Basin	-	7.5	133
Total ecosystem credits		**480.01**	**11,177**

*15.5 ha are equivalent to Eucalypt Forest and Woodland CEEC.

^ Includes 0.09 ha of planted native vegetation.

Table ES-2 Impacts that require an offset - species credits

Common name	Scientific name	Loss of habitat (ha) or individuals	Number of species credits required
Cotoneaster Pomaderris	*Pomaderris cotoneaster*	0.07*	2
Pink-tailed Legless Lizard	*Aprasia parapulchella*	207.14[1]	4,147^
Regent Honeyeater	*Anthochaera phrygia*	80.5	3,410
Large-eared Pied Bat	*Chalinolobus dwyeri*	113.02	5,137
Eastern Cave Bat	*Vespadelus troughtoni*	113.02	5,137
Squirrel Glider	*Petaurus norfolcensis*	113.02	3,425
Koala	*Phascolarctos cinereus*	113.02	3,425
Total species credits			**24,683**

* 0.07 ha loss associated with the 30 m buffer around the area of suitable habitat where the species was observed. No individuals would be impacted.

^ Including 405 credits for impacts to habitat on Category 1 – exempt land

[1] This area includes 25.3 ha of Category 1 – exempt land.

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Shortened forms

Table 1. Abbreviations

Term or abbreviation	Definition
ASL	above sea level
AOO	Area of Occupancy
BAM	Biodiversity Assessment Methodology
BAM-C	BAM Credit Calculator
BC Act	NSW *Biodiversity Conservation Act 2016*
BC Regulation	NSW *Biodiversity Conservation Regulation 2017*
BCS	NSW Biodiversity, Conservation and Science Directorate
BDAR	Biodiversity Development Assessment Report
BMP	Biodiversity Management Plan
BOM	Bureau of Meteorology
CEEC	Critically Endangered Ecological Community
cm	centimetre
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DBH	Diameter at breast height
Cth DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
NSW DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
DECCW	Department of Environment, Climate Change and Water
DEWHA	Department of the Environment, Water, Heritage and the Arts
DNG	Derived Native Grassland
DOE	Department of the Environment
DPHI	NSW Department of Planning, Housing and Infrastructure (formerly Department of Planning and Environment, DPE)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
ELA	Eco Logical Australia
EOO	Extent of Occurrence
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GDE	Groundwater Dependent Ecosystems
GDE Atlas	Groundwater Dependent Ecosystems Atlas
GIS	Geographic Information System
GPS	Global Positioning System
GWMP	Groundwater Management Plan
ha	hectare/s
IBRA	Interim Biogeographic Regionalisation for Australia
IGGAM	Interim Grasslands and other Groundcover Assessment Method
km	kilometre
LGA	Local Government Area

Term or abbreviation	Definition
LiDAR	Light Detection and Ranging
LLS Act	NSW *Local Land Services Act 2013*
m	metre
MCM	Moolarben Coal Mines Pty Ltd
MCO	Moolarben Coal Operations Pty Ltd
MIC	Maximum Instantaneous Charge
mm	millimetres
mm/s	millimetres per second
MNES	Matters of National Environmental Significance (from the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*).
Mt	million tonnes
Mtpa	million tonnes per annum
Niche	Niche Environment and Heritage Pty Ltd
NSW	New South Wales
NVRM	Native Vegetation Regulatory map
OC	Open cut mine
OEH	Office of Environment and Heritage
PCT	Plant Community Type
RDP	Rapid Data Point
RMP	Rehabilitation Management Plan
PMST	Protected Matters Search Tool
ROM	Run-of-mine
SAII	Serious and Irreversible Impacts
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
TARP	Trigger Action Response Plan
TBDC	Threatened Biodiversity Database Collection
TDS	Total Dissolved Solids
TEC	Threatened Ecological Community
The EIS	Moolarben Coal Complex OC3 Extension Project Environmental Impact Statement
The Project	Open Cut 3 Extension Project
TSSC	Threatened Species Scientific Committee
UG	Underground mine
VEC	Vulnerable Ecological Community
VI	Vegetation Integrity
VZ	Vegetation Zone
Yancoal	Yancoal Australia Limited
YM	Yancoal Moolarben Pty Ltd

Declarations

1. Certification under clause 6.15 Biodiversity Conservation Act 2016

I certify that this report has been prepared based on the requirements of, and information provided under, the Biodiversity Assessment Method and clause 6.15 of the *Biodiversity Conservation Act 2016* (BC Act).

Signature: 

Date: 7 March 2024

BAM Assessor Accreditation no: BAAS19016

This BDAR has been prepared to meet the requirements of BAM 2020. Appendix A provides an assessment of compliance with the minimum information requirements outlined in BAM Appendix K.

2. Details and experience of author/s and contributors

This BDAR has been prepared by the accredited personnel and support staff identified in Table 2. Niche Environment and Heritage Pty Ltd (Niche) prepared this report in collaboration with Ecologists from Premise as detailed below. Field data relating to vegetation and flora was collected by Eco Logical Australia (ELA) and Niche. All field data relating to fauna was collected by AMBS Ecology and Heritage. Vegetation mapping data provided by ELA was ground-truthed by Premise and both the flora and fauna survey reports were reviewed by Niche and Premise for compliance with the Biodiversity Assessment Method (BAM).

Table 2. Assessor and support staff qualifications and resources.

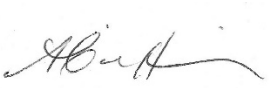
Name	BAM Assessor Accreditation number	Position/Role	Tasks performed	Relevant qualifications
Amanda Griffith	BAAS19016	Principal Ecology Consultant – Niche Project director/manager	Project direction/management and co-ordination, technical and quality review of report.	BSc (Hons), PhD Accredited Biodiversity Assessor
Ryan Sébire	N/A	Senior Ecology Consultant – Niche Co-project manager	Report preparation, impact assessment, data management and review/audit, BAM Calculations	BEnvSc&Mgmt
Alex Christie	BAAS18131	Senior Ecology Consultant – Niche Co-project manager	Report preparation, impact assessment, data management and review/audit, BAM Calculations	BEnvSc Accredited Biodiversity Assessor
Mandy Melvaine	N/A	Ecology Consultant – Niche Project support	Report preparation	BAVetBioSci (Hons), MEnvScMgt

Name	BAM Assessor Accreditation number	Position/Role	Tasks performed	Relevant qualifications
Sophia Dunn	N/A	Ecology Consultant – Niche Project support	Report preparation	BSc (EnvSci), MESCM
Sally Kirby	BAAS21027	Senior Ecologist - Premise	Report preparation, impact assessment, data management and review, audit/ground-truth of site data	BSc, M. Env. Studies Accredited Biodiversity Assessor
Isobel Colson	BAAS22028	Senior Ecologist – Premise	Report preparation, impact assessment, data management and review, audit/ground-truth of site data	BSc, MSc Accredited Biodiversity Assessor
Michelle Lindsay	N/A	Ecologist – Premise	Report preparation, impact assessment, data management and review, audit/ground-truth of site data	BioCons

3. Conflict of interest

I declare that I have considered the circumstances and there is no actual, perceived or potential conflict of interest:

This declaration has been made in the interests of full disclosure to the decision-maker. Full disclosure has also been provided to the client.

Signature: 

Date: 7 March 2024

BAM Assessor Accreditation no: BAAS19016

1 Introduction

1.1 Proposed development

1.1.1 Background

The Moolarben Coal Complex is an existing mining operation located approximately 40 kilometres (km) north of Mudgee, New South Wales (NSW) (Figure 1). The Moolarben Coal Complex is operated by Moolarben Coal Operations Pty Ltd (MCO) on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Yancoal Moolarben Pty Ltd [YM] and a consortium of Korean power companies). MCO, MCM and YM are wholly owned subsidiaries of Yancoal Australia Limited (Yancoal).

Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038 with a combined coal production rate of 22 million tonnes per annum (Mtpa) in accordance with Project Approval (05_0117) (Stage 1) (as modified) and Project Approval (08_0135) (Stage 2) (as modified). The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining-related infrastructure (including coal processing and transport facilities) (Figure 2).

MCO is proposing to extend open cut mining operations immediately south of the approved OC3 open cut pit as well as develop four new open cut pits to the east and south-east of the approved OC3 mining area, within the existing mining tenements (the Project).

The extended open cut mining operations would provide approximately 10 years of mining (from 2025 to 2034), maximise use of the existing mining fleet and maintain steady production of run-of-mine (ROM) coal at the Moolarben Coal Complex post-completion of mining within the approved OC3 mining area.

Project Environmental Impact Statement

MCO (2022a) prepared the Moolarben Coal Complex OC3 Extension Project Environmental Impact Statement (the EIS) for the Project to support the assessment process under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The EIS was placed on public exhibition by the Department of Planning and Environment (DPE) (now Department of Planning, Housing and Infrastructure [DPHI]) from 17 November to 14 December 2022. During this period, government agencies, organisations and members of the public were invited to provide submissions on the EIS to DPE.

The EIS included the following activities:

- Extension of open cut mining operations within Mining Lease 1691, and Exploration Licence (EL) 6288, and EL 7073 to allow mining of additional coal resources.
- Extraction of up to 9 Mtpa of ROM coal with a total of approximately 40 million tonnes (Mt) over the life of the Project.
- Mining operations between approximately 2025 to 2034 (which is within the approved life of the Moolarben Coal Complex ending on 31 December 2038).
- Extension of employment of existing open cut workforce.
- Construction and operation of ancillary infrastructure, services, plant and equipment in support of mining operations.

- Construction and operation of water management and water storage infrastructure in support of mining operations.
- Development of an integrated final landform with the approved OC3 mining area.
- Ongoing exploration activities in the Project area.
- Construction of haul road creek crossings.
- Quarrying and/or excavation of borrow pits within approved disturbance areas to retrieve construction materials.
- Conventional open cut mining related activities such as drilling and blasting, and other associated activities.
- Rehabilitation, decommissioning and closure.

In response to submissions received on the EIS, MCO is proposing to amend the Project Development Footprint (including reduced ROM coal and peak annual production and revised mine schedules and rehabilitation plan). These changes are described in the Amendment Report. The amended Project Development Footprint has been designed to incorporate additional avoidance measures relative to the EIS.

When compared to the EIS, the proposed amendments to the Project include:

- A reduction in the extent of proposed open cut mining.
- A reduction in total resource extracted from 40 Mt to approximately 30 Mt over the life of the Project.
- A reduction in the peak annual ROM mining rate from 9 Mt to 8.5 Mt over the life of the Project.
- No change to the duration of the mine life (i.e. between approximately 2025 to 2034), peak workforce, or hours of operation of the mine.
- No change to the proposed integrated final landform with the approved OC3 mining area (including no final voids in the rehabilitated final landform).
- A revised conceptual post-mining land use which incorporates additional areas of native woodland and increases the proposed extent of the Habitat Enhancement Area.

The amended Project general arrangement is shown on Figure 3. Development of the Project would occur as per the staging shown in Figure 4.

The Biodiversity Development Assessment Report (BDAR) prepared for the EIS has now been updated (this document) and forms part of the Amendment Report.

1.1.2 Proposed development and the Development Footprint

The Subject Land, hereafter referred to as the Development Footprint, is the indicative surface disturbance extent of the Project. The amended Project Development Footprint encompasses approximately 675.21 hectares (ha) of land (150.37 ha less than the Development Footprint presented in the EIS).

The land associated with the Development Footprint is zoned RU1 (Primary Production) in the Mid-Western Regional Local Environmental Plan (NSW Government 2012). The site map including the Development Footprint is shown in Figure 5 and encapsulates the maximum total clearance required for the Project. It includes all activities and development components which result in surface disturbance.

The Development Footprint is situated to the immediate south of MCO's existing operations (including open cut and underground operations, Figure 6a) and comprises land of predominately derived native grassland (DNG) and regenerating woodland, but also contains areas of remnant woodland and forest.

There are areas of remnant woodland and forest in the Development Footprint that are well connected to extensive areas of native vegetation within Munghorn Gap Nature Reserve to the south and east (Figure 6b), and Goulburn River National Park located 10 km to the north via vegetated hills and ridgelines.

The Study Area is a larger area encompassing the Development Footprint.

1.2 Biodiversity Offsets Scheme entry

Development Consent for the Project is sought under the State Significant Development provisions (i.e. Division 4.7) under Part 4 of the EP&A Act. As such, a BDAR prepared in accordance with the Biodiversity Assessment Method (BAM) (NSW Department of Planning, Industry and Environment [DPIE] 2020a) is required to assess impacts to biodiversity as per the NSW *Biodiversity Conservation Act 2016* (BC Act).

1.2.1 Secretary's Environmental Assessment Requirements

In preparing this BDAR, the Secretary's Environmental Assessment Requirements (SEARs) issued for the Project on 21 January 2022 (and subsequent Commonwealth Government assessment requirements) have been addressed. The key matters raised by the Secretary that are applicable to this BDAR, and the section within this report which addresses each of the SEARs, are outlined in Section 5.

1.3 Excluded impacts

The Study Area contains extensive areas of grassland that were assessed to be Category 1 – exempt land. The NSW *Local Land Services Act 2013* (LLS Act) defines Category 1 – exempt land as land that meets any of the following (LLS, 2021):

- *Land cleared of native vegetation as at 1 January 1990 or lawfully cleared after 1 January 1990*
- *Low conservation grasslands*
- *Land containing only low conservation groundcover (not being grasslands)*
- *Native vegetation identified as regrowth in a Property Vegetation Plan under the repealed Native Vegetation Act 2003*
- *Land bio-certified under the BC Act.*

Eco Logical Australia (ELA) (2023) identified Category 1 – exempt land within the Study Area using the following sources:

- Historic aerial imagery (NSW Government Spatial Services 2021c)
- Mid-Western Regional Local Environmental Plan 2012 (MWRC LEP) Sensitivity Biodiversity Map (BIO_005) (MWRC 2012)
- Transitional Native Vegetation Regulatory Map (NVRM) (DPE 2022g)
- NSW Woody Vegetation Extent (DPIE 2015)
- NSW Landuse 2017 layer (DPIE 2017).

Land categorisation surveys were conducted in December 2021 and January 2022 in accordance with the *Interim Grasslands and other Groundcover Assessment Method* (IGGAM) (Office of Environment and Heritage [OEH] 2018a) to confirm the conservation value of potential Category 1 – exempt land. IGGAM transects were undertaken in summer when perennial groundcover was at its peak and groundcover species were easily identifiable. ELA (2023) describe that grassland areas had not been grazed (or disturbed) within six (6) months prior to the assessment of condition, therefore the vegetation was considered suitable for assessment.

A total of 20 IGGAM transects were undertaken to assess the proportion of native and exotic perennial groundcover species in accordance with Section 3.2.3 of the IGGAM, and a native species assessment was undertaken in accordance with Section 3.3 of the IGGAM to be thorough. All data was inserted into the IGGAM Calculator to determine the conservation value of the grassland and other groundcover. A full description of the Category 1 – exempt land assessment is provided in Appendix C of the ELA (2023) Baseline Flora Report.

In addition to ELA's (2023) land categorisation assessment, a site-based floristic assessment was also undertaken by Niche from the 31 July 2023 to the 4 August 2023 to further review the categorisation of the land within the Development Footprint (particularly within the areas identified as DNG) which included 15 additional IGGAM and BAM plots (see Appendix K for site data and Figure 8 for plot locations). These additional surveys were undertaken during the cooler months and the areas were subject to livestock grazing. However, native and perennial ground cover species remained identifiable by intact inflorescences, new season leaf growth, habit, soil type and position in landscape.

Niche's field data was reviewed to further assess the categorisation of the land. Four plots (KLG11, KLG12, KLG13 and KLG15) had over 50% perennial exotic vegetation cover, predominantly dominated by exotic perennial species such as *Phalaris aquatica* (Harding Grass), *Setaria parviflora* (Slender Pigeon Grass) and *Chloris Gayana* (Rhodes Grass). Eleven plots (plots KLG01, KLG02, KLG03, KLG04, KLG05, KLG07, KLG06, KLG08, KLG09, KLG10, KLG14) were determined to have over 50% native species cover. However, all of these eleven plots had a Vegetation Integrity (VI) score <15 and were therefore determined to have low conservation value (and are not required to be offset under Section 9.2.1 of the BAM).

In accordance with the recently published guideline for *Determining native vegetation land categorisation for application in the Biodiversity Offset Scheme* (DPE 2023b), Niche applied the following methodology to determine land categorisation in accordance with the flowchart provided in section 2.2 of this guideline (DPE 2023b):

1. **Is the subject land excluded on the transitional or draft NVR map? Yes/No**

   No.

2. **On the transitional or draft NVR map is the subject land category 2-vulnerable regulated and/or category 2-sensitive regulated? Yes/No**

   Yes, partially. As identified by ELA (2023) "*Category 1 Land is not defined on the Transitional NVRM (DPE 2022a). The Study Area contains Category 2 – Vulnerable Regulated Land (Category 2 Land) along Moolarben Creek and Murdering Creek. Mapped Category 2 Land has been excised from Category 1 Land within the Study Area*". That is, the land mapped as Category 1 – exempt land within the Development Footprint does not contain any of the land mapped on the NVR map as Category 2 – vulnerable regulated land.

   Further assessment for those areas not identified as Category 2 – vulnerable regulated land on the NVR map is outlined below.

3. **Is the subject land category 2-regulated land? Yes/No**

   Yes, partially. Of the criteria outlined in Table 1 of the guideline (DPE 2023b), the subject land contains land that was not cleared of native vegetation as at 1 January 1990 and areas of native ground cover that are not grasslands or low conservation ground cover.

   These outcomes were supported by analysis of the following as described by ELA (2023):

- Historic aerial imagery (NSW Spatial Services 2022)
- Mid-Western Regional Local Environmental Plan 2012 (MWRC LEP) Sensitivity Biodiversity Map (BIO_005)
- Transitional Native Vegetation Regulatory Map (NVRM) (DPE 2022)
- NSW Woody Vegetation Extent (DPIE 2015)
- NSW Landuse 2017 layer (NSW DCCEEW 2019).

ELA (2023) explains that "*A portion of grassland in the eastern section of the Study Area was not cleared of native woody vegetation until 1990 (available imagery dated 28 November 1990; Appendix C)*".

Consideration of critically endangered communities

Critically Endangered Ecological Communities (CEECs) and critically endangered species of plants are designated as Category 2- sensitive regulated land (clause 108(2)(b), LLS Regulation), however, state-wide comprehensive mapping of all CEECs and critically endangered species of plants is not currently published on the transitional NVR map. No Category 2 – sensitive regulated land is mapped within the Development Footprint on the NVR map.

DPE (2023i) notes that "*The presence of CEECs and/or critically endangered plants must be considered for site-scale refinement, regardless of published map products*" and that "*site-based floristic assessment to confirm the presence or absence of CEECs and/or critically endangered plants for any reasonable assessment of NVR map land category*".

As such, areas of grassland within the Development Footprint that were identified as Category 1 – exempt land by ELA (2023) were assessed to determine if they meet the criteria for *Notice and reason for the Final Determination for White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin* (Threatened Species Scientific Committee (TSSC) 2020a).

The areas mapped as Category 1 – exempt land contain some native species that are associated with Plant Community Type (PCT) 281, which occurs adjacent (in a DNG form) and has been aligned to the Box Gum Woodland CEEC. However, ELA (2023) determined in their assessment; "*due to the highly modified nature of Category 1 – exempt land within the Study Area, resulting in the dominance of exotic perennial groundcover species, the Category 1 – exempt land does not conform to any PCT or TEC*".

A comparison of the plot data obtained within the mapped Category 1 – exempt land and the areas mapped as PCT 281 as detailed below and shown in Table 3, further indicates the area mapped as Category 1 – exempt land does not constitute BC Act listed Box Gum Woodland CEEC.

An ecological community is defined as 'an assemblage of species occupying a particular area'. The ecological community that once occurred in areas mapped at Category 1 – exempt land has been lost through historic clearance, cropping and pasture improvement as evidenced by current and historic aerial photos and a review of the floristic data. It is considered that the vegetation in the cleared land is not the BC Act listed Box Gum Woodland CEEC on the basis that:

- it is not characterised by the assemblage of native species listed in Part 1.1 of the Final Determination. Rather it is characterised by the following, the majority of which are exotic species; *Arctotheca calendula*, *Bromus catharticus*, *Chloris Gayana*, *Cirsium vulgare*, *Conyza bonariensis*, *Hypericum perforatum*, *Hypochaeris radicata*, *Paspalum dilatatum*, *Phalaris aquatica*, *Plantago lanceolata*, *Rumex acetosella*, *Setaria parviflora*, *Trifolium repens* and *Verbena bonariensis;*
- the native understorey species listed in Part 1.1 of the Final Determination which are present (*Sporobolus creber, Microlaena stipoides, Lomandra multiflora subsp. Multiflora, Oxalis perennans, Rumex brownii, Aristida ramosa, Panicum effusum, Geranium solanderi, Chloris ventricosa, Themeda triandra, Austrostipa aristiglumis, Bothriochloa macra, Anthosachne scabra, Cheilanthes sieberi subsp. Sieberi, Euchiton sphaericus, Hypericum gramineum, Wahlenbergia communis, Glycine clandestina* and *Rytidosperma spp.*) are not uniformly distributed across the area mapped as Category 1 – exempt land. Only two plots supported eight or more native species (IGGAM4 [11] and IGGAM5 [8]) while the remaining plots only supported two to three native species per plot. Further, those two plots with the relatively higher understorey species diversity (IGGAM4 and IGGAM5) had 68% and 84.2% exotic weed cover, respectively;
- the majority of the cleared land was dominated by exotic species regardless of dominant native species abundance (six plots with high native abundance with high exotic cover). This abundance to cover ratio is notably higher compared to the derived native grassland vegetation zones mapped within the study area and woodland in the study area with neither acquiring plots with high native abundance and high exotic cover;
- the cleared land lacks native species diversity (total of 55 native species across all plots) which is notably lower compared to the derived native grassland vegetation zones mapped within the study area [128 native species] and woodland in the study area [195 native species]);
- the cleared land is dominated by exotics (average of 42.6 % cover) (notably more than the DNG vegetation zones mapped within the study area (average of 18.3 %) and woodland in the study area (2.9 %);
- the zone doesn't conform to a PCT (which would have once been present) because there is no canopy or shrub layer and the ground stratum is floristically depauperate containing only five of the characteristic groundcover species listed on BioNet Profile for PCT 281;
- the integrity of the zone has been all but lost, evidenced by a VI score of 3 out of 100. This is well below the threshold for offsetting impacts to CEECs which is required for areas with a VI score of 15 or above (BAM [2020]); and
- the zone has lost the ability to function as the ecological community (evidenced by a function score of 0 out of 100). Natural restoration is unlikely in this transformed state and would likely need a high degree of active intervention and revegetation (i.e. many flora species brought into the site to recreate the community that once occurred) (Good et al., 2021).

Table 3. Summary of floristic characteristics of Category 1 – exempt land compared to areas mapped as Box-Gum Woodland (CEEC)

	Woodland (PCT 281 High)	**DNG** (PCT 281 DNG)	**Cleared Land**
Native Species Diversity	195	128	55
Exotic Cover	2.9 %	18.3 %	42.6 %
VI Score	90.4	33.3	3

As such, land assigned as Category 1 – exempt land by ELA (2023) was not considered to meet the conditions to be classified as PCT 281 or any other PCT and therefore does not meet the conditions to be classified as *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, NSW South Western Slopes, South East Corner and Riverina Bioregions* listed under the BC Act.

These areas of cleared land were further assessed to determine if they meet the criteria of Box-Gum Woodland DNG in accordance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) listed *White Box – Yellow Box – Blakey's Red Gum Grassy Woodlands and Derived Native Grasslands* Approved Conservation Advice (Commonwealth Department of Climate Change, Energy, the Environment and Water [Cth DCCEEW 2023c]). Using the key diagnostic characteristics and condition classes and thresholds outlined in the Approved Conservation Advice (Cth DCCEEW 2023), Niche's assessment determined that those areas mapped as Category 1 - exempt land do not meet the criteria of the EPBC Act listed *White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland* due to absence of a predominantly native understorey (plots KLG11, KLG12, KLG13 and KLG15) and/or the absence of twelve or more native understorey species (excluding grasses) (plots KLG01, KLG02, KLG03, KLG04, KLG05, KLG07, KLG06, KLG08, KLG09, KLG10, KLG14). In addition, none of the patches contained an average of 20 or more trees per hectare, or natural regeneration of the dominant overstorey eucalypts. As such, the areas mapped as Category 1 – exempt land do not meet the criteria to be classified as Box-Gum Woodland CEEC under the EPBC Act.

In summary, it was determined that the area mapped as Category 1 – exempt land does not conform to the BC Act or EPBC Act listed CEEC, and thus does not constitute Category 2 – sensitive regulated land.

4. Is the subject land category 1-exempt land? Yes/No

Yes, all remaining land not previously identified above. Of the criteria outlined in Table 2 of the guideline (DPE 2023b), the subject land contains land that was cleared of native vegetation as at 1 January 1990 and areas of low conservation ground cover.

These outcomes were supported by analysis of the following as described by ELA (2023):

- Historic aerial imagery (NSW Spatial Services 2021)
- Mid-Western Regional Local Environmental Plan 2012 (MWRC LEP) Sensitivity Biodiversity Map (BIO_005)
- Transitional Native Vegetation Regulatory Map (NVRM) (DPE 2022)
- NSW Woody Vegetation Extent (DPIE 2015)

- NSW Landuse 2017 layer (NSW DCCEEW 2019).

"*The earliest available historic aerial imagery (1960) and subsequent images (1968, 1982 and 1994) (NSW Spatial Services 2022) indicates that grassland areas throughout the Study Area have been subject to long-term, on-going agricultural land uses, such as livestock grazing, hay making and cropping. The earliest available imagery (1960) demonstrates that the majority of grassland areas were cleared of woody vegetation prior to 1960. Examples of this are provided in Appendix C*" (ELA 2023).

Following land categorisation surveys, 186.6 ha within the Development Footprint was classified as Category 1 – exempt land. These are predominantly areas subject to pasture cropping and were dominated by exotic perennial species such as *Paspalum dilatatum* (Paspalum)*, Digitaria eriantha* (Digit Grass) *and Pennisetum clandestinum* (Kikuyu) as determined by Niche in 2023 and ELA (2023).

Clause 6.8(3) of the BC Act specifies that the BAM (DPIE 2020a) is to exclude the assessment of impacts of any clearing of native vegetation and loss of habitat on Category 1 – exempt land, with assessment of impacts to Category 1 – exempt land also excluded from the BDAR. However, prescribed impacts associated with the loss of vegetation on Category 1 – exempt land is still assessed in this BDAR in accordance with Clause 6.1 of the *Biodiversity Conservation Regulation 2017*.

Category 1 – exempt land within the Development Footprint is shown in Figure 7. Non-vegetative areas such as access roads, buildings and dams do not need further assessment as per Section 9.3 of the BAM (DPIE 2020a).

1.4 Matters of National Environmental Significance

This BDAR assesses impacts to Matters of National Environmental Significance (MNES) listed under the EPBC Act. MCO referred the Project to the Commonwealth Minister of the Environment who determined the Project to be a "Controlled Action" under the EPBC Act on 2 May 2022. The controlling provisions for the Project were "listed threatened species and communities" (Sections 18 and 18A of the EPBC Act) and "a water resource, in relation to coal seam gas development and large coal mining development" (Sections 24D and 24E of the EPBC Act). The Project (EPBC 2022/9162) will be assessed under the Bilateral Agreement between NSW and the Commonwealth.

The Commonwealth Department of Agriculture, Water and the Environment (DAWE) (now Cth DCCEEW) has provided input in the SEARs. The SEARs include the Commonwealth's assessment requirements for the MNES relevant to the Project (Section 8; Appendix D). This BDAR has addressed the relevant SEARs from the Commonwealth Government.

1.5 Information sources

Resources and survey guidelines reviewed in the preparation of this BDAR are detailed in Table 4 and listed in Section 11. This BDAR uses site data, vegetation mapping, species likelihood of occurrence and habitat assessments and species polygons as collected and provided by ELA (2023), AMBS (2023) and Niche. Field data relating to vegetation and flora was collected by ELA and Niche. All field data relating to fauna was collected by AMBS Ecology and Heritage. Vegetation mapping data provided by ELA was ground-truthed by Premise and both the flora and fauna survey reports were reviewed by Niche and Premise for compliance with the BAM. Where relevant, information from these reports (such as methods, survey effort, etc.) has been summarised within the BDAR, with reference to further detail being provided within the reports in Appendices B and C.

On 14 April 2023, the BAM Credit Calculator was updated to include the revised PCT classification for Eastern NSW. Transitional arrangements allow assessors with in-progress BAM-Credit Calculator assessments, to maintain the legacy PCT classification. The BAM case for this BDAR was opened in March 2022 prior to the revised PCT classification and therefore the transitional arrangements apply. The vegetation mapping was also completed prior to the revised PCT classification so the legacy PCT classification was retained for the assessment. On 1 February 2023, the BAM-Credit Calculator was updated to include Version 1.2 benchmarks, which have been used in this assessment.

Table 4. Assessment resources and guidelines used.

Assessment resources/guideline	
Assessment guidelines	▪ BAM (DPIE 2020a) ▪ BAM Operational Manual – Stage 1 (DPIE 2020b, DPE 2022a) ▪ BAM Operational Manual – Stage 2 (DPE 2023j) ▪ BAM-C User Guide (OEH 2018b) ▪ *Interim Grasslands and other Groundcover Assessment Method Determining Conservation Value of Grasslands and Groundcover Vegetation in NSW* (OEH 2018a). ▪ *Determining native vegetation land categorisation for application in the Biodiversity Offset Scheme* (DPE 2023b).
Survey guidelines	▪ *Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method* (DPIE 2020c) ▪ *'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method* (OEH 2018c, DPIE 2021) ▪ *NSW Survey Guide for Threatened Frogs: A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method* (DPIE 2020d) ▪ *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities – Working Draft* (Department of Environment and Conservation [DEC] 2004) ▪ *Species specific survey requirements* in the *NSW BioNet Threatened Biodiversity Database Collection* (TBDC) (DPE 2023a) ▪ *Koala (Phascolarctos cinereus): Biodiversity Assessment Method Survey Guide* (DPE 2022c) ▪ *Threatened Reptiles – Biodiversity Assessment Method Survey Guide* (DPE 2022f). In the absence of specific survey guidelines issued at the state level, Commonwealth survey guidelines were adapted: ▪ *Survey Guidelines for Australia's Threatened Mammals: Guidelines for detecting mammals listed as threatened under the* Environment Protection and Biodiversity Conservation Act 1999 (Department of Sustainability, Environment, Water, Population and Communities [DSEWPaC] 2011a) ▪ *Survey Guidelines for Australia's Threatened Reptiles: Guidelines for detecting reptiles listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (DSEWPaC 2011b) ▪ *Environment Protection and Biodiversity Conservation Act 1999 referral guidelines for the vulnerable striped legless lizard, Delma impar* (DSEWPaC 2011c) ▪ *Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment, Water, Heritage and the Arts [DEWHA] 2010a) ▪ *Draft Survey Guidelines for Australia's Threatened Orchids: Guidelines for detecting orchids listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment [DOE] 2013) ▪ *Survey Guidelines for Australia's Threatened Bats: Guidelines for detecting bats listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999* (DEWHA 2010b).

Assessment resources/guideline	
Previous ecological assessments	▪ Moolarben Coal Project – Stage 1 – Environmental Assessment (MCO 2017) ▪ Moolarben Coal Project – Stage 2 – Environmental Assessment Report (MCO 2018) ▪ Ecological Impact Assessment – Stage 2 of the Moolarben Coal Project, Ulan, NSW (Ecovision 2008) ▪ Moolarben Coal Complex UG1 Optimisation Modification Environmental Assessment (MCO 2016) ▪ Moolarben Coal Complex – UG1 Optimisation Modification Flora and Fauna Impact Assessment (ELA 2015a) ▪ Moolarben UG2 Modification – Threatened Bat Fauna Surveys (AMBS 2021) ▪ Moolarben Coal Complex UG2 Modification – Baseline Vegetation Assessment (ELA 2021).
Key resources	▪ This assessment has used the latest version of the BAM-C: o BAM app last updated: 13/04/2023 10:00 [Version: 1.4.0.00] o BAM data last updated: 22/06/2023 [Version: 61] ▪ Vegetation mapping used for this BDAR has been based on the vegetation validation and BAM plot collection by ELA (2023) and Niche field surveys. ▪ Threatened species polygons have been based on data and reporting undertaken for the Project by AMBS (2023) and Niche field surveys. Other publications and guidelines used have been referenced within the text and included in the references section.

2 Stage 1 – Biodiversity Assessment – Methods

2.1 Methods

2.1.1 Site context methods

Landscape features

Landscape features were identified according to Section 3.1 of the BAM (DPIE 2020a). A combination of desktop and field survey methods were undertaken by ELA (2023) to identify landscape features within the Development Footprint. The following resources were reviewed by Niche:

- NSW State Vegetation Type Map (DPIE 2019b; NSW DCCEEW 2022b)
- Transitional Native Vegetation Regulatory Map (DPE 2022)
- Gulgong 1:100,000 Geological Map (NSW Government Mining, Exploration and Geoscience 2000)
- NSW Landuse 2017 spatial data (DPIE 2017)
- NSW Woody Vegetation Extent (DPIE 2015)
- MCO aerial imagery 2022 (MCO 2022e)
- NSW BioNet Vegetation Classification (DPE 2022e [2])
- Topographic mapping (2 m contours) as supplied by MCO
- *Water Management (General) Regulation 2018* Hydro Line spatial data (DPIE 2018)
- NSW Land and Property Information (LPI) Roads Layer (NSW Government Spatial Services 2021a)
- Historical aerial imagery (NSW Government Spatial Services 2021, 2022).

An initial vegetation map of the Study Area was prepared based on the previous resource review. Field surveys undertaken between 2019 and 2022 involved collecting rapid data points (RDPs) and walking transects (ELA 2023) to confirm the extent and condition of these landscape features. Data collected at each RDP included:

- Dominant canopy, mid-storey and groundcover species present
- Vegetation formation and class in accordance with Keith (2004)
- Landform and landscape type
- Weed species
- Management issues
- Soil type
- Evidence of previous disturbance
- A photograph.

The area of investigation for the vegetation and flora surveys was the Study Area which extended beyond the Development Footprint. Over 500 RDPs were collected across the Study Area during surveys to verify PCTs and stratify PCTs into Vegetation Zones (VZs) within broad condition states. RDPs were stratified and then targeted during VI plot surveys.

[2] NSW BioNet Vegetation Classification (DPE 2023b) has been reviewed and no updates required.

Native vegetation cover

The percentage of native vegetation cover estimated to remain in the landscape was assessed according to Section 3.2 of the BAM (DPIE 2020a). A 1,500 m buffer was applied to the edge of the Development Footprint and all native vegetation within this area was digitised using Geographic Information System (GIS) editing tools.

Native vegetation extent was mapped using the latest available aerial imagery (MCO 2020a) and digitised using GIS. The initial vegetation maps were ground-truthed in the field between 2019 and 2022. Native vegetation within the 1,500 m buffer that was not within the vegetation survey area was identified using the State Vegetation Type Map (NSW DCCEEW 2022b). Native vegetation in both surveyed areas and outside of the survey area was digitised using GIS and the total area calculated to determine native vegetation cover.

2.1.2 Native vegetation, threatened ecological communities and vegetation integrity methods

Existing information

PCTs in the Study Area encompassing the Development Footprint were determined according to Section 4.2 of the BAM (DPIE 2020a). Desktop review of the State Vegetation Type Map (NSW DCCEEW 2022b) and BioNet Vegetation Classification (DPE 2022e[2]) were used to identify potentially occurring PCTs. Draft vegetation mapping developed was then refined following field surveys, based on 500 RDPs and 80 VI plots collected across the site between 2019 and 2022 (ELA 2023).

Filters were applied to the BioNet Vegetation Classification (DPE 2022e[2]) using a combination of Interim Biogeographic Regionalisation for Australia (IBRA) region, IBRA sub-region, vegetation formation and species composition. Analysis of floristic data from VI plots and abiotic factors such as landscape position, soil type, geology influence and other relevant information was used to determine the most appropriate PCT for each VZ.

Threatened Ecological Communities (TECs) within the Development Footprint were identified in accordance with the relevant listing under the BC Act and EPBC Act. ELA (2023) assessed TECs associated with PCTs in the BioNet Vegetation Classification (DPE 2022e[2]) against the following literature and publications to determine TEC extent:

- *Notice of and Reason for the Final Determination: White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (TSSC 2020a), hereafter referred to as the Box-Gum Woodland Final Determination
- *EPBC Act Policy Statement: White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands* (DEH 2006)
- *Commonwealth listing advice on White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (TSSC 2006[3]), hereafter referred to as the Box-Gum Woodland Listing Advice
- *Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion – vulnerable ecological community listing* (TSSC 2021)

[3] Approved Conservation Advice for the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (DCCEEW 2023c) was reviewed 6 November 2023. The minimum condition threshold required for protection under the EPBC Act is consistent with the Box-Gum Woodland Listing Advice (TSSC 2006).

- *Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community* (DOE 2015a).

The presence of TECs was assessed during late Autumn 2021 as this was identified as the best time of year to assess TEC condition due to the demise of annual species (DEH 2006 cited in ELA 2023).

Plot-based vegetation survey

RDP data, VI plot data, and historical and current aerial photography were used in the determination of PCTs and to stratify the Development Footprint into VZs (ELA 2023).

Plot-based floristic vegetation surveys were based on 20 m x 20 m (or 400 square metres [m^2] equivalent) plots. The following data was collected at each VI plot:

- Site name
- Name of recorder(s)
- Date
- Plot orientation, slope, and aspect
- Easting and Northing using Global Positioning System (GPS)
- Site photographs.

Species composition was also assessed within the 400 m^2 plot including:

- Full name and number of all native and exotic plant species present
- Growth form group for each native species as prescribed by Appendix F of the BAM (DPIE 2020a) ((T) Tree; (S) Shrub; (G) Grass and grass-like (F) Forb; Fern; (O) other)
- If the species is native, exotic, a high threat weed or a non-high threat weed.

Vegetation structure was assessed within each 400 m^2 plot including:

- Estimate of the foliage cover of each recorded species: in decimals if less than 1 percent (%), in whole numbers up to 5% and to the nearest 5% if > 5%
- Relative abundance rating or count (when less than 10) or estimate (when greater than 10) of the number of individuals of a species within the plot using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1,000, or specify a number greater than 1,000 if required.

Vegetation function was assessed within a 1,000 m^2 plot (50 m x 20 m):

- Number of large trees, tree regeneration, tree stem size class, total length of fallen logs, number of hollow-bearing trees
- Litter cover within five 1 m x 1 m sub-plots.

All VI plots collected by ELA within the Development Footprint were verified by Premise ecologists on-site between 26-28 April, 10-12 May and 24-26 May 2022. The purpose of this field validation was to ensure the VI plots were representative, and the data reliable to assess the VI scores of the Development Footprint.

Premise ecologists located each VI plot within the Development Footprint using a handheld GPS unit, recorded the dominant species in the upper, mid and lower stratums, noting vegetation formation,

slope and landscape position to ensure the accuracy of the original VI data. Feedback was provided to ELA and changes incorporated into the final Baseline Flora Survey Report (ELA 2023).

Interim Grasslands and other Groundcover Assessment Method (IGGAM)

In addition to ELA's (2023) land categorisation assessment, land categorisation surveys were also conducted by Niche from the 31st of July 2023 to the 4th of August 2023 in accordance with the IGGAM (OEH 2018a) to confirm the conservation value of potential Category 1 – exempt land. This included 15 additional IGGAM (see Appendix K for site data and Figure 8 for plot locations). These additional surveys were undertaken during the cooler months and the areas were subject to livestock grazing. However, native and perennial ground cover species remained identifiable by intact inflorescences, new season leaf growth, habit, soil type and position in landscape.

Vegetation integrity survey

The minimum number of VI Plots was determined according to Table 3, Section 4.3.4 of the BAM (DPIE 2020a). The total area of each VZ was calculated using GIS and the minimum number of plots determined in accordance with the BAM (DPIE 2020a). Plot locations were chosen in accordance with Section 4.3.4 of the BAM (DPIE 2020a) to ensure they captured attributes relevant to that vegetation zone. VI Plot locations are shown on Figure 8.

Scattered trees

Scattered trees in the Development Footprint were identified as three or fewer trees with diameter at breast height (DBH) greater than or equal to 5 centimetres (cm) within 50 m of one another, but greater than 50 m from any other living tree with a DBH greater than or equal to 5 cm. Individual scattered trees were recorded during field surveys conducted for the Baseline Flora Survey Report ELA (2023) using GPS, identified to species level, and habitat features such as presence or absence of hollows were noted.

Scattered trees surrounded by DNG were considered to be remnant of those vegetation communities. Scattered trees surrounded by exotic grassland/Category 1 – exempt land were assigned to the most appropriate PCT based on the species and nearby vegetation. Further detail regarding how these trees were incorporated into the impact assessment and treated within the BAM-C are provided in Section 3.3.4.

2.1.3 Threatened flora survey methods

Review of existing information

ELA (2023) undertook a comprehensive review of literature to compile a list of species to target during threatened flora species surveys. These were reported as follows:

- NSW BioNet Atlas search with a 30 km buffer (DPE 2022d[4]) conducted 7th February 2022.
- Protected Matters Search Tool (PMST) within the same 30 km buffer (DAWE 2022a[5]) conducted 7th February 2022.

[4] NSW BioNet Atlas search (NSW DCCEEW 2024a) was conducted 6 February 2024. Three additional threatened species were identified and assessed further, where applicable.
[5] PMST (Cth DCCEEW 2024a) was conducted 1 February 2024. Nine additional threatened species were identified and assessed further, where applicable.

- ELA threatened species records for the local region from 2017 to 2021 (as referred to in ELA 2023)
- NSW BioNet Threatened Biodiversity Database Collection (DPE 2022a)
- The BAM Calculator (BAM-C) (OEH 2022).
- Threatened flora species records in all publicly available biodiversity assessments for MCO Project Approval and Approval Modifications (MCO 2022b)
- Threatened flora species records in all publicly available biodiversity assessments for the nearby Wilpinjong Coal Mine (Peabody Energy 2021) and Ulan Mine Complex Project Approvals and Approval Modifications (Glencore 2022)
- Publicly available and MCO-specific vegetation mapping for the greater region (Cumberland Ecology 2012; DPE 2011; NSW DCCEEW 2022b; MCO 2013; MCO 2022c).

Each flora species identified in the literature search was assessed in the context of the Development Footprint to determine whether it could potentially occur. Individual species profiles information on the TBDC (DPE 2022a) and the BAM-C (OEH 2022) were used by ELA (2023) to identify habitat requirements, or habitat constraints, for each species.

Niche also undertook the following database searches to identify if survey for any additional species, not considered/surveyed by ELA (2023) was required:

- NSW BioNet Atlas (DPE 2022d[4]) search with a 30 km buffer (conducted 25 February 2022 and 6 February 2024)
- PMST (Cth DCCEEW 2022a[5]) search with a 30 km buffer (conducted September 2022 and February 2024)
- BAM-C predicted and candidate species lists.

The PMST undertaken by Niche (2022) identified an additional potential candidate species (Austral Toadflax [*Thesium australe*]) that was not considered by ELA (2023) (Section 3.4.1). However, given this species was not identified by the BAM-C as a candidate species, the comprehensive survey effort undertaken and the lack of records within 30 km of the Development Footprint (DPE 2022d[4]), the species was excluded from further assessment.

Dichanthium setosum and *Euphrasia arguta* were precautionarily included in this assessment for consideration due to their association with the Inland Slopes IBRA subregion, which is located less than 2 km west of the Development Footprint (ELA 2023). Neither of these species are associated with the Kerrabee IBRA subregion in which the Development Footprint is wholly located within. There are also no records for either species within 30 km of the Development Footprint (NSW DCCEEW 2024a). Under Section 5.2.1 of the BAM (DPIE 2020a), criteria 2a to 2f state the criteria by which threatened species must be considered under the BAM. Criteria 2 (a) specifies "*the distribution of the species includes the IBRA subregion within which the subject land is mostly located*". Section 5.2.1 states that *"If any one of the criteria (2.a–2.f) relevant to the threatened species is not met, the subject land should be considered as unsuitable habitat for that species. No further assessment is required for that species*".

In considering the potential presence of both species, ELA (2023) reviewed vegetation condition, soils and geology to refine the potential survey areas and species habitat for *Dichanthium setosum* and *Euphrasia arguta* within their respective BioNet Vegetation Classification (DPE 2023b) PCT

associations within the Study Area (ELA 2023). ELA (2023) describes in detail why areas of habitat within the Study Area were excluded as providing potential habitat for both species based on review of soil databases and land use.

Given *Dichanthium setosum* and *Euphrasia arguta* are not associated with the Kerrabee IBRA subregion, there are no records within 30 km of the Development Footprint, and the species were further considered unlikely to occur due to lack of suitable habitat (as described in ELA 2023), the subject land (i.e. the Development Footprint) is considered as unsuitable habitat and no further assessment is required for these species.

Flora field surveys

A threatened flora species survey was undertaken in accordance with the BAM (DPIE 2020a) and the methods described in the Threatened Flora Survey Guideline (DPIE 2020c). Threatened flora surveys were conducted over the Study Area where suitable habitat occurred (ELA 2023) (Figure9).

Incidental observations of non-target threatened flora as well as threatened fauna species were recorded simultaneously while undertaking targeted survey (ELA 2023).

The Threatened Flora Survey Guideline (DPIE 2020c) was used to prepare a field survey plan. Parallel field traverses were undertaken for searches in relatively small patches, generally less than 50 ha. The maximum distance between parallel field traverse per life form and vegetation density is outlined in Table 1 of the Threatened Flora Survey Guideline (DPIE 2020c). The maximum distance between parallel traverses for trees is larger in open vegetation (40 m) and smaller in dense vegetation (20 m). Similarly, the maximum distance between parallel traverses depends on the size of the species being targeted (for example 40 m maximum parallel traverses for trees, and 10 m maximum parallel traverses for orchids). Guidance is provided for the length of field traverses relative to the area of habitat being searched in Table 2 of the Threatened Flora Survey Guideline (DPIE 2020c). Where suitable habitat overlapped for species of a different life form, the smaller distance between transects was adopted.

For searches conducted in larger habitat areas greater than 50 ha, a two-phase grid-based systematic survey approach was undertaken, following the method described in the Threatened Flora Survey Guideline (Section 4.4) (DPIE 2020c). A grid spaced at 100 m^2 was placed over a topographic map of the Threatened Flora Study Area, which was nested within a one-square-kilometre grid. Within this two-phase grid, targeted searches were undertaken at the 100 m^2 gridlines within suitable habitat for each targeted species. At each intersection a search was conducted within a 40 m diameter area. Survey locations were pre-loaded onto a GPS unit.

In the event that a threatened flora species was detected during the grid-based survey, finer-scale grid surveys were undertaken in accordance with Table 4 of the Threatened Flora Survey Guideline (DPIE 2020c) to determine the number of individuals.

Survey effort focused on seasonal requirements for optimal detection of each candidate species. Targeted searches were undertaken in the months of January, September, October and November to allow maximum opportunity to observe flowering or fruiting species. Reference sites of known individual threatened plants or populations within the locality were inspected periodically prior to

field surveys to confirm conditions were favourable for species identification, for example species flowering.

Targeted surveys within potentially suitable habitat within the Development Footprint included (ELA 2023):

- 22 km of 10 m parallel transects (the appropriate distance at which to detect small forbs; DPIE 2020c) within PCT 1655 in September – October
- 1,194 40 m radius searches during Spring and October within areas of potential woodland habitat across the Development Footprint
- 293 40 m radius searches within 88 ha of potentially suitable woodland habitat in the south of the Development Footprint.

All searches were conducted by ELA ecologists experienced in threatened plant detection and identification (ELA 2023). Tracks were recorded using a GPS and survey effort is displayed on Figure 9.

Survey effort conducted was assessed against relevant guidelines for each species after the field survey (see ELA 2023 for further details), with justification and limitations discussed.

2.1.4 Threatened fauna survey methods

Review of existing information

Prior to the fauna field surveys, AMBS (2023) completed a desktop review of relevant databases and spatial information using the following resources to identify species requiring survey:

- PCT mapping (ELA 2023)
- NSW BioNet Atlas records (DPE 2022d[4])
- EPBC Act PMST (Cth DCCEEW 2022a[5])
- Previous records and species information for predicted threatened species available in the TBDC (DPE 2023a) and Threatened Species Profile Database (DPE 2023e) were also reviewed.

The review of this existing information was undertaken to identify threatened fauna known or predicted to occur in the locality.

Niche also undertook the following database searches to identify if survey for any additional species not considered/surveyed by AMBS (2023) was required:

- NSW BioNet Atlas (DPE 2022d[4]) search with a 30 km buffer (conducted 25 February 2022)
- PMST (Cth DCCEEW 2022a[5]) search with a 30 km buffer (conducted September 2022)
- BAM-C predicted and candidate species lists (DPE 2023d).

Niche did not identify any additional species requiring consideration.

Habitat constraints assessment

Habitat assessments conducted by AMBS (2023) between January 2021 and March 2022 involved detailed recording and analysis of fauna habitat features throughout the Study Area. Habitat features recorded include:

- Vegetation structure and age
- Site condition
- Dominant flora species
- Presence of livestock
- Evidence of feral animals
- Hollow-bearing trees and decorticating bark
- Nectar or fruit resources
- Rocky areas, including escarpments, outcrops and pagodas
- Scattered trees
- The abundance of potential roosting habitat, including rocky areas containing caves, tunnels, mines, culverts, overhangs, escarpments, outcrops, crevices or boulder piles
- Logs, fallen timber and leaf litter
- Ephemeral and permanent waterbodies
- Evidence of disturbance (e.g. grazing, fire, tracks, logged stumps, erosion)
- Important feed trees and shrubs (e.g. primary feed trees for Koala, *Allocasuarina* sp. And *Acacia* sp.)
- Abundance of ground or arboreal termite mounds
- Mistletoe.

Where possible, bat habitat features (e.g. caves, overhangs, escarpments, outcrops, crevices, boulder piles) were inspected to determine potential suitability for roosting bats. The GPS location of notable habitat features with potential to support roosting bats was recorded when observed.

Habitat constraints for each species credit species were investigated in the Baseline Fauna Survey Report (AMBS 2023), in accordance with Section 5.2.2 of the BAM (DPIE 2020a). Habitat constraints were used to inform methodology of targeted survey required.

In 2023, since submission of the EIS, Mine Subsidence Engineering Consultants (MSEC) (2023) undertook mapping of features (cliffs and rock face features) from Light Detection and Ranging (LiDAR). To compliment AMBS (2023), LiDAR data identifying potential natural geological features such as cliffs, minor cliffs and rock face features which may be utilised by sandstone specialist threatened species within and surrounding the Project was acquired and analysed by MSEC. The mapped LiDAR features were defined as follows:

- Cliffs – A continuous rock face, including overhangs, having a minimum length of 20 metres, a minimum height of 10 metres and a minimum slope of 2 in 1 (>63.4°)
- Minor cliffs – A continuous rock face, including overhangs, which has a:
  - Minimum length of 20 metres and a height between 5 metres and 10 metres, or a maximum length of 20 metres and a minimum height of 10 metres; and
  - Minimum slope of 2 to 1 (>63.4°)
- Rock face features – A continuous rock face, including overhangs, which has a:
  - Minimum length of 20 metres and a height between 3 metres and 5 metres, or a maximum length of 20 metres and a minimum height of 5 metres; and
  - Minimum slope of 2 to 1 (>63.4°)

- Steep slopes – An area of land having a gradient between 1 in 3 (33% or 18.3°) and 2 in 1 (200% or 63.4°).

A 100 m buffer was applied to the geological features to identify potential breeding habitat for the Large-eared Pied Bat, Eastern Cave Bat and the Broad-headed Snake. Potential breeding habitat was found to intersect the Development Footprint in five locations, where habitat for these species had not been previously mapped by AMBS (2023). As such, an additional on-site survey was conducted to ground-truth these areas and determine their suitability as potential habitat for Large-eared Pied Bat, Eastern Cave Bat and the Broad-headed Snake. It was determined that all five areas represent potentially suitable habitat for the Broad-headed Snake, and three of the areas represent potentially suitable habitat for the Large-eared Pied Bat and the Eastern Cave Bat.

Based on the results of the LiDAR mapping and the ground-truthing survey, the species polygons for sandstone specialist species (the Large-eared Pied Bat, Eastern Cave Bat and the Broad-headed Snake) were updated to incorporate the newly identified areas of potential habitat as determined from the LiDAR data.

Fauna field surveys

A number of field survey techniques were used to target threatened fauna species within the Development Footprint and surrounds between December 2020 and March 2022 (AMBS 2023) (Figure 10). Descriptions of the survey techniques employed by AMBS are detailed in Appendix C and summarised below. Survey conducted was assessed against relevant guidelines for each species (see AMBS 2023 for further details), with justification and limitations discussed. Limitations relevant to this assessment are reproduced in Section 2.3.

Incidental observations of non-target threatened fauna species were also recorded simultaneously whilst undertaking targeted survey (AMBS 2023).

Reptile surveys

Reptile surveys were conducted between 23-29 August 2021 and 13-17 September 2021 in line with the suitable survey period outlined in the TBDC for all candidate reptile species (DPE 2023a). Surveys targeting the Pink-tailed Legless Lizard (*Aprasia parapulchella*) and Striped Legless Lizard (*Delma impar*) involved 25.5 person-hours at 13 locations turning surface rock within native grassland or woodland areas (150-200 rocks turned at each location). Surveys targeting the Broad-headed Snake (*Hoplocephalus bungaroides*) involved four person-hours at three locations (Figure 10) undertaking rock turning and crevice searches in areas of sandstone outcropping. The active searches for Pink-tailed Legless Lizard and Striped Legless Lizard were undertaken in areas with surface rock within native grassland or woodland and targeted in the south-west of the Study Area due to early detection of the Pink-tailed Legless Lizard and an assessment of potential habitat for the Striped Legless Lizard (Figure 10).

In December 2021, six pitfall traps were deployed for four nights at each of two sites (i.e. 24 pitfall trap-nights total per site), and a total of four funnel traps were placed in pairs approximately 5 m from each end of the pitfall trap drift fences (i.e. two pairs of two funnel traps at each site). Traps were checked each morning within three hours of dawn. These surveys targeted Striped Legless Lizard and Pale-headed Snake (*Hoplocephalus bitorquatus*) (AMBS 2023).

Spotlighting surveys were undertaken at four locations in December 2021 and March 2022, targeting the Pale-headed Snake, and Broad-headed Snake. Each site was surveyed for at least 60 person-minutes, accumulating approximately 7 person-hours survey effort within the Study Area (AMBS 2023).

A review of recently published *Threatened reptile – Biodiversity Assessment Method survey guide* (DPE 2022f) was undertaken to assess the survey method and efforts conducted in AMBS (2023) (based on the previous guideline) still complied with the current publication. It was confirmed the targeted survey methods and efforts described above comply with DPE (2022b).

Diurnal bird surveys

Diurnal bird surveys were conducted in Autumn and Winter involving approximately 23.5 person-hours, over nine days and across 66 sites, targeting the Swift Parrot (*Lathamus discolor*) and South-eastern Glossy Black-Cockatoo (*Calyptorhynchus lathami lathami*).

Diurnal bird surveys were also conducted in Spring and Summer with over 12 person-hours targeting the Superb Parrot (*Polytelis swainsonii*), and eight person-hours targeting the Gang-gang Cockatoo (*Callocephalon fimbriatum*). These surveys targeted areas of suitable habitat including forested areas and scattered trees which were identified to have hollow entrances ≥5 cm diameter.

Spring diurnal bird surveys were undertaken at 17 sites during September 2021, totalling approximately 15 person-hours over five days. Spring survey involved targeted searches for nesting raptors including White-bellied Sea-Eagle (*Haliaeetus leucogaster*), Little Eagle (*Hieraaetus morphnoides*), and Square-tailed Kite (*Lophoictinia isura*). Searches targeted woodland, forest and scattered trees to identify the presence of nesting male and female; female with nesting material; or an individual on a large stick nest in the top half of the tree canopy.

Harp traps and Anabats

Targeted threatened bat survey was conducted to identify the presence of threatened bats within the Study Area. Survey focused on the identification of threatened bats that are species credit species or dual credit species including the Little Bent-winged Bat (*Miniopterus australis*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Large-eared Pied Bat (*Chalinolobus dwyeri*), Eastern Cave Bat (*Vespadelus troughtoni*) and Grey-headed Flying Fox (*Pteropus poliocephalus*).

Survey was completed between December 2020 and January 2021 within the recommended survey period outlined in the TBDC (DPE 2023a). The survey effort focussed on locations with mapped rocky habitat for cave dwelling bats and was conducted in accordance with the NSW *'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method* (OEH 2018c).

Harp trapping was undertaken throughout the Study Area with a total of 110 harp trap nights completed during January 2021. The location of most harp traps was changed each morning after the bats had been collected, unless cave entrances were observed nearby and then harp traps remained in the same location for two consecutive nights.

Anabat detectors were deployed throughout the Study Area in January 2021, conducting a total of 92 Anabat detection nights at 38 different sites. Detectors were deployed for between one and five nights, within flyways, or near potential foraging areas, watercourses or cave entrances.

The location of Anabats and harp traps deployed during the survey are shown on Figure 10.

Remote cameras

Survey using 60 remote cameras was undertaken in April-June 2021 (Autumn/Winter), targeting the Brush-tailed Phascogale (*Phascogale tapoatafa*) and Spotted-tailed Quoll (*Dasyurus maculatus*). Each camera was baited with a sardine tin screwed onto a tree trunk or branch with multiple holes drilled into the exposed side of the tin. The tin was located approximately 1.5-2 m above the ground.

Honey-water was also sprayed on the trunk in front of each camera. Cameras were deployed and left for a minimum of four weeks, with cameras checked and baits replaced approximately every two weeks, and honey water resprayed. Survey for the Autumn/Winter period totalled 2,280 camera trap nights.

Note the Department of Planning and Environment – Biodiversity Conservation Division (DPE-BCD) was consulted in relation to the proposed survey effort for the Brush-tailed Phascogale as detailed in AMBS (2023).

An additional two remote cameras were deployed at 14 sites (28 cameras total) during November-December 2021 (Spring/Summer), targeting the Squirrel Glider (*Petaurus norfolcensis*), Greater Glider (*Petauroides volans*), Eastern Pygmy Possum (*Cercatetus nanus*), Yellow-bellied Glider (*Petaurus australis australis*) and Brush-tailed Rock-Wallaby (*Petrogale penicillata*). At each site, one camera was placed on the ground and the other was attached to a bracket approximately 3 m high in a tree. Both cameras were baited with universal bait (honey, rolled oats and peanut butter) and in both instances, the bait was positioned approximately 1-3 m from the camera. All cameras were deployed for a minimum of 14 nights.

Call playback

Call playback was undertaken in May, July and August 2021, at a total of 14 sites located within woodland and forested areas, all separated by at least 800-1,000 m. Call playback targeted the Masked Owl (*Tyto novaehollandiae*), Powerful Owl (*Ninox strenua*), Barking Owl (*Ninox connivens*) and Bush Stone-curlew (*Burhinus grallarius*).

Consistent with DEC (2004) survey guidelines, each standard call playback started with an initial listening period of 10-15 minutes, followed by a 10-minute spotlight. At sites where Bush Stone-curlew call playback was undertaken, calls for the species were broadcast for 30 seconds, followed by 4.5 minutes of listening, with the 5-minute cycle repeated three times. Calls of the target owl species were played intermittently for 5 minutes, followed by a 10-minute listening period. After all the calls were played, a final 10-minutes spotlighting was undertaken.

Locations of the call playback sites are shown on Figure 10.

Hollow-bearing tree surveys and hollow monitoring

As signs of breeding Masked Owl were detected within the Study Area during call playback, potential nest trees were mapped. The TBDC (DPE 2023a) identifies potential nest trees for the Masked Owl as "Living or dead trees with hollows greater than 20 cm diameter". Hollow-bearing tree surveys were undertaken during 12-18 July 2021 by three people, and 26-31 July 2021 by four people.

Hollow surveys were undertaken in PCTs associated with the Masked Owl. For each potential nest tree found, the following was recorded:

- tree GPS location
- tree species
- estimate of tree DBH
- estimate of tree height

- estimate of hollow height and angle
- estimate of hollow diameter (at least 20 cm).

A total of 265 potential nest trees were recorded within the Study Area. The 56 hollows that were watched during hollow watching surveys are shown on Figure 10.

Hollow watching was undertaken during 27-31 July 2021 by four people, 10-15 August 2021 by two people, and 24-29 August 2021 by five people, resulting in a total of 56 hollows being watched on one occasion each (i.e. 209 potential hollows within the Study Area were not monitored).

Hollow watching involved an ecologist watching the potential hollow, beginning 30 minutes before sunset and continuing until 1.5 hours after sunset to record any sign of the species (e.g. dusk calls, an owl exiting a hollow, male providing food for female/chicks).

The DPE-BCD was consulted in relation to proposed survey effort for the Masked Owl as detailed in AMBS (2023).

Pitfall, Elliot and funnel traps

Pitfall, Elliot and funnel trapping was undertaken at two sites within the Study Area in December 2021. Six pitfall traps were deployed for four nights at the two sites (i.e. 24 pitfall trap-nights total per site). Each pit consisted of a 20-litre bucket spaced approximately 5 m apart along a 30-40 m drift fence. A small sheet of styrofoam was placed within each bucket to provide cover for trapped animals and to act as a float in the event of heavy rainfall.

A total of four funnel traps were deployed at the two sites, placed in pairs approximately 5 m from each end of each pitfall trap drift fence (i.e. two pairs of two funnels trap at each site).

At each of the two sites, a total of 25 Elliott A Traps (on ground) were deployed for four nights (i.e. 100 Elliott trap-nights total per site). Each trap contained cotton wool and universal bait (peanut butter, rolled oats and honey). Each trap was placed in a plastic bag for weather protection, and spacing between traps was 10 m.

All Pitfall, Elliot and funnel traps were checked each morning within three hours of dawn. The locations of Pitfall, Elliott and funnel traps are shown on Figure 10.

Spotlighting

Spotlighting surveys were undertaken at four locations in December 2021 and March 2022 (Figure 10). Each site was surveyed for at least one person-hour, totalling approximately seven person-hours of survey effort within the Study Area. Spotlighting was conducted by two people using spotlights and head-torches, meandering through potential habitat, searching for eye-shine and listening for potential vocalisations. All species detected during spotlighting surveys were recorded.

Scat transects

Scat transects were undertaken in four locations during December 2021 and March 2022, targeting the Brush-tailed Rock-wallaby (*Petrogale penicillata*). At each site 30 person-minutes was invested surveying potential habitat for scats or other signs of the species.

2.2 Weather conditions

2.2.1 Fauna surveys

Rainfall and temperature data for the time in which AMBS conducted fauna surveys were sourced from an MCO weather station and are shown in Table 2.8 of the Baseline Fauna Survey Report (Appendix C). Significant fluctuations in day and night-time temperatures were recorded (minimums below freezing and maximums in the high 20s). Rainfall occurred sporadically, with generally dry conditions throughout autumn and winter, followed by wetter periods during spring and early summer. Weather conditions were not identified as a constraint to survey or detectability of target species.

2.2.2 Flora surveys

Flora surveys conducted in Spring (September and October) 2021 and Summer (January) 2022 were generally undertaken on clear days with little to no wind to maximise detectability (ELA 2023). Complete weather data for survey days is provided in Appendix F2 of Appendix B (ELA 2023). Weather conditions were not identified as a constraint to survey or detectability of targeted species.

2.3 Limitations

The following limitations and resolutions were recognised within the ELA (2023) and AMBS (2023) Baseline Reports:

- **Pomaderris cotoneaster.** Suitable habitat for Pomaderris cotoneaster was surveyed in September, outside the prescribed survey period for this species. Due to the similarities and difficulty distinguishing members of the Pomaderris genus, all Pomaderris spp. identified within the Study Area were recorded while undertaking threatened flora species searches. This limitation was overcome as populations were then re-visited when flowering to confirm species identification
- **Fauna survey.** Due to the threatened fauna surveys being limited to the survey periods specified in the TBDC (DPE 2023a), species that were detected early were assumed present throughout the Development Footprint and species polygons were mapped using habitat constraints identified during survey. Subsequent survey then predominantly focused on species where potential habitat had been identified within the Development Footprint but the species hadn't been detected
- Surveys for the Broad-headed Snake were only undertaken at three locations, which did not include all areas of potential habitat within the Development Footprint. This was due to staff limitations as a result of a COVID-19 lockdown enforced on Greater Sydney. However, as it was detected within the Study Area, it was considered potentially present within all areas of suitable habitat in the Development Footprint
- Survey effort for the Pink-tailed Legless Lizard was limited to sites located in the south-west of the Study Area. This was due to an early detection of the species during a targeted reptile survey. Similar to above, due to staff limitations as a result of a COVID-19 lockdown enforced on Greater Sydney, subsequent survey effort focused primarily on the Striped Legless Lizard, for

which potential habitat was limited to PCTs that occur in the south-west of the Study Area. However, as it was detected within the Study Area, it was considered potentially present within all areas of suitable habitat in the Development Footprint.

3 Stage 1 – Biodiversity Assessment – Results

3.1 Site context

The Development Footprint is predominantly comprised of a grassy valley floor with ephemeral to semi-permanent drainage lines (mostly outside of the Development Footprint) and wooded rises. Elevation on the site ranges from 470 m above sea level (ASL) at the grassland northern tip to 620 m ASL at the woodland south-western tip.

Waterbodies partly within the Development Footprint include Murdering Creek, Spring Creek and Moolarben Creek. Moolarben Creek flows into the Goulburn River approximately 7 km north of the Development Footprint (Digital Atlas 2022).

The Development Footprint predominantly lies within the Ulan Soil Landscape which occurs on mid to low slopes, flats and drainage lines, with the Lees Pinch Soil Landscape occurring on crests, mid-slopes and upper slopes (DPE 2023f). The Ulan Soil Landscape contains hardsetting, imperfectly drained, slightly acidic Yellow Podzolic Soils and Yellow Solodic Soils comprised of brown-black fine sandy loam and grey-yellow-brown sandy clay. In comparison, the Lees Pinch Soil Landscape contains Shallow Siliceous Sands, Yellow Earths and Yellow Podzolic Soils that are loose to hardsetting, moderately well-drained and slightly acidic loamy sand and fine sandy clay loam soils.

3.1.1 Assessment area

The BDAR assessment area for the Project (encompassing a 1,500 m buffer surrounding the Development Footprint) is 4,471.9 ha, and includes:

- 543.4 ha of non-native vegetation
- 1,018.3 ha of DNG
- 2,910.2 ha of woody vegetation.

The assessment area, showing the extent of woody and non-woody native vegetation is shown on Figure 6a.

3.1.2 Landscape features

Landscape features within the Development Footprint and assessment area are described below in accordance with Section 3.1 of the BAM (DPIE 2020a) and shown on Figures 6a and 6b.

IBRA bioregions and IBRA subregions

The Development Footprint and assessment area is located wholly within the Sydney Basin IBRA region and the Kerrabee IBRA subregion (Figure 5).

Rivers, streams, estuaries and wetlands

Moolarben Creek, a fifth-order Strahler Stream, runs through the centre of the Development Footprint and is the main tributary to the Goulburn River, which forms part of the Upper Goulburn River Catchment. A number of creeks and ephemeral drainage lines feed Moolarben Creek within the Development Footprint and the larger assessment area, including Murdering Creek (fourth-order Stream) which flows from the south-west corner of the Development Footprint into Moolarben

Creek, and Spring Creek (third-order Stream) which enters Moolarben Creek north of the Murdering Creek confluence (Strahler 1957; Figure 6b). A number of small ephemeral drainages run into Moolarben Creek along the mountain range to the east of the assessment area.

Moolarben Creek flows into the Goulburn River approximately 7 km north of the Development Footprint, where it continues in an easterly direction meandering through bushland for over 100 km before entering the Hunter River, ultimately flowing out to sea at Newcastle (NSW Government Spatial Services 2021c).

The majority of the drainage lines within the Development Footprint and within the larger assessment area are considered intermittent waterways filled by overland flows resulting from seasonal rainfall.

No wetlands or wetland features occur within the Development Footprint or within the larger assessment area. The nearest mapped wetlands are reservoirs found on Ulan Mine Complex immediately north of the Development Footprint (DPE 2010). The nearest internationally important Ramsar wetland is the Hunter Estuary Wetlands, 187 km south-east of the Development Footprint (DPE 2012). Due to the distance and terrain between the Development Footprint and the Hunter Estuary Wetland, water from the Development Footprint would not be directly connected to the wetland.

Habitat connectivity

Most of the native vegetation that formerly occurred in the Development Footprint (particularly the lower slopes and flat land) has been previously cleared for agriculture and habitats are fragmented. Native vegetation remaining in the Development Footprint (particularly on the upper slopes) is directly connected to extensive areas of native vegetation to the south with Munghorn Gap Nature Reserve, and along the ranges running to the east (Figure 6a). These extensive areas contain hills and mountains covered in remnant native vegetation, which form high-quality fauna and flora habitat. This native vegetation would enable dispersal of native fauna from the eastern seaboard to the western side of the Great Dividing Range. The Development Footprint is on the edge of this extensive area of native vegetation.

Karst, caves, crevices, cliffs, rocks or other geological features of significance

Mapped rocky habitat (with caves, crevices, cliffs and rocks) around the edge of the Development Footprint provides habitat for the Eastern Cave Bat, Large-eared Pied Bat and Broad-headed Snake (Figure 6b). This mapped rocky habitat (with caves, crevices, cliffs and rocks) does not occur within the Development Footprint.

Scattered surface rock (associated with the Pink-tailed Legless Lizard) is present throughout the Development Footprint, most notably on the fringes of the Study Area and within the south-western section containing native woodland/grassland habitats on lower slopes (Figure 6b). Access to the mine site would be restricted, eliminating potential removal or disturbance of scattered rocks within the Development Footprint.

There are no high hazard soil areas mapped in the Development Footprint.

Areas of outstanding biodiversity value

There are no areas of outstanding biodiversity value, as declared by the NSW Minister for the Environment, within the Development Footprint or assessment area.

Additional Landscape Features

No additional landscape features have been identified in any SEARs for the Project.

NSW (Mitchell) landscape

The Development Footprint is located within the following NSW (Mitchell) Landscapes (Department of Environment and Climate Change [DECC] 2002):

- Upper Goulburn Valleys and Escarpment (57% cleared)
- Wollemi Ranges (5% cleared).

The Development Footprint occurs almost entirely within the Upper Goulburn Valleys and Escarpment landscape with only a small area of the outer edges of the Development Footprint occurring within the Wollemi Ranges landscape in the south and south-west (Stage 1 and Stage 3 of the Project). As such, the Upper Goulburn Valleys and Escarpment landscape was used in the BAM-C for all three stages of the Project.

3.1.3 Native vegetation cover

Native vegetation in the assessment area (within the 1,500 m buffer) was estimated to be 3,928.5 ha. Woody vegetation was calculated using State Vegetation Type Mapping (NSW DCCEEW 2022b), and non-woody vegetation layers and historical aerial photography were estimated as per methods described in Section 2.1.2. The sum total of native vegetation is 3,928.5 ha, or 87.9% of the 4,471.9 ha assessment area. The percentage of native vegetation cover was assigned to >70% intact as per the BAM (DPIE 2020a). Figure 6a shows native vegetation cover within the assessment area.

3.2 Native vegetation, threatened ecological communities and vegetation integrity

3.2.1 Native vegetation extent

The Development Footprint contains 480.01 ha of native vegetation including 366.9 ha of DNG, 93.64 ha of remnant woodland, 17.2 ha of regenerating woodland, 2.18 ha of scattered trees and 0.09 ha of planted native vegetation (Figure 11).

Changes to the mapped native vegetation extent

The extent of native vegetation within the Development Footprint is similar to that shown on the aerial imagery used in the figures, except for some grassland areas that were confirmed during site surveys, and some other areas that have regenerated since the date of the aerial photography (MCO 2020a). Another deviation from aerial imagery was the mapping of scattered trees, as some scattered trees identified via aerial imagery were not located by ELA (2023) during vegetation surveys. This is due to the use of out-of-date aerial imagery and the occurrence of clearing or natural dieback since the aerial imagery was taken. All mapped scattered trees are those identified via the most recent aerial imagery available and ground-truthing vegetation surveys. Grassland areas were assessed to determine the species composition and attributed to either Category 1 – exempt land

using the IGGAM, or DNG using VI Plots. Areas where native vegetation has regenerated since the aerial photograph were mapped and attributed to the most appropriate PCT and condition.

Areas that are not native vegetation

Areas within the Development Footprint that are not native vegetation include access roads, buildings and dams (8.6 ha) and Category 1 – exempt land (186.6 ha). Grassland areas where exotic species are dominant were attributed to Category 1 – exempt land as described in Section 1.3.

3.3 Plant community types

3.3.1 Overview

PCTs and their area within the Development Footprint in each stage are listed in Table 5 and shown on Figure 11.

A total of 13 PCTs were identified within the Study Area, with nine of these PCTs occurring within the Development Footprint. Detailed descriptions of each PCT (as provided by ELA 2023 and validated on-site by Premise) are available in Section 3.1.2 of Appendix B.

Justification for PCT selection is provided in Appendix E.

Table 5. PCTs identified within the Development Footprint.

PCT ID	PCT name	Stage 1 Area (ha)	Stage 2 Area (ha)	Stage 3 Area (ha)	Total Area within Development Footprint (ha)
Vegetation Class – Western Slopes Grassy Woodlands					
266	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	5.6	18.4	11.3	**35.3**
281	Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	162.5	116.9	86.38	**365.78**
483	Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	0.04	-	-	**0.04**
Vegetation Class – Western Slopes Dry Sclerophyll Forests					
1610	White Box – Black Cypress Pine shrubby woodland of the Western Slopes	2.7	16.2	9.3	**28.2**
1629	Narrow-leaved Stringybark – Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	0.8	4.7	-	**5.5**
1655	Grey Box – Slaty Box shrub – grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	11.99*	1.9	2.3	**16.19***

PCT ID	PCT name	Stage 1 Area (ha)	Stage 2 Area (ha)	Stage 3 Area (ha)	Total Area within Development Footprint (ha)
1661	Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	3.7	-	-	**3.7**
1711	Tantoon – *Lepyrodia leptocaulis* shrubland on sandstone drainage lines of the Sydney Basin	-	1.6	5.9	**7.5**
Vegetation Class – Sydney Hinterland Dry Sclerophyll Forests					
1656	Narrow-leaved Ironbark – Black Pine – Narrow-leaved Wattle shrub – grass open forest on sandstone slopes of the upper Hunter and Sydney Basin	17.8	-	-	**17.8**
Total area		**205.13**	**159.7**	**115.18**	**480.01**

* Includes 0.09 ha of planted native vegetation.

3.3.2 Threatened ecological communities

Two BC Act TECs occur within the Development Footprint: *White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin* CEEC (Box-Gum Woodland CEEC) and *Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion* Vulnerable Ecological Community (VEC) (Hunter Valley Footslopes Slaty Gum Woodland VEC) (Figure 12). As described in the previous section, all the VZs mapped as constituting Box-Gum Woodland CEEC under the BC Act, also constitute *White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland* CEEC as defined under the EPBC Act. With respect to VZs mapped as constituting Hunter Valley Footslopes Slaty Gum Woodland VEC under the BC Act, only some of these patches also constitute *Central Hunter Valley eucalypt forest and woodland CEEC* (Eucalypt Forest and Woodland CEEC) as defined under the EPBC Act.

An assessment of conformance of vegetation patches with the Box-Gum Woodland CEEC listed under the EPBC Act was carried out by ELA (Appendix B). The method treats all areas of PCTs 266, 281 and 483 as one patch due to their connectivity and the dominance of native perennial groundcovers across all zones within these PCTs on the Study Area. In accordance with the EPBC Act listing advice (TSSC 2006[3]) the Box-Gum Woodland within the Development Footprint is greater than 0.1 ha and includes more than 12 non-grass native groundcover species and at least one important species (Appendix B). Therefore, all areas of PCTs 266, 281 and 483 equate to the Box-Gum Woodland CEEC listed under the BC Act and EPBC Act. PCT 266 Scattered Tree and PCT 281 Scattered Tree do not meet the listing advice for the Box-Gum Woodland CEEC, however scattered trees were assessed as the TEC consistent with PCTs 266 and 281. An assessment of conformance of vegetation patches with the Hunter Valley Footslopes Slaty Gum Woodland VEC under the BC Act and the Eucalypt Forest and Woodland CEEC under the EPBC Act was undertaken by ELA (Appendix B). This assessment determined all patches of PCT 1655 within the Development Footprint meet the BC Act listing, while seven of the eight PCT 1655 patches conform with the EPBC Act listing. The occurrence of the Eucalypt Forest and Woodland CEEC within the Development

Footprint represents in the order of less than 0.02% of the likely extent of the CEEC in the Kerrabee subregion (estimated at 65,806 ha) (DPE 2023b; NSW DCCEEW 2022b). TECs associated with PCTs within the Development Footprint are listed in Table 6 and shown on Figure 12.

Table 6. TECs within the Development Footprint.

TEC name	BC Act status	EPBC Act status	Associated PCTs within the Development Footprint	Area within Development Footprint (ha) (All Stages)	Total (ha)
Box-Gum Woodland CEEC	CEEC	CEEC	PCT 266	35.3	401.12 (34.22 woodland and 366.9 DNG)
			PCT 281	365.78	
			PCT 483	0.04	
Hunter Valley Footslopes Slaty Gum Woodland VEC	VEC	-	PCT 1655	16.1	16.1
Eucalypt Forest and Woodland CEEC	-	CEEC	PCT 1655	15.5	15.5

3.3.3 Vegetation zones

A total of 16 vegetation zones were mapped across the Development Footprint (Table 7).

Patch size classes were identified in accordance with BAM (DPIE 2020a) subsection 4.3.2 which states '*A patch is an area of native vegetation that occurs on the subject land and includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤ 30 m for non-woody ecosystems)*'. A patch may extend onto adjoining land. Patch sizes were assigned to one of the following classes: < 5 ha, 5-< 25 ha, 25-100 ha and ≥ 100 ha (Table 7).

Table 7. Vegetation zones and patch sizes.

Vegetation zone ID	Vegetation zone name	Area (ha)	Patch size class	No. vegetation integrity plots required	No. vegetation integrity plots completed	No. vegetation integrity plots used in assessment	Plot IDs of vegetation integrity plots used in assessment
VZ1	PCT 266 Remnant Woodland	6.7	☒ >100 ha	3	4	4	VI Plots 12, 23, 26, 57
VZ2	PCT 266 Derived Native Grassland	28	☒ >100 ha	4	5	5	VI Plots 27, 30, 33, 58, 9
VZ3	PCT 281 Remnant Woodland	25.3	☒ >100 ha	4	6	6	VI Plots 3, 8, 22, 29, 46, 62
VZ4	PCT 281 Derived Native Grassland (High)	203.3	☒ >100 ha	6	13	13	VI Plots 6, 20, 25, 39, 44, 50, 68, 70, 71, 72, 79, 80, 81
VZ5	PCT 281 Derived Native Grassland (Low)	135.6	☒ >100 ha	6	6	6	VI Plots 2, 65, 66, 69, 73, 74
VZ9	PCT 483 Remnant Woodland	0.04	☒ >100 ha	1	5	5	VI Plots 35, 36, 37, 38, 78
VZ11	PCT 1610 Remnant Woodland	17	☒ >100 ha	3	5	5	VI Plots 18, 28, 48, 59, 61
VZ12	PCT 1610 Regenerating	11.2	☒ >100 ha	3	3	3	VI Plots 31, 32, 34
VZ14	PCT 1629 Remnant Forest	5.5	☒ >100 ha	3	6	6	VI Plots 7, 11, 13, 24, 56, 77
VZ15	PCT 1661 Remnant Woodland	3.7	☒ >100 ha	2	2	2	VI Plots 41, 42
VZ16	PCT 1655 Remnant Woodland	16.1	☒ >100 ha	3	3	3	VI Plots 1, 4, 19
VZ17	PCT 1656 Remnant Forest	11.8	☒ >100 ha	3	3	3	VI Plots 40, 43, 47
VZ18	PCT 1656 Regenerating	6	☒ >100 ha	3	3	3	VI Plots 49, 51, 52
VZ19	PCT 1711 Remnant Shrubland	7.5	☒ >100 ha	3	3	3	VI Plots 5, 16, 21

Vegetation zone ID	Vegetation zone name	Area (ha)	Patch size class	No. vegetation integrity plots required	No. vegetation integrity plots completed	No. vegetation integrity plots used in assessment	Plot IDs of vegetation integrity plots used in assessment
VZ20	PCT 266 Scattered Trees	0.6	☒ 1 ha	1	1	1	VI Plots 23
VZ21	PCT 281 Scattered Trees	1.58	☒ 1 ha	1	1	1	VI Plots 46

3.3.4 Vegetation integrity (vegetation condition)

Vegetation integrity survey plots

VI plot data was used in the determination of PCTs and to stratify the Development Footprint into VZs (ELA 2023). The minimum number of plots required for each vegetation zone area was sampled in accordance with the BAM (DPIE 2020a) (Table 7). However, in an effort to avoid and minimise potential impacts to biodiversity, the Development Footprint has been significantly refined since the initial VI plots were undertaken by ELA (2023). This has resulted in some of the VI plots occurring outside of the amended Project Development Footprint. In order to fulfill the plot requirement under the BAM (DPIE 2020a), some VI plots located outside the Development Footprint were used. These plots were assessed as being representative of the PCTs and vegetation condition zones that occur within the Development Footprint. Justification for the use of VI plots that occur outside the Development Footprint is provided in Table 8.

Table 8. Justification for the use of VI Plots outside of the Development Footprint.

Vegetation Zone	VI Plot outside of Development Footprint	Justification
1610 High	18, 28, 48, 59, 61	All plots for this vegetation zone are outside the Development Footprint. Similar floristics and structure across all plots. Number of species varied from 31-52. *Eucalyptus albens* and *Callitris endlicheri* were common canopy species across the plots. *Bursaria spinosa* and *Acacia decora* were common shrubs. *Microlaena stipoides*, *Dichondra repens*, *Lomandra multiflora* and *Rytidosperma spp.* were common ground species across all plots.
1610 Regeneration	34	Plots 31 and 32 are in the same vegetation zone and fall within the Development Footprint. All three plots had similar floristics and structure. The total cover for plot 34 was 41.8, with 42.4 for plot 31. *Acacia implexa, Bursaria spinosa* and *Pimelea spp.* present within the mid storey in all plots. *Rytidosperma spp., Themeda triandra, Microlaena stipoides* and *Bothriochloa macra* common ground species across the plots.
1629 High	11, 13, 24, 56, 7, 77	All plots for this veg zone are outside the Development Footprint. Similar floristics and cover across all plots. *Eucalyptus punctata, Eucalyptus sparsifolia* and *Acacia linearifolia* common canopy species across plots. *Persoonia linearis, Podolobium ilicifolium* and *Hibbertia riparia* common mid stratum species across plots. *Lomandra confertifolia, Lomandra multiflora, Microlaena stipoides* and *Pomax umbellata* common ground cover species across plots.
1656 Regeneration	52	Plots 49 and 51 are in the same vegetation zone and fall within the Development Footprint. Similar floristics and cover across all three plots. *Angophora floribunda* is a common canopy species. *Cassinia sifton* and *Hibbertia riparia* common mid stratum species across the plots. *Aristida ramosa, Calotis lappulacea, Lomandra multiflora* and *Rytidosperma spp.* Common ground species across plots.
266 DNG	27, 30	Plots 33, 58 and 9 are in the same vegetation zone and fall within the Development Footprint. Similar floristics and cover across all plots. Plot 27 and 30 had a similar number of species and total cover (33 species, 84.4% cover for plot 27 and 26 species and 94.3% cover for plot 30) and were similar also to plot 9 which is within the alignment (31 species and 96.2% cover). *Aristida ramosa, Austrostipa scabra,*

Vegetation Zone	VI Plot outside of Development Footprint	Justification
		Bothriochloa macra, Panicum effusum and *Sporobolus creber* common across all plots.
266 Scattered Trees	23	The most representative VI Plot data from PCT 266 remnant woodland (High) in close proximity to the scattered trees was used for the 'PCT 266 Scattered Trees' vegetation zone. VI Plot 23 was located in PCT 266 remnant woodland in the south-east of the Development Footprint. VI Plot 23 contained a single White Box tree with 25% cover. VI Plot 23 was considered to be representative of VZ20, 'PCT 266 Scattered Trees'.
266 Remnant Woodland (High)	12, 57	Plots 23 and 26 are in the same vegetation zone and fall within the Development Footprint. Similar floristics and cover across all plots. *Eucalyptus albens* dominant canopy species in all plots. *Calotis lappulacea, Einadia hastata, Microlaena stipoides* and *Sporobolus creber* common ground species across plots.
281 DNG	20, 25, 39,	Only 6 VI plots were required for this vegetation area, however 13 were included in the calculation. 10 of these plots are within the Development Footprint (VI plots 6, 44, 50, 68, 70, 71, 72, 79, 80, 81). Similar floristics and cover across all plots. *Aristida ramosa, Bothriochloa macra, Cynodon dactylon, Eragrostis leptostachya, Microlaena stipoides, Panicum effusum* and *Sporobolus creber* common ground species across the plots.
281 DNG Low	65	Plots 2, 66, 69, 73 and 74 are in the same vegetation zone and fall within the Development Footprint. Similar floristics and cover across all plots. *Cynodon dactylon, Eragrostis leptostachya, Oxalis perennans* and *Sporobolus creber* common ground species across the plots.
281 High	29, 3, 46, 62, 8	Plot 22 is in the same vegetation zone and falls within the Development Footprint. Similar floristics and cover across all plots. *Eucalyptus blakelyi* one of the dominant canopy species in all plots. *Eucalyptus melliodora* also dominant in majority of plots. *Austrostipa scabra, Einadia nutans, Geranium solanderi, Microlaena stipoides* and *Sporobolus creber* common ground species across plots.

Scattered tree alignment to PCT

Scattered trees surrounded by Category 1 – exempt land were included within the species polygons for the Koala, Eastern Cave Bat and Large-eared Pied-bat; therefore, the Streamlined Assessment Module for Scattered Trees Assessment could not be applied. The scattered trees were accounted for in BAM-C by digitising around the canopy of each tree and the aggregated area attributed to the most representative PCTs based on species. White Box trees were assigned to PCT 266 and Yellow Box and Rough-barked Apple were assigned to PCT 281. Scattered trees assigned to PCT 266 and 281 were mapped as separate vegetation zones, VZ20 and VZ21, respectively, to ensure the scattered trees were included in the BAM-C for both ecosystem and species credit calculations. The most representative VI Plot data from PCT 266 remnant woodland (High) in close proximity to the scattered trees was used for the 'PCT 266 Scattered Trees' vegetation zone. VI Plot 23 was located in PCT 266 remnant woodland in the south-east of the Development Footprint. VI Plot 23 contained a single White Box tree with 25% cover. VI Plot 23 was considered to be representative of VZ20, 'PCT 266 Scattered Trees'. VI Plot 46 was located in PCT 281 remnant woodland in the north-east of

the Development Footprint, between low-quality DNG and Category 1 – exempt land. VI Plot 46 contained two trees, Yellow Box and Rough-barked Apple, with a combined cover of 15%. VI Plot 46 was considered to be representative of VZ21, 'PCT 281 Scattered Trees'.

Floristic and functional attribute scores for each vegetation zone

Table 9 identifies the composition, structure, function and VI scores for each vegetation zone for Stages 1-3 of the Project.

Use of benchmark data

Benchmark data was sourced from the NSW BioNet Vegetation Classification (DPE 2023b) for each PCT in the relevant IBRA Bioregion (DPE 2023b).

Table 9. Vegetation Integrity Scores

PCT	Vegetation Zone Name – ID	Composition Condition Score	Structure Condition Score	Function Condition Score	Current VI Score	Future VI Score	Change in VI Score	Number of Hollow Bearing Trees Present
266	Remnant Woodland – VZ1	82.1	86	96.8	88.1	0	-88.1	9
	Derived Native Grassland – VZ2	71	60.2	14.8	39.8	0	-39.8	0
	Scattered Trees – VZ20	83.5	38.4	94.8	67.2	0	-67.2	1
281	Remnant Woodland – VZ3	83.5	89	99.4	90.4	0	-90.4	9
	Derived Native Grassland (High) – VZ4	60.1	58.6	10.5	33.3	0	-33.3	0
	Derived Native Grassland (Low) – VZ5	57.6	64.8	9.4	32.7	0	-32.7	0
	Scattered Trees – VZ21	78.5	76.7	100	84.4	0	-84.4	3
483	Remnant Woodland – VZ9	84.1	99.4	69.5	83.4	0	-83.4	0
1610	Remnant Woodland – VZ11	67.6	12.3	98.8	43.5	0	-43.5	4
	Regenerating Woodland – VZ12	65.5	17	63.1	41.2	0	-41.2	1
1629	Remnant Forest – VZ14	66.8	26.7	99.8	56.3	0	-56.3	9
1661	Remnant Woodland – VZ15	62.6	22.6	98.7	51.9	0	-51.9	5
1655	Remnant Woodland – VZ16	52.3	29.3	93.5	52.3	0	-52.3	3
1656	Remnant Forest – VZ17	54	20.4	97.2	47.5	0	-47.5	7
	Regenerating Forest – VZ18	59.5	32.6	90.3	56	0	-56	1
1711	Remnant Shrubland – VZ19	61.1	21.4	80.5	47.2	0	-47.2	1

3.4 Habitat suitability for threatened species

3.4.1 Identification of threatened species for assessment

Ecosystem credit species (fauna)

As detailed in Section 2.1.4, a comprehensive desktop review was conducted by AMBS (2023) to identify threatened fauna species for assessment which have, or may have, suitable habitat within the Development Footprint. This was followed by a comprehensive assessment of fauna habitat within the Development Footprint (as summarised in Section 2.1.4 and detailed in Appendix C), and targeted survey for those species requiring survey under the BAM (DPIE 2020a) and/or considered likely to occur.

A total of 50 predicted ecosystem credit or dual credit fauna species were identified as requiring consideration (Table 10). This includes 38 species identified by the BAM-C, and an additional 12 species recognised as ecosystem credit species identified in the PMST search and on the TBDC (Cth DCCEEW 2022a[5]; DPE 2022d[4]). Niche also undertook database searches as detailed in Section 2.1.4, to ensure all required threatened species were considered and no additional species requiring consideration were identified.

Details regarding the listing status, associated PCTs, sensitivity to gain and statement regarding the requirement for further assessment are provided in Table 10. None of the predicted ecosystem credit species identified by the BAM-C were excluded from further assessment.

Eleven species recognised as ecosystem credit species identified in the PMST and TBDC searches (Cth DCCEEW 2022a[5]; DPE 2022d[4]) were excluded from further assessment as potential candidate species based on the following:

- Six species were excluded from further assessment based on dependence on wetland habitat and absence of suitable habitat within the Development Footprint (Blue-billed Duck [*Oxyura australia*], Freckled Duck [*Stictonetta naevosa*], White-fronted Chat [*Epthianura albifrons*], Australian Painted Snipe [*Rostratula australis*], Eastern Curlew [*Numenius madagascariensis*] and Curlew Sandpiper [*Calidris ferruginea*])
- The Grey Falcon (*Falco hypoleucos*) was excluded based on the species being restricted to arid and semi-arid environments, with annual average rainfall less than 500 millimetres (mm) (not within the sub-region)
- Malleefowl (*Leipoa ocellata*) was excluded due to absence of suitable habitat for the species, which occurs in Mallee eucalypt woodland in Western NSW
- Plains-wanderer (*Pedionomus torquatus*) was excluded due to absence of suitable habitat for the species, which occurs in semi-arid, lowland native grasslands in the Riverina region of NSW
- New Holland Mouse (*Pseudomys novaehollandiae*) was excluded based on non-detection during targeted fauna surveys (Elliot and pitfall trapping, AMBS 2023) and absence of suitable habitat and associated PCTs within the Development Footprint (see Section 8.1.3 for further details)
- Superb Parrot (*Polytelis swainsonii*) was excluded based on low likelihood of occurrence and non-detection during targeted bird surveys (see Section 8.1.3 for further details).

The Southern Whiteface (*Aphelocephala leucopsis*), Blue-winged Parrot (*Neophema chrysostoma*) and Pilotbird (*Pycnoptilus floccosus*) were also identified in the PMST search (Cth DCCEEW 2022a[5]),

however these species have an incomplete profile on the TBDC and are not currently listed as ecosystem credit species or species credit species on the TBDC (NSW DCCEEW 2024b). These species are considered further in Section 8.

Each of the EPBC Act listed ecosystem credit or dual credit species are addressed in detail in Section 8.

Candidate fauna species (species credit species) as identified by the BAM-C are detailed in Section 3.5.3.

Table 10. Predicted ecosystem credit fauna species.

Common name	Scientific name	Listing status		Credit status	Source	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID	Sensitivity to gain class
		BC Act	EPBC Act						
REPTILES									
Broad-headed Snake	*Hoplocephalus bungaroides*	E	E	Species/Ecosystem	BAM-C	No	Species polygon occurs outside the Development Footprint. Refer to Figure 17c	-	High
Rosenberg's Goanna	*Varanus rosenbergi*	V	-	Ecosystem	BAM-C	Yes		281, 1629, 1655	High
BIRDS									
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	Species/Ecosystem	BAM-C, PMST	Yes		266, 281, 483, 1610, 1655	High
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Ecosystem	BAM-C	Yes		266, 281	Moderate
Curlew Sandpiper	*Calidris ferruginea*	E	CE	Species/Ecosystem	PMST	No	Wader dependent on wetland habitat. No suitable wetland habitat on Development Footprint.	-	High

Common name	Scientific name	Listing status		Credit status	Source	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID	Sensitivity to gain class
		BC Act	EPBC Act						
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	E	Species/Ecosystem	BAM-C, PMST	Yes		266, 281, 1629, 1655	Moderate
South-eastern Glossy Black-Cockatoo	*Calyptorhynchus lathami lathami*	V	V	Species/Ecosystem	BAM-C	Yes		266, 1629, 1655	High
Pied Honeyeater	*Certhionyx variegatus*	V	-	Ecosystem	TBDC	No	Unlikely to occur with no associated PCTs, old record dating back to 1991 and not detected during targeted bird surveys	-	Moderate
Speckled Warbler	*Chthonicola* sagittata	V	-	Ecosystem	BAM-C	Yes		266, 281, 1610, 1629, 1655, 1656, 1661	High
Spotted Harrier	*Circus assimilis*	V	-	Ecosystem	BAM-C	Yes		266, 281	Moderate

Common name	Scientific name	Listing status		Credit status	Source	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID	Sensitivity to gain class
		BC Act	EPBC Act						
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	V[6]	Ecosystem	BAM-C	Yes		266, 281, 1610, 1629, 1655, 1656, 1661	High
Varied Sittella	*Daphoenositta chrysoptera*	V	-	Ecosystem	BAM-C	Yes		266, 281, 1610, 1629, 1655, 1656, 1661	Moderate
White-fronted Chat	*Epthianura albifrons*	V	-	Ecosystem	TBDC	No	Wader dependent on wetland habitat. No suitable wetland habitat on Development Footprint.	-	Moderate
Grey Falcon	*Falco hypoleucos*	V	V	Ecosystem	PMST	No	Grey Falcon is a species of arid and semi-arid environments, with annual average	-	Moderate

[6] This species was not listed under the EPBC Act at the time of the controlled action decision (2 May 2022) and therefore this species is not assessed as 'Vulnerable' (refer section 158A of the EPBC Act)

Common name	Scientific name	Listing status		Credit status	Source	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID	Sensitivity to gain class
		BC Act	EPBC Act						
							rainfall less than 500 mm. Habitat occurs in high rainfall area.		
Black Falcon	*Falco subniger*	V	-	Ecosystem	BAM-C	Yes		266, 281, 1656, 1661	Moderate
Little Lorikeet	*Glossopsitta pusilla*	V	-	Ecosystem	BAM-C	Yes		266, 281, 483, 1610, 1629, 1655	High
Painted Honeyeater	*Grantiella picta*	V	V	Ecosystem	BAM-C, PMST	Yes		266, 281, 483, 1610, 1629, 1655	Moderate
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	-	Species/Ecosystem	BAM-C	Yes		266, 281	High
Little Eagle	*Hieraaetus morphnoides*	V	-	Species/Ecosystem	BAM-C	Yes		266, 281, 1629, 1655	Moderate
White-throated Needletail	*Hirundapus caudacutus*	-	V	Ecosystem	BAM-C, PMST	Yes		266, 281, 483, 1610, 1629, 1655, 1656, 1661, 1711	High

Common name	Scientific name	Listing status		Credit status	Source	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID	Sensitivity to gain class
		BC Act	EPBC Act						
Swift Parrot	*Lathamus discolor*	E	CE	Species/Ecosystem	BAM-C, PMST	Yes		266, 281, 1629, 1655	Moderate
Malleefowl	*Leipoa ocellata*	E	V	Ecosystem	PMST	No	Malleefowl associated with Mallee eucalypt woodland in western NSW. No suitable habitat.	-	High
Square-tailed Kite	*Lophoictinia isura*	V	-	Species/Ecosystem	BAM-C	Yes		266, 281, 1610, 1629, 1655, 1661	Moderate
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	E	E[7]	Ecosystem	BAM-C	Yes		266, 281, 1610, 1629, 1655, 1656, 1661	Moderate
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	V	-	Ecosystem	BAM-C	Yes		266, 281, 1629, 1655	Moderate

[7] This species was not listed under the EPBC Act at the time of the controlled action decision (2 May 2022) and therefore this species is not assessed as 'Endangered' (refer section 158A of the EPBC Act)

Common name	Scientific name	Listing status		Credit status	Source	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID	Sensitivity to gain class
		BC Act	EPBC Act						
Turquoise Parrot	*Neophema pulchella*	V	-	Ecosystem	BAM-C	Yes		266, 281, 483, 1610, 1629, 1655, 1656, 1661	High
Barking Owl	*Ninox connivens*	V	-	Species/Ecosystem	BAM-C	Yes		266, 281, 483, 1610, 1629, 1655, 1656, 1661	High
Powerful Owl	*Ninox strenua*	V	-	Species/Ecosystem	BAM-C	Yes		281, 1629, 1655	High
Eastern Curlew	*Numenius madagascariensis*	-	CE	Species/Ecosystem	PMST	No	Wader dependent on wetland habitat. No suitable wetland habitat on Development Footprint.	-	High
Blue-billed Duck	*Oxyura australis*	V	-	Ecosystem	TBDC	No	Wader dependent on wetland habitat. No suitable wetland habitat on	-	Moderate

Common name	Scientific name	Listing status		Credit status	Source	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID	Sensitivity to gain class
		BC Act	EPBC Act						
							Development Footprint.		
Plains-wanderer	*Pedionomus torquatus*	E	CE[8]	Species/Ecosystem	PMST[5]	No	Associated with semi-arid grasslands in Riverina Region. No suitable habitat on Development Footprint.	-	High
Scarlet Robin	*Petroica boodang*	V	-	Ecosystem	BAM-C	Yes		266, 281, 1629, 1655, 1656, 1661	Moderate
Flame Robin	*Petroica phoenicea*	V	-	Ecosystem	BAM-C	Yes		266, 281, 1629, 1655, 1656, 1661	Moderate
Superb Parrot	*Polytelis swainsonii*	V	V	Species/Ecosystem	PMST	No	Low likelihood of occurrence and not detected during targeted bird surveys.	266, 281	Moderate

[8] This species was not listed under the EPBC Act at the time of the controlled action decision (2 May 2022) and therefore this species is not assessed as 'Critically Endangered' (refer section 158A of the EPBC Act)

Common name	Scientific name	Listing status		Credit status	Source	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID	Sensitivity to gain class
		BC Act	EPBC Act						
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-	Ecosystem	BAM-C	Yes		266, 281, 1629, 1655	Moderate
Australian Painted Snipe	*Rostratula australis*	E	E	Ecosystem	PMST	No	Wader dependent on wetland habitat. No suitable wetland habitat on Development Footprint.	-	Moderate
Diamond Firetail	*Stagonopleura guttata*	V	V[9]	Ecosystem	BAM-C	Yes		266, 281, 1655	Moderate
Freckled Duck	*Stictonetta naevosa*	V	-	Ecosystem	TBDC	No	Wader dependent on wetland habitat. No suitable wetland habitat on Development Footprint.	-	Moderate
Masked Owl	*Tyto novaehollandiae*	V	-	Species/Ecosystem	BAM-C	Yes		266, 281, 1629, 1655	High

[9] The species was not listed under the EPBC Act at the time of the controlled action decision (2 May 2022) and therefore this species is not assessed as 'Vulnerable' (refer section 158A of the EPBC Act)

Common name	Scientific name	Listing status		Credit status	Source	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID	Sensitivity to gain class
		BC Act	EPBC Act						
MAMMALS									
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	Ecosystem	BAM-C, PMST	Yes		266, 281, 1610, 1629, 1655, 1656, 1661, 1711	High
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-	Ecosystem	BAM-C	Yes		266, 1629, 1655	High
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V	-	Ecosystem	BAM-C	Yes		1629	High
Little Bent-winged Bat	*Miniopterus australis*	V	-	Species/Ecosystem	BAM-C	Yes		1629	High
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V	-	Species/Ecosystem	BAM-C	Yes		266, 281, 1629, 1655	High
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	V	Ecosystem	BAM-C, PMST	Yes		266, 1629, 1655, 1661	High

Common name	Scientific name	Listing status		Credit status	Source	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID	Sensitivity to gain class
		BC Act	EPBC Act						
Yellow-bellied Glider	*Petaurus australis australis*	V	V	Ecosystem	BAM-C, PMST	Yes		1629	High
New Holland Mouse	*Pseudomys novaehollandiae*	-	V	Ecosystem	PMST	No	Excluded based on non-detection during targeted surveys (Elliot and pitfall trapping, AMBS 2023) and absence of suitable habitat within the Development Footprint (see Section 8.1.3 for further details).	-	High
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Species/Ecosystem	BAM-C	Yes		266, 281, 1629, 1655	High
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Ecosystem	BAM-C	Yes		266, 281, 1629, 1655	High
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-	Ecosystem	BAM-C	Yes		1629, 1655	High

V = Vulnerable, E = Endangered, CE = Critically Endangered.

Species credit species

Species credit species identified by the BAM-C and desktop review are detailed below.

Flora species and populations

A total of 42 threatened flora species and four threatened flora populations were identified in the desktop review as potential candidate threatened flora species, as listed in Table 11, including:

- 24 species/populations identified from the BAM-C
- Eight additional species as identified from the PMST (Cth DCCEEW 2022a[5]) (Bluegrass [*Dichanthium setosum*]*, Euphrasia arguta*, Spiny Peppercress [*Lepidium aschersonii*], Smooth Bush-Pea [*Pultenaea glabra*], Slender Darling Pea [*Swainsona murrayana*], Small Purple-pea [*Swainsona recta*]*,* Austral Toadflax [*Thesium australe*] and *Vincetoxicum forsteri* listed as *Tylophora linearis*)
- 14 additional species/populations which were not identified by the BAM-C or PMST (Cth DCCEEW 2022a[5]) but have been previously recorded in equivalent vegetation to those mapped within the Development Footprint as informed by the TBDC (DPE 2023b; DPE 2022d[4])*.*

An additional species*, Pomaderris cotoneaster,* is listed in Table 11 as it was recorded during the field surveys by ELA (2023).

Table 11 details the listing status, associated PCTs and statement regarding the requirement for further assessment. The list of threatened flora species was reviewed to identify threatened flora species that have, or may have, suitable habitat within the Development Footprint.

Seven flora candidate species listed in Table 11 were excluded from further assessment at this stage: Austral Toadflax (*Thesium australe*), Pine Donkey Orchid (*Diuris tricolor)* population in the Muswellbrook Local Government Area (LGA), Slender Darling Pea (*Swainsona murrayana*), Spiny Peppercress (*Lepidium aschersonii), Commersonia procumbens, Commersonia rosea* and Large-leafed Monotaxis (*Monotaxis macrophylla*)*.*

Two flora candidate species, *Commersonia procumbens* and *Monotaxis macrophylla* were previously assumed present in the original EIS due to lack of conditions conducive to detection (notably fire and/or disturbance). These species were subsequently excluded from further assessment based on a review of whether the microhabitats required by the target species are present or absent in accordance with Section 5.2.3 of the BAM (DPIE 2020a). The review was undertaken by the highly experienced botanist Dr Stephen Bell (Eastcoast Flora Survey and adjunct researcher at the University of Newcastle) (Bell 2024, provided in Appendix L). Bell (2024) has found that neither species is likely to occur as the microhabitats required by the target species are absent within the Development Footprint.

Bell's (2024) review of literature, voucher collections, observational records and full floristic plot surveys from the 11 *Monotaxis macrophylla* meta-populations found 15 PCTs to be likely key vegetation types for this species. None of these PCTs shown to support or potentially support *Monotaxis macrophylla* in NSW match the PCTs found within the Study Area. The site inspection

(conducted in December 2023) further supported this assessment with Bell (2024) concluding that none of the locations visited supported habitat suitable for *Monotaxis macrophylla*.

Similarly, the seven *Commersonia procumbens* meta-populations assessed by Bell (2024) included 24 PCTs that were found to be likely key vegetation types for this species. None of the PCTs shown to support or potentially support *Commersonia procumbens* in NSW match the PCTs found within the Study Area. The site inspection (conducted in December 2023) further supported this desktop assessment with Bell (2024) concluding that none of the locations visited supported habitat suitable for *Commersonia procumbens*.

For both species, Bell (2024) concludes "Both of these species almost always occur in scrubby heath vegetation on rocky ridgelines or outcrops, a feature completely lacking from the Study Area". Bell (2024) also states "Neither species has known populations within the Permian-aged Illawarra coal measures, and while both do have known populations on Triassic Narrabeen geology, which fringes the Project Area, the relevant PCTs and structural vegetation types are absent". As such, both species have been excluded from further assessment based on lack of associated habitat and PCTs within the Development Footprint.

Austral Toadflax (*Thesium australe*) and Slender Darling Pea (*Swainsona murrayana*) were not identified as a potential candidate species within the Baseline Flora Survey Report (ELA 2023). Austral Toadflax and Slender Darling Pea were identified as a potential candidate species through the PMST search conducted by Niche after the surveys were complete (Cth DCCEEW 2022a[5]). As such, Austral Toadflax and Slender Darling Pea were not identified as a target species within the targeted threatened species surveys undertaken by ELA (2023). Given the comprehensive survey effort conducted and the lack of records within 30 km of the Development Footprint (DPE 2022d[4]), it is considered that Austral Toadflax and Slender Darling Pea are unlikely to occur within the Development Footprint. These species were not identified by the BAM-C as a candidate species and as such have been excluded from further assessment.

The Pine Donkey Orchid (*Diuris tricolor*) population in the Muswellbrook LGA is the only candidate threatened species or population that can be excluded on the basis of geographic constraints, since the Development Footprint is not located within the Muswellbrook LGA. However, *Diuris tricolor* cannot be excluded on the same basis.

Spiny Peppercress (*Lepidium aschersonii*), was excluded from further assessment based on its association with gilgai or grey loamy clays and Grey Box and Belah communities which do not occur within the Development Footprint.

Hibbertia acaulothrix was also identified in the PMST search (Cth DCCEEW 2023a), however this species is not currently listed as a species credit species on the TBDC (DPE 2023a). This species is considered further in Section 8.

Threatened flora species previously recorded within the locality of the Development Footprint are shown in Figure 13.

Table 11. Predicted flora species credit species.

Common name	Scientific name	Listing status		Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act				
Ausfeld's Wattle	*Acacia ausfeldii*	V	-	BAM-C	Yes	-	PCT 281, PCT 266, PCT 1610
Bynoe's Wattle	*Acacia bynoeana*	E	V	TBDC	Yes	-	Associated with PCT 1629 within the Wollemi IBRA Subregion (adjacent IBRA sub-region)
	Acacia dangarensis	CE	CE[10]	BAM-C	Yes	-	PCT 1655
Acacia pendula population in the Hunter Catchment	*Acacia pendula*	EP	-	TBDC	Yes	-	Review of TBDC habitat and ecology indicates that PCT 1655 is suitable habitat (DPE 2023a)
Thick-leaf Star-hair	*Astrotricha crassifolia*	V	V	TBDC	Yes	-	Associated with PCT 1629 within the Wollemi IBRA Subregion (adjacent IBRA sub-region)
	Commersonia procumbens	V	V	BAM-C	No	Excluded as microhabitats required by the species are absent, as detailed in Section 3.5.3 and provided in Appendix L	
	Commersonia rosea	E	E	BAM-C	Yes	-	PCT 1655
Cymbidium canaliculatum population in the Hunter Catchment	*Cymbidium canaliculatum*	EP	-	TBDC	Yes	-	Recorded in Slaty Box Forest (equivalent to PCT 1655) within 30km of Study Area

[10] The species was not previously listed under the EPBC Act at the time of initial assessments and therefore this species is not assessed as 'Critically Endangered' (refer section 158A of the EPBC Act)

Common name	Scientific name	Listing status		Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act				
White-flowered Wax Plant	*Cynanchum elegans*	E	E	BAM-C	Yes	-	PCT 1629
Bluegrass	*Dichanthium setosum*	V	V	PMST	Yes	-	Species or species habitat likely to occur within area (Cth DCCEEW 2022a[5]). Basalt intrusion in the southwest of the Study Area, within PCT 266, PCT 483 and PCT 281. Refinement of targeted search area is documented in the Baseline Flora Report (ELA 2023)
Pine Donkey Orchid	*Diuris tricolor*	V	-	BAM-C	Yes	-	PCT 1655, PCT 510 (PCT 281 equivalent)
Pine Donkey Orchid population in the Muswellbrook local government area	*Diuris tricolor*	EP	-	BAM-C	No	Geographic constraint	PCT 1655, PCT 281
River Red Gum population in the Hunter Catchment	*Eucalyptus camaldulensis*	EP	-	BAM-C	Yes	-	Review of TBDC habitat and ecology indicates PCT 281 is suitable habitat (DPE 2023a)
Capertee Stringybark	*Eucalyptus cannonii*	V	-	BAM-C	Yes	-	PCT 1610, PCT 1655, PCT 796 (equivalent to PCT 281 DNG), PCT 1881 Western Hunter Flats Rough Barked Apple Forest (equivalent to PCT 281)
Creswick Apple Box	*Eucalyptus corticosa*	V	-	TBDC	Yes	-	Associated with PCT 1629 within the Wollemi IBRA Subregion (adjacent IBRA sub-region)

Common name	Scientific name	Listing status		Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act				
Broken Back Ironbark	*Eucalyptus fracta*	V	-	BAM-C	Yes	-	PCT 1655
Wallangarra White Gum	*Eucalyptus scoparia*	E	V	TBDC	Yes	-	Recorded in PCT 796 (equivalent to PCT 281 DNG) within 30 km of Study Area
	Euphrasia arguta	CE	CE	PMST	Yes	-	Associated with PCT 266 and PCT 281 within the Inland Slopes IBRA Subregion (<2 km to the west of Study Area). Refined Study Area overlaps with Study Area for *Dichanthium setosum* and includes high condition grassy woodland and grassland habitat in PCT 266 and 281 in the south-west corner of the Study Area. Refinement of targeted search area is documented in the Baseline Flora Report (ELA 2023)
Fairy Bells	*Homoranthus darwinioides*	V	V	BAM-C, PMST	Yes	-	PCT 1655
Leafless Indigo	*Indigofera efoliata*	E	E	TBDC	Yes	-	Recorded in Grey Gum Narrow-leaved Stringybark Forest (equivalent to PCT 1629) within 30 km of Study Area
	Kennedia retrorsa	V	V	BAM-C	Yes	-	PCT 1655
	Lasiopetalum longistamineum	V	V	BAM-C	Yes	-	PCT 1655

Common name	Scientific name	Listing status		Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act				
	Leionema lamprophyllum subsp. *Fractum*	CE	CE[10]	BAM-C, PMST	Yes	-	PCT 1629
Spiny Peppercress	*Lepidium aschersonii*	V	V	PMST	No	Associated with gilgais or grey loamy clays. Associated with Grey Box and Belah communities. No such habitat occurs within the Study Area	-
Hoary Sunray	*Leucochrysum albicans* var. *tricolor*	E	E	TBDC	Yes	-	Recorded in PCT 266, PCT 1610 within 30 km. Species or species habitat may occur within area (PMST)
Grove's Paperbark	*Melaleuca groveana*	V	-	TBDC	Yes	-	Associated with PCT 1629 within the Wollemi IBRA Subregion (adjacent IBRA sub-region)
Large-leafed Monotaxis	*Monotaxis macrophylla*	E	-	BAM-C	No	Excluded as microhabitats required by the species are absent, as detailed in Section 3.5.3 and provided in Appendix L	
	Olearia cordata	V	V	TBDC	Yes	-	Associated with PCT 1629 within the Wollemi IBRA Subregion (adjacent IBRA sub-region)
	Ozothamnus tesselatus	V	V	BAM-C	Yes	-	PCT 1655

Common name	Scientific name	Listing status		Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act				
Hairy Geebung	*Persoonia hirsuta*	E	E	TBDC	Yes	-	Associated with PCT 1629 within the Wollemi IBRA Subregion (adjacent IBRA sub-region)
Cotoneaster Pomaderris	*Pomaderris cotoneaster*	E	E	Survey result	Yes	-	Species or species habitat may occur within area (Cth DCCEEW 2022a[5]). Review of TBDC habitat and ecology indicates that PCT 1629 and PCT 1610 are suitable habitat (DPE 2023a)
Scant Pomaderris	*Pomaderris queenslandica*	E	-	BAM-C	Yes	-	PCT 1655, PCT 1656, PCT 1661, PCT 1629, Slaty Box Forest (equivalent to PCT 1655)
Denman Pomaderris	*Pomaderris reperta*	CE	CE	BAM-C	Yes	-	PCT 1655
Silky Pomaderris	*Pomaderris sericea*	E	V	BAM-C	Yes	-	PCT 1629, PCT 1655
Tarengo Leek Orchid	*Prasophyllum petilum*	E	E	BAM-C, PMST	Yes	-	PCT 281
	Prasophyllum sp. Wybong*	-	CE	BAM-C, PMST	Yes	-	PCT 266, PCT 281
Wollemi Mint-bush	*Prostanthera cryptandroides* subsp. *Cryptandroides*	V	V	BAM-C	Yes	-	PCT 1629, PCT 1655
	Prostanthera discolor	V	V	BAM-C	Yes	-	PCT 1629, PCT 1655
Mount Vincent Mint-bush	*Prostanthera stricta*	V	V	BAM-C	Yes	-	PCT 1655
Smooth Bush-Pea	*Pultenaea glabra*	V	V	PMST	Yes	-	Species or species habitat known to occur within area (Cth DCCEEW 2022a[5]). Review of

Common name	Scientific name	Listing status		Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act				
							TBDC indicates that PCT 1629 is suitable habitat (DPE 2023a)
Slender Darling Pea	*Swainsona murrayana*	V	V	PMST[5]	No	There are no associated PCTs recorded within the Study Area to provide potential habitat for the Slender Darling Pea (DPE 2023a). BioNet Atlas does not record any species sighting within 30 km of the Development Footprint (DPE 2023c[4]).	-
Small Purple-pea	*Swainsona recta*	E	E	PMST	Yes	-	Associated with PCT 266 and PCT 281 within the Inland Slopes IBRA Subregion (adjacent IBRA sub-region)
Silky Swainson-pea	*Swainsona sericea*	V	-	TBDC	Yes	-	Associated with PCT 266 and PCT 281 within the Inland Slopes IBRA Subregion adjacent IBRA sub-region) PCT 281 (all zones, except PCT 281 DNG Low), PCT 266
	Tetratheca glandulosa	V	-	TBDC	Yes	-	Associated with PCT 1629 within the Wollemi IBRA Subregion (adjacent IBRA sub-region)

Common name	Scientific name	Listing status		Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act				
Austral Toadflax	*Thesium australe*	V	V	PMST	No	Lack of records within 30 km of the Development Footprint and lack of detection during extensive threatened flora surveys conducted by ELA (2023).	-
	Vincetoxicum forsteri listed as *Tylophora linearis*	V	E	PMST	Yes	-	Recorded in Slaty Box Forest (equivalent to PCT 1655) within 30 km
	Velleia perfoliata	V	V	TBDC	Yes	-	Associated with PCT 1629 and PCT 1655 within the Wollemi IBRA Subregion (adjacent IBRA sub-region)

V = Vulnerable, E = Endangered, EP = Endangered Population, CE = Critically Endangered.

* *Prasophyllum* sp. Wybong is a synonym of the Tarengo Leek Orchid (*Prasophyllum petilum*) in the Australian Plant Name Index. While it is no longer listed under the BC Act, *Prasophyllum* sp. Wybong is still listed under the EPBC Act because the synonym is yet to be accepted by the Australian Plant Census.

Fauna species

A total of 33 candidate threatened fauna species were identified from the desktop assessment, as listed in Table 12. A total of 28 species were identified by the BAM-C and five through PMST search (Cth DCCEEW 2022a[5]). The BioNet Atlas Database (DPE 2022d[4]) did not return any additional species not already identified through the BAM-C and the PMST (Cth DCCEEW 2022a[5]).

Table 12 identifies the listing status, associated PCTs and whether the species was retained for further assessment. Eight species, Booroolong Frog (*Litoria booroolongensis*), Giant Burrowing Frog (*Heleioporus australiacus*), Sloane's Froglet (*Crinia sloanei*), Red-crowned Toadlet (*Pseudophryne australis*), Bathurst Grassland Earless Dragon (*Tympanocryptis mccartneyi*), Red Goshawk (*Erythrotriorchis radiatus*), Plains-wanderer (*Pedionomus torquatus*), and Pink Robin (*Petroica rodinogaster*) were excluded from further assessment based on absence of suitable habitat within the Development Footprint. A summary of the exclusion of these species is provided in Table 12.

None of the species in Table 12 have been excluded from consideration on the basis of geographic constraints (DPE 2023e). Important Habitat Maps are applicable to breeding habitat for the Regent Honeyeater, Swift Parrot and Plains-wanderer. Important Habitat Mapping is applicable to the Regent Honeyeater within the Development Footprint but not for Swift Parrot or Plains-wanderer; however, the Swift Parrot was still included for consideration due to the presence of foraging habitat. The remaining 26 species were considered further in targeted surveys.

Threatened fauna species previously recorded within the locality of the Development Footprint are shown in Figure 14a and Figure 14b.

Table 12. Predicted fauna species credit species.

Common name	Scientific name	Listing status		Credit class	Sources	Species retained for further assessment ?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act					
AMPHIBIANS								
Sloane's Froglet	*Crinia sloanei*	E	E	Species	PMST[5]	No	There a no associated PCTs recorded within the Study Area to provide potential habitat for the Sloane's froglet (DPE 2023a). BioNet Atlas does not record any species sighting within 30 km of the Development Footprint (DPE 2023c[4]). This species did not occur in the Commonwealth DCCEEW (2022a[3]) PMST.	-
Giant Burrowing Frog	*Heleioporus australiacus*	V	V	Species	BAM-C	No	The only PCT recorded within the Study Area which provided potential habitat for Giant Burrowing Frog was PCT 1629. Breeding habitat for the Giant Burrowing Frog consists of soaks or pools within first or second order streams, as well as 'hanging swamp' seepage lines and where small pools form from the collected water. AMBS	1629

Common name	Scientific name	Listing status		Credit class	Sources	Species retained for further assessment ?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act					
							(2023) did not record any suitable breeding habitat within the Study Area, nor was any suitable habitat identified within the Aquatic Ecology Assessment (Bio-Analysis 2022). In addition, the species has never been recorded as far west as the Study Area with the closest record occurring 60km to the south east.	
Booroolong Frog	*Litoria booroolongensis*	E	E	Species	PMST	No	The Booroolong Frog can be associated with PCT 281 elsewhere in NSW (DPE 2023a) and PCT 281 was mapped within the Study Area along the riparian zones of Moolarben Creek. The Booroolong Frog was not originally included as a candidate species in AMBS (2023) as it is not associated with the Kerrabee IBRA subregion and the Study Area occurs at the edge of the	281

Common name	Scientific name	Listing status		Credit class	Sources	Species retained for further assessment ?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act					
							species predicted range. The closest record for the Booroolong Frog occurs 80 km to the south of the Study Area. The species was included as a candidate species in the BDAR due to the EPBC Act PMST (Cth DCCEEW 2022[5]) search indicating that it may occur in the search area. Targeted survey was not conducted for this species due to the Study Area occurring on the outer margins of the species known and predicted range, in addition to aquatic habitat within the Study Area not providing suitable habitat for the species. The Booroolong Frog requires permanent, or near permanent river environment with rocky structures (bedrock or cobble) (DPIE 2020d). The species is reliant on permanent running water and does not occupy	

Common name	Scientific name	Listing status		Credit class	Sources	Species retained for further assessment ?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act					
							ephemeral streams, or streams that have dried during severe drought (Hunter & Smith 2013). Whilst the Aquatic Ecology Assessment (Bio-Analysis 2022) describes Moolarben Creek (the largest creek within the Study Area) as providing good to very good aquatic habitat (in general), it also notes that this section of Moolarben Creek is characterised as "*a non-permanently flowing (intermittent) creek with clearly defined bed and banks and semi-permanent to permanent waters in pools.*". Therefore, this section of Moolarben Creek and any other ephemeral streams or creeks within the Study Area would not provide suitable habitat for the Booroolong Frog.	

Common name	Scientific name	Listing status		Credit class	Sources	Species retained for further assessment ?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act					
Red-crowned Toadlet	*Pseudophryne australis*	V	-	Species	BAM-C	No	As detailed in AMBS (2023), the Red-crowned Toadlet is found only on Triassic sandstones which are not present within the Study Area (Raymond *et al*. 2012). The microhabitats required by the species are absent from the Study area. Areas of potential habitat for the species include areas of heathland and woodland located on Triassic sandstones within 100 m of ephemeral streams or pools (DPIE 2020d). The Development Footprint contains two PCTs, PCT 1629 and PCT 1711, which are listed in the TBDC as PCT's associated with the species. Intact areas of PCT 1629 within 100 m of ephemeral streams or pools will be avoided. PCT 1711 occurs within the Development Footprint in the south, however, these areas have been	1629, 1711

Common name	Scientific name	Listing status		Credit class	Sources	Species retained for further assessment ?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act					
							subject to historic and ongoing disturbance and fragmentation as a result of land clearing for agriculture and are degraded. The closest record of the species is located about 35 km to the southeast of the Study Area.	
REPTILES								
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	Species	BAM-C, PMST	Yes		266, 281, 483, 1655
Striped Legless Lizard	*Delma impar*	V	V	Species	BAM-C, PMST	Yes		483, 1655
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	-	Species	BAM-C	Yes		1629, 1655
Broad-headed Snake	*Hoplocephalus bungaroides*	E	E	Species/ Ecosystem	BAM-C	Yes		1629, 1711
Bathurst Grassland	*Tympanocryptis mccartneyi*	CE	CE	Species	PMST[5]	No	This species is only associated with the Bathurst subregion. There a no associated PCTs	

Common name	Scientific name	Listing status		Credit class	Sources	Species retained for further assessment ?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act					
Earless Dragon							recorded within the Study Area to provide potential habitat for the Bathurst Grassland Earless Dragon (DPE 2023a). BioNet Atlas does not record any species sighting within 30 km of the Development Footprint (DPE 2023c[4]). This species did not occur in the Commonwealth DCCEEW (2022a[5]) PMST.	
BIRDS								
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	Species/ Ecosystem	BAM-C, PMST	Yes		266, 281, 483, 1610, 1655
Bush Stone-curlew	*Burhinus grallarius*	E	-	Species	BAM-C	Yes		266, 281, 1629, 1655
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	E	Species/ Ecosystem	BAM-C, PMST	Yes		266, 281, 1629, 1655
South-eastern Glossy Black-Cockatoo	*Calyptorhynchus lathami lathami*	V	V	Species/ Ecosystem	BAM-C, PMST	Yes		266, 1629, 1655
Red Goshawk	*Erythrotriorchis radiatus*	CE	CE[10]	Species	PMST	No	Species preferred habitat is mixed subtropical rainforest,	

Common name	Scientific name	Listing status		Credit class	Sources	Species retained for further assessment ?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act					
							Melaleuca swamp forest and riparian *Eucalyptus* forest of coastal rivers (DPE 2023e). This habitat type does not occur within the Development Footprint and the Development Footprint does not support any PCTs associated with the species (DPE 2023a). Further, the Development Footprint is located towards the southern limit of known range; and it was not recorded during targeted surveys (AMBS 2023).	
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	-	Species/ Ecosystem	BAM-C	Yes		266, 281
Little Eagle	*Hieraaetus morphnoides*	V	-	Species/ Ecosystem	BAM-C	Yes		266, 281, 1629, 1655
Swift Parrot	*Lathamus discolor*	E	CE	Species/ Ecosystem	BAM-C, PMST	Yes		266, 281, 1629, 1655
Square-tailed Kite	*Lophoictinia isura*	V	-	Species/ Ecosystem	BAM-C	Yes		266, 281, 1610, 1629, 1655, 1661

Common name	Scientific name	Listing status		Credit class	Sources	Species retained for further assessment ?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act					
Barking Owl	*Ninox connivens*	V	-	Species/ Ecosystem	BAM-C	Yes		266, 281, 483, 1610, 1629, 1655, 1656, 1661
Powerful Owl	*Ninox strenua*	V	-	Species/ Ecosystem	BAM-C	Yes		281, 1629, 1655
Plains-wanderer	*Pedionomus torquatus*	E	CE	Species/ Ecosystem	PMST[5]	No	Development Footprint not within Important Habitat Mapping	
Pink Robin	*Petroica rodingaster*	V	-	Species	TBDC	No	Species preferred habitat is mixed rainforest and tall, open eucalypt forests, particularly in densely vegetated gullies (DPE 2023e). This habitat type does not occur within the Development Footprint and the Development Footprint does not support any PCTs associated with the species (DPE 2023a). Further, the Development Footprint is located towards the northern limit of known range; and it was not recorded during targeted surveys (AMBS 2023).	
Masked Owl	*Tyto novaehollandiae*	V	-	Species/ Ecosystem	BAM-C	Yes		266, 281, 1629, 1655

Common name	Scientific name	Listing status		Credit class	Sources	Species retained for further assessment ?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act					
MAMMALS								
Eastern Pygmy-possum	*Cercartetus nanus*	V	-	Species	BAM-C	Yes		1629, 1655
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	E	Species	BAM-C, PMST	Yes		281, 1629, 1655
Little Bent-winged Bat	*Miniopterus australis*	V	-	Species/ Ecosystem	BAM-C	Yes		1629
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V	-	Species/ Ecosystem	BAM-C	Yes		266, 281, 1629, 1655
Greater Glider	*Petauroides volans*	E	E	Species	BAM-C, PMST	Yes		1629, 1655
Squirrel Glider	*Petaurus norfolcensis*	V	-	Species	BAM-C	Yes		266, 281, 1629, 1655
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	V	Species	BAM-C, PMST	Yes		266, 281, 1629, 1655
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	-	Species	BAM-C	Yes		1629
Koala	*Phascolarctos cinereus*	E	E	Species	BAM-C, PMST	Yes		266, 281, 1629, 1655
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Species/ Ecosystem	BAM-C, PMST	Yes		266, 281, 1629, 1655

Common name	Scientific name	Listing status		Credit class	Sources	Species retained for further assessment?	Reason for exclusion from further assessment	Vegetation zone ID species retained within, including PCT ID
		BC Act	EPBC Act					
Eastern Cave Bat	*Vespadelus troughtoni*	V	-	Species	BAM-C	Yes		281, 1629, 1655

V = Vulnerable, E = Endangered, CE = Critically Endangered.

3.5 Threatened species surveys

3.5.1 Flora species

Threatened flora targeted searches were conducted by ELA (2023) as described in Section 2.1.3. A summary of the survey effort conducted for each threatened flora species, the outcome of the survey and requirement for further assessment are provided in Table 13 and Table 14 and Figure 15 show survey effort and species recorded, respectively.

Details regarding the presence/absence of the various candidate flora species is discussed in further detail in Section 3.5.3.

As detailed in Section 3.5.3, one threatened species, *Pomaderris cotoneaster,* was recorded within the Study Area. As per Section 5.2.5 of the BAM (DPIE 2020a), the area of suitable habitat was determined and a species polygons developed. This is described in Section 3.6.1.

Table 13. Threatened species surveys for candidate flora species credit species.

Common name	Scientific name	Threatened flora species surveys			Present	Further assessment required (BAM Subsections 5.2.5 and 5.2.6)
		Survey method (transects or grids)	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort (hours & no. people)		
White-flowered Wax Plant	*Cynanchum elegans*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff: 132.3 hectares	No	No
Kennedia retrorsa	*Kennedia retrorsa*	10 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 14.2 hectares	No	No
Large-leafed Monotaxis	*Monotaxis macrophylla*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	190.8 hectares	Assumed present	Yes
Silky Swainson-pea	*Swainsona sericea*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 650.7 hectares	No	No
Ausfeld's Wattle	*Acacia ausfeldii*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 754.2 hectares	No	No
	Acacia dangarensis	20 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 14.2 hectares	No	No
Fairy Bells	*Homoranthus darwinioides*	20 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 16.5 hectares	No	No
	Lasiopetalum longistamineum	20 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 14.2 hectares	No	No
	Leionema lamprophyllum subsp. *Fractum*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 132.3 hectares	No	No
Scant Pomaderris	*Pomaderris queenslandica*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 170.3 hectares	No	No
Denman Pomaderris	*Pomaderris reperta*	20 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 14.2 hectares	No	No

Common name	Scientific name	Threatened flora species surveys			Present	Further assessment required (BAM Subsections 5.2.5 and 5.2.6)
		Survey method (transects or grids)	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort (hours & no. people)		
Silky Pomaderris	*Pomaderris sericea*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff;146.4 hectares	No	No
Pine Donkey Orchid	*Diuris tricolor*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 599.6 hectares	No	No
Tarengo Leek Orchid	*Prasophyllum petilum*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 585.4 hectares	No	No
	Prasophyllum sp. Wybong	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 650.7 hectares	No	No
	Commersonia procumbens	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 266.5 hectares	Assumed present	Yes
	Commersonia rosea	10 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 14.2 hectares	No	No
	Ozothamnus tesselatus	15 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 14.2 hectares	No	No
Wollemi Mint-bush	*Prostanthera cryptandroides subsp. Cryptandroides*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 146.4 hectares	No	No
	Prostanthera discolor	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 146.4 hectares	No	No
Mount Vincent Mint-bush	*Prostanthera stricta*	15 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 14.2 hectares	No	No
	Senecio linearifolius var. *dangarensis*	15 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 4.9 hectares	No	No

Common name	Scientific name	Threatened flora species surveys			Present	Further assessment required (BAM Subsections 5.2.5 and 5.2.6)
		Survey method (transects or grids)	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort (hours & no. people)		
Capertee Stringybark	*Eucalyptus cannonii*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 698.2 hectares	No	No
Broken Back Ironbark	*Eucalyptus fracta*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 132.3 hectares	No	No
	Tylophora linearis	10 parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 14.2 hectares	No	No
Hoary Sunray	*Leucochrysum albicans var. tricolor*	Grid- based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 166.5 hectares	No	No
Cymbidium canaliculatum population in the Hunter Catchment	*Cymbidium canaliculatum*	10 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 14.2 hectares	No	No
Leafless Indigo	*Indigofera efoliata*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 132.3 hectares	No	No
Wallangarra White Gum	*Eucalyptus scoparia*	40 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 585.4 hectares	No	No
River Red Gum population in the Hunter Catchment	*Eucalyptus camaldulensis*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 585.4 hectares	No	No
Acacia pendula population in the Hunter Catchment	*Acacia pendula*	40 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 14.2 hectares	No	No
Cotoneaster Pomaderris	*Pomaderris cotoneaster*	20 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 235.7 hectares	Yes	Yes
Smooth Bush-Pea	*Pultenaea glabra*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 132.3 hectares	No	No

Common name	Scientific name	Threatened flora species surveys			Present	Further assessment required (BAM Subsections 5.2.5 and 5.2.6)
		Survey method (transects or grids)	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort (hours & no. people)		
Bluegrass	*Dichanthium setosum*	Grid-based	Yes: January [12.01.22-13.01.22; 17.01.22-18.01.22; 20.01.22; 24.01.22-25.01.22; 27.01.22]	3 staff; 264.7 hectares	No	No
Rough Eyebright	*Euphrasia arguta*	Grid-based	Yes: January [12.01.22-13.01.22; 17.01.22-18.01.22; 20.01.22; 24.01.22-25.01.22; 27.01.22]	3 staff; 264.7 hectares	No	No
Small Purple-pea	*Swainsona recta*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 650.7 hectares	No	No
	Tetratheca glandulosa	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 132.3 hectares	No	No
	Velleia perfoliata	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 146.4 hectares	No	No
Bynoe's Wattle	*Acacia bynoeana*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 132.3 hectares	No	No
Thick-leaf Star-hair	*Astrotricha crassifolia*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 132.3 hectares	No	No
Grove's Paperbark	*Melaleuca groveana*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 132.3 hectares	No	No
	Olearia cordata	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 132.3 hectares	No	No
Hairy Geebung	*Persoonia hirsuta*	Grid-based	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 132.3 hectares	No	No
Creswick Apple Box	*Eucalyptus corticosa*	40 m parallel transects	Yes: September [1.9.21-9.9.21; 13.9.21-16.9.21;20.9.21] and October [12.10.21-25.10.21]	3 staff; 132.3 hectares	No	No

Dark grey highlighted species require preparation of species polygons.

Table 14. Determining the presence of candidate flora species credit species within the Development Footprint.

Common name	Scientific name	Listing status		Method used to determine presence	Present?	Further assessment required? (BAM Subsections 5.2.5 and 5.2.6)
		BC Act	EPBC Act			
Ausfeld's Wattle	*Acacia ausfeldii*	V	-	Targeted threatened species survey	No	No
Bynoe's Wattle	*Acacia bynoeana*	E	V	Targeted threatened species survey	No	No
	Acacia dangarensis	CE	CE[10]	Targeted threatened species survey	No	No
Acacia pendula population in the Hunter Catchment	*Acacia pendula*	EP	-	Targeted threatened species survey	No	No
Thick-leaf Star-hair	*Astrotricha crassifolia*	V	V	Targeted threatened species survey	No	No
	Commersonia procumbens	V	V	Expert report	No	No
	Commersonia rosea	E	E	Targeted threatened species survey	No	No
Cymbidium canaliculatum population in the Hunter Catchment	*Cymbidium canaliculatum*	EP	-	Targeted threatened species survey	No	No
White-flowered Wax Plant	*Cynanchum elegans*	E	E	Targeted threatened species survey	No	No
Bluegrass	*Dichanthium setosum*	V	V	Targeted threatened species survey	No	No
Pine Donkey Orchid	*Diuris tricolor*	V	-	Targeted threatened species survey	No	No
River Red Gum population in the Hunter Catchment	*Eucalyptus camaldulensis*	EP	-	Targeted threatened species survey	No	No
Capertee Stringybark	*Eucalyptus cannonii*	V	-	Targeted threatened species survey	No	No
Creswick Apple Box	*Eucalyptus corticosa*	V	-	Targeted threatened species survey	No	No
Broken Back Ironbark	*Eucalyptus fracta*	V	-	Targeted threatened species survey	No	No
Wallangarra White Gum	*Eucalyptus scoparia*	E	V	Targeted threatened species survey	No	No
	Euphrasia arguta	CE	CE	Targeted threatened species survey	No	No

Common name	Scientific name	Listing status		Method used to determine presence	Present?	Further assessment required? (BAM Subsections 5.2.5 and 5.2.6)
		BC Act	EPBC Act			
Fairy Bells	*Homoranthus darwinioides*	V	V	Targeted threatened species survey	No	No
Leafless Indigo	*Indigofera efoliata*	E	E	Targeted threatened species survey	No	No
	Kennedia retrorsa	V	V	Targeted threatened species survey	No	No
	Lasiopetalum longistamineum	V	V	Targeted threatened species survey	No	No
	Leionema lamprophyllum subsp. Fractum	CE	CE[10]	Targeted threatened species survey	No	No
Hoary Sunray	*Leucochrysum albicans var. tricolor*	E	E	Targeted threatened species survey	No	No
Grove's Paperbark	*Melaleuca groveana*	V	-	Targeted threatened species survey	No	No
Large-leafed Monotaxis	*Monotaxis macrophylla*	E	-	Expert report	No	No
	Olearia cordata	V	V	Targeted threatened species survey	No	No
	Ozothamnus tesselatus	V	V	Targeted threatened species survey	No	No
Hairy Geebung	*Persoonia hirsuta*	E	E	Targeted threatened species survey	No	No
Cotoneaster Pomaderris	*Pomaderris cotoneaster*	E	E	Targeted threatened species survey	Yes	Yes
Scant Pomaderris	*Pomaderris queenslandica*	E	-	Targeted threatened species survey	No	No
Denman Pomaderris	*Pomaderris reperta*	CE	CE	Targeted threatened species survey	No	No
Silky Pomaderris	*Pomaderris sericea*	E	V	Targeted threatened species survey	No	No
Tarengo Leek Orchid	*Prasophyllum petilum*	E	E	Targeted threatened species survey	No	No
	Prasophyllum sp. Wybong	-	CE	Targeted threatened species survey	No	No
Wollemi Mint-bush	*Prostanthera cryptandroides subsp. Cryptandroides*	V	V	Targeted threatened species survey	No	No
	Prostanthera discolor	V	V	Targeted threatened species survey	No	No

Common name	Scientific name	Listing status		Method used to determine presence	Present?	Further assessment required? (BAM Subsections 5.2.5 and 5.2.6)
		BC Act	EPBC Act			
Mount Vincent Mint-bush	*Prostanthera stricta*	V	V	Targeted threatened species survey	No	No
Smooth Bush-Pea	*Pultenaea glabra*	V	V	Targeted threatened species survey	No	No
	Senecio linearifolius var. dangarensis	E	-	Targeted threatened species survey	No	No
Small Purple-pea	*Swainsona recta*	E	E	Targeted threatened species survey	No	No
Silky Swainson-pea	*Swainsona sericea*	V	-	Targeted threatened species survey	No	No
	Tetratheca glandulosa	V	-	Targeted threatened species survey	No	No
	Tylophora linearis	V	E	Targeted threatened species survey	No	No
	Velleia perfoliata	V	V	Targeted threatened species survey	No	No

V = Vulnerable, E = Endangered, EP = Endangered Population, CE = Critically Endangered.
Dark grey highlighted species require further assessment.

3.5.2 Fauna species

Threatened fauna searches were undertaken by AMBS (2023) as described in Section 2.1.4. Table 15 provides a description of the record of the 22 threatened species recorded by AMBS (2023). Table 16 provides a summary of the targeted surveys conducted for each species and dual credit species, their presence within the Study Area and requirement for further assessment. Fauna survey methods and effort is summarised in Table 17, shown in Figure 10 and fauna recorded during the surveys are shown in Figure 16. As detailed in Section 3.6.2, a total of seven species were identified as requiring species polygons.

Table 15. Threatened species recorded within the broader Study Area during surveys for candidate fauna species credit species.

Common name	Scientific name	Conservation Status		Biodiversity Credit Class	Description of AMBS Records
		BC Act	EPBC Act		
REPTILES					
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	Species	Recorded on one occasion in 2021, during a diurnal reptile survey, in grassland at the edge of woodland in the south-west of the Study Area. The juvenile individual was found when shifting a small stick with exfoliating bark rather than under a rock.
Broad-headed Snake	*Hoplocephalus bungaroides*	E	E	Species/ Ecosystem	Recorded on one occasion in 2021, during a targeted reptile survey, in woodland in the south of the Study Area. The individual was recorded beneath a sandstone rock.
BIRDS					
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Ecosystem	Recorded on 12 occasions in 2021. The species was observed and heard during diurnal bird surveys as well as opportunistic sightings.
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	E	Species/ Ecosystem	Recorded during surveys in 2021, however no signs of breeding were identified during the targeted field survey.
Speckled Warbler	*Chthonicola sagittata*	V	-	Ecosystem	Recorded in 20 locations widely throughout the Study Area. The species was observed and heard, during diurnal bird surveys, opportunistic sightings, and once during a spotlight survey.
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	V[6]	Ecosystem	Recorded in 35 locations widely throughout the Study Area. The species was observed and heard during diurnal bird surveys as well as opportunistic sightings.
Varied Sittella	*Daphoenositta chrysoptera*	V	-	Ecosystem	Recorded in 10 locations in 2021. The species was observed and heard during diurnal bird surveys as well as opportunistic sightings.
Black Falcon	*Falco subniger*	V	-	Ecosystem	Recorded on two occasions within the Study Area in 2021. The species was observed once during a diurnal bird survey, and once opportunistically.

Common name	Scientific name	Conservation Status		Biodiversity Credit Class	Description of AMBS Records
		BC Act	EPBC Act		
Little Eagle	*Hieraaetus morphnoides*	V	-	Species/ Ecosystem	Recorded in three locations during surveys in 2021. For two sightings, two individuals were recorded opportunistically flying over the canopy. The third sighting was classified as "possible", with one individual observed during a Diurnal Bird Survey.
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	V	-	Ecosystem	Recorded opportunistically in nine locations in 2021. The species was observed and heard mostly opportunistically, but also during diurnal bird surveys. The number of individuals ranged from one to eight.
Powerful Owl	*Ninox strenua*	V	-	Species/ Ecosystem	Recorded in nine locations in 2021, during forest owl call playback. For each sighting, an individual was heard responding to call broadcasts.
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-	Ecosystem	Recorded opportunistically on three occasions in 2021. The species was observed and heard opportunistically, with numbers of individuals ranging from two to ten.
Diamond Firetail	*Stagonopleura guttata*	V	V[8]	Ecosystem	Recorded in four locations in 2021. The species was observed and heard during diurnal bird surveys as well as opportunistic sightings.
Masked Owl	*Tyto novaehollandiae*	V	-	Species/ Ecosystem	Recorded in seven locations in the Study Area in 2021, during forest owl call playback and hollow monitoring. The range of sightings included a pair responding to call broadcasts (two birds were observed and heard), an individual bird heard responding to call broadcasts, and an individual bird heard and observed flying over the call broadcast location. In addition, a Masked Owl nest tree was recorded just outside the Study Area. A more detailed summary of these sightings is provided in Appendix C. One individual was also heard during a spotlight survey in 2022.
MAMMALS					
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	E	Species	During January 2021, 13 individuals were caught in harp traps and six were observed (or hand-caught) during habitat searches. Of these, one adult female was lactating (later stages) and two

Common name	Scientific name	Conservation Status		Biodiversity Credit Class	Description of AMBS Records
		BC Act	EPBC Act		
					males were immature. One additional female was non-breeding at the time of the survey but may have bred in the past (indicated by black nipples). The species was recorded on Anabat detectors at 30 locations. Three roosts were recorded during habitat searches.
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V	-	Ecosystem	Recorded (definite) on Anabat detectors at one location.
Large Bent-winged Bat (probable)	*Miniopterus orianae oceanensis*	V	-	Species/ Ecosystem	Recorded on Anabat detectors at eleven locations. Analysis of the calls concluded the identification of the species as "probable".
Squirrel Glider	*Petaurus norfolcensis*	V	-	Species	Recorded opportunistically on one occasion in 2021, while spotlighting during transit between call playback locations. The individual was observed foraging in riparian vegetation.
Koala	*Phascolarctos cinereus*	E	E	Species/ Ecosystem	Recorded on seven occasions in 2021. Two Koalas were heard during call playback surveys in July and August, two were heard during nocturnal surveys in December, two were observed opportunistically during a daytime survey in September, and scats were found at the base of a tree in August.
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Ecosystem	Recorded on Anabat detectors at six locations. At least two of these records were classified as definite.
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-	Ecosystem	Recorded (definite) on Anabat detectors at seven locations.
Eastern Cave Bat	*Vespadelus troughtoni*	V	-	Species	During January 2021, six individuals were caught in harp traps. Of these, one adult female was post-lactating and three males were immature. The species was recorded on Anabat detectors at 15 locations. One roost was recorded outside of the Development Footprint during habitat searches.

Table 16. Determining the presence of species credit fauna species requiring further assessment.

Common name	Scientific name	Listing status		Method used to determine presence	Present?	Further assessment required? (BAM Subsections 5.2.5 and 5.2.6)
		BC Act	EPBC Act			
REPTILES						
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	Targeted threatened species survey	Yes	Yes
Striped Legless Lizard	*Delma impar*	V	V	Targeted threatened species survey	No	No
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	-	Targeted threatened species survey	No	No
Broad-headed Snake	*Hoplocephalus bungaroides*	E	E	Targeted threatened species survey	Yes	Yes
BIRDS						
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	Within Important Habitat Mapping	Assumed present	Yes
Bush Stone-curlew	*Burhinus grallarius*	E	-	Targeted threatened species survey	No	No
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	E	Targeted threatened species survey	Yes	No
South-eastern Glossy Black-Cockatoo	*Calyptorhynchus lathami lathami*	V	V	Targeted threatened species survey	No	No
Red Goshawk	*Erythrotriorchis radiatus*	CE	CE[10]	Targeted threatened species survey	No	No
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	-	Targeted threatened species survey	No	No
Little Eagle	*Hieraaetus morphnoides*	V	-	Targeted threatened species survey	Yes	No
Swift Parrot	*Lathamus discolor*	E	CE	Targeted threatened species survey	No	No
Square-tailed Kite	*Lophoictinia isura*	V	-	Targeted threatened species survey	No	No
Barking Owl	*Ninox connivens*	V	-	Targeted threatened species survey	No	No
Powerful Owl	*Ninox strenua*	V	-	Targeted threatened species survey	Yes	No

Common name	Scientific name	Listing status		Method used to determine presence	Present?	Further assessment required? (BAM Subsections 5.2.5 and 5.2.6)
		BC Act	EPBC Act			
Masked Owl	*Tyto novaehollandiae*	V	-	Targeted threatened species survey	Yes	Yes
MAMMALS						
Eastern Pygmy-possum	*Cercartetus nanus*	V	-	Targeted threatened species survey	No	No
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	E	Targeted threatened species survey	Yes	Yes
Little Bent-winged Bat	*Miniopterus australis*	V	-	Targeted threatened species survey	No	No
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V	-	Targeted threatened species survey	Yes	No
Greater Glider	*Petauroides volans*	E	E	Targeted threatened species survey	No	No
Squirrel Glider	*Petaurus norfolcensis*	V	-	Targeted threatened species survey	Yes	Yes
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	V	Targeted threatened species survey	No	No
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	-	Targeted threatened species survey	No	No
Koala	*Phascolarctos cinereus*	E	E	Targeted threatened species survey	Yes	Yes
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Targeted threatened species survey	No	No
Eastern Cave Bat	*Vespadelus troughtoni*	V	-	Targeted threatened species survey	Yes	Yes

V = Vulnerable, E = Endangered, CE = Critically Endangered.
Dark grey highlighted species require further assessment.

Table 17. Threatened species surveys conducted for species credit fauna species.

Common name	Scientific name	Threatened fauna species surveys			Present?	Further assessment required (BAM Subsections 5.2.5 and 5.2.6)
		Survey method (e.g. harp trap, Elliott trap, bioacoustics, etc.)	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort (hours & no. people)		
REPTILES						
Pink-tailed Legless Lizard	*Aprasia parapulchella*	Reptile search (rock-turning)	☑Yes Active diurnal reptile searches undertaken in September 2021. Recommended timing is in spring and early summer (DSEWPaC 2011b)	A total of 25.5 person-hours was applied at 13 locations.	Yes	Yes
Striped Legless Lizard	*Delma impar*	Reptile search (rock turning)	☑Yes Recommended Sep- December. Conducted September.	A total of 25.5 person-hours – 13 locations across 6 days.	No	No
Pale-headed Snake	*Hoplocephalus bitorquatus*	Spotlight	☑Yes Recommended Nov-March. Conducted Dec 2021 and March 2022.	Spotlight: 4 sites, 7 person-hours.	No	No
Broad-headed Snake	*Hoplocephalus bungaroides*	Active diurnal reptile search, Spotlight	☑Yes Diurnal search conducted August 2021. ☑No Spotlight: December 2021 and March 2022	Active diurnal reptile search: 4 person-hours at three locations. Spotlight: 4 sites total 7 person-hours.	Yes	Yes
BIRDS						
Regent Honeyeater	*Anthochaera phrygia*	Diurnal bird survey	☑Yes When Eucalyptus is flowering. Conducted April and May.	23.5 hours, 9 days, 66 locations.	No	Yes (Important Habitat Map within

Common name	Scientific name	Threatened fauna species surveys			Present?	Further assessment required (BAM Subsections 5.2.5 and 5.2.6)
		Survey method (e.g. harp trap, Elliott trap, bioacoustics, etc.)	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort (hours & no. people)		
						Development Footprint)
Bush Stone-curlew	*Burhinus grallarius*	Call playback, Spotlight	☑Yes All Year suitable for survey (DPE 2023a). It may be easier to detect during breeding season, possibly calls all year, but it is unclear how well it responds to playback (DPE 2023a). Spotlight and Call playback: May, July and August 2021. Additional spotlight: December 2021 and March 2022.	Call playback surveys at 12 sites. Bush Stone-curlew call playback involved 5 nights at 6 sites, 4 nights at 2 sites, 3 nights at 3 sites, and 1 night at 1 site. Additional spotlight: 4 sites, total 7 person-hours.	No	No
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Diurnal bird survey, Opportunistic searches	☑Yes Where potential nest trees are identified on site, they should be monitored during the breeding season (October – January) to confirm the presence of any actual nest trees on site (DPE 2023a). Diurnal bird surveys: November and December 2021.	Survey effort included approximately 8 person hours. Survey of forested areas which support trees with hollows.	Yes	No
South-eastern	*Calyptorhynchus lathami lathami*	Diurnal bird survey	☑Yes	Total survey effort of 23.5 hours, over 9 days, across 66 locations.	No	No

Common name	Scientific name	Threatened fauna species surveys			Present?	Further assessment required (BAM Subsections 5.2.5 and 5.2.6)
		Survey method (e.g. harp trap, Elliott trap, bioacoustics, etc.)	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort (hours & no. people)		
Glossy Black-Cockatoo			Potential nest trees should be monitored during the breeding season (April – August) to confirm the presence of any actual nest trees on site (DPE 2023a). Diurnal bird survey conducted April to May 2021.			
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Diurnal bird survey	☑Yes Recommended July-December. Conducted Sep and Nov	28 person hours over 2 months.	No	No
Little Eagle	*Hieraaetus morphnoides*	Diurnal bird survey	☑Yes Recommended Aug-Oct. Conducted Sep.	15 person-hours.	Yes	No
Swift Parrot	*Lathamus discolor*	Diurnal bird survey	☑Yes Recommended March-July. Conducted April and May.	23.5 hours over 9 days and 66 locations.	No	No
Square-tailed Kite	*Lophoictinia isura*	Diurnal bird survey, Stick-nest searches	☑Yes Recommended Sep-Jan. Conducted Sep and Nov.	28 person-hours.	No	No
Barking Owl	*Ninox connivens*	Call playback, Spotlight, Hollow watch.	☑Yes Spotlight: conducted December 2021.	Call-playback surveys: 5 nights at 12 sites.	No	No

Common name	Scientific name	Threatened fauna species surveys			Present?	Further assessment required (BAM Subsections 5.2.5 and 5.2.6)
		Survey method (e.g. harp trap, Elliott trap, bioacoustics, etc.)	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort (hours & no. people)		
			Hollow watch conducted 27-31 July 2021; 10-15 August 2021; 24-29 August 2021.	Spotlighting: 4 sites total 7 person-hours. Hollow watch: four people in July, two people 10-15 August, and by five people 24-29 August. Total of 56 hollows being watched on one occasion each (i.e. the remaining 209 potential hollows within the Study Area were not monitored).		
Powerful Owl	*Ninox strenua*	Call playback, Spotlight, Hollow watch, Opportunistic searches	☑Yes Recommended May-Aug. Conducted July-Aug.	Call playback: 6 nights. Hollow -watch: June – 7 days x 3 people, 6 nights x 4 people, July – 5 days x 4 people, August – 6 days x 2 people, 6 days x 5 people. Spotlight: 4 sites, Dec and March, 7 person-hours.	Yes	No
Masked Owl	*Tyto novaehollandiae*	Call playback, Spotlight, Hollow watch, Opportunistic searches.	☑Yes Recommended May- Aug. Conducted July-Aug.	Call playback: 6 nights. Hollow watch: June – 7 days x 3 people, 6 nights x 4 people, July – 5 days x 4 people, August – 6 days x 2 people, 6 days x 5 people. Spotlight: 4 sites, Dec and March, 7 person-hours.	Yes	Yes

Common name	Scientific name	Threatened fauna species surveys			Present?	Further assessment required (BAM Subsections 5.2.5 and 5.2.6)
		Survey method (e.g. harp trap, Elliott trap, bioacoustics, etc.)	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort (hours & no. people)		
MAMMALS						
Eastern Pygmy-possum	*Cercartetus nanus*	Baited remote camera, Spotlight, Pitfall Trap, Elliott Trap	N/A No species-specific survey requirements defined (DPE 2023a). The Eastern Pygmy-possum is very difficult to detect, especially via spotlighting (DPE 2023a). Baited Remote Cameras: November 2021- December 2021. Pitfall Trap: December 2021. Spotlight: December 2021, March 2022. Elliott Trap: December 2021.	Baited remote camera traps: (one terrestrial and one arboreal) deployed at 14 sites for a minimum of 14 nights. Six pitfall traps were deployed for four nights at 2 sites (48 trap-nights total). Spotlighting was undertaken at 4 sites, total 7 person-hours. Elliott Trapping was undertaken at 2 sites. At each site, 25 Elliott traps were deployed for four nights (i.e. 100 Elliott trap-nights per site).	No	No
Large-eared Pied Bat	*Chalinolobus dwyeri*	Harp Trap, Anabat	☑Yes Recommended Dec-Feb. Conducted Jan.	110 harp trap nights, 92 Anabat nights.	Yes	Yes
Little Bent-winged Bat	*Miniopterus australis*	Harp Trap, Anabat	☑Yes Recommended Dec-Feb. Conducted Jan.	110 harp trap nights, 92 Anabat nights.	No	No
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	Harp Trap, Anabat	☑Yes Recommended Dec-Feb. Conducted Jan.	110 harp trap nights, 92 Anabat nights.	Yes	No

Common name	Scientific name	Threatened fauna species surveys			Present?	Further assessment required (BAM Subsections 5.2.5 and 5.2.6)
		Survey method (e.g. harp trap, Elliott trap, bioacoustics, etc.)	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort (hours & no. people)		
Greater Glider	*Petauroides volans*	Baited remote camera, Spotlight	☑Yes All year.	Camera traps: deployed 14 sites, 14 nights. Spotlight: 2 sites in Dec and March, 7 person-hours.	No	No
Squirrel Glider	*Petaurus norfolcensis*	No specific requirements. Spotlight, Baited camera trap	☑Yes Recommended all year. Conducted in Nov-Dec.	Camera traps: deployed 14 sites, 14 nights. Spotlight: 2 sites in Dec and March, 7 person-hours.	Yes	Yes
Brush-tailed Rock-wallaby	*Petrogale penicillata*	Spotlight, Baited remote camera, Scat search, Opportunistic searches	☑Yes All Year suitable for survey (DPE 2023a). Spotlight: December 2021, March 2022. Baited Remote Camera: November – December 2021. Scat Search: November-December 2021, March 2022.	Spotlight: 2 sites in December 2021 and March 2022, total 7 person-hours. One baited terrestrial camera trap was deployed at 14 sites. Minimum 14 nights per camera. Targeted scat searches: 4 locations within the Study Area, and searches for scats were also undertaken concurrently with all other survey techniques.	No	No

Common name	Scientific name	Threatened fauna species surveys			Present?	Further assessment required (BAM Subsections 5.2.5 and 5.2.6)
		Survey method (e.g. harp trap, Elliott trap, bioacoustics, etc.)	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort (hours & no. people)		
Brush-tailed Phascogale	*Phascogale tapoatafa*	Baited remote camera, Spotlight	☑Yes Survey Dec – Jun, noting that Dec – Feb is the main juvenile dispersal period and May – Jun is the peak mating season (DPE 2023a). Remote Camera survey: April to June 2021. Spotlight: December 2021 and March 2022.	Remote camera: April-June 2021 – 60 baited camera traps deployed, 4 weeks per camera, bait replaced after 2 weeks (total of 2,280 camera trap nights). Nov-Dec 2021 – two baited camera traps (one terrestrial and one arboreal) deployed at 14 sites. Minimum 14 nights per camera. Spotlight:4 sites total 7 person-hours.	No	No
Koala	*Phascolarctos cinereus*	Spotlight, Scat search, Habitat assessment	☑Yes All year.	Spotlight: 7 person-hours, 4 sites. Total searches 50 person-days.	Yes	Yes
Grey-headed Flying-fox	*Pteropus poliocephalus*	Habitat assessment, Diurnal searches, Spotlight	☑Yes Recommended Oct-December. Searches Oct-Nov, Spotlight Dec.	Spotlight 7 person-hours. Total searches 50 person-days.	No	No
Eastern Cave Bat	*Vespadelus troughtoni*	Harp trap; Anabat	☑Yes Recommended November-January. Harp trapping undertaken January 2021. Anabat surveys undertaken January 2021.	Survey effort should include at least 16 harp trap or Anabat nights over at least 4 nights, for areas up to 50 ha (OEH 2018c). Anabat: 92 nights achieved.	Yes	Yes

Common name	Scientific name	Threatened fauna species surveys			Present?	Further assessment required (BAM Subsections 5.2.5 and 5.2.6)
		Survey method (e.g. harp trap, Elliott trap, bioacoustics, etc.)	Timing of survey – within recommended period? (BAM-C / TBDC)	Effort (hours & no. people)		
				Harp Trap: total of 110 nights achieved.		

Dark grey highlighted species require preparation of species polygons.

3.5.3 Presence of candidate species credit species

Flora species

As described in Section 2.1.3, targeted threatened flora survey was undertaken by ELA (2023) in accordance with the BAM (DPIE 2020a) and the methods described in the Threatened Flora Survey Guideline (DPIE 2020c). Species targeted included those potential species credit species as identified in the desktop assessment (Table 11).

Of the 44 species targeted in the ELA (2023) surveys, one threatened flora species, Cotoneaster Pomaderris (*Pomaderris cotoneaster*), which is listed as Endangered on the schedules of the BC Act and EPBC Act was recorded within the Study Area.

Within the Study Area, *Pomaderris cotoneaster* was recorded:

- On a range of sedimentary rock derived substrates including sandy loam, sandy clay loam and sand, and with a range of associated outcropping sedimentary rock including shale/mudstone, coarse-grained sandstone and conglomerate.
- Across a range of landscape positions including colluvial sediments on valley floor/gully, on scree/talus slope, amongst clifflines and boulders positioned on the upper slope and on relatively exposed sandstone plateaus.
- Where there was no evidence of recent fire history (i.e. charring on trees and logs was absent).
- Generally, on south-west, west and north-west aspects.
- Growing mostly in association with *Eucalyptus punctata* (PCT 1629)*;* however, was also recorded growing in association with *Eucalyptus albens* and *Callitris endlicheri* (PCT 1610) and *Eucalyptus fibrosa* (PCT 478).
- At altitudes between 520 m ASL and 580 m ASL.
- Mature plants, seedlings and saplings were identified throughout the population. The population was in good health and actively growing as identified by the presence of strong apical shoots. Different reproductive stages were observed within the population during field surveys.
- Flower buds were observed to be developing during September 2021.
- The population was flowering during early October 2021.
- The development of fruiting bodies was observed during mid to late October 2021.

A species polygon for *Pomaderris cotoneaster* is mapped on Figure 17a as per Section 3.6.

Olearia cordata is found in woodland on sandstone rocky ridges and is known to germinate in large numbers after fire (Benson and McDougall 1994; DPE 2023a). It reaches maturity after 1-2 years and seeds are capable of germinating without fire, particularly after periods of significant rainfall (DPE 2023e). Although most of the survey area has been without fire in the last ten years, data from the Ulan Water weather station (062036) indicates that rainfall was significantly greater than the mean and median for the Ulan area in late 2020, 12 months prior to the period of survey (Bureau of Meteorology [BOM] 2021) with 148 mm in October and 176 mm in December, more than double the monthly averages. This followed very dry conditions in 2019 which were below the average rainfall in all months. The species is likely to have germinated in response to the significant rainfall in 2020

and therefore it is considered that the targeted survey effort conducted (ELA 2023) would have been sufficient to detect the species in spring of 2021.

Fauna species

As described in Section 2.1.4 a range of targeted fauna surveys were undertaken by AMBS (2023) between December 2020 and March 2022 within the Study Area.

A total of 22 threatened fauna species listed as threatened under the BC Act were recorded within the Study Area, of which five were also listed as threatened under the EPBC Act at the time they were recorded and two species have since been listed under the EPBC Act. A summary of the species recorded within the Study Area is provided in Table 15.

Species recorded during surveys by AMBS (2023) included a total of five species credit species, six dual credit species and 12 ecosystem credit species as follows:

- Species credit species
  - Pink-tailed Legless Lizard (Aprasia parapulchella)
  - Large-eared Pied Bat (Chalinolobus dwyeri)
  - Koala (Phascolarctos cinereus)
  - Squirrel Glider (Petaurus norfolcensis)
  - Eastern Cave Bat (Vespadelus troughtoni)
- Dual credit species
  - Gang-gang Cockatoo (Callocephalon fimbriatum)
  - Little Eagle (Hieraaetus morphnoides)
  - Broad-headed Snake (Hoplocephalus bungaroides)
  - Large Bent-winged Bat (*Miniopterus orianae oceanensis*) (probable)
  - Powerful Owl (*Ninox strenua*)
  - Masked Owl (Tyto novaehollandiae)
- Ecosystem credit species
  - Dusky Woodswallow (Artamus cyanopterus cyanopterus)
  - Speckled Warbler (Chthonicola sagittate)
  - Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae)*
  - Varied Sittella (Daphoenositta chrysoptera)
  - Black Falcon (*Falco subniger*)
  - Little Lorikeet (Glossopsitta pusilla)
  - Black-chinned Honeyeater (Melithreptus gularis gularis)
  - Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*)
  - Grey Crowned Babbler (Pomatostomus temporalis temporalis)
  - Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
  - Greater Broad-nosed Bat (*Scoteanax rueppellii*)
  - Diamond Firetail (Stagonopleura guttata).

With respect to the 26 potential candidate species credit species identified in Table 12, including those identified during the targeted surveys, a summary of species presence, or otherwise, and the requirement for further assessment in the BDAR under Section 5.2.5 and 5.2.6 of the BAM (DPIE 2020a) was determined (Table 15. and Table 16).

In accordance with Section 5.2.2 of the BAM (DPIE 2020a), the habitat constraints for each species credit or dual credit species that was recorded, were investigated (AMBS 2023). It was determined that each of the species credit species and two of the six dual credit species were identified as requiring further assessment as species credits (preparation of a species polygon). The four dual credit species identified as not requiring further assessment as species credits were the Gang-gang Cockatoo, Little Eagle, Powerful Owl and Large Bent-winged Bat for the following reasons (as per AMBS 2023):

- Gang-gang Cockatoo – no signs of breeding, consistent with the requirements in the TBDC (DPE 2023a) were recorded in the Study Area
- Little Eagle – no evidence was recorded of the species occupying a nest or breeding within the Study Area
- Powerful Owl – no signs of breeding, consistent with the requirements in the TBDC (DPE 2023a) were recorded in the Study Area
- Large Bent-winged Bat – no individuals were captured in harp traps and only a small number of (probable) records were obtained from Anabats. No caves or crevices that would likely be suitable for maternity/breeding were observed in the Study Area.

Further to this, and with regard to the Large Bent-winged Bat, the TBDC notes that this species is a dual credit because foraging habitat is broad ranging but breeding habitat is highly specific. AMBS (2023) notes that "*No caves or crevices that would likely be suitable for a maternity/breeding roost were observed in the Study Area*" and "*The small number of calls, no animals captured in harp traps, and the lack of suitable habitat observed suggests it is unlikely for there to be breeding caves in the Study Area*" (Section 3.4, Table 3.3).

Of the records for the Large Bent-winged Bat that were detected during targeted survey, no individuals were captured in harp traps and only a small number of (probable) records were obtained from Anabats (AMBS 2023). Large Bent-winged Bats form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about a 300 km range of maternity caves. Breeding or roosting colonies can number from 100 to 150,000 individuals (DPE 2023e).

AMBS (2023) conducted thorough surveys of all rocky habitat within the Study Area, as well as harp trapping in accordance with the '*Species Credit' Threatened Bats and their Habitats* (OEH 2018c, 'Species credit' threatened bats and their habitats). It was determined that there was no suitable breeding habitat for Large Bent-winged Bat based on cave preference for maternity roosts which require very specific temperature and humidity regimes (DPE 2023e).

One other dual credit species, the Regent Honeyeater (*Anthochaera phrygia*), is considered likely to use habitat within the Development Footprint based on the presence of Important Habitat Mapping for the species within the Development Footprint (DPE 2023g).

Further targeted survey, an expert report and/or the assumption of presence within previously unsurveyed areas was determined to not be necessary to exclude presence of the Eastern Pygmy Possum (*Cercartetus nanus*) or Brush-tailed Rock Wallaby (*Petrogale penicillata*), based on the following:

Eastern Pygmy Possum

- There are no recent or old records of the Eastern Pygmy-possum within 80 km of the Project (DPE 2023c[4]). The closest record of Eastern Pygmy Possum is located 80 km to the southeast in Goulburn River National Park
- Survey effort undertaken for the species included (ELA 2023):
  - Two remote (Spring/Summer) camera traps (one terrestrial and one arboreal) deployed for 14 nights at 14 sites in the Study Area
  - Six pitfall traps deployed over four nights at two sites
  - Twenty-five Elliot traps over four nights at two sites and
  - Spotlighting undertaken at four sites totalling seven person hours
- The survey effort was consistent with survey information provided in the TBDC (DPE 2023a) and also the Commonwealth Threatened Mammal Guidelines (DSEWPaC 2011a) and targeted key areas of likely preferred habitat for the species considering foraging and shelter resources required and present and connectivity of habitat
- The species has not been recorded opportunistically or otherwise during targeted nocturnal fauna surveys and/or small mammal surveys conducted in relation to development applications within the vicinity of the Project
- It is considered unlikely that Eastern Pygmy-possum would have remained undetected during the surveys.

Based on the above justification, no further targeted surveys are required for the Eastern Pygmy Possum.

Brush-tailed Rock Wallaby

- The closest record of Brush-tailed Rock-wallaby is located is 10 km to the Northeast in Wollemi National Park (DPE 2023c[4])
- Survey effort undertaken for the species included (ELA 2023):
  - One remote camera trap (terrestrial) deployed for 14 nights at 14 sites in the Study Area
  - Spotlighting undertaken at two sites totaling seven person hours and
  - Targeted scat searches at four locations within the Study area
- The survey effort was consistent with survey information provided in the TBDC (DPE 2023a) and also the Commonwealth Threatened Mammal Guidelines (DSEWPaC 2011a) and targeted key areas of likely preferred habitat for the species considering foraging and shelter resources required and present and connectivity of habitat

- The species has not been recorded opportunistically or otherwise during targeted nocturnal fauna surveys and/or small mammal surveys conducted in relation to development applications within the vicinity of the Project
- It is considered unlikely that Brush-tailed Rock Wallaby would have remained undetected.

Based on the above justification, no further targeted surveys are required for the Brush-tailed Rock Wallaby.

In summary, a total of eight fauna species credit species or dual credit species were recorded during the surveys, or have Important Habitat Mapped within the Study Area, and meet the requirements to prepare a species polygon for species credits:

- Pink-tailed Legless Lizard
- Regent Honeyeater
- Broad-headed Snake
- Masked Owl
- Large-eared Pied Bat
- Squirrel Glider
- Koala
- Eastern Cave Bat.

The remaining 15 species were not detected and thus considered absent from the Development Footprint. These species are not addressed further.

Broad-headed Snake was recorded on one occasion in 2021 (AMBS 2023), during a targeted reptile survey, in woodland in the south of the Study Area. The individual was recorded beneath a sandstone rock. As described in Section 2.1.4, LiDAR mapping and ground-truthing was applied to identify suitable habitat within and surrounding the Study Area. This informed the species polygon that was generated for this species which includes a 100 m buffer applied to all suitable rocky habitat for this species. The species polygon for this species does not overlap with the Development Footprint and therefore does not generate any species credits.

AMBS (2023) indicate that one other dual credit species, the Swift Parrot (*Lathamus discolor)*, is highly likely to occur, despite not being recorded during targeted surveys. This is based on the proximity of local records (the species has been recorded in contiguous habitat to the north and there are also records in the wider locality, including with the nearby Munghorn Gap Nature Reserve [AMBS 2023]) and the presence of associated PCTs and autumn/winter flowering food tree species within the Development Footprint.

The Swift Parrot breeds in Tasmania during the Summer but migrates and disperses across the mainland of south-eastern Australia to forage in Winter (DPE 2023e). Key foraging areas for this species within NSW are identified within the Important Habitat Map for the species. The Important Habitat Map for the species includes "*Areas with sightings of five or more birds recorded over any*

two or more years, or single sightings of 40 or more birds" and is defined by a 2 km radial buffer on all cleaned and checked Swift Parrot sighting records from 1990-2020.

No areas of habitat identified on the Swift Parrot Important Habitat Map occur within the Development Footprint. The dual credit Swift Parrot is considered a species credit species (and preparation of a species polygon is required) only where Important Habitat Mapping for the species occurs within the Development Footprint (DPE 2023a). Based on this and the lack of records within the Development Footprint that could qualify as an area of "Important Habitat", for the purposes of this assessment, the Swift Parrot is considered an ecosystem credit species. Potential impacts to this species under the EPBC Act are addressed in Section 8.

Three records of the Bush Stone-curlew were accidentally included within AMBS (2023) and subsequently added to BioNet. AMBS confirmed that the species was not recorded during the targeted surveys and the records are erroneous. The erroneous records have been marked as "Suspect" in BioNet, which removes the records from searches of the BioNet database for the public, registered users, and holders of sensitive species licences.

3.5.4 Expert reports

Dr. Stephen Bell is an accredited expert under the BC Act for *Commersonia rosea* and *Kennedia retrorsa.* His expert report is provided in Appendix L (Bell 2024). In relation to *Commersonia rosea* and *Kennedia retrorsa,* Dr. Stephen Bell concludes that the species are unlikely to be present on or use habitat on the subject land.

As discussed in Section 3.4.1, Dr Stephen Bell also reviews the potential habitat for *Commersonia procumbens* and *Monotaxis macrophylla* but not as an accredited expert*,* there are no accredited experts under the BC Act for as *Commersonia procumbens* and *Monotaxis macrophylla.*

3.5.5 More appropriate local data (where relevant)

No additional local data was used in place of threatened species surveys.

3.6 Area or count, and location of suitable habitat for a species credit species (a species polygon)

The total area of habitat within the Study Area for each species has been calculated by ELA (2023) for flora species and by AMBS (2023) for fauna species. Species polygons were generated in accordance with the BAM (DPIE 2020a) and the TBDC (DPE 2023a). Species polygons are shown in Figure 17 map series (a-j). All species, except *Pomaderris cotoneaster* have an 'area' unit of measure (DPE 2023a). The total area of habitat for each species within the Development Footprint is provided in Table 18.

3.6.1 Flora species

Pomaderris cotoneaster

The species polygon for *Pomaderris cotoneaster* was generated based on extensive targeted surveys conducted by ELA in 2021 (ELA 2023) after the identification of the species in the Study Area. Surveys confirmed that the species is present in one location of the Study Area, adjacent to the north-east of the Development Footprint (Figure 17a) and absent from other portions of the Study Area. The location in which it was recorded has the suitable microhabitats for the species. Within the Study Area, the species was found growing mostly within PCT 1629 (Remnant Forest), as well as PCT 281 (Remnant Woodland), PCT 478 (Remnant Forest) and PCT 1610 (Remnant Woodland). Based on the survey data, the species is expected to occur within the location it was recorded and is not expected to occur elsewhere. The suitable habitat is therefore considered to be the area that it was recorded and immediate adjoining areas where the species was not observed but is considered likely to occur.

A 30 m buffer has been included around the area of suitable habitat where the species was observed. This additional buffer is not required by the BAM (i.e. the species polygon could be reduced by 30 m around the outside of the area of suitable habitat), but it has been added to encompass all suitable habitat. A 30 m buffer is applied around 'individual' species credit species (according to the BAM) so it is considered a reasonable buffer to apply. Areas of PCT 281 DNG (High and Low condition) within 30 m of the habitat were not included in species polygon, as these areas

did not support suitable habitat (ELA 2023). The species polygon for *Pomaderris cotoneaster* within the Development Footprint is comprised of suitable habitat within PCT 1629 (Remnant Forest).

3.6.2 Fauna species

Pink-tailed Legless Lizard

The species polygon for the Pink-tailed Legless Lizard was developed in consideration of habitat constraints, suitable habitat identified during habitat assessment surveys and survey limitations discussed in Section 2.3. One individual was recorded in grassland at the edge of woodland in the south-west of the Study Area, outside of the Development Footprint, and it has been assumed present within the Development Footprint. Suitable rocky grassland habitat was thoroughly mapped by AMBS (Appendix C) and forms the basis of the species polygon within the Development Footprint.

Approximately 1.3 ha of potential Pink-tailed Legless Lizard surface rocky habitat overlaps Category 1 – exempt land, however when the species 50 m buffer of rocky areas habitat constraint is applied to this rocky habitat, approximately 25.3 ha overlaps the Category 1 – exempt land. As credits cannot be generated within the BAM-C for impacts to non-native vegetation, an offset for impacts to potential habitat Pink-tailed Legless Lizard habitat within Category 1 – exempt land was estimated and is outlined in Section 5.3.4. Mine rehabilitation will include the development of a surface rock trial site to assess if introducing new surface rock can restore surface rocky habitat for the Pink-tailed Legless Lizard. Access to the mine site would be restricted, eliminating potential further removal or disturbance of scattered rocks within the Development Footprint.

Regent Honeyeater

No individuals of the Regent Honeyeater were recorded during survey by AMBS (Appendix C). However, the Development Footprint is located within Important Habitat Mapping for the species (DPE 2023g), therefore a species polygon has been generated by overlaying the Important Habitat Mapping layer within the Development Footprint.

Some overlap of the Important Habitat Mapping layer occurs within Category 1 – exempt land and mapped areas of infrastructure (approximately 0.26 ha), owing to slight inaccuracies in the digitisation of woodland habitat in the Important Habitat Mapping layer. These areas have been excluded from credit generation because they are either devoid of vegetation or represent exotic grassland and do not represent habitat for the species.

Broad-headed Snake

Broad-headed Snake was recorded on one occasion in 2021 (AMBS 2023), during a targeted reptile survey, in woodland in the south of the Study Area. The individual was recorded beneath a sandstone rock.

As described in Section 2.1.4, LiDAR mapping and ground-truthing was applied to identify suitable habitat within and surrounding the Study Area. This informed the species polygon that was generated for this species which includes a 100 m buffer applied to all suitable rocky habitat for this species. The species polygon for this species does not overlap with the Development Footprint and therefore does not generate any species credits.

Masked Owl

The TBDC (DPE 2023a) recommended method for creating a species polygon for the Masked Owl is to create a 100 m buffer around a known nest tree. One breeding pair was identified using a single tree outside the Study Area. The species polygon for this species does not overlap with the Development Footprint and therefore does not generate any species credits.

Large-eared Pied Bat

The Large-eared Pied Bat was regularly recorded by AMBS (2023) across the Study Area. A total of 19 individuals were caught during trapping, and the species was recorded on Anabats at 30 locations, with three confirmed roosts within the Study Area. A species polygon was generated for this species to include all suitable foraging vegetation within 2 km of rocky habitat.

Potential breeding habitat for the Large-eared Pied Bat was also mapped (100 m buffer of rocky bat habitat). In 2023, since submission of the EIS, MSEC (2023) undertook mapping of features (cliffs and rock face features) from LiDAR. The LiDAR information was used to check the extent of potential roosting habitat previously mapped by AMBS (2023). As such, an additional on-site survey was conducted by Niche ecologists on 26 September 2023 to ground-truth these areas and determine their suitability as potential habitat for Large-eared Pied Bat. The breeding habitat polygon was increased to include some finer detailed habitat picked up through LiDAR analysis.

Squirrel Glider

One individual Squirrel Glider was found during survey by AMBS (2023). According to the TBDC (DPE 2023a), habitat containing large old trees with less than 50 m separation between patches is suitable for use by the species. All contiguous woodland habitat was used to generate the species polygon.

The species has not been otherwise recorded in the wider locality, including within the nearby Munghorn Gap Nature Reserve (DPE 2023a).

Important foraging resources include food sources such as nectar, flowers and sap from trees species such as White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*), Broken Back Ironbark (*E. fracta*), Beyer's Ironbark (*E. beyeriana*), Broad-leaved Ironbark (*E. fibrosa*), Narrow-leaved Ironbark (*E. crebra*) and Mugga Ironbark (*E. sideroxylon*) (LLS 2017) These trees are all present within the Study Area. These resources vary seasonally dependent on availability with a reliance on nectar and pollen for carbohydrate intake, and insects for protein. Trees also provide refuge and nesting sites, especially those with abundant hollows within 50 m of each other, to traverse the landscape safely from predators. Movement from dens can alter between warmer and cooler months, where they must spend more time resting to conserve energy in the latter.

Important breeding and refuge habitat is present within Squirrel Glider associated PCTs 266, 281, 471, 1629, and 1655, which are present in varying conditions across the Study Area (Figure 11) (DPE 2023b). Other PCTs within the Study Area that are not associated with Squirrel Gliders in the TBDC but still likely to contain suitable habitat important for connectivity and movement, and possibly hollow-bearing trees for breeding, include PCTs 478, 481, 1610, 1614, 1656, 1661, and 1711.

Hollow-bearing trees are an essential breeding and refuge habitat for the Squirrel Glider. Large old trees with hollows containing entrances 5-10 cm in width are species-specific for the Squirrel Glider. Areas of vegetation containing large old trees with less than 50 m separation between patches are considered highly beneficial for the survival of this species. Hollow-bearing trees occur across the Study Area ranging from scattered to common in the forested and woodland areas, to rare or absent in the grassland areas (Figure 10).

Koala

The Koala was recorded at three broad locations in woodland/forest habitat around the periphery of the Study Area by direct observation and indirectly from scats, scratches and vocalisations. The species has also been recorded in contiguous habitat less than a kilometre from the north of the Study Area (AMBS 2021) and there are records of the Koala in the wider locality, including within 2 km in the nearby Munghorn Gap Nature Reserve (DPE 2023a).

Foraging resources include important feed tree species such as White Box (*Eucalyptus albens*), Grey Gum (*E. punctata*), Blakely's Red Gum (*E. blakelyi*), Yellow Box (*E. melliodora*), Grey Box (*E. moluccana*) and Narrow-leaved Stringybark (*E. sparsifolia*) (Youngentob *et al.* 2021; DPE 2023b), which are all present within the Study Area. Refuge habitat may be considered to include trees or woodland areas that provide refuge from predators when moving across the landscape, or also shelter from extreme temperatures (such as woodland areas within the valleys/adjacent to riparian areas in hotter months).

A species polygon was generated by AMBS (2023) (Appendix C) using all vegetation zones within the Development Footprint that contain key food tree species as identified in 'A review of koala tree use across New South Wales (OEH 2018d). Foraging, breeding and refuge habitat for Koalas is present within the Study Area in PCTs that are associated with Koala as defined in the TBDC (DPE 2023a), including PCTs 266, 281, 471, 1629, and 1655 (Figure 11) which are present in varying conditions. Other PCTs, not associated with Koalas, still contain Koala feed trees and are important for connectivity and movement. Within the Study Area, these include PCTs 478, 481, 483, 1610, 1614, 1656, 1661, and 1711. According to Youngentob *et al.* (2021) "*Determining the minimum spatial extent required to support koalas at either the individual scale or the population level is complicated by the fact that koalas can persist in highly fragmented landscapes and the amount of area needed differs widely across the range of the koala due to spatial and temporal differences in the quality and availability of resources".*

Eastern Cave Bat

The Eastern Cave Bat was also regularly recorded by AMBS (2023) on Anabat detectors at 15 locations, and six individuals were caught during harp trapping. One roost was confirmed during habitat searches in the Study Area, outside of the Development Footprint. All suitable foraging habitat within 2 km of rocky habitat was included in the species polygon.

Potential breeding habitat for the Eastern Cave Bat was also mapped (100 m buffer of rocky bat habitat). As described above for the Large-eared Pied Bat, MSEC (2023) undertook mapping of

features (cliffs and rock face features) from LiDAR, which was ground-truthed by Niche Ecologists on 26 September 2023. The breeding habitat polygon was increased to include some finer detailed habitat picked up through LiDAR analysis.

Table 18. Summary of Species Credit Species recorded or assumed present within the Development Footprint.

Common name	Scientific name	Biodiversity risk weighting (DPE 2023a)	SAII entity** (DPE 2023a)	Habitat constraints / microhabitats present within the Development Footprint	Extent (ha) of suitable habitat in the Development Footprint	TBDC species specific recommendations e.g. buffers, general comments (where relevant)	Habitat condition (vegetation integrity score for each vegetation zone in the polygon – area species only)
Flora							
Cotoneaster Pomaderris	*Pomaderris cotoneaster*	High (2)	No	This species does not have a habitat constraint.	Stage 1: 0 Stage 2: 0.07 Stage 3: 0	N/A	1629_High: 56.3
Fauna							
Regent Honeyeater	*Anthochaera phrygia*	Very High (3)	Yes	Intersect with Important Habitat Map	Stage 1: 37.23 Stage 2: 22.73 Stage 3: 20.54	Area of intersect with Important Habitat Map.	266_High: 88.1 266_DNG: 39.8 266_Scattered: 67.2 281_High: 90.4 281_DNG: 33.3 281_DNG_Low: 32.7 281_Scattered: 84.4 1610_High: 43.5 1610_Regenerating: 41.2 1629_High: 56.3 1655_High: 52.3 1656_High: 47.5 1656_Regenerating: 56 1661_High: 51.9 1711_High: 47.2

Common name	Scientific name	Biodiversity risk weighting (DPE 2023a)	SAII entity** (DPE 2023a)	Habitat constraints / microhabitats present within the Development Footprint	Extent (ha) of suitable habitat in the Development Footprint	TBDC species specific recommendations e.g. buffers, general comments (where relevant)	Habitat condition (vegetation integrity score for each vegetation zone in the polygon – area species only)
Pink-tailed Legless Lizard	*Aprasia parapulchella*	High (2)	No	Rocky areas suitable for this species (and 50 m buffer) included locations with surface rock and native grasses (e.g. *Themeda* sp., *Lomandra* sp. etc.), mostly within PCTs 266, 281, 483 and 1655. Smaller sections of suitable rocky habitat within areas of PCTs not associated with the species, including PCTs 1610, 1629 and 1656.	Stage 1: 77.92 (65.72 ha native vegetation and 12.2 ha Category 1 – exempt land) Stage 2: 96.6 (83.9 ha native vegetation and 12.7 ha Category 1 – exempt land) Stage 3: 32.62 (32.22 ha native vegetation and 0.4 ha Category 1 – exempt land)	50 m buffer applied around suitable areas of rocky habitat (DPE 2023a)	266_High: 88.1 266_DNG: 39.8 266_Scattered: 67.2 281_High: 90.4 281_DNG: 33.3 281_DNG_Low: 32.7 483_High: 83.4 1610_High: 43.5 1610_Regenerating: 41.2 1629_High: 56.3 1655_High: 52.3 1656_High: 47.5 1656_Regenerating: 56.0 1661_High: 51.9 1711_High: 47.2
Large-eared Pied Bat	*Chalinolobus dwyeri*	Very High (3)	Yes	PCTs 281, 1629, 1655 within a 2 km radius of	Stage 1: 44.94	*Species polygon boundary should*	266_High: 88.1 266_Scattered: 67.2

Common name	Scientific name	Biodiversity risk weighting (DPE 2023a)	SAII entity** (DPE 2023a)	Habitat constraints / microhabitats present within the Development Footprint	Extent (ha) of suitable habitat in the Development Footprint	TBDC species specific recommendations e.g. buffers, general comments (where relevant)	Habitat condition (vegetation integrity score for each vegetation zone in the polygon – area species only)
				identified roosting habitat (such as rocky areas containing caves, overhangs, escarpments, outcrops, or crevices). The species polygon includes PCTs associated with the species, as well as: PCTs 266, 483, 1610 because the species was recorded within these during the surveys; and PCTs 481, 1656, 1661 and 1711.	Stage 2: 29.5 Stage 3: 38.58	*align with PCTs on the subject land to which the species is associated that are within 2km of identified potential roost habitat features.*	281_High: 90.4 281_Scattered: 84.4 483_High: 83.4 1610_High: 43.5 1610_Regenerating: 41.2 1629_High: 56.3 1655_High: 52.3 1656_High: 47.5 1656_Regenerating: 56.0 1661_High: 51.9 1711_High: 47.2
Broad-headed Snake	*Hoplocephalus bungaroides*	Very High (3)	Yes	No rocky habitat in Development Footprint.	No overlap with Development Footprint	*Refer to the Threatened reptiles - Biodiversity Assessment Method survey guide for information on*	N/A

Common name	Scientific name	Biodiversity risk weighting (DPE 2023a)	SAII entity** (DPE 2023a)	Habitat constraints / microhabitats present within the Development Footprint	Extent (ha) of suitable habitat in the Development Footprint	TBDC species specific recommendations e.g. buffers, general comments (where relevant)	Habitat condition (vegetation integrity score for each vegetation zone in the polygon – area species only)
						targeted survey requirements and mapping species polygons	
Squirrel Glider	*Petaurus norfolcensis*	High (2)	No	This species does not have a habitat constraint. Hollow-bearing trees and suitable food sources nectar, flowers, and sap present widely over site. Associated PCTs 266, 281, 1629 and 1655. Also non-associated PCTs but with suitable habitat: PCTs 483, 1610, 1656, 1661, 1711.	Stage 1: 44.94 Stage 2: 29.5 Stage 3: 38.58	*Relies on large old trees with hollows for breeding and nesting. These trees are also critical for movement and typically need to be closely connected (i.e. no more than 50 m apart).*	266_High: 88.1 266_Scattered: 67.2 281_High: 90.4 281_Scattered: 84.4 483_High: 83.4 1610_High: 43.5 1610_Regenerating: 41.2 1629_High: 56.3 1655_High: 52.3 1656_High: 47.5 1656_Regenerating: 56.0 1661_High: 51.9 1711_High: 47.2
Koala	*Phascolarctos cinereus*	High (2)	No	Key food tree species present White Box (*Eucalyptus albens*), Grey Gum (*E. punctata*), Blakely's Red Gum (E.	Stage 1: 44.94 Stage 2: 29.5 Stage 3: 38.58	*Refer to the Koala (Phascolarctos cinereus): Biodiversity Assessment*	266_High: 88.1 266_Scattered: 67.2 281_High: 90.4 281_Scattered: 84.4

Common name	Scientific name	Biodiversity risk weighting (DPE 2023a)	SAII entity** (DPE 2023a)	Habitat constraints / microhabitats present within the Development Footprint	Extent (ha) of suitable habitat in the Development Footprint	TBDC species specific recommendations e.g. buffers, general comments (where relevant)	Habitat condition (vegetation integrity score for each vegetation zone in the polygon – area species only)
				blakelyi), Yellow Box (*E. melliodora*), Grey Box (*E. moluccana*) and Narrow-leaved Stringybark (*E. sparsifolia*). Associated PCTs 266, 281, 1629 and 1655. Not associated PCTs but containing key food tree species: PCTs 483, 1610, 1656, 1661, 1711.		*Method Survey Guide for information on targeted survey requirements and mapping species polygons.*	483_High: 83.4 1610_High: 43.5 1610_Regenerating: 41.2 1629_High: 56.3 1655_High: 52.3 1656_High: 47.5 1656_Regenerating: 56.0 1661_High: 51.9 1711_High: 47.2
Masked Owl	*Tyto novaehollandiae*	High (2)	No	Breeding pair and nest in tree 100 m outside Study Area.	No overlap with Development Footprint	*Species polygon should be established by providing a circular buffer with a 100m radius around the nest tree*	N/A
Eastern Cave Bat	*Vespadelus troughtoni*	Very High (3)	Yes	PCTs 266, 281, 483, 1610, 1629, 1655, 1656, 1661, and 1711 within a	Stage 1: 44.94 Stage 2: 29.5	*Species polygon boundary should align with PCTs on*	266_High: 88.1 266_Scattered: 67.2

Common name	Scientific name	Biodiversity risk weighting (DPE 2023a)	SAII entity** (DPE 2023a)	Habitat constraints / microhabitats present within the Development Footprint	Extent (ha) of suitable habitat in the Development Footprint	TBDC species specific recommendations e.g. buffers, general comments (where relevant)	Habitat condition (vegetation integrity score for each vegetation zone in the polygon – area species only)
				2 km radius of identified roosting habitat (such as rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles), and old mines, tunnels, old buildings or sheds). The species polygon includes PCT 281 associated with the species , as well as: PCTs 266, 483, 1610, 1629, 1655, 1656, 1661, and 1711 because the species was recorded within these during the surveys.	Stage 3: 38.58	*the subject land to which the species is associated that are within 2km of identified potential roost habitat features.*	281_High: 90.4 281_Scattered: 84.4 483_High: 83.4 1610_High: 43.5 1610_Regenerating: 41.2 1629_High: 56.3 1655_High: 52.3 1656_High: 47.5 1656_Regenerating: 56.0 1661_High: 51.9 1711_High: 47.2

** A list of Serious and Irreversible Impact (SAII) entities is also available on the department's website

3.7 Identifying prescribed impacts

Prescribed biodiversity impacts are impacts on biodiversity values in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. Prescribed additional biodiversity impacts (prescribed impacts) must be assessed as part of the NSW Biodiversity Offsets Scheme, as per clause 6.1 of the NSW *Biodiversity Conservation Regulation 2017* (BC Regulation). The BC Regulation states:

(1) The impacts on biodiversity values of the following actions are prescribed (subject to subclause (2) as biodiversity impacts to be assessed under the biodiversity offsets scheme—

(a) the impacts of development on the following habitat of threatened species or ecological communities—

(i) karst, caves, crevices, cliffs and other geological features of significance,

(ii) rocks,

(iii) human made structures,

(iv) non-native vegetation,

(b) the impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range,

(c) the impacts of development on movement of threatened species that maintains their lifecycle[11]*,*

(d) the impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining or other development),

(e) the impacts of wind turbine strikes on protected animals,

(f) the impacts of vehicle strikes on threatened species of animals or on animals that are part of a threatened ecological community.

An analysis of prescribed impacts has been provided in Table 19 for the threatened species credit species that have been confirmed/assumed to have presence within the Development Footprint.

[11] The BAM (DPIE 2020) does not provide assessment requirements for this prescribed matter.

Table 19. Prescribed impacts identified

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC, that are at risk of vehicle strike
Karst, caves, crevices, cliffs, rocks or other geological features of significance	☒Yes / ☐No	Areas of scattered surface rock occur within the Development Footprint. A number of varying landforms were identified at least 100 m from the Development Footprint, ranging from small isolated stony hills with limited outcropping rock to larger, steeper sandstone hills and ridgetops with extensive outcropping, caves, crevices, overhangs, cliff faces and boulders.	Pink-tailed Legless Lizard (scattered surface rock within the Development Footprint) Broad-headed Snake (rocky habitat outside of the Development Footprint) Large-eared Pied Bat (rocky habitat outside of the Development Footprint) Eastern Cave Bat (rocky habitat outside of the Development Footprint)
Human-made structures	☐Yes / ☒No	N/A	N/A
Non-native vegetation	☒Yes / ☐No	Approximately 186.6 ha of Category 1 – exempt land has been mapped as occurring within the Development Footprint. These areas are restricted to vegetation that has been subject to ongoing intensive agriculture and dominated by exotic pasture species. Generally, areas of Category 1 – exempt land are located away from remnant native vegetation, on areas containing flat fertile soil that are easily cultivated.	Threatened birds may forage over exotic grassland areas, sourcing seed and nesting material, or hunting for lizards and small mammals in areas adjacent to remnant woodland. Pink-tailed Legless Lizard may use rocky areas within non-native vegetation.
Habitat connectivity	☒Yes / ☐No	Habitat within the valley of the Development Footprint has been previously cleared and is highly fragmented, with only small patches of woodland and riparian vegetation providing partial connectivity across the valley. Forest and woodland on the slopes, rises and ridges are well-connected with surrounding habitats, including the adjacent Munghorn Gap Nature Reserve.	All threatened species

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC, that are at risk of vehicle strike
Features that provide for movement of threatened species that maintains their lifecycle	☒Yes / ☐No	Features within the Development Footprint that provide for the movement of threatened species that may be required to maintain lifecycle process primarily constitutes the native woodland/forest vegetation. This vegetation provides shelter/foraging resources for species that are nomadic or move more widely across the landscape. The ephemeral water sources within Moolarben and Murdering Creeks may also be an important resource for fauna, however, connectivity/access to the creek will be maintained via the retained riparian corridor and Habitat Enhancement Area.	Species dependent on trees for shelter/refuge while traversing the landscape: Koala Squirrel Glider Swift Parrot Regent Honeyeater. The Swift Parrot is a seasonal migrant that breeds in Tasmania but migrates to the mainland to forage over the winter months. It has been considered to have the potential to utilise foraging resources within the Development Footprint (AMBS 2023). Key areas of habitat for the Regent Honeyeater as identified on the Important Habitat Map (DPE 2023g) are present within the Study Area (Figure 17f). The Important Habitat Map identifies land that is considered by DPE (2023g) important to support critical life stages of the species. Potential impacts to the removal of this resource on the species lifecycle are described below in Section 3.7.3
Waterbodies, water quality and hydrological processes	☒Yes / ☐No	Murdering Creek and Spring Creek flow into Moolarben Creek, a fifth-order stream, which eventually flows into the Goulburn River outside the Study Area. These creeks were flowing during the field survey and Moolarben Creek in particular was identified to contain chains of ponds. A number of ephemeral drainages and farm dams were also identified scattered throughout the Development Footprint.	Threatened fauna species may use the waterbodies within the Development Footprint for water and foraging habitat: Koala Large-eared Pied Bat Eastern Cave Bat.

Feature	Present	Description of feature characteristics and location	Threatened entities that use, are likely to use, or are part of the habitat feature. Where relevant, threatened species or fauna that are part of a TEC, that are at risk of vehicle strike
		Moolarben Creek is mapped as having low potential for groundwater interaction in the immediate vicinity of the Project. Downstream sections of Moolarben Creek and Lagoon Creek (west of the approved OC2 and OC3) are mapped as having moderate potential for groundwater interaction. The Goulburn River is mapped as having moderate potential for groundwater interaction (approximately 9 km downstream of the Project).	
Wind turbine strikes (wind farm development only)	☐Yes / ☒No	N/A	N/A
Vehicle strikes	☒Yes / ☐No	There is potential for vehicle strike of fauna species along access roads and haul roads during construction and on-going maintenance for the Project.	Threatened fauna or animals that are part of the TECs identified within the Development Footprint: Pink-tailed Legless Lizard Broad-headed Snake Regent Honeyeater Large-eared Pied Bat Squirrel Glider Koala Eastern Cave Bat. The likelihood of vehicle strike impacting these species is assessed in Section 5.3.6.

Where a potential prescribed impact has been identified for a threatened entity or their habitat in Table 19 above, evidence for how the list of threatened entities was generated, as well as the importance of each habitat feature to each threatened entity (impacts on life cycle or movement patterns), has been provided below.

3.7.1 Karst, caves, crevices, cliffs, rocks or other geological features of significance

Since cliffs, crevices, and rocks occur within the Development Footprint, the assessor must:

- *prepare a list of threatened entities that use or are likely to use these habitat features on the subject land and within the surrounding assessment area*

Only the Pink-tailed Legless Lizard (*Aprasia parapulchella*) is likely to use the scattered surface rock within the Development Footprint (and within the surrounding assessment area). Within the surrounding assessment area outside the Development Footprint, the following species use rocky habitat:

- Broad-headed Snake (Breeding) (*Hoplocephalus bungaroides*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Eastern Cave Bat (*Vespadelus troughtoni*).

- *describe how these features provide habitat for, or are used by, each threatened entity (based on published literature and other reliable sources).*

Habitat for the Pink-tailed Legless Lizard in the Development Footprint (and within the surrounding assessment area) includes locations with surface rock and native grass cover, mostly within PCTs associated with the species. The Pink-tailed Legless Lizard is commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows beneath these rocks (DPE 2023a). One juvenile individual of the species was found outside of the Development Footprint on a north-west facing moderate slope just below sandstone outcropping. The species has been assumed present within the Development Footprint.

Rocky habitat suitable for the Broad-headed Snake occurs within the surrounding assessment area outside the Development Footprint. Broad-headed Snake is a nocturnal reptile that shelters in rock crevices and under flat sandstone rocks during autumn, winter and spring before moving to crevices and hollow-bearing trees within 500 m of escarpments during the summer months (DPE 2023a). One individual was identified outside the Development Footprint during targeted survey (Figure 16; Figure 17c).

Rocky habitat suitable for the Large-eared Pied Bat occurs within the surrounding assessment area outside the Development Footprint. The rocky habitat is likely to comprising breeding and non-breeding roost sites. Sites selected for roosting are located close to foraging habitat and are usually cool during the early morning and act as heat sinks during the afternoon and early evening (Williams and Tomson 2018). Breeding habitat is usually formed from domed caves in which the ambient temperature is insulated from extreme fluctuations (Pennay 2008). As juveniles and a post-lactating female were recorded by AMBS (2023), the roosting habitat outside the Development Footprint is conservatively considered breeding habitat.

Rocky habitat suitable for the Eastern Cave Bat occurs within the surrounding assessment area outside the Development Footprint. The rocky habitat is likely to comprising breeding and non-breeding roost sites. Sites selected for roosting are usually warm and humid during the day and

warm and less humid during the evening (Law and Chidel 2007; Law *et al*. 2005). Breeding habitat is usually formed of domed caves; however, they have been recorded breeding in a farm shed in northern NSW (Law and Chidel 2007). As juveniles and a post-lactating female were recorded by AMBS (2023), the roosting habitat outside the Development Footprint is conservatively considered breeding habitat.

3.7.2 Habitat connectivity

Most of the native vegetation that formerly occurred in the Development Footprint (particularly the lower slopes and flat land) has been previously cleared for agriculture and habitats are fragmented. Approximately 16.8% of the Development Footprint contains wooded vegetation (Including scattered trees, regenerating trees, and planted natives) as shown on Figure 11. There are no well-defined corridors of wooded vegetation and most of the native vegetation cover (shown on Figure 6a) is DNG.

Where corridors or other areas of connectivity link habitat for threatened entities, the assessor must:

i. prepare a list of threatened entities that are likely to use or are a part of the connectivity or corridor.

All threatened fauna and flora species that are known or assumed to be present within the Development Footprint (Table 18) would likely use the habitat for connectivity. Those threatened species that are known or assumed to be present within the Development Footprint, and thus would use the surrounding landscape for connectivity, are provided in Section 3.5.

ii. describe the importance of the connectivity to threatened entities, particularly for maintaining movement that is crucial to the species' life cycle (based on published literature and other reliable sources).

Connectivity across the landscape is primarily provided by intact woodland habitat around the periphery of the Development Footprint adjacent to Munghorn Gap Nature Reserve and along Moolarben Creek. The areas to be retained include the majority of the seasonal foraging, breeding and refuge resource within the Study Area.

There are threatened fauna species that are potentially impacted by the removal of vegetation from the Development Footprint as it reduces connectivity between habitats. Both Koala and Squirrel Glider rely on trees to provide refuge when moving between areas of habitat. While Koalas may use isolated patches of trees to provide shelter/foraging resources as they move across the landscape, the relatively large gaps between patches of trees (>50m) precludes movement by the Squirrel Glider across most of the Study Area.

Threatened birds of prey recorded during surveys within the Development Footprint, including Black Falcon, Little Eagle, Powerful and Masked Owls, likely use the area for hunting. No nest sites are present in the Development Footprint. Due to the high mobility of these species, their ability to disperse to suitable habitat is not likely to be affected.

Threatened bats for which breeding habitat occurs outside of the Development Footprint use foraging habitat with the Development Footprint. Hollow-bearing trees were rare to absent within the grassland areas of the Study Area, thus limiting the habitat use to foraging in open valley floors to catch insects. Connectivity of woodland vegetation is retained outside of the Development Footprint and along Moolarben Creek and the movement of bats is not likely to be impacted.

Pink-tailed Legless Lizard uses areas of grassy woodland and grassland with surface rock habitat, which is present in extensive areas of the Development Footprint and Study Area. Connectivity would be modified by the Project because large areas of grassy habitat with surface rock would be removed from a large central portion of the Study Area, which will separate habitat between the northern and southern extents.

Broad-headed Snake uses dry forest within a distance of up to 500 m within sandstone shelters for foraging in summer months (DPE 2023e). The habitat within the Development Footprint that meets these criteria is relatively limited since woodland in the valley has been historically cleared for agriculture. Connected habitat outside the Development Footprint is to be retained.

Threatened woodland birds that are known to, or thought likely to, utilise the Study Area include the Regent Honeyeater, Dusky Woodswallow, Speckled Warbler, Brown Treecreeper (eastern subspecies), Varied Sittella, Little Lorikeet, Swift Parrot, Black-chinned Honeyeater, Grey-crowned Babbler and Diamond Firetail. Connectivity between woodland habitat around the boundary of the Development Footprint will not be affected, however connectivity between smaller woodland patches and open grassland matrix, habitat that is utilised by the Dusky Woodswallow, Grey-crowned Babbler and Diamond Firetail would be impacted. Hollow-bearing trees were rare to absent within the grassland areas of the Study Area, thus limiting the habitat use to foraging habitat.

The removal of trees and wooded areas within the Development Footprint is not likely to affect movement patterns of wide-ranging and nomadic species such as the Swift Parrot and Regent Honeyeater which may utilise the resources within the Development Footprint for movement and foraging on an irregular or seasonal basis. These species have not been recorded within the Development Footprint but are known to occur in close proximity (AMBS 2023). However, these species are also known to utilise resources within more suitable intact habitat in the wider local area, including within the adjacent and protected Munghorn Gap Nature Reserve (AMBS 2023). As such, the removal of the potential foraging resources within the Development Footprint is considered unlikely to substantially impact movement that is crucial to the species' life cycle.

Despite woodland habitat present around the edge of the Development footprint, the Project restricts some fauna activity through the development.

The amended Project Development Footprint (Figure 18b) has significantly reduced the total area of native vegetation removal compared to the Development Footprint presented in the EIS (Figure 18a), resulting in the avoidance of an additional 144.2 ha of native vegetation, including generally higher quality woodland areas, and mapped rocky habitat. As a result, connectivity would be modified to a lesser degree by retaining larger areas of habitat for species movement around the Project. As part of the amended Project design, the Habitat Enhancement Area along Moolarben and

Murdering Creeks has also been increased from 160 ha to a total of 188 ha. The Habitat Enhancement Area has been designed to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened ecological communities, and threatened species habitat within the riparian zone of Moolarben Creek and Murdering Creek, including the facilitation of movement for threatened species through the Project site. Overall, the amended Project design improves connectivity from the Development Footprint presented in the EIS by increasing the area of available habitat and decreasing the distance between other areas of habitat.

3.7.3 Features that provide for movement of threatened species that maintains their lifecycle

Features within the Development Footprint that provide for the movement of threatened species that may be required to maintain lifecycle processes primarily constitutes the native woodland/forest vegetation. This vegetation may provide shelter and foraging resources for species that are nomadic or move more widely across the landscape; namely the Swift Parrot and Regent Honeyeater.

The Swift Parrot is a seasonal migrant that breeds in Tasmania but migrates to the mainland to forage over the winter months. It has the potential to utilise foraging resources within the Development Footprint (AMBS 2023). Foraging habitat that is considered critical for their survival has been mapped within NSW on the Important Habitat Map for the species (DPE 2023g). The Development Footprint does not include any areas mapped on The Important Habitat Map (as detailed in Section 2.1.4), therefore the Project is considered unlikely to impact on important resources or features that might provide for movement of the Swift Parrot that maintains the lifecycle of the species.

Key areas of habitat for the Regent Honeyeater as identified on the Important Habitat Map (DPE 2023g) are present within the Development Footprint (Figure 17f). The Important Habitat Map identifies land that is considered by DPE (2023g) as important to support critical life stages of the species. Assessment of potential impacts to these species' lifecycle are described in section 5.3.3. As detailed above, foraging, breeding and refuge resources are primarily associated with woodland/forested habitat for both the Koala and Squirrel Glider. While the Koala and Squirrel Glider likely utilise the resources within the Development Footprint, none of the resources to be impacted would be relied upon exclusively for breeding/movement across the landscape. Potential impacts regarding the depletion of seasonal foraging, breeding and refuge resources, have been avoided and minimised through the amended Project Development Footprint as described in Section 4.2.

3.7.4 Waterbodies, water quality and hydrological processes

Waterbodies

A number of creeks and drainages partly occur within the Development Footprint, including Moolarben Creek, Murdering Creek and Spring Creek. There are also constructed dams.

Hydrological Processes

The BOM developed a national dataset of Australian Groundwater Dependent Ecosystems (GDEs) to inform groundwater planning and management, referred to as the *Groundwater Dependent Ecosystem Atlas* (GDE Atlas) (BOM 2023). The GDE Atlas contains information about three types of ecosystems defined in the *Australian Groundwater-Dependent Ecosystems Toolbox* (Richardson *et al*. 2011).

GDEs derived in the GDE Atlas are mapped according to the following classifications:

- High potential for groundwater interaction
- Moderate potential for groundwater interaction
- Low potential for groundwater interaction.

The GDE Atlas identifies the following potential terrestrial GDEs in the vicinity of the Project:

- The regionally mapped Western Hunter Flats Rough-barked Apple Forest vegetation community along Moolarben Creek and its tributaries is mapped as having high potential for groundwater interaction
- The regionally mapped Central Tableland Ribbon Gum-Apple Gully Forest at the base of the nearby escarpments is mapped as having moderate potential for groundwater interaction
- Remnant woodland vegetation in the vicinity of the Project (including on the ridgelines associated with the Munghorn Gap Nature Reserve) is mapped as having low potential for groundwater interaction.

The Western Hunter Flats Rough-barked Apple Forest vegetation community is described in *The Native Vegetation of North-West Wollemi National Park and Surrounds – Volume 1: Technical Report* (OEH 2012) as follows:

> *Western Hunter Flats Rough-barked Apple Forest (S_FoW19), is found on the sandy alluviums that adjoin or rest above the river banks. This forest is most extensive on the lower-lying valleys that drain the Narrabeen sandstone plateaux. Rough-barked Apple (Angophora floribunda) is typically dominant, with red gums (Eucalyptus blakelyi/E. tereticornis) and grey gum (Eucalyptus punctata) locally common. The ground layer is a patchy to continuous cover of weeping grass (Microlaena stipoides) with herbs such as (Dichondra repens). The mixed sand and clay material support a sparse to open shrub layer of blackthorn (Bursaria spinosa) and coffee bush (Breynia oblongifolia) and shrubs such as geebung (Persoonia linearis).*

The Central Tableland Ribbon Gum-Apple Gully Forest vegetation community is described in *The Native Vegetation of North-West Wollemi National Park and Surrounds – Volume 1: Technical Report* (OEH 2012) as follows:

> *Central Tableland Ribbon Gum-Apple Gully Forest (S_WSF25) is situated on the elevated sandy alluviums and gully systems that lie below the Great Dividing Range in the west of the Study Area. The composition of the forest varies with the degree of protection. While ribbon gum (Eucalyptus viminalis) is often present, other species include rough-barked apple (Angophora floribunda),*

Blakely's red gum (Eucalyptus blakelyi), yellow box (Eucalyptus melliodora), grey gum (Eucalyptus punctata) and Sydney peppermint (Eucalyptus piperita). Tall wattles are common amongst a scatter of tea-tree, banksias and beard- heath. The ground cover is dominated by weeping grass (Microlaena stipoides) and bracken (Pteridium esculentum).

ELA (2023) has undertaken contemporary vegetation mapping within the Study Area in accordance with the BAM (DPIE 2020a). Likely GDEs are as follows (Figure 11):

- PCT 1711 – due to the presence of *Callistemon pinifolius* (Pine-leaved Bottlebrush), *Leptospermum arachnoides* and *Melaleuca thymifolia* (Thyme Honey-myrtle)
- PCT 281 – along the creeks due to the presence of yellow box (*Eucalyptus melliodora*) and *Angophora floribunda*.

These findings are broadly consistent with the GDE Atlas and associated regional studies, particularly with regard to the likely presence of GDEs along Moolarben Creek and the presence of Yellow Box (*Eucalyptus melliodora*) in the Study Area.

Where water bodies or any hydrological processes that sustain threatened entities occur on the subject land, the assessor must:

a. prepare a list of threatened entities that may use or depend on water bodies or hydrological processes for all or part of their life cycle, or

These waterbodies are likely to be used for drinking water by threatened species, such as the Koala, or species that occur as part of a TEC. Microchiropteran bats, including Large-eared Pied Bat and Eastern Cave Bat, are also known to fly over riparian areas at night foraging for insects.

b. prepare a list of threatened entities that will be, or are likely to be impacted by changes to existing water bodies or hydrological processes or the construction of a new water body

Infrastructure has been minimised within the riparian zone of Moolarben Creek and Murdering Creek (three haul road creek crossings are proposed), where practicable and feasible. Therefore, Moolarben Creek and Murdering Creek and adjacent riparian habitat within 200 m of Moolarben Creek and Murdering Creek would remain intact and available to threatened species around the Development Footprint.

c. describe the habitat provided for each threatened entity by the water body or hydrological process, including consideration of water quality, volume, flow paths and seasonal patterns (based on published literature and other reliable sources).

Moolarben Creek and Murdering Creek are ephemeral creeks and as such would provide an ephemeral water source for the threatened fauna species listed above. The Koala may drink water in times of heat stress. It is unknown if the Squirrel Glider would be heavily reliant on streams or creeks for water. Microchiropteran bats, including Large-eared Pied Bat and Eastern Cave Bat, are also known to fly over riparian areas at night foraging for insects.

3.7.5 Vehicle strikes

Where the proposal may result in vehicle strike on threatened fauna, or animals that are part of a TEC, the assessor must:

a. identify potential impact locations on the Site Map, and

There is potential for vehicle strike of fauna species along all access roads and haul roads during construction and on-going maintenance for the Project. Access roads are shown in Figure 22.

b. prepare a list of threatened fauna or animals that are part of a TEC at risk of vehicle strike.

All predicted fauna species listed in Table 10 and fauna candidate species in Table 12 have a potential to interact with vehicles along access tracks and haul roads during the construction and on-going maintenance for the Project. However, mitigation measures are proposed (e.g. slow speed limits and personnel training) to minimise the potential for vehicle strikes. Further discussion of the locations of potential impacts and assessment of particular risk to species is carried out in Section 5.3.6.

4 Stage 2 – Impact Assessment – Avoid and Minimise Impact

This section provides the measures to avoid and minimise direct and indirect impacts on biodiversity values. The biodiversity values in the area were identified (AMBS 2023; ELA 2023) and used to inform decisions about the location and design of the Project, in consideration of other environmental and design constraints. The following definitions apply:

Avoid: *measures taken by a proponent such as careful site selection, or actions taken through the design, planning, construction and operational phases of the development, to completely prevent impacts on biodiversity values, or certain areas of biodiversity.*

Minimise: a process applied throughout the development planning and design life cycle that seeks to reduce the residual impacts of development on biodiversity values.

This section also describes how direct impacts on Munghorn Gap Nature Reserve would be avoided and indirect impacts would be minimised.

4.1 Location of the development to avoid or minimise direct and indirect biodiversity impacts

4.1.1 Alternative locations that would avoid or minimise impacts on biodiversity values

The general location of the Project has been determined by the presence of the coal resource able to be economically mined, existing mining tenements and environmental constraints.

The Project is located to maximise the use of existing coal handling, processing and transport infrastructure at the existing Stage 1 Coal Handling and Preparation Plant and provide for the continuation of existing mining operations (i.e. thereby minimising the extent of new disturbance areas that would be required).

The Project open cut voids would be progressively backfilled as mining progresses to reinstate the landform to approximate the gently undulating pre-mining topography. The location of the Project would also enable an improved final landform within the approved OC3 area as the approved mine void would be backfilled using waste rock from the Project, resulting in more land with the potential to provide habitat in the future.

An alternative to the Project was considered where the extent of mining operations included other MCO mining and exploration tenements outside of the Moolarben Valley. However, mining outside of Moolarben Valley would likely increase amenity impacts to private receivers, and would therefore be inconsistent with the objective to develop the Project within existing amenity criteria.

Alternative locations for the Project would not have the benefit of maximising the use of existing facilities at the Moolarben Coal Complex or improving the final landform with no final voids (including within the approved OC3 area).

4.1.2 Alternative modes or technologies that would avoid or minimise impacts on biodiversity values

Due to the very low depth of cover to the coal resource within the Study Area, underground mining methods were determined to be unsuitable for the Project.

In addition, it would result in the loss of substantial economic benefits that would otherwise accrue locally or on a State and/or national level, including rates, royalties and taxes, community enhancement projects and the extension of employment of full-time mine workers and support staff associated with the existing open cut operations.

Clearance of native vegetation/habitat would occur progressively and generally align with the open cut progression. A Vegetation Clearance Protocol including best practice measures would be implemented, including measures to avoid accidental clearance of vegetation to be retained.

4.1.3 Alternative routes that would avoid or minimise impacts on biodiversity values

The Project infrastructure areas would include supporting linear infrastructure, such as internal haul roads and creek crossings, internal access roads, electricity supply infrastructure and water management infrastructure (Figure 3). The clearance required for linear infrastructure would be minimised by:

- Locating infrastructure areas immediately adjacent to open cut mining areas
- Avoiding disturbance in vegetation and habitat associated with the steeper terrain adjacent to the Munghorn Gap Nature Reserve, as far as practicable
- Minimising infrastructure within the riparian zone of Moolarben Creek and Murdering Creek and locating creek crossings (three haul road creek crossings are proposed) within previously cleared areas, where practicable and feasible.

4.1.4 Alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values

There are no alternative sites within which to locate the Project. The location and extent of the Project is constrained by the location of existing mining and exploration tenements and Moolarben-owned freehold land, and the extent of the recoverable coal resource. Impacts of clearing native vegetation on biodiversity and threatened species habitat have been avoided or minimised through Project design as described below.

4.2 Design of the development to avoid or minimise direct and indirect impacts on biodiversity values

The Project as presented in the EIS incorporated a number of measures to avoid and minimise impacts to environmental features, native vegetation and threatened species habitat within the study area, including (Figure 18a):

- No direct disturbance of mapped rocky habitat associated with threatened bat species and the Broad-headed Snake
- Blast designs during Project operations to comply with a conservative vibration limit of 50 millimetres per second (mm/s) at the nearest mapped rocky habitat (safe design 5% exceedance level peak particle velocity [PPV] limit)

- Reduced disturbance of vegetation/habitat associated with steeper terrain adjacent to Munghorn Gap Nature Reserve
- No open cut mining within 200 m of Moolarben Creek and Murdering Creek
- Minimising the extent of infrastructure within the riparian zone of Moolarben Creek and Murdering Creek
- Locating haul road creek crossings within previously cleared areas, where practicable and feasible
- Maximising use of existing infrastructure at the Moolarben Coal Complex (i.e. coal handling and transport infrastructure) to minimise construction of additional infrastructure areas for the Project
- Preferentially locating disturbance in Category 1 – exempt land or where vegetation/habitat is in the poorest condition (e.g. low quality DNG)
- Reducing the number of voids in the Moolarben Valley from one to zero, therefore increasing the area available for rehabilitation and post-mining land uses.

Following the EIS exhibition period, the submission from the NSW Biodiversity, Conservation and Science Directorate (BCS) and NPWS raised concerns with potential direct impacts to threatened species habitat, particularly SAII species, as well as potential indirect impacts to the Munghorn Gap Nature Reserve.

In response, MCO has reviewed the Project design and reduced the Development Footprint (including reduced ROM coal and peak annual production, and revised mine schedules and rehabilitation plan) to avoid and/or minimise impacts to additional areas of threatened species habitat. These changes are described in the Amendment Report.

The amended Project design achieves the following:

- Avoidance of disturbance within 100 m of the Munghorn Gap Nature Reserve
- 100% avoidance of disturbance of mapped rocky habitat and breeding habitat (defined as relevant vegetation within 100 m of mapped rocky habitat) associated with threatened bat species (i.e. Large-eared Pied Bat and Eastern Cave Bat) and the Broad-headed Snake
- 59% reduction in disturbance of the woodland component of Box-Gum Woodland CEEC compared to the EIS
- 56% reduction in disturbance of Regent Honeyeater Important Habitat Mapping compared to the EIS
- Reduced disturbance of habitat for threatened species including Pink-tailed Legless Lizard, Koala, Swift Parrot and Squirrel Glider
- Reduction in disturbance to the threatened flora species Cotoneaster Pomaderris.

The location of key impact avoidance/minimisation measures from the amended Project design are shown in Figure 18b.

Higher value threatened species habitat remaining within the amended Project Development Footprint comprises isolated stands and scattered patches of woodland separated by areas of Category 1 – exempt land or DNG (i.e. not contiguous areas or corridors). It would not be feasible to avoid all of this habitat as the discontinuous nature would result in open cut pits which are not mineable or economic.

As part of the amended Project, the proposed Habitat Enhancement Area (shown on Figure 19b and described in Section 5.7) would be increased in size from 160 ha to 188 ha. The Habitat Enhancement Area would be managed to facilitate ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened ecological communities and threatened species habitat within riparian zones along Moolarben and Murdering Creeks. The Habitat Enhancement Area comprises 135 ha of DNG/cleared land with scattered trees that would be revegetated.

Approximately 535 ha of rehabilitated or revegetated woodland and 140 ha of native grassland with scattered trees is proposed to be established in the final landform. The Project final landform would include area of habitat establishment of surface rock trial site to restore habitat for the Pink-tailed Legless Lizard.

4.2.1 Design of the development to avoid or minimise direct and indirect impacts on threatened species

All species credit species listed in Table 18 have a high or very high biodiversity risk weighting. Measures to avoid and/or minimise impacts on these species are discussed below.

Following the EIS exhibition period, the submission from the NSW BCS and NPWS raised concerns with potential direct impacts to threatened species habitat, particularly SAII species, as well as potential indirect impacts to the Munghorn Gap Nature Reserve.

In response, MCO reviewed the Project design and reduced the Development Footprint to avoid and/or minimise impacts to additional areas of threatened species habitat.

The amended Project Development Footprint avoids approximately 117.5 ha (51.0%) of the forest and woodland vegetation (reduced from 230.52 ha to 113.02 ha) that would otherwise have been impacted by the Development Footprint presented in the EIS. In particular, the revised design minimises the extent of open cut mining to avoid higher quality Box-Gum Woodland remnants in the Study Area adjacent to Munghorn Gap Nature Reserve. Overall, the area of Box-Gum Woodland to be cleared within the Development Footprint has been reduced from 84.22 ha to 34.22 ha (i.e. an additional 50 ha of Box-Gum Woodland will be retained). The areas of woodland vegetation within the Development Footprint as they currently exist are heavily fragmented and do not provide complete connectivity across the Study Area.

Progressive rehabilitation and revegetation of back-filled areas will be carried out to minimise impacts to species by ensuring on-going replacement of resources and minimising the time between loss and replacement of resources.

Riparian habitat adjacent to waterbodies such as creeks and drainages provide movement, foraging, refuge and breeding resources for many threatened species. These include riparian zones within the Development Footprint such as Moolarben Creek and Murdering Creek (Figure 5). Waterbodies provide water resources and intact riparian zones provide connectivity for traversing the landscape as well as foraging resources and hollow-bearing trees for breeding.

The total area of the Habitat Enhancement Area to be created along Moolarben and Murdering Creeks has been increased from the Development Footprint presented in the EIS (Niche 2022) from a total of 160 ha to 188 ha, including 53 ha of existing woodland and 135 ha of DNG and cleared land (Figure 19b). The Habitat Enhancement Area will be extended within riparian zones along Moolarben Creek and Murdering Creek outside of the Development Footprint, which is proposed to be revegetated and fenced, and will include weed, animal pest and fire management. Figure 19a shows the Development Footprint presented in the EIS and the indicative final land use which includes the Habitat Enhancement Area, while Figure 19b shows the revised design for indicative final land use.

Pomaderris cotoneaster

The *Pomaderris cotoneaster* population is outside of the Development Footprint, and no loss of individuals is expected. Previous plants located inside the Development Footprint in the EIS are now being avoided, and only parts of the buffer around the area of suitable habitat are being cleared. The amended Project design results in 98.5% reduction in disturbance of habitat compared to the EIS, from 4.81 ha to 0.07 ha. Measures to mitigate impacts on this species are discussed in Section 5.7.

Pink-tailed Legless Lizard

The location of the Pink-tailed Legless Lizard record (Figure 17b) continues to be avoided and is outside of the Development Footprint. The amended Project design results in 25.3% reduction in disturbance of species habitat from 277.2 ha to 207.14 ha. Access to the mine site would be restricted, eliminating potential removal or disturbance of scattered rocks within the Development Footprint. Measures to avoid and/or minimise prescribed impacts on habitat for this species (i.e. surface rocky habitat) are discussed in Section 5.7.

Broad-headed Snake

Measures to avoid and/or minimise prescribed impacts on habitat for this species (caves, crevices, cliffs and rocks) are discussed in Section 4.4.1 and shown in Figure 18b. The amended Project design results in 100% avoidance of disturbance of mapped rocky habitat and breeding habitat (defined as relevant vegetation within 100 m of mapped rocky habitat) associated with the Broad-headed Snake.

Masked Owl

Targeted surveys were undertaken that identified a Masked Owl nest tree outside of the Development Footprint (Figure 17e). All of the Project design measures to avoid and/or minimise impacts on woodland described above would also avoid and/or minimise impacts on potential foraging habitat for the Masked Owl.

Regent Honeyeater

Important Habitat Mapped for the Regent Honeyeater occurs in the Development Footprint and is represented by remnant woodland (Figure 17f). All of the Project design measures to avoid and/or minimise impacts on woodland described above would also avoid and/or minimise impacts on potential habitat for the Regent Honeyeater. The amended Project design results in 56% reduction in disturbance of Regent Honeyeater Important Habitat Mapping compared to the EIS, from 184.4 ha to 80.5 ha.

Koala

All of the Project design measures to avoid and/or minimise impacts on woodland described above would also avoid and/or minimise impacts on habitat for Koala (Figure 17g). In particular, minimising the extent of open cut mining to avoid higher quality Box-Gum Woodland remnants in the Study Area adjacent to Munghorn Gap Nature Reserve which is considered to provide critical seasonal foraging, breeding and refuge resource for this species. The Project design also seeks to minimise infrastructure within the riparian zone of Moolarben Creek and Murdering Creek and locating creek crossings (three haul road creek crossings are proposed) within previously cleared areas, where practicable and feasible, as well as the proposed Habitat Enhancement Area and revegetation along Moolarben Creek and Murdering Creek (as shown in Figure 19b). Retention of the riparian corridor along these creeks will allow for continued connectivity across the landscape and access to seasonal foraging, breeding and refuge resources within the Project area. Cumulative impacts and impacts to connectivity are addressed further in Section 5.1.3 and 5.3.2. The amended Project design results in a 51% reduction in disturbance of habitat compared to the EIS, from 230.6 ha to 113.02 ha.

Squirrel Glider

All of the Project design measures to avoid and/or minimise impacts on woodland described above would also avoid and/or minimise impacts on potential habitat for Squirrel Glider (Figure 17h). In particular, minimising the extent of open cut mining to avoid higher quality Box-Gum Woodland remnants in the Study Area adjacent to Munghorn Gap Nature Reserve which is considered to provide critical seasonal foraging, breeding and refuge resource for this species. As discussed above, the removal of vegetation within the Development Footprint is also not likely to impede connectivity for this species due to their inability to cross large open spaces. Furthermore hollow-bearing trees are rare to absent within the grassland areas of the Study Area. The Project design also seeks to minimise infrastructure within the riparian zone of Moolarben Creek and Murdering Creek and locating creek crossings (three haul road creek crossings are proposed) within previously cleared areas, where practicable and feasible, as well as the proposed Habitat Enhancement Area and revegetation along Moolarben Creek and Murdering Creek (as shown in Figure 19b). Retention of the riparian corridor along these creeks will allow for continued connectivity across the landscape and access to seasonal foraging, breeding and refuge resources within the Project area. Cumulative impacts and impacts to connectivity are addressed further in Section 5.1.3 and 5.3.2. The amended Project design results in a 51% reduction in disturbance of habitat compared to the EIS, from 230.6 ha to 113.02 ha.

Large-eared Pied Bat and Eastern Cave Bat

Measures to avoid and/or minimise prescribed impacts on habitat for these species (caves, crevices, cliffs and rocks) are discussed in Section 4.4.14.6 and shown in Figure 18b. All of the Project design measures to avoid and/or minimise impacts on woodland described above would also avoid and/or minimise impacts on potential foraging habitat for these bats. The amended Project design results in 100% avoidance of disturbance of mapped rocky habitat and breeding habitat (defined as relevant vegetation within 100 m of mapped rocky habitat) associated with these bats. The amended Project design results in 51% reduction in disturbance of habitat for both species compared to the EIS, from 230.6 ha to 113.02 ha.

Other Species

Ecosystem credit species are listed in Table 10. Measures to avoid and/or minimise prescribed impacts on habitat (i.e. caves, crevices, cliffs and rocks; woodland; grassland; scattered trees; and waterbodies) for these species are discussed in Section 4.4. All of the Project design measures to avoid and/or minimise impacts on rocky areas, woodland, grassland or waterbodies described above would also avoid and/or minimise impacts on potential habitat for the Ecosystem Species. Access to the mine site would be restricted, eliminating potential removal or disturbance of scattered rocks within the Development Footprint.

4.2.2 Design of the development to avoid or minimise direct and indirect impacts on threatened ecological communities or highly cleared plant community types

Box-Gum Woodland CEEC

Impacts from clearing native vegetation, including Box-Gum Woodland CEEC have been avoided or minimised through the Project design by:

- Preferentially locating disturbance in areas lacking Box-Gum Woodland CEEC (e.g. Category 1 – exempt land) or where the vegetation/habitat is in the poorest condition (e.g. low quality DNG)
- Avoiding open cut mining within 200 m of Moolarben Creek and Murdering Creek (which have a riparian zone comprising Box-Gum Woodland CEEC)
- Minimising infrastructure within the riparian zone of Moolarben Creek and Murdering Creek and locating creek crossings (three haul road creek crossings are proposed) within previously cleared areas, where practicable and feasible
- Condensing the Development Footprint by locating infrastructure areas immediately adjacent to open cut mining areas; and
- Progressively back-filling open cut pits to minimise the required disturbance extent (i.e. reducing the need for large out-of-pit overburden emplacements) as far as practically possible, as well as removing residual pit voids from the final landform.

The amended Project design results in further minimisation of impacts to Box-Gum Woodland CEEC, particularly the relatively high-quality woodland areas. The amended Development Footprint results in a 59.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha) and a 6.8% reduction in the area of DNG impacted (from 393.53 ha to 366.9 ha). The total area of Box-Gum Woodland to be impacted has been reduced by 76.63 ha (16%).

Measures to mitigate impacts on this TEC are discussed in Section 5.7. All native vegetation cleared for the Project (including the Box-Gum Woodland CEEC) would be offset in accordance with the BC Act (Section 9).

Hunter Valley Footslopes Slaty Gum Woodland VEC/Eucalypt Forest and Woodland CEEC

There are eight small patches of Hunter Valley Footslopes Slaty Gum Woodland VEC (seven of the eight patches are Eucalypt Forest and Woodland CEEC) that cannot be avoided. The conceptual final landform for the Project (Figure 19b) would include rehabilitation of 535 ha of the Development Footprint to native woodland/open woodland and species characteristic of the Hunter Valley Footslopes Slaty Gum Woodland VEC/Eucalypt Forest and Woodland CEEC. All native vegetation cleared for the Project (including the Hunter Valley Footslopes Slaty Gum Woodland VEC/Eucalypt Forest and Woodland CEEC) would be offset in accordance with the BC Act (Section 9).

4.2.3 Breeding habitat

All of the measures to avoid and/or minimise impacts on woodland described above would also avoid and/or minimise impacts on breeding habitat (e.g. hollow-bearing trees). Measures to avoid and/or minimise impacts on prescribed impacts (such as caves, crevices, cliffs and rocks that provide breeding habitat for threatened bats and the Broad-headed Snake) are discussed in Section 4.4 and shown in Figure 18b.

4.3 Location of the development to avoid or minimise prescribed biodiversity impacts

The analysis and justification of the Project location is provided in Section 4.1.

4.4 Design of the development to avoid or minimise prescribed biodiversity impacts

4.4.1 Caves, crevices, cliffs and rocks

Direct impacts on mapped rocky habitat (i.e. caves, crevices, cliffs, rocks) for the Broad-headed Snake, Eastern Cave Bat and Large-eared Pied Bat would be avoided by the Project as detailed above and shown in Figure 18b. The mine design incorporates a 100 m setback of all Project disturbance (including open cut pit extents) from mapped rocky habitat associated with sandstone specialist threatened species. As a result, the Project would not cause direct physical impacts to mapped rocky habitat features, and blast vibration at mapped rocky habitat features would be reduced, due to the greater distance from the proposed open cut pit extents when compared to the EIS. Access to the mine site would be restricted, eliminating potential removal or disturbance of scattered rocks within the Development Footprint. Therefore, the only remaining potential pathway for impact to mapped rocky habitat would be indirectly through blasting vibration.

In order to minimise the potential for indirect blast vibration impacts (that may constitute prescribed impacts), MCO would adjust blast designs during Project operations to comply with a conservative vibration limit of 50 mm/s at the nearest mapped rocky habitat (safe design 5% exceedance level PPV limit), unless further geotechnical investigation supports a higher value. As such, the damage criterion has been reduced from 125mm/s PPV to a site specific 50 mm/s PPV. PSM (2024) notes that the recommended limits may be conservative when compared to relevant case studies and site-specific data, and incremental increases to the limit could be facilitated where justified (following review of monitoring data in consultation with a geotechnical engineer). Accordingly, sensitive

geological features located further from blasting than the mapped rocky habitat (e.g. deeper into the Munghorn Gap Nature Reserve) would be expected to experience limited to no vibration as a result of this limit. Blast adjustment measures to achieve the vibration limit would include moderation of Maximum Instantaneous Charge (MIC) and/or implementation of pre-split blasts where appropriate, in accordance with the Moolarben Coal Complex (MCC) Blast Management Plan.

The proposed blast vibration limit was determined by specialist geotechnical engineers (PSM 2024) through a comprehensive analysis of historical blast monitoring data, inspection of other sensitive geological features subject to historical blasting (geotechnical characteristics, analysis of mining-related impacts on proximal rocky outcrops and assessment of likely cause of suspected blast interactions), ground truthing of mapped rocky habitat surrounding the Project, and review of site-specific modelling predictions of vibration effects.

It is noted that higher vibration limits (250 mm/s) than proposed for the Project (50 mm/s) have been adopted at Moolarben based on recommendations from SLR (2018) to protect rock features associated with Aboriginal heritage shelter sites (this is the current design criterion under the Blast Management Plan [MCO, 2020d]). Analysis from geotechnical engineers (PSM 2024) suggests that vibration from blasting has caused no distinguishable impacts from natural processes or other anthropogenic sources (e.g. visitors moving rocks).

MCO would implement the following monitoring and mitigation measures to manage potential blast vibration impacts to mapped rocky habitat:

- pre-blast desktop assessment to identify the proximity of mapped rocky habitat to planned blast areas, in order to inform vibration modelling and therefore blast design
- site-specific vibration modelling per blast to calculate MIC required to meet PPV limit for nearest mapped rocky habitat
- continuation of existing vibration monitoring as described in the Blast Management Plan (MCO, 2020d), and implementation of additional vibration monitoring at one or more new representative sites of mapped rocky habitat adjacent to the Project
- ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary and
- visual inspections of key representative mapped rocky habitat on a 6-monthly basis to confirm that the target outcome of no physical impact to mapped rocky habitat (and therefore no physical impact to the Munghorn Gap Nature Reserve) as a result of blasting vibrations continues to be achieved.

Seeking to extend mining operations within the mapped rocky habitat (i.e. caves, crevices, cliffs, rocks) for the Broad-headed Snake, Eastern Cave Bat and Large-eared Pied Bat would increase the total magnitude of resource available for extraction. However, given the mapped rocky habitat is located within steeper slopes on the edge of the proposed open cuts, there was an opportunity to avoid all direct disturbance to the mapped rocky habitat by at least 100 m and therefore meet the Project objective to avoid key sensitive environmental features.

As a result of the proposed vibration limit (as well as related mitigation and avoidance measures), it is considered likely that blasting vibration would result in no physical damage distinguishable from natural process (PSM 2024). Therefore, the impacts of vibration are considered unlikely to result in a residual prescribed impact to the threatened species occupying sandstone habitats surrounding the Project.

Potential surface rocky habitat associated with the Pink-tailed Legless Lizard occurs throughout the lower slopes of the Development Footprint and are not able to be entirely avoided for the Project. As described above, the amended Project design reduces clearance of this species habitat from 307.33 ha to 207.14 ha.

4.4.2 Habitat connectivity and movement

Due to historic and ongoing agriculture, there are no continuous woodland linkages across the existing Moolarben valley from east to west. Within the valley floor area, the most continuous patch of woodland occurs north to south along Moolarben Creek and Murdering Creek (Figure 6b). The Project has been located and designed to minimise adverse impacts on the woodland which occurs along Moolarben Creek and Murdering Creek and improve habitat connectivity by:

- Avoiding open cut mining within 200 m of Moolarben Creek and Murdering Creek
- Avoiding direct impacts within 100 m of mapped rocky habitat
- Avoiding direct impacts within 100 m of the Munghorn Gap Nature Reserve
- Minimising the extent of open cut mining to avoid higher quality Box-Gum Woodland remnants in the south-east of the Study Area adjacent to Munghorn Gap Nature Reserve
- Minimising infrastructure within the riparian zone of Moolarben Creek and Murdering Creek (three haul road creek crossings are proposed), where practicable and feasible
- Establishing the Habitat Enhancement Area to facilitate the ecological restoration and ongoing maintenance of native vegetation within the riparian zone of Moolarben Creek and Murdering Creek (Figure 19b).

Approximately 535 ha of rehabilitated or revegetated native woodland and 140 ha of native grassland with scattered trees is proposed to be established in the final landform to minimise long-term impacts to vegetation and habitat connectivity (Figure 19b).

Connectivity of mapped rocky habitat (caves, crevices, cliffs, rocks) is discussed in Section 3.7.

4.4.3 Waterbodies, water quality and hydrological processes

The Project has been located and designed to minimise adverse impacts on waterbodies, water quality and hydrological processes by:

- Avoiding open cut mining within 200 m of Moolarben Creek and Murdering Creek
- Minimising clearance within the riparian zone of Moolarben Creek and Murdering Creek where practicable and feasible (three haul road creek crossings are proposed to access each mining area)
- Enhancement of the riparian zone of Moolarben Creek and Murdering Creek within the Habitat Enhancement Area (Figure 19b)
- Implementation of a Project water management strategy to maximise the diversion of clean water runoff as far as practically feasible around disturbance areas, contain and re-use mine

water (to prevent downstream contamination), as well as control sediment runoff from disturbed areas (such as waste rock emplacements or areas cleared before mining)

- Implementation of a Groundwater Water Management Plan (GWMP), which includes a Trigger Action Response Plan (TARP) for site-specific investigation trigger values to manage and mitigate potential impacts to groundwater levels and quality in the Alluvial and Triassic aquifers.

4.4.4 Vehicle strike

All workers and deliveries would access the site from the existing main site access via Ulan-Wollar Road and then be transported to the site via internal roads. Internal roads have speed limits imposed that assist in minimising the risk of vehicle strike as well as personnel training (contractors, visitors, and other representatives) to minimise interactions with native fauna.

4.5 Actions and measures to avoid the direct and indirect impacts on Threatened Ecological Communities at risk of SAII

The following actions and measures have been/will be implemented to avoid and minimise direct and indirect impacts on TECs at risk of SAII (Box-Gum Woodland CEEC):

- Project design
  - Preferentially locating disturbance in areas without Box-Gum Woodland CEEC (e.g. Category 1 – exempt land) or where the vegetation/habitat is in the poorest condition (e.g. low quality DNG)
  - Avoiding open cut mining within 200 m of Moolarben Creek and Murdering Creek (which have a riparian zone comprising Box-Gum Woodland CEEC)
  - Minimising infrastructure within the riparian zone of Moolarben Creek and Murdering Creek and locating creek crossings (three haul road creek crossings are proposed) within previously cleared areas, where practicable and feasible
  - Condensing the Development Footprint by locating infrastructure areas immediately adjacent to open cut mining areas
  - Progressively back-filling open cut pits to minimise the required disturbance extent (i.e. reducing the need for large out-of-pit overburden emplacements), as far as practically possible, as well as removing residual pit voids from the final landform
  - Reduction of the Development Footprint post initial EIS submission to further avoid impacts to Box-Gum Woodland CEEC, particularly the relatively high-quality woodland areas. The amended Project Development Footprint will result in a 59.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha) and a 6.8% reduction in the area of DNG impacted (from 393.53 ha to 366.9 ha). (The total area of Box-Gum Woodland to be impacted has been reduced by 76.63 ha (16%)
- Habitat Enhancement Area
  - The proposed Habitat Enhancement Area includes the riparian zone along Moolarben and Murdering Creek (outside of the Development Footprint) and is shown on Figure 19b. The Habitat Enhancement Area includes approximately 75.5 ha of Box-Gum Woodland CEEC that is proposed to be revegetated. Management measures would include: revegetation and stabilisation, fencing, weed management, animal pest management and fire management, as required
- Mine rehabilitation

- Progressive rehabilitation and revegetation of backfilled areas with species consistent with Box-Gum Woodland. Approximately 535 ha of native woodland and 140 ha of native grassland with scattered trees (suitable for agricultural use) is proposed to be established as part of the conceptual post-mining land use for the Project

- Vegetation Clearance Protocol
  - Mine staff and contractors involved in vegetation clearance works would be made aware of clearing limits via the ground disturbance process
  - Clear delineation of the areas to be disturbed prior to clearing activities, disturbance boundaries would be digitally captured and displayed within the site survey and GIS databases. This data would be made available either digitally or in map format. Where native vegetation clearing is to be carried out on a campaign basis, then prior to each clearing campaign the area to be cleared would be identified and marked.

4.6 Actions and measures to avoid direct and indirect impacts on threatened species at risk of SAII

Threatened species at risk of SAII that have the potential to be impacted by the Project include the Regent Honeyeater, Large-eared Pied Bat, Broad-headed Snake, Swift Parrot and Eastern Cave Bat. The following actions and measures have been/will be implemented to avoid and minimise direct and indirect impacts on these threatened species as follows:

- Broad-headed Snake, Eastern Cave Bat and Large-eared Pied Bat
  - Avoidance of direct impacts on mapped rocky habitat (i.e. caves, crevices, cliffs, rocks)
  - Mitigation and minimisation of indirect vibration impacts to nearby rocky habitat through: pre-blast desktop assessments; site-specific vibration modelling per blast to calculate MIC required to meet PPV limit for nearest mapped rocky habitat; continuation of existing vibration monitoring as described in the Blast Management Plan (MCO, 2020d); additional vibration monitoring at one or more new representative sites of mapped rocky habitat adjacent to the Project; ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary
  - Visual inspections of key representative mapped rocky habitat on a 6-monthly basis
- Regent Honeyeater
  - Avoidance of impact to Important Habitat Mapping located around the periphery of the Development Footprint and some larger patches of remnant vegetation in the south-west of the Study Area. The amended Project Development Footprint will result in a 56.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha). The majority of this is located in the south-east of the Development Footprint adjacent to Munghorn Gap Nature Reserve
  - Important Habitat (DPE, 2023g) mapped along Moolarben and Murdering Creeks will also be retained and enhanced through revegetation
- Swift Parrot
  - Avoidance of impact to foraging habitat including Box-Gum Woodland located around the periphery of the Development Footprint and some larger patches of remnant vegetation in the south-west of the Study Area. The amended Project Development Footprint will result in a 56.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha). The majority of this is located in the south-east of the Development Footprint adjacent to Munghorn Gap Nature Reserve

- Potential foraging habitat along Moolarben and Murdering Creeks will also be retained and enhanced through revegetation.

4.7 Actions and measures to avoid direct and indirect impacts on Munghorn Gap Nature Reserve

The following actions and measures (further discussed in detail in Section 5.5) have been/will be implemented to avoid and minimise indirect impacts to Munghorn Gap Nature Reserve:

- Development Footprint is set back a minimum of 100 m from the boundary of Munghorn Gap Nature Reserve. The distance between the Development Footprint and the Munghorn Gap Nature Reserve boundary exceeds the 100 m buffer at various locations across the Study Area.
- Implementation of a Blast Management Plan with blast criterion of 50 mm/s at nearest rocky habitat features (PSM 2024) (see Section 5.7 for details)
- No construction activity would occur on NPWS estate
- The risk of accidental damage to adjacent habitat or vegetation due to the Project operations would be managed through a Vegetation Clearance Protocol and a ground disturbance procedure
- Control of invasive species (weeds and animal pests) would occur in areas adjacent to the Development Footprint and the Munghorn Gap Nature Reserve
- A Noisy Miner monitoring and management program would be implemented to manage Noisy Miners (*Manorina melanocephala*; an aggressive bird species)
- MCO would continue to participate in co-ordinating strategic pest management programs in consultation with NPWS as described in NPWS (2022b)
- Use of directional lighting (shielded fittings that direct and confine the spread of light to only the area intended area to be lit or similar) and warm-white bulbs, where practicable to minimise indirect artificial lighting impacts on the Munghorn Gap Nature Reserve
- To avoid inadvertent impacts on *Pomaderris cotoneaster* a fence would be erected between the known plants and the adjacent Development Footprint. Any fencing along the Munghorn Gap Nature Reserve Boundary would be in accordance with the NPWS (2020) *Boundary Fencing Policy (updated 2020)*
- Bushfire risk would continue to be managed in accordance with the MCC Bushfire Management Plan.

Management and mitigation measures proposed for the Project are further discussed in Section 5.7.

4.8 Summary of measures to avoid and minimise impacts

Table 20 documents the measures to avoid and minimise direct, indirect and prescribed impacts associated with the Project and also within retained areas of native vegetation that have been avoided by the Project. Further measures to minimise and manage residual impacts are detailed in the following section.

Table 20. Avoidance and minimisation measures for direct, indirect and prescribed impacts.

Action	Outcome	Timing	Responsibility
Project design (e.g. locating infrastructure areas immediately adjacent to open cut mining areas) (Figure 3)	Reduce impacts to native vegetation, flora and fauna habitat and the overall area of impact (e.g., preferentially locating disturbance in Category 1 – exempt land or where the vegetation/habitat is in the poorest condition [e.g. low quality DNG]). Reduce the risk of vehicle strike by condensing the disturbance extent, having speed limits, and personnel training).	The areas of the Development Footprint approved for disturbance to be clearly delineated prior to clearing.	MCO
Avoid all direct disturbance to mapped rocky habitat. (Figure 18b)	Direct impacts on mapped rocky habitat (i.e. caves, crevices, cliffs, rocks) for the Broad-headed Snake, Eastern Cave Bat and Large-eared Pied Bat would be avoided by the Project.	The areas of the Development Footprint approved for disturbance to be clearly delineated prior to clearing.	MCO
Implementation of Blast Management Plan with blast criterion of 50 mm/s at nearest rocky habitat features	Mitigation and minimisation of indirect vibration impacts to nearby rocky habitat for the for the Broad-headed Snake, Eastern Cave Bat and Large-eared Pied Bat. Will include: • Pre-blast desktop assessments • Site-specific vibration modelling per blast to calculate MIC required to meet PPV limit for nearest mapped rocky habitat. • Continuation of existing vibration monitoring as described in the MCC Blast Management Plan (MCO 2020d). • Additional vibration monitoring at one or more new representative sites of mapped rocky habitat adjacent to the Project. • Ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary.	Throughout the duration of construction and operations as required.	MCO

Action	Outcome	Timing	Responsibility
	• Visual inspections of key representative mapped rocky habitat on a 6-monthly basis.		
Avoid and minimise clearance within riparian habitat associated with Moolarben Creek and Murdering Creek (Figure 18b)	Retain habitat connectivity for threatened species and ecological communities. Minimise adverse impacts on waterbodies, water quality and hydrological processes.	The areas of the Development Footprint approved for disturbance to be clearly delineated prior to clearing.	MCO
Minimise impacts on the Box-Gum Woodland CEEC	Box-Gum Woodland CEEC of the riparian corridor of Moolarben and Murdering Creeks would be retained and managed as a habitat connectivity corridor. As stated above, the Project design also avoids impacts to this community and the threatened species that utilise this community by preferentially locating disturbance in Category 1 – exempt land or where the vegetation/habitat is in the poorest condition [e.g. low quality DNG]. The Development Footprint was reduced post initial EIS submission to further avoid impacts to Box-Gum Woodland CEEC, particularly the relatively high-quality woodland areas. The amended Project Development Footprint will result in a 59.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha) and a 6.8% reduction in the area of DNG impacted (from 393.53 ha to 366.9 ha). (The total area of Box-Gum Woodland to be impacted has been reduced by 76.63 ha (16%).	The areas of the Development Footprint approved for disturbance to be clearly delineated prior to clearing.	MCO

Action	Outcome	Timing	Responsibility
Progressively back-filling open cut pits	The Project open cut voids would be progressively backfilled as mining progresses to reinstate the landform to approximate the gently undulating pre-mining topography. The location of the Project would also enable an improved final landform within the approved OC3 area as the approved mine void would be backfilled using waste rock from the Project, resulting in more land with the potential to provide habitat in the future.	Disturbed areas would be progressively rehabilitated with native vegetation following completion of active mine operations.	MCO
Habitat Enhancement Area (Figure 19b)	The proposed Habitat Enhancement Area described in Section 5.7 would be established to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened ecological communities and threatened species habitat within the riparian zone of Moolarben Creek and Murdering Creek.	During construction and throughout the duration of construction and operations.	MCO

5 Stage 2 - Impact Assessment

5.1 Direct impacts

Stage 2 of the BAM (DPIE 2020a) provides the requirements for the impact assessment of the BDAR. The impact assessment has incorporated findings from the specialist studies (AMBS 2023; ELA 2023) in order to assess the potential direct, indirect and prescribed impacts in line with Chapter 8 of the BAM (DPIE 2020a). Direct impacts of the Project on native vegetation, threatened ecological communities, threatened species and their habitat have been assessed according to Section 8.1 of the BAM (DPIE 2020a). These impacts are considered residual direct impacts remaining following the implementation of measures to avoid and minimise impacts discussed in Section 4 and mitigation measures discussed in Section 5.7.

5.1.1 Clearance of native vegetation

The Project would result in the direct loss of all native vegetation (480.01 ha) in the Development Footprint (Table 21). Of the native vegetation to be cleared, 366.9 ha is DNG, 93.64 ha is remnant woodland/forest/shrubland, 17.2 ha is regenerating Woodland/Forest, 2.18 ha is scattered trees and 0.09 ha is planted native vegetation. The clearance of planted native vegetation was assessed in the BAM-C as part of PCT 1655.

Two PCTs listed in Table 21 (PCT 266 and PCT 483) are over 90% estimated cleared in NSW (DPE 2023b) based on regional mapping. These two PCTs conform to the Box-Gum Woodland CEEC. The other PCTs listed in Table 21 have a low to moderate sensitivity to loss (≤ 69% estimated cleared in NSW [DPE 2023b]). The regional mapping (DPE 2023) shows a much smaller area of PCT 266 in the Development Footprint (i.e. 0.1 ha) than was ground-truthed during the detailed survey work (i.e. 35.3 ha) and PCT 483, recorded during surveys, is absent according to the regional mapping (NSW DCCEEW 2022b). Therefore, it is considered that the Project is unlikely to have a substantial effect on the percentage estimated cleared in NSW (DPE 2023b).

The current VI scores for all vegetation zones are provided in Table 9 and include the change in VI score post-development. The VI scores range from 32.7 to 90.4 which indicates that the vegetation is in moderate to good condition. The future VI scores for all vegetation zones are assumed to be zero as the vegetation would be cleared.

Clearance would occur progressively over the life of the Project in three separate stages. Mining activities for the Project would be carried out until approximately 2034 and material rehandling and landform establishment activities would continue following cessation of mining activities.

As described in Section 5.7, areas disturbed by mining would be progressively rehabilitated and revegetated following completion of active mining operations. All mining-related infrastructure would be decommissioned when redundant and removed at mine closure, unless needed to support future post-mining land uses (in consultation with relevant stakeholders). Approximately 535 ha of revegetated woodland and 140 ha of native grassland with scattered trees is proposed to be established as part of the conceptual post-mining land use for the Project.

Within the first year of commencing the Project, the Habitat Enhancement Area covering 188 ha of land (outside of the Development Footprint) would be established (Figure 19b). The Habitat Enhancement Area includes approximately 53 ha of existing woodland and approximately 135 ha of DNG and cleared land which is proposed to be progressively revegetated to provide additional habitat.

As described in Section 9, all native vegetation cleared for the Project would be offset in accordance with the BC Act.

Table 21. Summary of native vegetation clearance.

Vegetation zone	Vegetation zone name	PCT	Total Area of Clearance (ha)	NSW Percent Cleared for PCT (DPE 2023b)
VZ1*	PCT 266 Remnant Woodland	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	6.7	94
VZ2*	PCT 266 Derived Native Grassland		28	
VZ20*	PCT 266 Scattered Trees		0.6	
VZ3*	PCT 281 Remnant Woodland	Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	25.3	67
VZ4*	PCT 281 Derived Native Grassland (high)		203.3	
VZ5*	PCT 281 Derived Native Grassland (low)		135.6	
VZ21*	PCT 281 Scattered Trees		1.58	
VZ9*	PCT 483 Remnant Woodland	Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	0.04	90
VZ11	PCT 1610 Remnant Woodland	White Box - Black Cypress Pine shrubby woodland of the Western Slopes	17	67
VZ12	PCT 1610 Regenerating Woodland		11.2	
VZ14	PCT 1629 Remnant Forest	Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	5.5	1
VZ15	PCT 1661 Remnant Forest	Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	3.7	50
VZ16^#	PCT 1655 Remnant Woodland	Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	16.1	36
VZ17	PCT 1656 Remnant Forest	Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin	11.8	8
VZ18	PCT 1656 Regenerating Forest		6	

Vegetation zone	Vegetation zone name	PCT	Total Area of Clearance (ha)	NSW Percent Cleared for PCT (DPE 2023b)
VZ19	PCT 1711 Remnant Shrubland	Tantoon - *Lepyrodia leptocaulis* shrubland on sandstone drainage lines of the Sydney Basin	7.5	0
		Total Remnant Woodland/Forest/Shrubland	**93.64**	
		Total Regenerating Woodland/Forest	**17.2**	
		Total Derived Native Grassland	**366.9**	
		Scattered Trees	**2.18**	
		Planted Native Vegetation	**0.09**	
		Total	**480.01**	

* Box-Gum Woodland CEEC

^ Hunter Valley Footslopes Slaty Gum Woodland VEC

Eucalypt Forest and Woodland CEEC

5.1.2 Clearance of Threatened Ecological Communities

Two TECs listed under the BC Act occur in the Development Footprint, namely the Box-Gum Woodland CEEC and Hunter Valley Footslopes Slaty Gum Woodland VEC.

As detailed in Section 4.2.2, the Development Footprint has been amended to further minimise impacts to Box-Gum Woodland CEEC listed under the BC Act, including the Box-Gum Woodland CEEC in the south-east of the Project. The amended Project Development Footprint has resulted in a 16% reduction in total impact from 477.75 ha to 401.12 ha (76.68 ha), including:

- 59.4% reduction in impact to woodland form of the CEEC (from 84.22 ha to 34.22 ha)
- 6.8% reduction in impact to DNG form of the CEEC (from 393.53 ha to 366.9 ha).

The Project would therefore result in the clearance of 401.12 ha of Box-Gum Woodland CEEC, comprising 34.22 ha[12] of woodland and 366.9 ha of DNG (Table 22) which meets the EPBC Act condition threshold.

While the majority of Box-Gum Woodland CEEC within the Development Footprint occurs as DNG (approximately 91.5%), some areas of intact woodland and good condition DNG occur; mostly around the margins of cleared paddocks and along riparian corridors.

As described in Section 5.7, to mitigate the impact on the Box-Gum Woodland CEEC, the Project would include:

1. Management of 108.1 ha of Box-Gum Woodland CEEC (comprising 32.6 ha of woodland and 75.5 ha of DNG) within the Habitat Enhancement Area (Figure 19b) and associated revegetation works and
2. Progressive rehabilitation and revegetation of areas disturbed by mining, including the planting/seeding of species with similar characteristics of the Box-Gum Woodland CEEC.

The Box-Gum Woodland CEEC is classified as an entity at risk of SAII under the BC Act and further assessment occurs in Appendix F in accordance with Section 9.1 of the BAM (DPIE 2020a). The Box-Gum Woodland CEEC listed under the EPBC Act is assessed in Section 8.

The Project would result in the clearance of 16.1 ha of Hunter Valley Footslopes Slaty Gum Woodland VEC (15.5 ha of which equates to the Eucalypt Forest and Woodland CEEC). The conceptual final landform for the Project (Figure 19b) would include rehabilitation of native woodland/open woodland, including species characteristic of the Hunter Valley Footslopes Slaty Gum Woodland VEC/Eucalypt Forest and Woodland CEEC. Assessment of the Eucalypt Forest and Woodland CEEC is provided in Section 8.

[12] This area also includes 2.18 ha of PCT 266 and PCT 281 Scattered trees which do not meet the listing criteria of the Box-Gum Woodland CEEC but were assessed as TEC consistent with PCTs 266 and 281.

As described in Section 3.3.4, the current and future VI scores are provided in Table 9. All native vegetation cleared for the Project (including the TECs) would be offset in accordance with the BC Act (Section 9).

Table 22. Summary of threatened ecological community clearance.

Threatened Ecological Community	BC Act status	EPBC Act status	SAII entity	Vegetation zone	Vegetation zone name	Area of Clearance (ha)	Total Area of Clearance (ha)
White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland	CE	CE	Yes	VZ1	266 Remnant Woodland	6.7	401.12
				VZ2	266 DNG	28	
				VZ20	266 Scattered Tree	0.6	
				VZ3	281 Remnant Woodland	25.3	
				VZ4	281 DNG	203.3	
				VZ5	281 DNG Low	135.6	
				VZ21	281 Scattered Tree	1.58	
				VZ9	483 Remnant Woodland	0.04	
Hunter Valley Footslopes Slaty Gum Woodland	V	-	No	VZ16	1655 Remnant Woodland	16.1	16.1
Eucalypt Forest and Woodland	-	CE	No	VZ16	1655 Remnant Woodland	15.5	15.5

5.1.3 Habitat Clearance

Native vegetation

The native vegetation to be cleared in the Development Footprint (Table 21) equates to the broad fauna habitat types identified by AMBS (2023) in Table 23. Most of the native vegetation that formerly occurred in the Development Footprint (particularly the lower slopes and flat land) has been previously cleared for agriculture and habitats are fragmented. Most of the Development Footprint (366.9 ha, approximately 54.3%) comprises native grasslands. The Development Footprint also comprises Open Forest and Woodland on Slopes (41.04 ha, approximately 6.1%), Valley Woodlands (flats) (34.38 ha, approximately 5.1%), and Valley Woodlands (small rises) (37.6 ha, approximately 5.6%).

Table 23. Summary of broad habitat type clearance.

Broad Habitat Type	Vegetation zone	Vegetation zone name	Area of Clearance (ha)	Total Area of Clearance (ha)
Grasslands	VZ2	266 DNG	28	366.9
	VZ4	281 DNG High	203.3	
	VZ5	281 DNG Low	135.6	
Open Forest and Woodland on Slopes	VZ1	266 Remnant Woodland	6.7	41.04
	VZ9	483 Remnant Woodland	0.04	
	VZ11	1610 Remnant Woodland	17	
	VZ12	1610 Regenerating Woodland	11.2	
	VZ14	1629 Remnant Forest	5.5	
	VZ20	266 Scattered Trees	0.6	
Valley Woodlands (flats)	VZ3	281 Remnant Woodland	25.3	34.38
	VZ19	1711 Remnant Shrubland	7.5	
	VZ21	281 Scattered Trees	1.58	
Valley Woodlands (small rises)	VZ15	1661 Remnant Forest	3.7	37.6
	VZ16	1655 Remnant Woodland	16.1	
	VZ17	1656 Remnant Forest	11.8	
	VZ18	1656 Regenerating Forest	6	
Mapped Rocky Habitat – Threatened Bats and Broad-headed Snake			0	0
		Total	**479.92**	

Note: 0.09 ha of planted native vegetation not included in table.

Rocky habitat

As described in Section 4.4.1, direct impacts on mapped rocky habitat (i.e. caves, crevices, cliffs, rocks) for the Broad-headed Snake, Eastern Cave Bat and Large-eared Pied Bat would be avoided by the Project.

The extent of the Pink-tailed Legless Lizard rocky habitat has been mapped on Figure 6b. It includes areas with surface rock and native grasses (e.g. *Themeda* sp., *Lomandra* sp. etc.) and areas associated with remnant and regenerating woodland and forest habitats as well as some areas of good quality DNG.

Waterways

The Project has minimised the direct impact on waterways (Section 4), however there would be three creek crossings to enable access to the proposed mining areas. These creek crossings are considered unlikely to materially impact water habitat resources. The potential for indirect impacts on water habitat resources are described in Section 5.3.5.

Hollow-bearing trees

Hollow-bearing trees occur in all habitat types within the Development Footprint (ranging from scattered to common in the forested and woodland areas to rare or absent in the grassland areas) and will be impacted by the development. Hollow-bearing trees can provide roosting, nesting and shelter habitat and may support threatened species such as the Broad-headed Snake, Squirrel Glider, Masked Owl, Powerful Owl, Brown Treecreeper (eastern subspecies), Eastern Coastal Free-tailed Bat, Greater Broad-nosed Bat, Little Lorikeet and Yellow-bellied Sheathtail-bat.

Scattered trees and mistletoe

Scattered trees within the Development Footprint occur throughout DNG areas or surrounded by Category 1 – exempt land. These include one White Box, two Yellow Box, six Blakely's Red Gum, four Kurrajong and five Rough-barked Apple (ELA 2023). All scattered trees in the Development Footprint would be removed for the Project.

Mistletoe is scattered to common within all forested and woodland areas on the slopes, valley flats and small rises but was rare or absent on the ridges and also within the grassland areas. Mistletoe provides foraging and shelter habitat for fauna with the following threatened fauna potentially utilising this resource within the Development Footprint: Black-chinned Honeyeater, Squirrel Glider, Little Lorikeet, Koala and Regent Honeyeater.

Habitat for the Koala and Squirrel Glider

Koala and Squirrel Glider habitat has been (impacted more broadly in the locality over the last two decades by other projects such as the Moolarben Coal Complex, Ulan Coal Mine and the Wilpinjong Coal Mine. Development of projects associated with the Central-West Orana Renewable Energy Zone Transmission will also likely impact habitat for these species once approved. Table 24 below outlines the total area of foraging, breeding and refuge habitat specific to these species that has been or would be impacted as a result of these projects, as well as the total area of habitat that is proposed to be removed by the Moolarben OC3 Project.

Table 24. Cumulative Impacts to Koala and Squirrel Glider Habitat

Threatened Species	Koala and Squirrel Glider Habitat Impact Area (ha)					
	Moolarben Coal Complex (Approved 6 November 2007) (Moolarben Biota 2006; Eco Logical 2015a; 2015b; 2017b; 2019)	Wilpinjong Coal Mine (Approved 1 February 2006) (Hunter Eco 2015)	Ulan Coal Mine (Approved 15 November 2010) (Eco Logical Australia 2017a)	Central-West Orana REZ Transmission (On Exhibition) (WSP 2023b)	Moolarben OC3 Extension (this BDAR)	Total

Threatened Species	Koala and Squirrel Glider Habitat Impact Area (ha)					
Koala	261.4	194.8	84.3	608.8	113.02	1,262.32
Squirrel Glider	22.4	383.8	58.6	369	113.02	946.82

A total of 1,149.3 ha of Koala habitat and 833.8 ha of Squirrel Glider habitat has been impacted by previous projects in the Moolarben area, with a further 113.02 ha of Koala habitat and 113.02 ha of Squirrel Glider habitat to be impacted by the Moolarben OC3 Extension Project. Combined, these projects result in a total of 1,262.32 ha of Koala habitat and 946.82 ha of Squirrel Glider habitat impacted.

Like this document, the projects in Table 24 have assessed impacts of vegetation clearance and connectivity disruption on these species and came to similar conclusions, that these species are unlikely to be significantly impacted by cumulative impacts given:

- The localised nature of the potential habitat in the Development Footprint compared to the wider distribution of the species and
- The greater extent of habitat in the locality known to be used by the species.

These projects have also implemented avoidance, mitigation and compensation measures to reduce the direct and indirect impacts on these species, including:

- Compensation via site rehabilitation and biodiversity offset strategies
- An aim to provide ecological connectivity (via linkage, buffer, home range or refuge habitat). A key objective of site rehabilitation is to increase the connectivity of woodland vegetation, linking remnant and rehabilitated areas.

5.1.4 Direct impacts on threatened species

The extent of threatened species habitat that would be cleared during the Project is identified in Table 25. Table 25 contains all threatened flora and fauna species recorded by AMBS (2023) and ELA (2023).

Table 25. Summary of threatened species habitat clearance.

Common name	Scientific name	BC Act status	EPBC Act status	Biodiversity Credit Class	SAII entity	Clearance Extent (ha)
Flora						
Cotoneaster Pomaderris	*Pomaderris cotoneaster*	E	E	Species	No	0.07
Reptiles						

Common name	Scientific name	BC Act status	EPBC Act status	Biodiversity Credit Class	SAII entity	Clearance Extent (ha)
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	Species	No	207.14
Broad-headed Snake	*Hoplocephalus bungaroides*	E	E	Species/Ecosystem	Yes	0
Birds						
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	Species/Ecosystem	Yes	80.5
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Ecosystem	No	401.1
Speckled Warbler	*Chthonicola sagittata*	V	-	Ecosystem	No	472.4
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	V[6]	Ecosystem	No	472.38
Varied Sittella	*Daphoenositta chrysoptera*	V	-	Ecosystem	No	472.4
Black Falcon	*Falco subniger*	V	-	Ecosystem	No	422.6
Little Lorikeet	*Glossopsitta pusilla*	V	-	Ecosystem	No	450.9
Little Eagle	*Hieraaetus morphnoides*	V	-	Species/Ecosystem	No	422.8
Swift Parrot	*Lathamus discolor*	E	CE	Species/Ecosystem	Yes	105.52
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	V	-	Ecosystem	No	422.7
Powerful Owl	*Ninox strenua*	V	-	Species/Ecosystem	No	387.5
Masked Owl	*Tyto novaehollandiae*	V	-	Species/Ecosystem	No	422.8
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-	Ecosystem	No	422.7
Diamond Firetail	*Stagonopleura guttata*	V	V[8]	Ecosystem	No	417.18
Mammals						

Common name	Scientific name	BC Act status	EPBC Act status	Biodiversity Credit Class	SAII entity	Clearance Extent (ha)
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	E	Species	Yes	113.02
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V	-	Ecosystem	No	5.5
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V	-	Species/Ecosystem	Yes	422.7
Squirrel Glider	*Petaurus norfolcensis*	V	-	Species	No	113.02
Koala	*Phascolarctos cinereus*	E	E	Species	No	113.02
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Ecosystem	No	422.7
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-	Ecosystem	No	21.6
Eastern Cave Bat	*Vespadelus troughtoni*	V	-	Species	Yes	113.02

V = Vulnerable, E = Endangered, CE = Critically Endangered.

Table 25 also includes the threat and SAII status of each species. Entities at risk of an SAII are assessed further in Appendix F in accordance with Section 9.1 of the BAM (DPIE 2020a).

The impact of the Project on each of the threatened species listed in Table 25 is described below.

Following the impact avoidance and minimisation measure in Section 4, the Project would remove approximately 0.07 ha of the species polygon for *Pomaderris cotoneaster*. The *Pomaderris cotoneaster* population extends beyond the Development Footprint with habitat extent within the Study Area being mapped as approximately 12.5 ha (ELA 2023). No individual plants would be removed as a result of the Project. As such, the proposed commitment of propagation and translocation program for this species in the EIS is no longer necessary. The impact is restricted to vegetation within the proposed buffer area for the species. Therefore, the Project would remove approximately >1% of the *Pomaderris cotoneaster* species polygon associated with the population within the Study Area which would be offset via species credits.

Approximately 472.4 ha of foraging and shelter habitat for the threatened woodland birds Black-chinned Honeyeater, Speckled Warbler, Varied Sitella, Brown Treecreeper (eastern subspecies), Diamond Firetail, Grey-crowned Babbler and Dusky Woodswallow would be removed as a result of the Project. These species are all listed as vulnerable under the BC Act and identified as ecosystem species under the BAM (DPIE 2020a). As such, residual impacts to their habitat (following the impact avoidance and minimisation measures in Section 4) would be offset via ecosystem credits.

The Black Falcon and Little Eagle likely utilise the habitats within the Development Footprint for hunting. No large stick nests were observed within the Development Footprint (AMBS 2023) and thus there was no evidence to suggest they are using the site for breeding. These species typically forage over grassland. As such, the removal of approximately 422.8 ha of foraging habitat for these species (following the impact avoidance and minimisation measures in Section 4) would be offset via ecosystem credits.

Following the impact avoidance and minimisation measure in Section 4, the Development Footprint contains approximately 422.7 ha of foraging habitat for four of the microbat species (Greater Broad-nosed Bat, Yellow-bellied Sheathtail-bat, Eastern Coastal Freetail-bat and Large Bent-winged Bat) recorded within the Study Area. This foraging habitat primarily consists of DNG. While these areas may not constitute preferred foraging habitat (which would include more wooded areas), these areas constitute associated PCTs and support scattered trees and open areas over which the species may forage. Within the Development Footprint, three of the species (Greater Broad-nosed Bat, Yellow-bellied Sheathtail-bat and Eastern Coastal Freetail-bat) are likely to be utilising the hollow-bearing trees for roosting/breeding. Thus, the Project would result in the removal of foraging and breeding habitat for these species. Additionally, the Large Bent-winged Bat may use the area for foraging (due to a probable record of the species but absence of suitable breeding habitat as discussed in previous Section 3.4.3). Three of these species are ecosystem credit species and thus impacts to their habitat would be offset via ecosystem credits.

The two other microbat species (Large-eared Pied Bat and Eastern Cave Bat) preferentially roost/breed in caves/cliffs and rocky overhangs and forage in vegetation. The Project has been designed to avoid these habitat types and thus would not directly impact on breeding features for these species. These two species are species credit species and identified as SAII entities (addressed in Appendix F). Following the impact avoidance and minimisation measure in Section 4, approximately 113.02 ha of potential foraging habitat for the bats would be removed as a result of the Project.

Following the impact avoidance and minimisation measure in Section 4, approximately 105.52 ha of potential foraging habitat for the Swift Parrot would be removed as a result of the Project. The species was not recorded during targeted surveys; however, it has the potential to use habitats in the Development Footprint on occasions. No areas of habitat identified on the Swift Parrot Important Habitat Map occur within the Development Footprint. As such, impacts to their habitat would be offset via ecosystem credits.

The Regent Honeyeater was not recorded within the Study Area; however, areas identified on the Important Habitat Map for the species occur within the Development Footprint. As such, a species polygon has been developed for this species and offsets for direct impacts developed in accordance with the BC Act. The Regent Honeyeater is identified as an SAII entity and thus is considered further in Appendix F.

The Project avoids all mapped rocky habitat for the Broad-headed Snake and clearance of woodland areas within 100 m of the mapped rocky habitat. The Broad-headed Snake is identified as an SAII entity and thus is considered further in Appendix F.

Following the impact avoidance and minimisation measure in Section 4, the Project would impact approximately 113.02 ha of habitat for the Koala. This includes foraging and shelter habitat for the species. The Koala is a species credit species and thus impacts to 113.02 ha of habitat would be offset as per the BC Act (see Section 9).

The Powerful Owl and Masked Owl were both recorded within the Development Footprint which supports approximately 387.5 ha and 422.7 ha of foraging habitat for these species, respectively. As such, the removal of approximately of 387.5 ha of foraging habitat for Powerful Owl and 422.7 ha of foraging habitat for Masked Owl would be offset via ecosystem credits.

The Little Lorikeet is a hollow-dependent ecosystem species under the BAM (DPIE 2020a). As such, impacts to approximately 450.9 ha of foraging and breeding habitat for this species would be offset as per the ecosystem credit requirement for the Project.

The Project would result in the removal of approximately 113.02 ha of foraging and breeding habitat for the Squirrel Glider. The Development Footprint contains many hollow-bearing trees which provide breeding and nesting resources for this species. The Squirrel Glider is a species credit species and as such direct impacts to habitat for this species would be offset as per the BC Act (see Section 9).

The Project would result in the removal of approximately 207.14 ha of habitat for the Pink-tailed Legless Lizard, 181.84 ha of which is native vegetation and 25.3 ha of which is Category 1 – exempt land. This species is restricted to areas within the Development Footprint with scattered surface rocks, which primarily includes most of the remnant and regenerating woodland and forest areas on lower slopes within the Study Area. Suitable habitat also occurs within some areas of DNG. Access to the mine site would be restricted, eliminating potential removal or disturbance of scattered rocks within the Development Footprint. The species is a species credit species and as such direct impacts to habitat for this species would be offset as per the BC Act (see Section 9) additional credits will also be offered by MCO for the habitat on Category 1 – exempt land.

The assessment of impacts on EPBC Act listed threatened species is provided in Section 8.

5.1.5 Loss of Fauna During Habitat Clearance

A Vegetation Clearance Protocol including best practices would be implemented to minimise and mitigate the loss of fauna during habitat clearance as described in Section 5.7. This would include searches for the Pink-tailed Legless Lizard and Broad-headed Snake prior to vegetation clearance of relevant vegetation zones associated with the species to relocate individuals to outside of the Development Footprint where possible.

5.2 Indirect impacts

Indirect impacts of the Project on native vegetation, threatened entities and their habitat have been assessed according to Section 8.2 of the BAM (DPIE 2020a) and include the nature, extent, frequency, duration and timing of the indirect impacts during construction, operation and in the long term (i.e. post-mining).

5.2.1 Inadvertent impacts on adjacent habitat or vegetation

Inadvertent impacts on adjacent habitat or vegetation are accidental impacts that may occur during all stages of the Project. Accidental damage of adjacent habitat is a potential inadvertent impact relevant to most projects involving vegetation clearing and associated activities near native vegetation and habitat.

The risk of accidental damage of adjacent habitat or vegetation due to the Project operations would be mitigated through a Vegetation Clearance Protocol and a ground disturbance procedure to avoid accidental clearance of vegetation to be retained (Section 5.7).

To avoid inadvertent impacts on *Pomaderris cotoneaster* a fence would be erected between the known plants and the adjacent Development Footprint. Any fencing along the Munghorn Gap Nature Reserve Boundary would be in accordance with the NPWS (2020) *Boundary Fencing Policy (updated 2020)*.

5.2.2 Reduced viability of adjacent habitat due to edge effects

The Development Footprint is located within a mostly cleared valley with woodland and forest remaining on the adjacent escarpment where slope and soils would have been unsuitable for agricultural use. Woodland/forest in the valley is highly fragmented and the patches that remain are subject to edge effects such as weeds from a history of agricultural land use and Noisy Miners from the modified habitat.

The Project would result in the progressive clearance of native vegetation and the creation of some new edges, mainly to the woodland/forest on the upper slopes. These habitat edges would exist during construction and operation until the cleared areas are revegetated. During construction and operation of the Project, the native vegetation adjacent to the Development Footprint has the potential to be subject to edge effects – mainly through altered light, noise and incursion of invasive species.

The potential impacts from noise are discussed in Section 5.2.3 and incursion of invasive species is discussed in Sections 5.2.6 and 5.2.15.

The edge effects from the Project would be most apparent where the Development Footprint abuts dense woodland, for example along the eastern boundary of the Project. Where the Development Footprint abuts cleared areas and DNG there is less likely to be an edge effect (these areas already having been exposed to edge effects to some extent).

The indirect impacts on threatened species and ecological communities would be incremental with the Staged development, and progressive revegetation and habitat enhancement/management

would counteract the impacts to a degree. The Project would also involve management and revegetation of land within the Habitat Enhancement Area (Figure 19b) and progressive rehabilitation and revegetation following completion of active mining operations.

Pomaderris cotoneaster was recorded on the edge of the woodland/forest on slopes. Patykowski *et al*. (2014) states flowering may not occur and growth may be poor under dense shade. Given this, relatively open areas may be favourable for the species, which may make it less susceptible to edge effects. Weeds would be managed adjacent to the Development Footprint where the *Pomaderris cotoneaster* plants were recorded.

The above assessment applies to threatened fauna species habitat identified adjacent to the Development Footprint, e.g., habitat for Regent Honeyeater, Pink-tailed Legless Lizard, Large-eared Pied Bat, Eastern Cave Bat, Broad-headed Snake, Squirrel Glider and Koala.

Noisy Miners

Noisy Miners (*Manorina melanocephala*) were recorded within the Development Footprint (AMBS 2023). Noisy Miners are known to occupy a variety of habitats including edge habitat, open forest areas and urban landscapes and are renowned for aggressively excluding virtually all other bird species from areas they occupy (Clarke and Oldland 2007).

Clarke and Oldland (2007) investigated the depth from edges that Noisy Miners penetrate into large woodland remnants and determined that the distance ranged from 150 m to more than 300 m depending on the type of habitat and size of the remnant. A possible indirect impact resulting from the Project is increased access of the Noisy Miner to habitat adjacent to the Development Footprint during operation and while the mine landform is being revegetated. This access may be reduced in the moderate to long term, as areas disturbed by mining would be revegetated (Section 5.7).

A Noisy Miner monitoring and management program would be implemented to manage Noisy Miners.

5.2.3 Reduced viability of adjacent habitat due to noise and blasting

Noise and Blast Sources

During the Project, noise would mainly be generated from blasts and open cut mining operations (SLR 2022). Noise impacts would include 24 hour operational noise (generated mainly by vehicles and machinery) and intermittent noise from blasting during daylight hours. The scale of noise impacts would be similar to the existing approved Moolarben Coal Complex but would extend into the new open cut extension and surrounding areas (SLR 2022).

Blasting currently occurs at the Moolarben Coal Complex and would continue as part of the Project at similar intervals and scale, though extended into the proposed new pit areas. Up to two blasts per day and up to nine blasts per week, averaged over any calendar year, would occur cumulatively at the Moolarben Coal Complex and the Project (unless additional blasts are required following misfires or for mine safety). Blasting would only occur during daylight hours.

Mining activities have occurred in the general locality since the commencement of operations for the Wilpinjong Coal Mine in 2006 and Moolarben Coal Complex in 2010. It is noted mining operations for the Wilpinjong Coal Mine are approved until 2034 and the Moolarben Coal Complex until 2038. Open cut mining is approved within 20 m of the Munghorn Gap Nature Reserve for Wilpinjong and within 50 m of the Munghorn Gap Nature Reserve for Moolarben. In the absence of the Project (which proposes mining to 2034), vibration and airblast impacts would continue to be experienced.

The surrounding area includes native vegetation adjacent to the Development Footprint and Munghorn Gap Nature Reserve. The Development Footprint is at least 100 m from the boundary of Munghorn Gap Nature Reserve (a buffer of which is vegetated) and ranges from 100 m to 300 m from Munghorn Gap Nature Reserve within the east and south of the Project (Stage 2 and 3). The buffer between the Stage 1 area and Munghorn Gap Nature Reserve is about 450 m.

Birds, Mammals (other than bats) and Reptiles

Figures 14a and 14b show threatened fauna (birds, mammals and reptiles) recorded in habitat surrounding the Project[1]. Noise has the potential to impact individual fauna near the source of the noise through disrupting routine activities (Shannon *et al*. 2015).

Studies on the effect of noise on wildlife have shown very variable responses to potential impacts (Phillips 2016; Shannon et al. 2015; Kinsella 2014; Brown 2001). The potential severity of an impact from a noise stimulus will depend on the hearing range of the species, and the frequency, intensity and timing of the noise stimulus (Francis & Barber 2013). Species specific information on the impacts of air blasting and/or operational noise is not available for the threatened species recorded within the Development Footprint, or that have been recorded within adjacent habitat. It is considered likely that fauna will generally prefer habitat with less noise disturbance and therefore may alter their ranges to move further away from proposed blasting areas.

Best practice noise minimisation and mitigation measures would be implemented for the Project.

Potential noise impacts would be minimised by implementation of the existing noise control and management measures for the Moolarben Coal Complex, as described in the approved Noise Management Plan. These noise control and management measures include attenuation of mobile equipment and use of rubber-lined truck bodies (where feasible), as well as implementation of a real-time noise monitoring program and meteorological forecasting.

Potential blasting impacts would be minimised by implementation of a blast vibration limit of 50 mm/s PPV at sensitive geological features (including mapped rocky habitat) near the Project, unless further geotechnical investigation supports a higher value. Existing blast mitigation measures and monitoring would also continue to be implemented for the Project, as described in the approved Blast Management Plan.

[1] The threatened species listed by BCS on Figure 4 of the BCS and NPWS submission is not an accurate depiction of the threatened species located within the figure extent. A total of 23 threatened species listed on Figure 4 are not present.

Considering the impact minimisation and mitigation/management measures to be implemented, the nature of the short-term impacts on fauna (other than bats, which are discussed separately below) is likely to be disruption of individual animals adjacent to the mine. When a blast occurs, individual animals (those that are more mobile) may move away from the disturbance to adjacent habitat. A wide range of fauna, including threatened species, have been recorded directly adjacent to operating mining areas following the commencement of Wilpinjong Coal Mine and Moolarben Coal Complex (NSW DCCEEW 2024a; Biodiversity Monitoring Services, 2015) indicating that fauna have continued to inhabit the surrounding land, despite ongoing blasting and operational noise. For example, Biodiversity Monitoring Services (2015) conducted fauna surveys for the extension of the Wilpinjong Coal Mine and recorded Black-chinned Honeyeater (eastern subspecies), Brown Treecreeper (eastern subspecies), Little Lorikeet and Speckled Warbler within approximately 500 m of the active mine (based on survey sites that were no closer than 500 m). Bird monitoring surveys undertaken in the MCO Onsite Offset Area in 2022 (ELA 2023), located within 250 m of where blasting had been undertaken approximately two months earlier, recorded 24 bird species (64 individuals) over two days, including the Little Eagle (ELA 2023).

The extent of the short-term noise impacts is likely to be relatively localised considering the extent of habitat surrounding the Project into which potentially affected fauna may retreat. The duration of short-term impacts would be during operation, which would conclude in 2034. Blasts would be of short duration and only occur temporarily in any one location (i.e. the blasts occur in different localised points as mining progresses).

In summary, the impacts from blasting on fauna (other than bats) may be expected to be minimal in the medium to long-term due to the localised, short duration and temporary nature of the disturbance. Despite the potential short-term impacts on fauna during the period of operation, the landscape will be re-vegetated and rehabilitated (Habitat Enhancement Area and Mine Rehabilitation) providing additional habitat for species in the longer-term.

In regard to the Regent Honeyeater, there are numerous records of the Regent Honeyeater within, and near, Munghorn Gap Nature Reserve, the closest record of which is within 500 m of an open cut pit within the Development Footprint. Annual inspections of the south-east corner of the Study Area (within 1 km from the closest record) would occur each breeding season (July-January) to search for the Regent Honeyeater. The likelihood of Regent Honeyeater breeding in the area is considered very low because the currently known breeding areas are not near the Project and there are no recent records of the species (records within Munghorn Gap Nature Reserve are 15-20 years old). However, MCO would implement reasonable and feasible measures to minimise blasting impacts on trees in use for Regent Honeyeater breeding (if found).

Bats

Threatened bats recorded in habitat surrounding the Project are listed in Table 15. Blasting has the potential to temporarily disrupt bat roosting/breeding causing them to exit the roost during the day.

Caves within cliffs are likely to be the most susceptible bat habitat to vibration from mine-related blasting. The amended Project design incorporates additional setbacks (i.e. 100 m from Munghorn Gap Nature Reserve, 100 m from mapped rocky habitat) and a reduced blasting criterion (50 mm/s at mapped rock habitat).

MCO would adjust blast designs during Project operations to comply with a conservative vibration limit of 50 mm/s at the nearest mapped rocky habitat with a 100 m setback (safe design 5% exceedance level PPV limit) as described in Section 4.4.1.

As a result of the proposed vibration limit (as well as related mitigation and avoidance measures as described in Section 4.8 and 5.7), it is indicated that blasting vibration would result in no physical damage distinguishable from natural process (PSM 2024). Therefore, the impacts to adjacent roosting habitat of vibration from blasting, are considered unlikely to result in a residual indirect impact to the threatened species occupying sandstone habitats surrounding the Project.

Implementation of the blasting criteria to keep potential vibration impacts to adjacent mapped rocky habitat within the range of likely expected 'natural' disturbance limits, would likely also result in a reduction in the associated noise impacts. Further, blasting will not occur at night, therefore foraging activity of microbats will not be affected by blasting noise, though it may be disruptive to their diurnal resting periods and/or affect the suitability of roost/breeding sites.

Considering the impact minimisation and mitigation/management measures, the nature of the short-term impacts on bats is likely to be impacts on individuals (no impacts on roost structures). The extent of the short-term impacts is likely to be relatively localised. As for the other fauna species, there are extensive areas of suitable roost and foraging habitat adjacent to the Development Footprint into which the bats may retreat. The duration of short-term impacts is likely to be mainly during operation.

Although noise and vibration from mine-related blasting has the potential to result in short-term impacts on bats during operations (until approximately 2034), impacts may be unlikely to occur in the medium to long term (post-mining) because:

- Clearance of mapped rocky habitat (breeding habitat) for threatened bats would be avoided (Section 4) and final landforms would be revegetated to provide foraging habitat (Section 5.7)
- Blasts would be of short duration and only occur temporarily in any one location (i.e. the blasts occur in different localised points as mining progresses)
- There are extensive areas of mapped rocky habitat for threatened bats (roosting and breeding) in the wider locality (Munghorn Gap Nature Reserve and Goulburn River National Park) which would likely sustain the species, in the event that blasting does impact a roost with a colony adjacent to the Development Footprint (see below for further details).
- Threatened bats have continued to inhabit land surrounding the Moolarben Coal Complex despite ongoing anthropogenic noise sources from mining operations (NSW DCCEEW 2024a).

- Despite the potential short-term impacts on bats during operations, the landscape will be re-vegetated and rehabilitated (Habitat Enhancement Area and Mine Rehabilitation) providing additional habitat for species in the longer-term than currently exists.

A monitoring program for Large-eared Pied Bat and Eastern Cave Bat would be implemented. This would involve targeted surveys and monitoring of select caves. In addition, MCO would implement the following monitoring measures to manage potential blast vibration impacts to mapped rocky habitat:

- Continuation of existing vibration monitoring as described in the Blast Management Plan (MCO 2020d), and implementation of additional vibration monitoring at one or more new representative sites of mapped rocky habitat adjacent to the Project
- Ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary and
- Visual inspections of key representative mapped rocky habitat on a 6-monthly basis to confirm that the target outcome continues to be achieved.

5.2.4 Reduced viability of adjacent habitat due to light spill

Artificial lighting has the potential to impact fauna individuals (particularly nocturnal species) through disrupting routine activities. Alteration of natural variation in diurnal and nocturnal light intensities and spectral properties has the potential to disrupt the physiology, behaviour, and ecology of reptiles (Perry *et.al*. 2008), while artificial light has been shown to impact bats by markedly delaying some species' emergence times from roosts, meaning that their foraging time is reduced and the health of the population may be at risk (Haddock *et.al*. 2019a; Haddock *et.al*. 2019b).

During construction and operation of the Project, artificial lighting would be necessary from stationary work lights, fixed/permanent lights and vehicle-mounted lights consistent with the approved lighting infrastructure at the Moolarben Coal Complex for operational safety. Artificial lighting within the open cut pit would occur in different localised points as mining progresses.

For stationary work lights and fixed/permanent lights, the Project would include the use of directional lighting (shielded fittings that direct and confine the spread of light to only the area intended to be lit or similar) and would implement warm-white bulbs, where practicable. These types of lights can attract more insects and can attract insectivorous bats. Longer-wave alternative LED types can produce a small amount of UV (DPE 2023e) and can be least attractive to insects, though they still (generally) emit blue light, to which animals can be sensitive to (DPE 2023e) and can still attract insects (Brehm *et al*. 2021).

The proposed principles for lighting at the Project would minimise the potential for adverse impacts on fauna where it is practicable to do so. However, it is likely that any impact would be localised and short-term (limited to the duration/direction of the artificial lighting).

Potential for vehicle strike (and associated lights) are discussed in Section 3.7.5.

5.2.5 Reduced viability of adjacent habitat due to dust

The habitats immediately adjacent to the Development Footprint are likely to be exposed to more dust as a result of the Project than currently experienced from the agricultural land use.

Todoroski Air Sciences (2022) has assessed the atmospheric dust emissions that would be produced by the Project. Dust from mining activities, exposed areas, waste rock handling and stockpiling activities would spread beyond the Development Footprint. However, the air quality modelling results indicate that the Project would not result in any significant change to potential air quality impacts of the approved Moolarben Coal Complex (Todoroski Air Sciences 2022). As such, any potential impacts from dust are likely to be localised and short-term (limited to the duration of construction and operation).

MCO currently operates a real-time air quality monitoring program which would continue for the Moolarben Coal Complex incorporating the Project.

5.2.6 Transport of weeds and pathogens from the site to adjacent vegetation

A total of 102 weed species were recorded during the surveys by ELA (2023). Twelve are high threat weed species that are known to occur in the Study Area including and surrounding the Development Footprint.

Myrtle Rust (*Austropuccinia psidii*) is a fungal disease known to affect plants such as eucalypts, bottlebrush and tea tree which are found on and around the Development Footprint. Myrtle Rust spreads naturally by wind, water, insects and animals as well as being carried in on contaminated vehicles and equipment. Myrtle Rust is prevalent in coastal areas with required humidity levels (Department of Primary Industries [DPI] 2022) and is not considered likely to become established due to the Project activities.

Phytophthora cinnamomi is a plant pathogen that can spread via any activity that moves soil, water or plant material. Dieback caused by the root-rot fungus is listed as a key threatening process under the EPBC Act. Spread of pathogens would be managed as part of the weed control program implemented to mitigate the potential impacts of weed invasion as described in Section 5.7.

Koala retrovirus (KoRV) and Chlamydia (*Chlamydia percorum)* cause infertility, blindness and death which affects population viability and is contributing to the species decline. These diseases are carried in wild populations of Koalas, and the effects are intensified following extreme stress from hot weather, habitat loss and fragmentation (TSSC 2022). Pre-clearance surveys and Vegetation Clearance Protocols outlined in Table 28 would reduce the potential to cause stress to any resident Koalas, and impact to adjacent habitat would be minimised and managed. Incremental clearing and rehabilitation of woodland areas would also mitigate potential indirect impacts to Koalas.

Psittacine Circoviral Disease (PCD), otherwise known as Beak and Feather Disease, was listed as a key threatening process under the EPBC Act in 2021. PCD mostly impacts parrots, including the Little Lorikeet and Swift Parrot. It is carried in wild populations and there is no effective treatment (Cth DCCEEW 2022b).

Access to the mining tenements would be restricted and weeds and pathogens are very unlikely to be transported from the site to adjacent vegetation via vehicles or human activity.

5.2.7 Increased risk of starvation or exposure and loss of shade or shelter

Habitat loss may result in displacement of resident fauna leading to increased risk of fauna starvation and exposure. There are no continuous woodland linkages across the existing Moolarben valley from east to west. Within the valley floor area, the most continuous patch of woodland occurs north to south along Moolarben Creek and Murdering Creek (Figure 6a).

Habitat clearance would be progressive over the life of the Project and access to Moolarben Creek would be maintained. Extensive areas of protected habitat also occur within Munghorn Gap Nature Reserve. These areas would provide habitat to which displaced animals may retreat during clearing/operation, reducing the risk of starvation/exposure as a result of the Project. As such, threatened species are considered unlikely to become isolated and subject to starvation/exposure as a result of the Project.

Further, the proposed Habitat Enhancement Area described in Section 4.2 would be established to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened ecological communities and threatened species habitat within the riparian zone of Moolarben Creek and Murdering Creek.

5.2.8 Loss of breeding habitat

The direct loss of breeding habitat is described in Section 5.1.3. Hollow-dwelling fauna displaced from the Development Footprint may need to compete for hollows in the adjacent habitat resulting in a potential indirect impact on hollow-dwelling fauna in the short to medium term. The Squirrel Glider and Yellow-bellied Sheathtail-bat are both likely to use hollow-bearing trees in the Development Footprint and surrounds.

As described in Section 4.2.24.4.2, in the long term the Project would result in a greater area of woodland/forest/shrubland established in the future than is currently present. This would be achieved through the establishment of 535 ha of woodland in mine rehabilitation and 53 ha of woodland in the Habitat Enhancement Area. These woodland areas would, over an extended period of time, develop hollow-bearing trees.

5.2.9 Trampling of threatened flora species

Pomaderris cotoneaster is known to occur adjacent to the Development Footprint. It is very unlikely that this species would be trampled as access beyond the Development Footprint would be controlled.

5.2.10 Inhibition of nitrogen fixation and increased soil salinity

Not applicable.

5.2.11 Fertiliser drift

Not applicable.

5.2.12 Rubbish dumping

Access to the mine site would be restricted and rubbish would be controlled in accordance with existing waste management procedures.

5.2.13 Wood collection

Access to the mine site would be restricted and no wood collection would be permitted outside of the Development Footprint.

5.2.14 Removal and disturbance of rocks, including bush rock

There would be no removal or disturbance of rocks, including bush rock outside of the Development Footprint. Access to the mine site would be restricted, eliminating potential removal or disturbance of scattered rocks within the Development Footprint.

5.2.15 Pest animals

Thirteen of the fauna species recorded in the Development Footprint Area are introduced: the Common Starling (*Sturnus vulgaris*), House Sparrow (*Passer domesticus*), House Mouse (*Mus musculus*), Black Rat (*Rattus rattus*), Red Fox (*Vulpes vulpes*), Feral Cat (*Felis catus*), European Brown Hare (*Lepus europaeus*), European Rabbit (*Oryctolagus cuniculus*), Pig (*Sus scrofa*), Cattle (*Bos taurus*), Goat (*Capra hircus*), Sheep (*Ovis aries*) and Fallow Deer (*Dama dama*).

Pest animals are not anticipated to increase as an indirect impact of the Project. The existing land use is a mixture of agricultural production and mining activities, and this would continue for the lifetime of the Project and beyond. Access to the Development Footprint is restricted and the majority of vehicles are kept on-site. Pest animals may increase through natural breeding if not controlled.

5.2.16 Risk of bushfire

The Project is unlikely to increase fire risk. Bushfire risk would continue to be managed in accordance with the MCC Bushfire Management Plan. Mitigation measures that would be implemented by MCO to reduce bushfire risk would focus on education and training, reducing bushfire hazard (principally fuel levels), minimising and controlling ignition sources (e.g. by appropriate engineering design, where relevant) and developing appropriate responses and evacuation strategies.

5.3 Prescribed impacts

Measures to avoid and minimise prescribed impacts have been discussed in Section 4.4. In accordance with the BAM (DPIE 2020a), this BDAR assesses the prescribed impacts that the Project would, or is likely to have, on threatened entities and their habitat, taking into account:

- The TECs, threatened species and their habitat
- Ongoing or future impacts that the Project would have on biodiversity values, considering the measures taken to avoid or minimise impacts
- The spatial and temporal extent of the impacts likely to result from changes in land use arising from the Project, in accordance with Section 8.3 of the BAM (DPIE 2020a).

The BDAR includes an assessment of any prescribed impacts of the Project on threatened entities and their habitat, and describes:

- The nature, extent, frequency, duration and timing of prescribed impacts that may occur:
  - during construction
  - during operation
  - that are uncertain (predictions should be made)
- The consequences of prescribed impacts on biodiversity values
- Any limitations to data, assumptions and predictions about impacts on biodiversity.

A summary of prescribed impacts is outlined in Table 26 below. A detailed assessment for each of the relevant prescribed biodiversity impacts is provided in the following sections below including discussion of avoidance and minimisation measures to be implemented.

Table 26. Summary of prescribed impacts

Prescribed Impact	Nature	Extent	Frequency / Duration / Timing	Consequence
Caves, crevices, cliffs and rocks	Direct impacts to mapped rocky habitat features such as caves, crevices, cliffs and other rock habitats used by the Broad-headed Snake, Large-eared Pied Bat and Eastern Cave Bat would be avoided by the Project. There are extensive areas of mapped rocky habitat in the wider locality (Munghorn Gap Nature Reserve and Goulburn River National Park) suitable for these species. Potential surface rocky habitat suitable for the Pink-tailed Legless Lizard occurs throughout the lower slopes of the Development Footprint. Access to the mine site would be restricted, eliminating potential further removal or disturbance of scattered rocks within the Development Footprint.	No direct physical impacts to rocky habitat for Broad-headed Snake, Large-eared Pied Bat and Eastern Cave Bat. Vibration impacts to surrounding mapped rocky habitat would be minor, with the proposed blast vibration limit of 50 mm/s at the nearest mapped rocky habitat, as well as 100 m setbacks from Mapped Rocky Habitat (PSM 2024). Therefore, the impacts to adjacent roosting habitat of vibration from blasting, are considered unlikely to result in a residual indirect impact to sandstone habitats surrounding the Project (PSM 2024). 207.14 ha of suitable Pink-tailed Legless Lizard rocky	Blasts would be of short duration and occur temporarily at any one location during operation of the mine (2025 to 2034). Impacts to Pink-tailed Legless Lizard habitat would occur during the construction phase of the Project and would be permanent in most areas, until rehabilitation of the mine after 2034.	The consequences of blasting impacts to surrounding mapped rocky habitat are considered minor. The proposed blast vibration limit would result in no damage distinguishable from natural processes or other anthropogenic sources at the nearest mapped rocky habitat. Roosting/resident fauna may re-locate further into adjacent available habitat to the Project. The direct impact to surface rocky habitat will likely have a significant impact on the Pink-tailed Legless Lizard. During rehabilitation of the mine, rock would be reinstated within a rehabilitation area of approximately 68 ha of open woodland/woodland.

Prescribed Impact	Nature	Extent	Frequency / Duration / Timing	Consequence
		and grassland habitat for will be directly impacted.		
Habitat connectivity	The Development Footprint is predominantly cleared with some isolated patches of native vegetation and riparian vegetation at creek crossings. The Project would remove some areas of stepping-stone habitat and result in a greater distance to travel for fauna moving across the landscape. Reduced connectivity of wooded habitat would displace threatened woodland birds, such as the Black-chinned Honeyeater, Speckled Warbler, Varied Sitella, Brown Treecreeper (eastern subspecies), Diamond Firetail, Grey-crowned Babbler and Dusky Woodswallow, that utilise this habitat for shelter, breeding and foraging resources. Reduced connectivity would remove some foraging habitat for Eastern Cave Bat, Large-eared Pied Bat and Large Bent-winged Bat. This foraging habitat may be used by individuals utilising nearby breeding habitat, thus reducing the value of the breeding habitat for these species.	The Project would result in the removal of 113.02 ha of wooded habitat within the Development Footprint. Riparian vegetation along Moolarben and Murdering Creeks provides for some connectivity of wooded habitat in a roughly north-south direction across the landscape. 207.14 ha of rocky and grassland habitat suitable for Pink-tailed Legless Lizard will be directly impacted, fragmenting habitat along the northern and southern extents of the Study Area.	Wooded habitat and Pink-tailed Legless Lizard rocky habitat would be cleared during the construction phase of the Project. Progressive rehabilitation of 535 ha of woodland in mine rehabilitation would occur across the Project to minimise impacts to habitat connectivity.	The impacts to connectivity of wooded habitat are considered minor due to the large areas of connected habitat to the east, south and west of the Development Footprint. The impacts of reduced connectivity of Pink-tailed Legless Lizard habitat would be permanent in most areas, until rock is reinstated within a rehabilitation area of approximately 68 ha of open woodland/woodland. The impacts associated with reduced habitat connectivity are also likely to reduce over time as progressive rehabilitation is undertaken.

Prescribed Impact	Nature	Extent	Frequency / Duration / Timing	Consequence
	Reduced connectivity would restrict movement of the Koala and Squirrel Glider across the Development Footprint, however habitat surrounding the site is connected allowing for continuity of movement to habitat areas on the east, south and west of the Development Footprint. For the Pink-tailed Legless Lizard with restricted dispersal ability, the loss of connectivity and fragmentation of suitable rocky habitat may isolate individuals.			
Features that provide for movement of threatened species that maintains their lifecycle	The removal of foraging resources (trees and wooded areas) within the Development Footprint has the potential to affect movement patterns for the Regent Honeyeater and Swift Parrot. Habitat for the Regent Honeyeater as identified on the Important Habitat Mapping is present within the Study Area, however Important Habitat for the Swift Parrot is not mapped within the Development Footprint (DPE 2023g). As stated above, rocky habitat crucial for the dispersal of the Pink-tailed Legless	80.5 ha of Regent Honeyeater foraging habitat and 105.52 ha of potential Swift Parrot foraging habitat will be removed as a result of the Project. 207.14 ha of rocky and grassland habitat suitable for Pink-tailed Legless Lizard will be directly impacted, fragmenting habitat along the northern and southern extents of the Study Area.	Trees, wooded habitat and rocky habitat would be directly impacted during the construction phase of the Project. Progressive rehabilitation will minimise the impact on potential foraging resources for these species.	The removal of foraging resources within the Development Footprint is considered unlikely to impact on foraging resources that are important for the lifecycle of the Regent Honeyeater or Swift Parrot due to lack of mapped habitat considered critical for the survival of the Swift Parrot, and the unlikely reliance of the Regent Honeyeater on the foraging resources present within the Development Footprint for survival. The direct impact to rocky habitat suitable for the Pink-tailed Legless Lizard will fragment habitat in the north and south of the Study Area, effectively isolating

Prescribed Impact	Nature	Extent	Frequency / Duration / Timing	Consequence
	Lizard will be directly impacted as a result of the Project.			individuals, reducing dispersal and gene flow.
Non-native vegetation	Areas of non-native vegetation within the Development are dominated by exotic pasture and may occasionally be used by foraging mobile threatened species or fauna species. Some threatened fauna species such as the Pink-tailed Legless Lizard are known to utilise non-native vegetation.	Approximately, 186.6 ha of non-native Category 1 – exempt land would be removed as a result of the Project. Approximately 1.3 ha of potential Pink-tailed Legless Lizard surface rocky habitat overlaps Category 1 – exempt land. With the species 50 m buffer, approximately 25.3 ha overlaps the Category 1 – exempt land.	Non-native vegetation removal would occur during the construction phase of the Project.	The loss of the non-native vegetation is expected to have a negligible or minor consequence on the majority of threatened species or fauna species recorded or that are part of a TEC. In the long-term, habitat opportunities for these species would be increased following revegetation works as part of the mine rehabilitation. The impact of removing approximately 1.3 ha of potential Pink-tailed Legless Lizard habitat will be offset accordingly. A rock trial site would also be established to provide compensatory habitat for the species.
Waterbodies, water quality and hydrology	There are several waterways that intersect the Development Footprint, including: • Moolarben Creek (flows into the Goulburn River approximately 7 km north of the Development Footprint) • Murdering Creek • Spring Creek.	The extent of impact would be mostly limited to Moolarben Creek and its tributaries. The Development Footprint incorporates avoidance of open cut mining within	During the operation phase of the project (2025 to 2034). Up to 30 years for groundwater levels to recover.	The potential impact on flows in Moolarben Creek and Goulburn is considered negligible. Impacts to fauna species are expected to be negligible. Impacts to water availability for terrestrial vegetation along Moolarben Creek and associated low lying areas are considered

Prescribed Impact	Nature	Extent	Frequency / Duration / Timing	Consequence
	These waterbodies are likely to be used for drinking water by threatened species or species that occur as part of a TEC such as the Koala. Microchiropteran bats, including Large-eared Pied Bat and Eastern Cave Bat, are also known to fly over riparian areas at night foraging for insects. A number of potential terrestrial GDEs have also been identified in the vicinity of the Project, coinciding with mapped TECs.	200 m of Moolarben Creek and Murdering Creek. Approximately 23 ha of potential GDEs have been mapped to occur within the maximum 2 m drawdown extent.		unlikely, with the exception of potential impacts to large trees with roots below 10 m during dry periods.
Vehicle strikes	The project has the potential to impact on fauna through interactions with vehicles/machinery.	The extent of vehicular strike may occur throughout the Project footprint where vehicles and machinery move through the landscape for construction and operation.	During construction and operation of the Project. Project mining operations would be conducted 24 hours per day, seven days per week.	Consequences of vehicle strikes are fauna injury and death.

5.3.1 Caves, crevices, cliffs and rocks

As discussed in Section 1.1 the extended open cut mining operations would provide approximately 10 years of mining (from 2025 to 2034). The Project will occur progressively with three stages. During the operation of the mine, indirect impacts from noise (and vibration) from mine-related blasting has the potential to result in likely short-term impacts on species that during operations (until approximately 2034), impacts may be unlikely to occur in the medium to long term (post-mining) because:

- Clearance of mapped rocky habitat would be avoided (Section 4)
- Blasts would be of short duration and only occur temporarily in any one location (i.e. the blasts occur in different localised points as mining progresses) and a Blast Management Plan would be implemented with blast criterion of 50 mm/s at nearest rocky habitat features such that the vibration from blasting would cause no damage distinguishable from natural processes or other anthropogenic sources (PSM 2024) (see Section 5.7 for details)
- There are extensive areas of mapped rocky habitat in the wider locality (Munghorn Gap Nature Reserve and Goulburn River National Park)
- There is evidence of species persistence within the vicinity of active coal mining operations in the region (Section 5.2.3).

Broad-headed Snake, Eastern Cave Bat and Large-eared Pied Bat Mapped Rocky Habitat

As described in Section 4.4.1, direct impacts on mapped rocky habitat (i.e. caves, crevices, cliffs, rocks) for the Broad-headed Snake, Large-eared Pied Bat and Eastern Cave Bat would be avoided by the Project (Figure 17c, Figure 17i and Figure 17j). The mine design incorporates a 100 m setback of all Project disturbance (including open cut pit extents) from mapped rocky habitat associated with sandstone specialist threatened species. As a result, the Project would not cause direct physical impacts to mapped rocky habitat features, and blast vibration at mapped rocky habitat features would be reduced, due to the greater distance from the proposed open cut pit extents when compared to the EIS. Therefore, the only remaining potential pathway for impact to mapped rocky habitat would be indirectly through blasting vibration.

In order to manage the potential impacts from blasting, MCO would implement measures as detailed in Section 4.4.1 to minimise blasting impacts on roosting bats. The proposed blast vibration limit of 50 mm/s at the nearest mapped rocky habitat (safe design 5% exceedance level PPV limit) was determined by specialist geotechnical engineers (PSM 2024) through a comprehensive analysis of historical blast monitoring data, inspection of other sensitive geological features subject to historical blasting (geotechnical characteristics, analysis of mining-related impacts on proximal rocky outcrops and assessment of likely cause of suspected blast interactions), ground truthing of mapped rocky habitat surrounding the Project, and review of site-specific modelling predictions of vibration effects. Accordingly, sensitive geological features located further from blasting than the mapped rocky habitat (e.g. deeper into the Munghorn Gap Nature Reserve) would be expected to experience limited to no vibration as a result of this limit. Blast adjustment measures to achieve the vibration limit would include moderation of MIC and/or implementation of pre-split blasts where appropriate, in accordance with the MCC Blast Management Plan. As a result of the proposed vibration limit (as

well as related mitigation and avoidance measures), it is considered likely that blasting vibration would result in no distinguishable impacts from natural processes (PSM 2024). Therefore, the impacts of vibration are considered unlikely to result in a residual prescribed impact to the threatened species occupying sandstone habitats surrounding the Project.

The breeding population present within the Development Footprint likely forms a subset of the larger breeding population in the locality. Given the extent of abundant high quality breeding habitat within the wider locality (Munghorn Gap Nature Reserve and Goulburn River National Park) the Project is considered unlikely to impact the breeding cycle of the species in a regional context.

Pink-tailed Legless Lizard Rocky Habitat

Potential surface rocky habitat occurs throughout the lower slopes of the Development Footprint and is not able to be entirely avoided for the Project. The impact on Pink-tailed Legless Lizard habitat includes direct impact on suitable rocky and grassland habitat within an area of 207.14 ha in the Development Footprint, which includes approximately 25.3 ha of Category 1 – exempt land.

The clearing of bush rock is a key threatening process for the Pink-tailed Legless Lizard (DPE 2023a) and would lead to a significant reduction in available habitat for the species during the construction and operation phases of the Project.

Avoidance of rocky habitat has been carried out in the planning phase where practicable, to reduce the impacts on species reliant on rocky areas, on upper slopes at a higher elevation than the Development Footprint. This would retain some refugia for individuals of the Pink-tailed Legless Lizard displaced during construction and mine operation. Access to the mine site would be restricted, eliminating potential removal or disturbance of scattered rocks within the Development Footprint.

During the rehabilitation of the mine, rock would be reinstated within a rehabilitation area of approximately 68 ha of open woodland/woodland. Rock would be reinstated to these areas along with planting of native tussock grasses (e.g. *Themeda triandra* and *Poa sieberiana*). McDougall *et al*. (2016) has demonstrated successful colonisation of constructed habitat by the Pink-tailed Legless Lizard within 20 m of existing rocky habitat.

5.3.2 Habitat connectivity

The Project would result in loss of connectivity and habitat fragmentation through removal of native vegetation in the Development Footprint, until revegetation areas associated with mine rehabilitation and the Habitat Enhancement Area mature and then connectivity would ultimately be improved.

The Development Footprint is predominantly located within a valley which has been extensively cleared for agriculture. The Project is surrounded by large tracts of native forest/woodland to the north, east, south and west, constituting Munghorn Gap Nature Reserve. Presently there is no continuous overstorey vegetation within the Development Footprint which connects native

vegetation surrounding the Project. However, there are some smaller, isolated patches of native vegetation within the Development Footprint as well as riparian vegetation at creek crossings. This would remove some areas of stepping-stone habitat and result in a greater distance to travel for fauna moving across the landscape.

The majority of vegetation providing for connectivity includes the forested areas around the periphery of the Development Footprint. These areas occur adjacent to large tracts of vegetation with Munghorn Gap Nature Reserve which surround the Development Footprint to the east, south and west.

The riparian vegetation along Moolarben and Murdering Creeks provides for some connectivity and flora and fauna habitat in a roughly north-south direction across the landscape (noting that there would be three creek crossings for the Project). While there would be creek crossings, most of this vegetation would not be impacted by the Project and would be retained and revegetated as part of the Habitat Enhancement Area (Figure 19b). The retention of this vegetation throughout the life of the Project would allow for the continued use of this habitat for more mobile fauna species (such as birds and bats) such that it is considered unlikely that threatened species would become isolated as a result of the Project.

Hollow-dependent bats and small, threatened woodland birds, such as the Black-chinned Honeyeater, Speckled Warbler, Varied Sitella, Brown Treecreeper (eastern subspecies), Diamond Firetail, Grey-crowned Babbler and Dusky Woodswallow, would be displaced through loss of vegetation (that may provide shelter, breeding and foraging resources). However, some patches of vegetation would be retained in the south-east of the Development Footprint and the retained vegetated corridor along Moolarben and Murdering Creeks would provide some refuge/stepping-stone/foraging habitat for displaced individuals. The Development Footprint is also surrounded by Munghorn Gap Nature Reserve in the east, south and west which supports large areas of connected habitat. Similarly, the three other threatened bat species as well as the Regent Honeyeater, Little Lorikeet and Black-chinned Honeyeater would be displaced through loss of foraging habitat and breeding resources (hollow-bearing trees), but given their highly mobile nature, the species are unlikely to be dependent on the habitat connectivity the Development Footprint provides for survival.

With respect to the Eastern Cave Bat, Large-eared Pied Bat and Large Bent-winged Bat, breeding habitat (rocky areas/escarpments/caves) would not be impacted by the Project. But the loss of forested/woodland areas within the Development Footprint would remove some foraging habitat that may have been used by individuals that utilise the nearby breeding habitat, thus reducing the value of the breeding habitat for these species. This is because individuals are likely to, in part, select breeding locations based on the availability of nearby foraging resources.

Terrestrial fauna species that are less mobile are likely to be impacted to a greater extent by the loss of patches of remnant vegetation.

The Broad-headed Snake was recorded on the periphery of the Study Area within rocky/escarpment areas. This species is restricted to these habitat types which mainly occur outside of the Development Footprint within the broader Study Area and areas adjacent to Munghorn Gap Nature Reserve. As such habitat connectivity for this species is considered unlikely to be impacted as a result of the Project.

The Koala and Squirrel Glider are both known to occur and move across fragmented landscapes utilising isolated patches of wooded vegetation. The habitat corridor along the creeks would provide for some connectivity of habitat in a north-south direction but movement between habitat to the east and west of the Development Footprint would be restricted. The habitat surrounding the site is connected allowing for continuity of movement to habitat areas on the east, south and west of the Development Footprint.

Pink-tailed Legless Lizards are relatively sedentary but would move to inhabit suitable habitat within a distance of at least 30 m (McDougall *et al*. 2016). Pink-tailed Legless Lizards require scattered loose surface rocks for connectivity, to facilitate dispersal, recolonisation and gene flow of populations (ACT Government 2017). The removal of available habitat as a result of the Project would fragment habitat in the northern portion of the Study Area and reduce connectivity along the southern extent of the Study Area.

Actions to minimise impacts on these species in the vicinity of the Project include:

- Progressive rehabilitation and revegetation of back-filled areas, as well as the inclusion of a surface rock trial site, to ensure on-going replacement of resources and minimising the time between loss and replacement of resources (Figure 19b)
- Retention of riparian habitat along Moolarben and Murdering Creeks within a dedicated Habitat Enhancement Area which facilitates species movement (Figure 19b)
- Extension and enhancement of habitat to provide on-going habitat connectivity and retention of foraging, refuge and breeding resources.

5.3.3 Features that provide for movement of threatened species that maintains their lifecycle

As discussed in Section 3.7.3, features within the Development Footprint that provide for the movement of threatened species that may be required to maintain lifecycle process primarily constitutes the native woodland/forest vegetation. This vegetation may provide shelter/foraging resources for species that are nomadic or move more widely across the landscape; namely the Swift Parrot and Regent Honeyeater. The removal of foraging resources (trees and wooded areas) within the Development Footprint has the potential to affect movement patterns of these species which may utilise the resources within the Development Footprint for foraging on an irregular or seasonal basis.

As discussed in Section 3.7.3, the Development Footprint does not include any areas that have been mapped on the Important Habitat Mapping (as detailed in Section 2.1.4) for the Swift Parrot,

therefore the Project is considered unlikely to impact on foraging resources that might be important for lifecycle of the species.

Habitat for the Regent Honeyeater as identified on the Important Habitat Mapping (DPE 2023g) is present within the Study Area (Figure 17f). The distribution of the Regent Honeyeater is usually focused on breeding sites and surrounding fragmented woodlands containing foraging resources. The species is nomadic, following the flowering of specific Eucalypt species through the landscape. There are four known key breeding areas for this species in Australia, three of which are in NSW in the Capertee Valley, Bundarra-Barraba and Hunter Valley districts.

The species was not recorded within the Study Area during targeted surveys (AMBS 2023). This species has previously been recorded on several occasions immediately adjacent to the Development Footprint, within adjacent Munghorn Gap Nature Reserve with a total of 153 records within 30 km of the Study Area (DPE 2022d[4]), although the majority of records are greater than 15-20 years old (DPE 2022d[4]). The potential habitat within the Development Footprint is unlikely to provide critical foraging and/or breeding resources on which the species depend to maintain their lifecycle due to the lack of recent records of the species within the vicinity of the site and the fact that is located outside the key known breeding areas for the species.

Regardless, actions to minimise potential impacts on these species in the vicinity of the Project include:

- Progressive rehabilitation and revegetation of back-filled areas to ensure on-going replacement of resources and minimising the time between loss and replacement of resources (Figure 19b)
- Retention of riparian habitat along Moolarben and Murdering Creeks within a dedicated Habitat Enhancement Area which facilitates species movement through the Project (Figure 19b)
- Extension and enhancement of habitat to provide on-going habitat connectivity and retention of foraging, refuge and breeding resources.

5.3.4 Non-native vegetation

Approximately, 186.6 ha of non-native Category 1 – exempt land would be removed as a result of the Project. These areas are dominated by exotic pasture which has previously been heavily modified as a result of historic and ongoing agricultural practices such as cultivation, pasture improvement and livestock grazing. This non-native vegetation may occasionally be used by foraging mobile threatened species or fauna species. The loss of the non-native vegetation is not expected to have a material consequence on the majority of threatened species or fauna species recorded or that are part of a TEC. Habitat opportunities for these species would be increased in the long-term due to revegetation works to be undertaken as part of the mine rehabilitation.

Approximately 1.3 ha of potential Pink-tailed Legless Lizard surface rocky habitat overlaps Category 1 – exempt land. However, when the species 50 m buffer of rocky areas habitat constraint was applied to this rocky habitat, approximately 25.3 ha overlaps the Category 1 – exempt land.

As credits cannot be generated within the BAM-C for impacts to non-native vegetation, an offset for impacts to potential habitat within the lowest condition native grassland habitat present (PCT

281_DNG-Low with a VI score of 32.7) was used to estimate the offset requirement for impacts to Pink-tailed Legless Lizard habitat within Category 1 – exempt land. Impacts to Pink-tailed Legless Lizard habitat within PCT 281_DNG-Low vegetation zone generated a requirement of 16 credits per hectare. It should be noted that the Category 1 – exempt land is of relatively poor quality with a VI score of 15 or less (less than half the VI score of the PCT 281 – DNG low).

Within the Development Footprint, the Pink-tailed Legless Lizard species polygon includes Category 1 – exempt land as follows:

- Stage 1: 12.2 ha
- Stage 2: 12.7 ha
- Stage 3: 0.4 ha.

Based on credit requirement of 16 credits per hectare, a total of 404.8 credits (rounded up to 405 credits) would be required to offset prescribed impacts to the Pink-tailed Legless Lizard based on the following staging:

- Stage 1: 195.2 credits
- Stage 2: 203.2 credits
- Stage 3: 6.4 credits.

5.3.5 Waterbodies, water quality and hydrological processes

Potential Impacts on Surface Water

The objectives of the Project water management system would be to (WRM 2022):

- Protect the integrity of regional and local water resources, including Moolarben Creek and Murdering Creek
- Separate runoff from areas undisturbed by mining and water generated from active mining areas, where reasonable and feasible
- Design and manage the water management system to operate reliably in all seasonal conditions, including both extended wet and dry periods, throughout the life of the Project
- Provide sufficient water supply for Project requirements (e.g. dust suppression).

The catchment area captured within the Project water management system would change as the mine advances and open cut pits are progressively backfilled. The shallow depth of mining facilitates rapid backfilling of open cut pits, which in turn reduces the total catchment excised by the Project at any point in time. WRM (2022) concludes that the loss of catchment flows in Moolarben Creek and Goulburn River would be indiscernible and, therefore, the potential impact on flows in Moolarben Creek and Goulburn River due to the excision of catchment from Project operations is considered negligible. At the completion of mining, the open cut pits would be backfilled and rehabilitated to a free-draining landform. Accordingly, there would be no loss of catchment post-mining (WRM 2022).

The results of the water balance modelling by WRM (2022) indicate that there would be no uncontrolled spills of mine-affected water from the Project to the receiving environment. An overflow would only occur during an extreme rainfall event which would also generate significant

volumes of runoff from the surrounding undisturbed catchment, as well as in the receiving waterways. Accordingly, mine water dam overflows (if they were to occur) would not have a measurable impact on receiving water quality (WRM 2022).

During operations, progressive rehabilitation of the waste rock emplacements would minimise the potential generation of sediment. Environmental risks from disturbed area runoff are expected to be low. In rainfall events below the design standard, runoff from disturbed areas would be intercepted by sediment dams. In larger events that exceed the design standards, these dams may overflow following a period of settlement (WRM 2022). WRM (2022) concludes that overflows from the proposed sediment dams would have a negligible impact on Moolarben Creek water quality.

Baseflow to the streams in the vicinity of the Project may be reduced as mining draws down the water table, influencing the magnitude and direction of surface water-groundwater exchange. The modelled base case scenario's predicted reduction in baseflow to the Moolarben Creek and its tributaries due to the Project is 2.8 megalitres per year (ML/year) at the end of mining. Baseflow to the Moolarben Creek has been estimated to be 180 – 225 ML/year during times of drought and groundwater baseflow contributions increasing up to 600 ML/year or higher during wetter years. The maximum predicted reduction of approximately 3 ML/year represents a net reduction of 1.5% of the estimated baseflows to Moolarben Creek during dry periods, which is considered negligible (AGE 2022).

Potential Impacts on Groundwater Dependent Vegetation

The BDAR has been revised to include additional information to inform nature, extent and duration of short and long-term impacts to GDEs and TECs as a result of the Project.

The Groundwater Dependent Ecosystem Assessment (MCO 2022d) identified likely GDEs in the vicinity of the Project that correspond with PCTs 281 and 1711, and areas of the Box-Gum Woodland TEC.

Nature of Impacts

Large areas of the Project area are currently unsaturated, limiting the potential for impacts associated with changes in groundwater levels. Existing monitoring bores in areas previously unaffected by mining operations indicate variations in groundwater levels of around 5 m due to climatic variations (AGE, 2022).

The progressive open cut mining is predicted to result in limited drawdown beyond the mine footprint, particularly given the relatively shallow open cuts would be rapidly backfilled, which would restore pre-mining hydraulic gradients and allow water levels to recover (AGE, 2024).

In addition, the Project proposes no residual final voids in the final landform. This is an improvement relative to the currently approved Moolarben Coal Complex (i.e. the Project would reduce the number of voids from 1 to 0 in the final landform).

Extent of Impacts

Approximately 6 ha of potential GDEs are predicted to experience greater than 2 m drawdown for the amended Project (AGE, 2024). The drawdowns predicted at the potential GDEs (i.e. a maximum of around 6 m) are similar to the natural variations observed at monitoring bores across the Project area.

The maximum predicted drawdown occurs in a single area along Moolarben Creek, where the groundwater level is approximately 10 m below the surface, and where the groundwater is simulated to occur below the quaternary alluvium in the Ulan Seam (AGE, 2024).

In addition, the potential GDEs located within the predicted maximum 2 m drawdown extent for the amended Project are located along the major surface water drainage lines, which are predicted to experience negligible change in baseflow and stream flows, for example due to the 200 m minimum setback on either side of these major drainage lines from open cut operations (AGE, 2024). Therefore, the terrestrial vegetation will continue to receive any surface flow contributions.

Duration of Impacts

Generally, groundwater levels across the Project area are predicted to experience minor (i.e. <2 m) drawdown at the potential GDEs, which would likely be indiscernible from natural variations (AGE, 2024).

The maximum predicted drawdown of 6 m at the single area of potential GDE adjacent to Moolarben Creek is predicted to occur for approximately 30-40 years, based on the predictions of the groundwater model (AGE, 2024). It is noted the groundwater model considers only average rainfall recharge, indicating that recharge could occur more quickly following large rainfall/streamflow events. Following recovery, groundwater levels return to pre-mining levels at this location.

Short-term Impacts

Given the rapid backfill of the relatively shallow open cuts, limited extent of drawdown at potential GDEs, that the groundwater level is approximately 10 m below the surface at the area of maximum drawdown at an area of potential GDEs, and the natural variability in groundwater levels (AGE, 2024), no significant impacts to GDEs is predicted in short-term.

Long-term Impacts

In the long-term groundwater levels are predicted to recover to pre-mining levels (AGE, 2024), meaning no significant impacts to GDEs are predicted in the long-term.

Monitoring and Management

Groundwater and surface water monitoring is proposed for the Project, which would be documented in a new or updated Water Management Plan. In addition, the majority of the 6 ha of

potential GDEs where greater than 2 m drawdown is predicted is located within the Project Habitat Enhancement Area, which would be subject to ongoing vegetation management and revegetation.

5.3.6 Vehicle strikes

Project mining operations, including associated mobile equipment movements, would be conducted 24 hours per day, seven days per week consistent with the currently approved operations for the Moolarben Coal Complex.

All employees, contractors and deliveries would access the site from the existing main site access for Stage 1 via Ulan-Wollar Road. Workers and delivered materials would then be transported to the site via internal roads. There may be continued use of ancillary site accesses from local roads for environmental monitoring, general land management, exploration activities and other ancillary activities.

The Project would involve the progressive development of unsealed internal haul roads between the open cut pits, waste emplacement areas and ROM pad. Internal access roads for light vehicles would also be constructed progressively within the Project mining area as required. Risk of vehicle strike varies among species credit species found within the Development Footprint as a result of differences in mobility and life history traits. All species are at greater risk of vehicle strike during spring and summer when they are more active.

Risk of vehicle strike for the Broad-headed Snake is highest in summer during its most active period, however the impact of individual mortality through incidents like vehicle strike is considered a lower risk to the long-term persistence of the species than destruction of their habitat (Webb and Shine 1997b). Pink-tailed Legless Lizard risk of vehicle strike is low outside of direct interaction with rocky habitat however the species has been recorded along roads in some instances (Wong *et al*. 2011). Its movement tends to occur more after rainfall and during the day, but similar to the Broad-headed Snake this species is more at long-term risk from removal of its habitat than from individuals lost through interaction with vehicles.

The Squirrel Glider travels between trees within a distance of 50-100 m and is active at night. Vehicle strike is a listed threat for the species (DPE 2023e), however potential loss may be reduced significantly through the use of crossing structures for the species (DPE 2023h).

The Koala has the highest risk of interaction with vehicles during construction and operation of the Project. The Koala is highly mobile, occurs in low densities and has been documented with a home range of several hundred hectares (OEH 2018d), therefore mortality of individuals can impact the local population. It utilises open ground to travel between woodland habitat and has been documented crossing roads and large areas of open grassland (Goldingay and Dobner 2014; White 1999). Risk of vehicle strike is particularly high during their breeding season in September-February when they are most active. Mitigation measures listed in Table 28 would be employed to manage the potential for vehicle strike on threatened fauna, with enforcement of speed limits on the site and training of personnel (contractors, visitors, and other representatives) on site.

The risk of vehicle strike to Eastern Cave Bat and Large-eared Pied Bat is low due to their small size and mobility, however operation of machinery around forested areas within 2 km of cave habitat does pose a minor risk in their active breeding period (spring and summer) (Williams and Tomson 2018). This is a low risk compared with direct impact to breeding habitat (Hoye 2005). Table 27 lists the threatened entities, likelihood and consequences if these entities are to be impacted through vehicle strike.

Table 27. Residual prescribed impacts – vehicle strikes.

Threatened fauna or protected fauna that are part of a TEC that are at risk of vehicle strike (identified in Section 3.7)	SAII entity	Likelihood of vehicle strike considering mobility, abundance range and other relevant lifecycle factors	Estimated vehicle strike rates	Consequences
Threatened fauna or animals that are part of a TEC	No	Moderate	Similar to current levels	Injury or mortality of fauna which is part of a TEC. Unlikely to lead to a decline in the local population.
Threatened reptile: Pink-tailed Legless Lizard	No	Low (mainly restricted to native grassland and woodland areas with rocky outcrops, scattered or partially buried rocks, or tussock grasses)	Similar to current levels	Injury or mortality of individuals. Unlikely to lead to a decline in the local population.
Threatened reptile: Broad-headed Snake	Yes	Low (mainly restricted to rocky areas/cliffs/caves and crevices and forested/wooded areas)	Similar to current levels	Injury or mortality of individuals. Unlikely to lead to a decline in the local population.
Threatened bird: Regent Honeyeater	Yes	Low	Similar to current levels	Injury or mortality of individuals. Unlikely to lead to a decline in the local population.
Threatened mammal: Squirrel Glider	No	Low	Similar to current levels	Injury or mortality of individuals. Unlikely to lead to a decline in the local population.
Threatened mammal: Koala	No	Moderate	Higher than current levels	Injury or mortality of individuals could lead to a decline in the local population.
Threatened bats: Eastern Cave Bat, Large-eared Pied Bat	Yes	Low	Similar to current levels	Injury or mortality of individuals possible at night. Unlikely to lead to a decline in the local population.

5.4 Cumulative impacts

Cumulative impacts are considered to be the total impact that would result from the incremental impacts of the Project in addition to past, present and reasonably foreseeable planned developments that may interact with Project impacts.

Key proposed or approved projects in the area include:

- The existing approved Moolarben Coal Complex
- Ulan Mine Complex, operated by Ulan Coal Mines Limited
- Wilpinjong Coal Mine, operated by Wilpinjong Coal Pty Ltd
- Bowdens Silver Project, a proposed silver, lead and zinc mine approximately 25 km south of the Project (currently under assessment)
- A number of solar and wind renewable projects in the wider region associated with the Central West Orana Renewable Energy Zone.

The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining-related infrastructure (including coal processing and transport facilities) (Figure 2). Stage 1 of the Moolarben Coal Complex comprises open cut operations in OC1, OC2 and OC3, underground operations in UG4 and coal processing and transport facilities. Stage 2 of the Moolarben Coal Complex comprises open cut operations in OC4 and underground operations in UG1 and UG2.

The approved Moolarben Coal Complex includes approximately 2,940 ha of approved disturbance. MCO currently manage approximately 7,000 ha of biodiversity offset areas (MCO 2022c) established to offset impacts related to the development and maintain long-term environmental benefit.

Known approved impact areas of native vegetation for the following key mining projects in close vicinity to the Project are as follows:

- Ulan Mine Complex – 411 ha (DPE 2022b)
- Wilpinjong Extension Project – 354 ha (Hunter Eco 2015)
- Bowdens Silver Project - 382 ha (Envirokey 2020)
- Central-West Orana Renewable Energy Zone (REZ) Transmission project – 1,031 ha (WSP 2023a).

Biodiversity offsets established for Wilpinjong Coal Mine are in the order of three times the area of land impacted (1,385 ha; Hunter Eco 2015). Biodiversity offsets for the Bowdens Silver Project are a total of 721 ha (Envirokey 2020) which accounts for just less than double the area of land impacted, and 1,697 ha of offsets have been established for the Ulan Mine Complex (DPE 2022b) which accounts for four times the area of land impacted. Areas of offset have yet to be established for central-West Orana REZ, however they are expected to offset 21,434 ecosystem credits and 52,089 species credits (WSP 2023b).

Although the Project would add to the cumulative impacts from other major developments in the locality, including the Moolarben Coal Complex, it would also add to the cumulative area of land

conserved for biodiversity in the form of offset areas. MCO currently manages land within a number of biodiversity offset areas established to offset impacts related to the approved Moolarben Coal Complex.

5.5 Munghorn Gap Nature Reserve

The Munghorn Gap Nature Reserve consists of expansive patches of bushland that provide important habitat, connectivity, and protection to threatened biodiversity across the region (Figure 4). The Nature Reserve is 5,935 ha in size (NPWS 2003).

Four threatened flora species and 29 threatened fauna species have been recorded within the Nature Reserve (DPE 2023a). Threatened flora includes *Eucalyptus cannonii*, *Pultenaea glabra, Acacia ausfeldii* and *Ozothamnus tesselatus.* Threatened fauna includes the following species: Broad-headed Snake, Koala and Large-eared Pied Bat, plus hollow-dependent birds, owls and mammals (Gang-gang Cockatoo, South-eastern Glossy Black-cockatoo, Little Lorikeet, Turquoise Parrot, Powerful Owl, Masked Owl, Greater Glider and Large Bent-winged Bat); raptors (Little Eagle, Square-tailed Kite and Black Falcon); and woodland birds (Regent Honeyeater, White-throated Needletail, Swift Parrot, Brown Treecreeper [eastern subspecies], Speckled Warbler, White-fronted Chat, Painted Honeyeater, Black-chinned Honeyeater, Grey-crowned Babbler, Varied Sitella, Dusky Woodswallow, Hooded Robin [south-eastern form], Scarlet Robin, Flame Robin and Diamond Firetail).

The *Developments Adjacent to NPWS Lands: Guidelines for Consent and Planning Authorities* (NPWS 2022b) has been considered in this assessment.

There would be a minimum of 100 m from the edge of any open cut pit to the boundary of the Nature Reserve. The Development Footprint is at least 100 m from the boundary of the Nature Reserve (a buffer of which is vegetated) and ranges from 100 to 300 m from the Nature Reserve within the east and south of the Project (Stage 2 and 3). The buffer between Stage 1 area and the Nature Reserve is about 450 m.

No construction activity would occur on NPWS estate. The risk of accidental damage to adjacent habitat or vegetation due to the Project operations would be managed through a Vegetation Clearance Protocol and a ground disturbance procedure to avoid accidental clearance of vegetation to be retained and avoid accidental clearance of vegetation to be retained.

Areas disturbed by mining would be progressively rehabilitated and revegetated following completion of active mining operations (Figure 19b). Following rehabilitation and revegetation of the final landform, a greater vegetated woodland buffer would occur along the boundary outside of the Nature Reserve compared to what currently exists.

As described in Section 5.2.2, created habitat edges (and potential edge effects on the habitat) would exist temporarily during construction and operation until the cleared areas are revegetated. Edge effects on the Munghorn Gap Nature Reserve are likely to be minimal given the Development Footprint is at least 100 m from the boundary and control of invasive species (weeds and animal pests) would occur in areas adjacent to the Development Footprint. Further, a Noisy Miner

monitoring and management program would be implemented to manage Noisy Miners (an aggressive bird species). MCO would continue to participate in co-ordinating strategic pest management programs in consultation with NPWS as described in NPWS (2022b).

Potential impacts from noise and blasting are described in Section 5.2.3. Impacts on fauna species are likely to be localised and restricted to habitat immediately adjacent to the Development Footprint. To minimise the potential impacts from blasting and vibration, MCO would implement measures and reduce blasting criterion (as detailed in Section 4.2). Accordingly, sensitive geological features located further from blasting than the mapped rocky habitat (e.g. deeper into the Munghorn Gap Nature Reserve) would be expected to experience limited to no vibration as a result of this limit.

Potential impacts from artificial lighting are described in Section 5.2.4. For stationary work lights and fixed/permanent lights, the Project would include the use of directional lighting (shielded fittings that direct and confine the spread of light to only the area intended area to be lit or similar) and would implement warm-white bulbs, where practicable. As such, indirect artificial lighting impacts on the Nature Reserve are likely to be minimal, localised and short-term (limited to the duration/direction of the artificial lighting).

Potential impacts on air quality are described in Section 5.2.5. Any potential impacts from dust are likely to be localised and short term (limited to the duration of construction and operation).

As described in Section 5.3.5, the Project is unlikely to impact on water-dependent assets in the Nature Reserve (including vegetation mapped as high-priority GDEs) as these are not connected to the regional groundwater system, as evidenced by AGE (2022). The Nature Reserve occurs upslope of the Project and therefore no surface water impacts are likely to occur (no risk of erosion, movement of sediment or runoff into the Nature Reserve).

To avoid inadvertent impacts on *Pomaderris cotoneaster* a fence would be erected between the known plants and the adjacent Development Footprint. Any fencing along the Nature Reserve Boundary would be in accordance with the NPWS (2020) *Boundary Fencing Policy (updated 2020).*

As described in Section 5.2.16, the Project is unlikely to increase fire risk. Bushfire risk would continue to be managed in accordance with the MCC Bushfire Management Plan. Mitigation measures that would be implemented by MCO to reduce bushfire risk would focus on education and training, reducing bushfire hazard, minimising and controlling ignition sources and developing appropriate responses and evacuation strategies.

5.6 State Environmental Planning Policy (Biodiversity and Conservation) 2021

The *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (Biodiversity and Conservation SEPP) began on 1 March 2022 and consolidates, transfers and repeals provisions of various SEPPs in NSW, including the Koala Habitat Protection SEPP (2020 and 2021). The provisions within the repealed SEPPs have been transferred to the new SEPP.

The land associated with the Development Footprint is zoned RU1 Rural. Chapter 3 of the Biodiversity and Conservation SEPP (Koala Habitat Protection 2020) applies for all RU1, RU2 and RU3 zoned land outside of the Sydney Metropolitan Area and some Local Government Areas (LGAs) of the Central Coast.

The Mudgee LGA is included in the Northwest Slopes Koala Management Area (KMA). Schedule 3 of the Biodiversity and Conservation SEPP lists Koala use tree species for each KMA.

Figure 16 and Figure 17g shows the location of Koalas recently recorded by AMBS (2023) during surveys and Koala habitat identified in the Development Footprint. Koala 'use tree species' listed in Schedule 2 of the Koala Habitat Protection SEPP for the Northwest Slopes KMA, and the nearby bordering Central Coast and Central and Southern Tablelands KMAs include (AMBS 2023) (Appendix C):

- White Box (*Eucalyptus albens*)
- Rough-barked Apple (*Angophora floribunda*)
- Narrow-leaved Ironbark (*Eucalyptus crebra*)
- Broad-leaved Ironbark (*Eucalyptus fibrosa*)
- Grey Gum (*Eucalyptus punctata*)
- Blakely's Red Gum (*Eucalyptus blakelyi*)
- Yellow Box (*Eucalyptus melliodora*)
- Grey Box (*Eucalyptus moluccana*)
- Narrow-leaved Stringybark (*Eucalyptus sparsifolia*)
- Beyer's Ironbark (*Eucalyptus beyeriana*)
- Mugga Ironbark (*Eucalyptus sideroxylon*).

The Development Footprint is therefore classified as 'core koala habitat' as per the SEPP. Development controls within the Biodiversity and Conservation SEPP do not apply to Part 4 development applications (such as the Project) which are determined by a consent authority other than a local council.

Potential direct and indirect impacts on the Koala are assessed in Section 5. The Project would result in the progressive disturbance of habitat and risk to individual Koalas present in clearance areas. However, the Project would also result in progressive revegetation of the vegetation cleared (specifically riparian vegetation along creeks to maintain natural biodiversity corridors) and offsets in accordance with the NSW Biodiversity Offsets Scheme. Given these factors, the Project is unlikely to lead to a decline in the viability of the local Koala population in the medium to long-term.

A number of measures have been adopted to avoid and minimise clearance as described in Section 4. Mitigation measures relevant to this species are outlined in Table 28 and include the following:

- Vegetation Clearance Protocol
- Progressive revegetation of disturbed areas (mine rehabilitation) and riparian corridors with species characteristic of the surrounding vegetation

- Management of animal pests within and adjacent to the Development Footprint
- Bushfire prevention and control measures
- Vehicle speed limits and personnel training.

5.7 Mitigating residual impacts – management measures and implementation

Section 8.4 of the BAM (DPIE 2020a) requires a BDAR to describe measures to mitigate and manage residual impacts following impact avoidance and minimisation measures. Existing measures to mitigate and manage residual impacts are presented in Table 28.

MCO is the responsible party for all mitigation measures.

5.7.1 Management Plans

MCO currently has a number of existing management strategies and plans associated with the existing Moolarben Coal Complex which include:

- *Landscape Management Plan* (MCO 2013)
- *Environmental Management Strategy* (MCO 2020b)
- *Biodiversity Management Plan* (BMP) (MCO 2020c)
- *Rehabilitation Management Plan* (RMP) (MCO 2022c)
- *Blast Management Plan (*MCO 2020d*)*.

MCO would review and where relevant, revise the approved BMP at the Moolarben Coal Complex to include the Project, or a new BMP would be prepared for the Project (subject to the conditions of any Development Consent for the Project).

MCO would review and where relevant, revise the RMP at the Moolarben Coal Complex to include the Project, or a new RMP would be prepared for the Project (subject to the conditions of any Development Consent for the Project) (including rehabilitation measures) in consultation with the relevant government agencies, and in accordance with the relevant rehabilitation and mine closure guidelines.

The Project disturbance areas would be progressively rehabilitated throughout the life of the Project.

The Project includes the establishment of a Habitat Enhancement Area to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened ecological communities and threatened species habitat (Figure 19b). Habitat Enhancement Area has the following values:

- Approximately 50.9 ha of woodland, comprising 32.6 ha of Box Gum Woodland CEEC listed under the BC Act and EPBC Act
- Approximately 75.5 ha of DNG, comprising 75.5 ha of Box Gum Woodland CEEC listed under the BC Act and EPBC Act
- Approximately 59.2 ha of currently cleared land that would be subject to revegetation.
- Habitat for threatened species, including:

  - Approximately 51.3 ha of foraging habitat for the Eastern Cave Bat and Large-eared Pied Bat, of which approximately 20.4 ha is within 100 m of rocky habitat
  - Approximately 52 ha of mapped important habitat for the Regent Honeyeater
  - Approximately 20.4 ha of habitat within 100 m of rocky habitat for the Broad-headed Snake
- Records of the Squirrel Glider and Large-eared Pied Bat, as well as potential habitat for species recorded in the surrounds (e.g. Pink-tailed Legless Lizard and Koala)
- Opportunity to expand and improve connectivity of the riparian vegetation along Moolarben Creek and Murdering Creek.

5.7.2 Monitoring Programs

The following monitoring programs relevant to terrestrial biodiversity would be developed and implemented for the Project:

- Weed monitoring
- Animal pest monitoring
- Mine site rehabilitation monitoring
- Monitoring of revegetation in the Habitat Enhancement Area
- *Pomaderris cotoneaster* monitoring
- Regent Honeyeater monitoring
- Large-eared Pied Bat and Eastern Cave Bat monitoring
- Monitoring of select representative rocky habitat features.

These are described below.

Weed Monitoring

During construction and operations visual inspections to identify high threat weed infestations in disturbance/rehabilitation areas would be undertaken.

Animal Pest Monitoring

During construction and operation visual inspections to identify pest animals in disturbance/rehabilitation areas would be undertaken.

Mine Site Rehabilitation Monitoring

In areas undergoing revegetation on the final landform, annual inspection of vegetation growth would be undertaken as part of the Rehabilitation Monitoring Program to evaluate the need for supplementary seeding/plantings.

Monitoring of Revegetation in the Habitat Enhancement Area

In areas undergoing revegetation within the Habitat Enhancement Area, inspections of revegetation areas would be undertaken to evaluate the need for supplementary seeding/plantings.

Pomaderris cotoneaster Monitoring

Monitoring the *Pomaderris cotoneaster* population adjacent to the Development Footprint for a 2-year period following adjacent clearing to confirm the population persists and is not impacted by mining.

Regent Honeyeater Monitoring

Annual inspections of the south-east corner of the Study Area (within 1 km from the closest record on Figure 17f) would occur each breeding season (July-January) to search for the Regent Honeyeater to confirm if the species breeds in that location and, if it does, evaluate if there are additional measures that could be implemented to improve breeding success in that location. MCO would implement measures to minimise blasting impacts on trees while in use for Regent Honeyeater breeding season.

Large-eared Pied Bat and Eastern Cave Bat Monitoring

A monitoring program for Large-eared Pied Bat and Eastern Cave Bat would be implemented. This would involve targeted surveys and monitoring of select caves.

Rocky Habitat Monitoring

MCO would implement the following monitoring measures to manage potential blast vibration impacts to mapped rocky habitat:

- Continuation of existing vibration monitoring as described in the Blast Management Plan (MCO 2020d), and implementation of additional vibration monitoring at one or more new representative sites of mapped rocky habitat adjacent to the Project
- Ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary and
- Visual inspections of key representative mapped rocky habitat on a 6-monthly basis to confirm that the target outcome continues to be achieved.

Table 28. Summary of proposed mitigation and management measures for residual impacts (direct, indirect and prescribed).

#	Mitigation measure	Method/technique	Timing	Frequency	Likely efficacy	Risk of failure	Consequence of failure of measure
1	Vegetation Clearance Protocol	The Vegetation Clearance Protocol for the Project would include, but not be limited to: • mine staff and contractors involved in vegetation clearance works would be made aware of clearing limits via the ground disturbance process • clear delineation of the areas to be disturbed prior to clearing activities, disturbance boundaries would be digitally captured and displayed within the site survey and GIS databases. This data would be made available either digitally or in map format. Where native vegetation clearing is to be carried out on a campaign basis, then prior to each clearing campaign the area to be cleared would be identified and marked • pre-clearance fauna surveys would be undertaken by a suitably trained and qualified ecologist or wildlife handler to: ▪ locate potential habitat features within proposed disturbance areas (such as hollows [e.g. habitat for threatened woodland birds, owls, arboreal mammals and bats]) that may require special management during clearing ▪ identify habitat features (such as hollows [e.g. habitat for threatened woodland birds, owls, arboreal mammals and bats]	Prior to and during vegetation clearing	As required during construction and operation	High	Low	Mortality of individual animals as a result of improper technique during clearing or improper handling and relocation.

#	Mitigation measure	Method/technique	Timing	Frequency	Likely efficacy	Risk of failure	Consequence of failure of measure
		and bushrock) that can be salvaged (where practicable) for reuse in rehabilitation areas or in adjoining non-disturbed native vegetation areas ▪ identify trees with actively nesting threatened birds ▪ search for threatened species within areas of suitable habitat including the: Pink-tailed Legless Lizard, Broad-headed Snake, Koala, and Regent Honeyeater • a suitably trained and qualified ecologist or wildlife handler would be present during the clearing of identified habitat trees to manage animals that may be encountered during land clearing • options to minimise harm to fauna by modifying the clearance method may include shaking or nudging tree trunks to evacuate mobile fauna or lowering trees with suspected tree hollows being used by fauna with the hollow facing upwards to enable fauna to exit • management of the Koala in consideration of the *Code of Practice for Injured, Sick and Orphaned Koalas* (DPE 2023k) • management of fauna may include relocating the individual to adjacent habitat or treating injuries as required.					
2	Mine rehabilitation - revegetation	Areas disturbed by the Project would be progressively rehabilitated and revegetated. All mining-related infrastructure would be decommissioned when	During operations and rehabilitation	Ongoing during	High. Risk is reduced by	Low	Risk of bare ground and, therefore, dust or erosion, long-term

#	Mitigation measure	Method/technique	Timing	Frequency	Likely efficacy	Risk of failure	Consequence of failure of measure
		redundant and removed, unless needed to support future post-mining land uses (in consultation with relevant stakeholders). Approximately 535 ha of native woodland and 140 ha of native grassland with scattered trees (suitable for agricultural use) is proposed to be established as part of the conceptual post-mining land use for the Project.		operations and closure	progressive ongoing approach to revegetation.		impacts to threatened species habitat.
3	Mine rehabilitation - surface rock trial site	Development of a surface rock trial site to assess if introducing new surface rock during mine rehabilitation can restore rocky habitat for the Pink-tailed Legless Lizard.	During rehabilitation	Ongoing during rehabilitation	High	Low	No additional habitat for Pink-tailed Legless Lizard after clearance and continued decline in local population.
4	Habitat Enhancement Area	The proposed Habitat Enhancement Area includes the riparian zone along Moolarben and Murdering Creeks (outside of the Development Footprint) and is shown on Figure 19b. Management measures would include: • Revegetation • Fencing, as required • Weed management • Animal pest management • Fire management.	Within the first year of commencement of mining and ongoing throughout Project operations	Throughout the duration of construction and operations	High	Low	Areas continue to provide current level of habitat value, possible increase in impacts from pest animals such as predation.
5	Weed and pathogen management	Weed and pathogen management for the Project with a focus on vehicle/machinery hygiene control to prevent spread of weeds and pathogens, as well as physical and/or chemical weed removal/control.	Within the first year of commencement of mining and ongoing throughout Project operations	Throughout the duration of construction operations	High	Low	Decrease in quality of habitat for threatened species.

#	Mitigation measure	Method/technique	Timing	Frequency	Likely efficacy	Risk of failure	Consequence of failure of measure
6	Animal pest management	Pest animal control for the Project with a focus on pest species known to impact native flora and fauna, specifically feral cat, wild dog, feral pig, feral goat, wild rabbit, red fox, fallow deer and feral birds.	Within the first year of commencement of mining and ongoing throughout Project operations	Throughout the duration of construction operations	High	Low	Increased risk of risk of predation and competition.
7	Noisy Miner monitoring and management program	Development of a Noisy Miner monitoring and management program for the Project prior to and during Regent Honeyeater breeding season (June to January).	Ongoing throughout Project timeframe	Monthly from July to January	High	Low	Potential for Noisy Miners to displace woodland birds from adjacent habitat
8	Bushfire management	Mitigation measures that would be implemented by MCO to manage and reduce bushfire risk would focus on education and training, annually assessing the bushfire hazards, minimising and controlling ignition sources (e.g. by appropriate engineering design, where relevant) and revising existing responses and evacuation strategies to include the Project area.	Annual assessment of bushfire hazards	Throughout the duration of construction and operations	High	Moderate	Destruction of habitat in the event of intense wildfire.
9	Fencing of *Pomaderris cotoneaster*	Erecting a fence between the known plants and the Development Footprint. Any fencing along the Nature Reserve Boundary would be in accordance with the NPWS (2020) *Boundary Fencing Policy (updated 2020).*	Prior to disturbance in the immediate area	Once	High	Low	Loss of individual plants through trampling or vehicle access
10	Minimise light spill	Any permanent lighting to be directed into the site to minimise illuminating adjacent woodland areas in the Munghorn Gap Nature Reserve, as far as practicable. Directional lighting and warm-white bulbs to be used where practicable.	Pre-construction and during operational phases	Throughout the duration of construction and operations	High	Low	Impact fauna individuals (particularly nocturnal species) through disrupting routine activities such

#	Mitigation measure	Method/technique	Timing	Frequency	Likely efficacy	Risk of failure	Consequence of failure of measure
							as foraging behaviour.
11	Vehicle speeds	Speed limits would be imposed on all vehicles using internal mine roads and access tracks, and training of personnel (contractors, visitors, and other representatives).	During operations	Throughout the duration of construction and operations	High	Low	Mortality of individual animals through vehicle strike
12	Blasting criteria	In order to minimise the potential for indirect blast vibration impacts (that may constitute prescribed impacts), MCO would adjust blast designs during Project operations to comply with a conservative vibration limit of 50 mm/s at the nearest mapped rocky habitat (safe design 5% exceedance level PPV limit). If a Regent Honeyeater breeding tree is confirmed, MCO would implement measures to minimise blasting impacts on trees while in use for Regent Honeyeater breeding.	During operations	During blasting	High	Moderate	Loss of Large-eared Pied Bat or Eastern Cave Bat roost sites due to blasting vibrations. Disruption of Regent Honeyeater breeding.

6 Stage 2 - Impact Assessment - Serious and Irreversible Impacts

The concept of assessing serious and irreversible impacts (SAII) is about protecting threatened entities that are most at risk of extinction from development (DPIE 2019a).

An impact is to be regarded as serious and irreversible if it is likely to contribute significantly to the risk of a threatened species (including endangered populations) or ecological community becoming extinct based on four principles, as set out in clause 6.7 of the *Biodiversity Conservation Regulation 2017* and the 'Guidance to assist a decisionmaker to determine a serious and irreversible impact' (DPIE 2019a):

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

The NSW DCCEEW has prepared a list of entities that it has determined as likely to be at risk of serious and irreversible impact. Based on the result of the field surveys, candidate species assessment and analysis against prescribed impacts, the following threatened entities at risk of an SAII (DPE 2023a) as relevant to the Project, the entities at risk of an SAII are listed in Table 29.

Table 29. Entities at risk of an SAII (DPE 2023a)

Common name	Scientific name
White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland Critically Endangered Ecological Community (CEEC)	N/A
Broad-headed Snake	*Hoplocephalus bungaroides*
Swift Parrot	*Lathamus discolor*
Regent Honeyeater	*Anthochaera phrygia*
Large-eared Pied Bat	*Chalinolobus dwyeri*
Eastern Cave Bat	*Vespadelus troughtoni*

To assist the decision-maker to evaluate the extent and severity of the impact on entities at risk of an SAII, Appendix F provides a detailed assessment against criteria as outlined in Section 9.1 of the

BAM (DPIE 2020a) and Appendix B of *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE 2019a).

Avoidance and minimisation measures designed specifically for reducing impacts to entities at risk of an SAII are outlined below.

6.1 White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland (Box-Gum Woodland CEEC)

6.1.1 Description

This ecological community can occur as either a woodland or derived native grassland (DNG). It has a ground layer of native tussock grasses and herbs, and a sparse, scattered shrub layer. White box (*Eucalyptus albens*), Yellow Box (*E. mellidora*) or Blakely's Red Gum (*E. blakelyi*) dominate the ecological community where a tree layer still occurs. Other species of eucalypts including Apple Box (*E. bridgesiana*), Red Stringybark (*E. macrorhyncha*), Brittle Gum (*E. mannifera*) and Candlebark (*E. rubida*) are also associated with the community (DEH 2006).

6.1.2 Condition of the community within the Development Footprint

PCTs which conform to the description of the CEEC within the Study Area are PCT 266, 281 and 483. The condition of these vegetation communities within the Study Area ranges from high condition (VI score of >80, woodland forms of the community) to moderate condition (VI scores around 30-40, DNG forms of the community). Composition, structure and function scores are provided in Table 9. The area of each PCT impacted by the Project and current VI scores are provided in the Table 30 below.

Table 30. Area and condition of PCTs aligning with Box-Gum Woodland CEEC within the Development Footprint.

PCT name	Condition	VI score	Impact area (ha)
PCT 266 White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	Woodland in High Condition	88.1	6.7
PCT 266	Scattered Trees	67.2	0.6
PCT 266	Derived Native Grassland	39.8	28.0
Sub-total PCT 266			35.3
PCT 281 Rough-Barked Apple - Red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Woodland in High condition	90.4	25.3
PCT 281	Scattered Trees	84.4	1.58

PCT name	Condition	VI score	Impact area (ha)
PCT 281	Derived Native Grassland (high)	33.3	203.3
PCT 281	Derived Native Grassland (low)	32.7	135.6
Sub-total PCT 281			365.78
PCT 483 Grey Box - White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	Woodland in High condition	83.4	0.04
TOTAL			**401.12**

The Project would result in the removal of 401.12 ha of Box-Gum Woodland CEEC, comprising 34.22 ha of woodland and 366.9 ha of DNG (Figure 20).

6.1.3 Actions to avoid, minimise and mitigate direct and indirect impacts

Actions to avoid and minimise direct and indirect impacts are detailed in Section 4.1 (alternatives), Section 4.2 (TEC), Section 4.4.2 (connectivity), Section 4.4.3 (hydrology), Section 4.5 (direct and indirect avoidance), Section 5.1.2, Section 5.2 and Section 8.4.1.

In summary, impacts to Box-Gum Woodland CEEC have been avoided through Project design by:

- Preferentially locating disturbance in areas lacking Box-Gum Woodland CEEC (e.g. Category 1 – exempt land) or where the vegetation/habitat is in the poorest condition (e.g. low quality DNG).
- Avoiding open cut mining within 200 m of Moolarben Creek and Murdering Creek (which have a riparian zone comprising Box-Gum Woodland CEEC).
- Minimising infrastructure within the riparian zone of Moolarben Creek and Murdering Creek and locating creek crossings (three haul road creek crossings are proposed) within previously cleared areas as far as is feasible.
- Condensing the Development Footprint by locating infrastructure areas immediately adjacent to open cut mining areas.
- Progressively back-filling open cut pits to minimise the required disturbance extent (i.e. reducing the need for large out of-pit overburden emplacements) as far as practically possible, as well as removing pit voids from the final landform.
- Reducing the Development Footprint post initial EIS submission to further avoid impacts to Box-Gum Woodland CEEC, particularly the relatively high-quality woodland areas. The revised Development Footprint will result in a 59.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha) and a 6.8% reduction in the area of DNG impacted (from 393.53 ha to 366.9 ha). The total area of Box-Gum Woodland to be impacted has been reduced by 76.58 ha (15.9%). A large proportion (91.5%) of the Box-Gum Woodland mapped within the Development Footprint is represented as DNG.

- Clearly delineating the areas to be disturbed prior to clearing activities. Disturbance boundaries would be digitally captured and displayed within the site survey and GIS databases. This data would be made available either digitally or in map format. Where native vegetation clearing is to be carried out on a campaign basis, then prior to each clearing campaign the area to be cleared would be identified and marked.

As a result of the above, areas of Box-Gum Woodland CEEC along the riparian zones, in the north, south-west and south-east of the Study Area would be avoided by the Project (Figure 18b).

Measures to mitigate indirect impacts of the Project on retained and adjacent areas of the CEEC include weed and pest animal monitoring and management, as well as dust suppression. The conceptual final landform for the Project (Figure 19b) includes rehabilitation of 535 ha of the Development Footprint to native woodland, including 140 ha of native grassland with scattered tree species characteristic of Box-Gum Woodland CEEC. As per objectives of the National Recovery Plan for White Box–Yellow Box–Blakely's Red Gum Grassy Woodland and Derived Native Grassland (DECCW 2010), this will contribute to the goal of no net loss in the extent and condition of the ecological community throughout its geographic distribution; increasing transitional areas around remnants and linkages between remnants; increasing landscape function of the community through management and restoration of degraded sites.

In addition, the Habitat Enhancement Area (Figure 19b, described in Section 4.2) has been increased from the original 160 ha (Niche 2022) to 188 ha, including 53 ha of existing woodland and 135 ha of DNG and cleared land. The Habitat Enhancement Area is located within riparian zones along Moolarben Creek and Murdering Creek (outside of the Development Footprint) and is proposed to be revegetated and fenced, with weed, animal pest and fire management measures undertaken to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened species, threatened ecological communities and their habitat. Revegetation works associated with the Habitat Enhancement Area will commence during operations.

Residual impacts to Box-Gum Woodland CEEC include removal of 401.12 ha of Box-Gum Woodland within the Development Footprint, comprising 34.22 ha of woodland and 366.9 ha of DNG. Indirect impacts to remaining Box-Gum Woodland CEEC within the surrounds (e.g. weeds, pest animals, Noisy Miners and dust) are likely to be minimal due to proposed mitigation measures. Indirect impacts are assessed in detail in Section 5.2.

Further to the proposed minimisation measures, measures to mitigate impacts on the Box-Gum Woodland CEEC would be described in and updated or new Biodiversity Management Plan, including:

- a vegetation clearance protocol to avoid accidental clearance of vegetation to be retained;
- measures to control priority and environmental weeds within the disturbance, revegetation and rehabilitation areas in a manner that would not adversely impact on nearby Box-Gum Woodland CEEC;

- measures to be implemented during construction and operations to identify and monitor priority and environmental weed infestations in the disturbance, revegetation and rehabilitation areas;
- measures to be implemented during construction and operations to manage the potential for plant pathogens in the disturbance, revegetation and rehabilitation areas;
- measures to be implemented during construction and operations to manage dust;
- measures to be implemented within the Habitat Enhancement Area to enhance the Box-Gum Woodland CEEC (to be commenced within the first year of mining), including:
    - active revegetation (planting), including species characteristic of Box-Gum Woodland CEEC;
    - fencing to exclude livestock (as required); and
    - managing weeds, animal pests and bushfire risk within approximately 109 ha (approximately 33 ha of woodland and approximately 76 ha of DNG) of mapped Box-Gum Woodland CEEC.
- identification of plant species consistent with the Box-Gum Woodland CEEC that will be included in areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform;
- measures to monitor areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform to evaluate the need for supplementary seeding/plantings; and
- measures to reduce the risk of unplanned bushfire occurring with the Box-Gum Woodland CEEC.

This community has been assessed in accordance with the BAM (DPIE 2020a) and would be offset under the BC Act for the removal of 401.12 ha of this CEEC. A total of 9,610 credits would be provided (as per Table 40 for impacts to PCTs 266, 281 and 483).

6.2 Regent Honeyeater (*Anthochaera phrygia*)

6.2.1 Description

The Regent Honeyeater occurs along the inland slopes of south-east Australia in 'dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes with high bird abundance and diversity' (DPE 2022d). This generalist forager relies on eucalyptus nectar, mistletoe fruit and nectar, lerp, honeydew or insects (DPE 2023a). Nesting occurs in open cup-shaped nests on horizontal branches or forks in mature eucalypts (DPE 2023a).

6.2.2 Habitat Condition within Development Footprint

The Development Footprint includes 80.5 ha (species polygon) mapped on the Important Habitat Map for the Regent Honeyeater (AMBS 2023). For this reason, the species is assumed present and targeted threatened species surveys were not required (DPE 2023a). Nonetheless, avian surveys were undertaken for a total of 23.5 hours over 9 days at 66 locations within the timeframe specified by BAM-C (when Eucalyptus is flowering) and the species was not detected within the Development Footprint. Parts of the Important Habitat Mapping on the Development Footprint are considered

unsuitable habitat for the Regent Honeyeater because they are represented by exotic grassland (approximately 0.26 ha, removed from the impact area calculation) or Derived Native Grassland (approximately 10 ha, not removed from the impact area calculation), rather than woodland.

6.2.3 Actions to avoid, minimise and mitigate direct and indirect impacts

Actions to avoid and minimise direct and indirect impacts are detailed in Section 5.1 and Section 5.2.

Avoidance measures include:

- Important Habitat Mapping located around the periphery of the Development Footprint, including larger patches of remnant vegetation in the south-west of the Study Area, has been avoided and is to be retained outside the Development Footprint
- Important Habitat (DPE 2023g) mapped along Moolarben and Murdering Creeks will be retained (and enhanced through revegetation)
- The revised Development Footprint (Figure 18b) has significantly reduced the total area of native vegetation removal compared to the original design (Figure 18a), resulting in the avoidance of an additional 144.2 ha of native vegetation, including generally higher quality woodland areas. The amended Project design results in 56% reduction in disturbance of Regent Honeyeater Important Habitat Mapping compared to the Project EIS, from 184.41 ha to 80.5 ha.

Further to the proposed minimisation measures, measures to mitigate impacts on the Regent Honeyeater would be described in an updated or new Biodiversity Management Plan, including:

- a vegetation clearance protocol to avoid accidental clearance of vegetation to be retained;
- measures to be implemented to manage Noisy Miners prior to and during Regent Honeyeater breeding season;
- measures to be implemented within the Habitat Enhancement Area to manage and enhance Mapped Important Habitat for the Regent Honeyeater (to be commenced within the first year of mining), including:
    - active revegetation (planting);
    - non-barbed wire fencing to exclude livestock (as required); and
    - managing weeds, animal pests and bushfire risk within approximately 51 ha of mapped habitat.
- a program to monitor for signs of the Regent Honeyeaters in the breeding season;
- provision to evaluate methods to increase breeding success, if Regent Honeyeaters are found to be breeding at the site (including measures to minimise blasting impacts on trees while in use for Regent Honeyeater breeding);
- identification of suitable Eucalypt species which could provide foraging habitat for the Regent Honeyeater that will be included in areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform; and
- measures to monitor areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform to evaluate the need for supplementary seeding/plantings.

6.3 Swift Parrot (*Lathamus discolor*)

6.3.1 Description

The Swift Parrot occurs in woodlands and forests of New South Wales throughout the coastal and western slopes regions each year from May to August, where it feeds on eucalypt nectar, pollen and associated insects. Following winter, they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum (Saunders and Tzaros 2011).

According to the Saving Our Species (SOS) program, there are three Priority Management Sites for the Swift Parrot: Central Coast, Riverina and Tarcutta Hills (SOS n.d.). The distribution of Swift Parrots throughout NSW is largely unknown, however favoured winter flowering feed trees include *Eucalyptus robusta* (Swamp Mahogany), *Corymbia maculata* (Spotted Gum), *Corymbia gummifera* (Red Bloodwood), *Eucalyptus tereticornis* (Forest Red Gum), *Eucalyptus sideroxylon* (Mugga Ironbark) and White Box (DPE 2022d[4]).

6.3.2 Habitat Condition within the Development Footprint

No areas of habitat identified on the Swift Parrot Important Habitat Map occur within the Development Footprint. Targeted surveys were undertaken for a total of 23.5 hours over 9 days at 66 locations within the timeframe specified by BAM-C and the species was not detected within the Development Footprint. Despite not being recorded during targeted surveys, the species is considered to have potential to utilise foraging resources within the Development Footprint (AMBS 2023).

6.3.3 Actions to avoid, minimise and mitigate direct and indirect impacts

Actions to avoid and minimise direct and indirect impacts are detailed in Section 5.1 and Section 5.2. In summary, avoidance measures include:

- Refinement of the Project design to reduce impacts to native vegetation, flora and fauna habitat through locating infrastructure areas immediately adjacent to open cut mining areas and preferentially locating disturbance in Category 1 – exempt land or where the vegetation/habitat is in the poorest condition.
- Avoidance/minimisation of vegetation clearance within riparian habitat associated with Moolarben Creek and Murdering Creek to retain habitat and connectivity and minimise adverse impacts on hydrological processes.
- Avoidance of impact to foraging habitat including Box-Gum Woodland located around the periphery of the Development Footprint and some larger patches of remnant vegetation in the south-west of the Study Area. The revised Development Footprint will result in a 59.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha).
- Avoidance of disturbance within 100 m of the Munghorn Gap Nature Reserve where sightings have been recorded.

Further to the proposed minimisation measures, measures to mitigate impacts on the Swift Parrot would be described in an updated or new Biodiversity Management Plan, including:

- a vegetation clearance protocol to avoid accidental clearance of vegetation to be retained;
- identification of suitable Eucalypt species which could provide foraging habitat for the Swift Parrot that will be included in areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform; and
- measures to monitor areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform to evaluate the need for supplementary seeding/plantings.

6.4 Broad-headed Snake (*Hoplocephalus bungaroides*)

6.4.1 Description

The Broad-headed Snake is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250 km of Sydney (DPE 2023a). It occurs in three general areas within the Sydney Basin bioregion: Wollemi, Yengo & Capertee Uplands subregions including Wollemi, Yengo & Blue Mountains National Parks; Sydney Cataract subregion from southern Sydney to the Wollongong hinterland; Ettrema subregion in the Nowra hinterland. This nocturnal species feeds mostly on geckos and small skinks, with frogs and small mammals eaten occasionally. The Broad-headed Snake shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. As conditions warm up it shifts to using hollows in trees, often in sandstone gully forest just downslope from the outcrops. It averages six offspring, but females breed only every second or third year or less frequently. Males reach sexual maturity at about three years, females not until four or five years.

6.4.2 Habitat Condition within the Study Area

Rocky habitat suitable for the Broad-headed Snake occurs within the surrounding assessment area outside the Development Footprint. No areas of mapped habitat occur within the Development Footprint. One individual was identified outside the Development Footprint during targeted survey.

6.4.3 Actions to avoid, minimise and mitigate direct and indirect impacts

Actions to avoid direct and indirect impacts are detailed in Section 5.1 and Section 5.2.

In summary, avoidance measures include:

- No direct disturbance of mapped rocky habitat associated with threatened bat species and the Broad-headed Snake.
- Blast designs during Project operations to comply with a conservative vibration limit of 50 millimetres per second (mm/s) at the nearest mapped rocky habitat (safe design 5% exceedance level peak particle velocity [PPV] limit).
- Reduced disturbance of vegetation/habitat associated with steeper terrain adjacent to Munghorn Gap Nature Reserve.

Further to the proposed avoidance measures, measures to mitigate impacts on the Broad-headed Snake would be described in an updated or new Biodiversity Management Plan, including:

- measures to ensure the disturbance area setbacks from mapped rocky habitat for the Broad-headed Snake are maintained;
- a program to monitor the Broad-headed Snake in response to vibration;
- measures to monitor and manage blast design to achieve the 50 mm/s blast vibration limit at mapped rocky habitat for the Broad-headed Snake (unless further geotechnical investigation supports a higher value);
- measures to be implemented within the Habitat Enhancement Area to enhance potential habitat for the Broad-headed Snake (to be commenced within the first year of mining), including:
    - active revegetation (planting);
    - non-barbed wire fencing to exclude livestock (as required); and
    - managing weeds, animal pests and bushfire risk within approximately 20 ha of breeding habitat.
- measures to salvage and reuse large hollow-bearing trees/stags potentially suitable for the Broad-headed Snake on the mine final landform; and
- measures to monitor areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform to evaluate the need for supplementary seeding/plantings.

6.5 Large-eared Pied Bat (*Chalinolobus dwyeri*)

6.5.1 Description

The National Recovery Plan for the Large-eared Pied Bat (DERM 2011) states that the species is insectivorous and found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It's main strongholds are in the Sydney sandstone region and Pilliga region (Woinarski et al. 2014) where it is uncommon and patchily distributed (DERM 2011; Pennay et al. 2011). The species population structure and number of locations are poorly known. The species distribution may be considered severely fragmented given that most individuals occur in small and relatively isolated subpopulations (DERM 2011).

6.5.2 Habitat Condition within the Study Area

The Large-eared Pied Bat was regularly recorded by AMBS (2023) across the Study Area. A total of 19 individuals were caught during trapping, and the species was recorded on Anabats at 30 locations, with three confirmed roosts in the Study Area. A species polygon was generated for this species to include all suitable foraging vegetation within two kilometres of rocky habitat (rocky habitat likely providing potential roosting/breeding habitat). Potential breeding habitat for the Large-eared Pied Bat within the Development Footprint, Study Area and broader surrounds was identified on-ground, from mapping resources and LiDAR imagery. All mapped rocky habitat for the Large-eared Pied Bat would be avoided by the Project, including woodland/forest within 100 m of the mapped rocky habitat. Foraging habitat for the Large-eared Pied Bat includes any suitable woodland/forest within two kilometres of suitable rocky habitat (DPE 2023a). Therefore, the Project would remove a total of 113.02 ha of foraging habitat for the Large-eared Pied Bat.

6.5.3 Actions to avoid, minimise and mitigate direct and indirect impacts

Actions to avoid and minimise direct and indirect impacts are detailed in Section 5.1 and Section 5.2. In summary, avoidance measures include:

- Avoidance of all direct disturbance to mapped rocky habitat (i.e. caves, crevices, cliffs, rocks) including a 100 m buffer.
- Avoidance of riparian habitat (where the species was recorded in 2023) and buffering by 200 m.
- Implementation of blast criterion of 50 millimetres per second (mm/s) at nearest rocky habitat features to minimise potential indirect vibration impacts to habitat for the Large-eared Pied Bat.

Further to the proposed avoidance measures, measures to mitigate impacts on the Large-eared Pied Bat would be described in an updated or new Biodiversity Management Plan, including:

- measures to ensure the disturbance area setbacks from mapped rocky habitat for the Large-eared Pied Bat are maintained;
- a program to monitor mapped rocky habitat, including:
    - measures to manage blast designs during Project operations to comply with a vibration limit of 50 mm/s at mapped rocky habitat for the Large-eared Pied Bat (unless further geotechnical investigation supports a higher value);
    - measures to monitor blast vibration, including monitoring at representative sites of mapped rocky habitat adjacent to the Project;
    - ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary; and
    - visual inspections of key representative mapped rocky habitat on a 6-monthly basis to confirm that the target outcome of no physical impact to mapped rocky habitat as a result of blasting vibrations is met.
- a program to monitor Large-eared Pied Bat in response to vibration;
- measures to be implemented within the Habitat Enhancement Area to enhance potential foraging habitat for the Large-eared Pied Bat (to be commenced within the first year of mining), including:
    - active revegetation (planting);
    - non-barbed wire fencing to exclude livestock (as required); and
    - managing weeds, animal pests and bushfire risk within approximately 51 ha of foraging habitat and approximately 20 ha of breeding habitat.
- Identification of suitable Eucalypt species which could provide foraging habitat for the Large-eared Pied Bat that would be included in areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform; and
- measures to monitor areas undergoing revegetation on the mine final landform and within the Habitat Enhancement Area to evaluate the need for supplementary seeding/plantings.

6.6 Eastern Cave Bat (*Vespadelus troughtoni*)

6.6.1 Description

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 (DPE 2023e). It is 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 (DPE 2023e). Very little is known about the biology of this uncommon species, and little is understood of its feeding or breeding requirements or behaviour (DPE 2023e).

6.6.2 Habitat Condition within the Study Area

The Eastern Cave Bat was regularly recorded by AMBS (2023) on Anabat detectors at 15 locations, and six individuals were caught during harp trapping. One roost was confirmed during habitat searches in the Study Area, outside of the Development Footprint. All suitable foraging habitat within two kilometres of rocky habitat was included in the species polygon. Potential breeding habitat for the Eastern Cave Bat within the Development Footprint, Study Area and broader surrounds was identified on-ground, from mapping resources and LiDAR imagery. All mapped rocky habitat for the Eastern Cave Bat would be avoided by the Project, including woodland/forest within 100 m of the mapped rocky habitat. Foraging habitat for the Eastern Cave Bat includes any suitable woodland/forest within two kilometres of suitable rocky habitat (DPE 2023a). Therefore, the Project would remove a total of 113.02 ha of foraging habitat for the Eastern Cave Bat.

6.6.3 Actions to avoid, minimise and mitigate direct and indirect impacts

Actions to avoid and minimise direct and indirect impacts are detailed in Section 5.1 and Section 5.2. In summary, avoidance measures include:

- Avoidance of all direct disturbance to mapped rocky habitat (i.e. caves, crevices, cliffs, rocks) including a 100 m buffer
- Avoidance of riparian habitat and buffering by 200 m
- Implementation of blast criterion of 50 millimetres per second (mm/s) at nearest rocky habitat features to minimise potential indirect vibration impacts to habitat for the Large-eared Pied Bat.

Further to the proposed avoidance measures, measures to mitigate impacts on the Eastern Cave Bat would be described in an updated or new Biodiversity Management Plan, including:

- measures to ensure the disturbance area setbacks from mapped rocky habitat for the Eastern Cave Bat are maintained;
- a program to monitor mapped rocky habitat, including:
    - measures to manage blast designs during Project operations to comply with a vibration limit of 50 mm/s at mapped rocky habitat for the Eastern Cave Bat (unless further geotechnical investigation supports a higher value);
    - measures to monitor blast vibration, including monitoring at representative sites of mapped rocky habitat adjacent to the Project;

  - ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary; and
  - visual inspections of key representative mapped rocky habitat on a 6-monthly basis to confirm that the target outcome of no physical impact to mapped rocky habitat as a result of blasting vibrations is met.
- a program to monitor Eastern Cave Bat in response to vibration;
- measures to be implemented within the Habitat Enhancement Area to enhance potential foraging habitat for the Eastern Cave Bat (to be commenced within the first year of mining), including:
- active revegetation (planting);
- non-barbed wire fencing to exclude livestock (as required); and
- managing weeds, animal pests and bushfire risk within approximately 51 ha of foraging habitat and approximately 20 ha of breeding habitat.
- identification of suitable Eucalypt species which could provide foraging habitat for the Eastern Cave Bat that would be included in areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform; and
- measures to monitor areas undergoing revegetation on the mine final landform and within the Habitat Enhancement Area to evaluate the need for supplementary seeding/plantings.

7 Stage 2 - Impact Assessment - Summary

7.1 Determine an offset requirement for impacts

7.1.1 Impacts on native vegetation and TECs (ecosystem credits)

Table 31 below identifies impacts to each vegetation zone that require an offset as per BAM (DPIE 2020a) Subsection 9.2.1(1). The table details vegetation removal to take place as part of each stage of the Project. Current and future VI scores, as well as the change in VI score for each vegetation zone are provided in Table 9. Impacts requiring offsetting are highlighted in Figure 21. Total credit requirement for each PCT is shown as discussed in the Section 7.3.1 and in the BAM-C Credit Reports, Appendices H-J.

Table 31. Impacts that require an offset – ecosystem credits.

Vegetation Zones	Name	Stage 1 impact area (ha)	Stage 2 impact area (ha)	Stage 3 impact area (ha)	Total area (ha)	Current VI score	Total credit requirement
VZ1	PCT 266 Remnant Woodland	0.6	0.3	5.8	6.7	88.1	1,091
VZ2	PCT 266 Derived Native Grassland	4.5	18	5.5	28	39.8	
VZ20	PCT 266 Scattered Trees	0.5	0.1	-	0.6	67.2	
VZ3	PCT 281 Remnant Woodland	6.6	3.5	15.2	25.3	90.4	8,517
VZ4	PCT 281 Derived Native Grassland (high)	40	110.2	53.1	203.3	33.3	
VZ5	PCT 281 Derived Native Grassland (low)	115.6	2	18	135.6	32.7	
VZ21	PCT 281 Scattered Trees	0.3	1.2	0.08	1.58	84.4	

Vegetation Zones	Name	Stage 1 impact area (ha)	Stage 2 impact area (ha)	Stage 3 impact area (ha)	Total area (ha)	Current VI score	Total credit requirement
VZ9	PCT 483 Remnant Woodland	0.04	-	-	0.04	83.4	2
VZ11	PCT 1610 Remnant Woodland	-	12	5	17	43.5	526
VZ12	PCT 1610 Regenerating Woodland	2.7	4.2	4.3	11.2	41.2	
VZ14	PCT 1629 Remnant Forest	0.8	4.7	-	5.5	56.3	116
VZ15	PCT 1661 Remnant Woodland	3.7	-	-	3.7	51.9	84
VZ16	PCT 1655 Remnant Woodland	11.99*	1.9	2.3	16.19*	52.3	372
VZ17	PCT 1656 Remnant Forest	11.8	-	-	11.8	47.5	336
VZ18	PCT 1656 Regenerating Forest	6	-	-	6	56.0	
VZ19	PCT 1711 Remnant Shrubland	-	1.6	5.9	7.5	47.2	133
Total		**205.13**	**159.7**	**115.18**	**480.01**		**11,177**

* includes 0.09 ha of planted native vegetation

7.1.2 Impacts on threatened species and their habitat (species credits)

Table 32 below identifies impacts on threatened species (species credits) that require an offset, as per BAM (DPIE 2020a) Subsection 9.2.2(2) (Figure 21). The table details the area of impact to each threatened species as part of each stage of the Project. Total credit requirement for each species is shown as discussed in the Section 7.3.2 and in the BAM-C Credit Reports, Appendix H-J.

Table 32. Impacts that require an offset – species credits.

Name of threatened species	BC Act status	EPBC Act status	Biodiversity risk weighting	Stage 1 loss of habitat (ha) or individuals	Stage 2 loss of habitat (ha) or individuals	Stage 3 loss of habitat (ha) or individuals	Total area (ha)	Total number of species credits required
Flora								
Cotoneaster Pomaderris (*Pomaderris cotoneaster*)	E	E	2	0	0.07	0	0.07	2
Fauna								
Regent Honeyeater (*Anthochaera phrygia*)	CE	CE	3	37.23	22.73	20.54	80.5	3,410
Pink-tailed Legless Lizard (*Aprasia parapulchella*)	V	V	2	77.92 (Incl. 12.2 ha of Category 1 – exempt land)	96.6 (Incl. 12.7 ha of Category 1 – exempt land)	32.62 (Incl. 0.4ha of Category 1 – exempt land)	207.14 (Incl. 25.3 ha of Category 1 – exempt land)	4,147 (native vegetation = 3,742, Category 1 – exempt land = 405)
Large-eared Pied Bat (*Chalinolobus dwyeri*)	V	E	3	44.94	29.5	38.58	113.02	5,137
Squirrel Glider (*Petaurus norfolcensis*)	V	-	2	44.94	29.5	38.58	113.02	3,425
Koala (*Phascolarctos cinereus*)	E	E	2	44.94	29.5	38.58	113.02	3,425
Eastern Cave Bat (*Vespadelus troughtoni*)	V	-	3	44.94	29.5	38.58	113.02	5,137
Total								**24,683**

7.1.3 Indirect and prescribed impacts

Indirect and prescribed impacts that remain after measures to avoid, minimise and mitigate have been applied, may be offset using additional biodiversity credits (above the credit requirement generated by the BAM-C for direct impacts) and/or other conservation measures.

Indirect impacts in Section 5.2 are not considered to require offsets due to low likelihood of impacts, as well as mitigation measures and adaptive management which are to be implemented as outlined in Section 5.7.

Prescribed impacts in Section 5.3 will require offsets for the Pink-tailed Legless Lizard as described in Section 5.3.4 in conjunction with mitigation measures and adaptive management which are to be implemented as outlined in Section 5.7.

7.2 Impacts that do not need further assessment

Areas within the Development Footprint that do not contain native vegetation do not need to be assessed for ecosystem credits. However, areas of land that do not contain native vegetation must still be assessed for threatened species habitat in accordance with Chapter 5 and prescribed biodiversity impacts in accordance with Chapter 6 of the BAM (DPIE 2020a) (Section 9.3).

Table 33 identifies impacts that do not need further assessment for ecosystem credits. Areas of impact not requiring offsetting are shown in Figure 22, while areas not requiring further assessment as shown in Figure 23.

Table 33. Impacts that do not need further assessment for ecosystem credits

Impact	Location within Development Footprint	Justification why no further assessment is required
Clearing of non-native vegetation (Category 1 – exempt land)	Fertile flats within the valley floor which have been extensively cleared and cultivated for agriculture	Does not contain suitable habitat for threatened biodiversity assessed apart from the Pink-Tailed legless Lizard. Approximately 1.3 ha of potential Pink-tailed Legless Lizard surface rocky habitat overlaps Category 1 – exempt land, however when the species 50 m buffer of rocky areas habitat constraint is applied to this rocky habitat, approximately 25.3 ha overlaps the Category 1 – exempt land. An estimate of the offset requirement has been calculated for clearance of the potential surface rocky habitat on Category 1 – exempt land (Section 5.3.4).

Impact	Location within Development Footprint	Justification why no further assessment is required
Removal of farm dams, access tracks and infrastructure	Scattered throughout the Development Footprint	Do not contain suitable habitat for threatened biodiversity

7.3 Biodiversity credit report

7.3.1 Ecosystem credits

The results of the BAM-C ecosystem offset credit requirements for each stage are shown in Table 31. Native vegetation communities identified within the Development Footprint generate a requirement of 11,177 ecosystem credits (Appendix H, I and J). These ecosystem credits also cover the credit requirement for predicted ecosystem credit species.

7.3.2 Species credits

The results of the BAM-C species offset credit requirements are shown in Table 32 and in the BAM-C Credit Reports (Appendix H, I and J). Threatened species identified or assumed to be present within the Development Footprint generate a requirement of 24,683 species credits.

8 Commonwealth Assessment – Impacts to Matters of National Environmental Significance

MCO referred the Project to the Commonwealth Minister of the Environment. The EPBC Act referral identified that the Project has the potential to significantly impact the Box-Gum Woodland CEEC and Large-eared Pied Bat and may significantly impact *Pomaderris cotoneaster* and Pink-tailed Legless Lizard. The Project was determined to be a "Controlled Action" under the EPBC Act and the controlling provisions are "listed threatened species and communities" (Sections 18 and 18A of the EPBC Act) and "a water resource, in relation to coal seam gas development and large coal mining development" (Sections 24D and 24E of the EPBC Act).

The following section details the presence/likely occurrence of MNES within the Development Footprint and an assessment of potential impacts. Detailed assessments of the significance of potential impacts as per the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013) were conducted for each species recorded, assumed present, or considered likely to occur. These are provided in Appendix D.

8.1 Scope, timing and methodology for surveys

As described in Section 2.1.3 and Section 2.1.4, a comprehensive review of literature and databases was undertaken to compile a list of species to be targeted during the threatened flora and fauna species surveys which included both BC Act and EPBC Act listed species. Information gathered from the database and literature review, as well as from the flora and fauna field assessments (ELA 2023; AMBS 2023), was used to identify potentially occurring EPBC Act listed species and communities for targeted surveys (Table 34).

A total of 60 species were identified as requiring consideration under the EPBC Act, including 30 flora species and 30 fauna species. These include:

- 19 fauna species identified as predicted ecosystem, species or dual credit species, as determined by the BAM-C
- Eleven EPBC Act listed fauna species were identified in the PMST search including Booroolong Frog (*Litoria booroolongensis*), Sloane's Froglet (*Crinia sloanei*), Australian Painted Snipe (*Rostratula australis*), Eastern Curlew (*Numenius madagascariensis*), Curlew Sandpiper (*Calidris ferruginea*), Plains-wanderer *(Pedionomus torquatus*), Grey Falcon (*Falco hypoleucos*), Malleefowl (*Leipoa ocellata*), Red Goshawk (*Erythrotriorchis radiatus)*, New Holland Mouse (*Pseudomys novaehollandiae*) and Superb Parrot (*Polytelis swainsonii*)
- All 30 flora species are species credit species as identified in the BAM-C.

EPBC Act listed species that have either been assumed present based on habitat assessment or were recorded within the Study Area (ELA 2023; AMBS 2023) are highlighted grey in Table 34. Impacts to these species are assessed in Section 8.4 and Appendix D.

An updated PMST search (Cth DCCEEW 2024a) was undertaken on 1 February 2024 to review species listed under the EPBC Act subsequent to submission of the EIS. An additional nine fauna species and one flora species were identified, which are discussed in Section 8.2.1 below.

8.1.1 Targeted Surveys for Threatened Ecological Communities

TECs were identified in accordance with the relevant listing under the EPBC Act. ELA (2023) assessed TECs against the following literature and publications to determine TEC extent:

- *EPBC Act Policy Statement White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands* (DEH 2006)
- *Commonwealth Listed Advice on White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (TSSC 2006[3]), hereafter referred to as the Box-Gum Woodland Listing Advice
- *EPBC Act Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community* (DOE 2015a).

The presence of TECs was assessed during late Autumn as this was identified as the best time of year to assess TEC condition due to the demise of annual species (DEH 2006 cited in ELA 2023).

8.1.2 Targeted Surveys for Threatened Flora

As described in Section 2.1.3 and Section 3.5.1, targeted threatened flora surveys were undertaken by ELA (2023) in accordance with the BAM (DPIE 2020a) and the methods described in the Threatened Flora Survey Guideline (DPIE 2020c) and the EPBC *Survey Guidelines for Australia's Threatened Orchids* (DOE 2013) to determine presence of species within the Study Area. ELA (2023) provides the details of the detailed scope, timing and methodology for the surveys.

The PMST search (Cth DCCEEW 2022a) indicated that Austral Toadflax (*Thesium australe*) may occur in the search area. Austral Toadflax was not identified as a potential candidate species within the BAM-C. A review of species habitat information and records was conducted to understand the likelihood of occurrence of Austral Toadflax within the Development Footprint. The species grows in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast, usually in association with Kangaroo Grass (DPE 2023e). Kangaroo Grass is present in multiple PCTs within the Development Footprint including PCTs 266, 483, 1610, 1656, 1661 and 1711 (ELA 2023). The species may be associated with PCT 1655 *Grey Box - Slaty Box shrub - grassy woodland on sandstone slopes of the upper Hunter and Sydney Basin remnant woodland* as per the TBDC (DPE 2023a), which occurs within the Development Footprint. There are no BioNet records for the species within 40 km of the Development Footprint (DPE 2022d[4]). Additional areas of potential grassy woodland (PCT 266, PCT 281, PCT 483 and PCT 1610) also occur within the Development Footprint.

Flora surveys within potentially suitable habitat for Austral Toadflax within the Development Footprint included (ELA 2023):

- 22 km of 10 m parallel transects (the appropriate distance at which to detect small forbs [DPIE 2020c]) within PCT 1655 in September – October
- 1,194 40 m radius searches during Spring and October within areas of potential woodland habitat across the Development Footprint
- 293 40 m radius searches within 88 ha of potentially suitable woodland habitat in the south of the Development Footprint.

While the timing of the surveys within PCT 1655 did not align with optimal time for detection of the species (January/February, DPE 2023a), surveys were conducted within other areas of potentially suitable habitat at that time.

Given the comprehensive survey effort conducted and the absence of records within 40 km of the Development Footprint, it is considered that Austral Toadflax is unlikely to occur within the Development Footprint and as such has been excluded from further assessment.

8.1.3 Targeted Surveys for Threatened Fauna

As described in Section 2.1.4, a range of targeted fauna surveys were undertaken by AMBS (2023) between December 2020 and March 2022 within the Study Area. AMBS (2023) details of the scope, timing and methodology for the surveys, including their consideration of Commonwealth Guidelines such as:

- Survey Guidelines for Australia's Threatened Birds (DEWHA 2010a)
- Survey Guidelines for Australia's Threatened Bats (DEWHA 2010b)
- Survey Guidelines for Australia's Threatened Mammals (DSEWPaC 2011a)
- Survey Guidelines for Australia's Threatened Reptiles (DSEWPaC 2011b).

The PMST search (Cth DCCEEW 2024a) indicated that Sloane's Froglet (*Crinia sloanei*) and Plains-wanderer (*Pedionomus torquatus*) may occur in the search area. Neither Sloane's Froglet or Plains-wanderer were identified as potential candidate species within the BAM-C. A review of species habitat information and records was conducted to understand the likelihood of occurrence of Sloane's Froglet and Plains-wanderer within the Development Footprint.

Sloane's Froglet is associated with periodically inundated areas in grassland, woodland and disturbed habitats. It is restricted to within 500 m of swamps, waterbodies, or semi-permanent or ephemeral wet areas containing relatively shallow sections with submergent or emergent vegetation. Although there is ephemeral aquatic habitat present within the Development Footprint at Spring Creek and the Moolarben Creek and Murdering Creek crossings, there are no associated PCTs recorded within the Study Area to provide potential habitat for the Sloane's Froglet (NSW DCCEEW 2024b). Additionally, BioNet Atlas does not record any species sighting within 30 km of the Development Footprint, with the closest record occurring 132.5 km away, slightly southwest of Dubbo (NSW DCCEEW 2024a). No frog surveys were carried out by AMBS (2023) as the Sloane's Froglet was not predicted to occur at the time of surveys and there was no suitable habitat present

within the Study Area for other predicted frog species. Sloane's Froglet was not opportunistically detected during surveys (AMBS 2023).

Plains-wanderer is associated with semi-arid, lowland native grasslands with the vast majority of records from the western Riverina region. The species is not associated with the Kerrabee IBRA subregion and there are no associated PCTs recorded within the Study Area to provide potential habitat for the Plains-wanderer (NSW DCCEEW 2024b). Additionally, the Development Footprint is not within the Important Habitat Mapping for the species (NSW DCCEEW 2024c), BioNet Atlas does not record any species sighting within 30 km of the Development Footprint, with the closest record occurring 39.3 km north of the Development Footprint (NSW DCCEEW 2024a), and the species was not opportunistically detected during bird surveys (AMBS 2023).

Given that there is no suitable habitat for Sloane's Froglet and Plains-wanderer within the Study Area and the absence of records within 40 km of the Development Footprint, it is considered that Sloane's Froglet and Plains-wanderer are unlikely to occur within the Development Footprint and as such have been excluded from further assessment.

Table 34. EPBC Act Species and Communities Targeted for Survey.

Common name	Scientific name	Listing status		Credit class	Species considered for further assessment under the EPBC Act?	Reason for exclusion or inclusion
		BC Act	EPBC Act			
Flora						
Bynoe's Wattle	*Acacia bynoeana*	E	V	Species	No	Not detected during targeted surveys
Thick-leaf Star-hair	*Astrotricha crassifolia*	V	V	Species	No	Not detected during targeted surveys
	Commersonia procumbens	V	V	Species	No	Not detected during targeted surveys and suitable habitat considered absent (Bell 2024).
	Commersonia rosea	E	E	Species	No	Not detected during targeted surveys and suitable habitat considered absent (Bell 2024).
White-flowered Wax Plant	*Cynanchum elegans*	E	E	Species	No	Not detected during targeted surveys
Bluegrass	*Dichanthium setosum*	V	V	Species	No	Not detected during targeted surveys
Wallangarra White Gum	*Eucalyptus scoparia*	E	V	Species	No	Not detected during targeted surveys
	Euphrasia arguta	CE	CE	Species	No	Not detected during targeted surveys
Fairy Bells	*Homoranthus darwinioides*	V	V	Species	No	Not detected during targeted surveys

Common name	Scientific name	Listing status		Credit class	Species considered for further assessment under the EPBC Act?	Reason for exclusion or inclusion
		BC Act	EPBC Act			
Leafless Indigo	*Indigofera efoliata*	E	E	Species	No	Not detected during targeted surveys
	Kennedia retrorsa	V	V	Species	No	Not detected during targeted surveys and suitable habitat considered absent (Bell 2024).
	Lasiopetalum longistamineum	V	V	Species	No	Not detected during targeted surveys
Spiny Peppercress	*Lepidium aschersonii*	V	V	Species	No	Associated with gilgais or grey loamy clays. Associated with Grey Box and Belah communities. No such habitat occurs within the Study Area.
Hoary Sunray	*Leucochrysum albicans var. tricolor*	E	E	Species	No	Not detected during targeted surveys
	Olearia cordata	V	V	Species	No	Not detected during targeted surveys
	Ozothamnus tesselatus	V	V	Species	No	Not detected during targeted surveys
Hairy Geebung	*Persoonia hirsuta*	E	E	Species	No	Not detected during targeted surveys
Cotoneaster Pomaderris	*Pomaderris cotoneaster*	E	E	Species	Yes	This species was detected during targeted surveys
Denman Pomaderris	*Pomaderris reperta*	CE	CE	Species	No	Not detected during targeted surveys

Common name	Scientific name	Listing status		Credit class	Species considered for further assessment under the EPBC Act?	Reason for exclusion or inclusion
		BC Act	EPBC Act			
Silky Pomaderris	*Pomaderris sericea*	E	V	Species	No	Not detected during targeted surveys
Tarengo Leek Orchid	*Prasophyllum petilum*	E	E	Species	No	Not detected during targeted surveys
	Prasophyllum sp. Wybong	-	CE	Species	No	Not detected during targeted surveys
Wollemi Mint-bush	*Prostanthera cryptandroides subsp. cryptandroides*	V	V	Species	No	Not detected during targeted surveys
	Prostanthera discolor	V	V	Species	No	Not detected during targeted surveys
Mount Vincent Mint-bush	*Prostanthera stricta*	V	V	Species	No	Not detected during targeted surveys
Smooth Bush-Pea	*Pultenaea glabra*	V	V	Species	No	Not detected during targeted surveys
Small Purple-pea	*Swainsona recta*	E	E	Species	No	Not detected during targeted surveys
Austral Toadflax	*Thesium australe*	V	V	Species	No	Not detected during targeted surveys

Common name	Scientific name	Listing status		Credit class	Species considered for further assessment under the EPBC Act?	Reason for exclusion or inclusion
		BC Act	EPBC Act			
	Velleia perfoliata	V	V	Species	No	Not detected during targeted surveys
	Vincetoxicum forsteri listed as *Tylophora linearis*	V	E	Species	No	Not detected during targeted surveys
Fauna						
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	Species/Ecosystem	Yes	Not detected during targeted surveys, however Important Habitat Mapped for this species occurs within the Study Area
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	Species	Yes	N/A
Curlew Sandpiper	*Calidris ferruginea*	E	CE	Species/Ecosystem	No	No suitable wetland habitat on Study Area
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	E	Species/Ecosystem	No	Detected during targeted surveys, however no signs of breeding were identified during the field survey
South-eastern Glossy Black-Cockatoo	*Calyptorhynchus lathami lathami*	V	V	Species/Ecosystem	No	Not detected during targeted surveys
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	E	Species	Yes	N/A
Sloane's Froglet	*Crinia sloanei*	E	E	Species	No	Study Area occurs outside of the species known or predicted range. There are no associated PCTs recorded within the Study Area to provide potential

Common name	Scientific name	Listing status		Credit class	Species considered for further assessment under the EPBC Act?	Reason for exclusion or inclusion
		BC Act	EPBC Act			
						habitat for the Sloane's froglet (DPE 2023a). BioNet Atlas does not record any species sighting within 30 km of the Development Footprint (DPE 2023c[4]).
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	Ecosystem	No	Not detected during targeted surveys
Striped Legless Lizard	*Delma impar*	V	V	Species	No	Not detected during targeted surveys
Red Goshawk	*Erythrotriorchis radiatus*	CE	E	Species	No	Species preferred habitat is mixed subtropical rainforest, *Melaleuca* swamp forest and riparian *Eucalyptus* forest of coastal rivers (DPE 2023e). This habitat type does not occur within the Development Footprint and the Development Footprint does not support any PCTs associated with the species (DPE 2023a). Further, the Development Footprint is located towards the southern limit of known range; and it was not recorded during targeted surveys (AMBS 2023).
Grey Falcon	*Falco hypoleucos*	V	V	Ecosystem	No	Grey Falcon is a species of arid and semi-arid environments, with annual average rainfall less than 500 mm. Development Footprint occurs in high rainfall area.
Painted Honeyeater	*Grantiella picta*	V	V	Ecosystem	No	Not detected during targeted surveys

Common name	Scientific name	Listing status		Credit class	Species considered for further assessment under the EPBC Act?	Reason for exclusion or inclusion
		BC Act	EPBC Act			
Giant Burrowing Frog	*Heleioporus australiacus*	V	V	Species	No	The only PCT recorded within the Study Area which provided potential habitat for Giant Burrowing Frog was PCT 1629. Breeding habitat for the Giant Burrowing Frog consists of soaks or pools within first or second order streams, as well as 'hanging swamp' seepage lines and where small pools form from the collected water. AMBS (2023) did not record any suitable breeding habitat within the Study Area, nor was any suitable habitat identified within the Aquatic Ecology Assessment (Bio-Analysis 2022). In addition, the species has never been recorded as far west as the Study Area with the closest record occurring 60km to the south east.
White-throated Needletail	*Hirundapus caudacutus*	-	V	Ecosystem	No	Not detected during targeted surveys
Broad-headed Snake	*Hoplocephalus bungaroides*	E	E	Species/Ecosystem	Yes	N/A
Swift Parrot	*Lathamus discolor*	E	CE	Species/Ecosystem	Yes	Not detected during targeted surveys, and no Important Habitat Mapped within the Study Area; however, the species is considered likely to occur (AMBS 2023).

Common name	Scientific name	Listing status		Credit class	Species considered for further assessment under the EPBC Act?	Reason for exclusion or inclusion
		BC Act	EPBC Act			
Malleefowl	*Leipoa ocellata*	E	V	Ecosystem	No	Malleefowl are associated with Mallee eucalypt woodland in western NSW. No suitable habitat occurs within the Study Area.
Booroolong Frog	*Litoria booroolongensis*	E	E	Species	No	The Booroolong Frog can be associated with PCT 281 elsewhere in NSW (DPE 2023a) and PCT 281 was mapped within the Study Area along the riparian zones of Moolarben Creek. The Booroolong Frog was not originally included as a candidate species in AMBS (2023) as it is not associated with the Kerrabee IBRA subregion and the Study Area occurs at the edge of the species predicted range. The closest record for the Booroolong Frog occurs 80 km to the south of the Study Area. The species was included as a candidate species in the BDAR due to the EPBC Act PMST (Cth DCCEEW 2022a[5]) search indicating that it may occur in the search area. Targeted survey was not conducted for this species due to the Study Area occurring on the outer margins of the species known and predicted range, in addition to aquatic habitat within the Study Area not providing suitable habitat for the species.
Eastern Curlew	*Numenius madagascariensis*	-	CE	Ecosystem	No	No suitable lakes, inlets, bays or estuarine habitat in Study Area

Common name	Scientific name	Listing status		Credit class	Species considered for further assessment under the EPBC Act?	Reason for exclusion or inclusion
		BC Act	EPBC Act			
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	V	Ecosystem	No	Not detected during targeted surveys
Plains-wanderer	*Pedionomus torquatus*	E	CE	Species/ Ecosystem	No	Not associated with Kerrabee IBRA subregion, no suitable semi-arid grassland habitat in Study Area.
Greater Glider	*Petauroides volans*	E	E	Species	No	Not detected during targeted surveys
Yellow-bellied Glider	*Petaurus australis australis*	V	V	Ecosystem	No	Not detected during targeted surveys
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	V	Species	No	Not detected during targeted surveys
Koala	*Phascolarctos cinereus*	E	E	Species	Yes	N/A
Superb Parrot	*Polytelis swainsonii*	V	V	Ecosystem	No	Not detected during targeted surveys
New Holland Mouse	*Pseudomys novaehollandiae*	-	V	Ecosystem	No	Not detected during targeted surveys
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	Species/Ecosystem	No	Not detected during targeted surveys
Pilotbird	*Pycnoptilus floccosus*	-	V	Nil	No	Not detected during targeted surveys and the Development Footprint does not contain the

Common name	Scientific name	Listing status		Credit class	Species considered for further assessment under the EPBC Act?	Reason for exclusion or inclusion
		BC Act	EPBC Act			
						preferred habitat of wet sclerophyll forests and temperate rainforest.
Australian Painted Snipe	*Rostratula australis*	E	E	Ecosystem	No	No suitable wetland habitat on Study Area

Dark grey highlighted species require preparation of species polygons.

8.2 Occurrence of EPBC Act listed communities

Two TECs listed under the EPBC Act occur within the Study Area:

- *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (Box-Gum Woodland CEEC)
- *Central Hunter Valley Eucalypt Forest and Woodland* (Eucalypt Forest and Woodland CEEC).

Table 35 provides a summary of the areas of occurrence of the above two CEECs within the Development Footprint. A total of 401.12 ha of Box-Gum Woodland CEEC and 15.5 ha of Eucalypt Forest and Woodland CEEC occurs in the Development Footprint as shown in Figure 12.

Table 35. Areas of EPBC Act listed Threatened Communities.

Threatened Ecological Community	BC Act status	EPBC Act status	Vegetation condition	Area of Clearance (ha)	Total Area of Clearance (ha)
White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland	CE	CE	Woodland	34.22*	401.12
			DNG	366.9	
Eucalypt Forest and Woodland	-	CE	Woodland	15.5	15.5

* Includes 2.18 ha of PCTs 266 and 281 Scattered Trees.

8.3 Occurrence of EPBC Act listed threatened species

An updated PMST search (Cth DCCEEW 2024a) was undertaken in February 2024 which identified an additional eight threatened fauna species and one threatened flora species listed under the EPBC Act:

- *Hibbertia acaulothrix*, listed as Endangered effective 7 September 2023
- Southern Whiteface (*Aphelocephala leucopsis*), listed as Vulnerable effective 31 March 2023
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*), listed as Vulnerable effective 31 March 2023
- Hooded Robin (south-eastern form) (*Melanodryas cucullata cucullata*), listed as Endangered effective 31 March 2023
- Blue-winged Parrot (*Neophema chrysostoma*), listed as Vulnerable effective 31 March 2023
- Diamond Firetail (*Stagonopleura guttata*), listed as Vulnerable effective 31 March 2023
- Latham's Snipe (*Gallinago hardwickii*), listed as Vulnerable effective 5 January 2024
- Sharp-tailed Sandpiper (*Calidris acuminata*), listed as Vulnerable effective 5 January 2024
- Bathurst Grassland Earless Dragon (*Tympanocryptis mccartneyi*), listed as Critically Endangered effective 1 June 2023.

Of these, three fauna species have been identified as an ecosystem or species credit species (Table 36). As these species were not listed under the EPBC Act at the time of the controlled action decision

(2 May 2022), they do not require further assessment under the EPBC Act (refer section 158A of the EPBC Act).

Table 36. EPBC Act species identified from PMST search conducted (Cth DCCEEWW 2024a) after referral decision

Common name	Scientific name	Listing status		Credit class	Present?	Addressed under the EPBC Act or BAM?
		BC Act	EPBC Act			
	Hibbertia acaulothrix	-	E	Nil	No	This species was not listed under the EPBC Act at the time of the referral decision and therefore is not assessed as 'Endangered'.
Southern Whiteface	*Aphelocephala leucopsis*	V	V	Nil	No	This species was not listed under the EPBC Act at the time of the referral decision and therefore is not assessed as 'Vulnerable'.
Sharp-tailed Sandpiper	*Calidris acuminata*	-	V	Nil	No	This species was not listed under the EPBC Act at the time of the referral decision and therefore is not assessed as 'Vulnerable'.
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	V[6]	Ecosystem	Yes	The Brown Treecreeper was not listed under the EPBC Act at the time of the referral decision and therefore is not assessed as 'Vulnerable'. This species was included as an ecosystem credit species within the BDAR. This species was detected during diurnal bird surveys and opportunistically (AMBS 2023).
Latham's Snipe	*Gallinago hardwickii*	-	V	Nil	No	This species was not listed under the EPBC Act at the time of the referral decision and therefore is not assessed as 'Vulnerable'.
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullate*	E	E	Ecosystem	No	The Hooded Robin was not listed under the EPBC Act at the time of the referral decision and therefore is not assessed as 'Endangered'. This species was included as an ecosystem credit species in the BDAR. This species was not detected

Common name	Scientific name	Listing status		Credit class	Present?	Addressed under the EPBC Act or BAM?
		BC Act	EPBC Act			
						opportunistically during diurnal bird surveys or other diurnal survey work (AMBS 2023).
Blue-winged Parrot	*Neophema chrysostoma*	V	V	Nil	No	This species was not listed under the EPBC Act at the time of the referral decision and therefore is not assessed as 'Vulnerable'.
Diamond Firetail	*Stagonopleura guttata*	V	V[9]	Ecosystem	Yes	The Diamond Firetail was not listed under the EPBC Act at the time of the referral decision and therefore is not assessed as 'Vulnerable'. This species was included as an ecosystem credit species in the BDAR. This species was detected during diurnal bird surveys and opportunistically (AMBS 2023).
Bathurst Grassland Earless Dragon	*Tympanocryptis mccartneyi*	CE	CE	Species	No	The Bathurst Grassland Earless Dragon was not listed under the EPBC Act at the time of the referral decision and therefore is not assessed as 'Critically Endangered'. This species was excluded as a candidate fauna species in the BDAR as it is only associated with the Bathurst subregion. There are no associated PCTs recorded within the Study Area to provide potential habitat for this species (DPE 2023a), BioNet Atlas does not record any species sighting within 30 km of the Development Footprint (DPE 2023c[4]), and it was not detected opportunistically during reptile searches (AMBS 2023).

Only one EPBC Act listed flora species was recorded during the surveys: *Pomaderris cotoneaster*, which is listed as Endangered under the EPBC Act.

Six fauna species listed as threatened under the EPBC Act were recorded within the Study Area and/or Development Footprint during the surveys:

- Pink-tailed Legless Lizard (*Aprasia parapulchella*)
- Broad-headed Snake (*Hoplocephalus bungaroides*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Koala (*Phascolarctos cinereus*)
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*)[6]
- Diamond Firetail (*Stagonopleura guttata*)[9].

The Regent Honeyeater (*Anthochaera phrygia*) was not recorded during targeted surveys but is considered likely to use habitat based on the presence of Important Habitat Mapping (DPE 2023g) for the species within the Development Footprint. The Swift Parrot (*Lathamus discolor*) was also not recorded, however, due to presence of suitable habitat within the Study Area and proximity of recent records, it was considered likely to occur within the Study Area (AMBS 2023).

Details regarding the location of each of these species within the Study Area and/or surrounds as well as habitat within the Study Area is provided in Table 37. Potential impacts to each of these species are addressed in the following section.

Table 37. EPBC Act listed species in the Study Area and/or Development Footprint.

Common name	Scientific name	Listing status		Credit class	Occurrence	Habitat within the Study Area and/ or Development Footprint
		BC Act	EPBC Act			
Flora						
Cotoneaster Pomaderris	*Pomaderris cotoneaster*	E	E	Species credit	Present	The species was recorded within the Study Area as described in Section 3.5.1. The area of habitat for this species within the Development Footprint (0.07 ha) was determined through development of the species polygon as described in Section 3.6.1 and was based on records of mature plants, seedlings and saplings within the Study Area and applying a 30 m buffer to each record. A total of 12.5 ha of habitat for this species was mapped within the Study Area, including 0.07 ha within the Development Footprint as shown in Figure 17a.
Fauna						
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	Dual credit	Likely to occur - suitable habitat present	Large portions of the vegetation to be cleared, predominantly the intact areas of woodland within the Development Footprint, are Important Habitat Mapped for the species and form part of the Mudgee-Wollar breeding area (DPE 2023f). The Important Habitat Map identifies land that is considered important to support critical life stages of the species (DPE 2023f). Regent Honeyeater habitat within the Development Footprint is 80.5 ha (Figure 17f).
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	Species credit	Present	One juvenile individual of the species was found by AMBS (2023) on a north-west facing moderate slope just below sandstone outcropping. The individual was recorded when shifting a small stick with exfoliating bark rather than under a rock. Habitat in this area includes native grasses, *Lomandra* sp. tussocks, and numerous and varied sizes of sandstone surface and embedded rock, as well as log debris. There is a small rocky sandstone outcrop and a tree canopy just upslope. This

Common name	Scientific name	Listing status		Credit class	Occurrence	Habitat within the Study Area and/ or Development Footprint
		BC Act	EPBC Act			
						sandstone outcrop sits just below the edge of a basalt hill, which also contains many surface and embedded rocks. Surveys targeting this species were not able to be undertaken throughout the potential habitat in the entire Study Area due to the COVID-19 lockdown enforced on Greater Sydney limiting the availability of staff (AMBS 2023). However, given the reasonably good connectivity of areas of potential habitat throughout the Study Area, it was considered likely that the species could utilise other areas of potential habitat throughout the Study Area, rather than being restricted only to the rocky areas in which it was recorded (AMBS 2023). The extent of suitable habitat for the species was mapped based on the presence of surface rock, native grasses (e.g. *Themeda sp*., *Lomandra sp*. etc.), mostly within PCTs associated with the species, including PCTs 266, 281, 483 and 1655 (AMBS 2023). Locations that have been heavily grazed or subject to soil disturbance from crops were excluded. Further, areas that did not contain surface rocks and logs were excluded. However, some small sections of degraded habitat were included based on the abundance of surface rock, presence of ants under rocks, and considering that these areas adjoined better condition habitat, which included some areas of land within PCTs not associated with the species. These areas of habitat could be used periodically and there is evidence that individuals of this species have been found in weed-dominated ground covers under surface rock. There is approximately 207.14 ha of Pink-tailed Legless Lizard habitat within the Development Footprint of which 181.84 ha is native vegetation and 25.3 ha is Category 1 – exempt land (Figure 17b) (AMBS 2023).

Common name	Scientific name	Listing status		Credit class	Occurrence	Habitat within the Study Area and/ or Development Footprint
		BC Act	EPBC Act			
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	V[6]	Ecosystem	Present	Recorded in 35 locations widely distributed throughout the Study Area and was observed and heard during diurnal bird surveys as well as opportunistic sightings (AMBS 2023). It is associated with PCTs 266, 281, 1610, 1614, 1629, 1655, 1656, 1661. Approximately 472.38 ha of foraging and shelter habitat would be removed as a result of the Project.
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	E	Species credit	Present	The Large-eared Pied Bat was regularly recorded by AMBS (2023) on Anabat detectors, in harp traps, and also roosting in caves or martin nests during daytime habitat searches within the Study Area (AMBS 2023). Fourteen individuals were caught in harp traps, eleven of which were adult males or non-breeding females. Two individuals were juvenile males, identified by their elongated wing joints with visible bands of cartilage, and their smaller size. One individual was a lactating adult female. Given juvenile animals and a lactating female have been recorded, roosting habitat within the Study Area is considered breeding habitat. Within the Study Area, potential roosting and breeding habitat for the Large-eared Pied Bat is extensive and highly variable. A variety of habitat features occur including tall sandstone rocks and boulders, small cavities and crevices within rocks, cavities between rocks, low entry caves, small domes, low and high overhangs, and Fairy Martin (*Petrochelidon ariel*) nests (which are known to be used by the Large-eared Pied Bat for roosting) (AMBS 2023; Schultz 1998). On the basis of the information outlined above, breeding and foraging habitat for the Large-eared Pied Bat occurs within the Study Area and nearby surrounds as mapped in Figure 17i. Breeding habitat in the form of mapped rocky habitat occurs outside

Common name	Scientific name	Listing status		Credit class	Occurrence	Habitat within the Study Area and/ or Development Footprint
		BC Act	EPBC Act			
						the Development Footprint and has been mapped where it occurs within 100 m of the Study Area boundary. In accordance with the NSW survey guide for *'Species Credit' Threatened Bats and Their Habitat* (DPIE 2021), a species polygon (occupied and/or suitable habitat) for the species includes woodland habitat of associated PCTs as per the TBDC (DPE 2023e) (i.e. PCTs 281, 1629, 1655) within a two km radius of identified roosting habitat. This species polygon within the Development Footprint occupies an area of 113.02 ha as shown on Figure 17i. The species polygon includes PCTs associated with the species, as well as: • PCTs 266, 483, 1610 because the species was recorded within these during the surveys; and • PCTs 1656, 1661 and 1711 because of their close proximity to roosting habitat and other areas of suitable habitat (i.e. PCTs associated with the species and habitat which contains species records), it is likely the species would utilise these areas of habitat for foraging and movement throughout the Study Area. It is likely the species would forage or move through woodland habitat of all PCTs in the Study Area.
Broad-headed Snake	*Hoplocephalus bungaroides*	E	E	Dual Credit	Present	One Broad-headed Snake was recorded during targeted surveys by AMBS (2023) in 2021. The individual was recorded approximately 96 m outside the Development Footprint at the edge of an escarpment under a large sandstone rock. The habitat in which the individual was recorded is contiguous with potential habitat that occurs within the Development Footprint.

Common name	Scientific name	Listing status		Credit class	Occurrence	Habitat within the Study Area and/ or Development Footprint
		BC Act	EPBC Act			
						No Broad-headed Snake habitat occurs within the Development Footprint and would not be directly impacted (Figure 17c), with adjoining areas of habitat potentially indirectly impacted (noise, vibration, and lighting impacts). The impacts would occur over the life of the Project as habitat is progressively cleared. The Development Footprint has been designed to avoid primary shelter habitat (i.e. mapped rocky habitat) as shown in Figure 17c. Indirect impacts from light, noise and vibration would be mitigated, managed and monitored as detailed in Section 5.7. Targeted pre-clearance surveys would also be conducted within areas of suitable habitat to allow for re-location of resident individuals prior to clearance. Foxes and feral cats would be controlled and monitored as part of the Biodiversity Monitoring Program.
Swift Parrot	*Lathamus discolor*	E	CE	Dual credit	Likely to occur – suitable habitat present	Two tree species that are considered favoured feed trees occur in the Study Area, White Box and Mugga Ironbark. Further, there are another six tree species that are known to flower in autumn or winter, and therefore can provide potential foraging habitat for the species; Broad-leaved Ironbark (*Eucalyptus fibrosa*), Narrow-leaved Stringybark (*Eucalyptus sparsifolia*), Grey Gum (*Eucalyptus punctata*), Narrow-leaved Ironbark (*Eucalyptus crebra*), Mugga Ironbark (*Eucalyptus sideroxylon*) and Yellow Box (*Eucalyptus melliodora*) (AMBS 2023). Potentially suitable habitat for the species occurs widely throughout the Study Area, including all woodland PCTs and scattered trees except PCT 1711. The species was not recorded during targeted surveys; however, based on the proximity of local records (the species has been recorded in contiguous habitat to the north and there are also records in the wider locality, including with the nearby

Common name	Scientific name	Listing status		Credit class	Occurrence	Habitat within the Study Area and/ or Development Footprint
		BC Act	EPBC Act			
						Munghorn Gap Nature Reserve (AMBS 2023), and the presence of associated PCTs and autumn/winter flowering food tree species within the Development Footprint (AMBS 2023), they were identified as having a high likelihood of occurrence. The species breeds in Tasmania during the Summer but migrates and disperses across the mainland of south-eastern Australia to forage throughout Winter (DPE 2023e). Key foraging areas for this species within NSW are identified within the Important Habitat Map for the species (DPE 2023f). No areas of habitat identified on the Swift Parrot Important Habitat Map occur within the Development Footprint. Potential foraging habitat for the Swift Parrot occupies an area of 105.52 ha within the Development Footprint and is shown Figure 17d (AMBS 2023).
Koala	*Phascolarctos cinereus*	E	E	Species credit	Present	The Koala inhabits eucalypt woodlands and forests feeding on the foliage of over 120 species of Eucalyptus, Corymbia and Angophora, with preferred browse species varying throughout their range (AMBS 2023; DAWE 2022b; DAWE 2022c). Primary food species differ across habitats, with preferences influenced by the chemical profiles and water content of different target food leaves (AMBS 2023). Various additional tree species are also used by the Koala for shelter (AMBS 2023; DAWE 2022b). Within the Study Area, the Koala was recorded in Woodland/forest habitat around the periphery of the Study Area. Six tree species that occur in the Study Area are considered key food trees for the Koala, including White Box (*Eucalyptus albens*), Grey Gum (*E. punctata*), Blakely's Red Gum (*E. blakelyi*), Yellow Box (*E. melliodora*), Grey Box (*E. moluccana*) and Narrow-leaved Stringybark (*E. sparsifolia*). A species polygon was generated by AMBS (2023) (Appendix C) using all vegetation zones

Common name	Scientific name	Listing status		Credit class	Occurrence	Habitat within the Study Area and/ or Development Footprint
		BC Act	EPBC Act			
						within the Study Area that contain key food tree species (Figure 17g). The area of species habitat within the Development Footprint is approximately 113.02 ha.
Diamond Firetail	*Stagonopleura guttata*	V	V[9]	Ecosystem	Present	The species was recorded in four locations in 2021 and was observed and heard during diurnal bird surveys as well as opportunistic sightings (AMBS 2023). It is associated with PCTs 266, 281, 471, 1655. Approximately 417.18 ha of foraging and shelter habitat would be removed as a result of the Project.

8.4 Impact Assessment

The nature and extent of the likely direct, indirect and consequential impacts (including short-term and long-term impacts) to each of the EPBC Act listed TECs and threatened species as a result of the Project is addressed below. The area of habitat to be directly impacted for each species is detailed in Table 38.

For the majority of MNES, the extent/magnitude of direct and indirect impact is largely known, or it is considered that they may be managed/mitigated such that impacts may be minimised. Monitoring programs are described in Section 5.7 for impacts that are unknown or unpredictable. The Project has been designed to minimise the risk of irreversible impacts (e.g. blasting criteria to protect caves in cliffs and progressive mine rehabilitation).

An analysis of the significance of the impacts in accordance with the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013) has been undertaken for relevant ecological communities and threatened species (Appendix D), with the results summarised below. Technical data/information used in the assessment has been referenced.

Table 38. Areas of habitat to be impacted for EPBC Act listed species.

Vegetation zone name	Condition/ other defining feature	Area (ha) of EPBC Act listed species habitat within vegetation zones					
		Pink-tailed legless lizard	Koala	Large-eared Pied Bat	Regent Honeyeater	Swift Parrot	*Pomaderris cotoneaster*
PCT 266 Remnant Woodland	High	0.64	6.7	6.7	3.06	6.7	0
PCT 266 Derived Native Grassland	High	23.5	0	0	0.67	0	0
PCT 266 Scattered Trees	Low	0.02	0.6	0.6	0.14	0.6	0
PCT 281 Remnant Woodland	High	9.1	25.3	25.3	13.7	25.3	0
PCT 281 Derived Native Grassland	High	80.6	0	0	6.7	0	0
PCT 281 Derived Native Grassland Low	Low	18.7	0	0	2.6	0	0
PCT 281 Scattered Trees	Low	0	1.58	1.58	0.93	1.58	0
PCT 483 Remnant Woodland	High	0.04	0.04	0.04	0	0.04	0
PCT 1610 Remnant Woodland	High	14.3	17	17	9.2	17	0
PCT 1610 Regenerating Woodland	High	9.8	11.2	11.2	1.7	11.2	0

Vegetation zone name	Condition/ other defining feature	Area (ha) of EPBC Act listed species habitat within vegetation zones					
		Pink-tailed legless lizard	Koala	Large-eared Pied Bat	Regent Honeyeater	Swift Parrot	*Pomaderris cotoneaster*
PCT 1629 Remnant Forest	High	5.2	5.5	5.5	5.1	5.5	0.07
PCT 1655 Remnant Woodland	High	11.04*	16.1	16.1	13.8	16.1	0
PCT 1656 Remnant Forest	High	2.2	11.8	11.8	11.3	11.8	0
PCT 1656 Regenerating Forest	High	6	6	6	3.6	6	0
PCT 1661 Remnant Forest	High	0.3	3.7	3.7	3.7	3.7	0
PCT 1711 Remnant Woodland/Shrubland	High	0.4	7.5	7.5	4.3	0	0
Category 1 – exempt land	N/A	25.3	-	-	-	-	-
Total		**207.14**	**113.02**	**113.02**	**80.5**	**105.52**	**0.07**

*Includes 0.09 ha of planted native vegetation.

8.4.1 White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC

Impacts from clearing Box-Gum Woodland CEEC have been avoided or minimised through the Project design by:

- Preferentially locating disturbance in areas lacking Box-Gum Woodland CEEC (e.g. Category 1 – exempt land) or where the vegetation/habitat is in the poorest condition (e.g. low quality DNG)
- Avoiding open cut mining within 200 m of Moolarben Creek and Murdering Creek (which have a riparian zone comprising Box-Gum Woodland CEEC)
- Minimising infrastructure within the riparian zone of Moolarben Creek and Murdering Creek and locating creek crossings (three haul road creek crossings are proposed) within previously cleared areas, where practicable and feasible
- Condensing the Development Footprint by locating infrastructure areas immediately adjacent to open cut mining areas
- Progressively back-filling open cut pits to minimise the required disturbance extent (i.e. reducing the need for large out-of-pit overburden emplacements), as far as practically possible, as well as removing residual pit voids from the final landform
- Reduction of the Development Footprint post initial EIS submission to further avoid impacts to Box-Gum Woodland CEEC, particularly the relatively high-quality woodland areas. The amended Project Development Footprint will result in a 59.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha) and a 6.8% reduction in the area of DNG impacted (from 393.53 ha to 366.9ha). The total area of Box-Gum Woodland to be impacted has been reduced by 76.63 ha (16%).

As a result of the above, areas of Box-Gum Woodland CEEC in the north, south-west and south-east of the Study Area would be avoided by the Project.

Measures to mitigate indirect impacts of the Project on retained and adjacent areas of the CEEC would be implemented (e.g. weeds, animal management and Noisy Miner monitoring and management as well as dust suppression). The conceptual final landform for the Project (Figure 19b) would include rehabilitation of 535 ha of the Development Footprint to native woodland/open woodland and 140 ha of open native grassland with scattered trees, including species characteristic of Box-Gum Woodland CEEC.

The Habitat Enhancement Area (Figure 19b) described in Section 4.2 would be established to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened ecological communities and threatened species habitat within riparian zones along Moolarben Creek and Murdering Creek. The Habitat Enhancement Area contains 108.1 ha of Box-Gum Woodland, comprising 32.6 ha of woodland and 75.5 ha of DNG that is proposed to be revegetated.

Residual impacts to Box-Gum Woodland CEEC include removal of 401.12 ha of Box-Gum Woodland within the Development Footprint, comprising 34.22 ha of woodland and 366.9 ha of DNG. Indirect impacts to remaining Box-Gum Woodland CEEC within the surrounds (e.g. weeds, pest animals,

Noisy Miners and dust) are likely to be minimal due to proposed mitigation measures listed above. These indirect impacts are assessed in detail in Section 5.2.

An assessment of the significance of impacts was undertaken for Box-Gum Woodland CEEC in consideration of the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013) (Appendix D). The assessment concluded that the Project is likely to result in a significant impact on Box-Gum Woodland CEEC through impacts that would:

- Reduce in the extent of the CEEC
- Fragment/increase fragmentation of the CEEC
- Adversely affect habitat critical to the survival of the CEEC
- Interfere with the recovery of the CEEC.

This community has been assessed in accordance with the BAM (DPIE 2020a) and would be offset under the BC Act for the removal of 401.12 ha of this CEEC, comprising 34.22 ha of woodland and 366.9 ha of DNG. A total of 9,610 credits would be provided (as per Table 30; PCTs 266, 281 and 483).

8.4.2 Central Hunter Valley Eucalypt Forest and Woodland CEEC

Approximately 15.5 ha of the Eucalypt Forest and Woodland CEEC was recorded within the Development Footprint and would be removed as a result of the Project (Figure 12). No Eucalypt Forest and Woodland CEEC is able to be avoided by the Project.

Impacts on Eucalypt Forest and Woodland CEEC have also been minimised by Project design as described in Section 4. The mitigation measures described for Box-Gum Woodland CEEC above would also mitigate impacts on adjacent areas of Eucalypt Forest and Woodland CEEC within the Study Area. The conceptual final landform for the Project (Figure 19b) would include rehabilitation of 535 ha of the Development Footprint to native woodland/open woodland, including species characteristic of the Eucalypt Forest and Woodland CEEC.

Indirect impacts to remaining Eucalypt Forest and Woodland CEEC within the surrounds (e.g. weeds, pest animals Noisy Miners and dust) are likely to be minimal. These indirect impacts are assessed in detail in Section 5.2.

The assessment for Eucalypt Forest and Woodland CEEC (Appendix D) concluded that, while the Project would result in fragmentation of the CEEC, it is unlikely to be significantly impacted, largely due to the extent remaining and relative impact of the Project (less than 0.02% of the likely extent of the CEEC in the Kerrabee subregion (estimated to be 65,806 ha, NSW DCCEEW 2022b; DPE 2023b) would be impacted as a result of the Project. It was also considered unlikely to adversely affect habitat critical to the survival of the CEEC, modify or cause change to habitat or interfere substantially with the recovery of the CEEC.

In any case, the equivalent VEC under the BC Act will be offset.

8.4.3 *Pomaderris cotoneaster*

Pomaderris cotoneaster is a shrub that grows to 4 m in height. This species was recorded within the Study Area by ELA in 2021 (ELA 2023). The amended Project Development Footprint avoids direct impacts to the *Pomaderris cotoneaster* populations recorded by ELA (2023). Only parts of the species polygon 30 m buffer around the area of suitable habitat will be impacted and no loss of individuals will occur. The amended Project design reduces clearance of this species habitat from 4.59 ha to 0.07 ha.

A summary of the occurrence of this species within the Study Area and impacts as a result of the Project are provided in Section 3.5.1 and below. The assessment for the species is provided in Appendix D.

The species polygon for *Pomaderris cotoneaster* has been prepared in accordance with the BAM (DPIE 2020a). *Pomaderris cotoneaster* is an 'area' species under the TBDC and the area of suitable habitat is to be included. The BAM defines suitable habitat as:

> *"habitat within an associated IBRA subregion (and geographic limitation if included) and PCT where the species is expected to occur or periodically use, that is in a condition suitable to support the species."*

The species polygon includes 12.5 ha for the species within the Study Area, of which 0.07 ha occurs within the Development Footprint. As mentioned above, the 0.07 ha of species polygon to be impacted is the buffer around the area of suitable habitat and no individuals will be removed.

ELA undertook extensive targeted surveys for *Pomaderris cotoneaster* and confirmed that the species is present in one location of the Study Area on the edge in the north-east of the Development Footprint (Figure 17a) and absent from other portions of the Study Area. The location in which it was recorded has the suitable microhabitats for the species. Within the Study Area, the species was found growing mostly within PCT 1629 (Remnant Forest), as well as PCT 281 (Remnant Woodland), PCT 478 (Remnant Forest) and PCT 1610 (Remnant Woodland). Based on the survey data, the species is expected to occur within the location it was recorded and is not expected to occur elsewhere. The suitable habitat is therefore considered to be the area that it was recorded and immediate adjoining areas where the species was not observed but is considered likely to occur. In addition, a 30 m buffer has been included around the area of suitable habitat where the species was observed.

There are only 12 known populations for this species in NSW, all of which occur south of the Project with the nearest known population occurring at Yerranderie, NSW, approximately 210 km to the south-east. The Development Footprint is not within the known distribution of this species, but it is within the predicted distribution of this species (DPE 2023e).

Given the number of individuals recorded within the Study Area, and continuity of habitat adjacent to the Study Area, it is likely that *Pomaderris cotoneaster* also occurs within contiguous habitat within adjacent Munghorn Gap Nature Reserve. However, based on the lack of evidence of a wider

occurrence of the species in the region, the population recorded within the Study Area is considered likely to be an important population for *Pomaderris cotoneaster*, based on its location outside of the known distribution of the species.

The Project would result in the removal of 0.07 ha of the 30 m buffer surrounding suitable habitat where the species was observed (PCT 1629 Remnant Forest) within the Development Footprint. *Pomaderris cotoneaster* was recorded on the edge of the woodland/forest on slopes. Patykowski *et al*. (2014) states flowering may not occur and growth may be poor under dense shade. Given this, relatively open areas may be favourable for the species, which may make it less susceptible to edge effects. Weeds would be managed adjacent to the Development Footprint where the *Pomaderris cotoneaster* plants were recorded. Indirect impacts to *Pomaderris cotoneaster* within the surrounds (e.g. weeds and dust) are likely to be minimal. These indirect impacts are assessed in detail in Section 5.2.

The *Pomaderris cotoneaster* population within the Study Area would be managed by:

- Erecting a fence between the known plants and the adjacent Development Footprint
- Monitoring the *Pomaderris cotoneaster* population for a 2-year period following adjacent clearing
- Monitoring and controlling any weed outbreaks with a potential to impact *Pomaderris cotoneaster.*

Based largely on the project avoidance of this important local population, as well as the planned management actions to be undertaken, the assessment concluded that the Project is not likely to have a significant impact to *Pomaderris cotoneaster*.

In consideration of the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013), the residual adverse impacts are not likely to be significant. Notwithstanding, a total of 2 credits would be provided for impact to 0.07 ha of habitat for this species in accordance with the BAM (area of impact: Table 37, offset liability: Table 39).

8.4.4 Pink-tailed Legless Lizard (*Aprasia parapulchella*)

As described by AMBS (2023), "*one juvenile individual of the species was found on a north-west facing moderate slope just below sandstone outcropping… This individual was recorded under a small stick with exfoliating bark rather than under a rock. Habitat near this record includes native grasses, Lomandra sp. tussocks, numerous and varied sizes of sandstone surface and embedded rock, as well as log debris. There is a small rocky sandstone outcrop and a tree canopy just upslope. This sandstone outcrop sits just below the edge of a basalt hill, which also contains many surface and embedded rocks*". Surveys targeting this species were not able to be undertaken throughout the entire extent of potential habitat in the Study Area due to the COVID-19 lockdown enforcements limiting the availability of staff and, instead, focused on the south-west of the Study Area due to early detection of the Pink-tailed Legless Lizard (AMBS 2023). However, given the reasonably good connectivity of areas of potential habitat throughout the Study Area, it was considered likely that the

species could utilise other areas of potential habitat throughout the Study Area, rather than being restricted only to the rocky areas in which it was recorded (AMBS 2023). There is only one record for this species from 2000, approximately 20 km to the east of the site in Goulburn River National Park, although this record is over 20 years old (DPE 2022d[4]).

The extent of suitable habitat within the Study Area for the species was mapped based on the presence of surface rock, native grasses (e.g. *Themeda* sp., *Lomandra* sp. etc.), mostly within PCTs associated with the species, including PCTs 266, 281, 471, 483 and 1655 (AMBS 2023). Locations that have been heavily grazed or subject to soil disturbance from crops were excluded. Further, areas that did not contain surface rocks and logs were excluded. However, some small sections of degraded habitat were included based on the abundance of surface rock, presence of ants under rocks, and considering that these areas adjoined better condition habitat, which included some areas of land within PCTs not associated with the species. Occupied and/or potential habitat for the species within the Development Footprint is approximately 207.14 ha, of which 181.84 ha comprises native vegetation and 25.3 ha is Category 1 – exempt land (AMBS 2023).

Within the Study Area, some suitable habitat contiguous with the occupied habitat within the south-west of the Project would be avoided by the Project where practicable. It is unknown if the species occurs within the other areas of suitable habitat mapped including a large patch within the north of the Study Area, the isolated patches of remnant vegetation within the northern half of the Stage 1 area, and the potential habitat around the periphery along the eastern and southern boundaries of the Development Footprint.

Based on the presence of a juvenile, it is understood the species is breeding within the Study Area. Further, the record for the species is located near the boundary between the known and predicted distribution of this species (DPE 2023e) suggesting its presence represents a record towards the edge of its range. Considering that a juvenile individual was recorded near the boundary of the known and predicted distribution of this species, the population within the Study Area may be considered as an important population as per the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013).

The Project has been designed to avoid large areas of Pink-tailed Legless Lizard habitat within the Study Area, particularly within the south-west of the Project. The Vegetation Clearance Protocol would include searches of this species prior to vegetation clearance of relevant vegetation zones associated with the species (where possible) to relocate individuals to outside of the Development Footprint. Access to the mine site would be restricted, eliminating potential further removal or disturbance of scattered rocks within the Development Footprint. The post-mining final landform (Figure 19b), would include an area of habitat restoration for the species with placement of surface rocks.

Approximately 207.14 ha of known and potential habitat for the Pink-tailed Legless Lizard would be removed as a result of the Project. The impacts would occur over the life of the Project as habitat is progressively cleared. The Project is unlikely to indirectly impact the Pink-tailed Legless Lizard.

Based largely on the potential importance of the local population, the assessment concluded that a significant impact to the Pink-tailed Legless Lizard is likely due to the following:

- Removal of habitat that may lead to a long-term decrease in the size of an important population
- Reduction in the AOO of the population of this species
- Fragmentation of the existing population into two or more populations
- Disruption to the breeding cycle of the population through the loss of habitat.

In consideration of the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013), the residual adverse impacts are likely to be significant and an offset is required. Impacts to 207.14 ha of native vegetation within the potential Pink-tailed Legless Lizard habitat would be offset in accordance with the BC Act as well as 25.3 ha of Category 1 – exempt land (Table 37). A total of 4,147 credits would be provided (Table 39).

8.4.5 Regent Honeyeater (*Anthochaera phrygia*)

The Regent Honeyeater was not recorded within the Study Area during targeted surveys (AMBS 2023). However, this species has previously been recorded on several occasions within Munghorn Gap Nature Reserve, though many of the records are greater than 15-20 years old (DPE 2022d[4]). Records for this species are classified as sensitive data, therefore records for this species are unable to be shown on the BDAR Figures. Key areas of habitat for the species as identified on the Important Habitat Map (DPE 2023g) for the species are present within the Study Area (Figure 17f). A large proportion of the remnant native vegetation within the Study Area constitutes Important Habitat for the species as shown in Figure 17f.

Large portions of the vegetation to be cleared, predominantly the intact areas of woodland within the Development Footprint, are mapped as Important Habitat for the species and form part of the Mudgee-Wollar breeding area (DPE 2023g). The Important Habitat Map identifies land that is considered by DPE (2023g) important to support critical life stages of the species. Where impact to habitat on the Important Habitat Map occurs, the species must be assessed as a species credit species and a species polygon developed. The species polygon (Figure 17f) includes 80.5 ha of habitat within the Development Footprint. This area corresponds with the extent of the Important Area Mapping within the Development Footprint.

According to the National Recovery Plan for the Regent Honeyeater (DOE 2016) habitat critical for the species survival includes:

- Any breeding or foraging areas where the species is likely to occur.
- Any newly discovered breeding or foraging locations.

Based on the presence of foraging resources and the likely occurrence of the species within the Development Footprint, and the location of the Project within the Mudgee-Wollar important breeding area, the habitat within the Development Footprint meets this definition of habitat critical for the survival of the species.

The Project would result in the removal of 80.5 ha of habitat for this species.

Noisy Miners are identified as a key threatening process for this species. They compete directly and aggressively for resources with the Regent Honeyeater and they are considered to have a negative effect on breeding success and survival of the species (DOE 2016). Crates *et al.* (2018) state that the presence of a single pair of Noisy Miners may pose a risk to Regent Honeyeater nest survival. Noisy Miners were recorded within the Development Footprint (AMBS 2023) and are known to occupy a variety of habitats including edge habitat, open forest areas and urban landscapes (Clarke and Oldland 2007). The impacts would occur over the life of the Project as habitat is progressively cleared.

The Project would avoid areas of Important Area Mapping located around the periphery of the Study Area and some larger patches of remnant vegetation in the south-west of the Study Area. Following submission of the EIS, the Project design was amended to further minimise the impacts to areas of woodland in the Study Area, particularly the relatively high-quality woodland areas mapped on the Regent Honeyeater Important Habitat Map adjacent to Munghorn Gap Reserve. The amended Development Footprint results in a 56.4% reduction to the area of woodland habitat impacted (from 184.4 ha to 80.5 ha) and a 6.8% reduction in the area of DNG impacted (from 393.53 ha to 366.9 ha). The total area of woodland to be impacted has been reduced by 80.5 ha (43.6%).

The Habitat Enhancement Area (Figure 19b) described in Section 4.2 would be established to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened ecological communities and threatened species habitat within the riparian zone of Moolarben Creek and Murdering Creek. The Habitat Enhancement Area contains 53 ha of foraging habitat for this species and 135 ha of DNG and cleared land which is proposed to be revegetated to provide additional habitat.

The Project conceptual final landform (Figure 19b) aims to provide a net increase in native vegetation and improve connectivity with adjacent woodland and forest communities at Munghorn Gap Nature Reserve. A Noisy Miner monitoring and management program would also be implemented to mitigate the potential impacts from Noisy Miners as described in Section 5.7.

Based largely on the fact that the Development Footprint contains habitat that is considered critical to the survival of the species, the significant impact assessment (Appendix D) concluded that residual impacts from the Project are likely to significantly impact the Regent Honeyeater due to the following:

- It is possible the Project may result in a long-term decrease in the size of the population of the species.
- The Project is considered likely to result in a reduction in the Area of Occupancy (AOO) of a population of this species.
- The Project is considered likely to adversely affect habitat that is critical to the survival of the species.

- It is possible the Project may disrupt the breeding cycle of a population through the loss of habitat as result of the Project.
- The Project is likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.
- It is possible the Project may result in increased access of invasive species (in particular the Noisy Miner) that is known to be harmful to this critically endangered species.
- The Project is likely to interfere with the recovery of the species.

In consideration of the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013), the residual adverse impacts are likely to be significant and an offset is required. Impacts to 80.5 ha of potential Regent Honeyeater habitat would be offset in accordance with the BC Act (Table 37). A total of 3,410 credits would be provided (Table 39).

8.4.6 Large-eared Pied Bat (*Chalinolobus dwyeri*)

During the surveys undertaken by AMBS in January 2021 (Appendix C), 13 individuals were caught in harp traps and six were observed (or hand-caught) during habitat searches. Of these, one adult female was lactating (later stages) and two males were immature. One additional female was non-breeding at the time of the survey but may have bred in the past (indicated by black nipples). The species was recorded on Anabat detectors at 30 locations. Three roosts were recorded during habitat searches.

Within the Study Area, potential roosting and breeding habitat for the Large-eared Pied Bat is extensive and highly variable. A variety of habitat features occur including tall sandstone rocks and boulders, small cavities and crevices within rocks, cavities between rocks, low entry caves, small domes, low and high overhangs, and Fairy Martin (*Petrochelidon ariel*) nests (which are known to be used by the Large-eared Pied Bat for roosting) (Schultz 1998). The species polygon (including rocky breeding habitat and foraging habitat within 2 km) is approximately 113.02 ha in the Development Footprint as shown on Figure 17i.

The National Recovery Plan suggests that sandstone cliffs and fertile wooded valley habitat within close proximity of each other should be considered habitat critical to the survival of the Large-eared Pied Bat (Department of Environment and Resource Management [DERM] 2011). On its own, the potential foraging habitat to be removed is not considered to comprise habitat critical to the survival of the species, given the availability of potential foraging habitat (open wooded valley habitat) in the surrounding area. However, the foraging habitat to be removed is adjacent to potential breeding/roosting habitat and would, therefore, be considered to be critical habitat due to its proximity to the breeding/roosting habitat, as per the definition of habitat critical to the survival of the species defined in the National Recovery Plan (DERM 2011). 'Vegetation clearance in the proximity of roosts' and the 'destruction of and interference with maternity roosts and other roosts' have been identified as key threats to this species, with the level of risk being imposed by these threats considered as very high (DCCEEW 2023e).

Given the number of individuals observed, the evidence of breeding and the presence of breeding and foraging habitat, the population within the Study Area is considered to be an important population for this species.

The Project would directly impact 113.02 ha of potential foraging habitat. The Project Development Footprint has been designed to avoid mapped rocky habitat as shown in Figure 17i.

The Habitat Enhancement Area described in Section 4.2 would be established to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened ecological communities and threatened species habitat. The Habitat Enhancement Area contains 53 ha of foraging habitat for this species and 135 ha of DNG and cleared land which is proposed to be revegetated to provide additional habitat.

The Project conceptual final landform aims to provide a net increase in native vegetation and improve connectivity with adjacent woodland and forest communities at Munghorn Gap Nature Reserve. Indirect impacts from light spill, noise and blasting would be mitigated, managed and monitored as detailed in Section 5.7. Monitoring and management of feral pests would be conducted as part of the Project.

Despite avoidance of direct impacts to the majority of breeding habitat (mapped rocky habitat) for this species, the assessment (Appendix D) concluded that residual impacts from the Project have the potential to significantly impact upon the Large-eared Pied Bat due to the following:

- Disruption of breeding (such as indirect impacts from noise [blasting and operational noise], lighting and vegetation clearance in proximity to roosts) has the potential to result in a long-term decrease in the size of an important population of the species
- The Project may adversely affect habitat that is critical to the survival of the species
- The Project may disrupt the breeding cycle of the population through the loss of habitat as a result of the Project
- The Project may modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline
- The Project may interfere with the recovery of the species.

In consideration of the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013), the residual adverse impacts are likely to be significant and an offset is required. Impacts to 113.02 ha of potential Large-eared Pied Bat habitat would be offset in accordance with the BC Act (Table 37). A total of 5,137 credits would be provided (Table 39).

8.4.7 Broad-headed Snake (*Hoplocephalus bungaroides*)

One Broad-headed Snake was recorded during targeted surveys by AMBS (2023) in 2021. The individual was recorded approximately 96 m outside the Development Footprint at the edge of the escarpment under a large sandstone rock. The habitat in which the individual was recorded is contiguous with potential habitat that occurs within the Development Footprint. No other records of

the species occur within 30 km of the Project (DPE 2022d[4]), although the species has long been thought to occur in the Munghorn Gap Nature Reserve (NPWS 2003).

The Broad-headed Snake has a preferred habitat centred on the communities occurring on the Triassic sandstone of the Sydney Basin. The sites where they occur are typified by exposed sandstone outcrops and benching and in these locations the vegetation is mainly woodland, open woodland and/or heath. The Broad-headed Snake seasonally occupies distinctive microhabitats within these broader habitat types. They utilise rock crevices and exfoliating sheets of weathered sandstone during the cooler months and tree hollows during summer (Webb and Shine 1998).

As described by AMBS (2023), "*this species is nocturnal, sheltering during the day in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring* (DPE 2023a). *In summer, the Broad-headed Snake moves from the sandstone rocks to shelter in crevices or hollows in large trees within 500 m of escarpments* (DPE 2023a). *This species diet consists primarily of geckos and small skinks, but also occasionally includes frogs and small mammals* (DPE 2023a). *Females produce between four and twelve live young from January to March, which is considered a relatively low level of fecundity*" (DPE 2023a). Rocky areas, escarpments, outcrops and pagodas make up the primary habitat for this species in terms of breeding, hunting and sheltering, with individuals often spending long periods of inactivity in a retreat site (DPE 2023a). Gravid females and juveniles will remain in rocky habitat, using cooler, shaded rocks and crevices (DPE 2023a). The Broad-headed Snake is an ambush predator, spending up to four weeks in the same retreat site and preying on small reptiles and mammals that enter the retreat (Webb and Shine 1997b).

No Broad-headed Snake habitat occurs within the Development Footprint and would not be directly impacted (Figure 17c), with adjoining areas of habitat potentially indirectly impacted (noise, vibration and lighting impacts). The impacts would occur over the life of the Project as habitat is progressively cleared.

The Development Footprint has been designed to avoid primary shelter habitat (i.e. mapped rocky habitat) as shown in Figure 17c. Indirect impacts from light, noise and vibration would be mitigated, managed and monitored as detailed in Section 5.7. Targeted pre-clearance surveys would also be conducted within areas of suitable habitat to allow for re-location of resident individuals prior to clearance. Foxes and feral cats would be controlled and monitored as part of the Biodiversity Monitoring Program.

In light of avoidance of key areas of mapped rocky habitat for this species, the assessment (Appendix D) concluded that residual adverse impacts are not likely to be significant and an offset is not required for impacts to the Broad-headed Snake.

8.4.8 Koala (*Phascolarctos cinereus*)

The Koala was recorded at three broad locations within the Study Area (AMBS 2023; ELA 2023). Four Koalas were heard responding to call playback, two were observed opportunistically and Koala scats were also observed at the base of a tree (AMBS 2023). The species has also been recorded in

contiguous habitat to the north of the Study Area (AMBS 2021) and there are records of the Koala in the wider locality, including within the nearby Munghorn Gap Nature Reserve (DPE 2023a). Koala records and habitat within the Study Area is shown on Figure 17g.

Suitable habitat for the species was determined to occur widely throughout the Study Area, including all woodland PCTs and scattered trees (AMBS 2023). The Koala habitat is considered to be continuous as the majority of the Koala habitat is well-connected, particularly around the perimeter of the Study Area. Habitat on the valley flats is highly fragmented, but riparian habitat along Moolarben Creek and Murdering Creek provides connectivity throughout the Study Area. Habitats within the Study Area were broadly in good condition (AMBS 2023). The majority of the Study Area has been unburnt for some time with only two small wildfires on record in the past 10 years (DPE 2023e); a 1 ha wildfire in 2011-12 and a 2 ha wildfire in 2013-14. Larger wildfires have occurred to the east and north, as well as several prescribed burns (DPE 2023e), but most were more than 10 years ago. Sightings of feral predators (e.g. dogs) were rare, with only five records obtained during the current surveys in 2021 (AMBS 2023). Six tree species that occur in the Study Area are considered key food trees for the Koala, including White Box (*Eucalyptus albens*), Grey Gum (*E. punctata*), Blakely's Red Gum (*E. blakelyi*), Yellow Box (*E. melliodora*), Grey Box (*E. moluccana*) and Narrow-leaved Stringybark (*E. sparsifolia*). A species polygon was generated by AMBS (2023) (Appendix C) (Figure 17g).

The species polygon for the Koala (including occupied and suitable habitat) was mapped using all vegetation zones within the Development Footprint which contain key food tree species.

The Project would avoid and/or minimise impacts on Koala habitat through Project design, including: preferentially locating disturbance in Category 1 – exempt land or where the vegetation/habitat is in the poorest condition (e.g. low quality DNG); avoiding disturbance in vegetation and habitat associated with the steeper terrain adjacent to the Munghorn Gap Nature Reserve, as far as practicable; avoiding open cut mining within 200 m of Moolarben Creek and Murdering Creek (allowing for retention and rehabilitation of this habitat as a movement corridor/refuge habitat); minimising infrastructure within the riparian zone of Moolarben Creek and Murdering Creek and locating creek crossings (three haul road creek crossings are proposed) within previously cleared areas, where practicable and feasible; and progressive rehabilitation and revegetation of backfilled areas to provide flora and fauna habitat, including potential habitat for threatened species. Pre-clearance surveys would be conducted to minimise impacts to resident Koalas.

The Habitat Enhancement Area (Figure 19b) described in Section 4.2 would be established to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened ecological communities and threatened species habitat within the riparian zone of Moolarben Creek and Murdering Creek. The Habitat Enhancement Area contains 53 ha of Koala habitat and 135 ha of DNG and cleared land which is proposed to be revegetated to provide additional habitat.

Following submission of the EIS, the Project design was amended to further minimise impacts to woodland habitat, particularly the relatively high-quality woodland areas. The amended Development Footprint results in a 59.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha) and a 6.8% reduction in the area of DNG impacted (from 393.53 ha to 366.9 ha). The total area of woodland to be impacted has been reduced by 76.63 ha (16%).

The revised Project would result in clearance of approximately 113.02 ha of relatively sparse isolated patches of Koala habitat across the valley floor, reducing the area of habitat and foraging resources available to the species and potentially impacting movement from east to west (Figure 17g). Koalas would be displaced over the life of the Project as habitat is progressively cleared.

The habitat within the Development Footprint was determined to potentially constitute habitat critical to the survival of the species, according to three of the criteria defined in *Conservation Advice for Phascolarctos cinereus (Koala) Combined Populations of Queensland, New South Wales and the Australian Capital Territory* (DAWE 2022b) (Appendix D), namely:

- (a) whether the habitat is used during periods of stress (examples: flood, drought or fire)
- (b) whether the habitat is used to meet essential life cycle requirements (examples: foraging, breeding, nesting, roosting, social behaviour patterns or seed dispersal processes)
- (c) the extent to which the habitat is used by important populations.

In relation to criteria (a), considering the number of records obtained within the Study Area in 2021, it was considered plausible that individuals survived the recent drought comparably better than some other populations within NSW. It is likely the habitat would have been used during the drought, a period of stress. Further, the Study Area was not burnt during the 2019-20 fires and thus may have acted as a refuge at this time (AMBS 2023).

In relation to criteria (b), male Koalas were heard bellowing on multiple occasions within the Study Area indicating that breeding is occurring, and the habitat is used to meet essential life cycle requirements.

In relation to criteria (c), it is considered that the population in the Study Area constitutes an 'important population' based on the fact that it may be considered 'climate-robust' and is located within a relatively well-connected landscape. Further detail regarding this assessment is provided in Appendix D and Appendix C.

Considering the recent large declines that have been recorded throughout the species range (DAWE 2022b; DAWE 2022c), and that there is evidence to suggest that the population within the Study Area has survived 2019-20 drought and bushfires comparably well, there is evidence to suggest habitats within the Study Area could be critical to the survival of the species (AMBS 2023).

Based largely on the potential importance of the local population and habitat within the Development Footprint, the assessment concluded that a significant impact to the Koala is likely due to the following:

- Removal of habitat (considered critical to survival of the population) that may lead to a long-term decrease in the size of an important population
- Adverse effects to habitat considered critical to the survival of a species.

In consideration of the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013), the residual adverse impacts are likely to be significant and an offset is required. Impacts to 113.02 ha of Koala habitat would be offset in accordance with the BC Act (Table 37). A total of 3,425 credits would be provided (Table 39).

8.4.9 Swift Parrot (*Lathamus discolor*)

The Swift Parrot was not recorded during targeted surveys, however the species has been recorded in contiguous habitat to the north and there are also records in the wider locality, including within the nearby Munghorn Gap Nature Reserve (AMBS 2023). This species breeds only in Tasmania and therefore no breeding habitat occurs within the Development Footprint. Key foraging areas for this species within NSW are identified within the Important Habitat Map for the species (DPE 2023g). The Important Habitat Map for the species includes "Areas with sightings of five or more birds recorded over any two or more years, or single sightings of 40 or more birds" and is defined by a 2 km radial buffer on all cleaned and checked Swift Parrot sighting records from 1990-2020. No areas of habitat identified on the Swift Parrot Important Habitat Map occur within the Development Footprint. This species is associated with PCTs 266, 281, 1629 and 1655, which are present within the Development Footprint.

Approximately 105.52 ha of potential Swift Parrot foraging habitat would be directly impacted (cleared), with adjoining areas of habitat potentially indirectly impacted (noise and lighting impacts and competitive exclusion by Noisy Miners).

The Habitat Enhancement Area (Figure 19b) described in Section 4.2 would be established to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened ecological communities and threatened species habitat within the riparian zone of Moolarben Creek and Murdering Creek. The Habitat Enhancement Area contains 53 ha of foraging habitat for this species and 135 ha of DNG and cleared land which is proposed to be revegetated to provide additional habitat.

Given that the species was not recorded within the Development Footprint and no breeding habitat or Important Habitat Mapping is present or would be impacted, the assessment (Appendix D) concluded that the Project is unlikely to significantly impact upon the Swift Parrot.

In consideration of the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013), the residual adverse impacts are not likely to be significant and an offset is not required.

8.5 Conclusion

Detailed assessment of the impacts of the Project on MNES (Appendix D) concluded that the Project is likely to have a significant impact on five MNES: Box-Gum Woodland CEEC, Pink-tailed Legless

Lizard, Koala, Large-eared Pied Bat and Regent Honeyeater through direct and indirect impacts to foraging, breeding habitat and/or critical habitat for these entities. Impacts to these species would be offset as per the BC Act. The significant impact assessments concluded that the Project is not likely to have a significant impact on the Eucalypt Forest and Woodland CEEC, *Pomaderris cotoneaster*, Swift Parrot or Broad-headed Snake.

Avoidance and mitigation measures implemented to minimise impacts to each MNES are summarised below. Offsets for MNES subject to significant impacts are detailed in Section 8.7.

8.6 Avoidance and Mitigation Measures for MNES

Avoidance and mitigation measures for each of the MNES addressed in this assessment are detailed in Table 39. They include those already discussed throughout the report as detailed in Sections 4 and 5. As per the SEARS, further detail regarding the impact, an assessment of the expected or predicted effectiveness of the mitigation measures and statutory basis for the proposed measures is provided. MCO would bear the cost of the mitigation measures.

Monitoring of the Regent Honeyeater, Large-eared Pied Bat and Eastern Cave Bat would be conducted as described in Section 5.7.

Table 39. Avoidance and Mitigation Measures for MNES.

Matter	Impact	Avoidance/ mitigation measure	Techniques	Likely effectiveness (low/ moderate/ high)	Basis for the Mitigation Measures
Box-Gum Woodland CEEC	Direct impact/ removal of Box-Gum Woodland CEEC	Project design	• Preferentially locating disturbance in areas lacking Box-Gum Woodland CEEC (e.g. Category 1 – exempt land) or where the vegetation/habitat is in the poorest condition (e.g. low quality DNG) • Avoiding open cut mining within 200 m of Moolarben Creek and Murdering Creek (which have a riparian zone comprising Box-Gum Woodland CEEC) • Minimising infrastructure within the riparian zone of Moolarben Creek and Murdering Creek and locating creek crossings (three haul road creek crossings are proposed) within previously cleared areas, where practicable and feasible • Condensing the Development Footprint by locating infrastructure areas immediately adjacent to open cut mining areas • Progressively back-filling open cut pits to minimise the required disturbance extent (i.e. reducing the need for large out-of-pit overburden emplacements), as far as practically possible, as well as removing residual pit voids from the final landform • Reduction of the Development Footprint post initial EIS submission to further avoid impacts to Box-Gum Woodland CEEC, particularly the relatively high-quality woodland areas. The amended Project Development Footprint will result in a 59.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha) and a 6.8% reduction in the area of DNG impacted (from 393.53 ha to 366.9 ha). (The total area	High: areas of Box-Gum Woodland CEEC in the north, south-west and south-east of the Study Area and some areas along Moolarben and Murdering Creeks would be avoided by the Project (Figure 20).	As per objectives of the National Recovery Plan for White Box–Yellow Box–Blakely's Red Gum Grassy Woodland and Derived Native Grassland (DECCW 2010): Achieving no net loss in extent and condition of the ecological community throughout its geographic distribution; Increasing transitional areas around remnants and linkages between remnants; increasing landscape function of the community

Matter	Impact	Avoidance/ mitigation measure	Techniques	Likely effectiveness (low/ moderate/ high)	Basis for the Mitigation Measures
			of Box-Gum Woodland to be impacted has been reduced by 76.63 ha (16%).		through management and restoration of degraded sites; and increasing transitional areas around remnants and linkages between remnants.
		Habitat Enhancement Area	The proposed Habitat Enhancement Area includes the riparian zone along Moolarben and Murdering Creek (outside of the Development Footprint) and is shown on Figure 19b. The Habitat Enhancement Area includes approximately 108.1 ha of Box-Gum Woodland CEEC that is proposed to be revegetated. Management measures would include: • Revegetation • Fencing, as required • Weed management • Animal pest management • Fire management.	Moderate-high with implementation of rehabilitation monitoring	
		Mine rehabilitation - revegetation	• Progressive rehabilitation and revegetation of backfilled areas with species consistent with Box-Gum Woodland. Approximately 535 ha of native woodland and 140 ha of native grassland with scattered trees (suitable for agricultural use) is proposed to be established as part of the conceptual post-mining land use for the Project.	Moderate-high with implementation of rehabilitation monitoring	
		Vegetation Clearance Protocol	• Mine staff and contractors involved in vegetation clearance works would be made aware of clearing limits via the ground disturbance process • Clear delineation of the areas to be disturbed prior to clearing activities, disturbance boundaries would be digitally captured and displayed within the site survey and GIS databases. This data would be made available either digitally or in map format. Where native	High with strict adherence to vegetation clearing protocols	

Matter	Impact	Avoidance/ mitigation measure	Techniques	Likely effectiveness (low/ moderate/ high)	Basis for the Mitigation Measures
			vegetation clearing is to be carried out on a campaign basis, then prior to each clearing campaign the area to be cleared would be identified and marked.		
Eucalypt Forest and Woodland CEEC	Direct impact/removal Eucalypt Forest and Woodland CEEC	Mine rehabilitation - revegetation	• Areas disturbed by the Project would be progressively rehabilitated and revegetated, with species consistent with Eucalypt Forest and Woodland CEEC. Approximately 535 ha of native woodland and 140 ha of native grassland with scattered trees (suitable for agricultural use) is proposed to be established as part of the conceptual post-mining land use for the Project.	Moderate-high with implementation of rehabilitation monitoring	There is no adopted or made Recovery Plan for this ecological community.
		Vegetation Clearance Protocol	• Mine staff and contractors involved in vegetation clearance works would be made aware of clearing limits via the ground disturbance process • Clear delineation of the areas to be disturbed prior to clearing activities, disturbance boundaries would be digitally captured and displayed within the site survey and GIS databases. This data would be made available either digitally or in map format. Where native vegetation clearing is to be carried out on a campaign basis, then prior to each clearing campaign the area to be cleared would be identified and marked.	High with strict adherence to vegetation clearing protocols	
		Habitat Enhancement Area	The proposed Habitat Enhancement Area includes the riparian zone along Moolarben and Murdering Creek (outside of the Development Footprint) and is shown on Figure 19b. The Habitat Enhancement Area includes approximately 53 ha of existing woodland and approximately 135 ha of DNG and cleared land that is proposed to be revegetated with species	Moderate-high with implementation of rehabilitation monitoring	

Matter	Impact	Avoidance/ mitigation measure	Techniques	Likely effectiveness (low/ moderate/ high)	Basis for the Mitigation Measures
			consistent with Eucalypt Forest and Woodland CEEC. Management measures would include: • Revegetation • Fencing (as required) • Weed management • Animal pest management • Fire management.		
Cotoneaster Pomaderris (*Pomaderris cotoneaster*)	Direct impact/removal of occupied habitat	Fencing of *Pomaderris cotoneaster*	Erecting a fence between known Pomaderris cotoneaster plants and the adjacent Development Footprint.	Moderate-high with implementation of rehabilitation monitoring	As per objectives of the National Recovery Plan (DECCW 2009): To ensure that all natural populations of *Pomaderris cotoneaster* are stable or increasing in size; to reduce or manage threats; and promote its recruitment wherever possible
		Weed and pathogen management	Weed and pathogen management to prevent spread of weeds and pathogens with a potential to impact *Pomaderris cotoneaster*.	Moderate-high with implementation of monitoring as per implementation of the BMP	
		Vegetation Clearance Protocol	• Mine staff and contractors involved in vegetation clearance works would be made aware of clearing limits via the ground disturbance process • Clear delineation of the areas to be disturbed on the ground prior to clearing activities, disturbance boundaries would be digitally captured and displayed	High with strict adherence to vegetation clearing protocols	

Matter	Impact	Avoidance/ mitigation measure	Techniques	Likely effectiveness (low/ moderate/ high)	Basis for the Mitigation Measures
			within the site survey and GIS databases. This data would be made available either digitally or in map format. Where native vegetation clearing is to be carried out on a campaign basis, then prior to each clearing campaign the area to be cleared would be identified and marked.		
Regent Honeyeater (*Anthochaera phrygia*)	Direct impact/removal of habitat	Habitat Enhancement Area	• The proposed Habitat Enhancement Area includes the riparian zone along Moolarben and Murdering Creek (providing foraging/nesting resources) covering 160 ha of land (outside of the Development Footprint) and is shown on Figure 19b. The Habitat Enhancement Area includes approximately 53 ha of existing woodland and approximately 135 ha of DNG and cleared land that is proposed to be revegetated.	Moderate-high with implementation of rehabilitation monitoring	Improve the extent and the quality of Regent Honeyeater habitat as per the National Recovery Plan (DOE 2016).
		Mine rehabilitation - revegetation	• Areas disturbed by the Project would be progressively rehabilitated and revegetated (providing foraging habitat). Approximately 535 ha of native woodland and 140 ha of native grassland with scattered trees is proposed to be established as part of the conceptual post-mining land use for the Project.	Moderate-high with implementation of rehabilitation monitoring	
Pink-tailed Legless Lizard *(Aprasia parapulchella)*	Direct impact/removal of potential habitat	Mine rehabilitation - surface rock trial site	Development of a surface rock trial site to assess if introducing new surface rock during mine rehabilitation can restore rocky habitat for the Pink-tailed Legless Lizard.	High with implementation of monitoring	As per the Conservation Advice for the species (TSSC 2015): Identify sites not protected in conservation reserves and seek to

Matter	Impact	Avoidance/ mitigation measure	Techniques	Likely effectiveness (low/ moderate/ high)	Basis for the Mitigation Measures
					secure the protection and conservation management of sites on which long-term conservation relies.
		Vegetation Clearance Protocol	The Vegetation Clearance Protocol for the Project would include: • Pre-clearance fauna surveys of relevant vegetation zones associated with the species would be undertaken by a suitably trained and qualified ecologist or wildlife handler to search for Pink-tailed Legless Lizard • A suitably trained and qualified ecologist or wildlife handler would be present during the clearing of identified habitat to manage animals that may be encountered during land clearing • Management of fauna may include relocating the individual to adjacent habitat or treating injuries as required.	High with strict adherence to vegetation clearing protocols	
Large-eared Pied Bat (*Chalinolobus dwyeri*)	Direct impact/removal of potential habitat	Project design	Avoiding disturbance in vegetation and habitat associated with the steeper terrain (i.e. mapped rocky habitat) adjacent to the Munghorn Gap Nature Reserve, as far as practicable.	High: results in the avoidance of large areas of primary habitat within the Study Area	As per the actions within the National Recovery Plan for the Species (DERM 2011): identifying,

Matter	Impact	Avoidance/ mitigation measure	Techniques	Likely effectiveness (low/ moderate/ high)	Basis for the Mitigation Measures
		Habitat Enhancement Area	The proposed Habitat Enhancement Area includes the riparian zone along Moolarben and Murdering Creek (outside of the Development Footprint) and is shown on Figure 19b. The Habitat Enhancement Area includes approximately 53 ha of existing woodland and approximately 135 ha of DNG and cleared land that is proposed to be revegetated. Management measures would include: • Revegetation • Fencing, as required • Weed management • Animal pest management • Fire management.	Moderate-high with implementation of rehabilitation monitoring	mapping and modelling bat colonies; identifying priority colonies for conservation management; surveying the species to clarify distribution and abundance to inform management; protecting known roosts.
		Mine rehabilitation - revegetation	Areas disturbed by the Project would be progressively rehabilitated and revegetated (providing foraging habitat). Approximately 535 ha of native woodland and 140 ha of native grassland with scattered trees (suitable for agricultural use) is proposed to be established as part of the conceptual post-mining land use for the Project.	Moderate-high with implementation of rehabilitation monitoring	
	Roost disruption and cave collapse from blast noise and vibration	Implementation of Blast Management Plan with blast criterion of 50 mm/s at nearest rocky habitat features	Mitigation and minimisation of indirect vibration/noise impacts to nearby rocky habitat for the for the Broad-headed Snake, Eastern Cave Bat and Large-eared Pied Bat will include: • Pre-blast desktop assessments • Site-specific vibration modelling per blast to calculate MIC required to meet PPV limit for nearest mapped rocky habitat • Continuation of existing vibration monitoring as described in the Blast Management Plan (MCO 2020d)	High with implementation of rehabilitation monitoring	

Matter	Impact	Avoidance/ mitigation measure	Techniques	Likely effectiveness (low/ moderate/ high)	Basis for the Mitigation Measures
			• Additional vibration monitoring at one or more new representative sites of mapped rocky habitat adjacent to the Project • Ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary • Visual inspections of key representative mapped rocky habitat on a 6-monthly basis.		
Broad-headed Snake (*Hoplocephalus bungaroides*)	Direct impact/removal of potential habitat	Project design	Avoidance of disturbance and direct impacts to Broad-headed Snake habitat within the Development Footprint which is associated with the steeper terrain (i.e. mapped rocky habitat) adjacent to the Munghorn Gap Nature Reserve.	High: results in the avoidance of large areas of primary habitat within the Study Area	As per the priority actions within Approved Conservation Advice (DCCEEW 2023f): limit habitat loss, disturbance and modification.
		Implementation of Blast Management Plan with blast criterion of 50 mm/s at nearest rocky habitat features	Mitigation and minimisation of indirect vibration/noise impacts to nearby rocky habitat for the for the Broad-headed Snake will include: • Pre-blast desktop assessments • Site-specific vibration modelling per blast to calculate MIC required to meet PPV limit for nearest mapped rocky habitat • Continuation of existing vibration monitoring as described in the Blast Management Plan (MCO 2020d)	High	

Matter	Impact	Avoidance/ mitigation measure	Techniques	Likely effectiveness (low/ moderate/ high)	Basis for the Mitigation Measures
			• Additional vibration monitoring at one or more new representative sites of mapped rocky habitat adjacent to the Project • Ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary • Visual inspections of key representative mapped rocky habitat on a 6-monthly basis.		
		Vegetation Clearance Protocol	The Vegetation Clearance Protocol for the Project would include: • Pre-clearance fauna surveys of relevant vegetation zones associated with the species would be undertaken by a suitably trained and qualified ecologist or wildlife handler to search for Broad-headed Snake • A suitably trained and qualified ecologist or wildlife handler would be present during the clearing of identified habitat to manage animals that may be encountered during land clearing • Management of fauna may include relocating the individual to adjacent habitat or treating injuries as required.	High with strict adherence to vegetation clearing protocols	
	Vehicle strike	Vehicle speeds	Speed limits would be imposed on all vehicles using internal mine roads and access tracks, and training of personnel (contractors, visitors, and other representatives).	Moderate: relies on all staff strictly following this procedure.	

Matter	Impact	Avoidance/ mitigation measure	Techniques	Likely effectiveness (low/ moderate/ high)	Basis for the Mitigation Measures
Koala (*Phascolarctos cinereus*)	Direct impact/removal of potential habitat	Project design	• Preferentially locating disturbance in Category 1 - exempt land or where the vegetation/habitat is in the poorest condition (e.g. low quality DNG) • Avoiding open cut mining within 200 m of Moolarben Creek and Murdering Creek • Minimising infrastructure within the riparian zone of Moolarben Creek and Murdering Creek and locating creek crossings (three haul road creek crossings are proposed) within previously cleared areas, where practicable and feasible (allowing for retention and rehabilitation of this habitat as a movement corridor/refuge habitat).	High	
		Vegetation Clearance Protocol	The Vegetation Clearance Protocol for the Project would include: • Pre-clearance fauna surveys of relevant vegetation zones associated with the species would be undertaken by a suitably trained and qualified ecologist or wildlife handler • A suitably trained and qualified ecologist or wildlife handler would be present during the clearing of habitat to manage animals that may be encountered during land clearing • Management of the Koala in consideration of the *Code of Practice for Injured, Sick and Orphaned Koalas* (DPE 2023k) • Management of fauna may include relocating the individual to adjacent habitat or treating injuries as required.	High with strict adherence to vegetation clearing protocols	

Matter	Impact	Avoidance/ mitigation measure	Techniques	Likely effectiveness (low/ moderate/ high)	Basis for the Mitigation Measures
		Habitat Enhancement Areas	The proposed Habitat Enhancement Area includes the riparian zone along Moolarben and Murdering Creek (providing habitat and connectivity) covering 160 ha of land (outside of the Development Footprint) as shown on Figure 19b. The Habitat Enhancement Area includes approximately 53 ha of existing woodland and approximately 135 ha of DNG and cleared land that is proposed to be revegetated. Management measures would include: • Revegetation • Fencing, as required • Weed management • Animal pest management • Fire management.	Moderate-high with implementation of rehabilitation monitoring	As per one of the key on-ground strategies within the National Recovery Plan for the species (DAWE 2022d): Strategically restore listed Koala habitat.
		Mine rehabilitation - revegetation	Areas disturbed by the Project would be progressively rehabilitated and revegetated (providing foraging/shelter habitat). Approximately 535 ha of native woodland and 140 ha of native grassland with scattered trees (suitable for agricultural use) is proposed to be established as part of the conceptual post-mining land use for the Project.	Moderate-high with implementation of rehabilitation monitoring	
	Vehicle strike	Vehicle speeds	Speed limits would be imposed on all vehicles using internal mine roads and access tracks, and training of personnel (contractors, visitors, and other representatives).	Moderate: relies on all staff strictly following this procedure.	Manage a direct threat to the species (DAWE 2022d).
Swift Parrot (*Lathamus discolor*)	Direct impact/removal of habitat	Habitat Enhancement Area	The proposed Habitat Enhancement Area includes the riparian zone along Moolarben and Murdering Creek (providing foraging habitat) covering 160 ha of land (outside of the Development Footprint) and is shown on Figure 19b. The	Moderate-high with implementation of rehabilitation monitoring	As per objective 2 of the National Recovery Plan (Saunders and

Matter	Impact	Avoidance/ mitigation measure	Techniques	Likely effectiveness (low/ moderate/ high)	Basis for the Mitigation Measures
			Habitat Enhancement Area includes approximately 53 ha of existing woodland and approximately 135 ha of DNG and cleared land that is proposed to be revegetated. Management measures would include: • Revegetation • Fencing, as required • Weed management • Animal pest management • Fire management.		Tzaros 2011): to protect and improve habitats and sites on all land tenures.
		Mine rehabilitation - revegetation	Areas disturbed by the Project would be progressively rehabilitated and revegetated (providing foraging habitat). Approximately 535 ha of native woodland and 140 ha of native grassland with scattered trees (suitable for agricultural use) is proposed to be established as part of the conceptual post-mining land use for the Project.	Moderate-high with implementation of rehabilitation monitoring	
All MNES	Potential weed and pathogen incursion	Weed and pathogen management	Weed and pathogen management for the Project with a focus on vehicle/machinery hygiene control to prevent spread of weeds and pathogens, as well as physical and/or chemical weed removal/control.	Moderate-high with implementation of monitoring as per implementation of the BMP	
	Light spill	Minimise light spill	Any permanent lighting to be directed into the site to minimise illuminating adjacent woodland areas in the Munghorn Gap Nature Reserve, as far as practicable. Directional lighting and warm-white bulbs to be used where practicable.	Moderate-high with implementation of monitoring as per implementation of the BMP	

Matter	Impact	Avoidance/ mitigation measure	Techniques	Likely effectiveness (low/ moderate/ high)	Basis for the Mitigation Measures
	Potential herbivory, predation and/or competition/ competitive exclusion by pest animals	Animal pest management	Pest animal control for the Project with a focus on pest species known to impact native flora and fauna, specifically feral cat, wild dog, feral pig, feral goat, wild rabbit, red fox, fallow deer and feral birds.	Moderate-high with implementation of monitoring as per implementation of the BMP	
	Potential habitat destruction from bushfire	Bushfire management	Mitigation measures that would be implemented by MCO to manage and reduce bushfire risk would focus on education and training, annually assess the bushfire hazards, minimising and controlling ignition sources (e.g. by appropriate engineering design, where relevant) and revising existing responses and evacuation strategies to include the Project area.	Moderate with strict implementation of management actions	
	Direct impact/removal of habitat	Mine rehabilitation - revegetation	Areas disturbed by the Project would be progressively rehabilitated and revegetated. All mining-related infrastructure would be decommissioned when redundant and removed, unless needed to support future post-mining land uses (in consultation with relevant stakeholders). Approximately 535 ha of native woodland and 140 ha of native grassland with scattered trees (suitable for agricultural use) is proposed to be established as part of the conceptual post-mining land use for the Project.	Moderate-high with implementation of rehabilitation monitoring	

8.7 Offset Strategy for MNES

As discussed in Section 9, the Australian Government has formally endorsed the NSW Biodiversity Offsets Scheme (and use of the BAM [DPIE 2020a] as the methodology for calculating biodiversity credit requirements) through the EPBC Act Condition-setting Policy (DAWE 2020). This allows the NSW Biodiversity Offsets Scheme to be applied to assess and meet biodiversity offset requirements for a project.

As per Division 6.6A of the BC Regulation, the Commonwealth does not support application of the variation rules to satisfy an offset obligation for MNES in relation to a controlled action, and as such impacts to MNES would be offset on a like-for-like basis and would be addressed via one, or a combination of the following:

- Retire biodiversity credits based on the like-for-like provisions in the BC Regulation
- Fund biodiversity conservation actions that are listed in the Ancillary rules: Biodiversity conservation actions and directly benefit the threatened entity impacted
- Commit to deliver mine site ecological rehabilitation that creates the same ecological community or threatened species habitat
- Pay into the Biodiversity Conservation Fund.

The offset requirement for each MNES with the potential to be significantly impacted is provided in Table 40.

Table 40. Offset Requirement for MNES impacted by the Project.

MNES	Impact (ha)	Offset credits	Significantly impacted? (as determined in Section 8.4 and Appendix D)
White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC	401.12	9,610	Yes
Eucalypt Forest and Woodland CEEC	15.5	372	No, however offsets still required under the BC Act
Cotoneaster Pomaderris (*Pomaderris cotoneaster*)	0.07	2	No, however offsets still required under the BC Act
Regent Honeyeater (*Anthochaera phrygia*)	80.5	3,410	Yes
Pink-tailed Legless Lizard (*Aprasia parapulchella*)	207.14	4,147^	Yes
Large-eared Pied Bat (*Chalinolobus dwyeri*)	113.02	5,137	Yes
Koala (*Phascolarctos cinereus*)	113.02	3,425	Yes

MNES	Impact (ha)	Offset credits	Significantly impacted? (as determined in Section 8.4 and Appendix D)
Swift Parrot (*Lathamus discolor*)	105.52	0	No, however offsets (via ecosystem credits) still required under the BC Act

^ Including 405 credits for impacts to habitat on Category 1 – exempt land

8.8 Relevant Commonwealth guidelines and policy statements

The relevant Commonwealth guidelines and policies that were considered for each of the MNES likely to be impacted by the Project have been referred to throughout this report and are as follows:

- Department of Agriculture, Water and the Environment (DAWE) (2020). *Environment Protection and Biodiversity Conservation Act 1999 Condition-setting Policy*
- Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023e). *Conservation Advice for Chalinolobus dwyeri (Large-eared Pied Bat)*
- Department of Agriculture, Water and the Environment (DAWE) (2022b). *Conservation Advice for Phascolarctos cinereus (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory*
- Department of Agriculture, Water and the Environment (DAWE) (2022c). *National Recovery plan for the Koala: Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory)*
- Department of Climate Change, Energy, the Environment and Water (Cth DCCEEW) (2022b). *Psittacine Circoviral (beak and feather) Disease: Advice to the Minister for the Environment and Heritage from the Threatened Species Scientific Committee on a public nomination of a Key Threatening Process under the Environmental Protection and Biodiversity Conservation Act 1999*
- Department of Environment and Conservation (DEC) (2004) *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities: Working Draft*
- Department of Environment, Climate Change and Water (DECCW) (2009). *National Recovery Plan for Pomaderris cotoneaster (Cotoneaster Pomaderris)*
- Department of Environment, Climate Change and Water (DECCW) (2010). *National Recovery Plan for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland*
- Department of Climate Change, Energy, the Environment and Water (Cth DCCEEW 2023c). *Conservation Advice for the White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*
- Department of Environment and Heritage (DEH) (2006). *White Box – Yellow Box – Blakely's Red Gum Grassy Woodlands and Derived Native Grasslands EPBC Act Policy Statements*
- Department of Environment and Resource Management (DERM) (2011). *National recovery plan for the large-eared pied bat Chalinolobus dwyeri*
- Department of the Environment and Energy (DEE) (2016). *Central Hunter Valley eucalypt forest and woodland: a nationally protected ecological community*
- Department of the Environment, Heritage, Water and the Arts (DEWHA) (2013). *Matters of National Environmental Significance - Significant impact guidelines 1.1*

- Department of Climate Change, Energy, the Environment and Water (DCCEEW) (2023f). *Conservation Advice for Hoplocephalus bungaroides (Broad-headed Snake)*
- Department of the Environment (DOE) (2015a). *Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community*
- Threatened Species Scientific Committee (TSSC) (2015). *Conservation Advice for Aprasia parapulchella (Pink-tailed worm-lizard)*
- Department of the Environment (DOE) (2015b). *Conservation Advice Anthochaera phrygia Regent Honeyeater*
- Department of the Environment (DOE) (2016). *National Recovery Plan for the Regent Honeyeater (Anthochaera phrygia)*
- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010a). *Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act*
- Department of the Environment, Water, Heritage and the Arts (DEWHA) (2010b). *Survey guidelines for Australia's threatened bats. Guidelines for detecting bats listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999*
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2011a). *Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act*
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2011b). *Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act*
- Threatened Species Scientific Committee (TSSC) (2006[3]). *Commonwealth Listing Advice on White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland*
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) (2011c). *Environment Protection and Biodiversity Conservation Act 1999 referral guidelines for the vulnerable striped legless lizard, Delma impar*
- Saunders and Tzaros (2011). *National Recovery Plan for the Swift Parrot Lathamus discolor*
- Department of the Environment (DOE) (2013a). *Draft Survey Guidelines for Australia's Threatened Orchids*
- Department of Planning, Industry and Environment (DPIE) (2020c). S*urveying Threatened Plants and their Habitats – NSW survey guide for the Biodiversity Assessment Method*.

9 Biodiversity Offset Strategy

The Project requires a biodiversity offset for both BC Act and EPBC Act listed threatened entities as detailed in Section 3.6 to address the potential residual impacts on biodiversity values associated with the Project. MCO would address the Commonwealth offset requirement consistent with the NSW Biodiversity Offsets Scheme under the Bilateral Agreement endorsed by the NSW Biodiversity Offsets Scheme, which includes the BAM (DPIE 2020a), the offset rules, the BC Regulation, and payments to the Biodiversity Conservation Trust. The ecosystem and species credit requirement for each stage of the Project is detailed in Section 7.3 and summarised in Table 41. The biodiversity offset would require the retirement of the biodiversity credit obligation as per the Biodiversity Offsets Scheme.

In relation to satisfying offsets for State and Commonwealth matters, the Australian Government has formally endorsed the NSW Biodiversity Offsets Scheme (and use of the BAM [DPIE 2020a] as the methodology for calculating biodiversity credit requirements) through the EPBC Act Condition-setting Policy (DAWE 2020), which allows the NSW Biodiversity Offsets Scheme to be applied to assess and meet biodiversity offset requirements for a project.

The biodiversity offset for each entity would be met according to the rules as detailed in Division 6.2 of the BC Regulation, which sets out the offset rules under the Biodiversity Offsets Scheme. The rules include retiring like-for-like credits, funding conservation actions that directly benefit the species or community impacted, paying into the Biodiversity Conservation Fund the value of the credits and application of variation rules, which allow for suitable offsets to be determined where it can be demonstrated that like-for-like offsets cannot be obtained. However, the Commonwealth does not support application of the variation rules to satisfy an offset obligation for MNES in relation to a controlled action (Division 6.6A of the BC Regulation).

As such, the offset obligation for each MNES would be addressed via one, or a combination of the following:

- The retirement of biodiversity credits based on the like-for-like provisions in the BC Regulation.
- The funding of a biodiversity conservation action.
- Undertaking ecological mine rehabilitation that creates the same ecological community or threatened species habitat.
- Payment into the Biodiversity Conservation Fund.

As per the BAM (DPIE 2020a), the biodiversity credit obligation for this Project is required to be discharged through one of the three options as provided by the Biodiversity Offsets Scheme:

- Establishment of a Biodiversity Stewardship Site and retirement of required credits
- Purchase and retirement of credits from the market
- Payment into the Biodiversity Conservation Fund for the value of the credits.

MCO are investigating the following options to formally satisfy the offset obligation for both State and Commonwealth, which include the following:

- Establishment of a Biodiversity Stewardship Site(s) with the required biodiversity values and formally retire the credits
- Retire credits from existing MCO BioBanking/Biodiversity Stewardship Sites
- Purchase biodiversity credits from the credit market and formally retire the credits
- Payment of the biodiversity offset obligation into the Biodiversity Conservation Fund.

MCO would reserve the right to discharge their offset obligation through one of these options upon Project approval.

Table 41. Summary of Biodiversity Credits required for the Project.

Name of threatened species	Stage 1 credits	Stage 2 credits	Stage 3 credits	Total
Ecosystem credits				
PCT 266 White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion[1]	166	469	456	1,091
PCT 281 Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion[1]	3,585	2,596	2,336	8,517
PCT 483 Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley[1]	2	0	0	2
PCT 1610 White Box - Black Cypress Pine shrubby woodland of the Western Slopes	49	304	173	526
PCT 1629 Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	17	99	0	116
PCT 1655 Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin[2]	275	44	53	372
PCT 1656 Narrow-leaved Ironbark – Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin	336	0	0	336
PCT 1661 Narrow-leaved Ironbark – Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	84	0	0	84
PCT 1711 Tantoon - *Lepyrodia leptocaulis* shrubland on sandstone drainage lines of the Sydney Basin	0	28	105	133
Total ecosystem credits	**4, 514**	**3,540**	**3,123**	**11,177**
Species credits				

Name of threatened species	Stage 1 credits	Stage 2 credits	Stage 3 credits	Total
Cotoneaster Pomaderris (*Pomaderris cotoneaster*)	-	2	-	**2**
Regent Honeyeater (*Anthochaera phrygia*)	1,520	865	1,025	**3,410**
Pink-tailed Legless Lizard (*Aprasia parapulchella*)	1,581.2^	1,827.2^	738.4^	**4,147^***
Large-eared Pied Bat (*Chalinolobus dwyeri*)	1,935	1,189	2,013	**5,137**
Squirrel Glider (*Petaurus norfolcensis*)	1,290	793	1,342	**3,425**
Koala (*Phascolarctos cinereus*)	1,290	793	1,342	**3,425**
Eastern Cave Bat (*Vespadelus troughtoni*)	1,935	1,189	2,013	**5,137**
Total species credits	**9,551.2**	**6,658.2**	**8,473.4**	**24,683***

1. White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland
2. Hunter Valley Footslopes Slaty Gum Woodland/Eucalypt Forest and Woodland

^ Including credits for impacts to habitat on Category 1 – exempt land

~ includes credits for 0.09 ha of planted native vegetation

* This number is rounded.

10 Conclusion

The Development Footprint provides known and potential habitat for:

- Nine PCTs in various condition states of which three PCTs align to TECs listed under the BC Act and/or EPBC Act (Box-Gum Woodland CEEC and Eucalypt Forest and Woodland CEEC)
- One threatened flora species *Pomaderris cotoneaster* (Endangered under both the BC Act and EPBC Act)
- 23 threatened fauna species listed as threatened under the BC Act, five of which are also listed as threatened under the EPBC Act. Species recorded included five species credit species, six dual credit species and 12 ecosystem credit species.

Following the EIS exhibition period (from 17 November to 14 December 2022) and in response to submissions received on the EIS, MCO is proposing to amend the Project Development Footprint (including reduced ROM coal and peak annual production, and revised mine schedules and rehabilitation plan). These changes are described in the Amendment Report. The amended Project Development Footprint has been designed to incorporate additional avoidance measures relative to the EIS. When compared to the EIS, the amended Project design achieves the following:

- A reduction in the extent of the Development Footprint, including:
  - Avoidance of disturbance within 100 m of the Munghorn Gap Nature Reserve
  - 100% avoidance of disturbance of mapped rocky habitat and breeding habitat (defined as relevant vegetation within 100 m of mapped rocky habitat) associated with threatened bat species (i.e. Large-eared Pied Bat and Eastern Cave Bat) and the Broad-headed Snake
  - 59.4% reduction in disturbance of the woodland component of Box-Gum Woodland CEEC compared to the EIS
  - 56% reduction in disturbance of Regent Honeyeater Important Habitat Mapping compared to the EIS
  - Reduced disturbance of threatened species habitat including Pink-tailed Legless Lizard, Koala, Swift Parrot and Squirrel Glider
  - Reduction in disturbance to the threatened flora species, Cotoneaster Pomaderris
- A revised conceptual post-mining land use which incorporates additional areas of native woodland and increases the proposed extent of the Habitat Enhancement Area.

After implementation of additional impact avoidance and minimisation measures, the amended Project Development Footprint would result in the direct loss of 480.01 ha of native vegetation.

Overall, the Project has been designed to avoid or minimise impacts to key habitat for the Large-eared Pied Bat, Eastern Cave Bat, Broad-headed Snake and Pink-tailed Legless Lizard, native woodland habitat as well as retention and rehabilitation of a Habitat Enhancement Area (connectivity corridor) along Moolarben and Murdering Creeks. Monitoring and management plans would be developed to mitigate and manage threats to biodiversity (e.g. weeds, pest animals) and key threatened flora and fauna (habitat rehabilitation for the Pink-tailed Legless Lizard and monitoring programs for the Large-eared Pied Bat, Eastern Cave Bat and Regent Honeyeater).

Biodiversity offsets would be secured for unavoidable impacts to native vegetation and threatened biodiversity as a result of the Project. This includes offsets for potentially significant impacts to five MNES (Box-Gum Woodland CEEC, Pink-tailed Legless Lizard, Regent Honeyeater, Koala and Large-eared Pied Bat).

Six entities at risk of SAII were relevant to this assessment: Box-Gum Woodland CEEC, Broad-headed Snake, Large-eared Pied Bat, Eastern Cave Bat, Swift Parrot and the Regent Honeyeater. Information required for consideration of SAII for each species has been provided in Appendix F.

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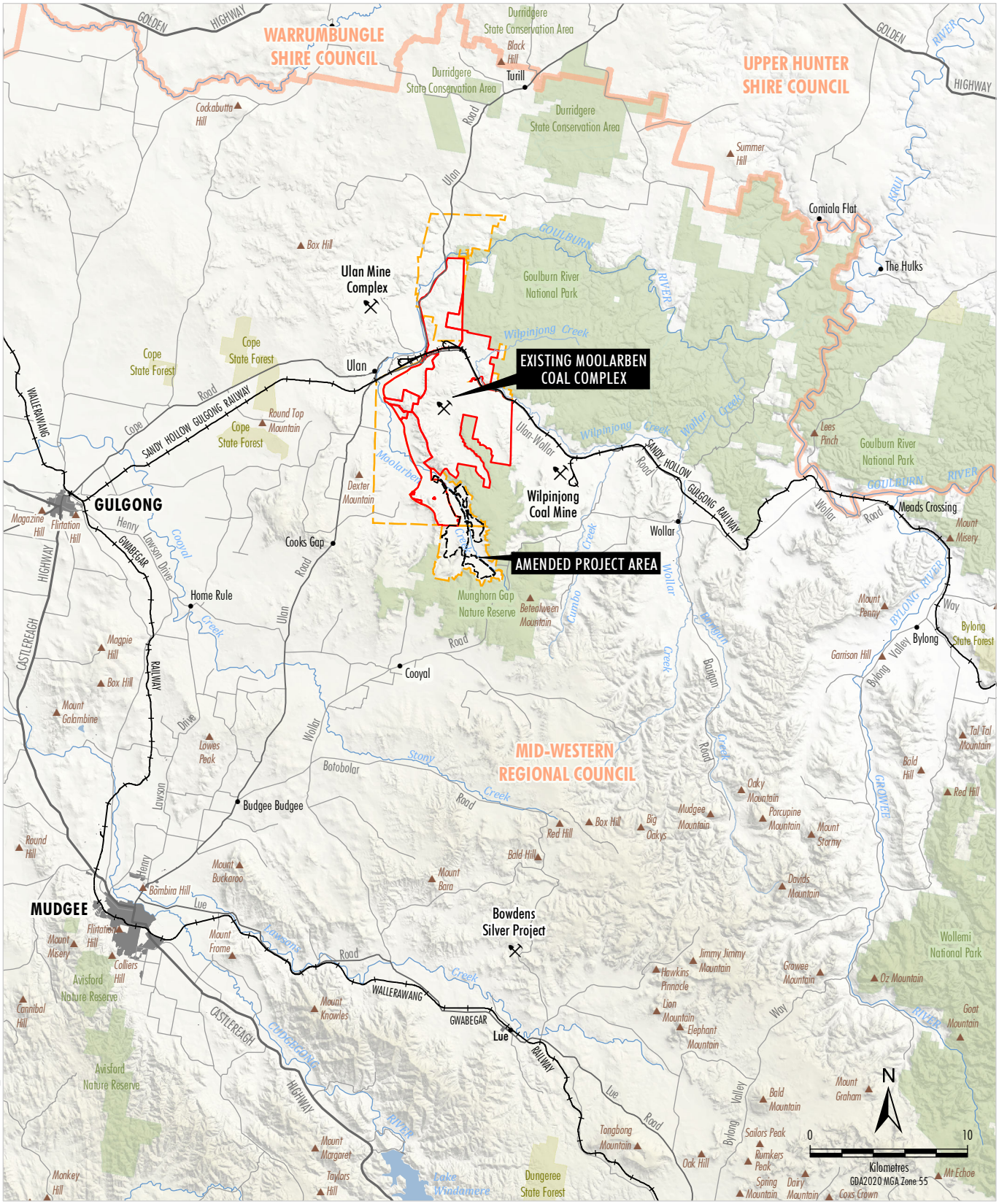
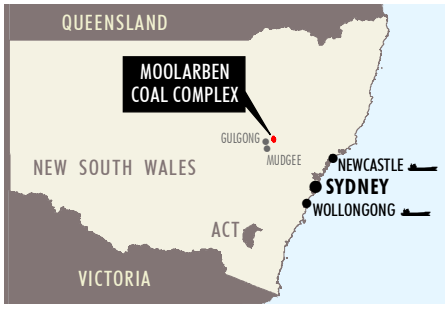
Figures





LEGEND

- State Forest
- National Park /Nature Reserve
- Local Government Boundary
- Exploration Licence Boundary
- Mining Lease Boundary
- Mining Operation
- Indicative Amended Project Surface Disturbance Extent

Source: NSW Spatial Services (2021)
MCO (2023)

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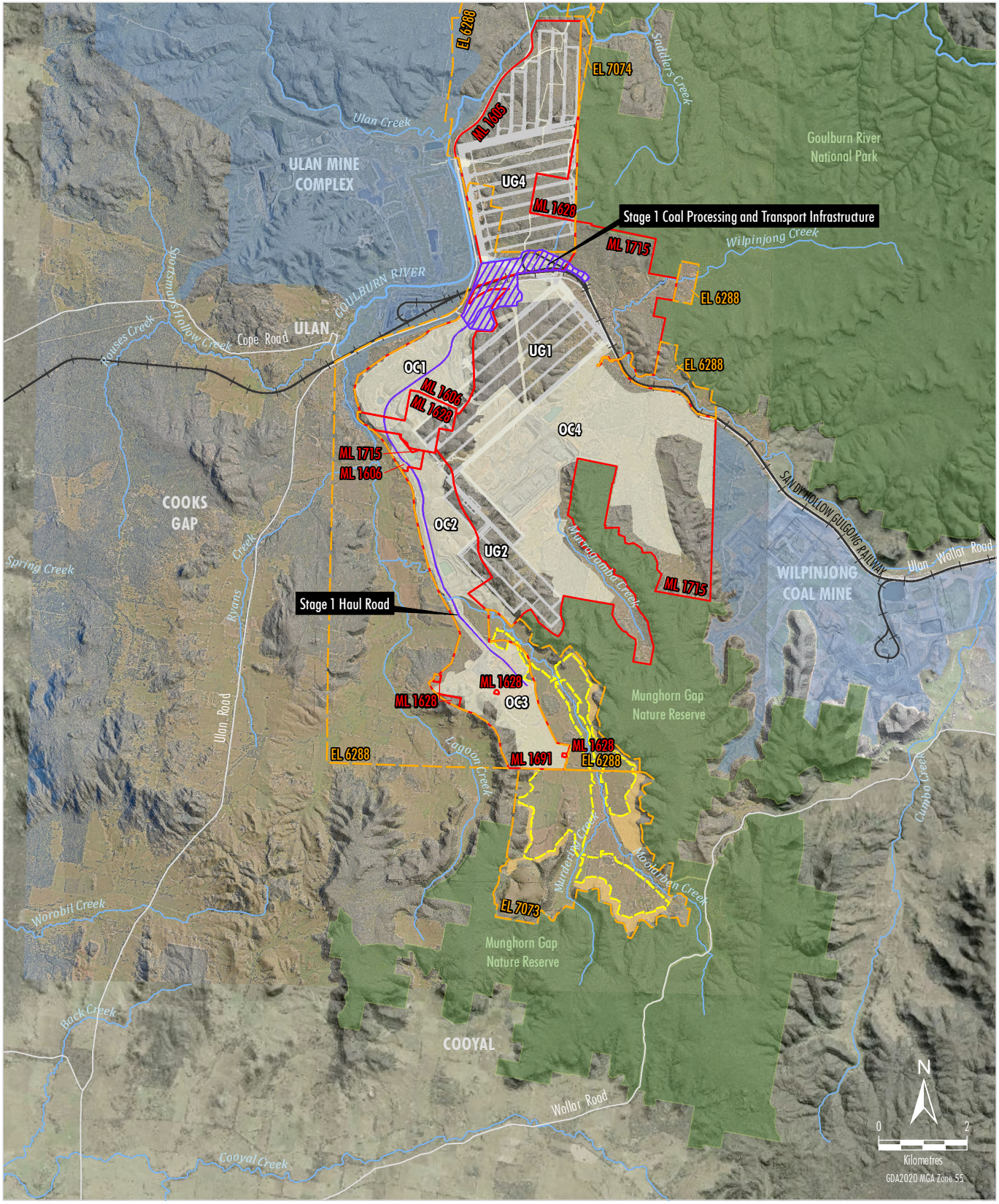
MOOLARBEN COAL

MOOLARBEN COAL COMPLEX

Project Location

Figure 1

MCM-20-18 OC3 Ext EIS AP BDAR_201B



MCM-20-18 OC3 Ext EIS AP BDAR_ 202C

LEGEND

- National Park/Nature Reserve
- Other Mining Operation
- Exploration Licence Boundary
- Mining Lease Boundary

Existing/Approved Development

- Underground Longwall Layout
- Moolarben Coal Complex Disturbance Footprint
- Stage 1 Coal Processing and Transport Infrastructure Footprint

OC3 Extension Project - Amended

- Indicative Amended Project Surface Disturbance Extent
- Additional Avoidance/Minimisation for the Amended Project

Source: MCO (2023); NSW Spatial Services (2021)
Orthophoto: MCO (2021)

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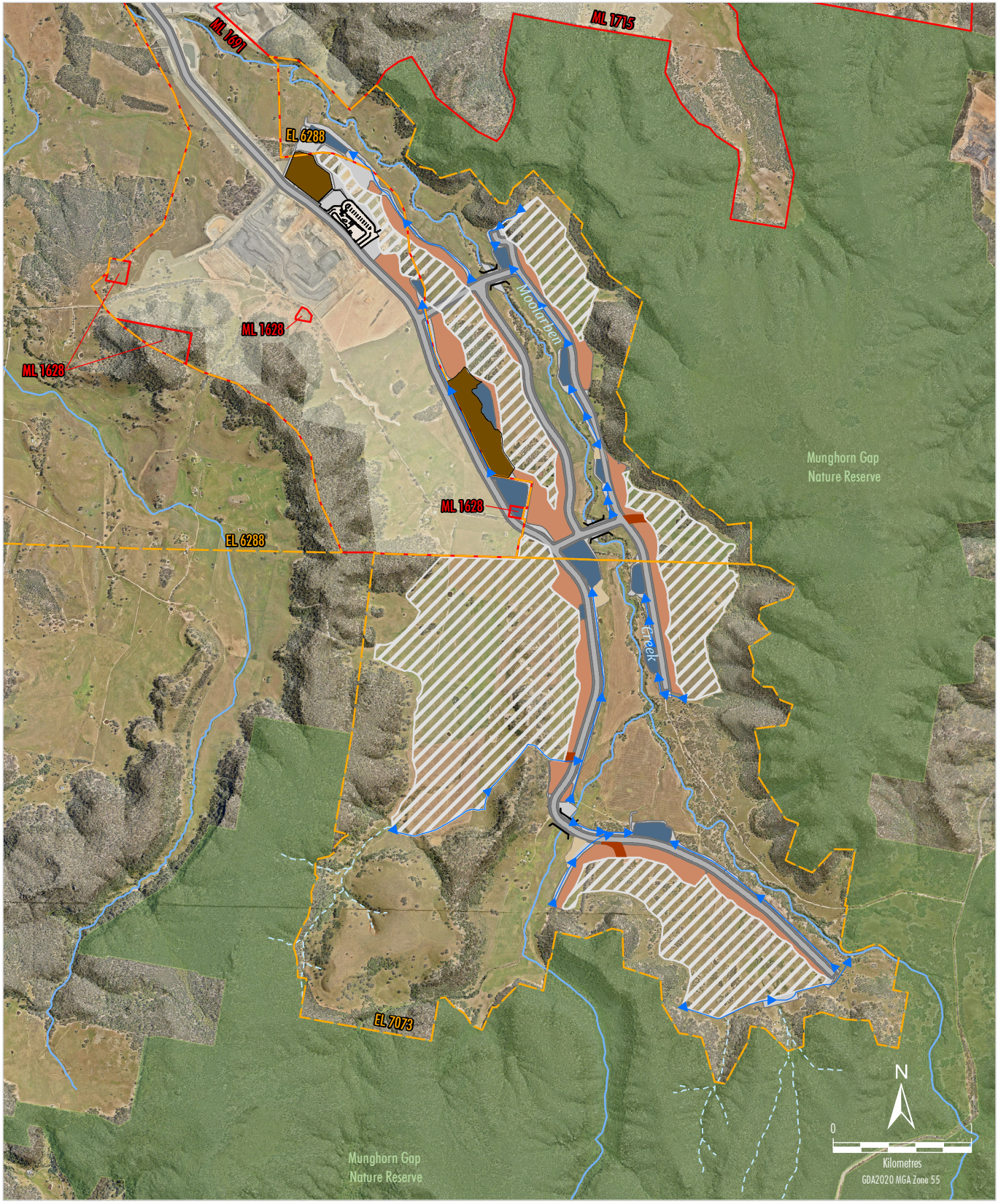
Approved Moolarben Coal Complex and Proposed Open Cut Extension

Figure 2



MCM-20-18 OC3 Ext EIS AP BDAR_203C

LEGEND

- National Park/Nature Reserve
- Exploration Licence Boundary
- Mining Lease Boundary
- Moolarben Coal Complex Disturbance Footprint
- OC3 Extension Project - Amended
- Indicative Open Pit Extent
- Indicative ROM Pad
- Culvert
- Indicative Haul Roads and Infrastructure Corridor
- Indicative Infrastructure Area
- Indicative Construction/Rehabilitation Material Stockpiles
- Conceptual Flood Levee Embankment
- Conceptual Water Management Infrastructure
- Indicative Vehicle Access
- Conceptual Surface Water Drain

Source: MCO (2023); NSW Spatial Services (2021)
Orthophoto: MCO (2021)

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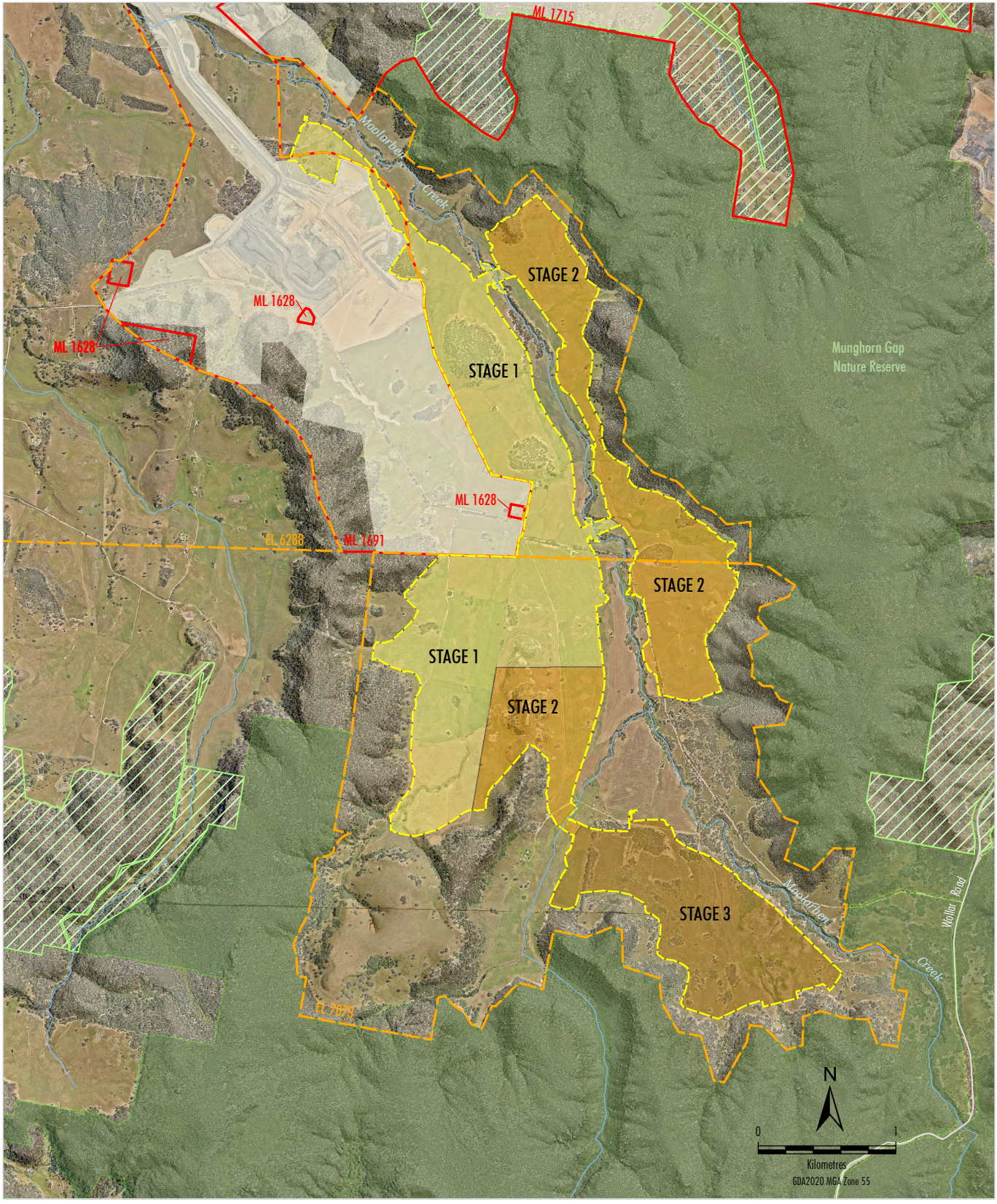
MOOLARBEN COAL

MOOLARBEN COAL COMPLEX

General Arrangement of the Amended Project

Figure 3



MCM-20-18 OC3 Ext EIS AP BDAR_204B

LEGEND

- National Park/Nature Reserve
- Existing Biodiversity Offset Area
- Exploration Licence Boundary
- Mining Lease Boundary
- Moolarben Coal Complex Disturbance Footprint
- Indicative Amended Project Surface Disturbance Extent

Indicative Project Stages - Amended

- Stage 1
- Stage 2
- Stage 3

Source: MCO (2023); NSW Spatial Services (2021); Orthophoto Mosaic: MCO (2021)

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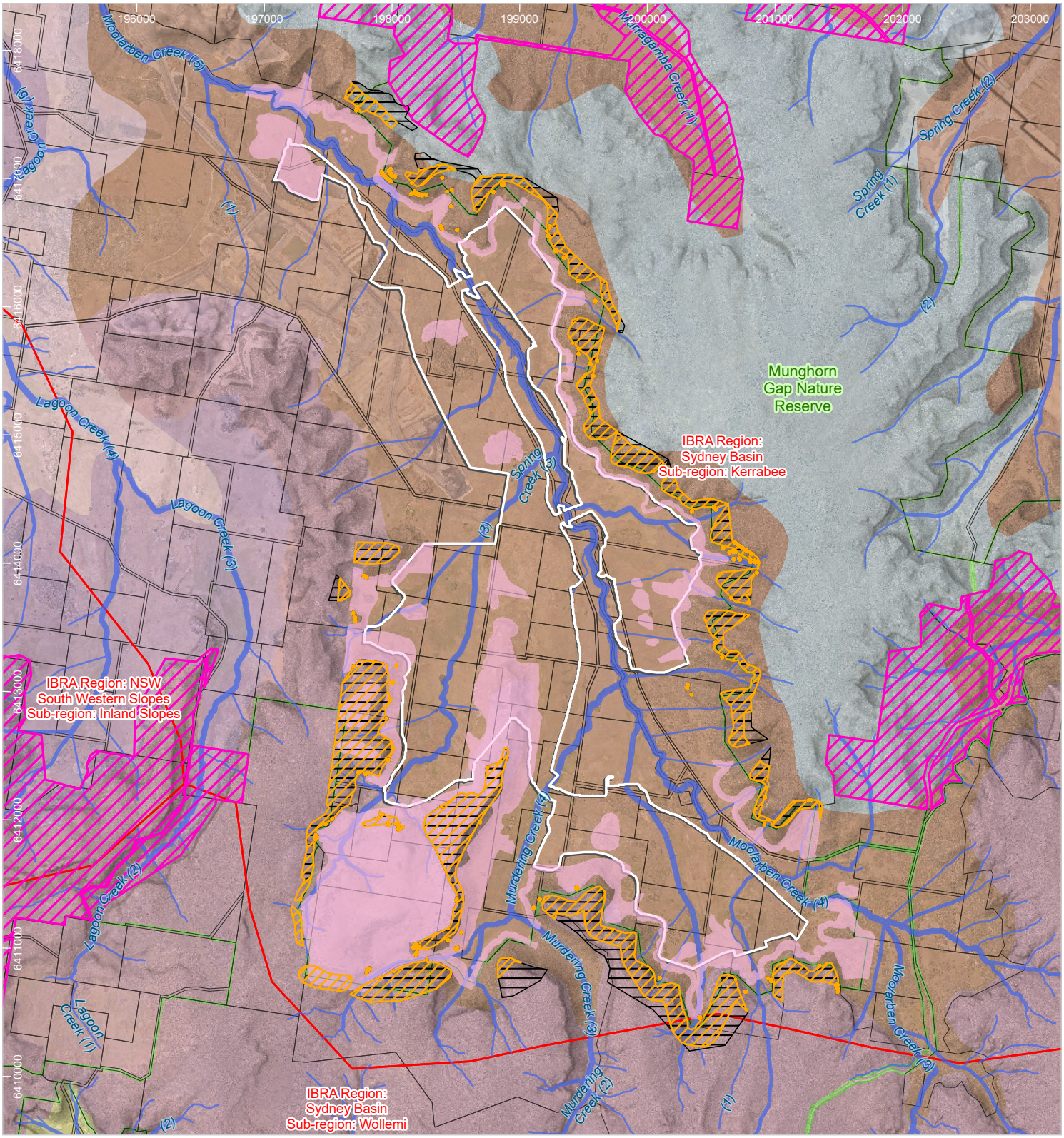
MOOLARBEN COAL

MOOLARBEN COAL COMPLEX

Project Offset Staging

Figure 4



- Development Footprint
- Existing Biodiversity Offset Areas
- Nature Reserve
- Lot
- IBRA Region/ Subregion
- Broad-headed Snake Mapped Rocky Habitat
- Eastern Cave Bat and Large-eared Pied Bat Mapped Rocky Habitat
- Pink-tailed Legless Lizard Rocky Habitat

Mitchell Landscapes

- Capertee Plateau
- Cope Hills Granite
- Gulgong Ranges
- Talbragar - Upper Macquarie Terrace Sands and Gravels
- Upper Goulburn Valleys and Escarpment
- Wollemi Ranges

Strahler Stream Order

- 1st order (10m buffer)
- 2nd order (20m buffer)
- 3rd order (30m buffer)
- 4th order (40m buffer)
- 5th order (40m buffer)

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WGS 1984 Web Mercator

Site Map

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 5

Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community | Watercourses, Waterbodies, Road and Rail alignments, Protected areas of NSW © Spatial Services 2021. | Niche uses GDA2020 as standard for all project-related data. In order to ensure that data from numerous sources and coordinate systems is aligned, on-the-fly transformation to WGS1984 Web Mercator Auxilliary Sphere is used in the map above. For ease of reference, the grid tick marks and labels shown around the border of the map are presented in GDA2020, using the relevant MGA zone.

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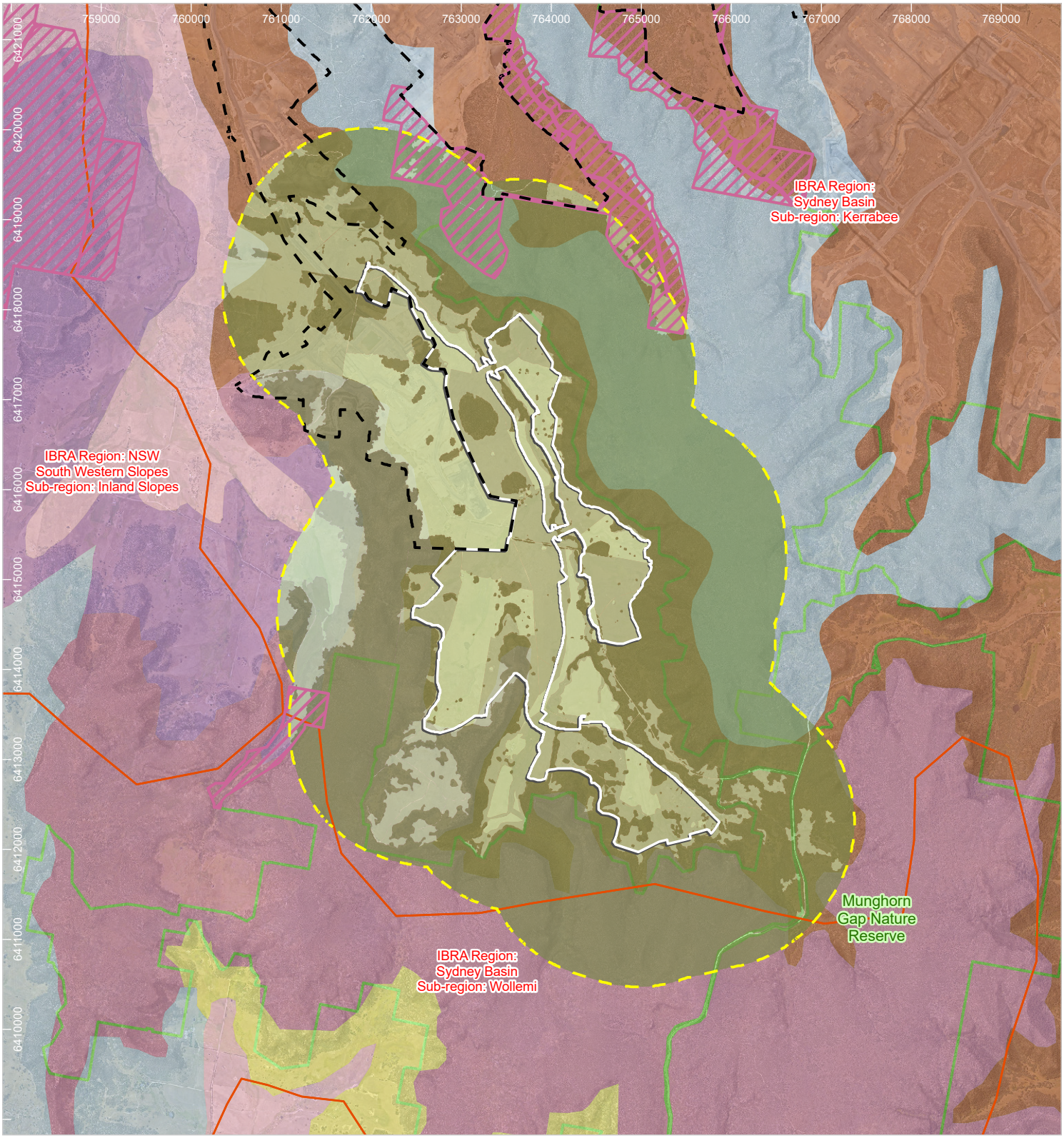

Development Footprint
Existing Biodiversity Offset Areas
Nature Reserve
IBRA Region/ Subregion

Assessment Area (1500m buffer)
Existing/Approved Indicative Surface Development Footprint

Vegetation Type (previous symbology)
Non Native
Non-woody
Woody (connectivity)

Mitchell Landscapes
Capertee Plateau
Cope Hills Granite
Gulgong Ranges
Talbragar - Upper Macquarie Terrace Sands and Gravels
Upper Goulburn Valleys and Escarpment
Wollemi Ranges

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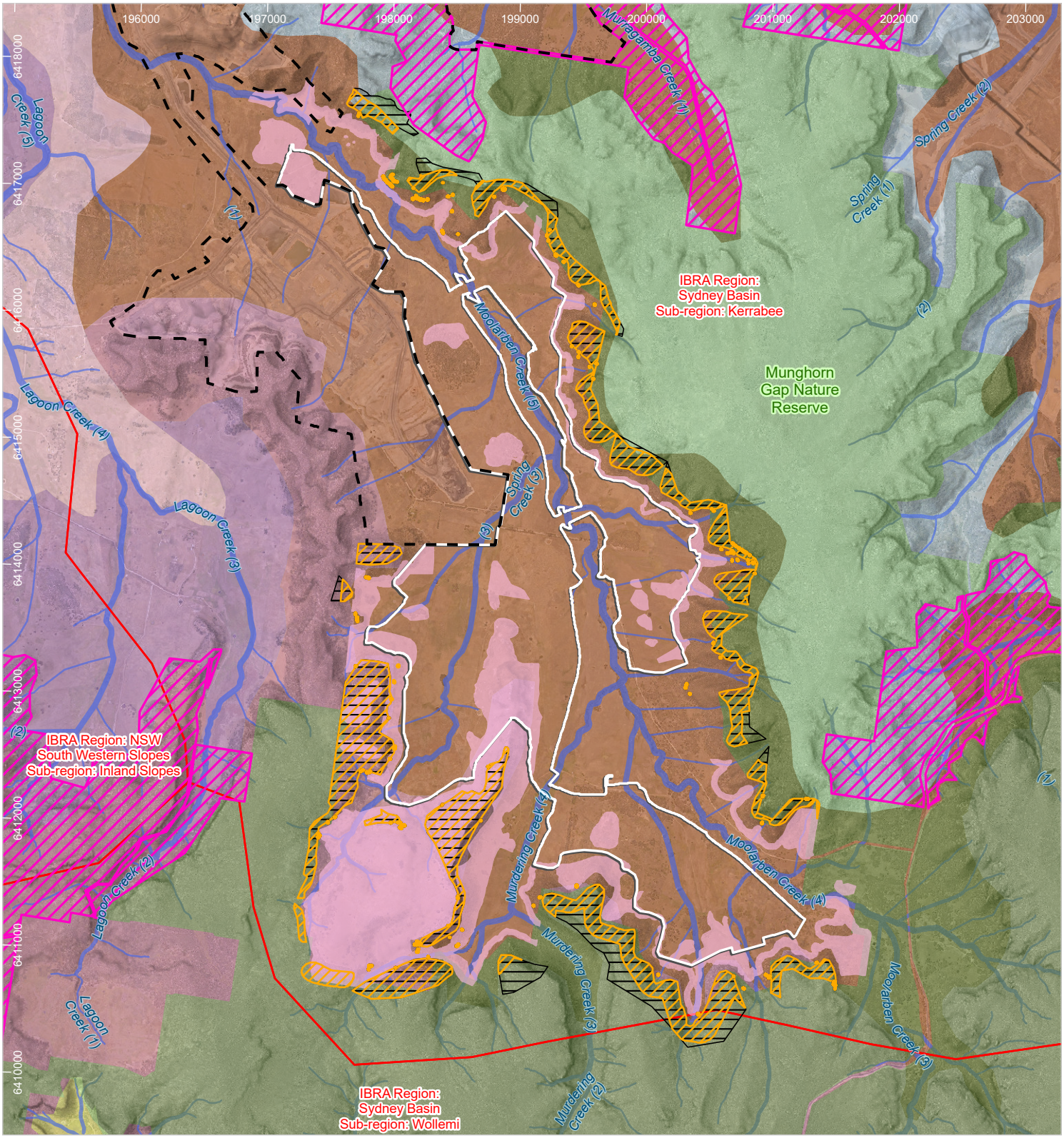
Location Map
Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 6a

Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community | Watercourses, Waterbodies, Road and Rail alignments, Protected areas of NSW © Spatial Services 2021. | Niche uses GDA2020 as standard for all project-related data. In order to ensure that data from numerous sources and coordinate systems is aligned, on-the-fly transformation to WGS1984 Web Mercator Auxilliary Sphere is used in the map above. For ease of reference, the grid tick marks and labels shown around the border of the map are presented in GDA2020, using the relevant MGA zone.



Development Footprint

Existing/Approved Indicative Surface Development Footprint

Existing Biodiversity Offset Areas

Nature Reserve

IBRA Region/ Subregion

Mitchell Landscapes

Capertee Plateau

Cope Hills Granite

Gulgong Ranges

Talbragar - Upper Macquarie Terrace Sands and Gravels

Upper Goulburn Valleys and Escarpment

Wollemi Ranges

Strahler Stream Order

1st order (10m buffer)

2nd order (20m buffer)

3rd order (30m buffer)

4th order (40m buffer)

5th order (40m buffer)

Fauna habitat

Pink-tailed Legless Lizard Rocky Habitat

Eastern Cave Bat and Large-eared Pied Bat Mapped Rocky Habitat

Broad-headed Snake Mapped Rocky Habitat

Transparency mask

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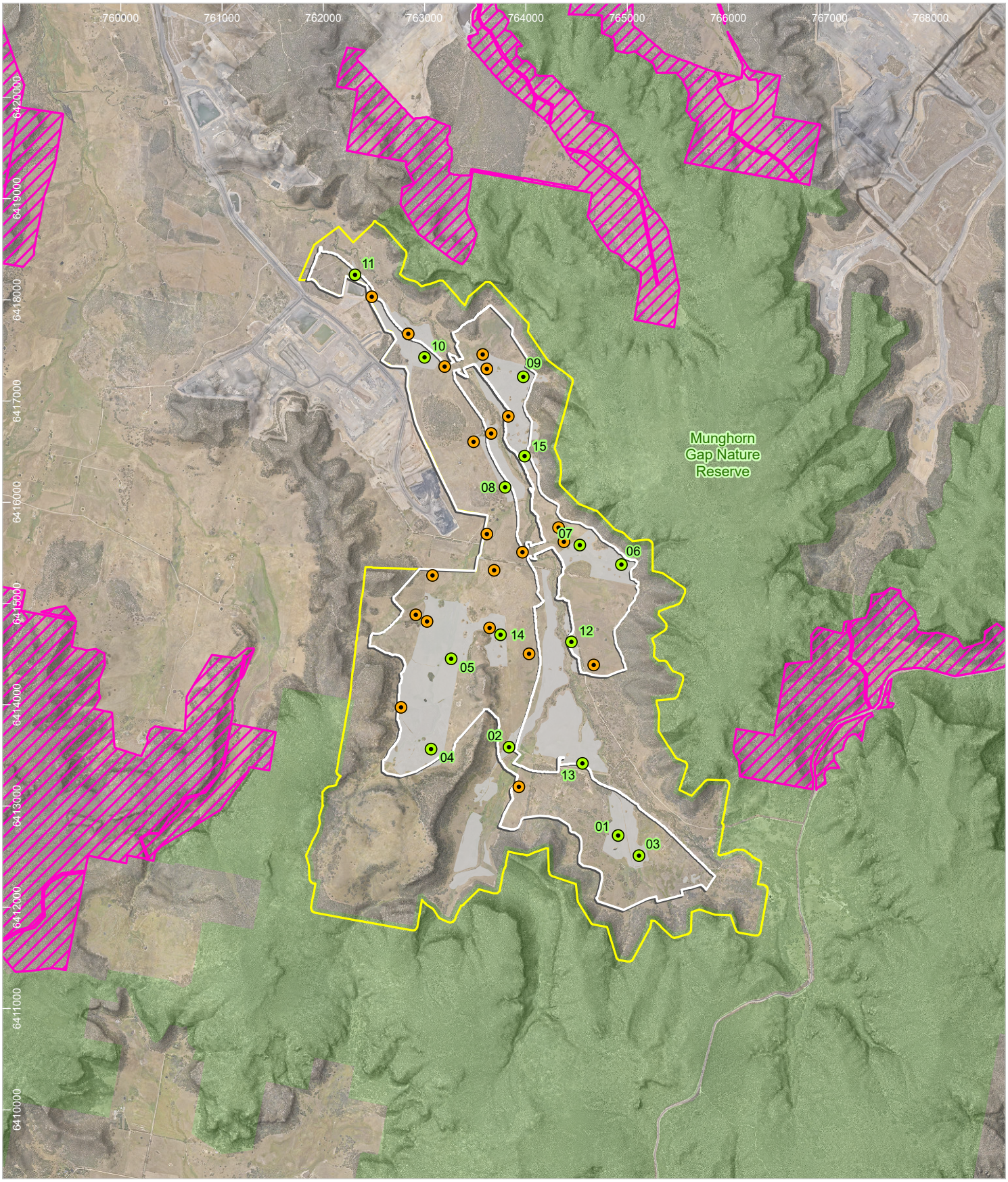
WGS 1984 Web Mercator

Location Map

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 6b



Development Footprint
Study Area
Existing Biodiversity Offset Areas
Nature Reserve
Category 1 – exempt land
IGGAM plots (Niche 2023)
IGGAM plots (ELA 2023)
public/NSW_Imagery
Footprint

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Land excluded from the BDAR (Category 1 - exempt land)

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 7

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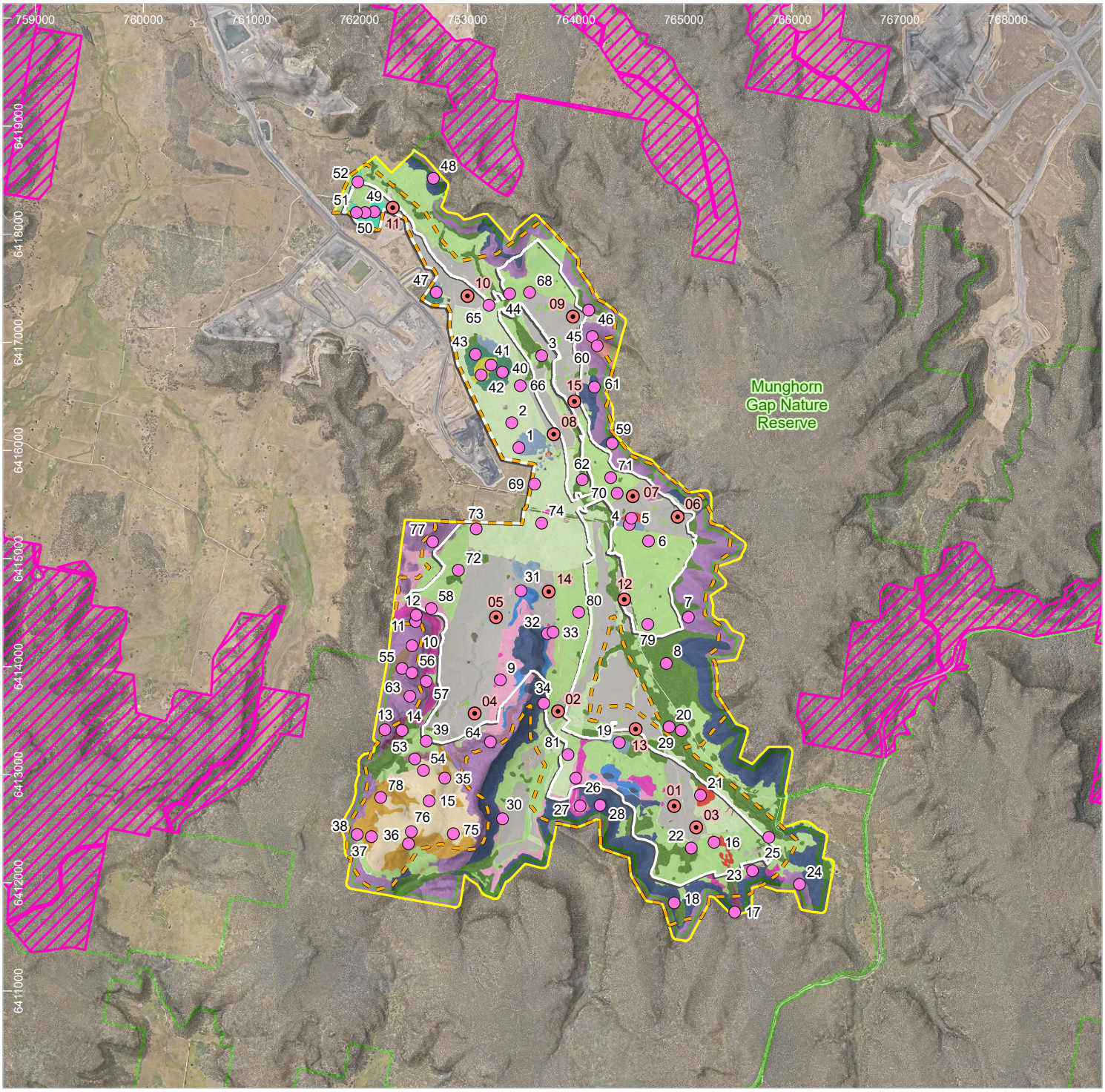

Development Footprint
Study Area
Existing Biodiversity Offset Areas
Nature Reserve
Threatened Flora Study Area
Vegetation Integrity plots (ELA 2023 verified by Premise)

BAM plots (Niche 2023)
Access road
Buildings
Dam

PCT Mapping (ELA 2023)

266, DNG
266, Scattered
266, High

281, DNG - Low
281, DNG
281, Scattered
281, High
471, High
478, High
481, High
483, DNG
483, High

1610, Regenerating
1610, High
1614, High
1629, High
1655, High
1656, Regenerating
1656, High
1661, High
1711, High

Planted natives
Category 1 – exempt land

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Footprint

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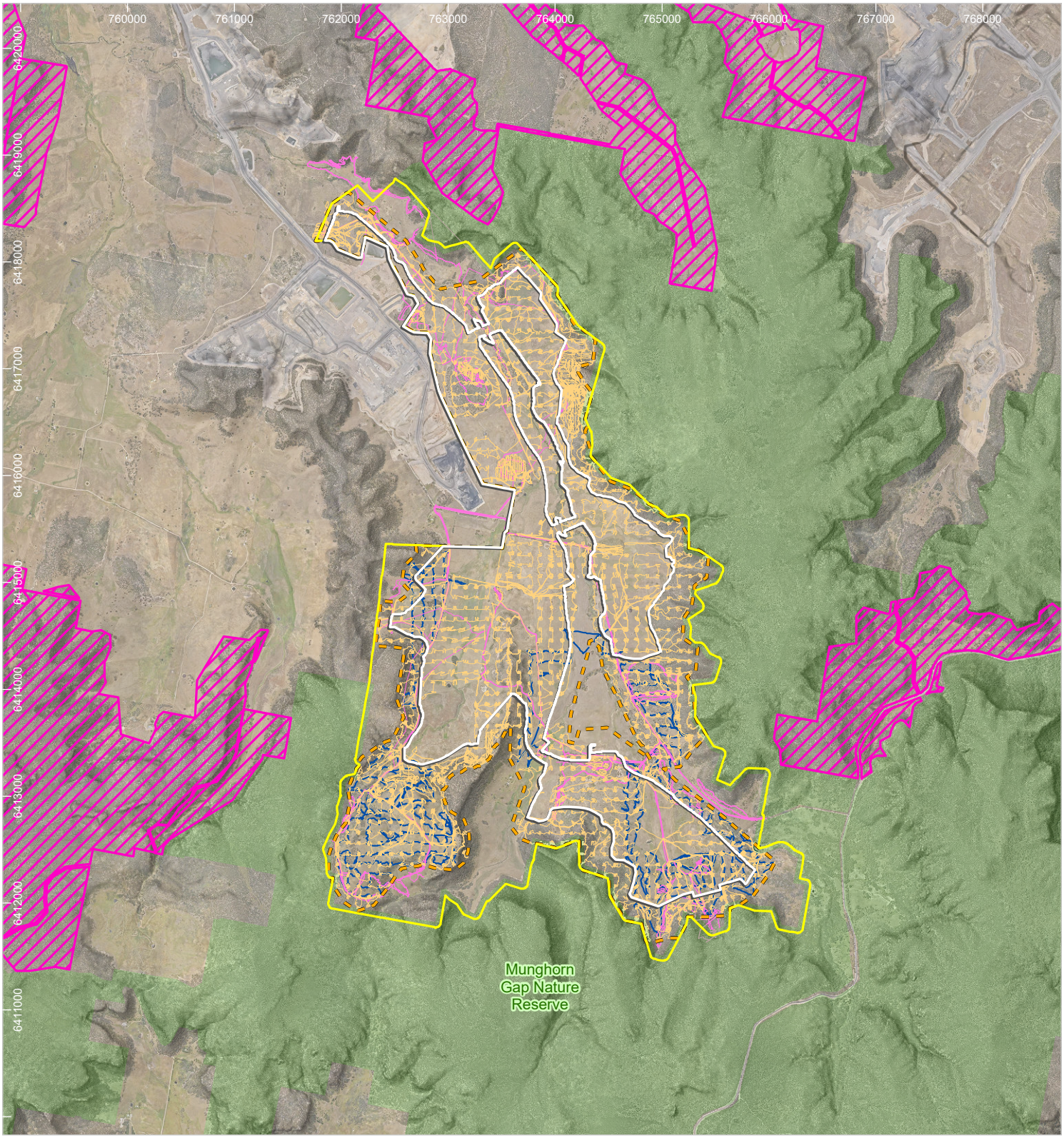
Note: Refer to Figure 9 for identification of Vegetation Zones

Vegetation Assessment Surveys
Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 8



Study Area

Development Footprint

Existing Biodiversity Offset Areas

Nature Reserve

Threatened Flora Study Area

Threatened flora survey – September/October 2021 (ELA 2023)

Threatened flora survey – October 2021 (ELA 2023)

Threatened flora survey – January 2022 (ELA 2023)

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Footprint

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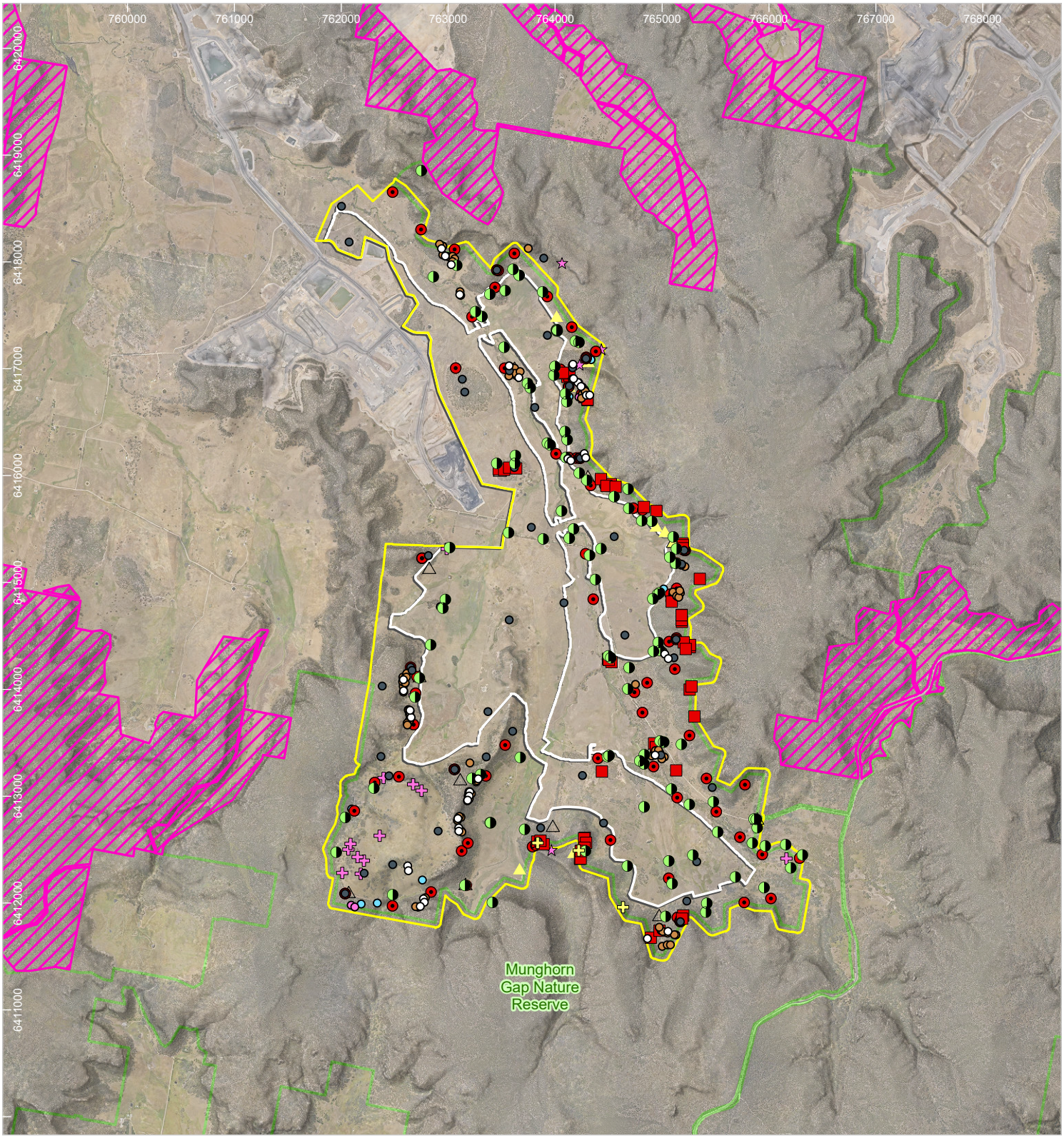
GDA2020 MGA Zone 55

Threatened Flora Survey Effort

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 9



- Study Area
- Development Footprint
- Existing Biodiversity Offset Areas
- Nature Reserve

AMBS Threatened Fauna Survey Locations

- Anabat
- Diurnal Bird Survey
- Habitat Assesment
- Harp Trap
- Hollow Monitoring
- Pitfall - Elliott - Funnel Traps
- Remote Camera
- Reptile Survey (Broad-headed Snake)
- Reptile Survey (Pink-tailed Legless Lizard)
- Scat Transect
- Spotlight
- Standard Call Playback
- Non-Standard Call Playback

public/NSW_Imagery

- Footprint

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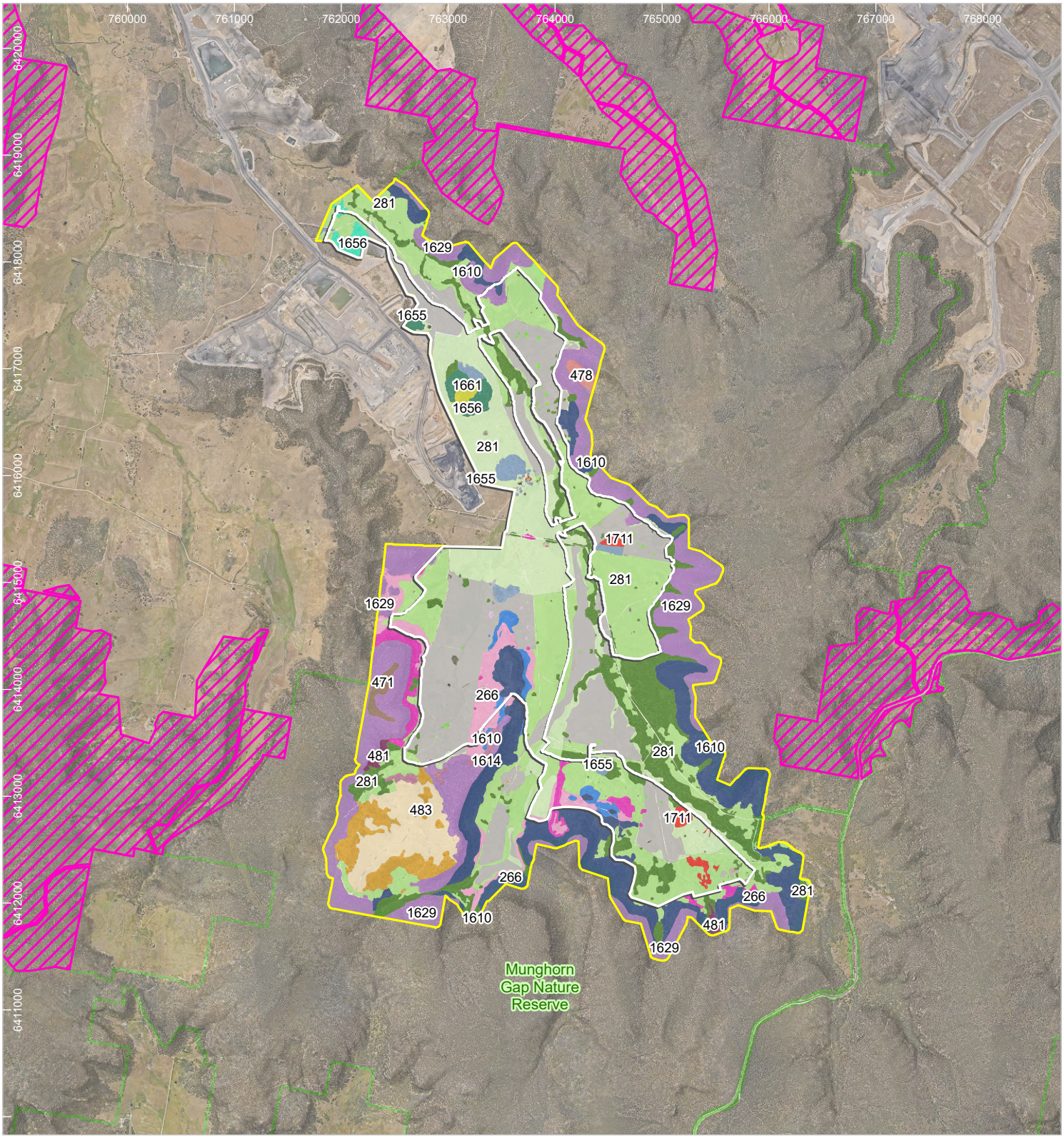
GDA2020 MGA Zone 55

Threatened Fauna Survey Methods and Effort

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 10



Development Footprint
Study Area
Existing Biodiversity Offset Areas
Nature Reserve
Access road
Buildings

Dam

PCT Mapping (ELA 2023)

266, DNG
266, Scattered
266, High
281, DNG - Low
281, DNG
281, Scattered
281, High
471, High
478, High
481, High
483, DNG
483, High
1610, Regenerating
1610, High
1614, High
1629, High
1655, High
1656, Regenerating
1656, High
1661, High
1711, High
Planted natives
Category 1 – exempt land

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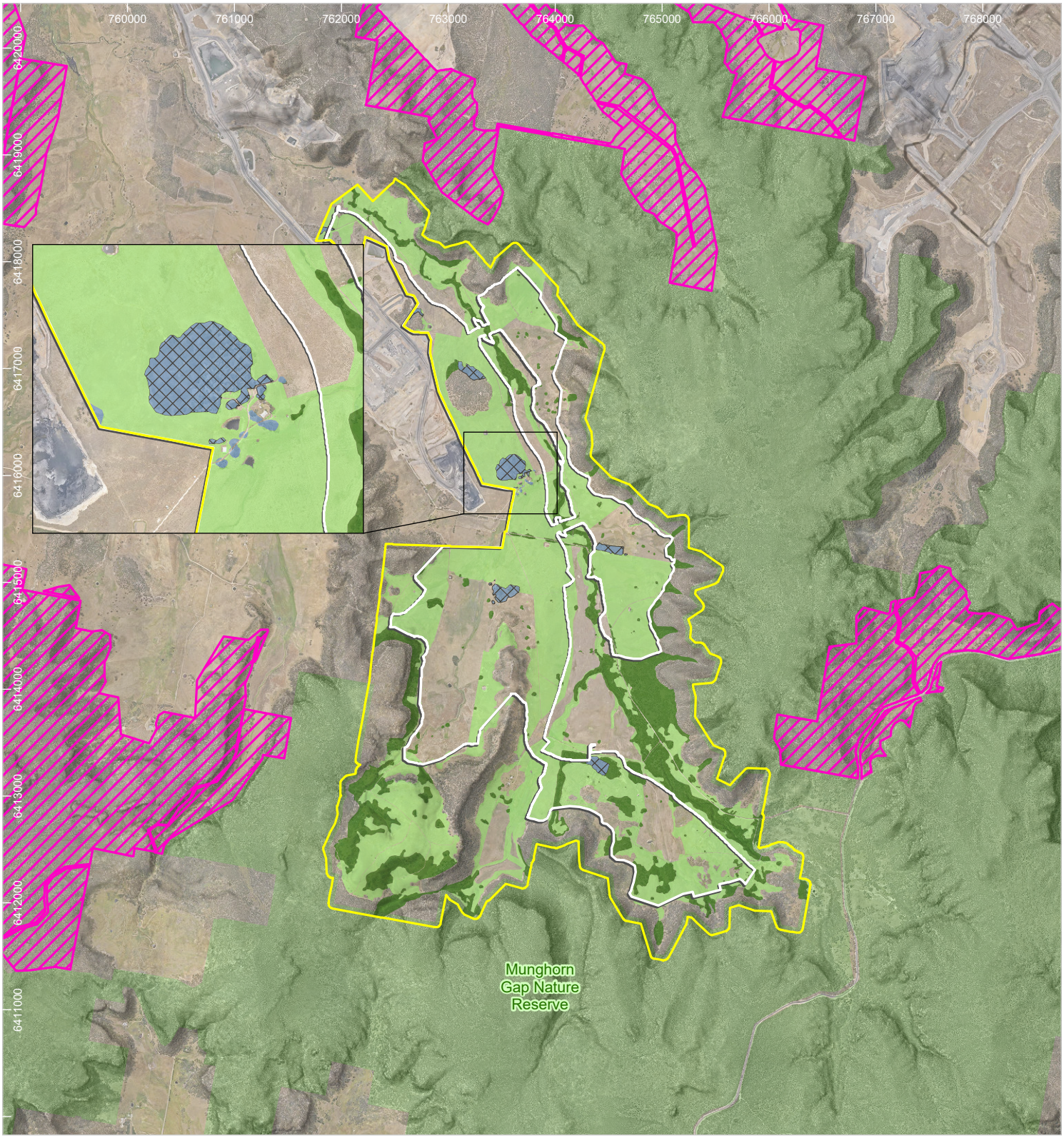
GDA2020 MGA Zone 55

Plant Community Types
Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 11



Development Footprint

Study Area

Existing Biodiversity Offset Areas

Nature Reserve

Treatened Ecological Communities

Treatened Ecological Communities

Box-Gum Woodland CEEC - BC Act and EPBC Act, DNG

Box-Gum Woodland CEEC - BC Act and EPBC Act, Woodland

Central Hunter Valley Eucalypt Forest CEEC - EPBC Act

Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion VEC - BC Act

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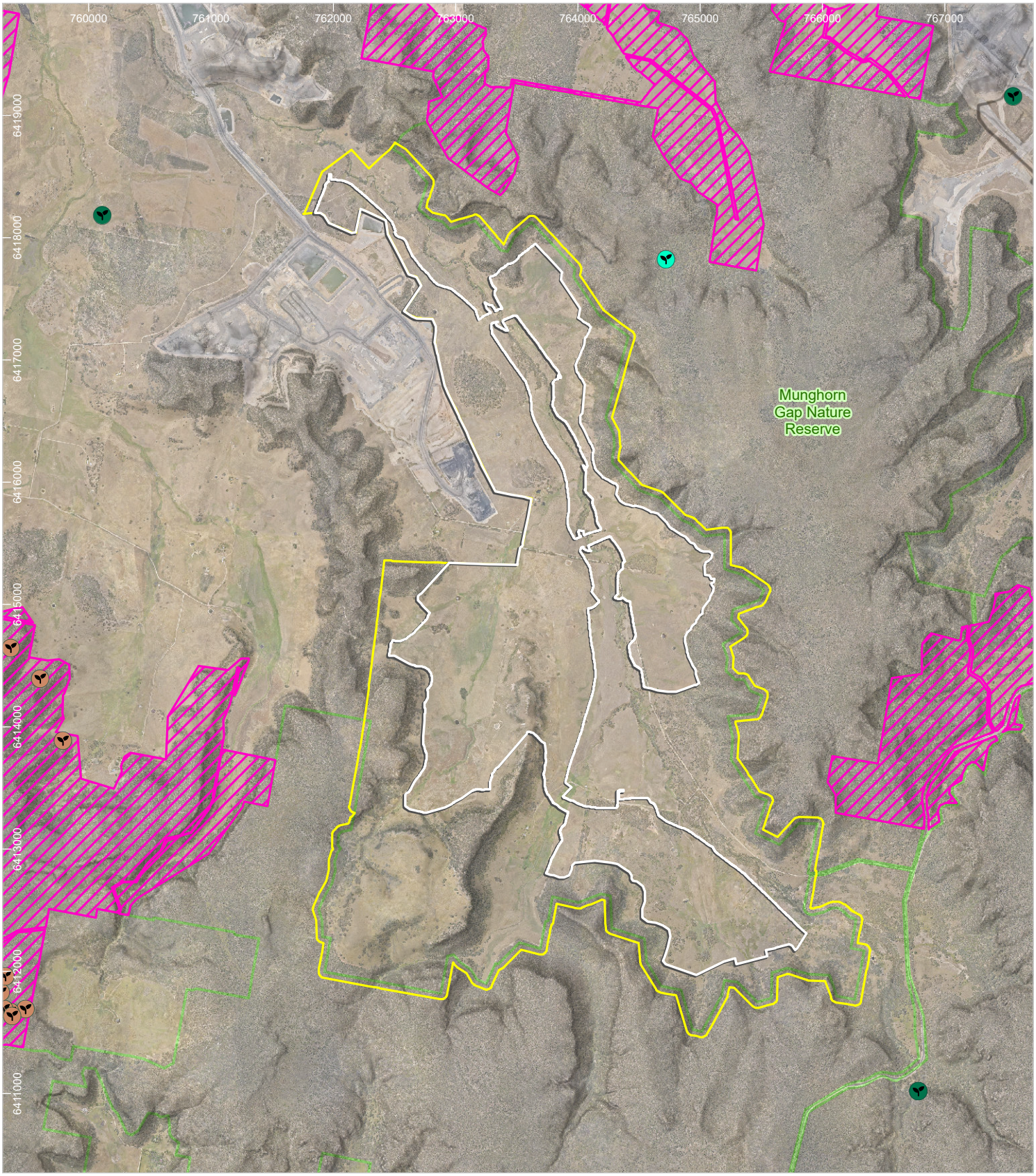
GDA2020 MGA Zone 55

Threatened Ecological Communities

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 12



Development Footprint

Study Area

Existing Biodiversity Offset Areas

Nature Reserve

BioNet Atlas Results (Feb 2024)

Flora

Acacia ausfeldii

Eucalyptus cannonii

Pultenaea glabra

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GDA2020 MGA Zone 55

**Does not include current survey results. Sensitive species within BioNet search displayed as per licence agreement.*

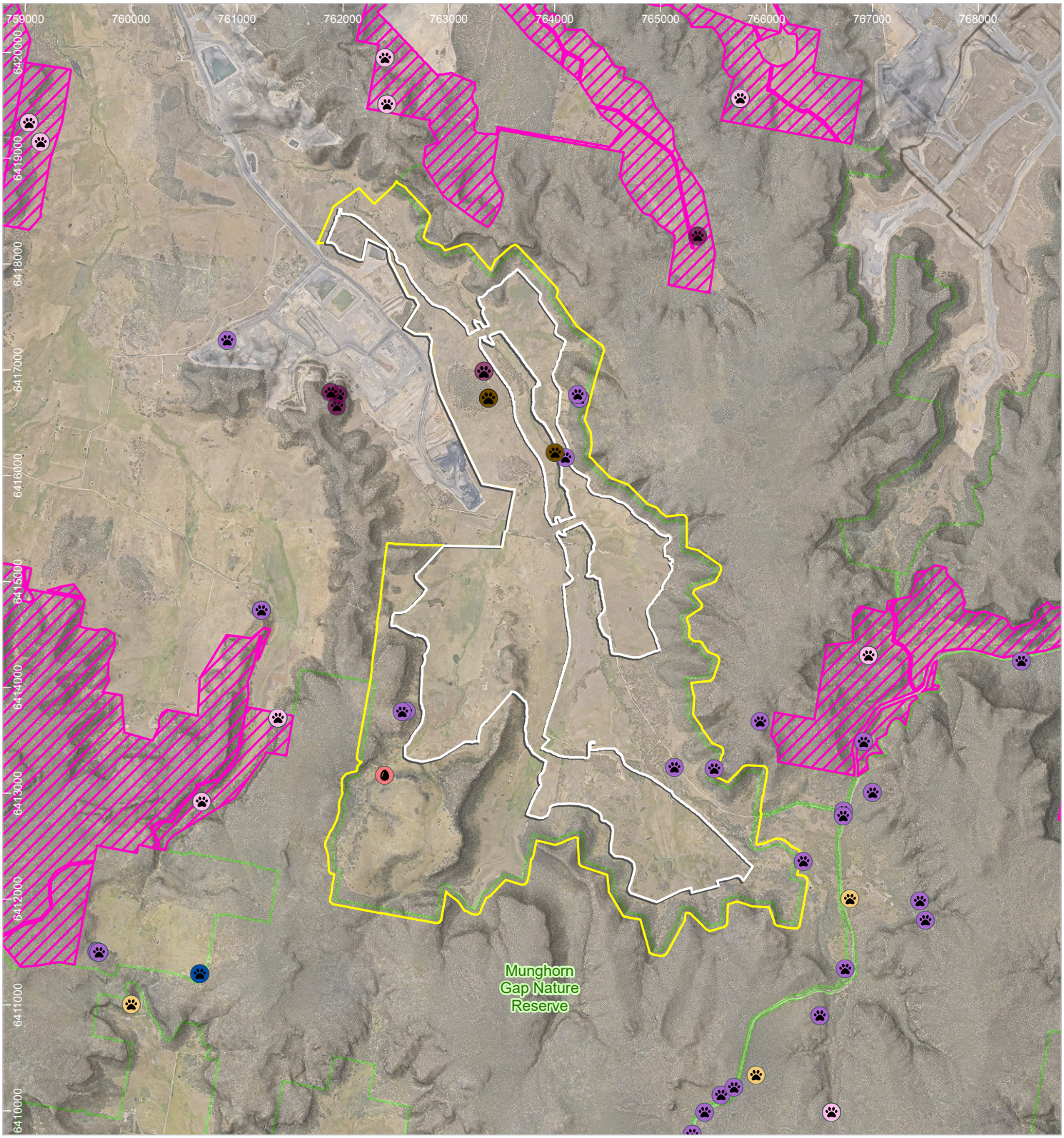
Threatened Flora within the Locality

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 13

Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community | Watercourses, Waterbodies, Road and Rail alignments, Protected areas of NSW © Spatial Services 2021. | Niche uses GDA2020 as standard for all project-related data. In order to ensure that data from numerous sources and coordinate systems is aligned, on-the-fly transformation to WGS1984 Web Mercator Auxilliary Sphere is used in the map above. For ease of reference, the grid tick marks and labels shown around the border of the map are presented in GDA2020, using the relevant MGA zone.



Development Footprint
Study Area
Existing Biodiversity Offset Areas
Nature Reserve

BioNet Atlas Results (Feb 2024)

Mammalia
- Eastern Cave Bat
- Koala
- Large Bent-winged Bat
- Large-eared Pied Bat
- Spotted-tailed Quoll
- Squirrel Glider
- Yellow-bellied Glider

Reptilia
- Pink-tailed Legless Lizard

**Broad-headed snake is not in updated Bionet record due to species sensitivity*

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N

0 800 m

GDA2020 MGA Zone 55

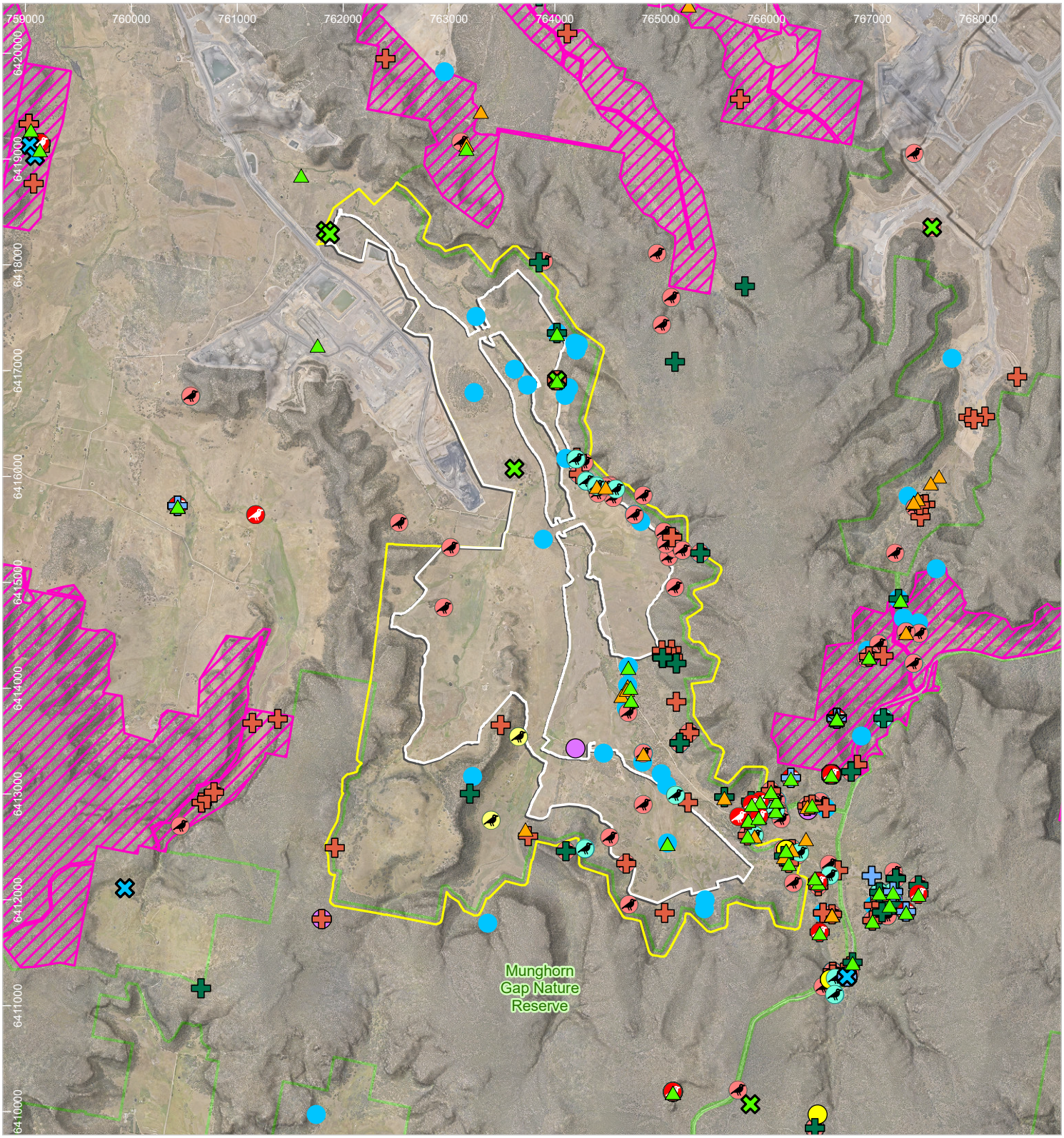
**Sensitive species within Bionet search displayed as per licence agreement.*

Threatened Fauna within the Locality (Mammalia and Reptilia)

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 14a



- Development Footprint
- Study Area
- Existing Biodiversity Offset Areas
- Nature Reserve

BioNet Atlas Results (Feb 2024)

Aves

- *Black Falcon*
- *Black-chinned Honeyeater (eastern subspecies)*
- *Brown Treecreeper (eastern subspecies)*
- *Diamond Firetail*
- *Dusky Woodswallow*
- *Flame Robin*
- *Grey-crowned Babbler (eastern subspecies)*
- *Little Eagle*
- *Little Lorikeet*
- *Painted Honeyeater*
- *Pied Honeyeater*
- *Pink Robin*
- *Scarlet Robin*
- *South-eastern Hooded Robin*
- *Southern Whiteface*
- *Speckled Warbler*
- *Swift Parrot*
- *Varied Sittella*
- *White-fronted Chat*
- *White-throated Needletail*

**Regent Honeyeater records not shown due to species sensitivity*

**Sensitive species within Bionet search displayed as per licence agreement.*

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0 800 m

GDA2020 MGA Zone 55

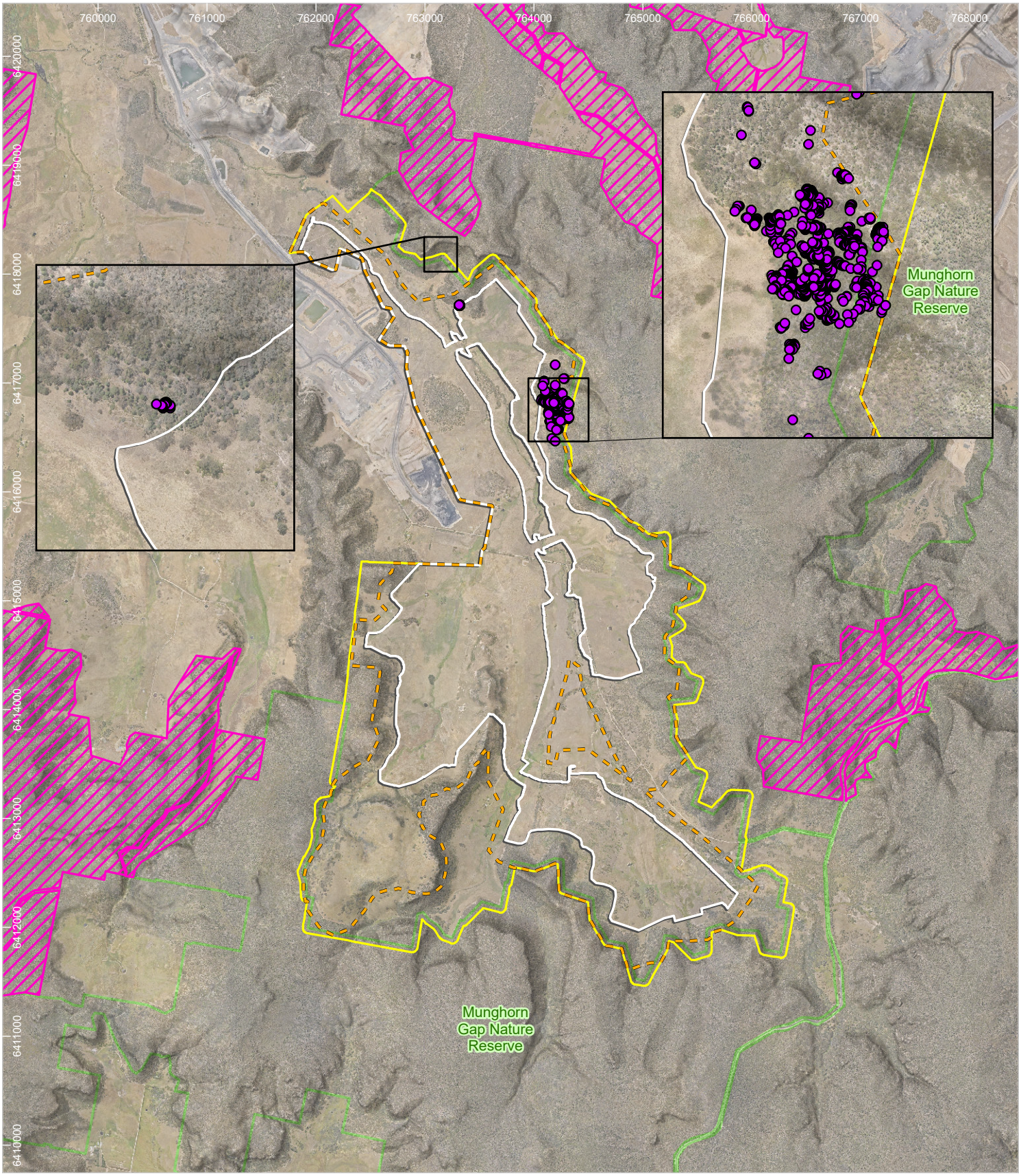
Threatened Fauna within the Locality (Aves)

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 14b

Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community | Watercourses, Waterbodies, Road and Rail alignments, Protected areas of NSW © Spatial Services 2021. | Niche uses GDA2020 as standard for all project-related data. In order to ensure that data from numerous sources and coordinate systems is aligned, on-the-fly transformation to WGS1984 Web Mercator Auxilliary Sphere is used in the map above. For ease of reference, the grid tick marks and labels shown around the border of the map are presented in GDA2020, using the relevant MGA zone.



Development Footprint

Study Area

Existing Biodiversity Offset Areas

Nature Reserve

Threatened Flora Study Area

Pomaderris cotoneaster (ELA 2023)

Drawn by: MatthewZajaczkowski Last updated: 7/03/2024 File: C:\OneDriveSync\Folder\Niche\GIS - APRX - APRX\a7000\a7037_MCO_OC3_BDAR_NSWProj\a7037_MCO_OC3_BDAR_NSW_reference_figures.aprx

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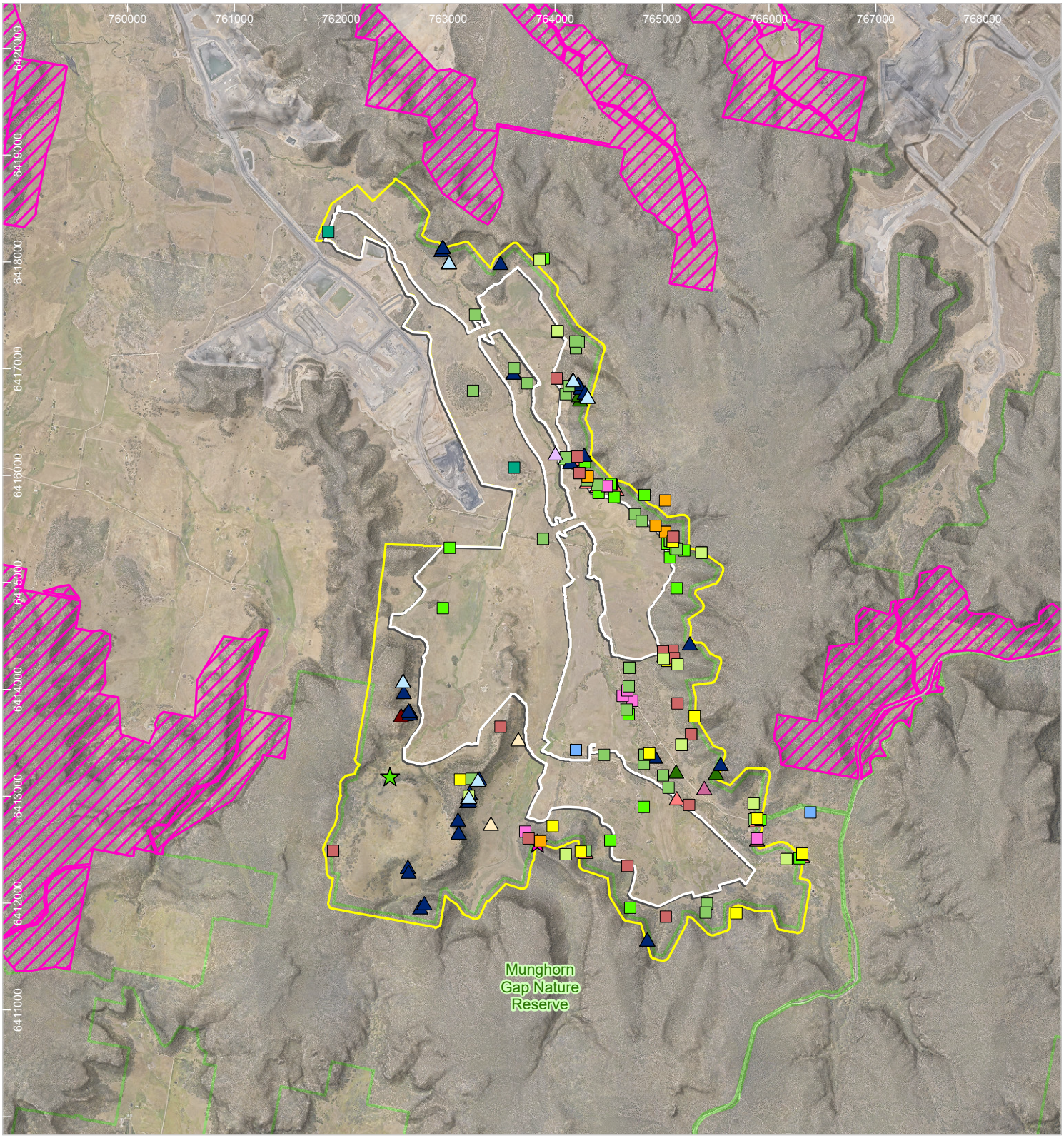
GDA2020 MGA Zone 55

Threatened Flora Recorded during Surveys

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 15



- Development Footprint
- Study Area
- Existing Biodiversity Offset Areas
- Nature Reserve
- Black Falcon
- Black-chinned Honeyeater
- Eastern Cave Bat
- Eastern Coastal Free-tailed Bat
- Greater Broad-nosed Bat
- Koala (ELA)
- Koala (Heard)
- Koala (Scat)
- Koala (Sighting)
- Large Bent-winged Bat
- Large-eared Pied Bat
- Squirrel Glider
- Yellow-bellied Sheathtail-bat
- Brown Treecreeper
- Diamond Firetail
- Dusky Woodswallow
- Grey-crowned Babbler
- Little Eagle
- Little Lorikeet
- Masked Owl
- Powerful Owl
- Speckled Warbler
- Varied Sittella
- Broad-headed Snake
- Pink-tailed Legless Lizard

Drawn by: MatthewZajaczkowski Last updated: 7/03/2024 File: C:\OneDriveSync\FolderNiche\GIS - APRX - APRX\a7000\a7037_MCO_OC3_BDAR_NSWProja7037_MCO_OC3_BDAR_NSW_reference_figures.aprx

niche Environment and Heritage

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0 800

m

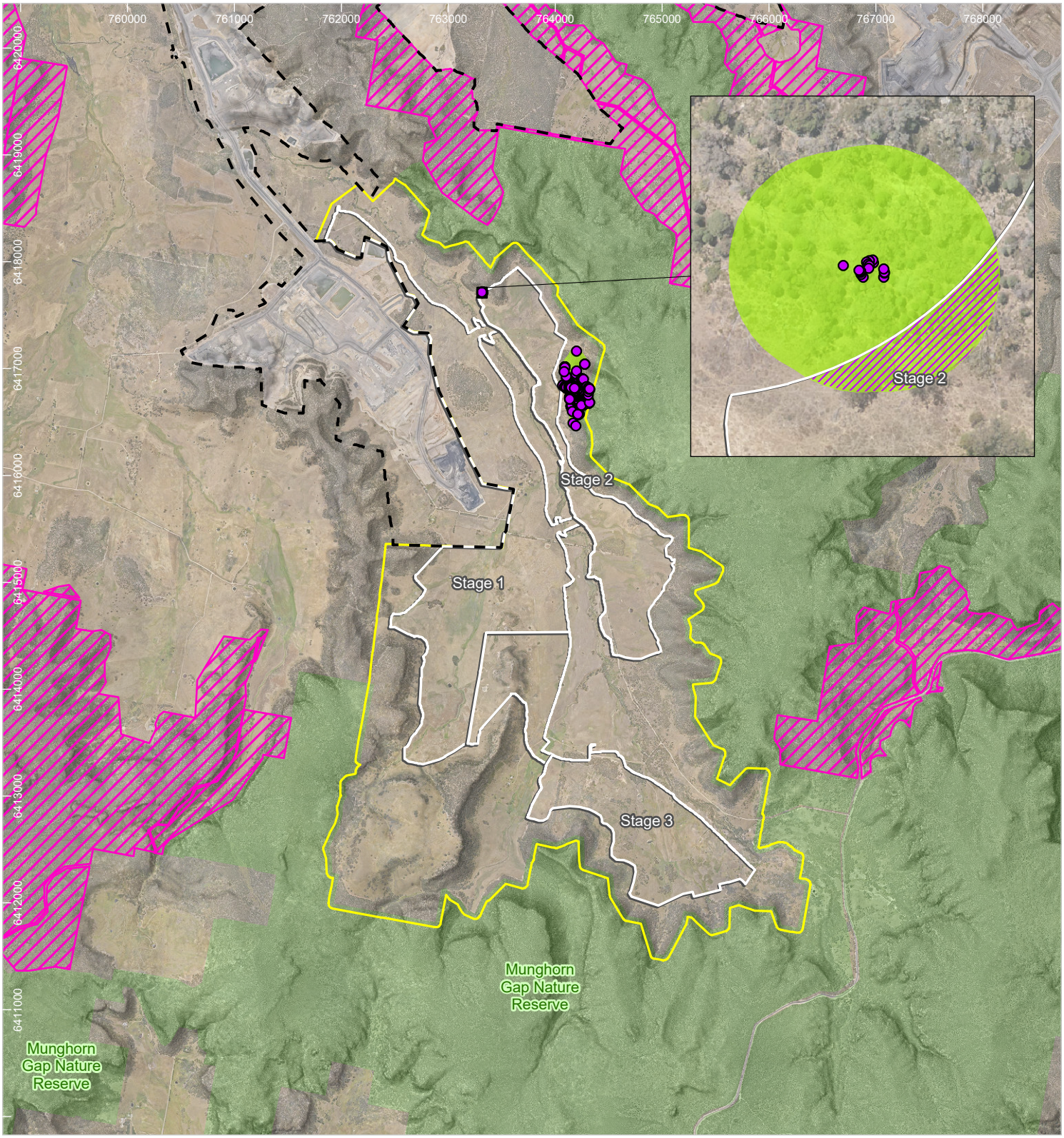
GDA2020 MGA Zone 55

Threatened Fauna Recorded during Surveys

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 16



Development Footprint

Study Area

Existing/Approved Indicative Surface Development Footprint

Existing Biodiversity Offset Areas

Nature Reserve

Pomaderris cotoneaster impacts requiring offset

Pomaderris cotoneaster Species Polygon (ELA 2023)

Pomaderris cotoneaster (ELA 2023)

Drawn by: MatthewZajaczkowski Last updated: 7/03/2024 File: C:\OneDriveSync\Folder\Niche\GIS - APRX - APRX\a7000\a7037_MCO_OC3_BDAR_NSW\Proj\a7037_MCO_OC3_BDAR_NSW_species_polygons.aprx

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GDA2020 MGA Zone 55

Pomaderris cotoneaster Species Polygon

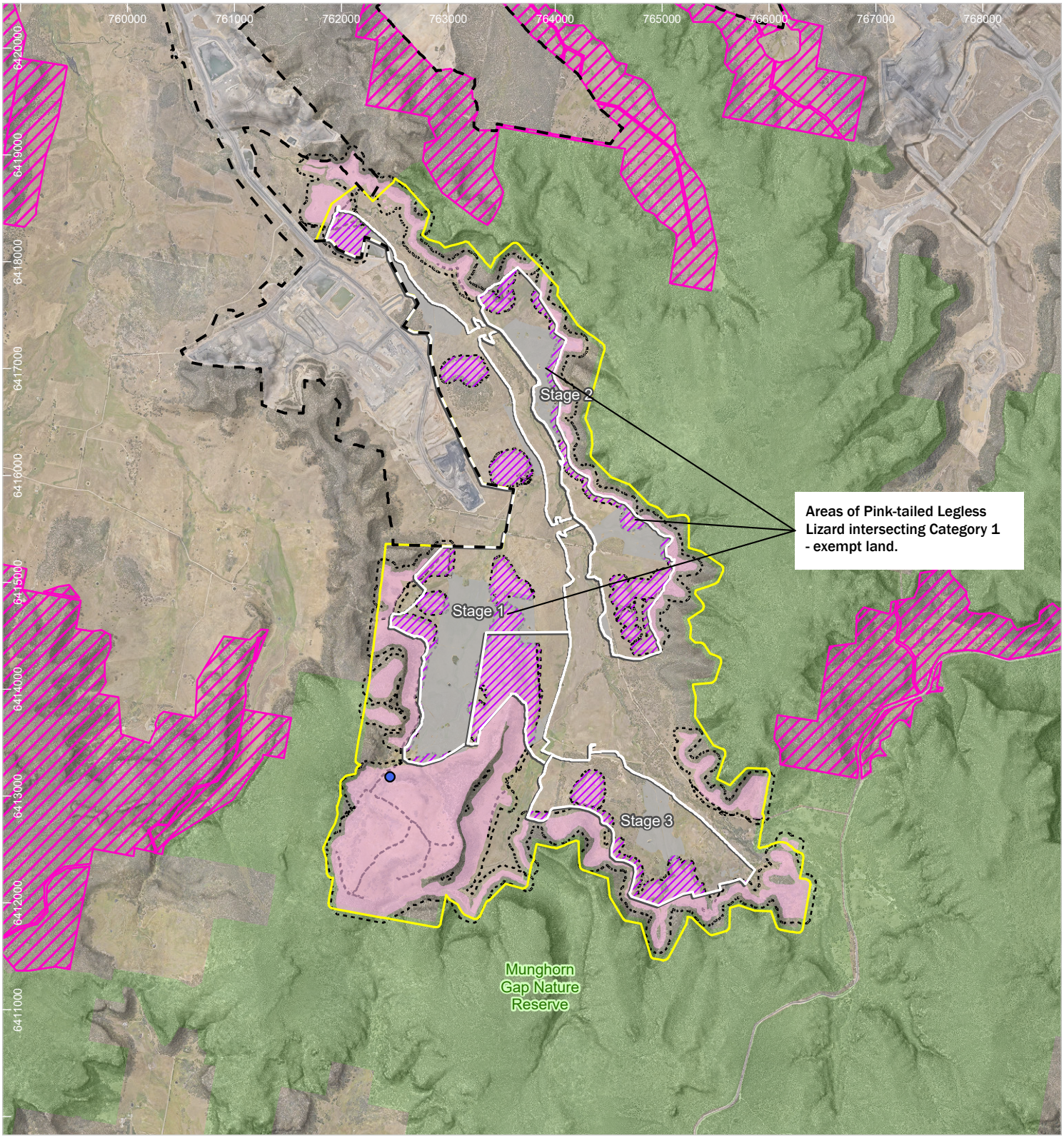
Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 17a

Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community | Watercourses, Waterbodies, Road and Rail alignments, Protected areas of NSW © Spatial Services 2021. | Niche uses GDA2020 as standard for all project-related data. In order to ensure that data from numerous sources and coordinate systems is aligned, on-the-fly transformation to WGS1984 Web Mercator Auxilliary Sphere is used in the map above. For ease of reference, the grid tick marks and labels shown around the border of the map are presented in GDA2020, using the relevant MGA zone.

v2.0



Development Footprint
Study Area
Existing/Approved Indicative Surface Development Footprint
Existing Biodiversity Offset Areas
Nature Reserve
Category 1 - exempt land
Pink-tailed Legless Lizard impacts requiring offset
Pink-tailed Legless Lizard Species Polygon
Pink-tailed Legless Lizard Rocky Habitat
Pink-tailed Legless Lizard (AMBS 2023)

Drawn by: MatthewZajaczkowski Last updated: 7/03/2024 File: C:\OneDriveSync\Folder\Niche\GIS - APRX - APRX\a7000\a7037_MCO_OC3_BDAR_NSWProja7037_MCO_OC3_BDAR_NSW_species_polygons.aprx

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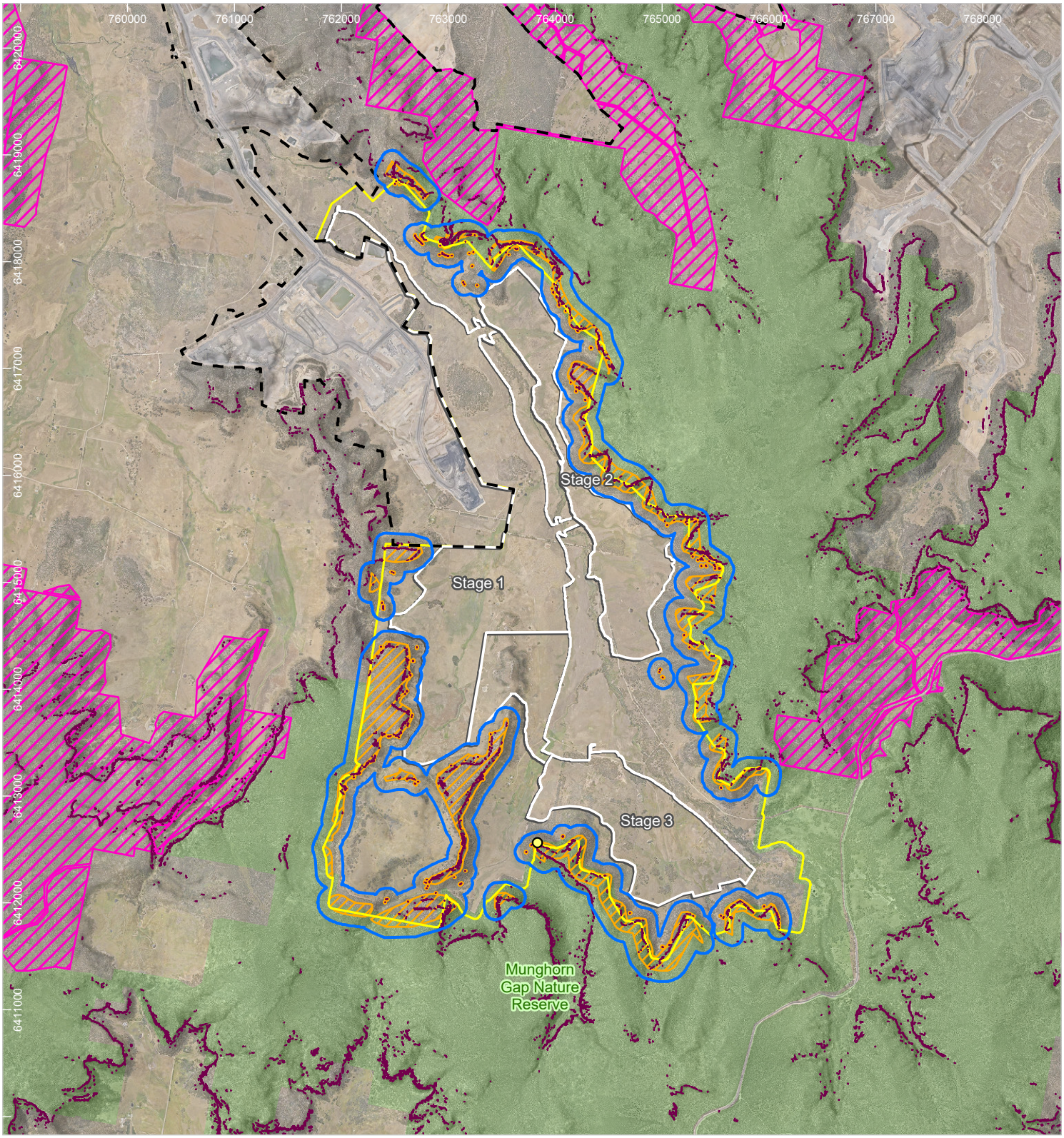
GDA2020 MGA Zone 55

Pink-tailed Legless Lizard Species Polygon
Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 17b



Development Footprint
Study Area
Existing/Approved Indicative Surface Development Footprint
Existing Biodiversity Offset Areas
Nature Reserve
Broad-headed Snake (AMBS 2023)
Broad-headed Snake Mapped Rocky Habitat
100m Buffer of the Broad-Headed Snake Mapped Rocky Habitat
Rocky features (LiDAR mapped)

Drawn by: MatthewZajaczkowski Last updated: 7/03/2024 File: C:\OneDriveSync\Folder\Niche\GIS - APRX - APRX\a7000\a7037_MCO_OC3_BDAR_NSWProja7037_MCO_OC3_BDAR_NSW_species_polygons.aprx

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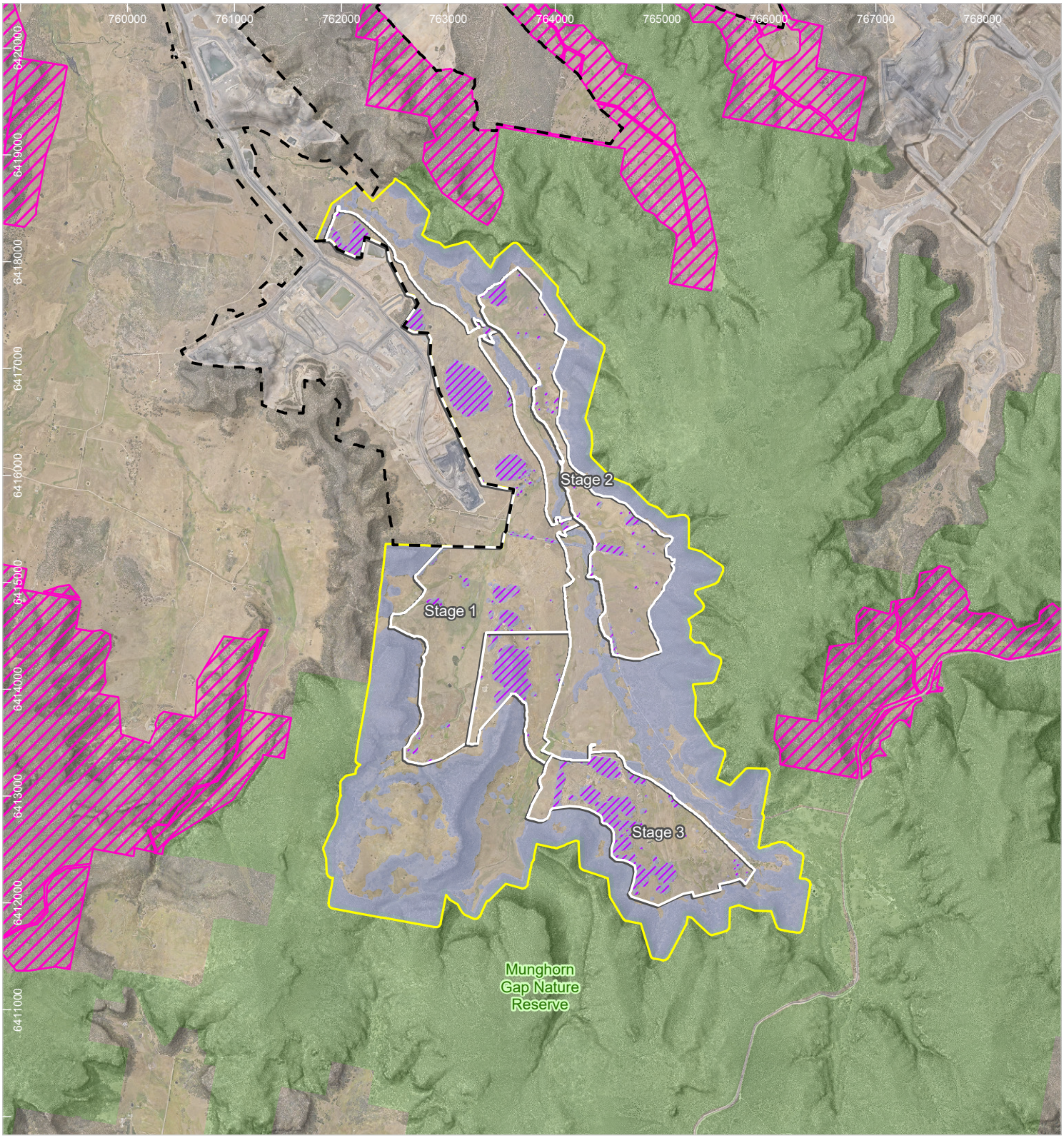
m
GDA2020 MGA Zone 55

Broad-headed Snake Species Polygon
Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 17c



Development Footprint
Study Area
Existing/Approved Indicative Surface Development Footprint
Existing Biodiversity Offset Areas
Nature Reserve
Swift Parrot Potential Foraging impacts requiring offset
Swift Parrot Potential Foraging Habitat

Drawn by: MatthewZajaczkowski Last updated: 7/03/2024 File: C:\OneDriveSync\FolderNiche\GIS - APRX - APRX\a7000\a7037_MCO_OC3_BDAR_NSWProja7037_MCO_OC3_BDAR_NSW_species_polygons.aprx

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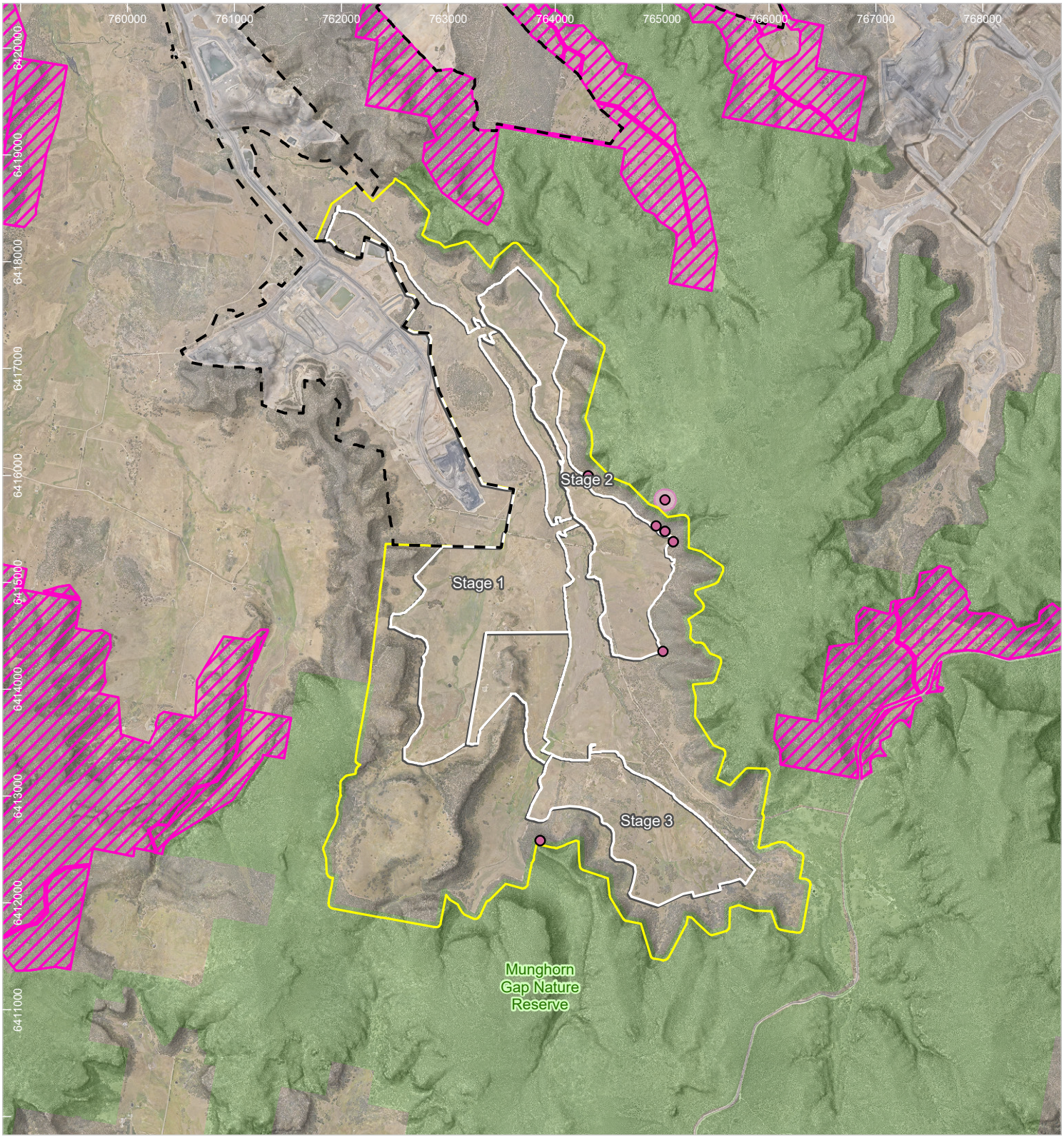
m
GDA2020 MGA Zone 55

Swift Parrot Potential Foraging Habitat
Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 17d



Development Footprint
Study Area
Existing/Approved Indicative Surface Development Footprint
Existing Biodiversity Offset Areas
Nature Reserve
Masked Owl Species Polygon
Masked Owl (AMBS 2023)

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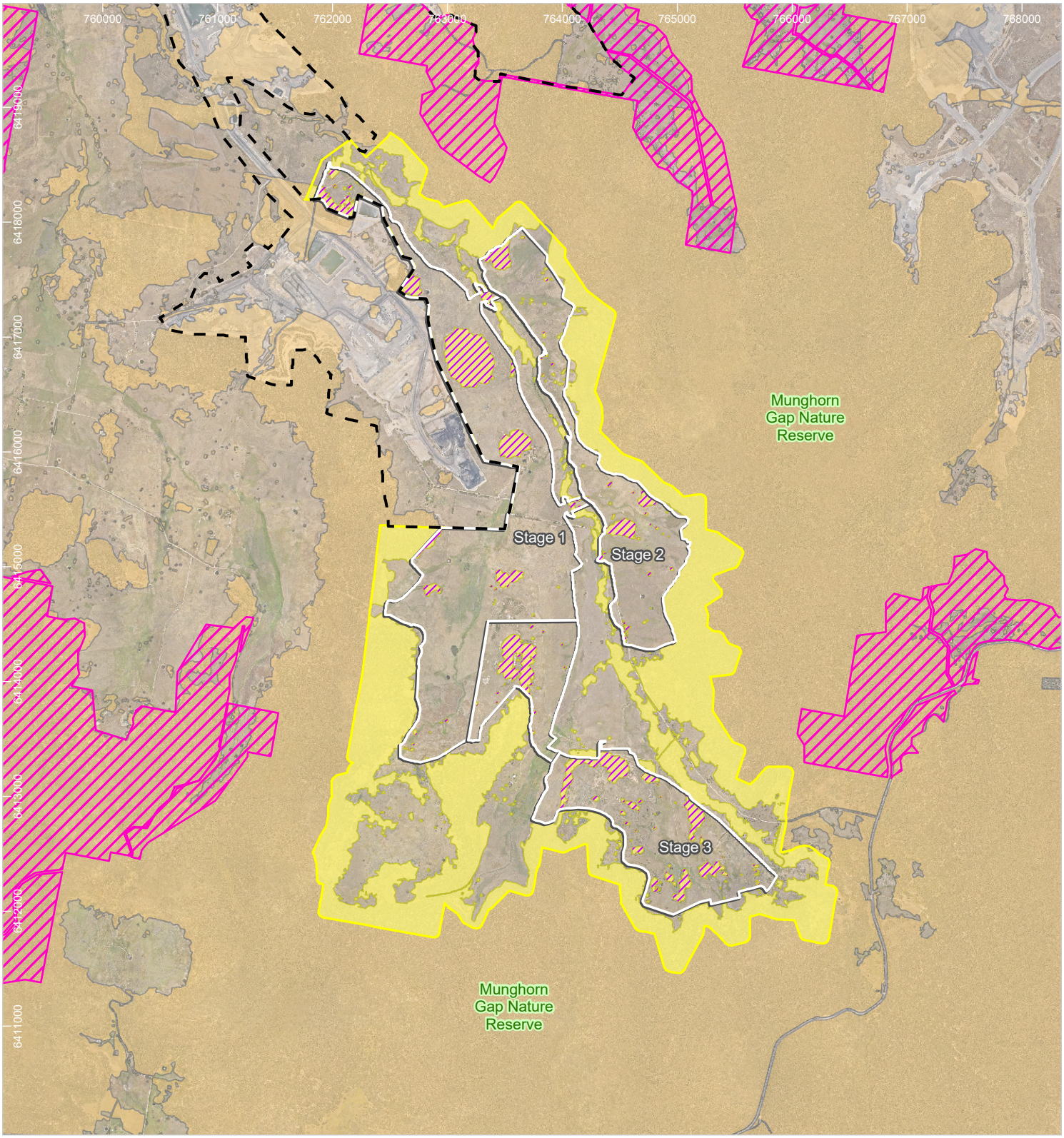
0 800
m
GDA2020 MGA Zone 55

Masked Owl Species Polygon
Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 17e



Development Footprint
Study Area
Existing/Approved Indicative Surface Development Footprint
Existing Biodiversity Offset Areas
Regent Honeyeater impacts requiring offset
Regent Honeyeater Species Polygon
Regent Honeyeater important habitat mapping

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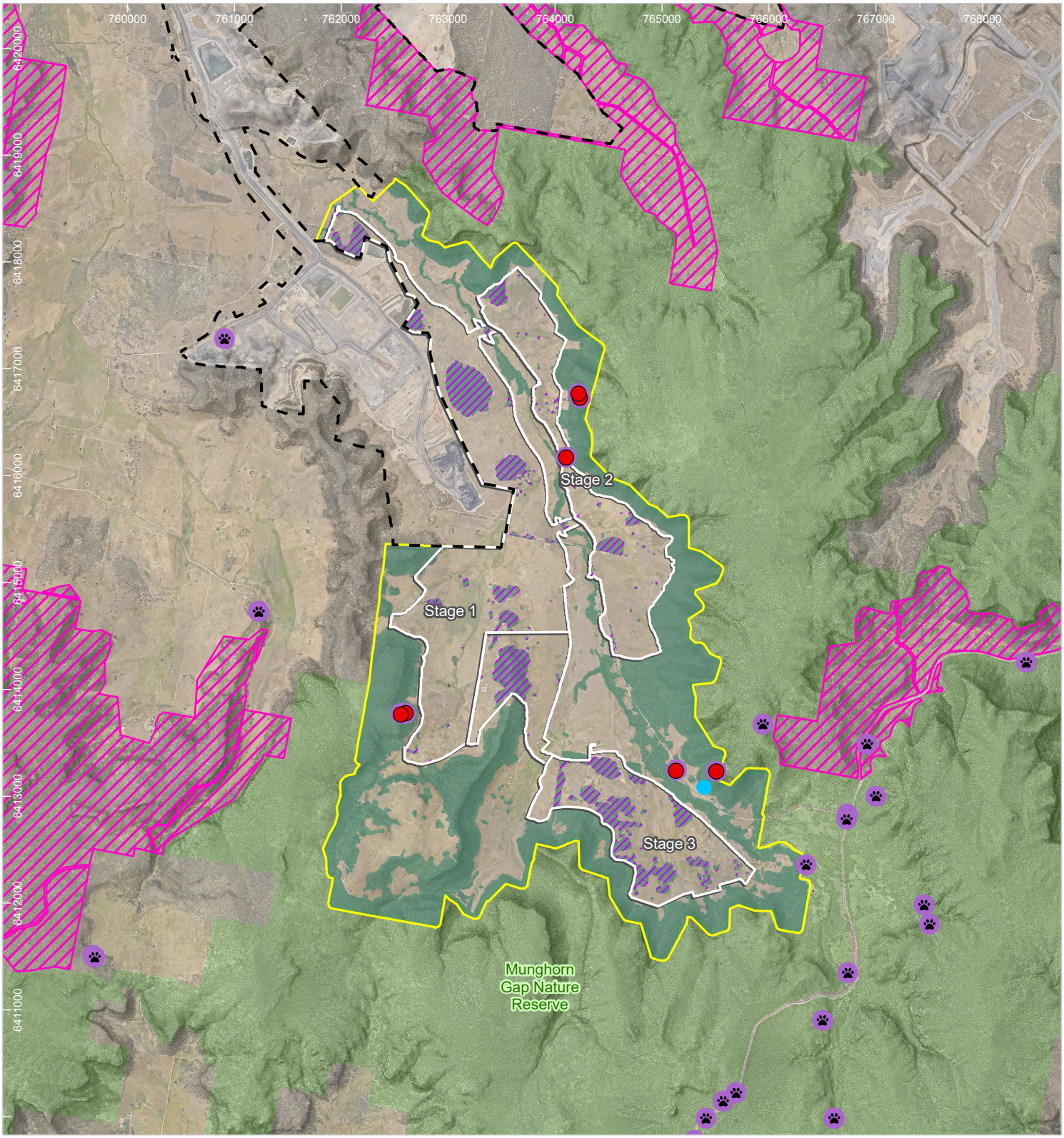
0 800
m
GDA2020 MGA Zone 55

Regent Honeyeater Species Polygon
Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 17f



Development Footprint
Study Area
Existing Biodiversity Offset Areas
Nature Reserve
Existing/Approved Indicative Surface Development Footprint
Koala impacts requiring offset
Koala Species Polygon
Koala (AMBS 2023)
Koala (ELA 2023)
Koala (BioNet 2024)

Drawn by: MatthewZajaczkowski Last updated: 7/03/2024 File: C:\OneDriveSync\Folder\NicheGIS - APRX - APRX\a7000\a7037_MCO_OC3_BDAR_NSWProja7037_MCO_OC3_BDAR_NSW_species_polygons.aprx

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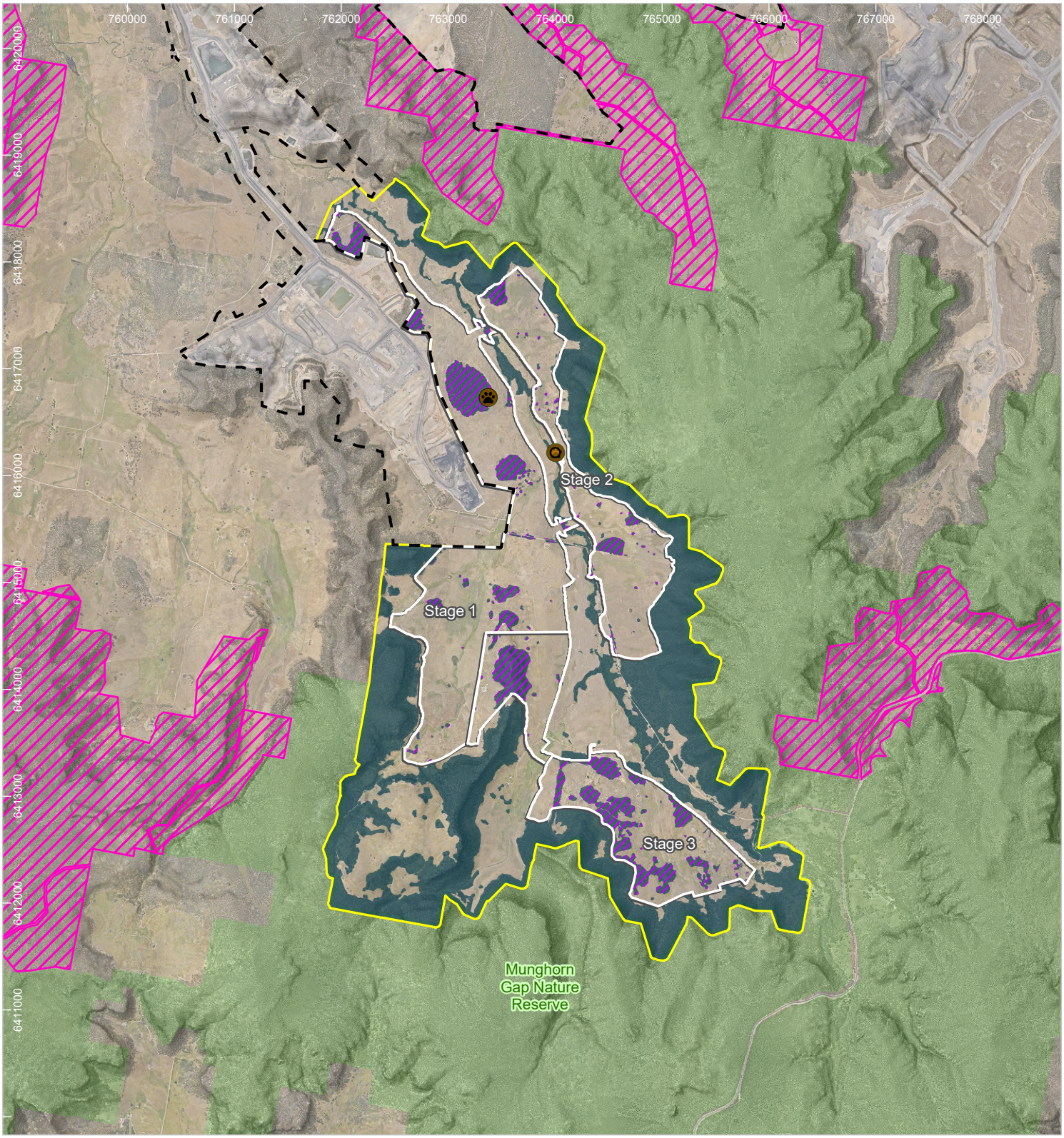
N
0 800
m
GDA2020 MGA Zone 55

**Bionet records that are duplicate with AMBS 2022 have been removed.*

Koala Species Polygon
Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 17g



Development Footprint
Study Area
Existing/Approved Indicative Surface Development Footprint
Existing Biodiversity Offset Areas
Nature Reserve
Squirrel Glider impacts requiring offset
Squirrel Glider Species Polygon
Squirrel Glider (AMBS 2023)
Squirrel Glider (BioNet 2024)

Drawn by: MatthewZajaczkowski Last updated: 7/03/2024 File: C:\OneDriveSync\Folder\NicheGIS - APRX - APRX\a7000\a7037_MCO_OC3_BDAR_NSWProja7037_MCO_OC3_BDAR_NSW_species_polygons.aprx

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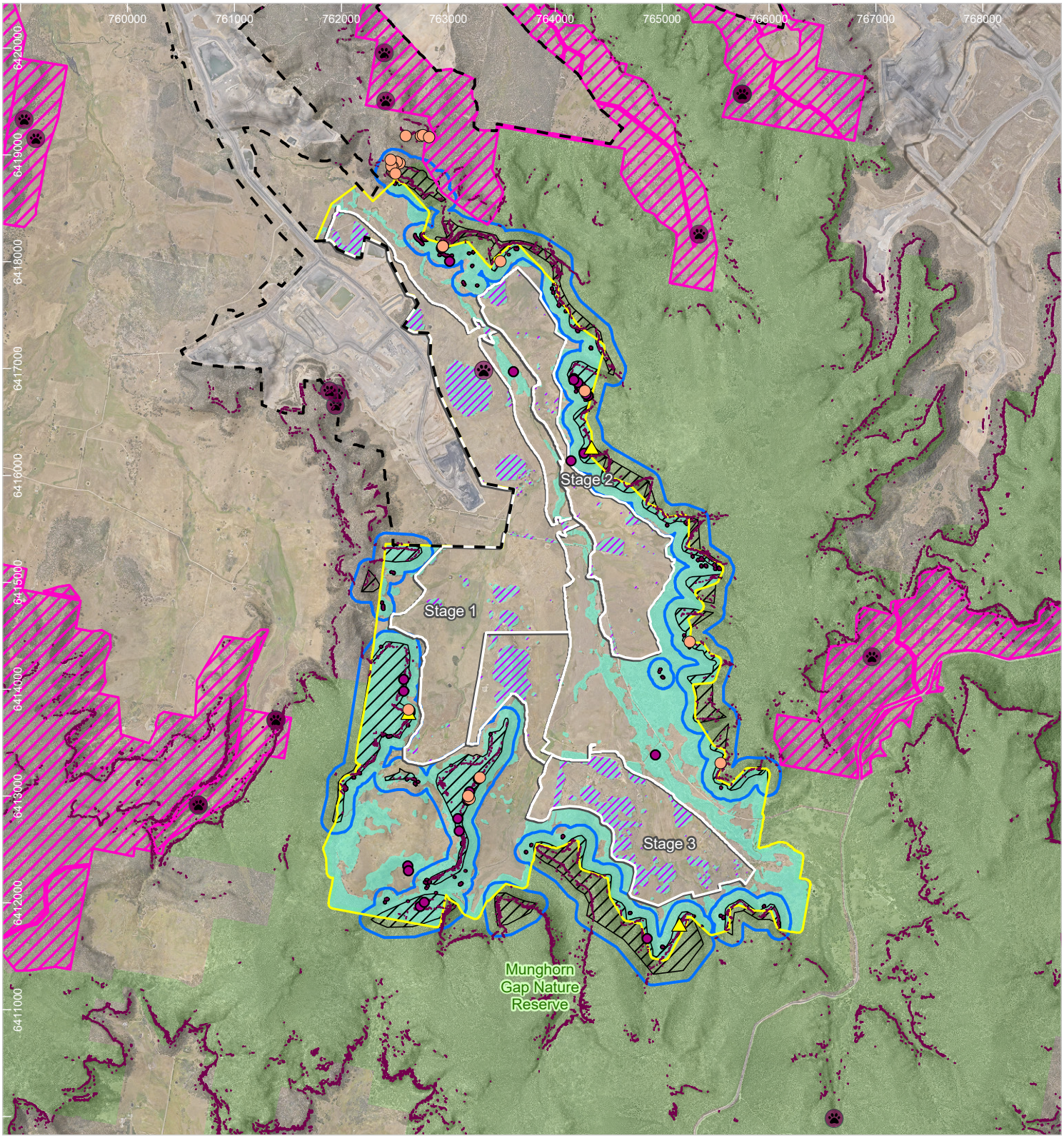
0 800
m
GDA2020 MGA Zone 55

Squirrel Glider Species Polygon
Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 17h



- Development Footprint
- Study Area
- Existing/Approved Indicative Surface Development Footprint
- Existing Biodiversity Offset Areas
- Nature Reserve
- Large-eared Pied Bat impacts requiring offset
- Biodiversity Monitoring Services observed roosts
- Large-eared Pied Bat Species Polygon
- Large-eared Pied Bat (BioNet 2024)
- Large-eared Pied Bat (AMBS 2023)
- Large-eared Pied Bat (AMBS - UG2)
- Large-eared Pied Bat Mapped Rocky Habitat
- Rocky features (LiDAR mapped)
- Bat Breeding Habitat (100m buffer from mapped rocky habitat)

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N

0 800

m

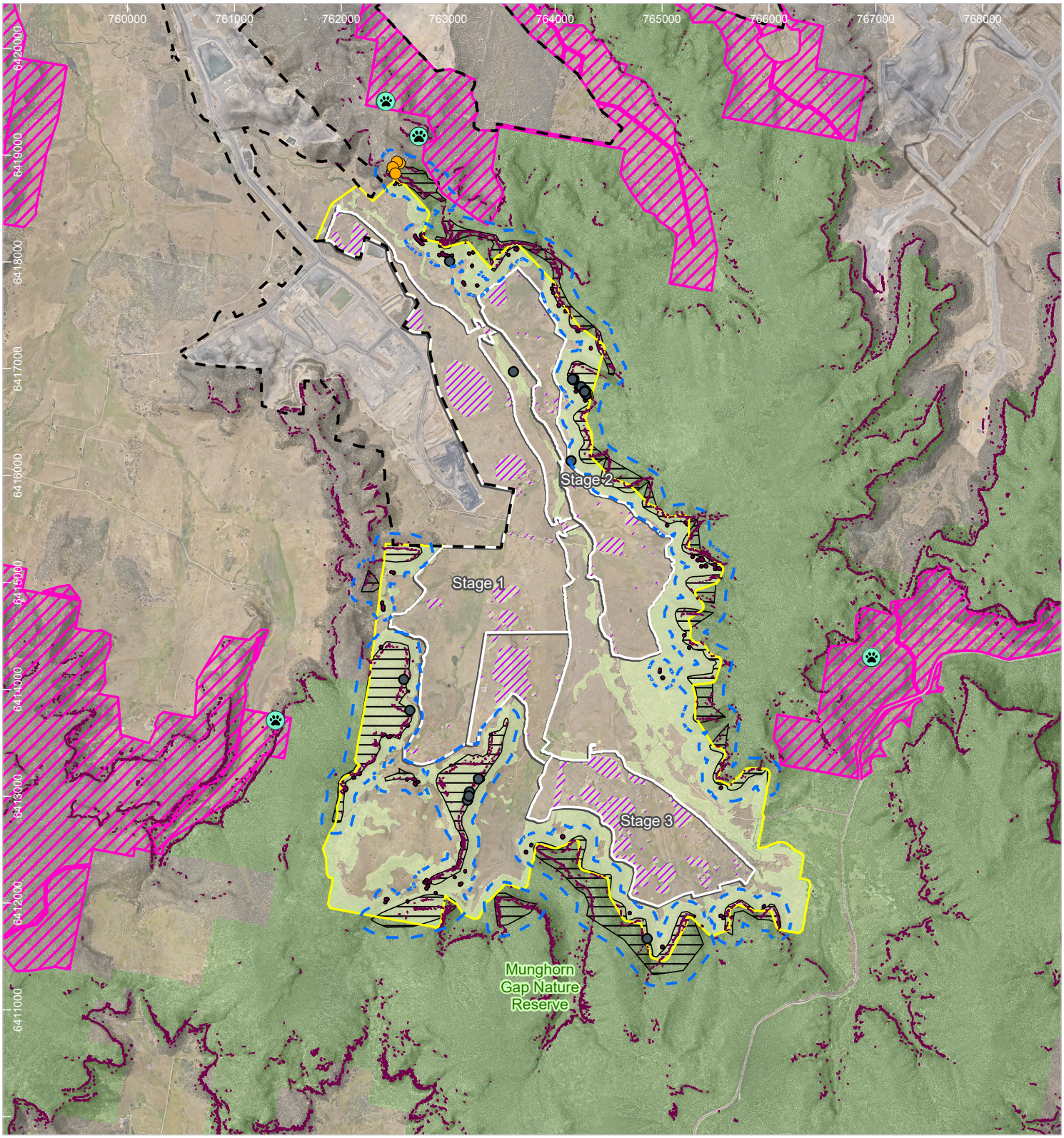
GDA2020 MGA Zone 55

Large-eared Pied Bat Species Polygon

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 17i



- Development Footprint
- Study Area
- Existing/Approved Indicative Surface Development Footprint
- Existing Biodiversity Offset Areas
- Nature Reserve
- Eastern Cave Bat impacts requiring offset
- Eastern Cave Bat Species Polygon
- Eastern Cave Bat (AMBS 2023)
- Eastern Cave Bat (AMBS - UG2)
- Eastern Cave Bat (BioNet 2024)
- Eastern Cave Bat Mapped Rocky Habitat
- Rocky features (LiDAR mapped)
- Bat Breeding Habitat (100m buffer from mapped rocky habitat)

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N

0 800

m

GDA2020 MGA Zone 55

Eastern Cave Bat Species Polygon

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 17j

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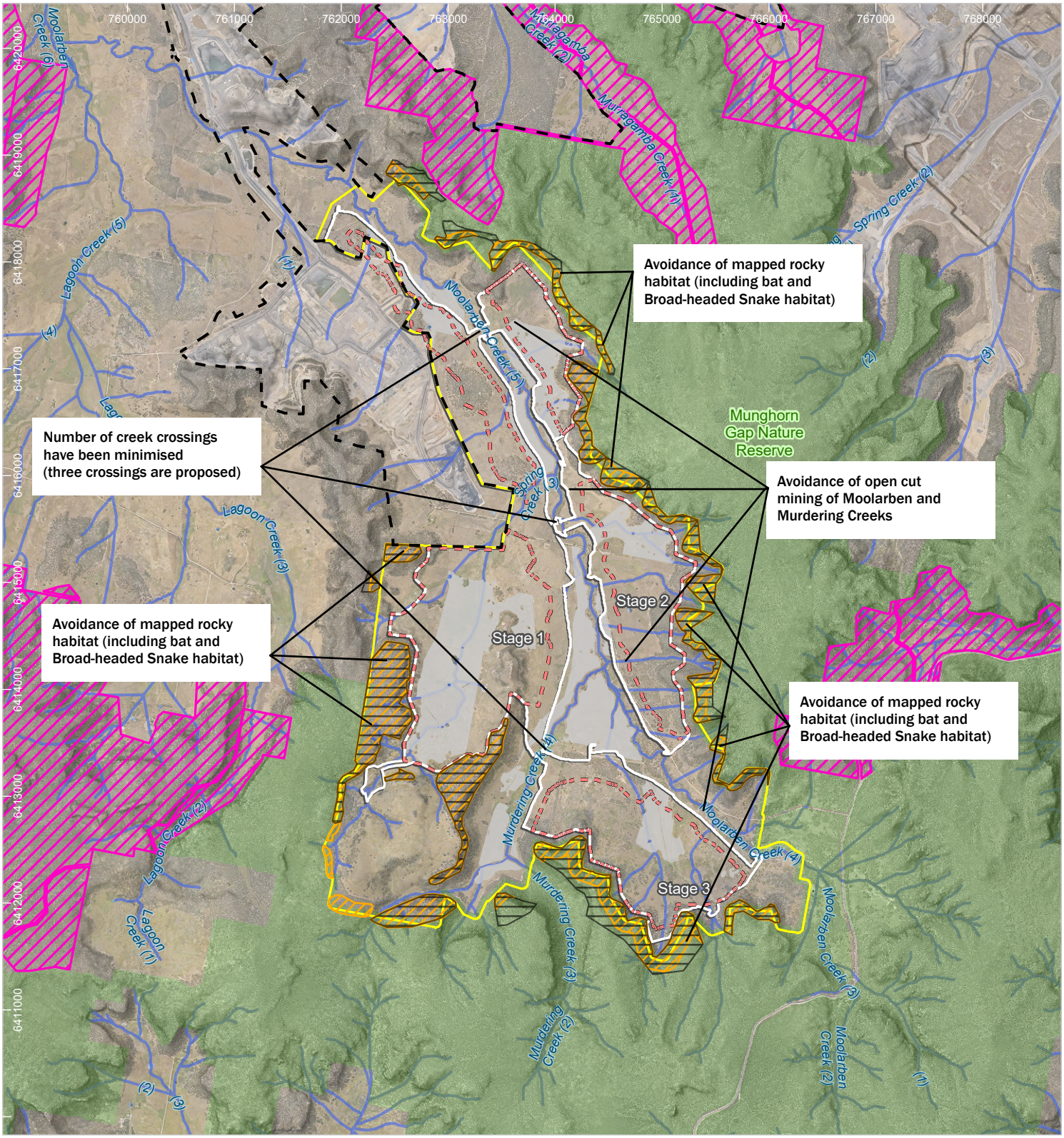


Development Footprint
Study Area
Existing Biodiversity Offset Areas
Nature Reserve

Broad-headed Snake Mapped Rocky Habitat
Eastern Cave Bat and Large-eared Pied Bat Mapped Rocky Habitat
Existing/Approved Indicative Surface Development Footprint

Indicative Open Cut Pit Extent
Category 1 – exempt land

Hydrography
Waterbody

Watercourse

public/NSW_Imagery
Footprint

niche Environment and Heritage

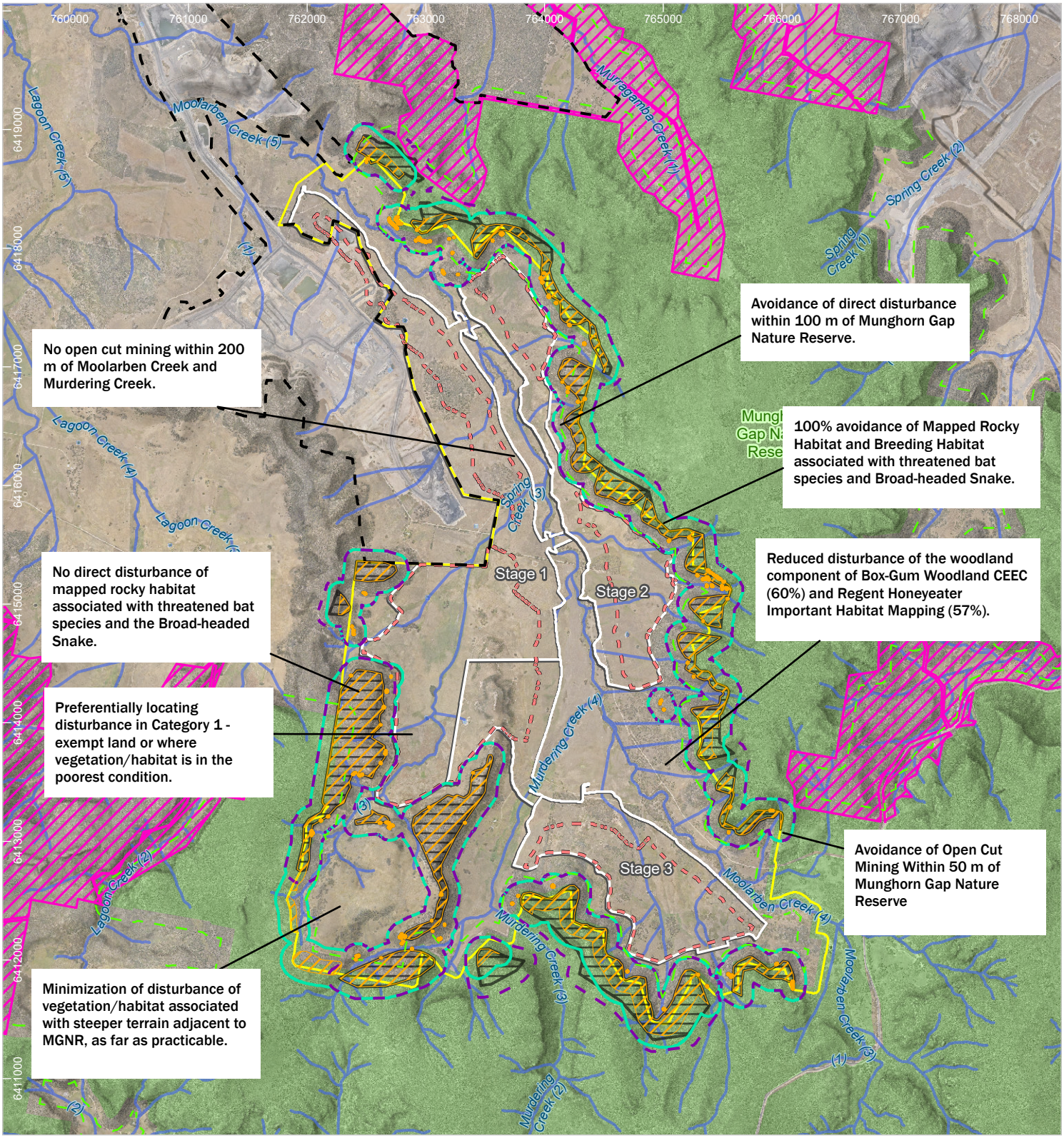
N
0 900
m
GDA2020 MGA Zone 55

Impact Avoidance and Minimisation Presented in the EIS
Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 18a

Drawn by: MatthewZajaczkowski Last updated: 7/03/2024 File: C:\OneDriveSync\Folder\NicheGIS - APRX - APRX\a7000\a7037_MCO_OC3_BDAR_NSWProja7037_MCO_OC3_BDAR_NSW_reference_figures.aprx
v2.0



- Study Area
- Development Footprint
- Existing Biodiversity Offset Areas
- Nature Reserve
- Munghorn Gap Nature Reserve (100m buffer)
- Amended Open Cut Pit Extent
- Existing/Approved Indicative Surface Development Footprint
- 100m Buffer of the Broad-headed Snake Mapped Rocky Habitat
- Broad-headed Snake Mapped Rocky Habitat
- Bat Breeding Habitat (100m buffer from mapped rocky habitat)
- Eastern Cave Bat and Large-eared Pied Bat Mapped Rocky Habitat

Hydrography

- Waterbody
- Watercourse

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0 900 m

GDA2020 MGA Zone 55

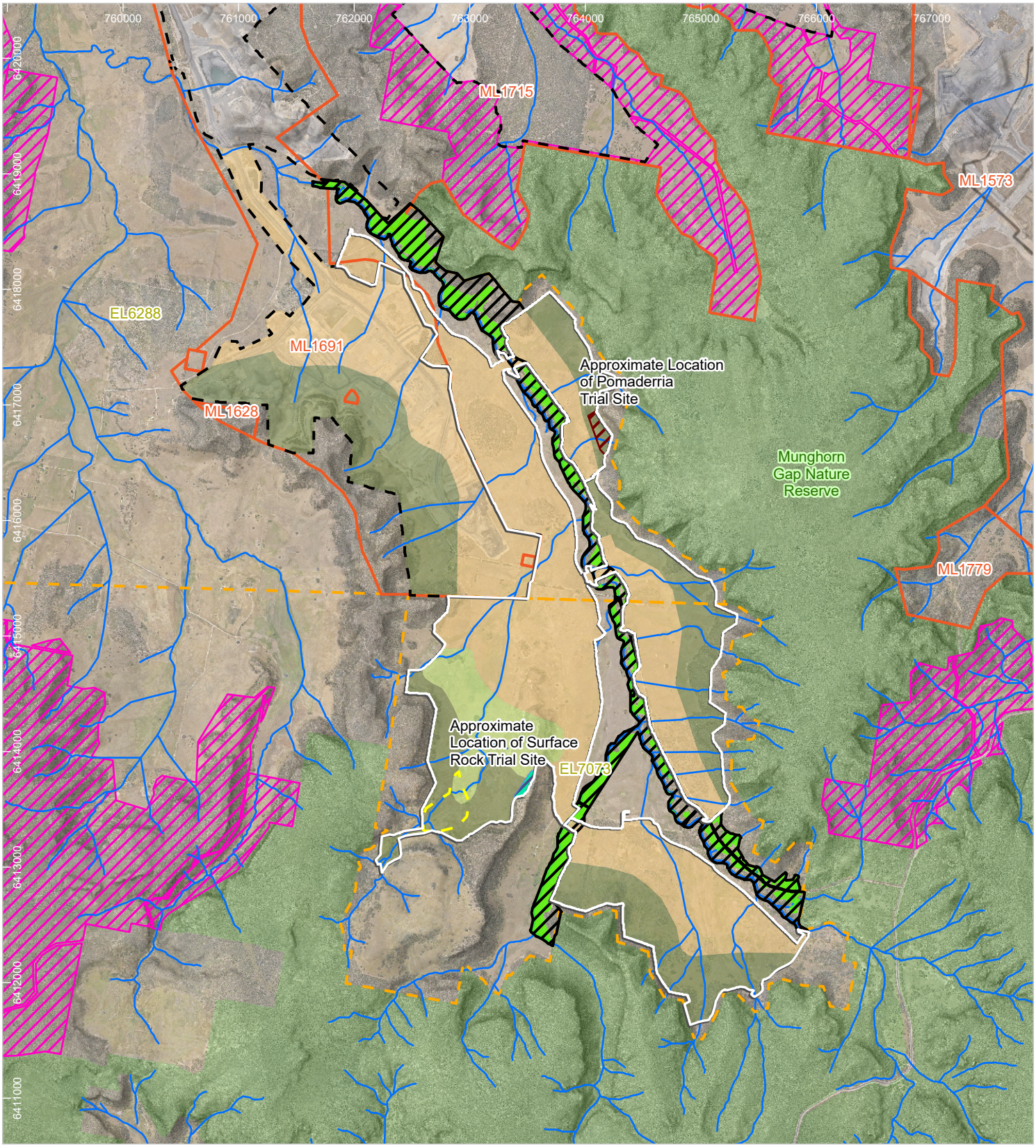
Additional Avoidance and Minimisation Measures for the Amended Project

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 18b

Drawn by: MatthewZajaczkowski Last updated: 7/03/2024 File: C:\OneDriveSync\FoldenNiche\GIS - APRX - APRX\a7000\a7037_MCO_OC3_BDAR_NSWProja7037_MCO_OC3_BDAR_NSW_reference_figures.aprx



- Development Footprint
- Existing Biodiversity Offset Areas
- Nature Reserve
- Existing/Approved Indicative Surface Development Footprint
- Approximate Location of Surface Rock Trial Site
- Approximate Location of Pomaderris Trial Site
- Highwall
- Exploration License
- Mining Lease
- Watercourse

Conceptual Post-mining Land Use Areas

- Agricultural Scattered Trees
- Native Open Woodland Surface Rock
- Native Woodland
- Habitat Enhancement Area Indicative Extent
- Revegetation Area Indicative Extent

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N

0 800

m

GDA2020 MGA Zone 55

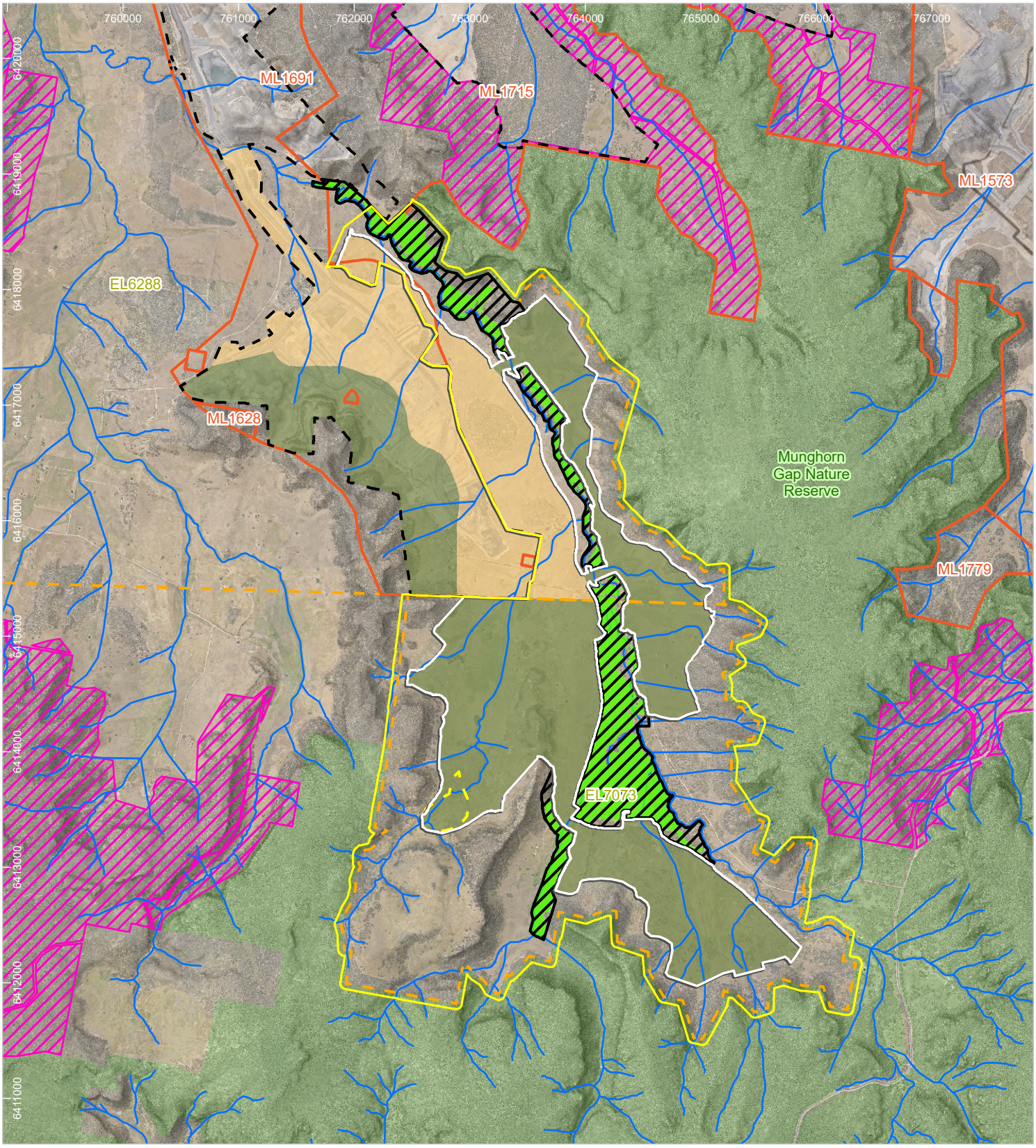
Indicative Final Land Use Presented in the EIS

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 19a

Drawn by: MatthewZajaczkowski Last updated: 7/03/2024 File: C:\OneDriveSync\Folder\Niche\GIS - APRX - APRXa7000\a7037_MCO_OC3_BDAR_NSWProja7037_MCO_OC3_BDAR_NSW_reference_figures.aprx



Development Footprint
Study Area
Existing Biodiversity Offset Areas
Nature Reserve
Existing/Approved Indicative Surface Development Footprint
Approximate Location of Surface Rock Trial Site
Exploration License
Mining Lease
Watercourse
Conceptual Post-mining Land Use Areas
Agricultural Pasture/ Scattered Trees
Native Woodland
Habitat Enhancement Area Indicative Extent
Revegetation Area Indicative Extent

Drawn by: MatthewZajaczkowski Last updated: 7/03/2024 File: C:\OneDriveSyncFolder\NicheGIS - APRX - APRXfa7000\a7037_MCO_OC3_BDAR_NSWProja7037_MCO_OC3_BDAR_NSW_reference_figures.aprx

niche Environment and Heritage

N

0 800

m

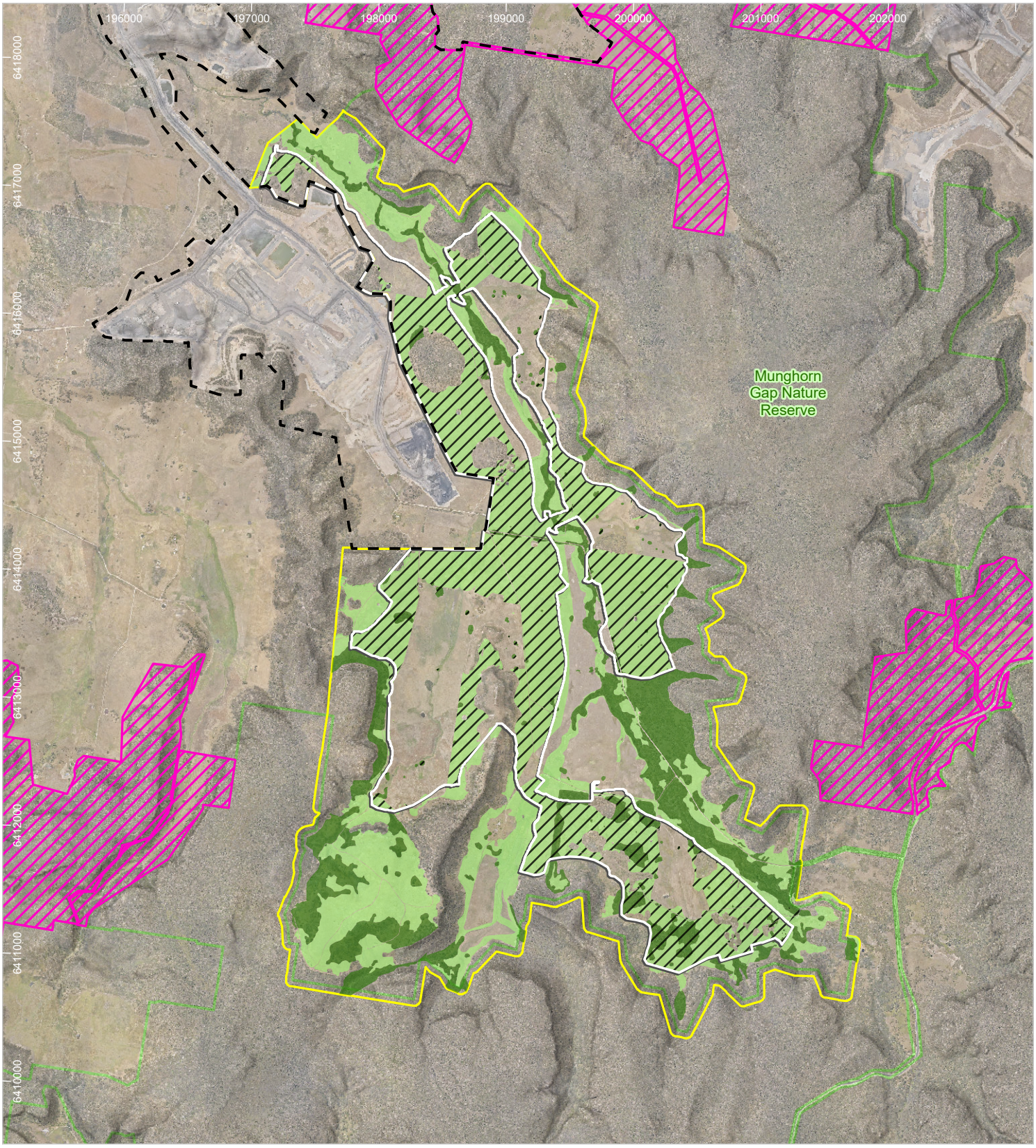
GDA2020 MGA Zone 55

Indicative Final Land Use for the Amended Project

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 19b



Development Footprint
Study Area
Existing Biodiversity Offset Areas
Nature Reserve
Existing/Approved Indicative Surface Development Footprint
Box Gum Woodland Impacts Requiring Offset
Box-Gum Woodland CEEC - BC Act and EPBC Act, DNG
Box-Gum Woodland CEEC - BC Act and EPBC Act, Woodland

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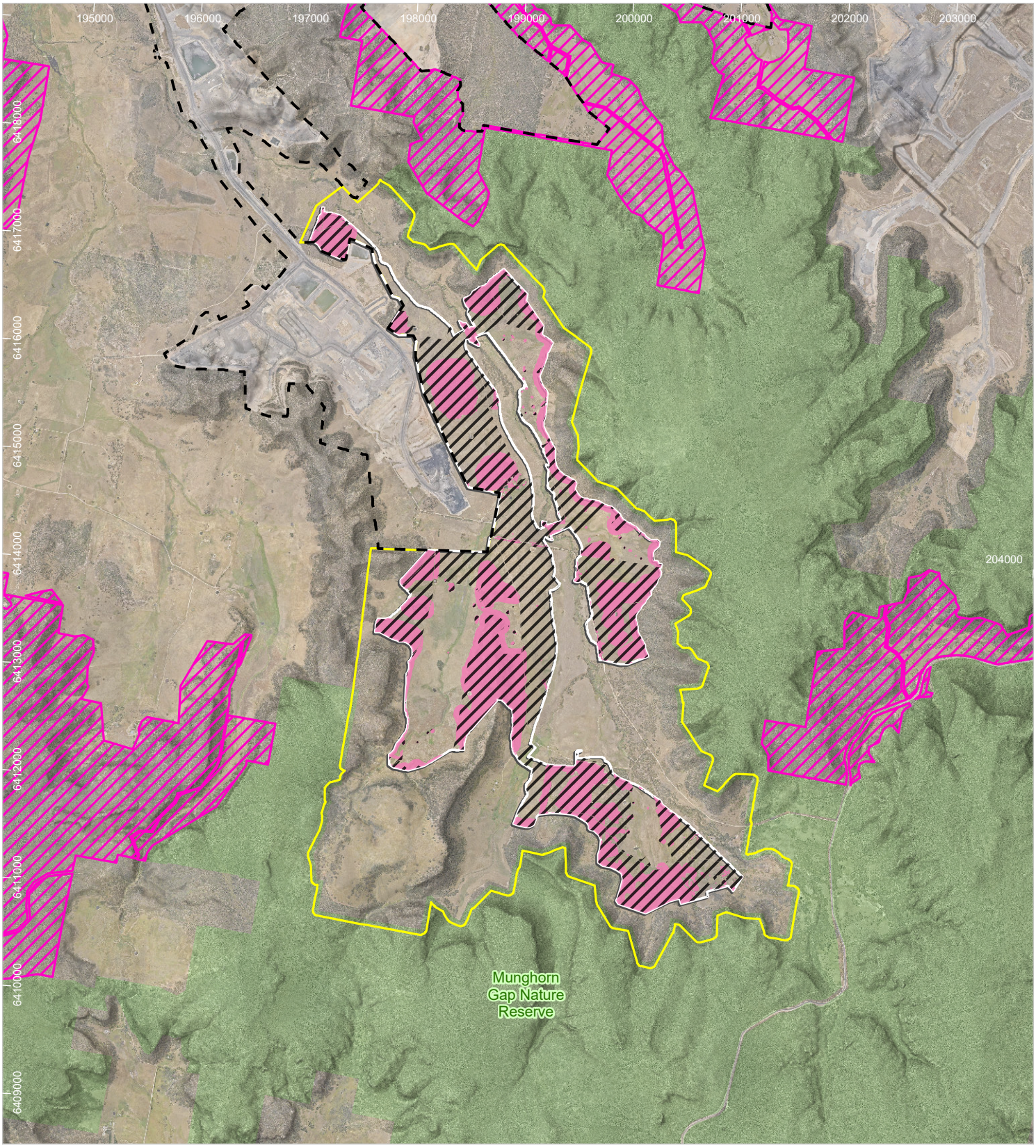
Potential Box-Gum Woodland SAII

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 20



Development Footprint
Study Area
Existing Biodiversity Offset Areas
Nature Reserve
Existing/Approved Indicative Surface Development Footprint
Areas Requiring Offset
Vegetation
Species Polygons
public/NSW_Imagery
Footprint

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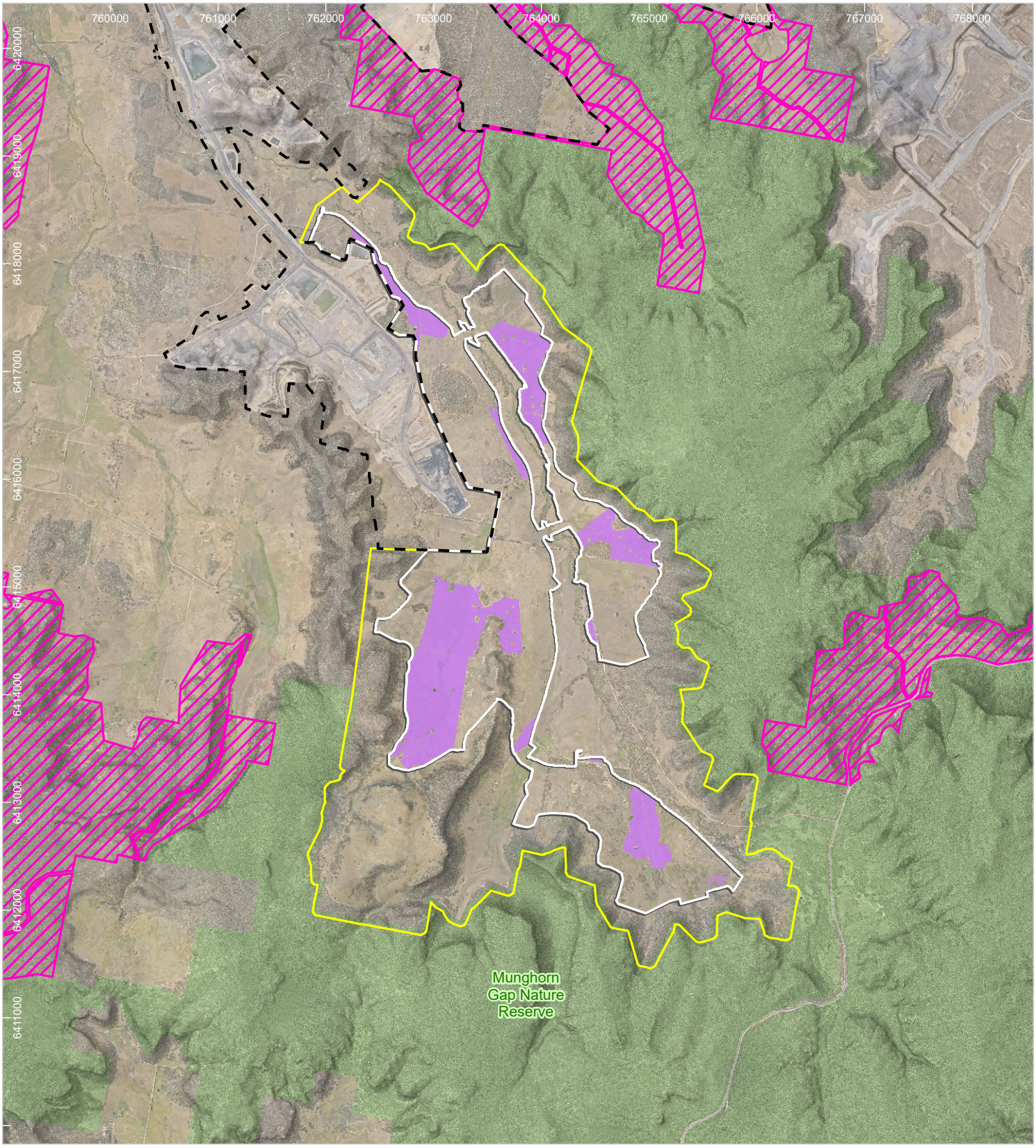
Impacts Requiring Offset
Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 21



Development Footprint
Study Area
Existing Biodiversity Offset Areas
Nature Reserve
Existing/Approved Indicative Surface Development Footprint
Impacts Not Requiring Offset
public/NSW_Imagery
Footprint

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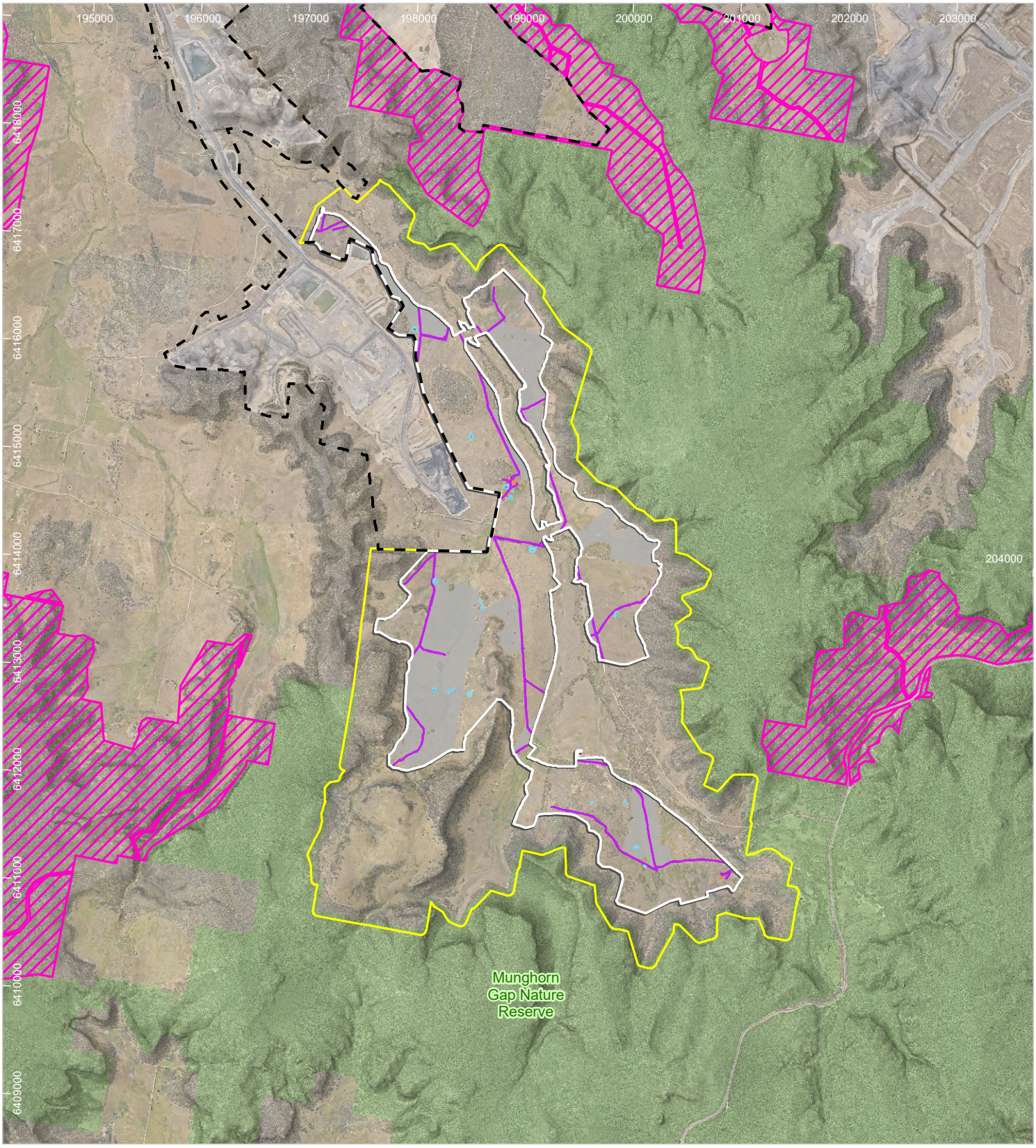
Impacts Not Requiring Offset

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 22



Development Footprint
Study Area
Existing Biodiversity Offset Areas
Nature Reserve
Existing/Approved Indicative Surface Development Footprint

Areas not Requiring Assessment
Access road
Buildings
Category 1 – exempt land

Dam
public/NSW_Imagery
Footprint

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Areas Not Requiring Assessment

Moolarben Coal Complex OC3 Extension Project BDAR

Niche PM: Amanda Griffith
Niche Proj. #: 7037
Client: Moolarben Coal Operations Pty Ltd

Figure 23

Appendix A. BDAR requirements compliance

Table 42. Assessment of compliance with BDAR minimum information requirements.

BDAR section	BAM ref.	BAM requirement
Introduction	Chapters 2 and 3	Information
		Introduction to the biodiversity assessment including:
1.1	Section 2 and 3	☒ brief description of the proposal
1.1.2	Section 2	☒ identification of subject land boundary, including:
1.1.2	Section 2	☒ operational footprint
1.1.2	Section 2	☒ construction footprint indicating clearing associated with temporary/ancillary construction facilities and infrastructure
1.1.2	Section 2	☒ general description of the subject land
1.5	Section 1.4	☒ sources of information used in the assessment, including reports and spatial data
1.2	Section 1	☒ identification and justification for entering the Biodiversity Offsets Scheme
		Maps and tables
Figure 3	Section 3	☒ Map of the subject land boundary showing the final proposal footprint, including the construction footprint for any clearing associated with temporary/ancillary construction facilities and infrastructure
Landscape	Sections 3.1 and 3.2, Appendix E	**Information**
		Identification of site context components and landscape features, including:
3.1.2	Section 3.1.3	☒ general description of subject land topographic and hydrological setting, geology and soils
3.1.3	Section 3.2	☒ percent native vegetation cover in the assessment area (as described in BAM [DPIE 2020a] Section 3.2)
3.1.2	Section 3.1.3	☒ IBRA bioregions and subregions (as described in BAM [DPIE 2020a] Subsection 3.1.3(2.)

BDAR section	BAM ref.	BAM requirement
3.1.2	Section 3.2	☒ rivers and streams classified according to stream order (as described in BAM [DPIE 2020a] Subsection 3.1.3(3.) and Appendix E)
3.1.2	Section 3.2	☒ wetlands within, adjacent to and downstream of the site (as described in BAM [DPIE 2020a] Subsection 3.1.3(3.))
3.1.2	Section 3.2	☒ connectivity of different areas of habitat (as described in BAM [DPIE 2020a] Subsection 3.1.3(5–6.))
3.1.2	Section 3.2	☒ karst, caves, crevices, cliffs, rocks and other geological features of significance and for vegetation clearing proposals, soil hazard features (as described in BAM [DPIE 2020a] Subsections 3.1.3(7.) and 3.1.3(12.))
3.1.2	Section 3.2	☒ areas of outstanding biodiversity value occurring on the subject land and assessment area (as described in BAM [DPIE 2020a] Subsection 3.1.3(8–9.))
3.1.2	Section 3.1.3	N/A any additional landscape features identified in any SEARs for the proposal
3.1.2	Section 3.2	☒ NSW (Mitchell) landscape on which the subject land occurs
2.1	Section 4.1	☒ details of field reconnaissance undertaken to confirm the extent and condition of landscape features and native vegetation cover (as described in Operational Manual Stage 1 Section 2.4)
		Maps and tables
Figure 5	Section 3.1	Site Map
		Property boundary
		☒ Boundary of subject land
		☒ Cadastre of subject land (including labelling of Lot and DP or section plan if relevant)
		☒ Landscape features identified in BAM (DPIE 2020a) Subsection 3.1.3
Figure 6a and Figure 6b	Section 3.1	Location Map
		☒ Digital aerial photography at 1:1,000 scale or finer
		☒ Boundary of subject land
		Assessment area (i.e. the subject land and either 1500 m buffer area or 500 m buffer for linear development)
		Landscape features identified in BAM (DPIE 2020a) Subsection 3.1.3
		Additional detail (e.g. local government area boundaries) relevant at this scale

BDAR section	BAM ref.	BAM requirement
		Landscape features identified in BAM (DPIE 2020a) Subsection 3.1.3 and to be shown on the Site Map and/or Location Map include:
Figure 6a and Figure 6b	Section 3.1.2	☒ IBRA bioregions and subregions ☒ rivers, streams and estuaries wetlands and important wetlands connectivity of different areas of habitat karst, caves, crevices, cliffs, rocks and other geological features of significance and if required, soil hazard features ☒ areas of outstanding biodiversity value occurring on the subject land and assessment area ☒ any additional landscape features identified in any SEARs for the proposal NSW (Mitchell) landscape on which the subject land occurs
		Data
		☒ All report maps as separate jpeg files
		Individual digital shape files of:
		☒ subject land boundary
		☒ assessment area (i.e. subject land and 1500 m buffer area) boundary
		☒ cadastral boundary of subject land
		☒ areas of native vegetation cover
		☒ landscape features
Native vegetation	Chapter 4, Appendix A and Appendix H	Information
3.2.1	Section 4.1	☒ Identify native vegetation extent within the subject land, including cleared areas and evidence to support differences between mapped vegetation extent and aerial imagery (as described in BAM (DPIE 2020a) Section 4.1(1–3.) and Subsection 4.1.1)

BDAR section	BAM ref.	BAM requirement
3.2.1	Section 4.1.2	☒ Provide justification for all parts of the subject land that do not contain native vegetation (as described in BAM (DPIE 2020a) Subsection 4.1.2)
3.2.1	Section 4.1.1	☒ Review of existing information on native vegetation including references to previous vegetation maps of the subject land and assessment area (described in BAM (DPIE 2020a) Section 4.1(3.) and Subsection 4.1.1)
2.1	Section 4.2.1	☒ Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM (DPIE 2020a) Section 4.2
		N/A Where relevant, describe the use of more appropriate local data, provide reasons that support the use of more appropriate local data and include the written confirmation from the decision-maker that they support the use of more appropriate local data (as described in BAM (DPIE 2020a) Subsection 1.4.2 and Appendix A)
		For each PCT within the subject land, describe:
3.2.2	Section 4.2.1	☒ PCT name and ID
3.2.2	Section 4.2.1	☒ vegetation class
3.2.2	Section 4.2.1	☒ extent (ha) within subject land
3.2.2	Section 4.2.1	☒ evidence used to identify a PCT including any analyses undertaken, references/sources, existing vegetation maps (BAM [DPIE 2020a] Section 4.2(1–3.))
3.2.2	Section 4.2.1	☒ plant species relied upon for identification of the PCT and relative abundance of each species
3.2.3	Section 4.2.2	☒ if relevant, TEC status including evidence used to determine vegetation is the TEC (BAM [DPIE 2020a] Subsection 4.2.2(1–2.))
5.1.1	Section 4.2.1	☒ estimate of percent cleared value of PCT (BAM [DPIE 2020a] Subsection 4.2.1(5.))
		Describe the vegetation integrity assessment of the subject land, including:
3.2.4	Section 4.3	☒ identification and mapping of vegetation zones (as described in BAM [DPIE 2020a] Subsection 4.3.1)
3.2.4	Section 4.3.1	☒ description of vegetation zones within the subject land (as described in Operational Manual Stage 1 Table 2 and Subsection 3.2.4)
3.2.4	Section 4.3.1	☒ area (ha) of each vegetation zone
3.2.4	Section 4.3.2	☒ assessment of patch size (as described in BAM [DPIE 2020a] Subsection 4.3.2)

BDAR section	BAM ref.	BAM requirement
3.2.5	Section 4.3.4	☒ survey effort (i.e. number of vegetation integrity survey plots) as described in BAM (DPIE 2020a) Subsection 4.3.4(1–2.)
3.2.5	Section 4.3.3	☒ use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM (DPIE 2020a) Subsection 4.3.3(5.))
3.2.5	Section 4.3.3	Where use of more appropriate local benchmark data is proposed (as described in BAM [DPIE 2020a] Subsection 1.4.2, BAM [DPIE 2020a] Subsection 4.3.3(5.) and BAM [DPIE 2020a] Appendix A):
		N/A identify the PCT or vegetation class for which local benchmark data would be applied
		N/A identify published sources of local benchmark data (if benchmarks obtained from published sources)
		N/A describe methods of local benchmark data collection (if reference plots used to determine local benchmark data)
		N/A provide justification for use of local data rather than BioNet Vegetation Classification benchmark values
		N/A provide written confirmation from the decision-maker that they support the use of local benchmark data
		Maps and tables
Figure 11	Section 3.2	☒ Map of native vegetation extent within the subject land at scale not greater than 1:10,000 including identification of all areas of native vegetation including areas that are ground cover only, cleared areas (as described in BAM [DPIE 2020a] Section 4.1(1–3.)) and all parts of the subject land that do not contain native vegetation (BAM [DPIE 2020a] Subsection 4.1.2)
Figure 11	Section 4.2	☒ Map of PCTs within the subject land (as described in BAM [DPIE 2020a] Section 4.2(1.))
Figure 11	Section 4.3	☒ Map of vegetation zones within the subject land (as described in BAM [DPIE 2020a] Subsection 4.3.1)
Figure 8	Section 4.2	☒ Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCT boundaries
Figure 12	Section 4.2	☒ Map of TEC distribution on the subject land and table of TEC listing, status and area (ha)
Figure 11 and Table 7	Section 4.2	☒ Map of patch size locations for each native vegetation zone and table of patch size areas (as described in BAM [DPIE 2020a] Subsection 4.3.2)
Table 9	Section 4.4	Table of current vegetation integrity scores for each vegetation zone within the site and including:
		☒ composition condition score
		☒ structure condition score

BDAR section	BAM ref.	BAM requirement
		☒ function condition score
		☒ presence of hollow-bearing trees
		Data
		☒ All report maps as separate jpeg files
		☒ Plot field data (MS Excel format)
		☒ Plot field datasheets
		Digital shape files of:
		☒ PCT boundaries within subject land
		☒ TEC boundaries within subject land
		☒ vegetation zone boundaries within subject land
		☒ floristic vegetation survey and vegetation integrity plot locations
Threatened species	Chapter 5	Information
		Identify ecosystem credit species likely to occur on the subject land, including:
3.3.1	Section 5.1.1	☒ list of ecosystem credit species derived from the BAM-C (as described in BAM [DPIE 2020a] Subsection 5.1.1 and Section 5.2(1.))
Table 10	Section 5.2	☒ justification and supporting evidence for exclusion of any ecosystem credit species based on geographic limitations, habitat constraints or vagrancy (as described in BAM [DPIE 2020a] Subsections 5.2.1 and 5.2.2)
		N/A justification for addition of any ecosystem credit species to the list
		Identify species credit species likely to occur on the subject land, including:
Table 11 and Table 12	Section 5.1.2	☒ list of species credit species derived from the BAM-C (as described in BAM [DPIE 2020a] Subsection 5.1.2)

BDAR section	BAM ref.	BAM requirement
Table 11 and Table 12	Section 5.2.2	☒ justification and supporting evidence for exclusions based on geographic limitations, habitat constraints or vagrancy (as described in BAM [DPIE 2020a] Subsections 5.2.1 and 5.2.2)
Table 11 and Table 12	Section 5.2.2	☒ justification and supporting evidence for exclusions based on degraded habitat constraints and/or microhabitats on which the species depends (as described in BAM [DPIE 2020a] Subsection 5.2.2)
		N/A justification for addition of any species credit species to the list
		From the list of candidate species credit species, identify:
3.4.3	Section 5.2.4	☒ species assumed present within the subject land (if relevant) (as described in BAM [DPIE 2020a] Subsection 5.2.4(2.a)
		☒ species present within the subject land on the basis of being identified on an important habitat map for a species (as described in BAM (DPIE 2020a) Subsection 5.2.4 (2.d)
		☒ species for which targeted surveys are to be completed to determine species presence (BAM [DPIE 2020a] Subsection 5.2.4 (2.b)
		N/A species for which an expert report is to be used to determine species presence (BAM [DPIE 2020a] Subsection 5.2.4 (2.c)
		Present the outcomes of species credit species assessments from:
3.4	Section 5.2.4	☒ threatened species survey (as described in BAM [DPIE 2020a] Section 5.2.4)
		N/A expert reports (if relevant) including justification for presence of the species and information used to make this determination (as described in BAM [DPIE 2020a] Subsection 5.2.4, Section 5.3, Box 3)
		Where survey has been undertaken include detailed information on:
2.1.3, 2.1.4, 3.4	Section 5.3	☒ survey method and effort (as described in BAM [DPIE 2020a] Section 5.3)
2.1.3, 2.1.4, 3.4	Section 5.3	☒ justification of survey method and effort (e.g. citation of peer-reviewed literature) if approach differs from the department's taxa-specific survey guides or where no relevant guideline has been published
2.1.3, 2.1.4, 3.4	Section 5.3	☒ timing of survey in relation to requirements in the TBDC or the department's taxa-specific survey guides. Where survey was undertaken outside these guides include justification for the timing of surveys

BDAR section	BAM ref.	BAM requirement
Declarations, AMBS 2023, ELA 2023	Section 5.3	☒ survey personnel and relevant experience
2.3	Section 5.3	☒ describe any limitations to surveys and how these were addressed/overcome
3.5	Section 5.3	Where an expert report has been used in place of survey (as described in BAM [DPIE 2020a] Section 5.3, Box 3), include:
		N/A justification of the use of an expert report N/A identify the expert, provide evidence of their expert credentials and departmental approval of expert status N/A all requirements of Box 3 have been addressed in the expert report
3.6		Where use of local data is proposed (BAM [DPIE 2020a] Subsection 1.4.2):
		N/A identify relevant species N/A identify data to be amended N/A identify source of information for local data, e.g. published literature, additional survey data, etc. N/A justify use of local data in preference to VIS Classification or TBDC data
		N/A provide written confirmation from the decision-maker that they support the use of local data
		Species polygon completed for species credit species present within the subject land (assumed present or determined on the basis of survey, expert report or important habitat map) ensuring that:
3.7	Section 5.2.6	☒ the unit of measure for each species is documented
		for species assessed by area:
3.7	Section 5.2.6	☒ the polygon includes the extent of suitable habitat for the target species within the subject land (as described in BAM [DPIE 2020a] Subsection 5.2.5)
3.7	Section 5.2.6	☒ a description of, and evidence-based justification for, the habitat constraints, features or microhabitats used to map the species polygon including reference to information in the TBDC for that species and any buffers applied
		for species assessed by counts of individuals:

BDAR section	BAM ref.	BAM requirement
		N/A the number of individual plants present on the subject land (as described in BAM [DPIE 2020a] Subsection 5.2.5(3.))
		N/A the method used to derive this number (i.e. threatened species survey or expert report) and evidence-based justification for the approach taken
		N/A the polygon includes all individuals located on the subject land with a buffer of 30 m around the individuals or groups of individuals on the subject land
		N/A Identify the biodiversity risk weighting for each species credit species identified as present within the subject land (as described in BAM [DPIE 2020a] Section 5.4)
		Maps and tables
Table 10	Section 5.1.1	☒ Table showing ecosystem credit species in accordance with BAM (DPIE 2020a) Subsection 5.1.1, and identifying:
Table 10	Section 5.1.1	☒ the ecosystem credit species removed from the list
Table 10	Section 5.1.1	☒ the sensitivity to gain class of each species
Table 11 and Table 12	Section 5.1.2	☒ Table detailing species credit species in accordance with BAM (DPIE 2020a) Section 5.1.2 and identifying:
Table 11 and Table 12	Section 5.1.2	☒ the species credit species removed from the list of species because the species is considered vagrant, out of geographic range or the habitat or microhabitat features are not present
Table 11 and Table 12	5.1.2	☒ the candidate species credit species not recorded on the subject land as determined by targeted survey, expert report or important habitat map
Table 18	5.1.2	☒ Table detailing species credit species recorded or assumed as present within the subject land, habitat constraints or microhabitats associated with the species, counts of individuals (flora)/extent of suitable habitat (flora and fauna) (as described in BAM [DPIE 2020a] Subsection 5.2.6) and biodiversity risk weighting (BAM [DPIE 2020a] Section 5.4)
Figure 15 to Figure 16	5.2.5	☒ Map indicating the GPS coordinates of all individuals of each species recorded within the subject land and the species polygon for each species (as described in BAM [DPIE 2020a] Subsection 5.2.5)
		Data
		☒ Digital shape files of suitable habitat identified for survey for each candidate species credit species

BDAR section	BAM ref.	BAM requirement
		☒ Survey locations including GPS coordinates of any plots, transects, grids
		☒ Digital shape files of each species polygon including GPS coordinates of located individuals
		☒ Species polygon map in jpeg format
		☒ Expert reports and any supporting data used to support conclusions of the expert report
		☒ Field datasheets detailing survey information including prevailing conditions, date, time, equipment used, etc.
Prescribed impacts	Chapter 6	Information
		Identify potential prescribed biodiversity impacts on threatened entities, including:
3.8	Section 6.1.1	☒karst, caves, crevices, cliffs, rocks and other geological features of significance (as described in BAM [DPIE 2020a] Subsection 6.1.1)
	Section 6.1.2	☒occurrences of human-made structures and non-native vegetation (as described in BAM [DPIE 2020a] Subsection 6.1.2)
	Section 6.1.3	☒corridors or other areas of connectivity linking habitat for threatened entities (as described in BAM [DPIE 2020a] Subsection 6.1.3)
	Section 6.1.4	☒ waterbodies or any hydrological processes that sustain threatened entities (as described in BAM [DPIE 2020a] Subsection 6.1.4)
	Section 6.1.5	N/A protected animals that may use the proposed wind farm development site as a flyway or migration route (as described in BAM [DPIE 2020a] Subsection 6.1.5)
	Section 6.1.6	☒where the proposed development may result in vehicle strike on threatened fauna or on animals that are part of a threatened ecological community (as described in BAM [DPIE 2020a] Subsection 6.1.6)
3.8	Section 6.1	☒ Identify a list of threatened entities that may be dependent upon or may use habitat features associated with any of the prescribed impacts

BDAR section	BAM ref.	BAM requirement
3.8	Section 6.1	☒ Describe the importance of habitat features to the species including, where relevant, impacts on life cycle or movement patterns (e.g. Subsection 6.1.3)
		Where the proposed development is for a wind farm:
		N/A identify a candidate list of protected animals that may use the development site as a flyway or migration route, including: resident threatened aerial species, resident raptor species and nomadic and migratory species that are likely to fly over the proposal area (as described in BAM [DPIE 2020a] Subsection 6.1.5)
		N/A provide details of targeted survey for candidate species of wind farm developments undertaken in accordance with BAM (DPIE 2020a) Subsection 6.1.5(2–3.)
		N/A predict the habitual flight paths for nomadic and migratory species likely to fly over the subject land and map the likely habitat for resident threatened aerial and raptor species (BAM [DPIE 2020a] Subsection 6.1.5(4.))
		Where the proposal may result in vehicle strike:
3.8	Section 6.1.6	☒ identify a list of threatened fauna or protected fauna species that are part of a TEC and at risk of vehicle strike due to the proposal
		Maps and tables
Figure 6b	Section 6.1	☒ Map showing location of any prescribed impact features (i.e. karst, caves, crevices, cliffs, rocks, human-made structures, etc.)
	Section 6.1	N/A Map showing location of potential vehicle strike locations
	Section 6.1	N/A Maps of habitual flight paths for nomadic and migratory species likely to fly over the site and maps of likely habitat for threatened aerial species resident on the site (for wind farm developments only)
		Data
		☒ Digital shape files of prescribed impact feature locations
		☒ Prescribed impact features map in jpeg format

BDAR section	BAM ref.	BAM requirement
Avoid and minimise impacts	Chapter 7	Information
		Demonstration of efforts to avoid and minimise impacts on biodiversity values (including prescribed impacts) associated with the proposal location in accordance with Chapter 7, including an analysis of alternative:
4.1.2	7.1.1	☒ modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology
4.1.3	7.1.1	☒ routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route
4.1.1	7.1.1	☒ alternative locations that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed location
4.2	7.1.1	☒ alternative sites within a property on which the proposal is located that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site
4.3	7.1.2	☒ Describe efforts to avoid and minimise impacts (including prescribed impacts) to biodiversity values through proposal design (as described in BAM [DPIE 2020a] Sections 7.1 and 7.2)
4.1.1	7.1	☒ Identification of any other site constraints that the proponent has considered in determining the location and design of the proposal (as described in BAM [DPIE 2020a] Subsection 7.2.1 (3.))
4.1	7.1	☒ Detail measures or options considered but not implemented because they are not feasible and/or practical (e.g. due to site constraints)
		Maps and tables
Table 20	7.2	☒ Table of measures to be implemented to avoid and minimise the impacts of the proposal, including action, outcome, timing and responsibility
Figure 18a and Figure 18b	7.2.1	☒ Map of alternative footprints considered to avoid or minimise impacts on biodiversity values; and of the final proposal footprint, including construction and operation
		N/A Maps demonstrating indirect impact zones where applicable

BDAR section	BAM ref.	BAM requirement
		Data
		Digital shape files of:
Figure 18a and Figure 18b		☒ alternative and final proposal footprint
		☒ direct and indirect impact zones
		☒ Maps in jpeg format
Assessment of impacts	Chapter 8, Sections 8.1 and 8.2	Information
5.1	Section 8.1	☒ Determine the impacts on native vegetation and threatened species habitat, including a description of direct impacts of clearing of native vegetation, threatened ecological communities and threatened species habitat (as described in BAM [DPIE 2020a] Section 8.1)
		Assessment of indirect impacts on vegetation and threatened species and their habitat including (as described in BAM [DPIE 2020a] Section 8.2):
5.2, Appendix D	Section 8.2	☒ description of the nature, extent, frequency, duration and timing of indirect impacts of the proposal
5.2, Appendix D	Section 8.2	☒ documenting the consequences to vegetation and threatened species and their habitat including evidence-based justifications
5.2, Appendix D	Section 8.2	☒ reporting any limitations or assumptions, etc. made during the assessment
5.2, Appendix D	Section 8.2	☒ identification of the threatened entities and their habitat likely to be affected
		Assessment of prescribed biodiversity impacts (as described in BAM [DPIE 2020a] Section 8.3) including:
		Assessment of the nature, extent frequency, duration and timing of impacts on the habitat of threatened species or ecological communities associated with:
5.3.1	Section 8.3	☒ karst, caves, crevices, cliffs, rocks and other features of geological significance

BDAR section	BAM ref.	BAM requirement
	Section 8.3	N/A human-made structures
5.3.4	Section 8.3	☒ non-native vegetation
5.3.2	Section 8.3	☒ connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
5.3.3	Section 8.3	☒ movement of threatened species that maintains their life cycle
5.3.5	Section 8.3	☒ water quality, waterbodies and hydrological processes that sustain threatened species and threatened ecological communities
		N/A assessment of the impacts of wind turbine strikes on protected animals
5.3.6	Section 8.3	☒ assessment of the impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC
5.3	Section 8.3	☒ evaluate the consequences of prescribed impacts
5.3	Section 8.3	☒ describe impacts that are uncertain
5.3	Section 8.3	☒ document limitations to data, assumptions and predictions
		Maps and tables
Table 9		☒ Table showing change in vegetation integrity score for each vegetation zone as a result of identified impacts
Mitigation and management of impacts	Chapter 8, Sections 8.4 and 8.5	Information
		Identification of measures to mitigate or manage impacts in accordance with the recommendations in BAM (DPIE 2020a) Sections 8.4 and 8.5 including:
Table 28	Section 8.4	☒ techniques, timing, frequency and responsibility
Table 28	Section 8.4	☒ identify measures for which there is risk of failure
Table 28	Section 8.4	☒ evaluate the risk and consequence of any residual impacts

BDAR section	BAM ref.	BAM requirement
5.7	Section 8.4	☒ document any adaptive management strategy proposed
		Identification of measures for mitigating impacts related to:
5.7	Section 8.4.1	☒ displacement of resident fauna (as described in BAM [DPIE 2020a] Subsection 8.4.1(2.))
5.7	Section 8.4.1	☒ indirect impacts on native vegetation and habitat (as described in BAM [DPIE 2020a] Subsection 8.4.1(3.))
5.7	Section 8.4.2	☒ mitigating prescribed biodiversity impacts (as described in BAM [DPIE 2020a] Subsection 8.4.2)
5.7	Section 8.5	☒ Details of the adaptive management strategy proposed to monitor and respond to impacts on biodiversity values that are uncertain (BAM [DPIE 2020a] Section 8.5)
		Maps and tables
Table 28		☒ Table of measures to be implemented before, during and after construction to mitigate and manage impacts of the proposal, including action, outcome, timing and responsibility
Impact summary	Chapter 9	Information
		Identification and assessment of impacts on TECs and threatened species that are at risk of a serious and irreversible impacts (SAII, in accordance with BAM [DPIE 2020a] Section 9.1) including:
6, Appendix F	Section 9.1.1	☒ addressing all criteria in Subsection 9.1.1 for each TEC listed as at risk of an SAII present on the subject land
Appendix F	Section 9.1.1	☒ for each TEC, report the extent of the TEC in NSW
Appendix F	Section 9.1.2	☒ addressing all criteria in Subsection 9.1.2 for each threatened species at risk of an SAII present on the subject land
Appendix F	Section 9.1.2	☒ for each threatened species, report the population size in NSW
Appendix F	Section 9.1.2	☒ documenting assumptions made and/or limitations to information
Appendix F	Section 9.1.2	☒ documenting all sources of data, information, references used or consulted
Appendix F	Section 9.1.2	☒ clearly justifying why any criteria could not be addressed
7.1	Section 9.2	☒ Identification of impacts requiring offset in accordance with BAM (DPIE 2020a) Section 9.2

BDAR section	BAM ref.	BAM requirement
7.2	Section 9.2	☒ Identification of impacts not requiring offset in accordance with BAM (DPIE 2020a) Subsection 9.2.1(3.)
7.2	Section 9.3	☒ Identification of areas not requiring assessment in accordance with BAM (DPIE 2020a) Section 9.3
		Maps and tables
Figure 20		☒ Map showing the extent of TECs at risk of an SAII within the subject land
Figure 17 map series		☒ Map showing location of threatened species at risk of an SAII within the subject land
		Map showing location of:
Figure 21Figure 21		☒ impacts requiring offset
Figure 22Figure 22		☒ impacts not requiring offset
Figure 23Figure 23		☒ areas not requiring assessment
		Data
		Digital shape files of:
Figure 20		☒ extent of TECs at risk of an SAII within the subject land
Figure 17 map series		☒ location of threatened species at risk of an SAII within the subject land
Figure 21		☒ boundary of impacts requiring offset
Figure 22		☒ boundary of impacts not requiring offset
Figure 23		☒ boundary of areas not requiring assessment
		☒ Maps in jpeg format

BDAR section	BAM ref.	BAM requirement
Impact summary	Chapter 10	Information
		Ecosystem credits and species credits that measure the impact of the development on biodiversity values, including:
Table 9		☒ future vegetation integrity score for each vegetation zone within the subject land (Equation 25 and Equation 26 in BAM (DPIE 2020a) Appendix H)
Table 9		☒ change in vegetation integrity score (BAM [DPIE 2020a] Subsection 8.1.1)
7.1.1, 7.3.1		☒ number of required ecosystem credits for the direct impacts of the proposal on each vegetation zone within the subject land (BAM [DPIE 2020a] Subsection 10.1.2)
Table 31		☒ biodiversity risk weighting for each
7.1.2, 7.3.2		☒ number of required species credits for each candidate threatened species that is directly impacted on by the proposal (BAM [DPIE 2020a] Subsection 10.1.3)
		Maps and tables
Table 30		☒ Table of PCTs requiring offset and the number of ecosystem credits required
Table 31		☒ Table of threatened species requiring offset and the number of species credits required
		Data
		☒ Submitted proposal in the BAM Calculator
Biodiversity credit report	Chapter 10	Information
		☒ Description of credit classes for ecosystem credits and species credits at the development or clearing site or land to be biodiversity certified (BAM [DPIE 2020a] Section 10.2)
		☒ BAM credit report in pdf format
		Maps and tables
Table 25		☒ Table of credit class and matching credit profile

Appendix B. Moolarben Coal Complex OC3 Extension Project Baseline Flora Survey Report

Moolarben Coal Complex OC3 Extension Project
Baseline Flora Survey Report

Moolarben Coal Operations Pty Ltd

ecological AUSTRALIA
A TETRA TECH COMPANY

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DOCUMENT TRACKING

Project Name	Moolarben Coal Complex OC3 Extension Project Baseline Flora Survey Report
Project Number	17898
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Prepared by	Rebecca Croake
Reviewed by	Kalya Abbey, Dr Matthew Dowle, Dr Meredith Henderson, Dr Cheryl O'Dwyer
Approved by	Kalya Abbey
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ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with input from Moolarben Coal Operations Pty Ltd and Resource Strategies Pty Ltd.

Template 2.8.1

Executive Summary

The Moolarben Coal Complex is located approximately 40 kilometres (km) north of Mudgee, New South Wales (NSW). The Moolarben Coal Complex is operated by Moolarben Coal Operations Pty Ltd (MCO), a wholly owned subsidiary of Yancoal Australia Limited (Yancoal). The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities).

MCO is proposing an extension to the approved OC3 mining operations to allow for extraction of additional coal within existing mining and exploration tenements adjacent to approved operations at the Moolarben Coal Complex (the Project). Approval for the Project is being sought under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The Project is a State Significant Development (SSD).

MCO (2022) prepared and submitted the Moolarben Coal Complex OC3 Extension Project Environmental Impact Statement (the EIS) for the Project to support the assessment process under the EP&A Act.

In response to submissions received on the Project EIS, MCO is proposing to amend the Project disturbance footprint which was described in the EIS. The amended Project disturbance footprint has been designed to incorporate additional avoidance measures relative to the EIS.

Eco Logical Australia (ELA) was engaged by MCO to undertake a baseline vegetation assessment for the Project. This Baseline Flora Survey Report provides supporting information to the updated Biodiversity Development Assessment Report (BDAR) that has been prepared to accompany the Submissions Report for the Project.

This report has been prepared to meet the requirements of the '*Native vegetation*' and *'Threatened species'* (flora only) sections of Table 24 of the NSW *Biodiversity Assessment Method* (BAM) (Department of Planning, Industry and Environment (DPIE) 2020a) established under Section 6.7 of the NSW *Biodiversity Conservation Act 2016* (BC Act). An assessment of Category 1 – Exempt Land (Category 1 Land) under the *Local Land Services Act 2013* (LLS Act) was also undertaken. Scattered trees were assessed in accordance with the BAM (DPIE 2020a) (Appendix B: Streamlined assessment module – Scattered trees assessment).

A total of 1,377 ha of native vegetation was mapped within the Project Study Area (hereafter referred to as the Study Area), with a further 286 ha mapped as Category 1 Land and 16 ha of tracks, infrastructure and dams. There is 2.2 ha of Scattered Trees in accordance with Appendix B of the BAM (2020a), which equates to 18 trees. A total of 13 Plant Community Types (PCTs) were mapped, of which five (5) were present in varying condition states. Native vegetation was stratified into 19 distinct Vegetation Zones (VZs) in consideration of PCT and condition. Four (4) of these PCTs were found to be associated with a Threatened Ecological Community (TEC) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and / or the BC Act. The Study Area contains:

- 860 ha of the Critically Endangered Ecological Community (CEEC) White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland as listed as a under both the BC Act and the EPBC Act.

- 18 ha of the BC Act listed Vulnerable Ecological Community (VEC) Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion, of which 17 ha also meets the listing criteria for the EPBC Act listed CEEC Central Hunter Valley Eucalypt Forest and Woodland.

Threatened flora surveys in accordance with the NSW *Surveying Threatened Plants and their Habitats: NSW Survey Guide for the Biodiversity Assessment Method* (DPIE 2020b) were undertaken for 44 candidate flora species (hereafter referred to as candidate species). The BC Act and EPBC Act listed threatened species, *Pomaderris cotoneaster* (Cotoneaster Pomaderris) was recorded. The species polygon for this species is 12.5 ha.

In accordance with the BAM (DPIE 2020a), there are six (6) offset trading groups present within the Study Area:

- *White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland* – CEEC – 860 ha.
- *Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion* – 18 ha.
- Sydney Hinterland Dry Sclerophyll Forests with a percentage cleared value <50% - 5.0 ha.
- Western Slopes Dry Sclerophyll Forest with a percentage cleared value <50% - 483.9 ha.
- North Coast Dry Sclerophyll Forest with a percentage cleared value <50% - 4.2 ha [1].
- Western Slopes Dry Sclerophyll Forest with a percentage cleared value ≥50 and <70% - 3.6 ha.

[1] PCT 481 Vegetation Class is listed as North Coast Dry Sclerophyll Forests in BioNet. This PCT occurs throughout the NSW South Western Slopes, Brigalow Belt South and Sydney Basin IBRA Regions and fits the Western Slopes Dry Sclerophyll Forest Vegetation Class (Keith 2004). Review of relevant sources which feed into BioNet (Keith 2004, Benson et al. 2010) indicates that the Vegetation Class for this PCT is likely listed incorrectly in BioNet. Given the implications to offset trading groups, ELA is currently seeking clarification from DPIE.

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Abbreviations

Abbreviation	Description
ASL	Above Sea Level
AVH	Australasian Virtual Herbarium
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method Calculator
BC Act	NSW *Biodiversity Conservation Act 2016*
CEEC	Critically Endangered Ecological Community
DEH	Commonwealth Department of the Environment and Heritage (former)
DNG	Derived Native Grassland
DPIE	NSW Department of Planning, Industry and Environment (former)
DPE	NSW Department of Planning and Environment
EEC	Endangered Ecological Community
EIS	Environmental Impact Statement
EL	Exploration Licence
ELA	Eco Logical Australia
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection Biodiversity Conservation Act 1999*
IGGAM	Interim Grasslands and other Groundcover Assessment Method
LLS Act	NSW *Local Land Services Act 2013*
MCO	Moolarben Coal Operations
Mtpa	Million tonnes per annum
OC	Open Cut
OEH	Office of Environment and Heritage
PCT	Plant Community Type
PMST	Protected Matters Search Tool
RDP	Rapid Data Point
ROM	Run-of mine
SSD	State Significant Development
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community
VI	Vegetation integrity
VIS	NSW BioNet Vegetation Information System
VZ	Vegetation Zone

1. Introduction

The Moolarben Coal Complex is located approximately 40 kilometres (km) north of Mudgee, New South Wales (NSW) (Figure 1). The Moolarben Coal Complex is operated by Moolarben Coal Operations Pty Ltd (MCO) on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Yancoal Moolarben Pty Ltd [YM] and a consortium of Korean power companies). MCO, MCM and YM are wholly owned subsidiaries of Yancoal Australia Limited (Yancoal).

Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038 with a combined coal production rate of 22 million tonnes per annum (Mtpa) in accordance with Project Approval (05_0117) (Stage 1) (as modified) and Project Approval (08_0135) (Stage 2) (as modified). The Moolarben Coal Complex comprises four (4) approved open cut mining areas (OC1 to OC4), three (3) approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities) (Figure 2).

MCO currently operates across multiple open cut mining areas and at current production rates, mining (i.e. run of mine [ROM] coal extraction) within the OC3 mining area will likely be completed in 2025. Mining of the remaining Stage 2 open cut mining area (OC4) would continue beyond 2025 within the currently approved mine life of the Moolarben Coal Complex (i.e. until 2038).

MCO has identified an opportunity to extend open cut mining operations immediately south of the approved OC3 open cut pit as well as develop four new open cut pits to the east and south-east of the approved OC3 mining area, within existing mining tenements (the Project).

The extended open cut mining operations would provide approximately 10 years of mining (from 2025 to 2034), maximise use of the existing mining fleet and maintain steady production of ROM coal at the Moolarben Coal Complex post-completion of mining within the approved OC3 mining area.

MCO (2022) prepared the Moolarben Coal Complex OC3 Extension Project Environmental Impact Statement (the EIS) for the Project to support the assessment process under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Project as presented in the EIS included the following activities:

- Extension of open cut mining operations within Mining Lease (ML) 1691, and Exploration Licence (EL) 6288, and EL 7073 to allow mining of additional coal resources.
- Extraction of up to 9 Mtpa of ROM coal with a total of approximately 40 million tonnes (Mt) over the life of the Project.
- Mining operations between approximately 2025 to 2034 (which is within the approved life of the Moolarben Coal Complex ending on 31 December 2038).
- Extension of employment of existing open cut workforce.
- Construction and operation of ancillary infrastructure, services, plant and equipment in support of mining operations.
- Construction and operation of water management and water storage infrastructure in support of mining operations.
- Development of an integrated final landform with the approved OC3 mining area.

- Ongoing exploration activities in the Project area.
- Construction of haul road creek crossings.
- Quarrying and/or excavation of borrow pits within approved disturbance areas to retrieve construction materials.
- Conventional open cut mining related activities such as drilling and blasting, and other associated activities.
- Rehabilitation, decommissioning and closure.

The Project EIS was placed on public exhibition by the Department of Planning and Environment (DPE) from 17 November to 14 December 2022. During this period, government agencies, organisations and members of the public were invited to provide submissions on the EIS to DPE.

In response to submissions received on the Project EIS MCO is proposing to amend the Project disturbance footprint. The amended Project disturbance footprint has been designed to incorporate additional avoidance measures relative to the EIS.

When compared to the EIS, the proposed amendments to the Project include:

- A reduction in the extent of proposed open cut mining.
- A reduction in total resource extracted from 40 Mt to approximately 30 Mt over the life of the Project.
- A reduction in the peak annual ROM mining rate from 9 Mt to 8.5 Mt over the life of the Project.
- No change to the duration of the mine life (i.e. between approximately 2025 to 2034), peak workforce, or hours of operation of the mine.
- No change to the proposed integrated final landform with the approved OC3 mining area (including no final voids in the rehabilitated final landform).
- A revised conceptual post-mining land use which incorporates additional areas of native woodland and increases the proposed extent of the Habitat Enhancement Area.

The Project general arrangement is shown on Figure 3.

Eco Logical Australia (ELA) was engaged by MCO to undertake baseline flora surveys for the Project's EIS. This Baseline Flora Survey Report has now been updated and forms part of the updated BDAR that has been prepared to accompany the Submissions Report.

This report has been prepared to meet the requirements of the '*Native Vegetation*' and *'Threatened species'* (flora only) sections of Table 24 of the *Biodiversity Assessment Method* (BAM) (Department of Planning, Industry and Environment (DPIE) 2020a) established under Section 6.7 of the NSW *Biodiversity Conservation Act 2016* (BC Act). A summary of the items listed in Table 24 of the BAM (DPIE 2020a) and their locations within this report is provided in Appendix A. Detailed assessment of any Category 1 – Exempt Land (Category 1 Land) was also undertaken as part of this report. Appendix B of the BAM (DPIE 2020a) – Streamlined assessment module – Scattered trees assessment was also used to identify scattered trees, with the results provided as part of this report.

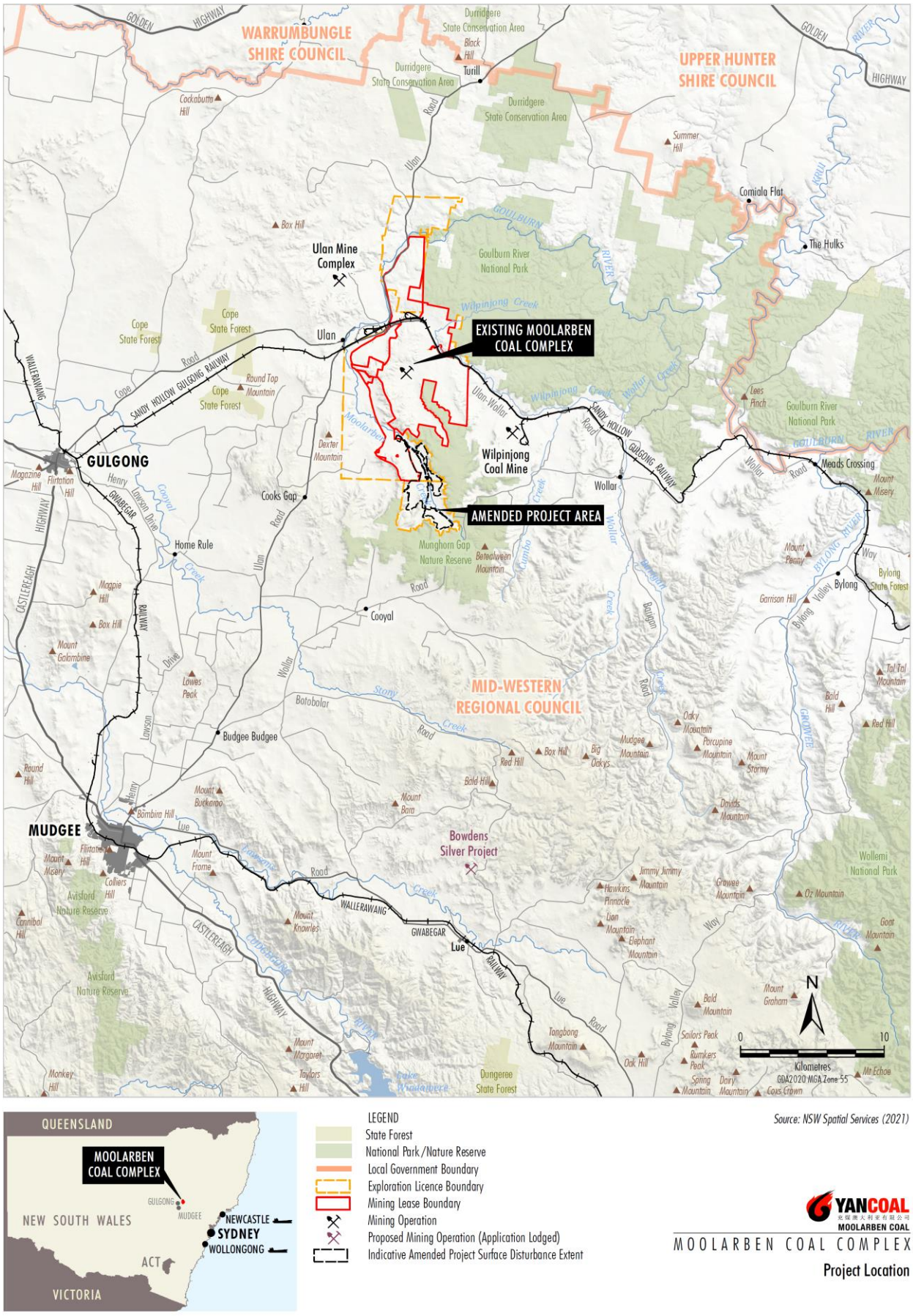

Figure 1: Project Location

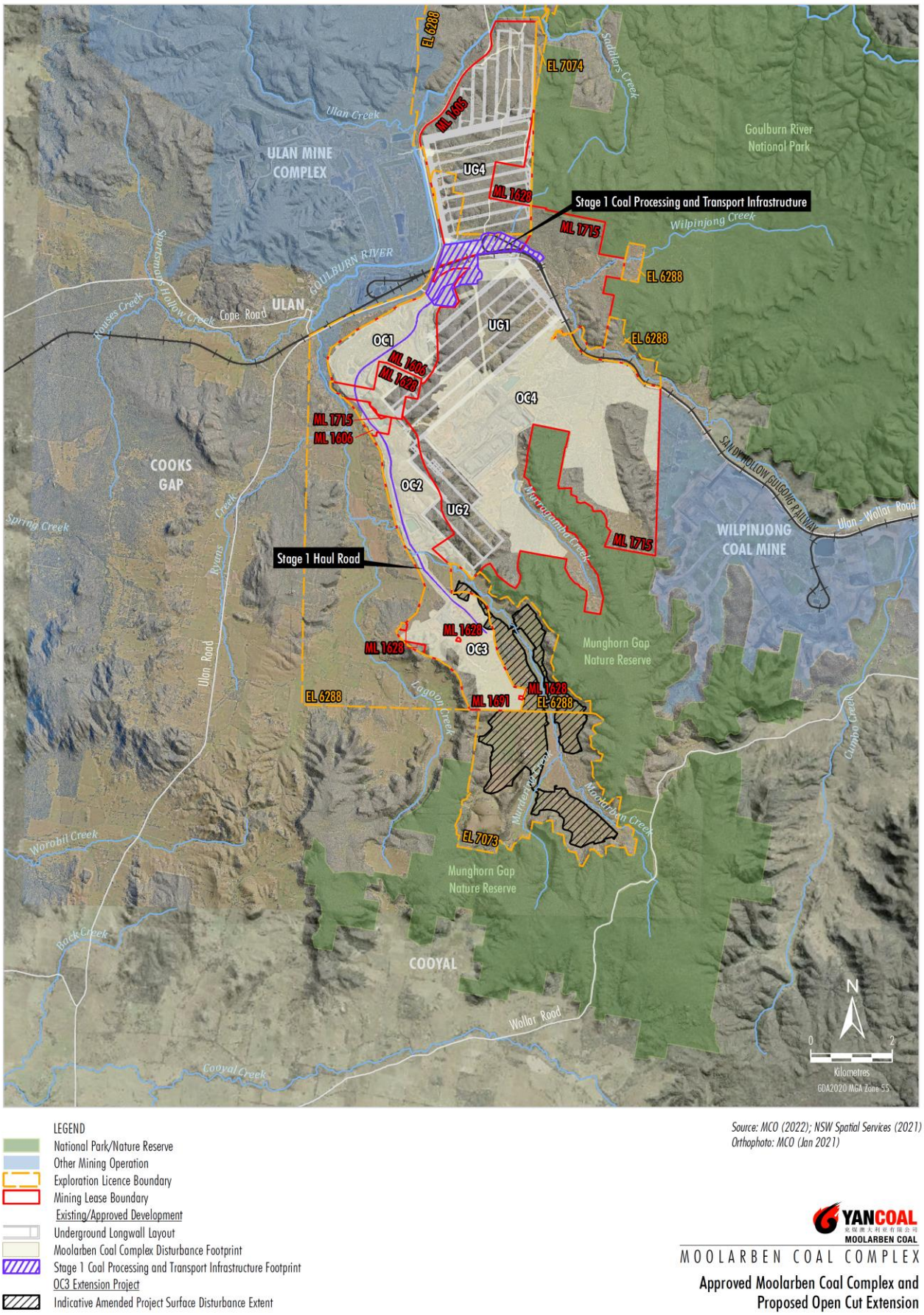

Figure 2: Approved Moolarben Coal Complex and Proposed Open Cut Extension

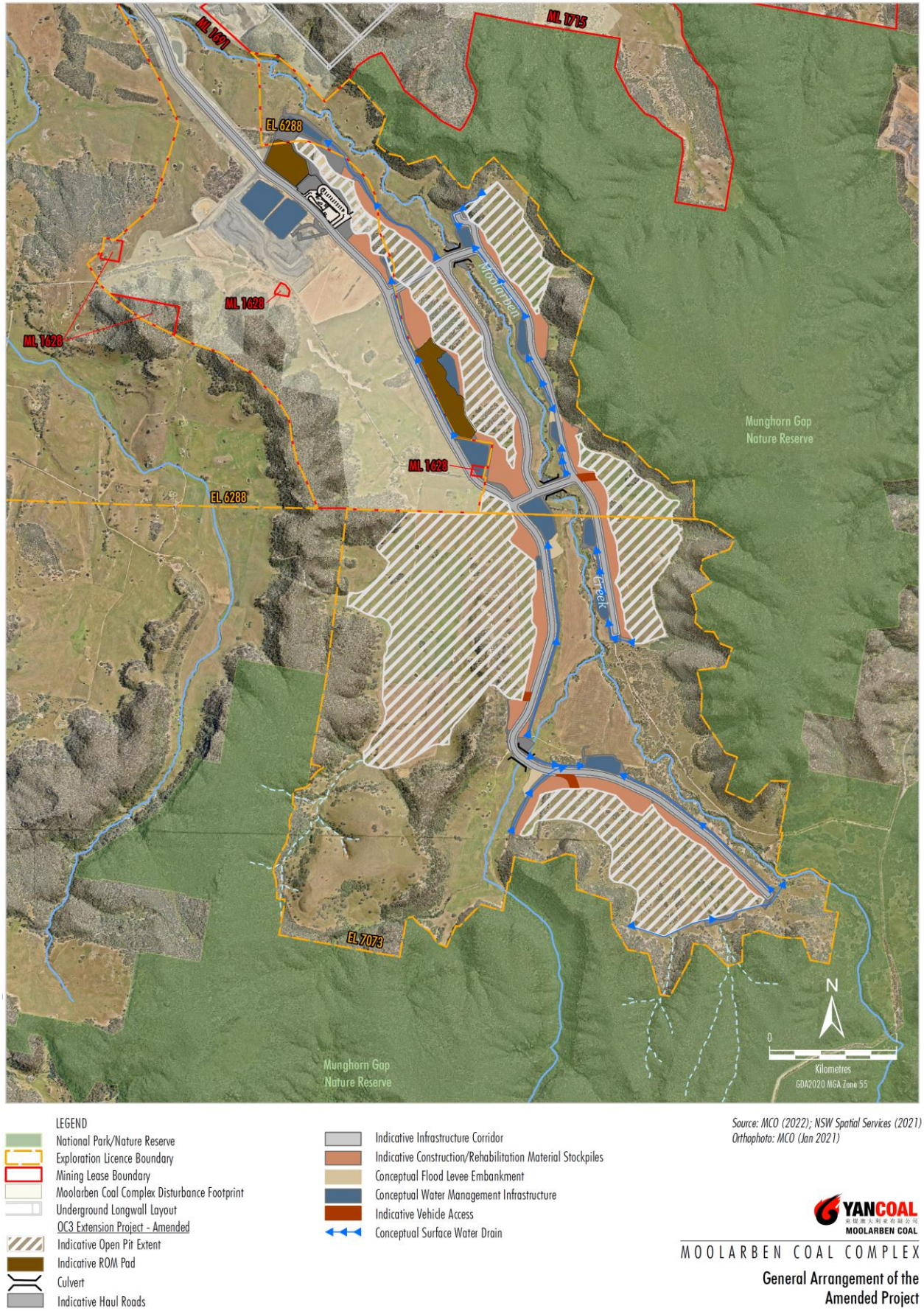

Figure 3: General Arrangement of the amended Project

1.1. Study Area context

The Study Area is located to the south of MCO's existing operations and is 1,680 ha in area. The Study Area comprises a mix of cleared agricultural land, derived native grassland (DNG), remnant woodland / forest / shrubland and regenerating woodland/forest. Moolarben Creek, an Order 5 Strahler stream, runs through the centre of the Study Area and is associated with numerous smaller drainage lines including Murdering Creek (Order 4 Strahler stream) and Spring Creek (Order 3 Strahler stream).

The Study Area is located within the Mid-Western Regional Council Local Government Area, in the Central Tablelands of NSW and within the Goulburn River catchment, which is a main tributary located in the Hunter Subregion of the Northern Sydney Basin Bioregion (Bioregional Assessment Program 2014).

The Study Area is located within the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) Region and in the south-western extent of the Kerrabee IBRA Subregion. The following IBRA Regions and Subregions are close to the Study Area:

- South Western Slopes IBRA Region, Inland Slopes IBRA Subregion – located approximately 1.5 km to the south west of the Study Area.
- Sydney Basin IBRA Region, Wollemi IBRA Subregion – located <1 km to the south of the Study Area.
- Brigalow Belt South IBRA Region, Pilliga IBRA Subregion – located 20 km to the north of the Study Area.

The Study Area is located within the following NSW (Mitchell) Landscapes (DPIE 2016):

- Upper Goulburn Valleys and Escarpment (57% cleared).
- Wollemi Ranges (5% cleared).
- Gulgong Ranges (81% cleared).

The Study Area context is shown below in Figure **4**.

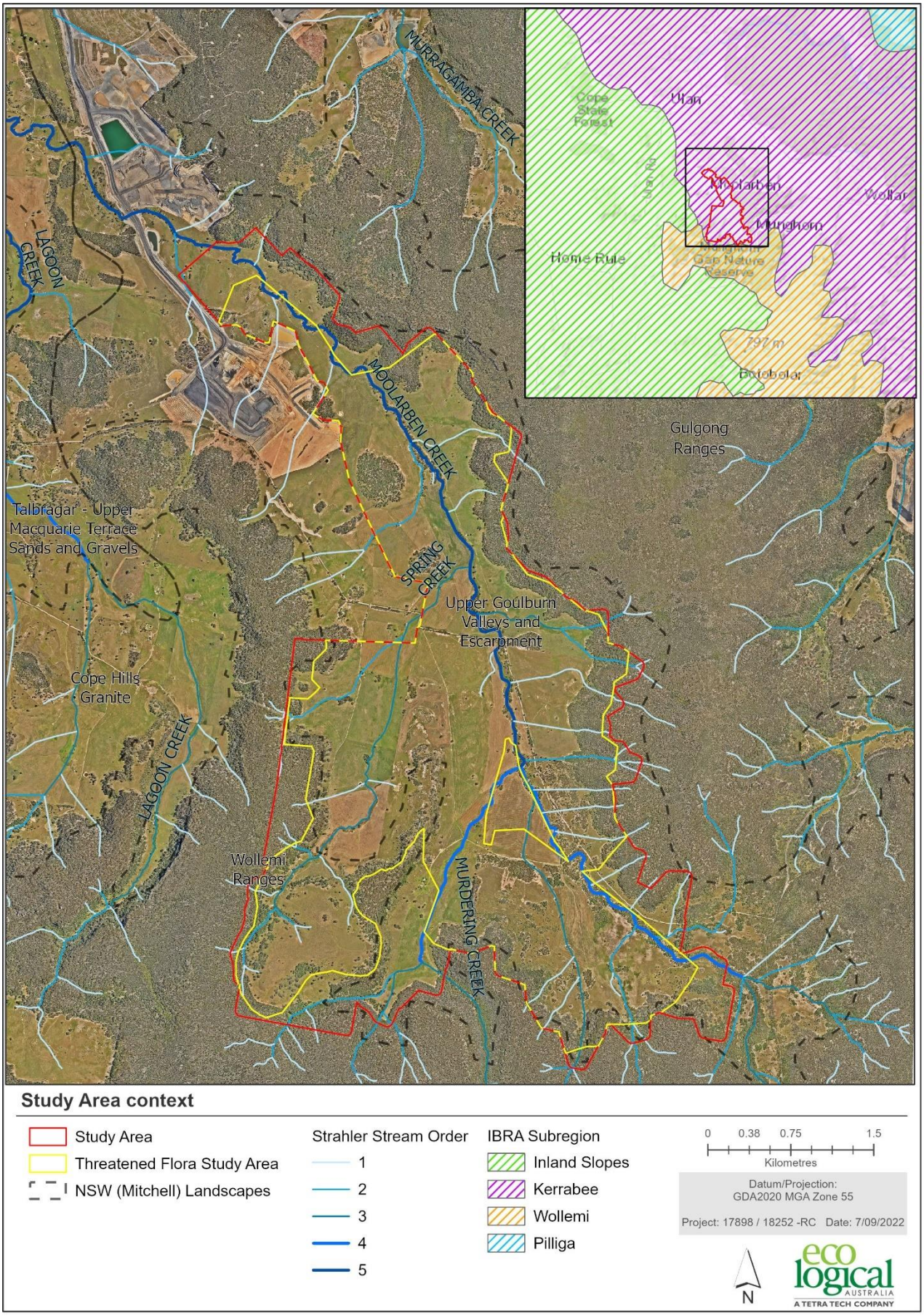

Figure 4: Study Area context

2. Methodology

2.1. Desktop review

A review of the existing information relevant to the Study Area was undertaken, including:

- NSW State Vegetation Type Map: Central Tablelands Region Version 1.0 (DPIE 2019)
- Gulgong 1:100,000 Geological Map (NSW Government Mining, Exploration and Geoscience 2000)
- NSW Landuse 2017 layer (DPIE 2017)
- MCO aerial imagery 2022 (MCO 2022a)
- NSW BioNet Vegetation Classification (DPIE 2021)
- Topographic mapping (2 m contours) as supplied by MCO
- *Water Management (General) Regulation 2018* Hydro Line spatial data (DPIE 2018)
- NSW Land and Property Information (LPI) Roads layer (NSW Government Spatial Services 2021a)
- Historical aerial imagery (NSW Government Spatial Services 2021b).

The results of the desktop review were used to produce vegetation mapping to Plant Community Type (PCT). Topography and geology mapping were used to assist with delineation of PCTs. A review of each PCT identified was undertaken to determine those PCTs associated with a Threatened Ecological Community (TEC) listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and / or the BC Act.

2.2. Vegetation assessment

2.2.1. PCT mapping and vegetation integrity assessment

Detailed PCT mapping was completed by ELA ecologists (Appendix F3) from the desktop assessment and a series of field surveys. Field surveys were undertaken across the entire Study Area which involved collecting Rapid Data Points (RDPs) during March 2019, March 2020, March – April and September – December 2021 and January 2022. RDPs were stratified and targeted to assess the expected environmental variation within the Study Area. At each RDP the following was recorded:

- Dominant canopy, midstorey, and ground species present in accordance with Section 4.2.3 of the BAM (DPIE 2020a)
- Vegetation formation and class in accordance with Keith (2004)
- Landform and landscape type
- Weeds
- Management issues
- Soil types
- Evidence of previous disturbance
- A photograph.

Over 500 RDPs were collected across the Study Area. Data collected was used, along with historical and current aerial imagery to verify PCTs and to stratify PCTs into Vegetation Zones (VZs) within broad condition states. RDPs were also used to inform Category 1 – Exempt Land, as discussed in Section 2.2.2 below. A map depicting the extent of RDPs across the Study Area is provided in Figure 5.

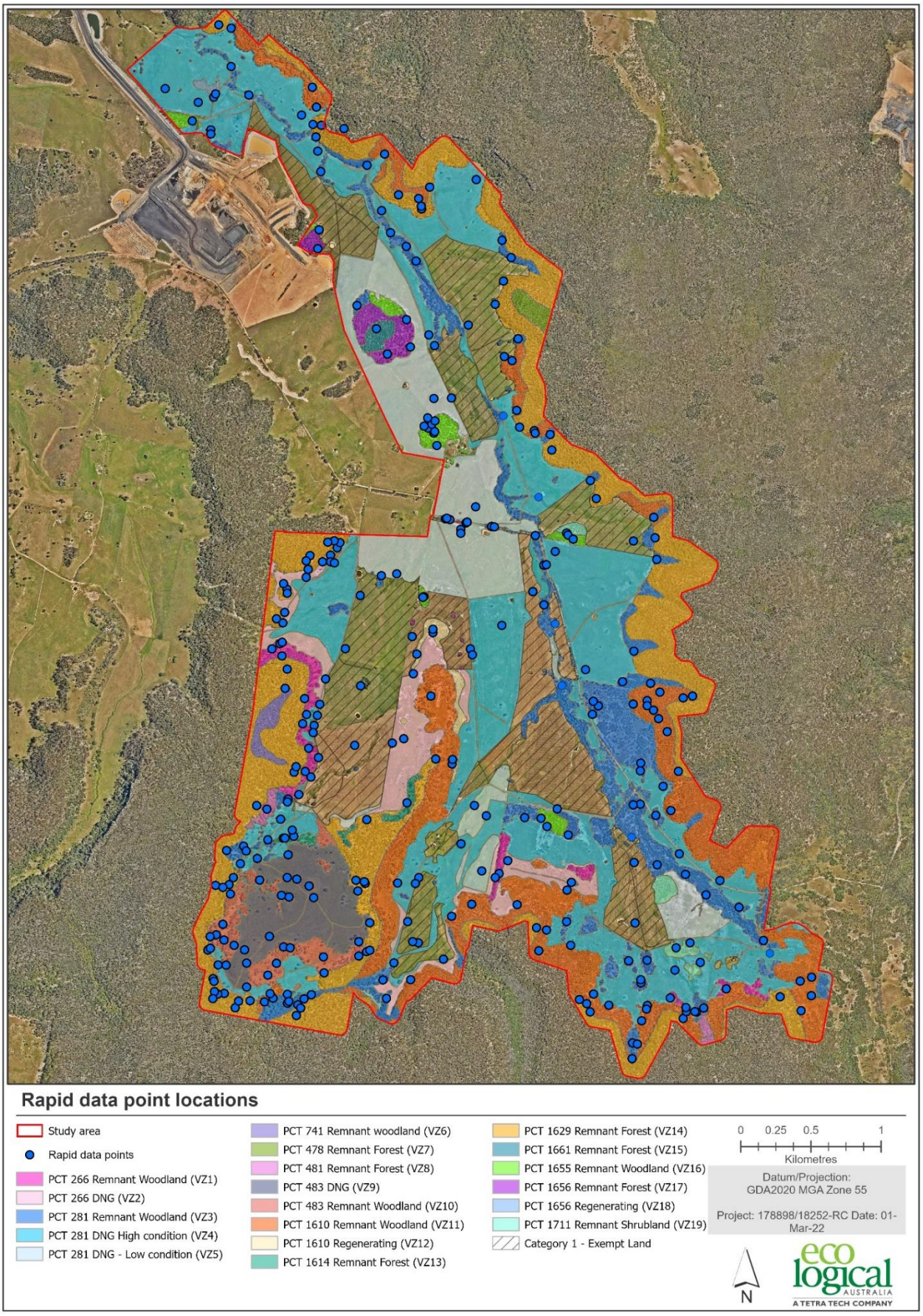

Figure 5: Location of Rapid Data Points

Vegetation integrity (VI) was assessed in accordance with Section 4.3 of the BAM (DPIE 2020a). A total of 80 VI plots were completed within native vegetation in accordance with the required number per VZ (Table 3 of the BAM (DPIE 2020a)) between 30 March to 22 April 2021 by ELA ecologists. VI plots were collected in accordance with Section 4.2.1 of the BAM (DPIE 2020a) and VI plot locations were chosen in accordance with Section 4.3.4 of the BAM (DPIE 2020a).

The following data was collected at each VI plot:

- Site name
- Name of recorder(s)
- Date
- Plot orientation, slope, and aspect
- Eastings and Northings
- Site photographs
- Assess composition within the 400 m^2 plot (20 x 20 m):
    - The full name and number of native plant species.
    - Growth form group for each native species as prescribed by Appendix F of the BAM (DPIE 2020a) ((T) Tree; (S) Shrub; (G) Grass and grass like (F) Forb; Fern; (O) other).
    - Whether each species is native, exotic, or if the species is a high threat exotic or non-high threat weed.
- Assess vegetation structure within the 400 m^2 plot (20 x 20 m):
    - An estimate of the appropriate cover measure for each recorded species: from 1-5% and then to the nearest 5%.
    - A relative measure of the number of individuals or shoots of a species within the plot using the following intervals: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20, 50, 100, 500, 1000, or specify a number greater than 1000 if required.
- Assess vegetation function within the 1000 m^2 plot (50 x 20 m):
    - Number of large trees, tree regeneration, tree stem size class, total length of fallen logs, number of hollow-bearing trees.
    - Litter cover within five (5) 1m x 1m sub-plots.

Location of VI plots is provided in Figure 6.

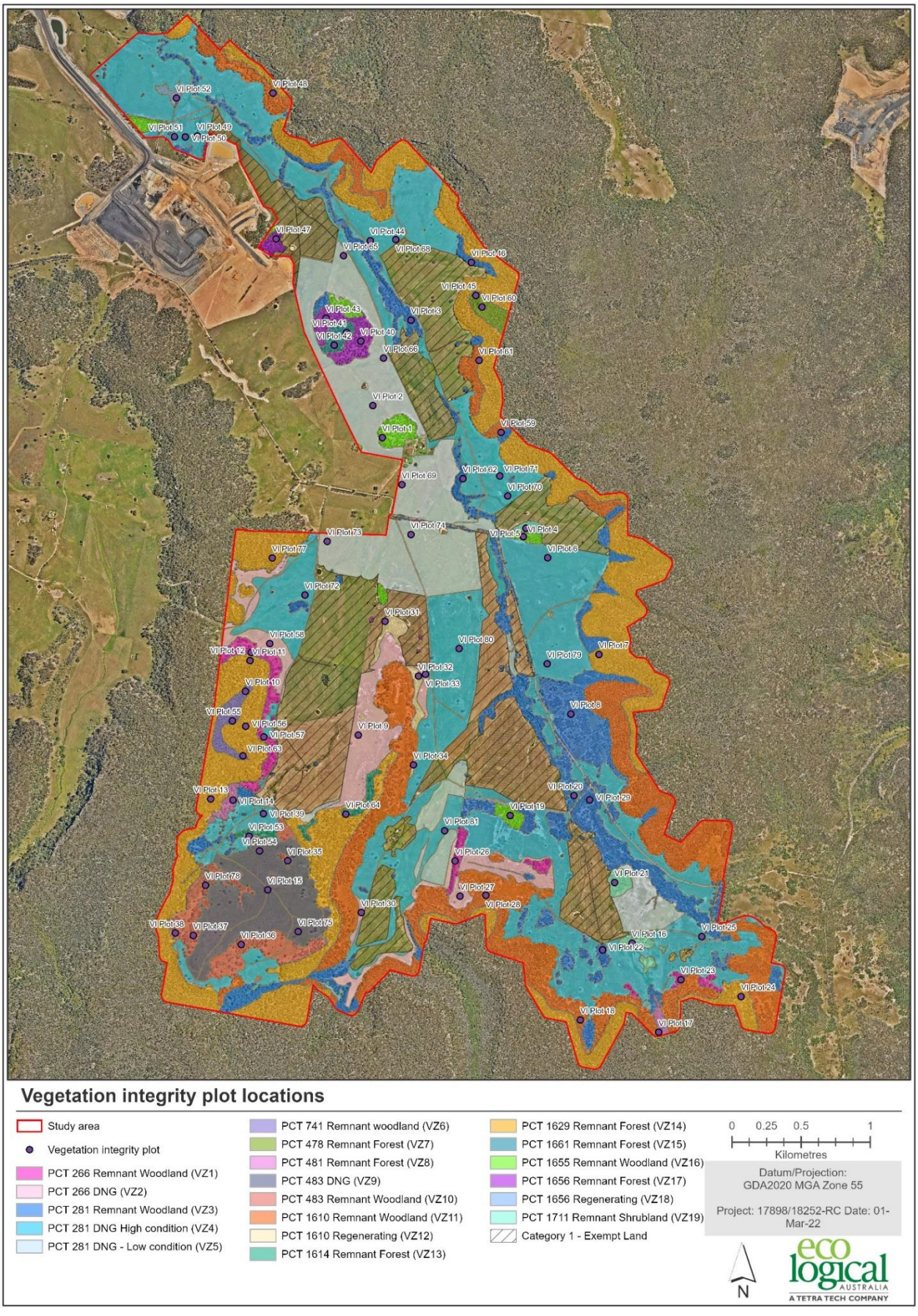

Figure 6: Location of Vegetation Integrity Plots

2.2.2. Assessment of Category 1 – Exempt Land

The *Local Land Services Act 2013* (LLS Act) defines Category 1 Land as land which meets any of the following criteria:

- Land cleared of native vegetation as at 1 January 1990 or lawfully cleared after 1 January 1990
- Low conservation grasslands
- Land containing only low conservation groundcover (not being grasslands)
- Native vegetation identified as regrowth in a Property Vegetation Plan under the repealed *Native Vegetation Act 2003*
- Land bio-certified under the BC Act.

The Study Area contains extensive areas of grassland, is not bio-certified under the BC Act and does not have a Property Vegetation Plan. As such, an assessment to determine the conservation value of grassland areas throughout the Study Area was suitable to be undertaken. The assessment involved review of the following data sources, which were used in conjunction with the *Interim Grasslands and other Groundcover Assessment Method Determining Conservation Value of Grasslands and Groundcover Vegetation in NSW* (IGGAM) ([former] Office of Environment and Heritage [OEH] 2018) to delineate Category 1 Land within the Study Area:

- Historic aerial imagery (NSW Government Spatial Services 2021b)
- *Mid-Western Regional Local Environmental Plan* (MWRC LEP) 2012. Sensitivity Biodiversity Map (BIO_005)
- Transitional Native Vegetation Regulatory Map (NVRM) (DPE 2022a)
- NSW Woody Vegetation Extent (DPIE 2015)
- NSW 2017 Landuse layer (DPIE 2017).

The IGGAM was prepared by OEH in accordance with Part 5A of the of the LLS Act and the amended *Local Land Services Regulation 2014* (LLS Regulation). The IGGAM is used to map the land according to the conservation value of the grasslands and other groundcover. The LLS Act and the LLS Regulation provide for:

- 'low conservation value' grasslands and other groundcover to be mapped as Category 1 Land.
- Land containing grasslands and other groundcover that are not low conservation value to be mapped as Category 2 – Regulated Land.
- 'high conservation value' grasslands and other groundcover to be mapped as Category 2 – Sensitive Regulated Land.

Impacts to biodiversity on Category 2 – Regulated Land and Category 2 – Sensitive Regulated Land within the Study Area requires assessment in accordance with the BC Act and the BAM (DPIE 2020a).

Assessment using the IGGAM (OEH 2018) was undertaken during December 2021 and January 2022, targeting areas which were identified during the data review and previous field surveys as potentially conforming to Category 1 Land, where:

- No woody vegetation, per the NSW Woody Vegetation layer (DPIE 2015), was present.
- The land was not mapped as Category 2 Land on the Transitional NVRM (DPE 2022a).
- The land was identified as one of the following categories on the NSW Landuse 2017 layer (DPIE 2017):
    - 3.3.0 Cropping

  - 3.2.0 Grazing modified pastures
  - 2.1.0 Grazing native vegetation.

- The land was not mapped in the MWRC LEP Sensitivity Biodiversity Map (BIO_005).
- Land where historic aerial imagery (NSW Spatial Services 2022) indicated intensive historical agricultural land-use.
- Groundcover was identified as predominately exotic in RDPs collected during previous field surveys (Section 2.2.1).

To gain representative data relating to cover of perennial grass species, surveys were undertaken during summer (December and January) where perennial groundcover (both native and exotic) was at its highest, and groundcover species were readily identifiable (i.e. presence of inflorescence and fruiting structures). Grassland areas assessed had not been disturbed within six (6) months prior to the assessment and the condition of the vegetation was suitable for assessment:

- There has been no documented fire within grassland areas over the six (6) months preceding the surveys (National Parks and Wildlife Service [NPWS] 2022) and there was no physical evidence of fire observed during field surveys.
- Whilst livestock grazing (sheep and cattle) was observed throughout grassland areas within the Study Area in the months preceding and during the surveys, it was not considered to be 'heavy' as there was high groundcover and presence of inflorescence and fruiting structures.
- Drought conditions did not occur in the six (6) months preceding the surveys (Appendix F2).
- Vegetative ground cover was typically high across grassland areas (>80%) the assemblage of species present was typical, as per section 3.1.3 of the IGGAM (OEH 2018).

A total of 20 IGGAM transects were undertaken across areas identified as potentially Category 1 Land across the Study Area. The proportion of native perennial and exotic perennial groundcover species was recorded (as per section 3.2.3 of the IGGAM [OEH 2018]) along with a native species assessment to determine vegetation integrity (as per section 3.3 of the IGGAM [OEH 2018]). Whilst it was not necessary to undertake the native species assessment at transects determined to have more exotic perennial cover compared to native perennial cover, it was undertaken at all transects for data completeness, and consistency with the BAM (DPIE 2020a). The location of IGGAM transects is provided in Figure 7.

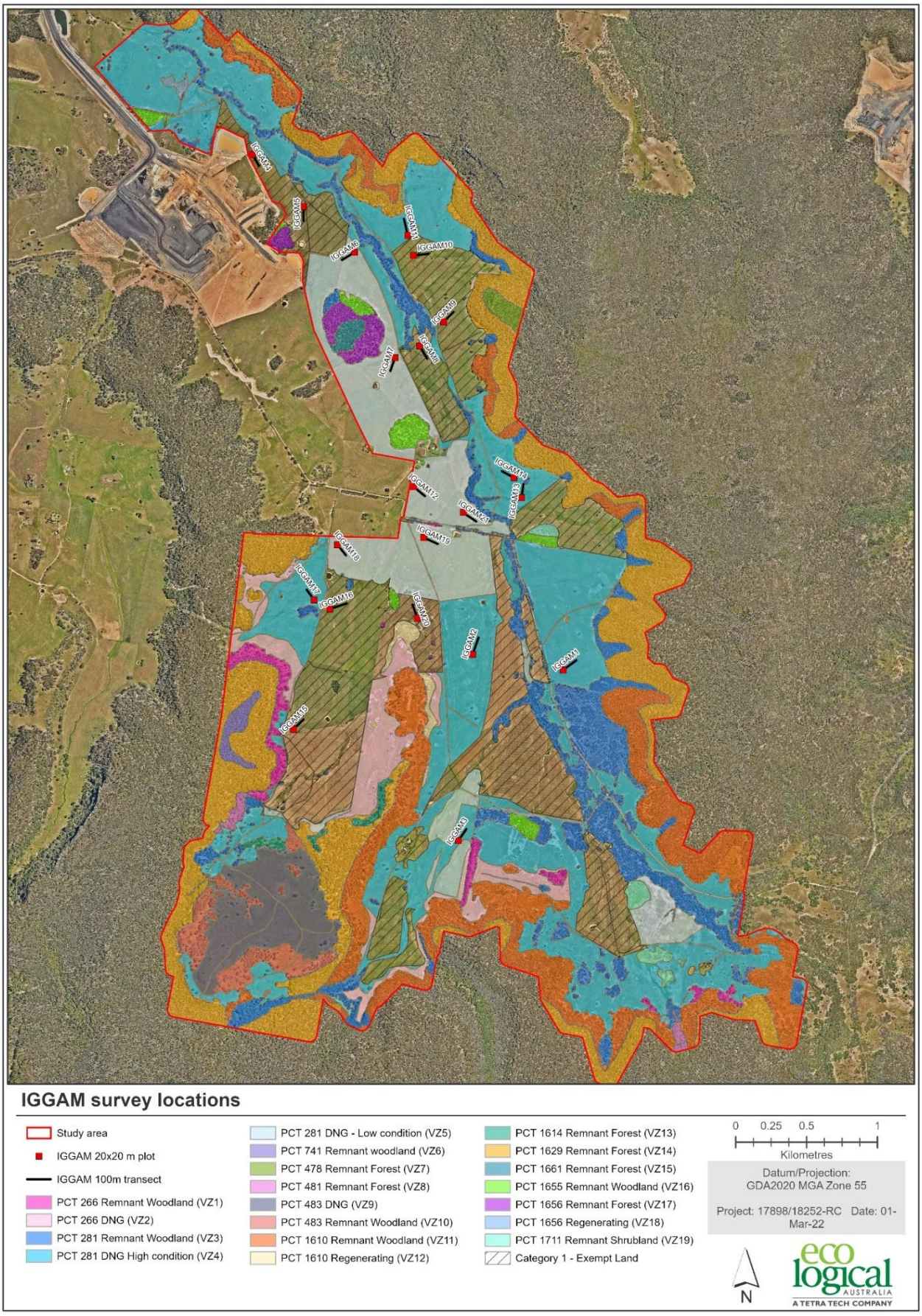

Figure 7: Location of IGGAM transects

2.2.3. Assessment of Threatened Ecological Communities

Identification of any TECs within the Study Area was undertaken in accordance with the relevant listings under the BC Act and EPBC Act. PCTs associated with TECs in the NSW BioNet Vegetation Classification (DPIE 2021) database and the BAM Calculator (BAM-C) were assessed against the following literature and publications to determine areas of TECs:

- *Notice and reason for the Final Determination* for White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin (Threatened Species Scientific committee (TSSC) 2020), hereafter referred to as the Box Gum Woodland Final Determination.
- *EPBC Act Policy Statement White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands* ([former] Department of the Environment and Heritage (DEH) 2006).
- *Commonwealth Listed Advice on White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (TSSC 2006), hereafter referred to as the Box Gum Woodland Listing Advice.
- *Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion – vulnerable ecological community listing final determination* (TSSC 2010).
- *Central Hunter Valley eucalypt forest and woodland: a nationally protected ecological community* (DEH 2016).
- EPBC Act *Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community* (TSSC 2015).

RDPs and VI plots used to inform TEC status were undertaken throughout areas of potential TECs. The best time of year to assess Box Gum Woodland condition is late autumn when the annual species have died back and have not started to regrow (DEH 2006).

Potential TECs were assessed by identifying continuous areas, or 'patches' for assessment. The description of a 'patch' varies between the descriptions of TECs listed under the EPBC Act. The NSW Scientific Determinations for relevant TECs do not provide a definition for 'patch' for TECs listed under the BC Act, therefore, the definition for 'patch' as per the respective EPBC Act TECs was applied to BC Act TECs. Definitions for 'patch' and to what TEC they are applied to is provided in Table 1.

Table 1: Patch definitions for EPBC Act listed TECs.

Source	Definition
EPBC Act Policy Statement White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands (DEH 2006) *Commonwealth Listed Advice on White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (TSSC 2006)	Patch – a patch is a continuous area containing the ecological community (areas of other ecological communities such as woodlands dominated by other species are not included in a patch). In determining patch size it is important to know what is, and what is not, included within any individual patch. The patch is the larger of: • An area that covers five (5) or more trees in which no tree is greater than 75 m from another tree, or, • The area over which the understorey is predominately native. Patches must be assessed at a scale of 0.1 ha (1000 m^2) or greater (DEH 2006).
Central Hunter Valley eucalypt forest and woodland: a nationally protected ecological community (DEH 2016)	A patch is a discrete and mostly continuous area of the ecological community (e.g. tree canopies within 30 m of each other). A patch of the Central Hunter Valley eucalypt forest and woodland ecological community is the largest area within which the projected canopy cover of trees is at least 10% (on average); or within which the native tree density is at least 10 native tree stems per 0.5 ha [i.e. at least 20 native tree stems/ha] (on average), that are at least one metre in height; or a combination of areas meeting either of these two measures (DEH 2016).

2.2.4. Threatened flora assessment

A threatened flora assessment was undertaken within the 'Threatened Flora Study Area' (as shown in Figure **4** above) as provided by Resource Strategies on 13 September 2021.

2.2.4.1. Identification of species credit species

A comprehensive review of the following literature and databases was undertaken to compile a candidate species list:

- NSW BioNet Atlas search with a 30 km buffer. A 30 km buffered search was undertaken due to a lack of ecological data in the south and east of the Study Area. BioNet Atlas searches were undertaken throughout the duration of survey planning and implementation to ensure the candidate species list was as temporally accurate as possible, with the most recent search undertaken on 7 February 2022 (DPE 2022b).
- EPBC Act Protected Matters Search Tool (PMST). Protected matters searches were undertaken throughout the duration of survey planning and implementation to ensure the candidate species list was as temporally accurate as possible, with the most recent search undertaken on 7 February 2022 (DAWE 2022).
- ELA threatened species records for the local region from 2017 to 2021.
- NSW BioNet Threatened Biodiversity Data Collection (TBDC) and associated search functions and reports. The most recent review of the TBDC was undertaken 17 June 2022, following updates to the TBDC (DPE 2022c).
- The BAM Calculator (BAM-C) (OEH 2022).
- Threatened flora species records in all publicly available biodiversity assessments for MCO Project Approval and Approval Modifications (MCO 2022b).
- Threatened flora species records in all publicly available biodiversity assessments for the nearby Wilpinjong Coal Mine (Peabody Energy 2022) and Ulan Coal Mines Project Approvals and Approval Modifications (Glencore 2022).
- Publicly available and MCO specific vegetation mapping for the greater region.

A total of 44 candidate species were identified including:

- 24 species identified from the BAM-C (OEH 2022) and TBDC (DPE 2022c) as associated with the Kerrabee IBRA Subregion, as provided in Table 2 below.
- Two (2) species which are known or may occur, one (1) species which is likely to occur and two (2) species associated with threatened populations which are likely to occur within the Study Area, as identified from the PMST (DAWE 2022) as shown in Table 3 below.
- Five (5) species which were not identified by the BAM-C, TBDC or PMST which have been previously recorded within 30 km of the Study Area in PCTs or equivalent vegetation to those mapped within the Study Area as shown in Table 3 below (MCO 2022b; Peabody Energy 2022; Glencore 2022).
- Ten (10) species which are associated with the nearby Inland Slopes or Wollemi IBRA Subregions within PCTs occurring within the Study Area[2] as shown in Table 3 below (OEH 2022; DPE 2022c).

The area of suitable habitat[3] for each species based on PCT associations for each species is listed in Tables 2 and 3, with the survey method required in accordance with the NSW *Surveying Threatened Plants and Their Habitats: NSW survey guide for the Biodiversity Assessment Method* (DPIE 2020b; the Threatened Flora Survey Guideline). The survey methodology is further detailed in Section 2.2.4.2 below.

[2] Due to the proximity of the Inland Slopes IBRA Subregion (approximately 1.5 km to the west) and the Wollemi IBRA Subregion (<1 km to the south) threatened flora species associated with the PCTs present in the Study Area throughout these IBRA Subregions which have been assessed as having potential to occur, have also been included in the assessment.

[3] Suitable habitat is defined as area(s) of the subject land that support PCT(s) where the species is expected to occur or periodically use. To be classified as suitable at least one habitat constraint, where these are listed for the species in the TBDC, is present and constraint(s) or any particular microhabitats are not significantly degraded (DPIE 2020b).

Table 2: Candidate flora species identified from the BAM-C and TBDC and justification for inclusion

Life form	Species	Common name	BC Act[1]	EPBC Act[2]	Associated IBRA Subregions	BioNet Associated PCTs	Additional PCTs for inclusion in suitable habitat due to records	Suitable habitat (ha)	Survey method
Climber	*Cynanchum elegans*	White-flowered Wax Plant	E	E	Kerrabee	PCT 1629	No records within 30 km [a, b]	132.3	Grid-based
	Kennedia retrorsa		V	V	Kerrabee	PCT 1655	No records within 30 km [a, b]	14.2	10 m parallel transects
Herbs and forbs	*Monotaxis macrophylla*	Large-leafed Monotaxis	E		Kerrabee	PCT 471*, PCT 478, PCT 481, PCT 483, PCT 1610, PCT 1661, PCT 1614, PCT 1656,	No records within 30 km [a, b]	190.8	Grid-based
	Swainsona sericea	Silky Swainson-pea	V		Inland Slopes	PCT 281, PCT 266	No records within 30 km [a, b]	650.7	Grid-based
Medium shrub	*Acacia ausfeldii*	Ausfeld's Wattle	V		Kerrabee, Inland Slopes	PCT 281, PCT 266, PCT 1610	PCT 481 [d], PCT 478 [d]	754.2	Grid-based
	Acacia dangarensis		CE		Kerrabee	PCT 1655	No records within 30 km [a, b]	14.2	20 m parallel transects
	Homoranthus darwinioides	Fairy Bells	V	V	Kerrabee	PCT 471*, PCT 1655	PCT 478 [d]	16.5	20 m parallel transects
	Lasiopetalum longistamineum		V	V	Kerrabee	PCT 1655	No records within 30 km [a, b]	14.2	20 m parallel transects
	Leionema lamprophyllum subsp. fractum		CE		Kerrabee	PCT 1629	No records within 30 km [a, b]	132.3	Grid-based
	Pomaderris queenslandica	Scant Pomaderris	E		Kerrabee	PCT 471*, PCT 1614, PCT 1655, PCT 1656, PCT 1661	PCT 1629 [c], Slatey Box Forest (equivalent to PCT 1655) [f], PCT 478 [e]	170.3	Grid-based
	Pomaderris reperta	Denman Pomaderris	CE	CE	Kerrabee	PCT 1655	No records within 30 km [a, b]	14.2	20 m parallel transects

Life form	Species	Common name	BC Act[1]	EPBC Act[2]	Associated IBRA Subregions	BioNet Associated PCTs	Additional PCTs for inclusion in suitable habitat due to records	Suitable habitat (ha)	Survey method
	Pomaderris sericea	Silky Pomaderris	E	V	Kerrabee	PCT 1629, PCT 1655	No records within 30 km [a, b]	146.4	Grid-based
Orchid	*Diuris tricolor*	Pine Donkey Orchid	V		Kerrabee	PCT 1655	PCT 510 (PCT 281 equivalent) [g]	599.6	Grid-based
	Prasophyllum petilum	Tarengo Leek Orchid	E	E	Kerrabee, Inland Slopes	PCT 281	No records within 30 km [a, b]	585.4	Grid-based
	Prasophyllum sp. Wybong			CE	Kerrabee, Inland Slopes	PCT 266, PCT 281	No records within 30 km [a, b]	650.7	Grid-based
Sub-shrub	*Commersonia procumbens*		V	V	Kerrabee	PCT 471*, PCT 478, PCT 481, PCT 1610, PCT 1655, PCT 1656, PCT 1661	No records within 30 km [a, b]	266.5	Grid-based
	Commersonia rosea		E	E	Kerrabee	PCT 1655	Recorded 20 km from the Study Area [b]	14.2	10 m parallel transects
	Ozothamnus tesselatus		V	V	Kerrabee	PCT 1655	No records within 30 km [a, b]	14.2	15 m parallel transects
	Prostanthera cryptandroides subsp. cryptandroides	Wollemi Mint-bush	V	V	Kerrabee	PCT 1629, PCT 1655	No records within 30 km [a, b]	146.4	Grid-based
	Prostanthera discolor		V	V	Kerrabee	PCT 1629, PCT 1655	No records within 30 km [a, b]	146.4	Grid-based
	Prostanthera stricta	Mount Vincent Mint-bush	V	V	Kerrabee	PCT 1655	No records within 30 km [a, b]	14.2	15 m parallel transects
	Senecio linearifolius var. dangarensis		E		Kerrabee	PCT 1614	No records within 30 km [a, b]	4.9	15 m parallel transects

Life form	Species	Common name	BC Act[1]	EPBC Act[2]	Associated IBRA Subregions	BioNet Associated PCTs	Additional PCTs for inclusion in suitable habitat due to records	Suitable habitat (ha)	Survey method
Tree	*Eucalyptus cannonii*	Capertee Stringybark	V		Kerrabee,	PCT 1610, PCT 1655	PCT 1610 [e], PCT 796 (equivalent to PCT 281 DNG) [e], PCT 1881 Western Hunter Flats Rough Barked Apple Forest (equivalent to PCT 281) [e]	698.2	Grid-based
	Eucalyptus fracta	Broken Back Ironbark	V		Kerrabee	PCT 1629	No records within 30 km [a, b]	132.3	Grid-based

[a]*DPE 2022b. NSW BioNet Atlas of Wildlife search 7 February 2022,* [b] *Australasian Virtual Herbarium 2021. Flora species profiles accessed 5 November 2021 from Home – Australasian Virtual Herbarium (AVH) (chah.org.au),* [c] *MCO UG1 LW101 to LW105 PCT Mapping,* [d] *Ulan Coal Complex PCT Mapping* (Glencore 2022) [e] *SEED PCT Mapping,* [f] *Wilpinjong Coal Mine extant veg map* (Peabody Energy 2022) [g] *MCO Biodiversity Offset Area mapping* (MCO 2022b).

1 Conservation status under the BC Act (current as of August 2022). V = Vulnerable, E = Endangered, CE = Critically Endangered.

2 Conservation status under the EPBC Act (current as of August 2022). V = Vulnerable, E = Endangered, CE = Critically Endangered.

* Whilst these species are associated with PCT 471, this PCT does not occur throughout the Threatened Flora Study Area.

Table 3: Additional threatened flora species with potential to occur within the Study Area

Justification for inclusion	Life form	Species	Common name	BC Act[1]	EPBC Act[2]	Comments	Suitable habitat (ha)	Survey methodology
Records within 30 km in PCTs (or equivalent PCTs) as those recorded within the Study Area.	Climber	*Tylophora linearis*		V	E	Recorded in Slatey Box Forest (equivalent to PCT 1655) within 30 km [f]	14.2	10 parallel transects
	Herbs and forbs	*Leucochrysum albicans var. tricolor*	Hoary Sunray		E	Recorded in PCT 266 [c], PCT 481 [d], PCT 1610 [e] within 30 km. Species or species habitat may occur within area (PMST)	166.5	Grid- based
	Orchid	*Cymbidium canaliculatum*	*Cymbidium canaliculatum* population in the Hunter Catchment	EP		Recorded in Slatey Box Forest (equivalent to PCT 1655) within 30km of Study Area [f]	14.2	10 m parallel transects
	Sub-shrub	*Indigofera efoliata*	Leafless Indigo	E	E	Recorded in Grey Gum Narrow-leaved Stringybark Forest (equivalent to PCT 1629) within 30 km of Study Area [f]	132.3	Grid-based
	Tree	*Eucalyptus scoparia*	Wallangarra White Gum	E	V	Recorded in PCT 796 (equivalent to PCT 281 DNG) within 30 km of Study Area [e]	585.4	40 m parallel transects
Identified by PMST	Tree	*Eucalyptus camaldulensis*	River Red Gum population in the Hunter Catchment	EP		Community likely to occur within area (DAWE 2021). Review of TBDC habitat and ecology indicates PCT 281 is suitable habitat (DPE 2022c).	585.4	Grid-based
	Tree	*Acacia pendula*	*Acacia pendula* population in the Hunter Catchment	EP		Community likely to occur within area (DAWE 2021). Review of TBDC habitat and ecology indicates that PCT 1655 is suitable habitat (DPE 2022c).	14.2	40 m parallel transects
	Medium shrub	*Pomaderris cotoneaster*	Cotoneaster Pomaderris	E	E	Species or species habitat may occur within area (DAWE 2021). Review of TBDC habitat and ecology indicates that PCT 478, PCT 1629, PCT 1610 and PCT 481 are suitable habitat (DPE 2022c).	235.7	20 m parallel transects
	Medium shrub	*Pultenaea glabra*	Smooth Bush-Pea	V	V	Species or species habitat known to occur within area (DAWE 2021). Review of TBDC indicates that PCT 1629 is suitable habitat (DPE 2022c).	132.3	Grid-based

Justification for inclusion	Life form	Species	Common name	BC Act[1]	EPBC Act[2]	Comments	Suitable habitat (ha)	Survey methodology
	Grass	*Dichanthium setosum*	Bluegrass	V	V	Species or species habitat likely to occur within area (DAWE 2021). Suitable habitat for this species is discussed in Appendix B.	264.7	Grid-based
Included due to association with nearby IBRA Subregion.	Herbs and forbs	*Euphrasia arguta*		CE	CE	No records within 30 km [a, b] Associated with PCT 266 and PCT 281 within the Inland Slopes IBRA Subregion (<2 km to the west of Study Area)	264.7	Grid-based
	Herbs and forbs	*Swainsona recta*	Small Purple-pea	E	E	No records within 30 km [a, b] Associated with PCT 266 and PCT 281 within the Inland Slopes IBRA Subregion (<2 km to the west of Study Area)	650.7	Grid-based
	Herbs and forbs	*Tetratheca glandulosa*		V		No records within 30 km [a, b] Associated with PCT 1629 within the Wollemi IBRA Subregion (<1 km to the south of Study Area)	132.3	Grid-based
	Herbs and forbs	*Velleia perfoliata*		V	V	No records within 30 km [a, b] Associated with PCT 1629 and PCT 1655 within the Wollemi IBRA Subregion (<1 km to the south of Study Area)	146.4	Grid-based
	Medium shrub	*Acacia bynoeana*	Bynoe's Wattle	E	V	No records within 30 km [a, b] Associated with PCT 1629 within the Wollemi IBRA Subregion (<1 km to the south of Study Area)	132.3	Grid-based
	Medium shrub	*Astrotricha crassifolia*	Thick-leaf Star-hair	V	V	No records within 30 km [a, b] Associated with PCT 1629 within the Wollemi IBRA Subregion (<1 km to the south of Study Area)	132.3	Grid-based
	Medium shrub	*Melaleuca groveana*	Grove's Paperbark	V		No records within 30 km [a, b] Associated with PCT 1629 within the Wollemi IBRA Subregion (<1 km to the south of Study Area)	132.3	Grid-based
	Medium shrub	*Olearia cordata*		V	V	No records within 30 km [a, b] Associated with PCT 1629 within the Wollemi IBRA Subregion (<1 km to the south of Study Area)	132.3	Grid-based

Justification for inclusion	Life form	Species	Common name	BC Act[1]	EPBC Act[2]	Comments	Suitable habitat (ha)	Survey methodology
	Medium shrub	*Persoonia hirsuta*	Hairy Geebung	E	E	No records within 30 km [a, b] Associated with PCT 1629 within the Wollemi IBRA Subregion (<1 km to the south of Study Area)	132.3	Grid-based
	Tree	*Eucalyptus corticosa*	Creswick Apple Box	V		No records within 30 km [a, b] Associated with PCT 1629 within the Wollemi IBRA Subregion (<1 km to the south of Study Area)	132.3	40 m parallel transects

[a] *DPE 2022b. NSW BioNet Atlas of Wildlife search 7 February 2022,* [b] *Australasian Virtual Herbarium 2021. Flora species profiles accessed 5 November 2021 from* ***Home – AVH (chah.org.au),*** [c] *MCO UG1 LW101 to LW105 PCT Mapping* (MCO 2022b) [d] *Ulan complex PCT Mapping* (Glencore 2022) [e] *SEED PCT Mapping,* [f] *Wilpinjong Coal Mine extant veg map* (Peabody Energy 2022) [g] *MCO Biodiversity Offset Area mapping* (MCO 2022b)

1 Conservation status under the BC Act (current as of August 2022). V = Vulnerable, E = Endangered, CE = Critically Endangered, Endangered Population.

2 Conservation status under the EPBC Act (current as of August 2022). V = Vulnerable, E = Endangered, CE = Critically Endangered.

2.2.4.2. Survey methodology

The threatened flora survey was undertaken in accordance with the BAM (DPIE 2020a) and the methods described in the Threatened Flora Survey Guideline (DPIE 2020b).

The bilateral agreement between the Commonwealth of Australia and the State of New South Wales relating to environmental assessment (the assessment bilateral agreement), allows the Commonwealth Minister for the Environment to rely on specified environmental impact assessment processes of the State of NSW in assessing actions under the EPBC Act. Furthermore, there are no published survey guidelines specific to threatened flora species survey for EPBC listed species, except orchids. As such, the survey methodology for all candidate species were undertaken in accordance with the BAM (DPIE 2020a) and the Threatened Flora Survey Guideline (DPIE 2020b).

The *Survey Guidelines for Australia's Threatened Orchids: Guidelines for Detecting Orchids Listed as 'Threatened' Under the Environment Protection and Biodiversity Conservation Act 1999* (hereafter referred to as the Commonwealth Orchid Survey Guideline; Commonwealth of Australia 2013) was reviewed and applied for *Prasophyllum* sp. Wybong. For this species, survey methodology prescribed under the Threatened Flora Survey Guideline (DPIE 2020b) and the Commonwealth Orchid Survey Guidelines (Commonwealth of Australia 2013) differ, where:

- The Threatened Flora Survey Guideline (DPIE 2020b) requires a grid-based survey (where suitable habitat is greater than 50 ha) involving a systematic search of a 40 m radius at each 100 x 100 m grid intersect locations, followed by a systematic search of a 4 m radius at each 10 x 10 m grid intersect where the species has been identified (DPIE 2021b).
- In contrast, the Commonwealth Orchid Survey Guidelines require a systematic targeted search parallel transects 5 to 10 m apart, followed by 6 m transects if the species is identified (Commonwealth of Australia 2013).

Surveys for *Prasophyllum* sp. Wybong were undertaken in accordance with the Threatened Flora Survey Guideline (DPIE 2020b) and the BAM (DPIE 2020a), which is in accordance with the assessment bilateral agreement.

Habitat assessment for threatened flora species was undertaken during field surveys from October 2020 to January 2022, with data collected using RDPs (Section 2.2.1). The area of suitable habitat for all candidate species, except for *Dichanthium setosum* and *Euphrasia arguta,* was determined to be the extent of their respective associated PCTs within the Study Area as suitable habitat could not be further refined due to their wide ecological association with soils, topography and geology. However, the refinement of suitable habitat for *Dichanthium setosum* and *Euphrasia arguta*, within their respective associated PCTs was possible due to the specific vegetation condition, soil and geological habitat constraints provided in published literature. Further discussion regarding the refinement of habitat for these species is provided in Appendix B.

Where the area of suitable habitat for a candidate species is less than 50 ha, parallel transects in accordance with the spacing provided in Table 4 were undertaken throughout areas of suitable habitat. Where the suitable habitat overlapped for species of different life forms (e.g. trees and orchids), the smaller distance between transects was undertaken.

Table 4: Maximum distance between parallel field traverses for species with potential habitat <50 ha (DPIE 2020b).

Life form	Maximum distance between parallel field traverse (m)
Trees	40
Medium shrubs	20
Sub-shrubs	15
Herbs and forbs	10
Orchids / Epiphytes and climbers	10

Where the area of suitable habitat for a candidate species is greater than 50 ha, a two-phase grid-based survey was implemented. This involved placing a grid spaced at 100 m^2 is nested within a 1 km^2 grid, over the Threatened Flora Study Area (Figure 4). Surveys were undertaken where the 100 m^2 gridlines intersect within suitable habitat for the target species. At each survey location (grid intersect), 40 m diameter areas were systematically searched for the target species.

Where a candidate species was identified during the two-phase grid-based survey, finer-scale grid surveys were implemented to locate population extent and help define the species polygon in accordance with the fine-scale grid spacing outlined in Table 5. The maximum distance between parallel field traverse follows the guidelines for surveying threatened plants in open vegetation (DPIE 2020b). The Study Area is 'sparse or open', or 'very sparse' vegetation based on projected canopy cover (National Committee on Soil and Terrain, 2009).

Table 5: Distance between parallel field traverses for trees, medium shrubs, sub-shrubs, herbs and forbs, and grasses (DPIE 2020b).

Life form	Fine-scale grid size (m)	Diameter for fine-scale grid searches (m)
Trees	40	16
Medium shrubs	20	8
Sub-shrubs	15	6
Herbs and forbs	10	4
Orchids / Epiphytes and climbers	10	4

2.2.4.3. Survey timing

The timing of targeted surveys for the candidate species is provided in Table 6 below.

Several areas of suitable habitat within the Study Area for *Pomaderris cotoneaster* were surveyed during September, which is outside the prescribed survey timing for this species. Due to the similarities and difficulties associated with distinguishing members of the *Pomaderris* genus, coupled with the high proportion of threatened *Pomaderris* spp. with potential to occur within the Study Area, all populations of *Pomaderris* spp. identified within the Study Area were recorded whilst undertaking the survey. Populations were then re-visited when flowering to confirm species identification during October – November, during which surveys in accordance with the Threatened Flora Survey Guideline (DPIE 2020b) were undertaken.

Reference sites were inspected periodically prior to field surveys to determine the most suitable time to survey (i.e., when plants are most detectable). Flowering time of species at reference sites is provided in Table 7 below. Survey timing aligned with flowering time of reference sites where applicable.

Table 6: Threatened flora species survey timing and optimal survey conditions

Survey Group	Species name	Common name	BC Act	EPBC Act	J	F	M	A	M	J	J	A	S	O	N	D	Optimal survey time / conditions (DPE 2022c)
Climbers	*Cynanchum elegans*	White-flowered Wax Plant	E	E									S	S			NA
	Tylophora linearis		V	E										S			*Use flowers and fruit to locate and identify. Easily confused with other climbers when not in flower or fruit.*
Grass	*Dichanthium setosum^*	Bluegrass	V	V	S												*Use seed-head to identify. Survey Nov – May 3 to 4 weeks after effective rainfall.* 16 mm received 3-4 weeks prior to surveys on 17 December (MCO 2022c).
	Leucochrysum albicans var. tricolor	Hoary Sunray		E									S	S			NA
	Monotaxis macrophylla	Large-leafed Monotaxis	E										S	S			*Survey within 6 months of disturbance or fire, if possible. Species is a short-lived annual and will not be present unless a recent disturbance/fire event has occurred and triggered germination. Strongly recommend expert report to discount presence or absence, or detection by soil seed analysis.* No disturbance or fire within 6 months. Closest records are 70 km to the west of the Study Area; near Martindale, NSW (AVH 2022).
Herbs & forbs	*Swainsona recta*	Small Purple-pea	E	E									S	S			NA
	Swainsona sericea	Silky Swainson-pea	V										S	S	S		*Survey months differ based on location. Survey Oct – Nov on Monaro. Survey Sep – Oct in the Riverina.* Surveys aligned with reference site population flowering (Table 7)
	*Euphrasia arguta^*		CE	CE	S												*Survey after rainfall or in areas with light enhancement (post fire, opening of canopy, on edges etc).* 16 mm received 3-4 weeks prior to surveys on 17 December (MCO 2022c).
	Kennedia retrorsa		V	V									S	S			*Use flowers to identify, as easily confused with Kennedia rubicunda when in a vegetative state. Survey within 3 years of fire. Strongly recommend expert report to discount presence or absence if conditions do not meet requirements.* No fire within 3 years. 50 km to the west of the Study Area; near Widden, NSW (AVH 2022)
	Tetratheca glandulosa		V										S	S			*Survey: Use flowers to locate. Occasionally flowers in Jul. Survey Aug – Nov.*
	Velleia perfoliata		V	V									S	S			*Survey: Use flowers to locate and identify. Can be identified by bracteole morphology year-round by a skilled botanist.*
	Cymbidium canaliculatum	*Cymbidium canaliculatum* population in the Hunter Catchment	EP										S	S			NA
Orchid	*Diuris tricolor*	Pine Donkey Orchid	V											S[a]			NA
	Prasophyllum petilum	Tarengo Leek Orchid	E	E										S[a]			*Survey months differ based on location. Survey Hunter populations in Sep – Oct, populations north of Queanbeyan in Oct, and south of Queanbeyan in Nov – Dec. (Timing may vary depending on season).* Surveys aligned with reference site population flowering (Table 7)
	Prasophyllum sp. Wybong			CE										S[a]			*Use flowers to identify to species. Flowering usually occurring in early Oct. May require multiple surveys. Survey Sep, if not found survey again in Oct.* Surveys aligned with reference site population flowering (Table 7)
Shrubs	*Pomaderris queenslandica*	Scant Pomaderris	E										S	S			*Flowers are useful to identify, as easily confused with P. intermedia, however species can be distinguished by leaf morphology – P. intermedia generally has a much larger leaf compared to P. queenslandica.*
	Pomaderris reperta	Denman Pomaderris	CE	CE									S	S			*Use flowers to identify, as easily confused with P. cotoneaster and other Pomaderris species. Species will not flower during extremely dry periods.*
	Pomaderris sericea	Silky Pomaderris	E	V									S	S			NA
	Pomaderris cotoneaster	Cotoneaster Pomaderris	E	E									S	S	S		NA
	Prostanthera cryptandroides subsp. cryptandroides	Wollemi Mint-bush	V	V									S	S			*Use flowers to locate and identify, flowering occurring mainly in Sep – Nov. Can be identified by foliage year round by a skilled botanist.*
	Prostanthera discolor		V	V									S	S			*Use flowers and fruit to identify, flowering occurring mainly in Sep – Oct. Can be identified by the leaves as they distinctive ciliate leaf margins.*

Survey Group	Species name	Common name	BC Act	EPBC Act	J	F	M	A	M	J	J	A	S	O	N	D	Optimal survey time / conditions (DPE 2022c)
	Prostanthera stricta	Mount Vincent Mint-bush	V	V									S	S			*Use flowers and fruit to identify, flowering occurring mainly in Sep – Nov. Inflorescence buds develop in Sep and produce racemose inflorescences.*
	Senecio linearifolius var. dangarensis		E	-										S			*Survey in normal conditions or after rain. Species will die back to root stock or seed store during dry conditions. Strongly recommend expert report to discount presence or absence if conditions do not meet requirements.* Survey undertaken following 18 mm on 12 October, 19 mm on 23 October (MCO 2022c).
	Acacia ausfeldii	Ausfeld's Wattle	V										S	S			*Use flowers and/or pods to identify, as species can be confused with A. verniciflua.* Surveys aligned with reference site population flowering (Table 7)
	Acacia bynoeana	Bynoe's Wattle	E	V									S	S			*Survey: Use reference population to identify vegetative state, which will assist in positive identification during survey.* No known populations located within 50 km (AVH 2022).
	Acacia dangarensis		CE										S	S			NA
	Melaleuca groveana	Grove's Paperbark	V										S	S			NA
	Olearia cordata		V	V									S	S			*Survey: Survey in disturbance margins or areas that were most recently burnt. Population size will reduce over time after disturbance.*
	Persoonia hirsuta	Hairy Geebung	E	E									S	S			NA
	Astrotricha crassifolia	Thick-leaf Star-hair	V	V									S	S			*Use buds, flowers and fruit to locate and identify. Hand lens is required to observe star hairs to confirm genus without fertile material.*
	Homoranthus darwinioides	Fairy Bells	V	V									S	S			*Flowers sporadically between Mar – Dec. Survey a number of times throughout the year if not flowering when initially surveyed.* Reference site population was readily identifiable during September and flowering during October (Table 7).
	Lasiopetalum longistamineum		V	V									S	S			*Use flowers to identify, as easily confused with L. ferrugineum and L. macrophyllum. Flower arrangement required to positively identify to species.*
	Leionema lamprophyllum subsp. fractum		CE										S	S			*Use mature budding and/or full flowering to locate and identify.*
	Pultenaea glabra	Smooth Bush Pea	V	V									S	S			*Use flowers to identify. Taxonomic confusion with this species.*
	Commersonia procumbens		V	V									S	S			*Survey recent fire or mechanical disturbance areas. Fire or disturbance within the last 1 to 2 seasons required for above ground identification. Species will then revert to underground thickened rootstock.* This species has been recently (October 2021) identified where canopy thinning has occurred likely because of drought related canopy dieback. Similar drought related dieback has likely occurred throughout the Study Area, in areas of suitable habitat.
	Commersonia rosea		E	E									S	S			*Fire ephemeral species. Survey 18 months post fire. After about 5 years, the species will no longer persist above ground but is likely to be present in the seedbank. Strongly recommend expert report to discount presence or absence if conditions do not meet requirements.* No fire within 5 years. Recorded 20 km to the north east: near Lees Pinch, NSW (AVH 2022)
	Ozothamnus tesselatus		V	V									S	S			*Use flowers to locate. Identified by foliage year-round by a skilled botanist.*
	Indigofera efoliata	Leafless Indigo	E	E									S	S			*This species is no longer presumed extinct as a confirmed record was discovered in 2021. Survey: Use flowers to locate and identify. Survey Sept – Oct. Plants die back to a substantial underground rootstock in unfavourable seasons with aerial parts only appearing with significant rainfall.*
Tree	*Acacia pendula*	*Acacia pendula* population in the Hunter Catchment	EP										S	S			*Use seed pods to identify, as easily confused with closely related arid Acacia species. Use seed pods to assess seed alignment. Successful fruiting has never been observed in the Hunter population, and all populations appear sterile. Plants have never produced seed and flowers are usually aborted. Plants sucker to expand vegetatively. Requires voucher confirmation from RBG.*
	Eucalyptus camaldulensis	*Eucalyptus camaldulensis* population in the Hunter Catchment	EP										S	S			NA
	Eucalyptus cannonii	Capertee Stringybark	V										S	S			*Use buds to identify. Flowering is sporadic and unreliable and taxonomic key identification requires buds. Hybridisation with E. macrorhyncha is also an issue. Survey multiple times throughout the year if buds are not present during a previous survey.*
	Eucalyptus corticosa	Creswick Apple Box	V										S	S			NA
	Eucalyptus scoparia	Wallangra White Gum	E	V									S	S			NA
	Eucalyptus fracta	Broken Back Ironbark	V										S	S			NA

Survey Group	Species name	Common name	BC Act	EPBC Act	J	F	M	A	M	J	J	A	S	O	N	D	Optimal survey time / conditions (DPE 2022c)

S *indicates the implemented survey timing.*

S[a] *indicates species which also underwent survey (10 m transect methodology) in the previous year (October 2020) throughout some areas.*

Green cells indicate appropriate months of survey according to the TBDC (DPIE 2021b).

Green text indicates where a survey condition has been achieved. Red text indicates where a survey condition has not been achieved.

^DAWE 2021

Table 7: Species flowering time at reference sites

Species	Common name	Flowering observed	Reference site location
Diuris tricolor	Pine Donkey Orchid	16 September to 25 October 2021	Mud Hut Creek Travelling Stock Reserve (TSR)
		16 September to 25 October 2021	MCO Biodiversity Offset Area 'Property 25/25'
Prasophyllum petilum / Prasophyllum sp. Wybong	Tarengo Leek Orchid	13 October 2021	Wilpinjong Coal 'Environment Conservation Area B'
		8 October 2021	Premer, Dunedoo and Pilliga localities, NSW
		13 October 2021	Mud Hut Creek TSR
Leucochrysum albicans var. *tricolor*	Hoary Sunray	From 27 August 2021	Windeyer, NSW
		From 31 August 2021	Mudgee, NSW
		1 September to 25 October 2021	Ulan Cemetery, NSW
Swainsona recta	Small Purple-pea	From 2 September 2021	Mudgee, NSW
		From 1 October 2021	Meroo, NSW
Swainsona sericea	Silky Swainson-pea	8 October 2021	Mudgee, NSW
Commersonia procumbens		22 September 2021	Near Bungaba, NSW
Acacia ausfeldii	Ausfeld's Wattle	Throughout September and October	Lagoons Rd, Ulan, NSW
Dichanthium setosum	Bluegrass	Seed heads visible 14 January 2021	Blackville, NSW
		Mature seed heads visible 4 February 2021	Coolah, NSW
Homoranthus darwinioides	Fairy Bells	October 2021	Lees Pinch, NSW

2.3. Streamlined assessment module – Scattered trees assessment

'Scattered trees' are defined in the BAM Streamlined Assessment Module (DPIE 2020a)– Scattered Tree Assessment as species listed in the tree growth form group that:

a. *have a percent foliage cover that is less than 25% of the benchmark of tree cover for the most likely plant community type and are on category 2-regulated land and surrounded by category 1-exempt land on the Native Vegetation Regulatory Map under the LLS Act, or*
b. *have a diameter at breast height (DBH) of greater than or equal to 5 centimetres (cm) and are located more than 50 m away from any living tree that is greater than or equal to 5 cm DBH, and the land between the scattered trees is comprised of vegetation that are all ground cover species on the widely cultivated native species list, or exotic species or human-made surfaces or bare ground, or*
c. *have three (3) or fewer trees with a DBH of greater than or equal to 5 cm and are within a distance of 50 m of each other, that in turn, are greater than 50 m away from the nearest living tree that is greater than or equal to 5 cm DBH, and the land between the scattered trees is comprised of vegetation that are all ground cover species on the widely cultivated native species list, or exotic species or human-made surfaces or bare ground.*

Isolated paddock trees like those within areas of DNG VZs, do not meet the definition for 'scattered trees' as they are:

- not located on category 1 – exempt land (as required per point 'a' above),
- the land between the scattered trees is not comprised of vegetation that are all ground cover species on the widely cultivated native species list, or exotic species or human-made surfaces or bare ground (as required per point 'b' and point 'c' above).

Impacts to biodiversity on isolated paddock trees, surrounded by DNG VZs have not been assessed via the Streamlined Assessment Module – Scattered Trees Assessment. Impacts to biodiversity on these has been captured by the BAM (DPIE 2020a).

There are several scattered trees surrounded by land Category 1 Exempt land (i.e. the groundcover between the scattered trees is comprised of exotic species, as per point 'b' and 'c' above). These trees were assessed in accordance with the Streamlined Assessment Module for scattered trees assessment in the BAM (DPIE 2020a). Scattered Trees were identified to species level and classified into one (1) of three (3) classes as per the BAM (DPIE 2020a):

- Class 1- trees <20 cm DBH and without hollows
- Class 2 – trees ≥20 cm DBH but less than 50 cm (large tree benchmark) or trees < 20 cm DBH but with at least one hollow
- Class 3 – trees ≥ 50 cm.

The location of each scattered tree was recorded during the field surveys with hand-held Global Positioning System (GPS) along with any evidence of fauna occupation, tree DBH, total number of hollows and tree species.

3. Results

3.1. Vegetation assessment

3.1.1. Desktop review of NSW State Vegetation Type Map

Seven (7) vegetation classes, attributed to 13 PCTs, are mapped within the Study Area in the NSW State Vegetation Type Map: Central Tablelands Region (DPIE 2019) as shown in Table 8. Some of these PCTs are not listed in the BioNet Vegetation Classification (DPIE 2021) or the BAM-C (OEH 2022) (i.e., PCT 1881, PCT 1886, PCT 1860, PCT 1861, PCT 1906, PCT 1871 and PCT 1878) and therefore cannot be used in accordance with the BAM (DPIE 2020a).

Table 8: Vegetation classes and PCTs mapped within the Study Area on the NSW State Vegetation Type Map: Central Tablelands Region

Vegetation class	PCT name
Western Slopes Grasslands	PCT 796 – Derived grassland of the NSW South Western Slopes
Eastern Riverine Forests	PCT 1881 – Western Hunter Flats Rough-barked Apple Forest
Western Slopes Grassy Woodlands	PCT 1886 – Western Hunter Footslopes Box Woodland PCT 1330 – Yellow Box – Blakely's Red Gum grassy woodland on the tablelands; South Eastern Highlands Bioregion
Southern Tableland Dry Sclerophylly Forests	PCT 1860 – Growee Ranges Grey Gum – Scribbly Gum Forest PCT 1861 – Growee Ranges Grey Gum Sheltered Forests
Southern Tablelands Wet Sclerophyll Forests	PCT 1906 – Central Tablelands Ribbon Gum – Apple Gully Forest
Western Slopes Dry Sclerophyll Forests	PCT 478 – Red Ironbark – Black Cypress Pine – stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong – Mendooran region, southern Brigalow Belt South Bioregion PCT 1661 – Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin PCT 1672 – Red Ironbark – Grey Gum – Black Pine heathy woodland on sandstone ranges of the Sydney Basin PCT 1610 – White Box – Black Cypress Pine shrubby woodland of the Western Slopes PCT 1871 – Western Hunter Dwyer's Red Gum – Cypress Woodland
North-west Slopes Dry Sclerophyll Woodlands	PCT 1878 – Capertee Escarpment Slatey Gum Forest

3.1.2. PCT mapping and vegetation integrity assessment

Field validation of vegetation identified a total of 1,377 ha of native vegetation within the Study Area, corresponding to two (2) Vegetation Formations, and three (3) Vegetation Classes as described in Table 9 below (Keith 2004).

Table 9: Vegetation Formations and Classes identified within Study Area 1 (Keith 2004)

Vegetation formation	Vegetation Class
Dry Sclerophyll Forests • Forests or rarely woodlands dominated by an abundance of hard-leaved (sclerophyllous) shrubs in the understorey. • Only rarely dominated by 'box' eucalypts. Groundcover is often sparse and typically dominated by sclerophyllous sedges but may sometimes include reasonably continuous swards of grasses. • Confined to the coast, tablelands, and the western slopes where average rainfall exceeds 500 mm, largely on infertile sandy or loamy soils.	**Western Slopes Dry Sclerophyll Forests:** • Typically dominated by Ironbarks and Cypress Pine 10 to 25 m tall, on shallow, sandy and infertile soils. **Sydney Hinterland Dry Sclerophyll Forests:** • Typically dominated by a range of Bloodwood, Ironbark, Stringybark and Gum Eucalypt species 10 to 25 m tall, on sandstone ridges, slopes and gullies within infertile soils.
Grassy woodlands • Woodlands or rarely forests, typically 15-35 m tall though shorter at subalpine elevations. • Groundcover continuous and dominated by perennial tussock grasses and interspersed perennial herbs including 'geophytic' orchids and lilies, but few ephemeral herbs and grasses. • Shrubs generally sparse and typically not including chenopods or other drought tolerant species. • Widespread on relatively fertile loams and clay loams of the coastal lowlands, the tablelands, and the western slopes where average annual rainfall exceeds 500 mm. • Western Slopes Grassy Woodlands are typically dominated by Box and Gum Eucalypt species up to 20 m tall, on fertile soils on slopes on the western side of the Great Dividing Range.	**Western Slopes Grassy Woodlands:** • Typically dominated by Box and Gum Eucalypt species up to 20 m tall, on fertile soils on slopes on the western side of the Great Dividing Range.

Thirteen (13) PCTs were identified using the PCT filter tool within the BioNet Vegetation Classification (DPIE 2021) which follows the Vegetation Classification Assessment (Benson *et al.* 2010) using a combination of IBRA region, sub-region, vegetation formations and species composition.

Quantitative analysis of VI plot data was undertaken to determine best fit PCTs where the proportion of characteristic canopy species, as defined by the BioNet Vegetation Classification (DPIE 2021), within each VZ was calculated. In some cases, several PCTs were identified by the quantitative analysis. Selection of PCTs based on quantitative analysis of floristic data alone is generally not sufficient to determine an accurate PCT. Therefore, a qualitative comparison of abiotic factors for each VZ with the BioNet Vegetation Classification (DPIE 2021) was undertaken for landscape position, soil type, geology influence and other relevant information.

Five of the 13 PCTs were present in different condition states (i.e. remnant woodland/forest/shrubland, DNG and regenerating), resulting in 19 VZs. The VZs are detailed below in Table 9 and shown in Figure 8 to Figure 10. A detailed description of each PCT and the justification for selection is provided in the sections below. A total of 80 VI plots were completed in accordance with the BAM (DPIE 2020a), data from which was used to

inform vegetation condition states. Calculations for vegetation structure, condition and function in accordance with Section 4.4 of the BAM (DPIE 2020a) has not been undertaken as part of this report.

Patch size, as provided in Table 10, differs from patch size used to assess EPBC Act listed TECs as provided in Section 2.2.2 and refers to Section 4.3.2 of the BAM (DPIE 2020a):

> *'A patch is an area of native vegetation that occurs on the subject land and includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤30 m for non-woody ecosystems).'*

Table 10: VZs identified within the Study Area

PCT #	PCT Name	Vegetation formation[1]	Vegetation class[1]	% cleared[1]	Condition	Vegetation zone ID	Area (ha)	Patch size	Plots surveyed	Plots required
266	White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	KF_CH3 Grassy Woodlands	Western Slopes Grassy Woodlands	94%	Remnant woodland	1	22.9	≥100 ha	4	4
					DNG	2	48.2	≥100 ha	5	4
281	Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	KF_CH3 Grassy Woodlands	Western Slopes Grassy Woodlands	67%	Remnant woodland	3	157.6	≥100 ha	6	6
					DNG – High condition	4	380.9	≥100 ha	13	7
					DNG – Low condition	5	168.8	≥100 ha	6	6
471	Dwyer's Red Gum – Black Cypress Pine – ironbark low woodland on sandstone hillcrests in the Dubbo – Gilgandra region, south-western Brigalow Belt South Bioregion	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	20%	Remnant woodland	6	5.5	≥100 ha	3	3
478	Red Ironbark – Black Cypress Pine – stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong – Mendooran region, southern Brigalow Belt South Bioregion	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	29%	Remnant forest	7	4.4	≥100 ha	2	2
481	Rough-barked Apple – Blakely's Red Gum – Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	North Coast Dry Sclerophyll Forests	28%	Remnant forest	8	4.2	≥100 ha	2	2
483	Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	KF_CH3 Grassy Woodlands	Western Slopes Grassy Woodlands	90%	DNG	9	49.9	≥100 ha	5	5
					Remnant woodland	10	32.0	≥100 ha	4	4
1610	White Box – Black Cypress Pine shrubby woodland of the Western Slopes	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	67%	Remnant woodland	11	184.6	≥100 ha	5	6
					Regenerating woodland	12	13.1	≥100 ha	3	3

PCT #	PCT Name	Vegetation formation[1]	Vegetation class[1]	% cleared[1]	Condition	Vegetation zone ID	Area (ha)	Patch size	Plots surveyed	Plots required
1614	Grey Gum – Grey Myrtle – Narrow-leaved Stringybark – Rusty Fig open forest on ranges of the Upper Hunter	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Hinterland Dry Sclerophyll Forests	27%	Remnant forest	13	5.0	≥100 ha	2	2
1629	Narrow-leaved Stringybark – Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	1%	Remnant forest	14	250.0	≥100 ha	6	6
1661	Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	50%	Remnant forest	15	3.6	≥100 ha	2	2
1655	Grey Box – Slaty Box shrub – grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	36%	Remnant woodland	16	18.0	≥100 ha	3	3
1656	Narrow-leaved Ironbark – Black Pine – Narrow-leaved Wattle shrub – grass open forest on sandstone slopes of the upper Hunter and Sydney Basin	KF_CH5B Dry Sclerophyll Forests (Shrubby Sub-formation)	Western Slopes Dry Sclerophyll Forests	8%	Remnant forest	17	11.7	≥100 ha	3	3
					Regenerating forest	18	7.3	≥100 ha	3	1
1711	Tantoon – *Lepyrodia leptocaulis* shrubland on sandstone drainage lines of the Sydney Basin	KF_CH5B Dry Sclerophyll Forests (Shrubby Sub-formation)	Western Slopes Dry Sclerophyll Forests	0%	Remnant woodland / shrubland	19	7.4	≥100 ha	3	3
Total							**1,377.2**		**80**	**72**

[1] BioNet Vegetation Classification (DPIE 2021).

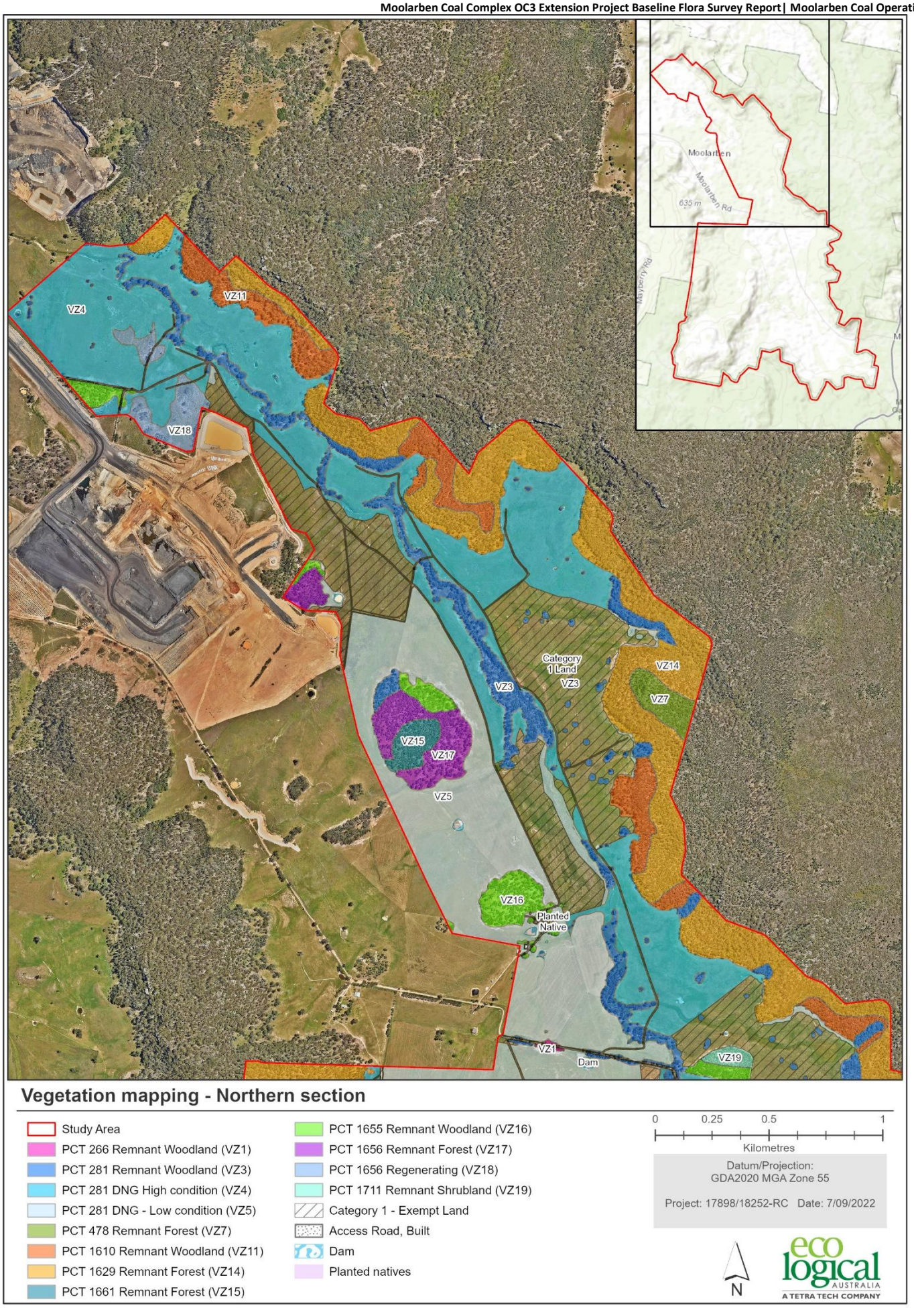

Figure 8: Plant Community Types – northern section

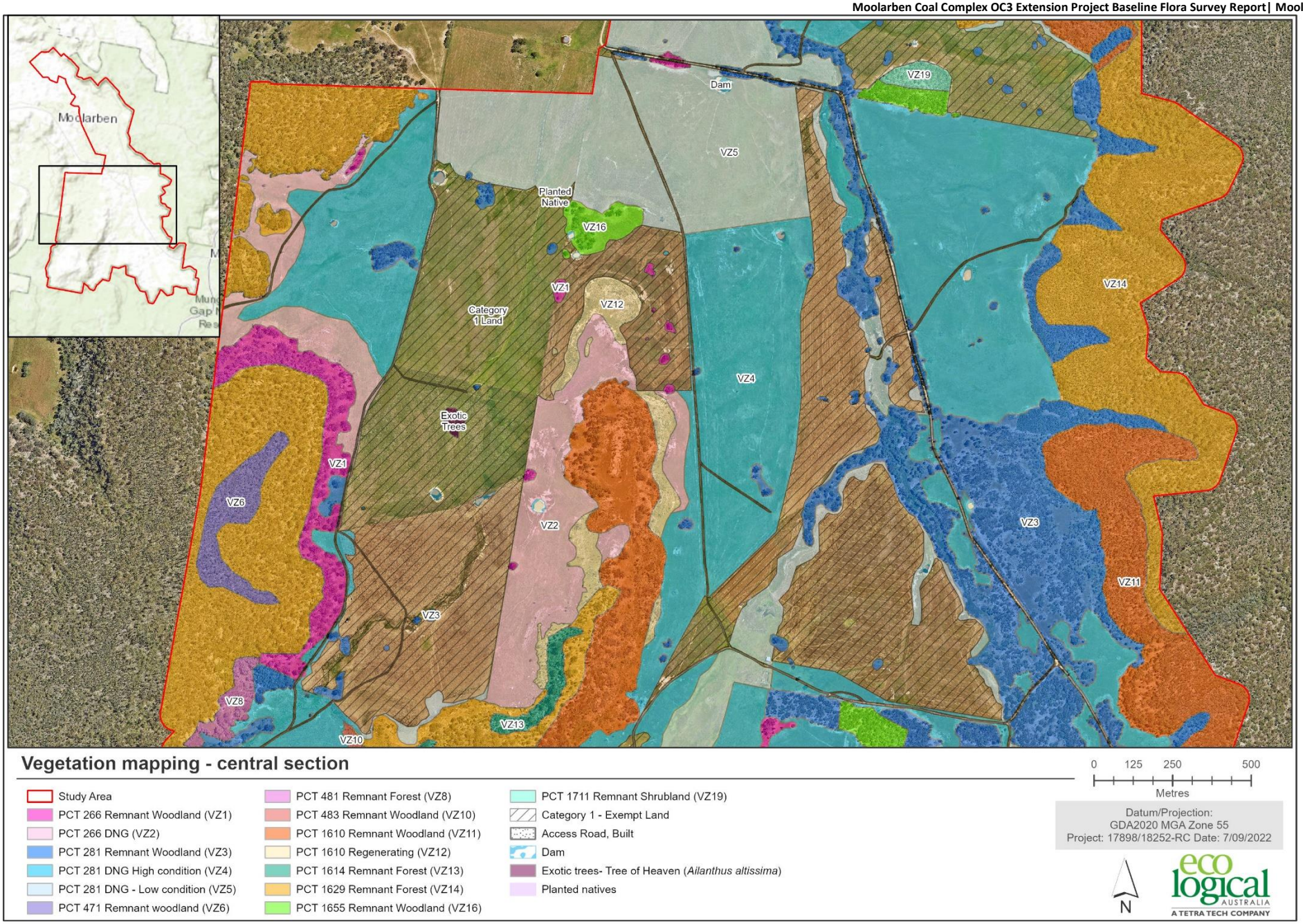

Figure 9: Plant Community Types – central section

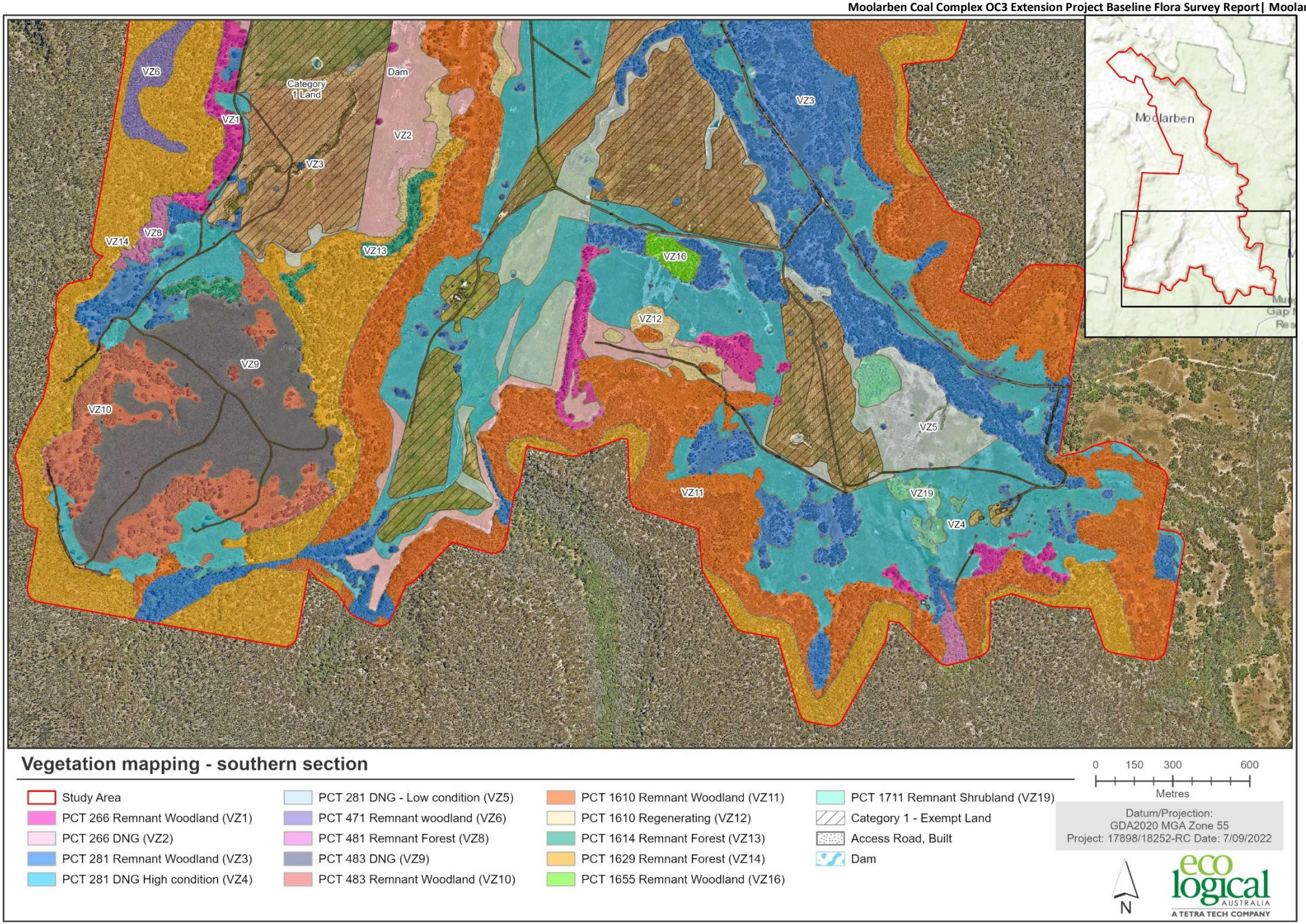

Figure 10: Plant Community Types – southern section

3.1.2.1. PCT 266 – White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion (VZ1 and VZ2)

PCT 266 is present within the Study Area in two (2) condition states:

- Remnant woodland (VZ1)
- DNG (VZ2)

The description of PCT 266 as provided in the NSW BioNet Vegetation Classification (DPIE 2021), and the descriptions of VZ1 and VZ2 are provided in Table 11. Example photographs of VZ1 and VZ2 are provided in Figures 11 to 14 below.

Table 11: PCT 266 BioNet Vegetation Classification description and VZ1 and VZ2 descriptions.

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ1 description	VZ2 description
IBRA Region	Sydney Basin	Sydney Basin	Sydney Basin
IBRA Subregion	Kerrabee	Kerrabee	Kerrabee
NSW (Mitchell) Landscape	Not provided in the NSW BioNet Vegetation Classification.	Upper Goulburn Valleys and Escarpment	Upper Goulburn Valleys and Escarpment
Soil type	Occurs over a large range on many lithologies and a number of soil types. The soils are mainly red-brown earths, red or yellow podsols with some brown and black earths. The soils are derived from a variety of lithologies including shale, limestone, fine grained metamorphic rocks, granite and basalt.	Occurs on fine grained sedimentary rock derived, clay loams.	Occurs on fine grained sedimentary rock derived, clay loams.
Landform position	Hillcrest, valley flat and hillslopes.	Footslopes.	Footslopes.
Structure	Tall woodland with trees to 25 m.	Woodland to open woodland, with trees to 25 m.	DNG with remnant *Eucalyptus albens* and *Brachychiton populneus* subsp. *populneus* present as scattered paddock trees.
Floristic description	Canopy is dominated by White Box (*Eucalyptus albens*) often as the only tree species. *Brachychiton populneus subsp. populneus* (Kurrajong) is often present, particularly on limestone or rocky ground. *Eucalyptus bridgesiana* or *Eucalyptus blakelyi* or *Eucalyptus melliodora* may also be present as minor components of the canopy. The shrub layer is usually sparse or absent depending on grazing history or soil type. Wattles are common shrubs including *Acacia decora, Acacia implexa, Acacia pycnantha, Acacia deanei* subsp. *paucijuga, Acacia genistifolia, Acacia penninervis* var. *penninervis, Acacia buxifolia* subsp. *buxifolia* and *Acacia paradoxa.* Other shrubs include *Dodonaea viscosa* subsp. *cuneata, Bursaria spinosa* subsp. *spinosa* and *Cassinia* spp. The ground cover is usually mid-dense to dense except during drought and may be very diverse in grass and forb species.	The midstorey was sparse (<1% cover) with *Acacia decora* (Western Silver Wattle) and *Acacia implexa* (Hickory) present. Groundcover was dense (>50% cover) and was dominated by *Microlaena stipoides* (Weeping Grass) and *Austrostipa scabra* subsp. *scabra* (Rough Spear Grass). The *Eucalyptus albens* dominated form of PCT 266 demonstrated a relatively high native herb diversity, with *Calotis cuneifolia* (Purple Burr Daisy), *Cynoglossum australe* and *Desmodium varians* (synonym *Grona varians*; Slender Tick-trefoil) consistently recorded across all VI plots.	Isolated *Eucalyptus albens* paddock trees were present throughout this VZ; however, canopy projected foliage cover was 0% across all VI plots. Midstorey was absent within the DNG form of PCT 266. Groundcover was dense and dominated by perennial native grasses including *Aristida ramosa* (Purple Wiregrass), *Austrostipa scabra* subsp. *scabra* and *Bothriochloa macra* (Red Grass). VZ2 also demonstrated a relatively high native herb diversity, with *Calotis lappulacea* (Yellow Burr Daisy), *Oxalis perennans* and *Glycine tabacina* recorded across most VI plots.
Disturbance	In heavily grazed sites fewer native species are present and the sites are dominated by *Austrostipa* spp, *Aristida* spp. and *Austrodanthonia* spp. Grasses with some hardy forbs	Three (3) high threat weeds were recorded throughout the *Eucalyptus albens* dominated form of PCT 266 including *Alternanthera pungens* (Khaki Weed), *Carthamus lanatus*	VZ2 has undergone significant disturbance and likely has a long history of agricultural use including livestock grazing. Four (4) high threat weeds were recorded throughout the

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ1 description	VZ2 description
	such as *Calotis* spp*, Xerochrysum viscosa, Vittadinia cuneata, Wahlenbergia luteola, Solenogyne dominii, Scutellaria humilis* and *Oxalis perennans*.	(Saffron thistle) and *Hypericum perforatum* (St John's wort); however, cover was very low (average 0.1% cover across VI plots).	DNG form of PCT 266 including *Alternanthera pungens, Carthamus lanatus, Hypericum perforatum* and *Paspalum dilatatum* (Paspalum); however, cover was very low (<1% at VI plots).
Associated TECs	PCT 266 is associated with the EPBC Act and BC Act listed CEEC White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin in the BAM-C (OEH 2022) and BioNet Vegetation Classification (DPIE 2021). TEC assessment is provided in Section 3.3 below.		
Other PCTs considered	**PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley** PCT 483 was considered for this VZ due to corresponding landform positions and presence of *Eucalyptus albens*; however, it was excluded from selection based on the substrate and geology listed in the BioNet Vegetation Classification (DPIE 2021) for this PCT (basalt). **PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion** PCT 281 was considered for these VZs due to presence of *Eucalyptus albens,* which is listed as an upper stratum species in the BioNet Vegetation Classification (DPIE 2021). PCT 281 was excluded from selection as PCT 266 demonstrates a more accurate canopy species assemblage as *Eucalyptus melliodora* and *Angophora floribunda* were generally absent from these VZs.		

Figure 11: PCT 266 remnant woodland (VZ1)

Figure 12: PCT 266 remnant woodland (VZ1)

Figure 13: PCT 266 DNG (VZ2)

Figure 14: PCT 266 DNG (VZ2)

3.1.2.2. PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion (VZ3, VZ4 and VZ5)

PCT 281 is present within the Study Area in three (3) condition classes:

- Remnant woodland (VZ3)
- High condition DNG (VZ4)
- Low condition DNG (VZ5)

The description of PCT 281 as provided in the NSW BioNet Vegetation Classification (DPIE 2021), and the descriptions of VZ3, VZ4 and VZ5 are provided in Table 12. Example photographs of VZ3, VZ4 and VZ5 are provided in Figure 15 to Figure 20 below.

Table 12: PCT 281 BioNet Vegetation Classification description and VZ3, VZ4 and VZ5 descriptions.

Attribute	BioNet vegetation classification description (DPIE 2021)	VZ3 Description	VZ4 description	VZ5 description
IBRA Region	Sydney Basin	Sydney Basin	Sydney Basin	Sydney Basin
IBRA Subregion	Kerrabee	Kerrabee	Kerrabee	Kerrabee
NSW (Mitchell) Landscape	Not provided in the NSW BioNet Vegetation Classification.	Upper Goulburn Valleys and Escarpment	Upper Goulburn Valleys and Escarpment	Upper Goulburn Valleys and Escarpment
Soil type	Black, brown and grey alluvial and colluvial clay loam, loam or sandy loam soils derived from a range of substrates.	Clay loam soils.	Clay loam soils.	Clay loam soils.
Landform position	Valley flats and footslopes in valleys in hill landform patterns.	Valley floor and along drainage lines.	Valley floor and along drainage lines.	Valley floor and along drainage lines.
Structure	Tall open forest or woodland with trees up to 30 m high.	Open woodland structure	DNG with isolated and scattered remnant paddock trees.	DNG with isolated and scattered remnant paddock trees.
Floristic description	Canopy is typically dominated by *Angophora floribunda* (Rough-barked Apple) usually with *Eucalyptus blakelyi* (Blakely's Red Gum) or *Eucalyptus melliodora* (Yellow Box). Other tree species may include *Callitris glaucophylla*, *Brachychiton populneus* and various red gum intergrades. *Casuarina cunninghamiana* subsp. *cunninghamiana* (River Oak) may be present but often forms its own riparian community in nearby riverbanks. The shrub layer is sparse or absent in heavily grazed locations. Shrub species may include wattles such *as Acacia implexa*, *Acacia decora, Acacia penninervis* var. *penninervis* and *Acacia deanei. O*ther shrub species may include *Dodonaea viscosa* subsp. *angustifolia, Bursaria spinosa, Olearia elliptica* subsp. *elliptica* and *Hibbertia obtusifolia.*	Dominant canopy species within VZ3 are *Eucalyptus blakelyi* or *Eucalyptus melliodora* and *Angophora floribunda*. The midstorey was generally very sparse and groundcover was dominated by native perennial grass species including *Austrostipa scabra* subsp. *scabra, Microlaena stipoides, Rytidosperma caespitosum* (Ringed Wallaby Grass) and *Sporobolus creber* (Western Rat-tail Grass), again consistent with the PCT 281 description from BioNet.	Isolated *Eucalyptus melliodora, Angophora floribunda* and *Eucalyptus blakelyi* paddock trees were present throughout this VZ; however, canopy projected foliage cover was 0% across all VI plots. The midstorey was absent. Groundcover was dense (>50% cover) and was dominated by *Microlaena stipoides* (Weeping Grass) and *Austrostipa scabra* subsp. *scabra* (Rough Spear Grass) and demonstrated a relatively high native herb diversity, with *Calotis cuneifolia* (Purple Burr Daisy), *Cynoglossum australe* and *Desmodium varians* (synonym *Grona varians*; Slender Tick-trefoil) consistently recorded across all VI plots.	Isolated *Eucalyptus melliodora* and *Eucalyptus blakelyi* paddock trees were present throughout this VZ; however, canopy projected foliage cover was 0% across all VI plots. Midstorey was absent within VZ5. Groundcover was typically sparse and was dominated by native perennial grasses including *Sporobolus creber* and *Eragrostis leptostachya*. Herb species resilient to disturbance were also present, including, *Calotis lappulacea, Oxalis perennans and Dysphania pumilo*.

Attribute	BioNet vegetation classification description (DPIE 2021)	VZ3 Description	VZ4 description	VZ5 description
	The ground cover is usually dense to mid-dense. It includes grass species such as *Austrostipa verticillata, Austrostipa scabra, Arundinella nepalensis, Digitaria breviglumis, Echinopogon* spp.*, Dichelachne micrantha, Poa labillardierei* var. *labillardierei* and *Themeda australis.* The mat-rush *Lomandra longifolia* may be common. Rush *(Juncus* spp.*)* occur along creeks and in depressions along with sedges such as *Carex incomitata*. Forb species include *Swainsona galegifolia, Haloragis heterophylla, Dianella revoluta* var. *revoluta, Ranunculus sessiliflorus* var. *sessiliflorus, Dichondra repens, Epaltes australis, Haloragis heterophylla, Epaltes australis, Calotis cuneifolia, Ajuga australis, Dichondra repens, Scutellaria humilis and Hydrocotyle laxiflora*. Scramblers include *Desmodium brachypodum, Desmodium repens* and *Glycine clandestina.*			
Disturbance	Most of its original extent has been cleared and weeds have invaded many remnants, but some stands remain. Varies greatly with disturbance and over range of its large distribution. In some areas *Eucalyptus blakelyi* has been cut out for fence posts or firewood so *Angophora floribunda* dominates the site. *Angophora floribunda* can regenerate quickly after clearing and dominate sites.	The high threat weeds *Acetosella vulgaris* (Sorrel)*, Bidens subalternans* (Cobblers Pegs)*, Carthamus lanatus, Hypericum perforatum* and *Rosa rubiginosa* (Sweet Briar) were present across VZ3; however, did not contribute significantly to cover (average of 0.2% cover per VI plot).	Many areas of VZ2 are currently subject to livestock grazing. The high threat weeds *Acetosella vulgaris, Bidens subalternans, Carthamus lanatus, Hypericum perforatum, Rosa rubiginosa, Paspalum dilatatum, Xanthium spinosum* (Bathurst Burr) and *Xanthium occidentale* (Noogoora Burr) were present across the DNG form of PCT 281 however, did not contribute significantly to cover (average of 2% cover per VI plot).	Many areas or VZ5 are currently subject to livestock grazing and have been cropped with annual exotic species, such as *Avena sativa* (Oats) within the last 12 months. Despite this, areas within VZ5 do not conform to Category 1 – Exempt Lands as discussed in Section 2.2.2 due to regeneration of native perennial grass species, and native herb diversity.
Associated TECs	PCT 281 is associated with the EPBC Act and BC Act listed CEEC White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin in the BAM-C (OEH 2022) and BioNet Vegetation Classification (DPIE 2021). TEC assessment is provided Section 3.3below.			

Attribute	BioNet vegetation classification description (DPIE 2021)	VZ3 Description	VZ4 description	VZ5 description
Other PCTs considered	**PCT 266 – White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion** PCT 266 was considered for this VZ; however, was excluded as *Eucalyptus albens* is not a dominant canopy component.			

Figure 15: PCT 281 remnant woodland (VZ3)

Figure 16: PCT 281 remnant woodland (VZ3)

Figure 17: PCT 281 DNG (VZ4)

Figure 18: PCT 281 DNG (VZ4)

Figure 19: PCT 281 DNG – Low condition (VZ5)

Figure 20: PCT 281 DNG – Low condition (VZ5)

3.1.2.3. PCT 471 – Dwyer's Red Gum – Black Cypress Pine – ironbark low woodland on sandstone hillcrests in the Dubbo – Gilgandra region, south-western Brigalow Belt South Bioregion (VZ6)

PCT 471 is present within the Study Area in one (1) condition class, remnant woodland (VZ6). The description of PCT 471 as provided in the NSW BioNet Vegetation Classification (DPIE 2021), and the description of VZ6 is provided in Table 13. Example photographs of VZ6 are provided in Figure 21 and Figure 22 below.

Table 13: PCT 471 BioNet Vegetation Classification description and VZ6 description.

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ6 description
IBRA Region	NSW South Western Slopes, Brigalow Belt South, Darling Riverine Plains.	Sydney Basin. PCT 471 does not occur in the Sydney Basin IBRA Region and Kerrabee IBRA Sub-region; however, does occur in the adjoining Brigalow Belt South IBRA Region and Pilliga IBRA Subregion, located approximately 25 km to the north of the occurrence of VZ6. PCTs containing the dominant canopy species of VZ6 (*Eucalyptus dwyeri* and *Eucalyptus beyeriana*) are poorly represented within the NSW BioNet Vegetation Classification (DPIE 2021). These canopy species are better represented in PCTs outside of the Kerrabee IBRA Subregion. Further justification for selecting a PCT from an adjoining IBRA Subregion is provided below.
IBRA Subregion	Inland Slopes, Talbragar Valley, Castlereagh-Barwon and Pilliga.	Kerrabee. The occurrence of VZ6 is approximately 1 km to the west of the Inland Slopes IBRA Subregion.
NSW (Mitchell) Landscape	Not provided on NSW BioNet Vegetation Classification.	Upper Goulburn Valleys and Escarpment.
Soil type	Occurs on yellow to orange sandy soil derived from Pilliga Sandstone.	Reddish to yellow sandy loam soils.
Landform position	Sandstone hillcrests.	Sandstone plateau and hillcrests.
Structure	Low to mid high mallee shrubland.	Low open woodland / shrubland.
Floristic description	Canopy is dominated by *Eucalyptus dwyeri* (Dwyer's Red Gum) with a mid-dense shrub cover. Other trees may include the Ironbarks, *Eucalyptus beyeriana* (Beyer's Ironbark) or *Eucalyptus nubila x fibrosa* (Blue-leaved Ironbark) and *Callitris endlicheri* (Black Cypress Pine)). The shrub layer is sparse to mid-dense and includes *Allocasuarina diminuta* subsp. *diminuta, Grevillea arenaria* subsp. *arenaria, Xanthorrhoea johnsonii, Acacia sertiformis, Ozothamnus diosmifolius, Boronia glabra* and *Hibbertia incana.* The ground cover is sparse and often dominated by bare soil or rock. Grass species include *Aristida jerichoensis* var. *jerichoensis, Entolasia stricta and Austrostipa densiflora.* The mat-rush *Lomandra multiflora* subsp. *multiflora* and rock fern *Cheilanthes sieberi* subsp. *sieberi* are usually present along with the sedge *Lepidosperma laterale.* Forb species include *Stypandra glauca, Pomax umbellata, Xerochrysum viscosa* and *Dampiera lanceolata* var. *lanceolata.*	VZ6 was dominated by canopy species *Eucalyptus beyeriana, Callitris endlicheri, Eucalyptus dwyeri* and *Eucalyptus punctata* (Grey Gum). These characteristic canopy species demonstrated a low (<10 m in height) open woodland structure consistent with PCT 471. The midstorey within areas of PCT 471 were dominated by a moderately dense cover (approximately 15% cover) of *Leucopogon muticus* (Blunt Beard-heath), *Phebalium squamulosum* (Scaly Phebalium), *Persoonia linearis* (Narrow-leaved Geebung) and *Sannantha cunninghamiana.* Small patches of PCT 471 graded into a heathier structure with *Leptospermum polygalifolium* (Tantoon) and *Calytrix tetragona* (Common Fringe-myrtle) more dominant in these areas, which is indicative of impeded drainage associated with shallow bedrock. A sparse ground stratum was dominated by *Lepidosperma laterale, Pomax umbellata, Lomandra glauca* (Pale Mat-rush) and *Entolasia stricta* (Wiry Panic).
Disturbance		This PCT demonstrated little evidence of disturbance, with no logging, grazing or historical clearing evident. Evidence of bushfire was present within the northern section of VZ6 with fire scarring on stags present

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ6 description
		throughout the VZ, and the high cover of *Leucopogon muticus* and *Phebalium squamulosum* a likely result of bushfire. It is estimated that this fire would have occurred more than 10 years ago. No high threat weeds were recorded across this VZ.
Associated TECs	PCT 471 is not associated with any TECs in the BAM-C (OEH 2022) or BioNet Vegetation Classification (DPIE 2021).	
Other PCTs considered	**PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine – stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion** PCT 479 was excluded from selection for this VZ due to the dominance of *Eucalyptus punctata* within this VZ. PCT 479 is mapped within the region outside of the Study Area; however, a distinct boundary exists between *Eucalyptus crebra* dominated forest (VZ4 PCT 479) on the surrounding plateaus to the *Eucalyptus punctata* dominated forest (VZ6 PCT 471) on the slopes and flats present within the Study Area. To the east of the Study Area, PCT 479 is dominated by *Eucalyptus crebra, Acacia linearifolia* and *Callitris endlicheri* (MCO 2022b). There is only one (1) PCT which contains *Eucalyptus beyeriana* within the Kerrabee IBRA Subregion. This PCT is PCT 467 Blue-leaved Ironbark – Black Cypress Pine shrubby sandstone open forest in the southern Brigalow Belt South Bioregion. PCT 467 is dominated by *Eucalyptus nubila* (Blue-leaved Ironbark) with *Callitris endlicheri* (DPIE 2021). VZ6 was dominated by *Eucalyptus dwyeri* and *Eucalyptus beyeriana,* which is better represented by PCT 471.	

Figure 21: PCT 471 remnant woodland (VZ6)

Figure 22: PCT 471 remnant woodland (VZ6)

3.1.2.4. PCT 478 – Red Ironbark – Black Cypress Pine – stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong – Mendooran region, southern Brigalow Belt South Bioregion

PCT 478 is present within the Study Area in one (1) condition class, remnant forest (VZ7). The description of PCT 478 as provided in the NSW BioNet Vegetation Classification (DPIE 2021), and the description of VZ7 is provided in Table 14. Example photographs of VZ7 are provided in Figure 23 and Figure 24 below.

Table 14: PCT 478 BioNet Vegetation Classification description and VZ7 description.

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ7 description
IBRA Region	Sydney Basin	Sydney Basin
IBRA Subregion	Kerrabee	Kerrabee
NSW (Mitchell) Landscape	Not listed	Upper Goulburn Valleys and Escarpment.
Soil type	Occurs sandy loam to clayey soils derived from sandstone, siltstone, shale or slate.	Shallow sand to sandy loams derived from sandstone and conglomerate.
Landform position	Footslopes, hillcrests and hillslopes in hill and low hill landform patters.	Hillslopes and crests associated with the broader escarpment landform pattern present within the Study Area
Structure	Mid-high to tall open forest.	Open forest.
Floristic description	Co-dominated by *Eucalyptus fibrosa* (Red Ironbark), *Callitris endlicheri* (Black Cypress Pine), *Eucalyptus macrorhyncha (*Red Stringybark), and/or *Eucalyptus punctata* (Narrow-leaved Stringybark) the small tree *Acacia linearifolia* (Narrow-leaved Wattle). The shrub layer is sparse and includes *Phyllanthus hirtellus* (Thyme Spurge), *Brachyloma daphnoides subsp. daphnoides* (Daphne Heath), *Hibbertia obtusifolia* (Hoary Guinea Flower), *Melichrus urceolatus* (Urn Heath), *Cassinia laevis* (Cough Bush), *Persoonia linearis* (Geebung), *Pultenaea microphylla, Dillwynia sieberi, Hibbertia circumdans, Olearia microphylla, Acacia uncinata, Indigofera australis, Lissanthe strigosa* subsp. *strigosa* (Peach Heath), *Bursaria spinosa* subsp. *spinosa* (Blackthorn) and *Ozothamnus diosmifolius*. The ground cover is mid-dense to sparse. The small shrubs *Platysace ericoides* and *Astroloma humifusa* (Native Cranberry) are often present. Grasses include *Joycea pallida* (syn. *Rytidosperma pallidum*) and *Rytidosperma racemosa*. The mat-rushes include *Lomandra filiformis* (Wattle Mat-rush), *Lomandra confertifolia* (Mat-rush) and *Lomandra multiflora* (Many-flowered Mat-rush) along with the sedge *Lepidosperma laterale*. Forb species include *Pomax umbellata, Chrysocephalum semipapposum* (Clustered Everlasting), *Goodenia hederacea* subsp. *hederacea* (Forest Goodenia), *Veronica plebeia,* and *Stypandra glauca* (Nodding Blue Lily).	VZ7 was dominated by canopy species *Eucalyptus fibrosa* (Broad-leaved Ironbark), *Eucalyptus sparsifolia* (Narrow-leaved Stringybark), *Eucalyptus punctata* and *Callitris endlicheri*. Midstorey cover was variable across VI plots and ranged from 4% to 25% cover comprised of *Leucopogon muticus, Persoonia linearis* and *Phebalium squamulosum.* Groundcover was sparse (<5% cover) and consisted of widely spaced *Cleistochloa rigida* tussocks, *Lomandra multiflora* subsp. *multiflora* (Many-flowered Mat-rush) and *Lepidosperma laterale.*
Disturbance		VZ7 showed signs of small-scale historical logging of *Eucalyptus fibrosa* and *Eucalyptus sparsifolia.* Grazing pressure may have also impacted on the condition of this PCT, with sheep grazing and livestock camps observed within the VZ. Overall, this PCT is in good condition. No high threat weeds were recorded across this VZ.
Associated TECs	PCT 478 is not associated with any TECs in the BAM-C (OEH 2022) or BioNet Vegetation Classification (DPIE 2021).	

Attribute	BioNet Vegetation Classification description (DPIE 2021) VZ7 description
	VZ7 does not conform to any TECs listed under the BC Act and/or the EPBC Act.
Other PCTs considered	**PCT 479 – Narrow-leaved Ironbark- Black Cypress Pine – stringybark +/- Grey Gum +/- Narrow-leaved Wattle shrubby open forest on sandstone hills in the southern Brigalow Belt South Bioregion and Sydney Basin Bioregion** PCT 479 was excluded from selection for this VZ due to the dominance of *Eucalyptus fibrosa* within this VZ. PCT 479 is mapped within the region outside of the Study Area; however, a distinct boundary exists between *Eucalyptus crebra* dominated forest (PCT 479) on the surrounding plateaus to the *Eucalyptus fibrosa* dominated forest (VZ7 PCT 478) on the slopes present within the Study Area. To the east of the Study Area, PCT 479 is dominated by *Eucalyptus crebra, Acacia linearifolia* and *Callitris endlicheri* (MCO 2022b).

Figure 23: PCT 478 remnant forest (VZ7)

Figure 24: PCT 478 remnant forest (VZ7)

3.1.2.5. PCT 481 – Rough-barked Apple – Blakely's Red Gum – Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region (VZ8)

PCT 481 is present within the Study Area in one (1) condition class, remnant forest (VZ8). The description of PCT 481 as provided in the NSW BioNet Vegetation Classification (DPIE 2021), and the description of VZ8 is provided in Table 15. Example photographs of VZ8 are provided in Figure 25 and Figure 26 below.

Table 15: PCT 481 BioNet Vegetation Classification description and VZ8 description.

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ8 description
IBRA Region	Sydney Basin	Sydney Basin
IBRA Subregion	Kerrabee	Kerrabee
NSW (Mitchell) Landscape	Not provided in the NSW BioNet Vegetation Classification.	Upper Goulburn Valleys and Escarpment
Soil type	Occurs on alluvial sands or loam soil derived mainly from sandstone.	Colluvial sandy loams derived from sandstone.
Landform position	Hill or low hill landforms.	Sheltered gullies associated with sandstone escarpment.
Structure	Tall open forest to woodland.	Open forest.
Floristic description	Dominated by *Eucalyptus blakelyi* with *Eucalyptus punctata* grading upslope into *Eucalyptus crebra, Eucalyptus sparsifolia, Acacia linearifolia* and *Callitris endlicheri.* Shrubs are sparse and include *Styphelia triflora, Hibbertia obtusifolia, Persoonia linearis* and *Xanthorrhoea johnsonii.* The ground cover is very sparse and bare in creek beds. Grasses include *Microlaena stipoides* var. *stipoides, Echinopogon caespitosus, Echinopogon ovatus, Imperata cylindrica* var. *major, Arundinella nepalensis* and *Lachnagrostis filiformis.* Forbs include *Dichondra repens, Persicaria prostrata, Hydrocotyle laxiflora, Geranium solanderi* var. *solanderi, Poranthera microphylla, Rorippa laciniata, Rumex brownii, Urtica incisa, Sigesbeckia australiensis, Veronica plebeia* and *Geranium potentilloides* var. *potentilloides.* The rock fern *Cheilanthes sieberi* subsp. *sieberi* and the tall ferns *Pyridium esculentum* or *Pteris tremula* also occur. The sedge *Carex appressa* and *rush Juncus psammophilus* may be present.	VZ8 is dominated by canopy species *Eucalyptus punctata* and *Angophora floribunda. Eucalyptus blakelyi* and *Eucalyptus sparsifolia* were also present in low densities throughout this VZ. The midstorey was moderately dense (approximately 30 to 70% cover) and was dominated by ferns species, *Todea barbara* (King Fern), *Pteridium esculentum* (Bracken Fern) and *Histiopteris incisa* (Bat's-wing Fern). Groundcover was sparse, and where present, consisted of *Microlaena stipoides* and *Cyperus gracilis* (Slender Flat sedge).
Disturbance		Evidence of recent fire history (<5 years old) was present throughout this VZ. No high threat weeds were recorded across this VZ.
Associated TECs	PCT 481 is not associated with any TECs in the BAM-C (OEH 2022) or BioNet Vegetation Classification (DPIE 2021).	
Other PCTs considered	**PCT 281 – Rough-Barked Apple – red gum – Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion** PCT 281 was considered due to presence of *Angophora floribunda*. PCT 281 was excluded due to the dominance of *Eucalyptus punctata* and absence of *Eucalyptus blakelyi* within this VZ.	

Figure 25: PCT 481 remnant forest (VZ8)

Figure 26: PCT 481 remnant forest (VZ8)

3.1.2.6. PCT 483 – Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley (VZ9 and VZ10)

PCT 483 is present within the Study Area in two (2) condition states:

- DNG (VZ9)
- Remnant woodland (VZ10).

The description of PCT 483 as provided in the NSW BioNet Vegetation Classification (DPIE 2021), and the descriptions of VZ9 and VZ10 are provided in Table 16. Example photographs of VZ9 and VZ10 are provided in Figure 26 to Figure 30 below.

Table 16: PCT 483 BioNet Vegetation Classification description and, VZ9 and VZ10 descriptions.

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ9 description	VZ10 description
IBRA Region	NSW South Western Slopes, Brigalow Belt South	Sydney Basin	Sydney Basin
IBRA Subregion	Inland Slopes, Talbragar Valley, Liverpool Range, Pilliga, Capertee Valley.	Kerrabee PCT 483 is not listed as occurring throughout the Sydney Basin IBRA Region or Kerrabee IBRA Subregion; however, does occur throughout the adjoining NSW South Western Slopes IBRA Region and Inland Slopes IBRA Subregion, located approximately 3 km to the west.	Kerrabee PCT 483 is not listed as occurring throughout the Sydney Basin IBRA Region or Kerrabee IBRA Subregion; however, does occur throughout the adjoining NSW South Western Slopes IBRA Region and Inland Slopes IBRA Subregion, located approximately 3 km to the west.
NSW (Mitchell) Landscape	Not provided in the NSW BioNet Vegetation Classification.	Upper Goulburn Valleys and Escarpment	Upper Goulburn Valleys and Escarpment
Soil type	Brown to black earth, chocolate loam to clay soils derived from basalt.	Brown to black loam to clay soils derived from basalt, with rock content increasing on slopes.	Brown to black earth, chocolate loam to clay soils derived from basalt.
Landform position	Hillslopes, hillcrests, footslopes and valley flats on rolling hills and low hills.	Hillslopes, hillcrests and gullies associated with basalt intrusion in South West section of the Study Area. Steep slopes (>20 °).	Hillslopes, hillcrests and gullies associated with basalt intrusion in South West section of the Study Area,
Structure	Mid-high to tall open woodland.	Open woodland.	DNG with scattered isolated *Eucalyptus albens* trees.
Floristic description	Dominated by a Grey Box (*Eucalyptus moluccana*) x White Box (*Eucalyptus albens*) hybrid forming a *Eucalyptus albens* <-> *moluccana* intermediate taxon. The trees tend to be closer to Grey Box than White Box over most of this region. Few other tree species occur with Rough-barked Apple (*Angophora floribunda*) and Yellow Box (*Eucalyptus melliodora*) occurring on footslopes and valley flats. Shrubs are absent or very sparse and include *Sclerolaena muricata, Sida trichopoda* and *Pimelea curviflora var. curviflora*. The ground cover is dense after rain but mid-dense to sparse in dry times. Grass species include *Austrostipa bigeniculata, Bothriochloa macra, Austrostipa aristiglumis, Elymus scaber* var. *scaber, Cynodon dactylon* and *Panicum queenslandicum* var. *queenslandicum*. The sedge *Cyperus gracilis* may be present. Forb species include *Boerhavia dominii, Oxalis perennans, Chamaesyce drummondii, Hibiscus trionum, Einadia nutans* subsp. *nutans, Asperula conferta, Rumex brownii, Mentha*	PCT 483 remnant woodland (VZ10) is dominated by *Angophora floribunda,* however; *Eucalyptus albens* is one of the most common overstorey species. *Angophora floribunda* can regenerate quickly after disturbance and dominate sites (DPIE 2021), as evidenced by high numbers of individuals of similar stem diameters (i.e 20-40 cm DBH). *Angophora floribunda* is a dominant species – a species which, because of its life-form and frequency, dominates the other members of the community in the sense that it conditions the habitats of its associates (Beadle Costin 1952). *Eucalyptus albens* is present throughout this VZ in lower densities compared to *Angophora floribunda*; however, *Eucalyptus albens* is also a dominant species. *Brachychiton populneus* subsp. *populneus* (Kurrajong) was also present. Groundcover was high throughout (average 39%); however, the cover of native grasses was generally lower compared to the DNG form of PCT 483 (average 61%). The DNG form of PCT 483 also demonstrated a relatively high native herb	*Eucalyptus albens* paddock trees growing on chocolate clay loams derived from a basalt intrusion in the south western section of the Study Area. This VZ was generally restricted to areas of flat to gently undulating topography. Due to landscape position and deeper soils with lower rock context, this VZ would have been dominated by *Eucalyptus albens* prior to clearing and there is no evidence supporting the historical presence or dominance of *Angophora floribunda* within this VZ. Midstorey and canopy was absent from this VZ. Groundcover was dense and dominated by perennial native grasses including *Aristida ramosa, Austrostipa scabra* subsp. *scabra* and *Bothriochloa macra*. This VZ also demonstrated a relatively high native herb diversity, with *Cymbonotus lawsonianus, Oxalis perennans* and *Glycine tabacina* consistently recorded across all VI plots.

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ9 description	VZ10 description
	diemenica, Geranium solanderi var. *solanderi* and *Calotis lappulacea*.	diversity, with *Asperula conferta* (Common Woodruff), *Oxalis perennans* and *Desmodium varians* consistently recorded across all VI plots.	
Disturbance	Threatened by fragmentation, weed invasion, tree dieback and intensive agricultural development of ground cover.	This VZ has undergone significant disturbance and has been subject to long term agricultural grazing. Historic aerial imagery indicates that the apparent condition of this VZ has not changed from 1960 compared to present day. The presence of high numbers of *Angophora floribunda* individuals of similar stem diameters (i.e 20-40 cm DBH) and relatively high cover of the shrub species *Bursaria spinosa* (Blackthorn) indicates that this VZ is likely to have been significantly disturbed and may be a result of high agricultural grazing pressure, bushfire or selective thinning. Hardwood stumps which are likely to be *Eucalyptus albens,* are present throughout this VZ. Three (3) high threat weeds were recorded throughout this VZ including *Bidens subalternans, Carthamus lanatus* and *Hypericum perforatum*; however, cover of high threat weeds was low (average 5% cover across VI plots).	This VZ has undergone significant disturbance and likely has a long history of agricultural use including livestock grazing and cropping. Three (3) high threat weeds were recorded throughout the DNG form of PCT 483 including *Bidens subalternans, Carthamus lanatus* and *Xanthium spinosum*; however, cover was very low (<0.2% at VI plots).
Associated TECs	PCT 483 is associated with the EPBC Act and BC Act listed CEEC White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin in the BAM-C (OEH 2022)and BioNet Vegetation Classification (DPIE 2021). TEC assessment is provided in Section 3.3 below.		
Other PCTs considered	**PCT 266 – White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion** PCT 266 was considered for VZ10 due to the presence of *Eucalyptus albens* and *Brachychiton populneus* subsp. *populneus;* however, it was excluded from selection due to geology and soil type, which more closely aligns with PCT 483. **PCT 274 – White Box – Rough-barked Apple alluvial woodland of the NSW central western slopes including in the Mudgee region** PCT 274 was considered for these VZs due to the presence of *Eucalyptus albens* and *Angophora floribunda.* This PCT was excluded due to differing lithology (shale, colluvial and alluvial sediments) compared to the VZs (rocky basalt clay loam soils).		

Figure 27: PCT 483 remnant woodland (VZ10)

Figure 28: PCT 483 remnant woodland (VZ10)

Figure 29: PCT 483 DNG (VZ9)

Figure 30: PCT 483 DNG (VZ9)

3.1.2.7. PCT 1610 – White Box – Black Cypress Pine shrubby woodland of the Western Slopes (VZ11 and VZ12)

PCT 1610 is present throughout the Study Area in two (2) condition classes:

- Remnant woodland (VZ11)
- Regenerating woodland (VZ12)

The description of PCT 1610 as provided in the NSW BioNet Vegetation Classification (DPIE 2021), and the descriptions of VZ11 and VZ12 are provided in Table 17. Example photographs of VZ11 and VZ12 are provided in Figure 31 to Figure 34 below.

Table 17:PCT 1610 BioNet Vegetation Classification description, and VZ11 and VZ12 descriptions.

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ11 description	VZ12 description
IBRA Region	Sydney Basin	Sydney Basin	
IBRA Subregion	Kerrabee	Kerrabee	
NSW (Mitchell) Landscape	Not listed.	Upper Goulburn Valleys and Escarpment.	Upper Goulburn Valleys and Escarpment.
Soil type	Not listed.	Clay loam to sandy loams derived from shale/slate.	Clay loam to sandy loams derived from shale/slate.
Landform position	Not listed.	Footslopes and shaley ridges.	Footslopes and shaley ridges.
Structure	Woodland	Open woodland to forest.	Shrubland to DNG with scattered, remnant *Eucalyptus albens* trees.
Floristic description	Characterised by a canopy strongly dominated by *Eucalyptus albens* in association with *Callitris endlicheri.* The midstorey consists of an open shrub layer typically dominated by *Cassinia sifton*. The ground layer is typically a mix of grasses with various forbs and graminoids including *Rytidosperma racemosa, Austrostipa scabra, Aristida ramosa, Microlaena stipoides, Dichondra repens, Einadia hastata, Einadia nutans, Veronica plebeia, Vittadinia cuneata* (Fuzz Weed)*, Calotis lappulacea* (Yellow Burr-daisy)*, Lomandra filiformis* and *Cheilanthes sieberi* (Rock Fern).	Dominated by canopy species *Eucalyptus albens* and *Callitris endlicheri*. The midstorey cover was variable (range 0.3% to 8% cover), and was dominated by *Bursaria spinosa, Cassinia sifton* (Sifton Bush) and *Acrotriche rigida*. Groundcover was also variable (range 1.4% to 83.9% cover), however the native grasses, *Microlaena stipoides, Paspalidium distans* and *Rytidosperma caespitosum* contributed substantially to groundcover and were recorded across most VI plots.	Contains *Eucalyptus albens* paddock trees and regenerating individuals and regenerating *Bursaria spinosa*. Midstorey was consistently dominated by *Bursaria spinosa* across VI plots. *Bursaria spinosa* is a pioneer species indicative of previous disturbance, such as land clearing.
Disturbance		Evidence of previous disturbance was minimal; however, livestock grazing was evident in some areas. Some areas containing dense *Bursaria spinosa* and *Cassinia sifton* may have also undergone historical disturbance given the propensity for these species to respond favourably to disturbance. The high threat weeds *Hypericum perforatum* and *Opuntia stricta* var. *stricta* (Common Prickly Pear) were present across this VZ however, did not contribute significantly to cover (average of 0.5% cover per VI plot).	This VZ has been previously cleared of midstorey and canopy stratum and is surrounded by Category 1 – Exempt Land. The high threat weeds *Carthamus lanatus* and *Hypericum perforatum* were present across Vegetation Zone 11; however, did not contribute significantly to cover (average of 0.2% cover per VI plot).
Associated TECs	PCT 1610 is not associated with any TECs in the BAM-C (OEH 2022) or BioNet Vegetation Classification (DPIE 2021).		
Other PCTs considered	**PCT 1606 – White Box – Narrow-leaved Ironbark – Blakely's Red Gum shrubby open forest of the central and upper Hunter** PCT 1606 was excluded from selection due to VZs 11 and 12 lacking *Eucalyptus crebra* and *Eucalyptus blakelyi*, which are listed as characteristic canopy species within PCT 1606. PCT 1606 is also categorised as North-west Slopes Dry Sclerophyll Forest and this VZ is more consistent with Western Slopes Dry Sclerophyll Forests in accordance with Keith (2004).		

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ11 description	VZ12 description
	PCT 266 – White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion		
	PCT 266 was considered due to the presence of *Eucalyptus albens* and *Brachychiton populneus;* however, was excluded from selection due to the differing vegetation structure and high shrub cover. This VZ is consistent with a Western Slopes Dry Sclerophyll Forest in accordance with Keith (2004) and the NSW BioNet Vegetation Classification (DPIE 2021). PCT 266 is categorised as a Western Slopes Grassy Woodland in the NSW BioNet Vegetation Classification (DPIE 2021).		

Figure 31: PCT 1610 remnant woodland (VZ11)

Figure 32: PCT 1610 remnant woodland (VZ11)

Figure 33: PCT 1610 regenerating woodland (VZ12)

Figure 34: PCT 1610 regenerating woodland (VZ12)

3.1.2.8. PCT 1614 – Grey Gum – Grey Myrtle – Narrow-leaved Stringybark – Rusty Fig open forest on ranges of the Upper Hunter (VZ13)

PCT 1614 is present throughout the Study Area in one (1) condition class, remnant forest (VZ13). The description of PCT 1614 as provided in the NSW BioNet Vegetation Classification (DPIE 2021), and the description of VZ13 is provided in Table 18. Example photographs of VZ13 are provided in Figure 35 and Figure 36 below.

Table 18: PCT 1614 BioNet Vegetation Classification description and VZ13 description.

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ13 description
IBRA Region	Sydney Basin	Sydney Basin
IBRA Subregion	Kerrabee	Kerrabee
NSW (Mitchell) Landscape	Werris Creek Basalt Hills and Valleys, Mount Royal Ridges, Slippery Rock Ridges, Manning Great Escarpment Southern Aspects, Liverpool Range Valleys and Footslopes, Manning Great Escarpment Western Aspects, Upper Hunter Channels and Floodplain, Scone – Gloucester Foothills, Central Hunter Foothills, Breeza Hills Sandstone-Shale Sheltered Slopes.	PCT 1614 is not listed on BioNet as occurring within the NSW (Mitchell) Landscapes of the Study Area (Wollemi Ranges, Upper Goulburn Valleys and Escarpment or the Gulgong Ranges); however, it is listed as occurring throughout the Lees Pinch Foothills NSW Landscape which occurs approximately 8 km to the northeast of the occurrence of PCT 1614 within the Study Area.
Soil type	Not listed.	Shallow sandy clay loam
Landform position	Sandstone ranges.	Sandstone escarpment at the interface of the basalt and sandstone.
Structure	Open forest.	Open forest.
Floristic description	Canopy is dominated by *Eucalyptus punctata*. The midstorey consists of small trees, sparse shrubs and scattered climbers. Epiphytic ferns are also common. The ground layer is typically a mix of grasses and ferns with scattered forbs. Sheltered sites on sandstone ranges of the Wingen area in the upper Hunter Valley at mid elevations.	*Ficus rubiginosa* dominated forest on sandstone escarpment and associated vegetated scree slope. Other canopy species include *Eucalyptus punctata, Eucalyptus sparsifolia, Brachychiton populneus* and *Angophora floribunda.* Midstorey was very sparse to absent and was comprised of *Acacia implexa,* regenerating *Ficus rubiginosa* (Rusty Fig) and *Cassinia quinquefaria.* Groundcover was generally sparse immediately underneath *Ficus rubiginosa* canopy; however, more open areas were more congruous for groundcover. Groundcover was comprised of *Microlaena stipoides, Asperula conferta* and fern species *Cheilanthes sieberi* (Rock Fern)*, Cheilanthes distans* (Bristly Cloak Fern) and *Anogramma leptophylla* (Annual Fern).
Disturbance		There was little to no evidence of disturbance. Only one (1) high threat weed, *Bidens subalternans,* was recorded within this VZ (average of 0.1% cover per VI plot).
Associated TECs	PCT 1614 is not associated with any TECs in the BAM-C (OEH 2022)or BioNet Vegetation Classification (DPIE 2021). This VZ does not conform to any TECs listed under the BC Act and/or the EPBC Act.	
Other PCTs considered	No other PCTs were considered for this VZ, as PCT 1614 is the only PCT in which *Ficus rubiginosa* (Rusty Fig) is listed as a characteristic canopy species within the Sydney Basin IBRA Region.	

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ13 description
	Species such as *Backhousia myrtifolia, Clerodendrum tomentosum* and *Pittosporum undulatum* which are listed as midstorey stratum in the BioNet Vegetation Classification (DPIE 2021) were absent from PCT 1614. Based on ELA's professional experience, these species are more commonly recorded in areas of higher rainfall and to the east of the Great Dividing Range. Despite the absence of these midstorey species, PCT 1614 fits this VZ due to the landscape position, structure, and canopy species present.	

Figure 35: PCT 1614 remnant forest (VZ13)

Figure 36: PCT 1614 remnant forest (VZ13)

3.1.2.9. PCT 1629 – Narrow-leaved Stringybark – Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin (VZ14)

PCT 1629 is present within the Study Area in one (1) condition class, remnant forest (VZ14). The description of PCT 1629 as provided in the NSW BioNet Vegetation Classification (DPIE 2021), and the description of VZ14 is provided in Table 19. Example photographs of VZ14 are provided in Figure 37 and Figure 38 below.

Table 19: PCT 1629 BioNet Vegetation Classification description and VZ14 description.

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ14 description
IBRA Region	Sydney Basin	Sydney Basin
IBRA Subregion	Kerrabee	Kerrabee
NSW (Mitchell) Landscape	Upper Goulburn Valleys and Escarpment	Upper Goulburn Valleys and Escarpment
Soil type	Not listed.	Shallow sand to sandy loam
Landform position	Sandstone ridges and upper slopes.	Sandstone ridges, slopes and escarpment.
Structure	Shrubby open forest.	Open forest.
Floristic description	The canopy is dominated by *Eucalyptus punctata* and *Eucalyptus sparsifolia.* Characteristic midstorey species include *Persoonia linearis, Podolobium ilicifolium* (Prickly Shaggy-Pea) and *Exocarpos*	Dominated by canopy species *Eucalyptus sparsifolia* and *Eucalyptus punctata.* Midstorey was generally sparse (<10% cover) and was dominated by *Podolobium ilicifolium* (Prickly Shaggy Pea),

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ14 description
	strictus (Dwarf Cherry Balart). Characteristic groundcover species include *Entolasia stricta* (Wiry Panic), *Lomandra confertifolia, Lomandra filiformis, Dianella caerulea, Dianella revoluta* and *Lepidosperma laterale.*	*Leucopogon muticus* and *Persoonia linearis.* Groundcover was generally low (<5%) and was dominated by *Lomandra confertifolia, Cleistochloa rigida* and *Lepidosperma laterale.*
Disturbance		This VZ showed signs of small-scale historical logging of *Eucalyptus sparsifolia*. Grazing pressure may also be impacted on the condition of this PCT, with livestock camps observed within the VZ. Overall, this PCT is in good condition. Four (4) high threat weeds were recorded across this VZ including *Carthamus lanatus, Eragrostis curvula* (African Lovegrass), *Hypericum perforatum* and *Paspalum dilatatum* (average <1% cover across VI plots).
Associated TECs	PCT 1629 is not associated with any TECs in the BAM-C (OEH 2022) or BioNet Vegetation Classification (DPIE 2021). This VZ does not conform to any TECs listed under the BC Act and/or the EPBC Act.	
Other PCTs considered	**PCT 1669 – Red Ironbark – Grey Gum – Narrow-leaved Stringybark – Brown Bloodwood shrubby open forest on sandstone ranges of the Sydney Basin** Canopy species *Eucalyptus fibrosa* and *Corymbia trachyphloia*, which are listed as characteristic canopy species throughout PCT 1669, were not present within this VZ.	

Figure 37: PCT 1629 remnant forest (VZ14)

Figure 38: PCT 1629 remnant forest (VZ14)

3.1.2.10. PCT 1661 – Narrow-leaved Ironbark – Black Pine – Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin (VZ15)

PCT 1661 is present within the Study Area in (1) condition state, remnant forest (VZ15). The description of PCT 1661 as provided in the NSW BioNet Vegetation Classification (DPIE 2021), and the description of VZ15 is provided in Table 20. Example photographs of VZ15 are provided in Figure 39 and Figure 40 below.

Table 20: PCT 1661 BioNet Vegetation Classification description and VZ15 description.

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ15 description
IBRA Region	Sydney Basin	Sydney Basin
IBRA Subregion	Kerrabee	Kerrabee
NSW (Mitchell) Landscape	Upper Goulburn Valleys and Escarpment	Upper Goulburn Valleys and Escarpment
Soil type	Not listed.	Clay loams.
Landform position	Sandstone hills. Elevation ranges from about 250 to 500m.	Low sandstone/shale rises.
Structure	Open forest.	Open forest.
Floristic description	Ironbark Open Forests with a moderately dense to sparse mid-stratum and a grass/forb ground stratum. Canopy is dominated by *Eucalyptus crebra* and *Callitris endlicheri*. Midstorey is dominated by *Cassinia arcuata (*syn. *Cassinia sifton), Leucopogon muticus, Phyllanthus hirtellus* and *Melichrus urceolatus.* The ground stratum typically contains *Pomax umbellata, Goodenia hederacea, Lomandra multiflora, Gahnia aspera, Joycea pallida (*syn. *Rytidosperma pallidum*).	Dominated by canopy species *Callitris endlicheri* and *Eucalyptus crebra* (Narrow-leaved Ironbark). Midstorey cover was generally low (average 3.7% across VI plots) and was typically dominated by *Cassinia sifton.* Groundcover was generally high (approximately 40%) and dominated by *Microlaena stipoides. Pomax umbellata* was present across both VI plots.
Disturbance		This VZ has undergone historical disturbance including logging of *Eucalyptus crebra* evidenced by the presence of stumps and livestock grazing evidenced by the presence of sheep within this VZ. High threat weed cover was low (average of 0.1% cover across VI plots) with only two (2) high threat weed species present, *Acetosella vulgaris* and *Bidens subalternans.*
Associated TECs	PCT 1661 is not associated with any TECs in the BAM-C (OEH 2022) or BioNet Vegetation Classification (DPIE 2021). This VZ does not conform to any TECs listed under the BC Act and/or the EPBC Act.	
Other PCTs considered	**PCT 1656 – Narrow-leaved Ironbark – Black Pine – Narrow-leaved Wattle shrub – grass open forest on sandstone slopes of the upper Hunter and Sydney Basin** PCT 1656 was considered for this VZ; however, was excluded due to the absence of characteristic canopy species *Angophora floribunda* within this VZ.	

Figure 39: PCT 1661 remnant forest (VZ15)

Figure 40: PCT 1661 remnant forest (VZ15)

3.1.2.11. PCT 1655 – Grey Box – Slaty Box shrub – grass woodland on sandstone slopes of the upper Hunter and Sydney Basin remnant woodland (VZ16)

PCT 1655 is present within the Study Area in one (1) condition state, remnant woodland (VZ16). The description of PCT 1655 as provided in the NSW BioNet Vegetation Classification (DPIE 2021), and the description of VZ16 is provided in Table 21. Example photographs of VZ16 are provided in Figure 41 and Figure 42 below.

Table 21: PCT 1655 BioNet Vegetation Classification description and VZ16 description.

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ16 description
IBRA Region	Sydney Basin	Sydney Basin
IBRA Subregion	Kerrabee	Kerrabee
NSW (Mitchell) Landscape	Upper Goulburn Valleys and Escarpment	Upper Goulburn Valleys and Escarpment
Soil type	Not listed.	Fine grained sedimentary rock derived, clay loams. Generally, occurs on soils derived from Permian sedimentary bedrock and the Triassic sediments located upslope.
Landform position	Rocky; sandstone slopes associated with larger streams. Elevation up to 700 m Above Sea Level (ASL).	Footslopes and small rises proximal to Moolarben Creek.
Structure	Woodland to open forest.	Woodland
Floristic description	Box Woodland to Open Forest; usually with a sparse shrub mid-stratum. The ground stratum is typically grassy but contains forbs; sub-shrubs and graminoid species. Canopy species include *Eucalyptus moluccana, Eucalyptus dawsonii* and *Callitris endlicheri.*	Dominated by canopy species *Eucalyptus moluccana* (Grey Box). *Eucalyptus dawsonii*, *Eucalyptus melliodora, Eucalyptus blakelyi, Eucalyptus crebra* and *Angophora floribunda* are also present within this VZ but are not the dominant canopy species. The midstorey was sparse (<1% cover) with *Acacia decora* and *Daviesia ulicifolia* (Gorse Bitter Pea)

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ16 description
	Midstorey species include *Notelaea microcarpa (*Native Olive*), Dodonaea viscosa* and *Olearia elliptica*. Ground cover species include *Aristida* spp. and *Gahnia aspera*.	present. Groundcover was variable throughout this VZ (approximately 10-60% cover) and was dominated by *Microlaena stipoides, Sporobolus creber* and *Austrostipa verticillata* (Slender Bamboo Grass). This VZ demonstrated a relatively high native herb diversity, with *Calotis cuneifolia*, *Einadia nutans* subsp. *nutans* (Climbing Saltbush) and *Oxalis perennans* consistently recorded across all VI plots.
Disturbance		This VZ has undergone significant disturbance and likely has a long history of agricultural use including livestock grazing evidenced by the presence of sheep and cattle within this VZ at time of survey. Three (3) high threat weeds were recorded including *Acetosella vulgaris, Bidens subalternans* and *Rosa rubiginosa*; however, cover of high threat weeds was very low (average 0.2% cover across VI plots).
Associated TECs	PCT 1655 is associated with the BC Act listed VEC Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion in the BAM-C (OEH 2022) and the BioNet Vegetation Classification (DPIE 2021).	
Other PCTs considered	**PCT 623 – Narrow-leaved Ironbark +/- Grey Box grassy woodland of the upper Hunter Valley, mainly Sydney Basin Bioregion** PCT 623 was considered due the canopy species assemblage of *Eucalyptus moluccana* and *Eucalyptus crebra*. This PCT was excluded as it is listed as a Coastal Valley Grassy Woodland vegetation class (DPIE 2021). This VZ more closely aligns with the Western Slopes Grassy Woodland vegetation class due to its geographical position and elevation.	

Figure 41: PCT 1655 remnant woodland (VZ16)

Figure 42: PCT 1655 remnant woodland with *Eucalyptus dawsonii* in background (VZ16)

3.1.2.12. PCT 1656 – Narrow-leaved Ironbark – Black Pine – Narrow-leaved Wattle shrub – grass open forest on sandstone slopes of the upper Hunter and Sydney Basin (VZ17 and VZ18)

PCT 1656 is present within the Study Area in two (2) condition classes:

- Remnant forest (VZ17)
- Regenerating forest (VZ18)

The description of PCT 1656 as provided in the NSW BioNet Vegetation Classification (DPIE 2021), and the descriptions of VZ17 and VZ18 are provided in Table 22. Example photographs of VZ17 and VZ18 are provided in Figure 43 to Figure 46 below.

Table 22: PCT 1656 BioNet Vegetation Classification description, and VZ17 and VZ18 descriptions.

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ17 description	VZ18 description
IBRA Region	Sydney Basin	Sydney Basin	Sydney Basin
IBRA Subregion	Kerrabee	Kerrabee	Kerrabee
NSW (Mitchell) Landscape	Upper Goulburn Valleys and Escarpment	Upper Goulburn Valleys and Escarpment	Upper Goulburn Valleys and Escarpment
Soil type	Not listed.	Sandy loam.	Sandy loam.
Landform position	Sandstone ranges between 300 and 400 m ASL.	Slight sandstone rises.	Slight sandstone rises.
Structure	Open forest.	Open forest	Regenerating open forest
Floristic description	Ironbark Open Forests with a variety of co-dominants occurring including *Eucalyptus crebra*, *Callitris endlicheri*, *Angophora floribunda* and *Eucalyptus fibrosa*. The mid-stratum comprises a moderately dense to sparse shrub layer dominated by sclerophyllous species such as *Acacia linearifolia, Dodonaea triangularis* and *Bursaria spinosa*. The ground cover is sparse and is a mix of sub-shrubs and ferns including *Sida petrophila, Goodenia rotundifolia, Calotis lappulacea* and *Cheilanthes sieberi*.	Dominated by canopy species *Angophora floribunda* and *Eucalyptus crebra*. *Eucalyptus blakelyi, Eucalyptus sideroxylon* (Mugga Ironbark)*, Eucalyptus melliodora and Callitris endlicheri* were also present within this VZ. Canopy species assemblages and densities varied throughout this VZ which is consistent with the descriptive attributes provided for PCT 1656 in the NSW BioNet Vegetation Classification (DPIE 2021). Midstorey cover was relatively low (<2%). The midstorey stratum was dominated by *Cassinia sifton*. Groundcover was relatively high, with the native grasses *Microlaena stipoides, Aristida ramosa* and *Digitaria breviglumis* contributing significantly to groundcover. The herb *Pomax umbellata* also contributed significantly to groundcover across this VZ.	A large assemblage of canopy species was present in this VZ, including *Angophora floribunda, Eucalyptus crebra* and *Eucalyptus sideroxylon.* The presence of these species as paddock trees in the landscape, and juveniles of the characteristic canopy species, as well as the occurrence of this VZ on low sandstone hills indicates that this VZ is a regenerating form of PCT 1656. Midstorey cover was variable, but contributed significantly to total cover, ranging from 5% to 61% across VI plots. Midstorey was consistently dominated by *Cassinia sifton*.
Disturbance		The high threat weeds *Acetosella vulgaris* and *Bidens subalternans* were present across this VZ; however, did not contribute significantly to cover (average of 0.2% cover per VI plot).	The presence of the pioneer species, *Cassinia sifton* is indicative of previous disturbance, such as land clearing. The high threat weeds *Eragrostis curvula* and *Hypericum perforatum* were present; however, did not contribute significantly to cover (average of 0.1% cover per VI plot).
Associated TECs	PCT 1656 is not associated with any TECs in the BAM-C (OEH 2022) or BioNet Vegetation Classification (DPIE 2021). This VZ does not conform to any TECs listed under the BC Act and/or the EPBC Act.		
Other PCTs considered	**PCT 1661 – Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin** PCT 1661 was considered for this VZ; however, was excluded due to the presence of *Angophora floribunda.*		

Figure 43: PCT 1656 remnant forest (VZ17)

Figure 44: PCT 1656 remnant forest (VZ17)

Figure 45: PCT 1656 regenerating forest (VZ18)

Figure 46: PCT 1656 regenerating forest (VZ18)

3.1.2.13. PCT 1711 – Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin (VZ19)

PCT 1711 Is present within the Study Area in one (1) condition class, remnant woodland / shrubland (VZ19). The description of PCT 1711 as provided in the NSW BioNet Vegetation Classification (DPIE 2021), and the description of VZ19 is provided in Table 23. Example photographs of VZ19 are provided in Figure 47 and Figure 48 below.

Table 23: PCT 1711 BioNet Vegetation Classification description and VZ19 description.

Attribute	BioNet Vegetation Classification description (DPIE 2021)	VZ19 description
IBRA Region	Sydney Basin	Sydney Basin
IBRA Subregion	Kerrabee	Kerrabee
NSW (Mitchell) Landscape	Upper Goulburn Valleys and Escarpment	Upper Goulburn Valleys and Escarpment
Soil type	Sandstone derived.	Clay loams derived from sandstone.
Landform position	Elevation 400 to 450 m ASL.	Ephemeral to semi-permanent drainage lines and alluvial fans with impeded drainage.
Structure	Shrublands	Shrubland to open woodland
Floristic description	Tall Shrublands dominated by *Leptospermum polygalifolium* (Tantoon) various Eucalypt or Callitris species may be present as emergent including *Eucalyptus blakelyi, Angophora floribunda* and *Callitris endlicheri.* The ground stratum is sparse and is typically graminoid in nature and may include *Goodenia paniculata* and *Lepyrodia leptocaulis*.	Dominated by shrub species *Callistemon pinifolius* (Pine-leaved Bottlebrush)*, Leptospermum arachnoides* and *Melaleuca thymifolia* (Thyme Honey-myrtle). The canopy species *Eucalyptus blakelyi* was also present in low densities. The perennial grasses *Arundinella nepalensis* (Reedgrass) and *Echinopogon ovatus* (Forest Hedgehog Grass) contribute substantially to groundcover, along with the herb species *Hydrocotyle laxiflora* (Stinking Pennywort)*, Haloragis heterophylla* (Rough Raspwort) and *Goodenia paniculata* (Branched Goodenia). Wetter areas within this VZ contained *Cyperus gracilis, Schoenus apogon* and *Lythrum hyssopifolia. Melaleuca thymifolia* and *Goodenia paniculata* are listed as characteristic species for this PCT in the NSW BioNet Vegetation Classification (DPIE 2021). The semi-permanent nature of the surface water indicates that some of this VZ may be situated on groundwater discharge (springs). This VZ may be located on a river baseflow system and form part of a groundwater dependent ecosystem.
Disturbance		Evidence of disturbance from livestock grazing, earthworks, and recent fire (<5 years old) was present within this VZ. Despite this, the VZ is in good condition. The high threat weeds *Acetosella vulgaris* and *Paspalum dilatatum* were present across Vegetation Zone 18; however, did not contribute significantly to cover (average of 2% cover per VI plot).
Associated TECs	PCT 1711 is not associated with any TECs in the BAM-C (OEH 2022) or BioNet Vegetation Classification (DPIE 2021). This VZ does not conform to any TECs listed under the BC Act and/or the EPBC Act.	
Other PCTs considered	**PCT 218 - Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion** PCT 281 was considered for this VZ due to the presence of *Eucalyptus blakelyi.* PCT 281 was excluded due to the shrubbiness of this VZ.	

Figure 47: PCT 1711 remnant woodland / shrubland (VZ19)

Figure 48: PCT 1711 remnant woodland / shrubland (VZ19)

3.2. Assessment of Category 1 – Exempt Land

The extent of Category 1 Land within the Study Area is shown on Figure 8 to Figure 10above.

A total of 311 ha of Category 1 Land was identified within the Study Area. Category 1 Land was restricted to areas which had clearly been subject to intensive agricultural practices such as pasture cropping and were dominated by exotic perennial pasture species such as *Paspalum dilatatum*, *Digitaria eriantha* (Digit Grass) and *Pennisetum clandestinum* (Kikuyu). Results of the IGGAM are summarised in Table 25. Screenshots from the IGGAM Calculator are provided in Appendix C.

Justification for Category 1 Land is provided in Table 24.

Table 24: Justification of Category 1 Land

Data source	Result
Historic aerial imagery (NSW Spatial Services 2022).	The earliest available historic aerial imagery (1964) and subsequent images (1982, 1988 and 1990) (NSW Spatial Services 2022) indicates that grassland areas throughout the Study Area have been subject to long-term, on-going agricultural land uses, such as livestock grazing, hay making and cropping. The earliest available imagery (1960) demonstrates that the majority of grassland areas were cleared of woody vegetation prior to 1960. Examples of this are provided in Appendix C. A portion of grassland in the eastern section of the Study Area was not cleared of native woody vegetation until 1990 (available imagery dated 28 November 1990; Appendix C).
MWRC LEP Sensitivity Biodiversity Map (BIO_005)	The Study Area contains no land mapped as High Biodiversity Sensitivity or Moderate Biodiversity Sensitivity as per the MWRC LEP.
MWRC LEP	The Study Area is zoned as RU1.
NVRM (DPE 2022a)	Category 1 Land is not defined on the Transitional NVRM (DPE 2022a). The Study Area contains Category 2 – Vulnerable Regulated Land (Category 2 Land) along Moolarben Creek and Murdering Creek. Mapped Category 2 Land has been excised from Category 1 Land within the Study Area.
NSW Woody Vegetation Extent (DPIE 2015)	Woody vegetation cannot be categorised as Category 1 Land in accordance with the LLS Act. As such, any land mapped as woody vegetation on the NSW Woody Vegetation Extent layer (DPIE 2015) has been excised from Category 1 Land.

Data source	Result
NSW Landuse 2017 layer (DPIE 2017)	Category 1 Land within the Study Area conforms to the following NSW Landuse 2017 categorisations (DPIE 2017): • 3.3.0 Cropping. • 3.2.0 Grazing modified pastures. • 2.1.0 Grazing native vegetation.
IGGAM transect data	Transects where the proportion of exotic perennial cover to native perennial cover were >0.5 indicate low conservation grasslands, in accordance with the IGGAM (OEH 2018). IGGAM results are provided in Table 25 below.
RDP data; VI plot data	RDP and VI plot data indicate that the land mapped as Category 1 Land within the Study Area is not habitat for threatened flora species. Threatened fauna species may utilise the Category 1 Land; however, threatened fauna species usage was not assessed as part of this report. Impacts to threatened fauna species and species habitat on Category 1 Land is assessed as a prescribed impact in accordance with the BAM (DPIE 2020a).
TEC assessment	Due to the highly modified nature of Category 1 Land within the Study Area, resulting in the dominance of exotic perennial groundcover species, the Category 1 Land does not conform to any PCT or TEC.

Table 25: IGGAM results summary

Site	Exotic perennial: native cover	Composition condition score	Structure condition score	Current VI score	Conservation value	Category
GGAM1	0	59.4	84	70.7	High	Category 2
GGAM2	0.3	82.6	83.4	83	High	Category 2
GGAM3	0	49.6	83.1	64.2	High	Category 2
GGAM4	0.6	83.2	70.8	76.8	Low	Category 1
GGAM5	0.7	46.2	48	47.1	Low	Category 1
GGAM6	0.3	76.9	83.5	80.1	High	Category 2
GGAM7	0	84.1	84	84	High	Category 2
GGAM8	0.8	30.2	22.1	25.8	Low	Category 1
GGAM9	0.6	48.9	83.3	63.8	Low	Category 1
GGAM10	0.6	42.5	72.3	55.4	Low	Category 1
GGAM11	0.3	25.5	83	46	Moderate	Category 2
GGAM12	0	72.1	36.8	51.5	Moderate	Category 2
GGAM13	0.2	74.9	88.7	81.5	High	Category 2
GGAM14	0.1	87.3	86.4	86.8	High	Category 2
GGAM15	1	19.9	15.1	17.3	Low	Category 1
GGAM16	0.7	49.2	67.1	57.4	Low	Category 1
GGAM17	0	83.9	85.2	84.5	High	Category 2
GGAM18	0.1	72.8	48.3	59.3	Moderate	Category 2
GGAM19	0	46.2	83.1	61.9	High	Category 2
GGAM20	0.6	74.5	83.7	79	Low	Category 1

3.3. Assessment of Threatened Ecological Communities

A summary of TECs present within the Study Area is provided in Table 26.

Table 26: TECs present within the Study Area

BC Act listed TEC	Equivalent EPBC Act listed TEC	PCTs	VZs	Patches which are a listed EPBC Act TEC	Area (ha)
White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin - CEEC	*White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland* - CEEC	PCT 266, PCT 281, PCT 483	VZ1, VZ2, VZ3, VZ4, VZ5, VZ9, VZ10	1 patch	BC Act - 860 ha EPBC Act -860 ha
Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion - VEC	*Central Hunter Valley eucalypt forest* - CEEC	PCT 1655	VZ16	Patches A, B, C, D, F, G and H as shown in Figure 50[4]	BC Act - 18 ha EPBC Act – 17 ha

3.3.1. BC Act listed White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC

Definition of the BC Act listed Box Gum Woodland is provided in Part 1 and Part 2 of the *Notice of and reason for the Final Determination for White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (TSSC 2020; hereafter referred to as the Determination), and states:

"Section 1.6 of the Act defines an ecological community as "an assemblage of species occupying a particular area". These features of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland are described in Parts 1 and 2 of this Determination, respectively."

Part 3 of the Determination describes the eligibility listing for this community as a CEEC and Part 4 of the determination provides additional field information intended to aid in recognition of this community in the field. Therefore, for VZs within the Study Area to meet the criteria listed in the Determination, only Part 1 and Part 2 need to be satisfied. As such, VZs containing PCT 266, PCT 281 and PCT 483 have been assessed against the descriptive attributes provided in Part 1 and Part 2 of the Determination.

Results of the assessment concluded that all areas of PCT 266, PCT 281 and PCT 483, which encompasses VZ1, VZ2, VZ3, VZ4, VZ5, VZ9 and VZ10 are the BC Act listed Box Gum Woodland. A full assessment of these VZs against Part 1 and Part 2 of the Determination is provided in Appendix D1.

[4] One patch (patch E) does not meet the listing criteria under the EPBC Act for *Central Hunter Valley eucalypt forest* due to not meeting the minimum size requirement of 0.5 ha.

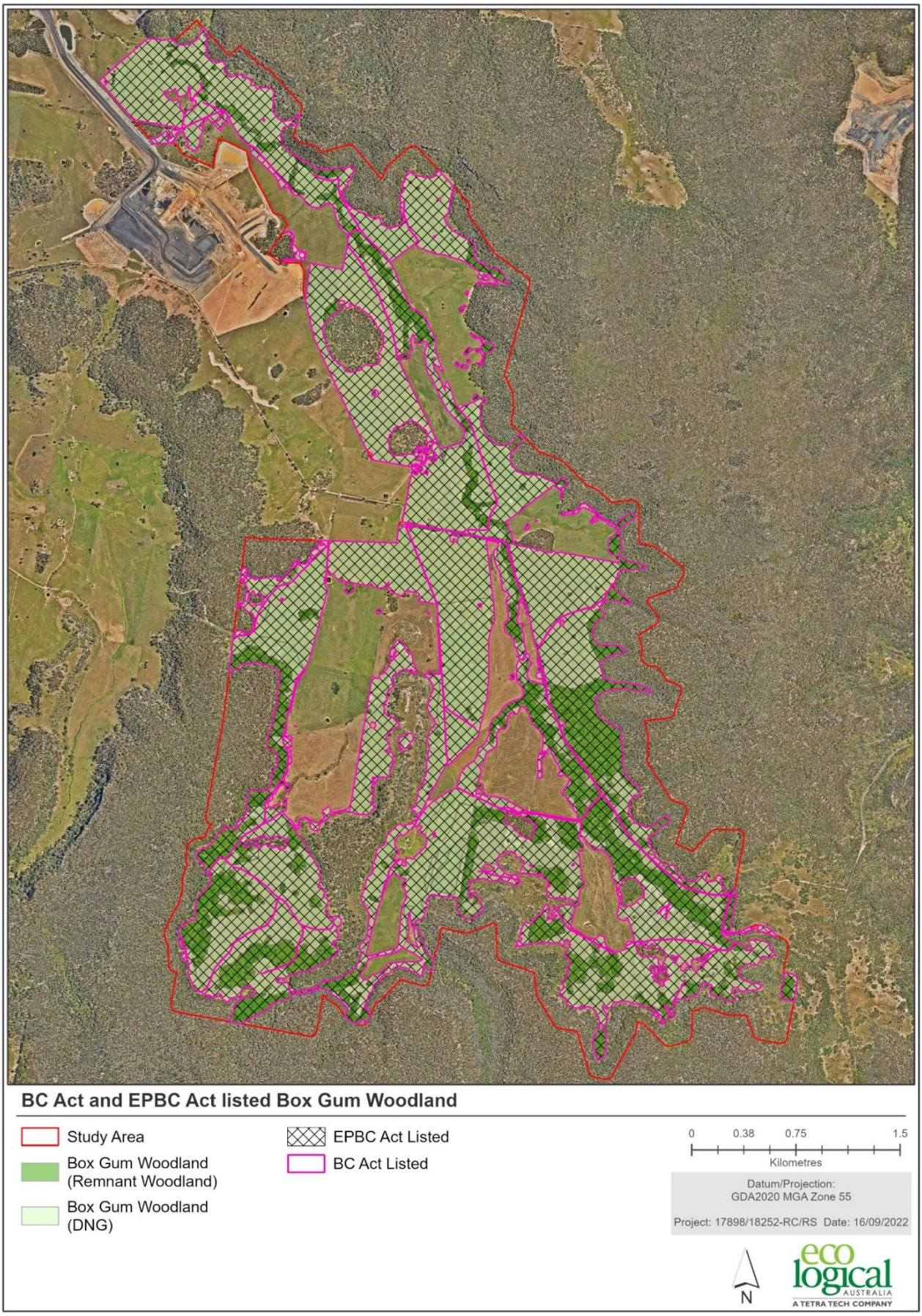

Figure 49: BC Act and EPBC Act listed Box Gum Woodland

3.3.2. EPBC Act listed White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland CEEC

One (1) continuous patch of the EPBC Act listed Box Gum Woodland was identified within the Study Area. The patch comprises VZs throughout PCT 281, PCT 266 and PCT 438 (VZ1, VZ2, VZ3, VZ4, VZ5, VZ9 and VZ10).

The EPBC Act listed Box Gum Woodland is characterised by (DEH 2006):

a. A ground layer dominated by native tussock grasses,
b. An overstorey dominated or co-dominated by *Eucalyptus albens*, *Eucalyptus melliodora* and *Eucalyptus blakelyi*; and,
c. A sparse or patchy shrub layer.

Definitions of dominant and co-dominant species defined by Beadle and Costin (1952) have been used to assess point 'a' above. The definitions of these terms are:

- Dominant – A species which, because of its life-form and frequency, dominates the other members of the community (except for other dominants) in the sense that it conditions the habitats of its associates.
- Co-dominant – Of more of less equal importance as dominants; applicable to two or more species in the same stand.

The patch of EPBC Act listed Box Gum Woodland within the Study Area:

- The ground layer is dominated by native tussock grasses such as *Sporobolus creber, Themeda triandra* and *Eragrostis leptostachya.*
- The overstorey is dominated or co-dominated by:
    - *Eucalyptus albens* throughout PCT 266 VZs (Table 11 above).
    - *Eucalyptus melliodora* and *Eucalyptus blakelyi* throughout PCT 281 VZs (Table 12 above).
    - *Eucalyptus albens* throughout PCT 483 (Table 16 above). Whilst *Angophora floribunda* has greater stem density compared to *Eucalyptus albens* throughout VZ10; however, *Eucalyptus albens* is a dominant species, in the sense that is conditions the habitat of its associates, in accordance with the definition provided by Beadle and Costin (1952). *Angophora floribunda* can regenerate quickly after disturbance and dominate sites (DPIE 2021).

The extent of the EPBC Act listed Box Gum Woodland is provided in Figure 49 above. A full assessment against the listing criteria for this TEC is provided in Appendix E1.

3.3.3. BC Act listed Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion VEC

Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion is the name given to the ecological community that generally occurs at the interface of Narrabeen Sandstone (Triassic sediments) and Permian sediments in the Hunter Valley and is typically dominated by *Eucalyptus dawsonii* (Slaty Gum) and/or *Eucalyptus moluccana*. The community typically forms a low to mid-high woodland (TSSC 2010).

PCT 1655 is associated with this VEC in BioNet and the BAM-C. All patches of PCT 1655 within the Study Area meet the listing criteria for this VEC. A full analysis against the listing criteria as provided in the *Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion - vulnerable ecological community listing final determination* (TSSC 2010) is provided in Appendix D2. The extent and patch identifications (patch A-H) is provided below in Figure 50.

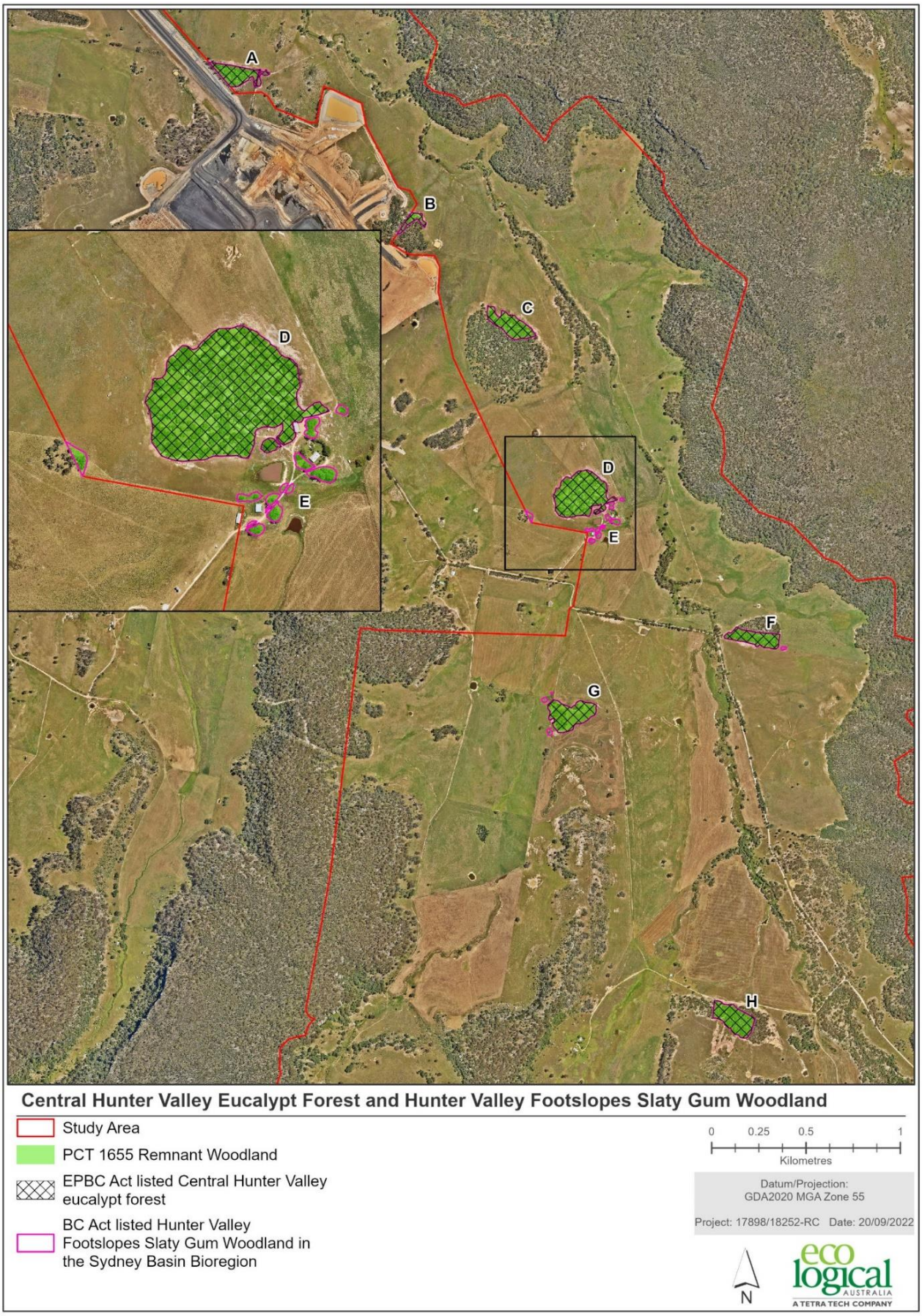

Figure 50: Central Hunter eucalypt forest and Hunter Valley Footslopes Slaty Gum Woodland

3.3.4. EPBC Act listed Central Hunter Valley eucalypt forest and woodland CEEC

Central Hunter Valley eucalypt forest and woodland is typically dominated by one or more of the following four (4) eucalypt species occurring on lower hillslopes and low ridges, valley floors in undulating country; or soils derived from Permian sedimentary rocks:

- *Eucalyptus crebra*
- *Corymbia maculata* (Spotted Gum)
- *Eucalyptus dawsonii*
- *Eucalyptus moluccana*

There are eight (8) patches of PCT 1655 (VZ16) within the Study Area; however, only seven (7) of these patches meet all criteria listed in the Approved Conservation Advice (TSSC 2015) and are therefore the Central Hunter Valley eucalypt forest and woodland CEEC. The extent of this TEC and patch identification (patches A-H) is provided above in Figure 50.

A full assessment against the listing criteria for this TEC is provided in Appendix E2.

3.4. Threatened flora survey

3.4.1. September – October survey

A total of 1,195 40 m radius search areas were systematically searched for the candidate flora species in accordance with the Threatened Flora Survey Guideline (DPIE 2020b) during September and October 2021. One threatened flora species (*Pomaderris cotoneaster*) was recorded within the Study Area. Survey effort per PCT for those PCTs which underwent 10 m parallel transects is provided in Table 27 below. Overall survey effort (i.e. GPS tracks) is provided in Figure 51 to Figure 53 below.

Assessment of Category 1 Land was undertaken during January 2022 (i.e. after the September-October round of threatened flora surveys). Several areas which were included in PCT 281 DNG – High condition at the time of the September-October surveys, was subsequently determined to be Category 1 Land following assessment during January 2022 as shown by the presence of surveyed search areas throughout Category 1 Land in Figure 51 and Figure 52 below. As discussed in Section 2.2.2 above, assessment of Category 1 Land was not undertaken during September due to inappropriate assessment conditions (i.e. perennial native grass cover was not at its highest).

Similarly, areas of PCT 281 DNG – Low condition were not surveyed for threatened flora during September – October 2021 as, at the time of survey, these areas were cropped or sprayed-out. Given the low condition and long history of disturbance of these areas, it is highly unlikely that habitat for the candidate species (as above in Table 2 and Table 3) are present within PCT 281 DNG – Low condition. Further survey of these areas is not required.

All species, except for *Monotaxis macrophylla*, *Kennedia retrorsa* and *Commersonia rosea*, were surveyed in accordance with the optimal survey conditions listed in the TBDC (DPE 2022c) (Table 6 above). Whilst the entire extent of suitable habitat was surveyed for these three species, the optimal survey conditions following fire were not able to be met (Table 6 above). There has been limited disturbance to the suitable habitat for these species within the Study Area, and no areas within the Threatened Flora Study Area have been subject to bushfire in recent years. This is evidenced by fire scarring on trees being mostly absent and limited scarring

on logs, suggesting a fire interval of greater than 10 years (NPWS 2022). Given the closest records for *Monotaxis macrophylla* and *Kennedia retrorsa* are more than 50 km to the east of the Study Area (Table 6 above), and extent of survey, it is highly unlikely these species occur within the Threatened Flora Study Area.

Commersonia rosea has been previously recorded within 20 km of the Study Area. This species was collected 31 March 2005 by Dr Lachlan Copeland and lodged with the Australian Virtual Herbarium (AVH 2022) where it was recorded growing on 'skeletal sandy soil over sandstone' in a 'layered woodland with *Eucalyptus dwyeri,* [SIC] *Melaleuca? nodosa, Boronia anethifolia, Cassinia arcuata* and *Lepidosperma laterale*' at a site which had been burnt 2 – 3 years prior to collection (AVH 2022). RDPs indicate that areas consistent with this vegetation description are not present within the Threatened Flora Study Area. Furthermore, the TBDC states that this species '*Occurs on skeletal sandy soils in heath vegetation with occasional emergents of Eucalyptus crebra, Callitris endlicheri or Eucalyptus caleyi subsp. caleyi (Caley's Ironbark)*' (DPE 2022c). Heath vegetation is described as shrublands which are commonly composed of aphyllous genera (e.g. *Leptospermum* and *Leucopogon* spp.), scattered stunted or mallee *Eucalyptus* spp. are commonly present (Beadle 1981). Heath vegetation is present within PCT 471 (VZ6; as described in Table 13 above); however, the entire extent of this VZ falls outside the Threatened Flora Study Area. Based on these factors it is considered unlikely that this species occurs within the Threatened Flora Study Area.

Surveys were generally undertaken during clear days with little to no wind to maximise detectability. Complete weather data for survey days is provided in Appendix F2. Experience of field staff who undertook the Threatened Flora surveys, as required in accordance with the Threatened Flora Survey Guideline, is provided in Appendix F3.

Table 27: Survey effort for PCTs which underwent 10 m parallel transect

PCT	Area (ha)	Transect distance required by Guideline (km)[1]	Distance of transects completed (km)	10 m spacing achieved?	Guideline[2] achieved?
PCT 478 - Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion	4.4	2.3	5.1	Yes	Yes
PCT 1614 - Grey Gum - Grey Myrtle - Narrow-leaved Stringybark - Rusty Fig open forest on ranges of the Upper Hunter	5	5	8.7	No - PCT 1614 contains continuous lengths of clifflines between 5 – 30 m in height and scree slopes greater than 45% slope so the 10 m spacing between transects could not be maintained. Where possible, additional searches in and around clifflines and scree slopes were undertaken.	Yes – the overall distance of traverse and survey time is above that required by the Threatened Flora Survey Guideline (DPIE 2020b).
PCT 1655 - Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin remnant woodland	18	14.2	22.2	Yes	Yes

[1] DPIE 2020b.

[2] based on a reasonable walking speed of 4 kilometres per hour in open vegetation and 1.5 kilometres per hour in dense vegetation (DPIE 2020b).

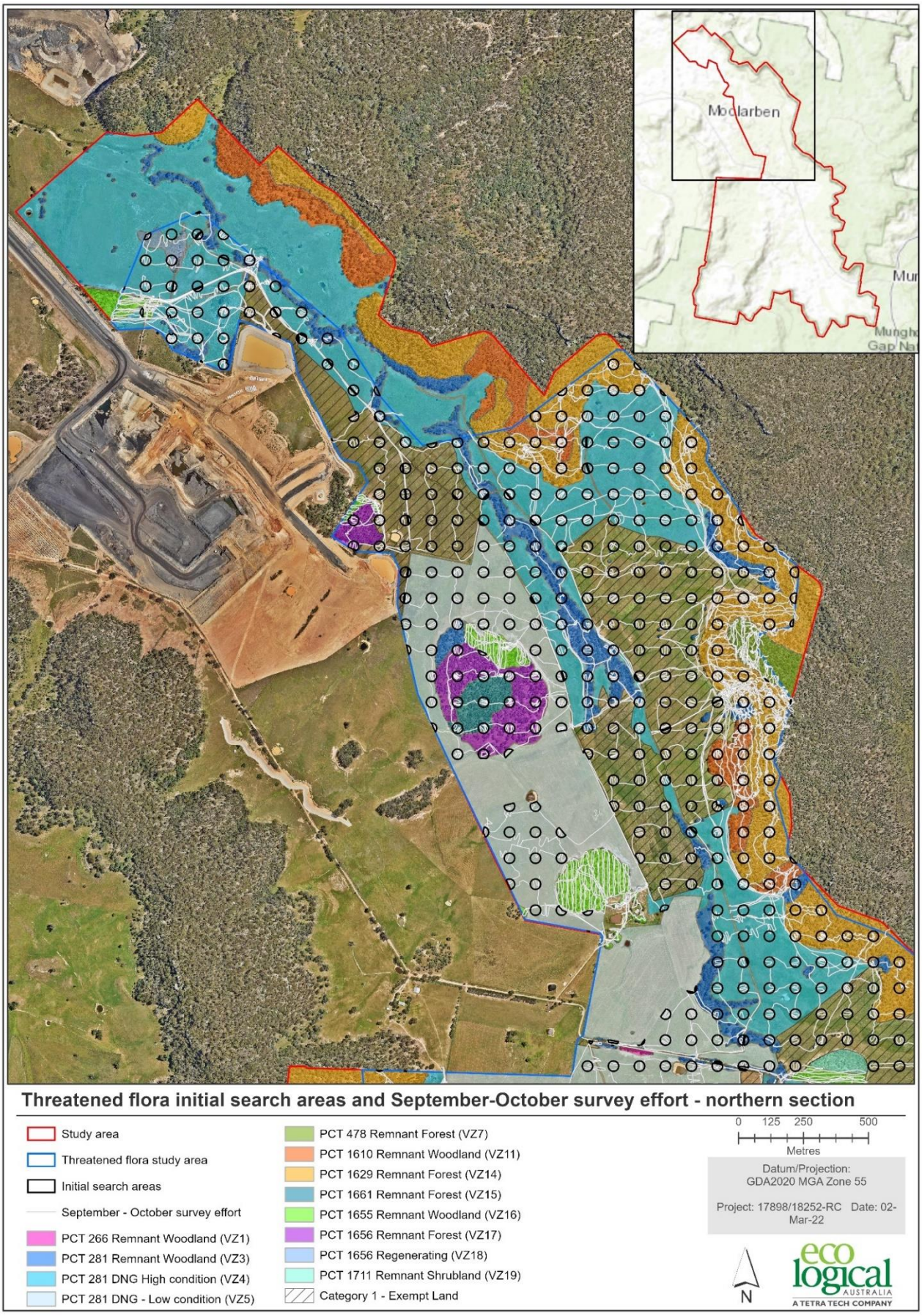

Figure 51: Threatened flora initial search areas and September-October survey effort – northern section.

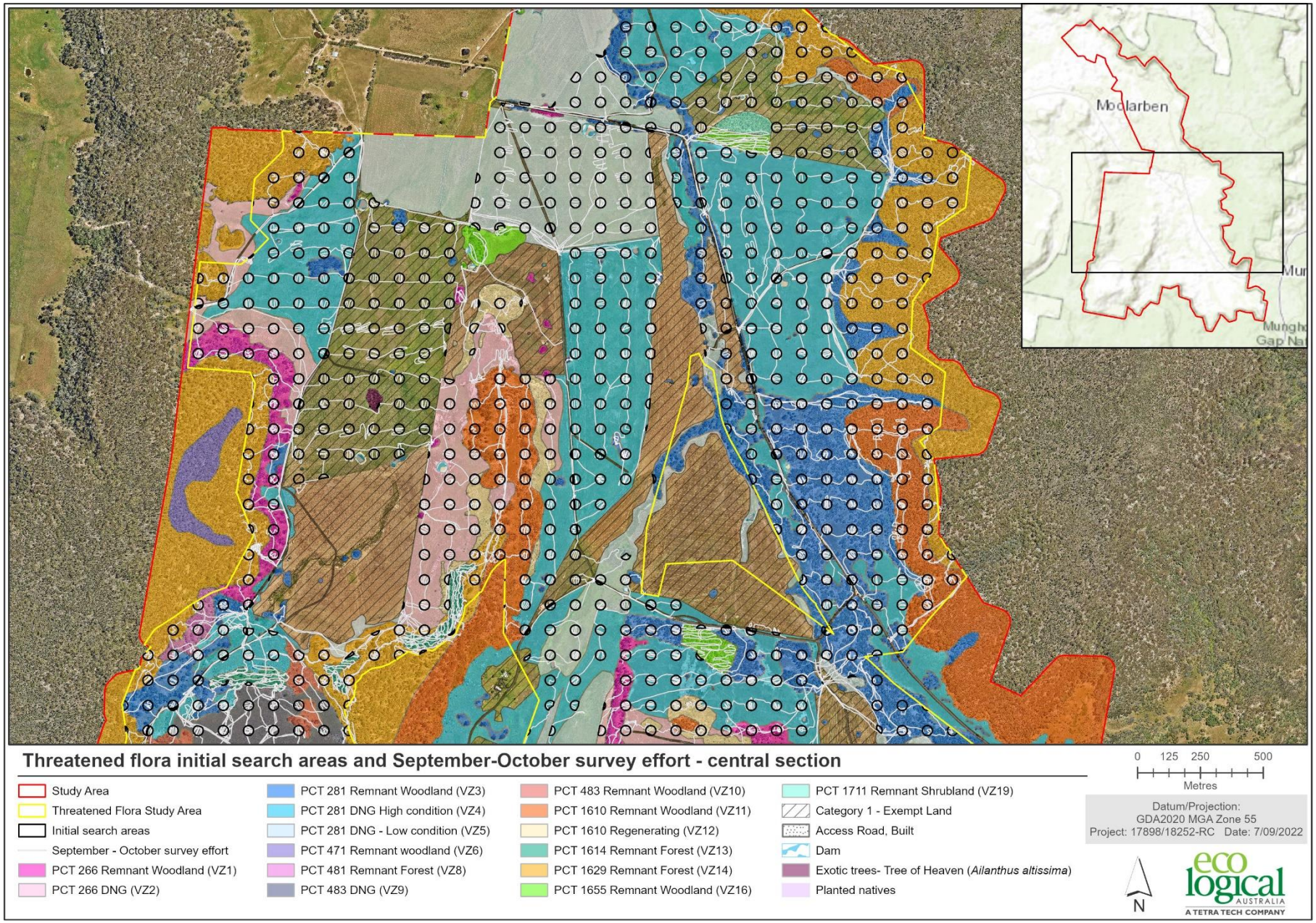

Figure 52: Threatened flora initial search areas and September-October survey effort - central section

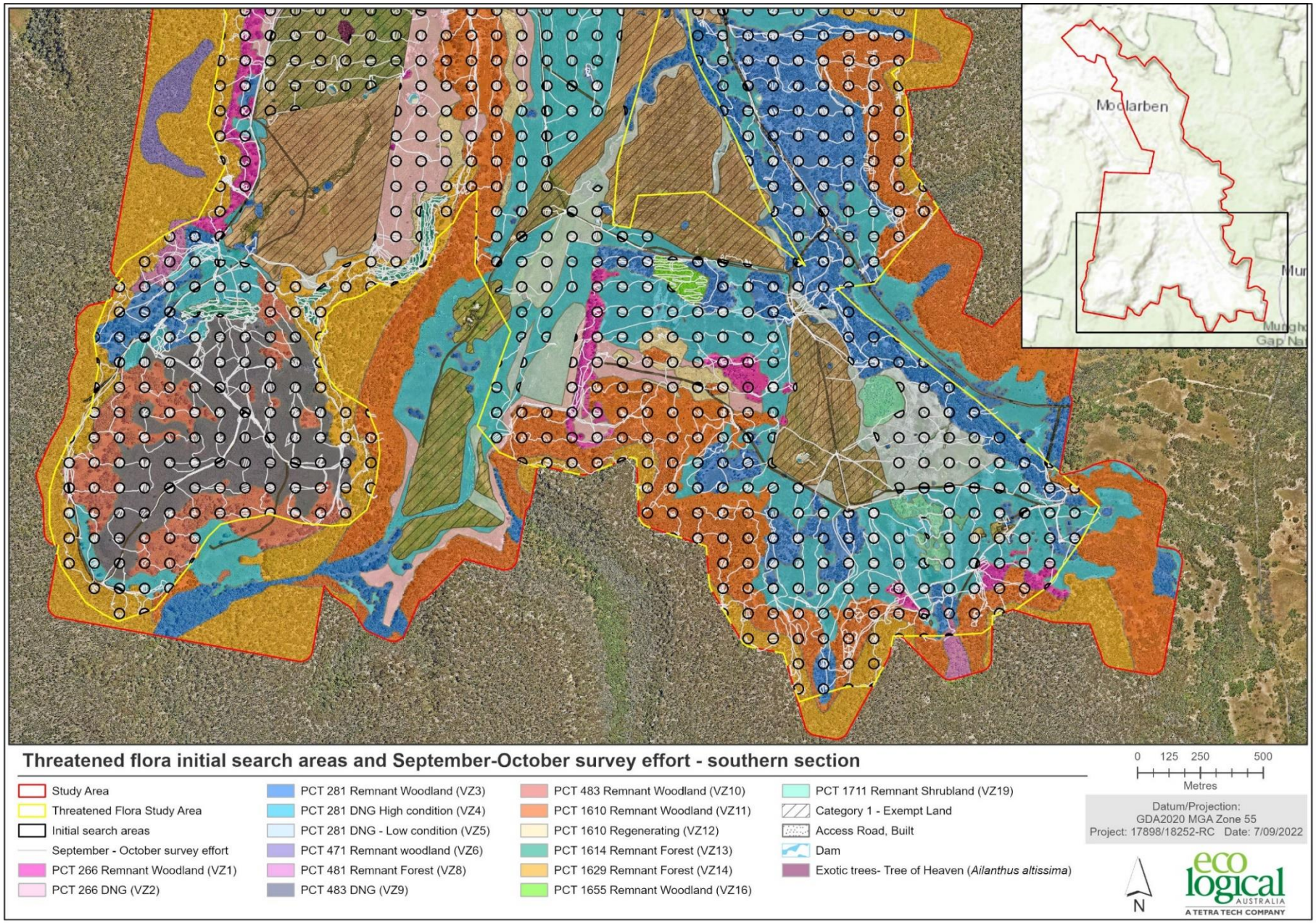

Figure 53: Threatened flora initial search areas and September-October survey effort – southern section

3.4.1.1. Pomaderris cotoneaster identification and species polygon

The identification of *Pomaderris cotoneaster* within the initial search areas (100 x 100 m grid intersect points with a 40 m radius) triggered subsequent fine scale searches. The subsequent fine scale searches were undertaken across a 20 x 20 m grid, with a search area radius of 8 m at the grid intersect locations prescribed for medium shrubs 1 – 6 m, in accordance with Table 4 in the Threatened Flora Survey Guideline (DPIE 2020b). Fine scale searches were only implemented where triggered by recording *Pomaderris cotoneaster* in the 100 x 100 m grid searches. Total survey effort for *Pomaderris cotoneaster* is shown in Figure 54.

Prior to completion of the September – October fine scale surveys, several samples of *Pomaderris cotoneaster* were collected between September to October 2021 to capture different stages of flowering and fruiting, and were sent to two (2) independent botanical experts for validation (correspondence provided in Appendix F1):

- Neville Walsh – Senior Conservation Botanist, Royal Botanic Gardens, Victoria. https://www.researchgate.net/profile/Neville-Walsh
- Dr Stephen Bell – Senior Ecologist, East Coast Flora Survey, NSW and Adjunct Associate Lecturer, School of Environmental and Life Sciences, University of Newcastle, NSW. https://www.researchgate.net/profile/Stephen-Bell-4

The unit of measure for *Pomaderris cotoneaster* is 'area' to determine species polygon. In accordance with the Threatened Flora Survey Guideline (DPIE 2020b) and the BAM (DPIE 2020a):

- The species polygon must also contain the habitat constraints or other suitable microhabitats and features associated with the species, and any buffer area identified for the species in the TBDC (DPE 2022c).
- For threatened plant species where the unit of measure is area (according to the TBDC), the species polygon is used to measure the area of suitable habitat (DPE 2022c).

Include the entire area of the subject land that is identified by an important habitat map for the species (DPIE 2020a). As provided in Table 2 above, there are no habitat or geographical constraints listed in the TBDC for *Pomaderris cotoneaster* (DPE 2022c). There is also no important habitat mapped for this species and habitat critical to the survival of the species is undefined (Department of Environment, Climate Change and Water 2009). Within the Study Area, *Pomaderris cotoneaster* was recorded:

- On a range of sedimentary rock derived substrates including sandy loam, sandy clay loam and sand, and with a range of associated outcropping sedimentary rock including shale / mudstone, coarse grained sandstone and conglomerate.
- Across a range of landscape positions including colluvial sediments on valley floor / gully, on scree / talus slope, amongst clifflines and boulders positioned on the upper slope and on relatively exposed sandstone plateaus.
- There was no evidence of recent fire history (i.e. charring on trees and logs was absent).
- Generally, on south west, west and north west aspects.
- Growing mostly in association with *Eucalyptus punctata* (PCT 1629)*;* however, was also recorded growing in association with *Eucalyptus albens* and *Callitris endlicheri* (PCT 1610) and *Eucalyptus fibrosa* (PCT 478).
- Altitudes between 520 m ASL and 580 m ASL.

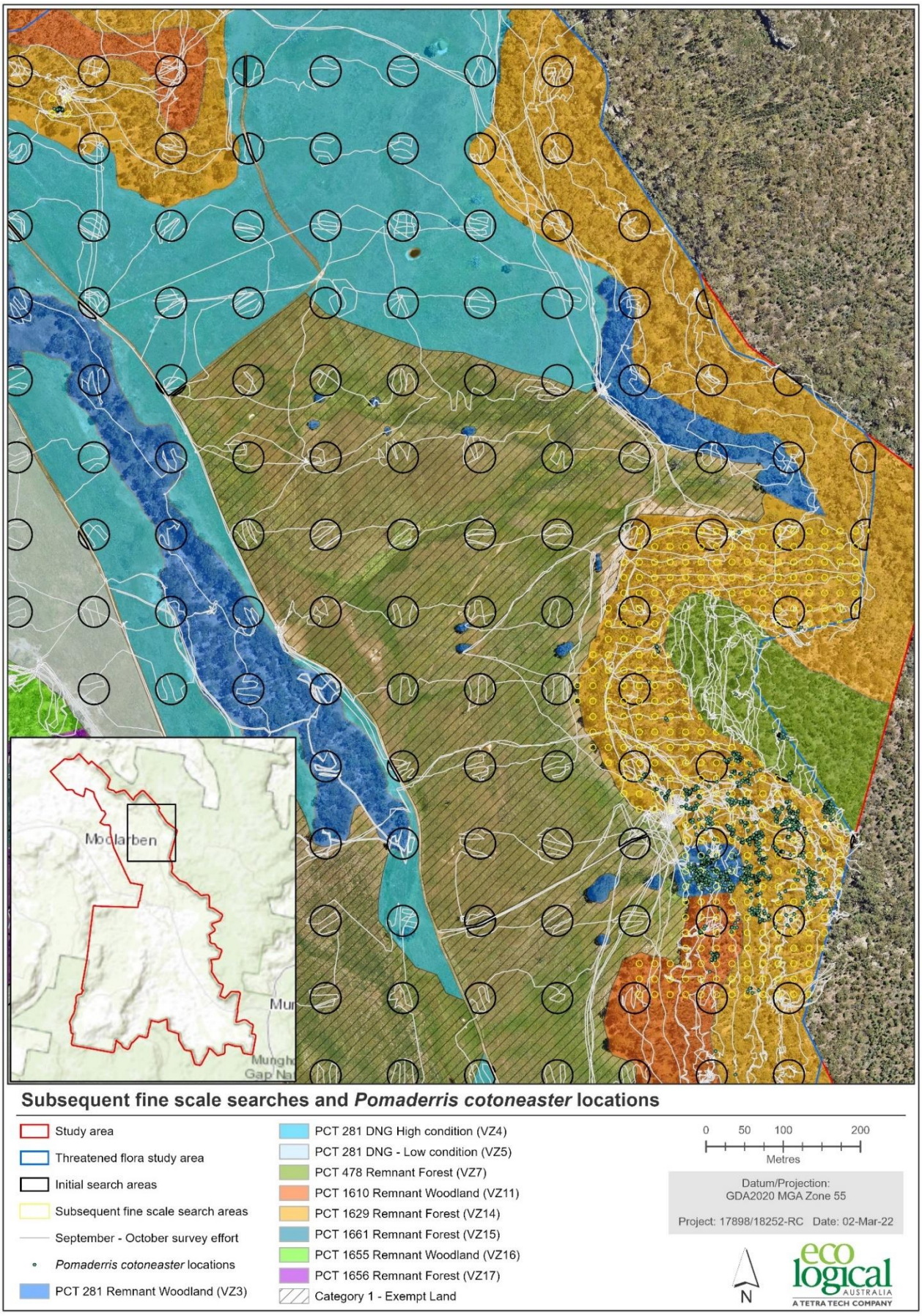

Figure 54: Subsequent fine scale survey effort for *Pomaderris cotoneaster*

Mature plants, seedlings and saplings were identified throughout the population. The population was in good health and actively growing as identified by the presence of strong apical shoots. Different reproductive stages were observed within the population during field surveys:

- Flower buds were observed to be developing during September 2021.
- The population was flowering during early October 2021.
- The development of fruiting bodies was observed during mid to late October 2021.

The following was undertaken to delineate the species polygon:

- A 30 m buffer was applied to *Pomaderris cotoneaster* records within the Threatened Flora Study Area.
- Any areas between the 30 m buffered extent were determined to be suitable habitat, and were included in the species polygon.
- Areas in PCT 281 DNG – High condition (VZ4) were removed from the 30 m buffered areas, as these areas are not considered suitable habitat.

The resulting species polygon, and size of the population, for Pomaderris cotoneaster is 12.5 ha and is shown in Figure 55 below.

3.4.2. January survey

A total of 293 40 m radius search areas were systematically searched across 88 ha of suitable habitat for *Dichanthium setosum* and *Euphrasia arguta* in accordance with the Threatened Flora Survey Guideline (DPIE 2020b) during January 2022. These species are not associated with the Kerrabee IBRA Subregion and therefore do not require survey in accordance with the BAM (DPIE 2020) and the Threatened Flora Survey Guideline (DPIE 2021). However, given the close proximity to the Inland Slopes IBRA subregion (1 km to the west), of which both species are associated and the presence of suitable habitat within the Threatened Flora Study Area, both species were included.

Dichanthium setosum and *Euphrasia arguta* have not been previously recorded within 30 km of the Study Area, however, a precautionary approach to the assessment of these species was undertaken given the cryptic nature of these species, sporadic regional records, and the presence of suitable habitat within the Threatened Flora Study Area. Therefore, both species were surveyed for in areas of suitable habitat within BAM-C associated PCTs listed in the TBDC (PCT 281, PCT 481, PCT 266 and PCT 483). The refinement of suitable habitat for *Dichanthium setosum* and *Euphrasia arguta*, and justification of survey effort is detailed in Appendix B.

No threatened flora species were identified during the January surveys. The survey effort (i.e. GPS tracks) for *Dichanthium setosum* and *Euphrasia arguta* are provided in Figure 56 below.

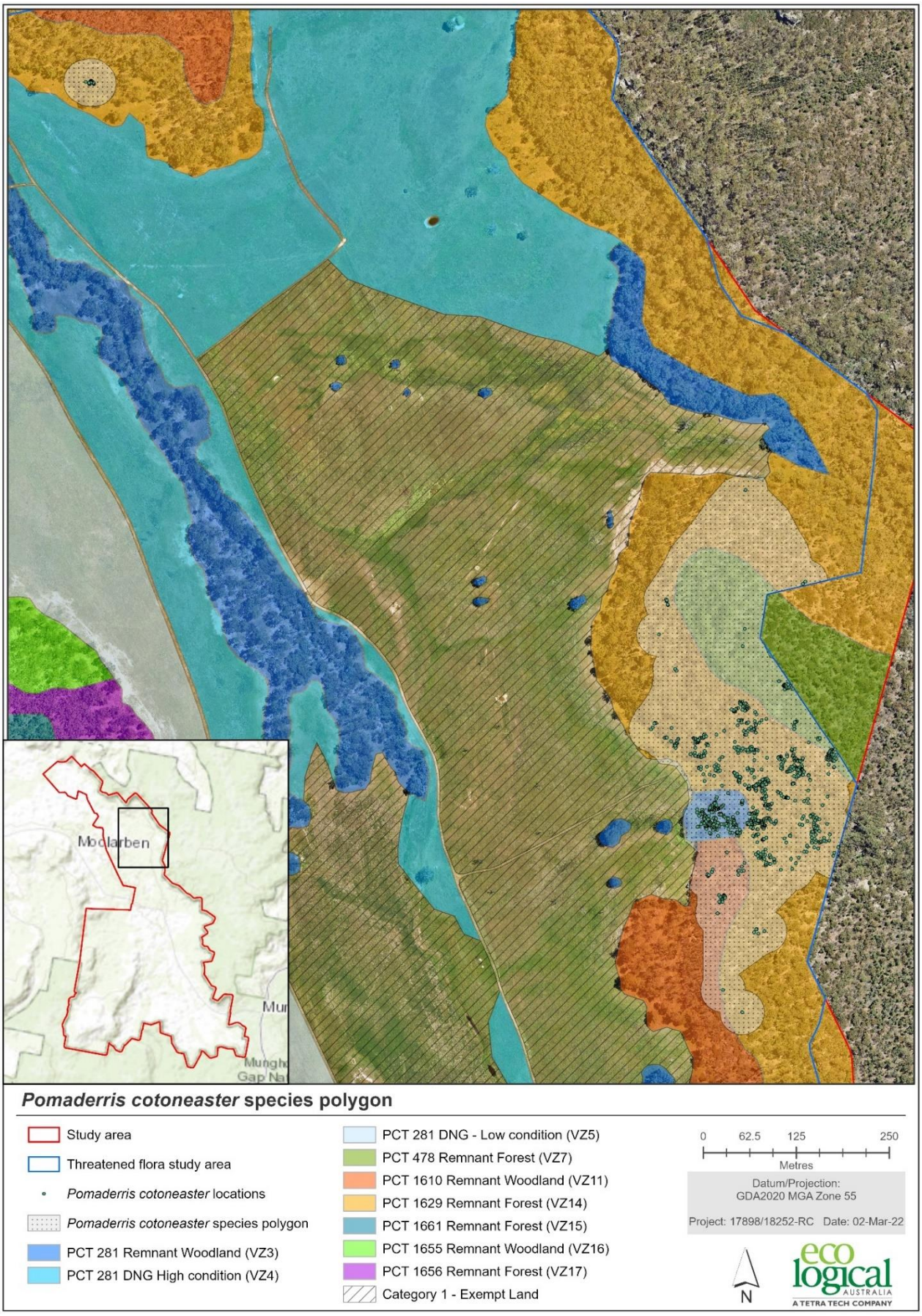

Figure 55: *Pomaderris cotoneaster* species polygon.

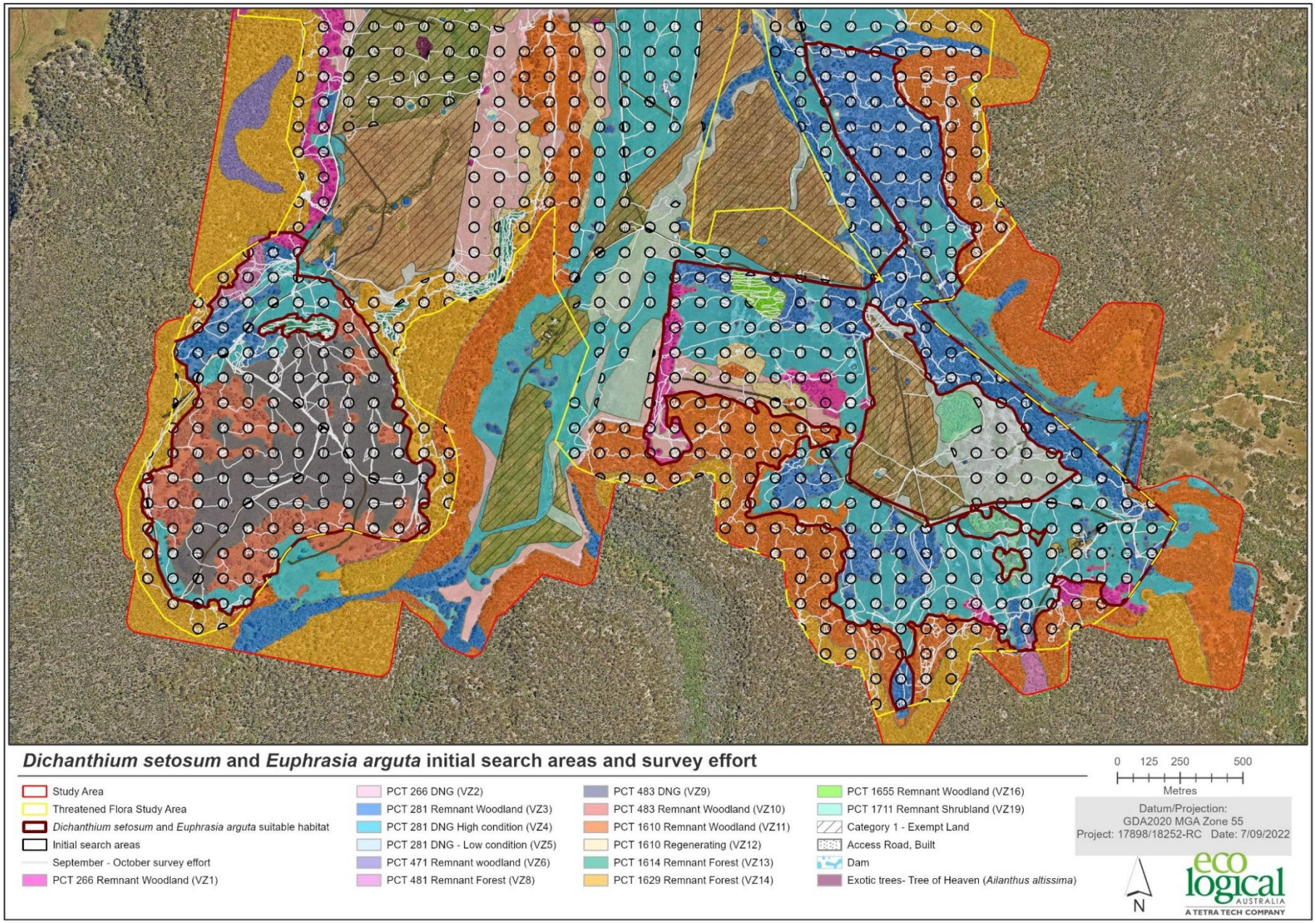

Figure 56: *Dichanthium setosum* and *Euphrasia arguta* flora initial search areas and survey effort

3.5. Streamlined assessment module - Scattered tree assessment

A total of 18 scattered trees were identified throughout the Study Area as shown in

Table 28 and Figure 57 below, including:

- Two (2) class 1 scattered trees (i.e. *trees that are <20 cm DBH and without hollows*)
- Six (6) class 2 scattered trees (i.e. *trees that are ≥20 cm DBH and less than the large tree benchmark for the most likely PCT or trees <20 cm DBH that contain at least one (1) hollow*)
- Ten (10) class 3 scattered trees (i.e. *trees that are greater than or equal to the large tree benchmark for the most likely PCT*).

The scattered trees meet the following definitions for scattered trees, as defined by Appendix B1 of the BAM (DPIE 2021):

- *Trees which have a DBH of greater than or equal to 5 cm and are located more than 50 m away from any living tree that is greater than or equal to 5 cm DBH, and the land between the scattered trees is comprised of vegetation that are all ground cover species on the widely cultivated native species list, or exotic species or human-made surfaces or bare ground.*
- *There are three or fewer trees that have a DBH of greater than or equal to 5 cm and are within a distance of 50 m of each other, that in turn, are greater than 50 m away from the nearest living tree that is greater than or equal to 5 cm DBH, and the land between the scattered trees is comprised of vegetation that are all ground cover species on the widely cultivated native species list, or exotic species or humanmade surfaces or bare ground.*

The nominated PCTs for scattered trees throughout the Study Area is PCT 281 - *Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion* and PCT 266: White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion. PCT 281 has been chosen due to the following:

- Scattered tree species include *Angophora floribunda, Eucalyptus melliodora* and *Eucalyptus blakelyi*, which are characteristic canopy species of PCT 281.
- *Angophora floribunda, Eucalyptus melliodora* and *Eucalyptus blakelyi* scattered trees are in valley floor or footslopes landscape positions, which correspond to the position of PCT 281 listed in the BioNet Vegetation Classification (DPIE 2021).

PCT 266 has been chosen due to the following:

- Scattered tree species *Eucalyptus albens* and *Brachychiton populneus* subsp. *populneus* are characteristic canopy species of PCT 266.
- *Eucalyptus albens* and *Brachychiton populneus* subsp. *populneus* scattered trees are located in footslope landform positions, consistent with PCT 266.

Both PCT 281 and PCT 266 are associated with the BC Act and EPBC Act CEEC Box Gum Woodland. The groundcover underneath the scattered trees is comprised of perennial and annual exotic species, such as *Marrubium vulgare* (horehound) and *Digitaria eriantha* (Premier Digit) and does not meet the listing criteria of Box Gum Woodland. Only one tree (*Eucalyptus melliodora*) contained hollows greater than 50 cm in diameter. There was no evidence of threatened fauna occupation in any scattered trees.

In accordance with Appendix B.3 of the BAM (DPIE 2020a), no further assessment is required for class 1 scattered trees.

Table 28: Scattered tree assessment results

Map reference	Species	DBH (cm)	No of hollows >50 mm diameter	Fauna usage	Scattered tree class	Most likely PCT that formerly occurred in the location	TEC
1	*Angophora floribunda*	90	0	None observed	3	PCT 281	No
2	*Eucalyptus melliodora*	40	2	None observed	2	PCT 281	No
3	*Eucalyptus melliodora*	100	0	None observed	3	PCT 281	No
4	*Brachychiton populneus*	50	0	None observed	2	PCT 281	No
5	*Brachychiton populneus*	30	0	None observed	2	PCT 281	No
6	*Eucalyptus blakelyi*	120	0	None observed	3	PCT 281	No
7	*Eucalyptus blakelyi*	50	0	None observed	1	PCT 281	No
8	*Eucalyptus blakelyi*	120	0	None observed	3	PCT 281	No
9	*Eucalyptus blakelyi*	120	0	None observed	3	PCT 281	No
10	*Eucalyptus blakelyi*	120	0	None observed	3	PCT 281	No
11	*Eucalyptus blakelyi*	120	0	None observed	3	PCT 281	No
12	*Angophora floribunda*	120	0	None observed	2	PCT 281	No
13	*Angophora floribunda*	60	0	None observed	3	PCT 281	No
14	*Angophora floribunda*	100	0	None observed	1	PCT 281	No
15	*Angophora floribunda*	80	0	None observed	3	PCT 281	No
16	*Brachychiton populneus*	40	0	None observed	2	PCT 266	No
17	*Brachychiton populneus*	50	0	None observed	3	PCT 266	No
18	*Eucalyptus albens*	85	0	None observed	2	PCT 266	No

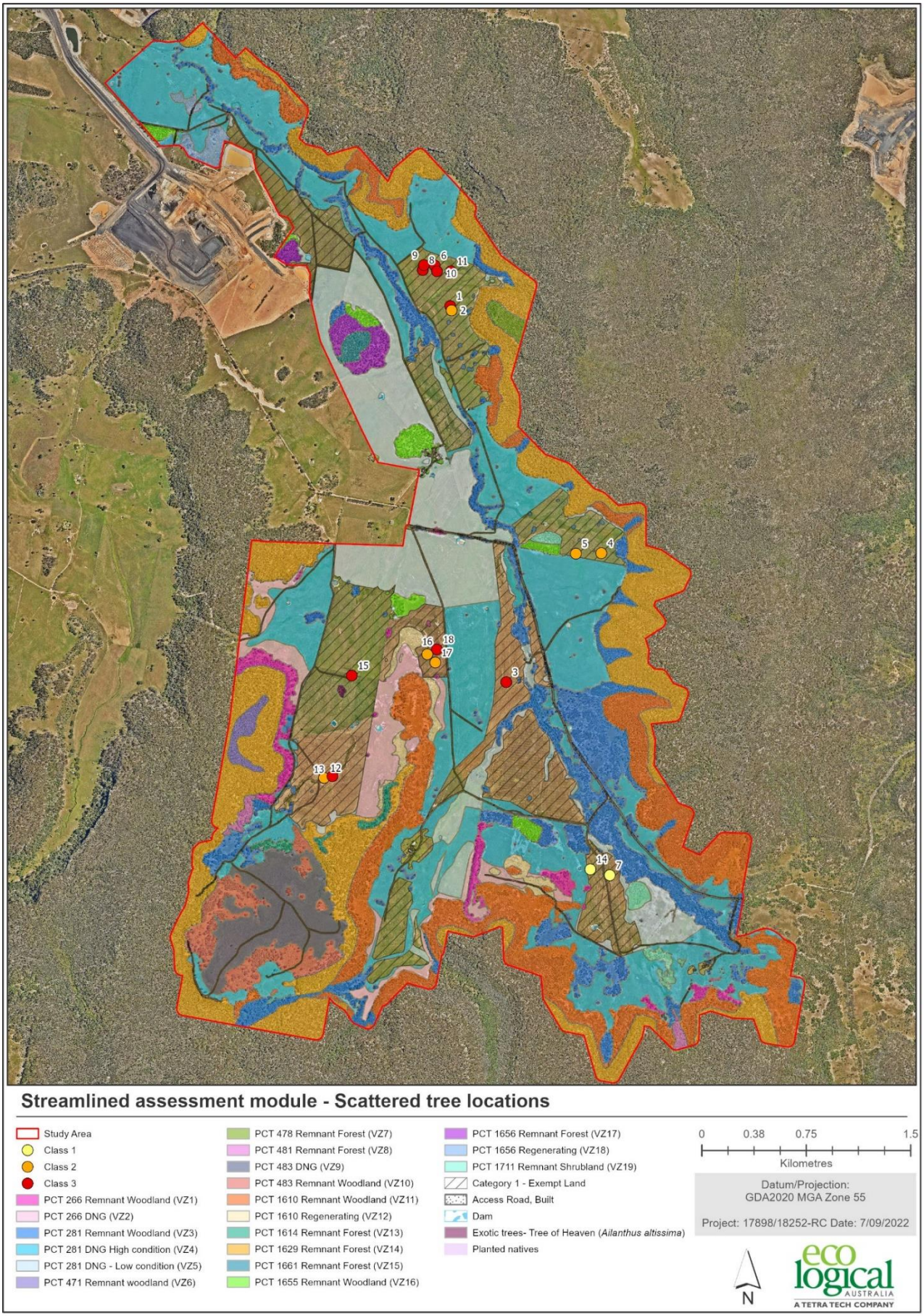

Figure 57: Streamlined assessment module – Scattered tree locations

3.6. Opportunistic threatened fauna observations

Fauna species listed under the BC Act and / or EPBC Act opportunistically recorded throughout the Study Area include:

- Speckled Warbler (*Chthonicola sagittata*), listed as vulnerable under the BC Act and recorded opportunistically within PCT 281 Remnant Woodland (VZ3) during March 2021 by ELA ecologist Kate Maslen.
- Diamond Firetail (*Stagonopleura guttata*), listed as vulnerable under the BC Act and recorded opportunistically within the interface of PCT 281 DNG (VZ4) and PCT 1610 (VZ11) during October 2021 by ELA ecologist Bec Croake.
- A carcass of a Koala (*Phascolarctos cinereus*), listed as endangered under the EPBC Act and endangered under the BC Act, and recorded within PCT 1610 Remnant Woodland (VZ11) during October 2020 by ELA ecologist Cheryl O'Dwyer.

The locations of threatened fauna species opportunistically recorded within the Study Area are provided in Appendix G.

4. Conclusion

A total of thirteen (13) PCTs were identified throughout the Study Area. Five (5) of these PCTs were present in more than one condition state, such as remnant, regenerating and / or DNG, with the remaining eight (8) PCTs present in their remnant form only. Consideration of PCT categorisation and condition class determined that 19 distinct VZs are present.

There is 1,377 ha of native vegetation, 286 ha of Category 1 Land and 16 ha of tracks, infrastructure, and dams, within the Study Area. Four (4) of the PCTs are also associated with a TEC listed under the BC Act and / or the EPBC Act. Assessments against the relevant literature for each TEC determined that the Study Area contains:

- 860 ha of BC Act listed CEEC *White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland*, all of which is also meets the listing criteria of EPBC Act listed CEEC *White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin Bioregions.*
- 18 ha of the BC Act listed VEC *Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion* of which 17 ha meets the listing criteria for the EPBC Act listed CEEC *Central Hunter Valley eucalypt forest and woodland.*

Threatened flora surveys in accordance with the NSW *Surveying Threatened Plants and their Habitats: NSW survey guide for the Biodiversity Assessment Method* (DPIE 2020b) were undertaken throughout the Study Area. The BC Act and EPBC Act listed species, *Pomaderris cotoneaster* was recorded. The species polygon for this species is 12.5 ha.

In accordance with the BAM, there are six (6) offset trading groups present within the Study Area as shown in Table 29 below:

- *White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland* – CEEC – 860 ha.
- *Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion* – 18 ha.
- Sydney Hinterland Dry Sclerophyll Forests with a percentage cleared value <50% - 5.0 ha.
- Western Slopes Dry Sclerophyll Forest with a percentage cleared value <50% - 483.9 ha.
- North Coast Dry Sclerophyll Forest with a percentage cleared value <50% - 4.2 ha [5].
- Western Slopes Dry Sclerophyll Forest with a percentage cleared value ≥50 and <70% - 3.6 ha.

[5] PCT 481 Vegetation Class is listed as North Coast Dry Sclerophyll Forests in BioNet. This PCT occurs throughout the NSW South Western Slopes, Brigalow Belt South and Sydney Basin IBRA Regions and fits the Western Slopes Dry Sclerophyll Forest Vegetation Class (Keith 2004). Review of relevant sources which feed into BioNet (Keith 2004, Benson et al. 2010) indicates that the Vegetation Class for this PCT is likely listed incorrectly in BioNet. Given the implications to offset trading groups, ELA is currently seeking clarification from DPIE.

Table 29: Offset trading groups

Offset trading group	VZ	PCT	Condition	% cleared[1]	Vegetation formation[1]	Vegetation class[1]	Area within the Study Area (ha)
White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland – CEEC	1	266	Remnant woodland	94%	KF_CH3 Grassy Woodlands	Western Slopes Grassy Woodlands	22.9
	2	266	DNG	94%			48.2
	3	281	Remnant woodland	67%			157.6
	4	281	High condition DNG	67%			380.9
	5	281	Low condition DNG	67%			168.8
	10	483	Remnant woodland	90%			32.0
	9	483	DNG	90%			49.9
	Total						**860.3**
Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion – VEC	16	1655	Remnant woodland	36%	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	18.0
	Total						**18.0**
Sydney Hinterland Dry Sclerophyll Forests with a percentage cleared value <50%.	13	1614	Remnant forest	27%	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Hinterland Dry Sclerophyll Forests	5.0
	Total						**5.0**
Western Slopes Dry Sclerophyll Forest with a percentage cleared value <50%.	6	471	Remnant woodland	20%	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	5.5
	7	478	Remnant forest	29%			4.4
	11	1610	Remnant woodland	67%			184.6
	12	1610	Regenerating woodland	67%			13.1
	14	1629	Remnant forest	1%			250.0
	17	1656	Remnant forest	8%			11.7
	18	1656	Regenerating forest	8%			7.3
	19	1711	Remnant woodland / shrubland	0%			7.4
	Total						**483.9**

Offset trading group	VZ	PCT	Condition	% cleared[1]	Vegetation formation[1]	Vegetation class[1]	Area within the Study Area (ha)
North Coast Dry Sclerophyll Forest with a percentage cleared value <50%.		481	Remnant forest	28%	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	North Coast Dry Sclerophyll Forest	4.2
	Total						**4.2**
Western Slopes Dry Sclerophyll Forest with a percentage cleared value ≥50 and <70%.		1661	Remnant forest	50%	KF_CH5B Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	3.6
	Total						**3.6**
Total native vegetation (ha)							**1,375.0**

[1] BioNet Vegetation Classification (DPIE 2021).

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Appendix A Location within report for items listed in Table 24 of the BAM

Information requirement for BDAR (DPIE 2020a)			Section of report
Information	Identify native vegetation extent within the subject land, including cleared areas and evidence to support differences between mapped vegetation extent and aerial imagery (as described in BAM Section 4.1(1–3.) and Subsection 4.1.1)		Section 3.1
	Provide justification for all parts of the subject land that do not contain native vegetation (as described in BAM Subsection 4.1.2).		Section 3.2
	Review of existing information on native vegetation including references to previous vegetation maps of the subject land and assessment area (described in BAM Section 4.1(3.) and Subsection 4.1.1).		Section 2.2.1
	Describe the systematic field-based floristic vegetation survey undertaken in accordance with BAM Section 4.2.		Section 2.2
	Where relevant, describe the use of more appropriate local data, provide reasons that support the use of more appropriate local data and include the written confirmation from the decision-maker that they support the use of more appropriate local data (as described in BAM Subsection 1.4.2 and Appendix A).		Not applicable
	For each PCT within the subject land, describe:	• vegetation class • extent (ha) within subject land • evidence used to identify a PCT including any analyses undertaken, references/sources, existing vegetation maps (BAM Section 4.2(1–3.)) • plant species relied upon for identification of the PCT and relative abundance of each species • if relevant, TEC status including evidence used to determine vegetation is the TEC (BAM Subsection 4.2.2(1–2.)) • estimate of percent cleared value of PCT (BAM Subsection 4.2.1(5.)) • identification and mapping of vegetation zones (as described in BAM Subsection 4.3.1	Section 3.1.2
	Describe the vegetation integrity assessment of the subject land, including:	• assessment of patch size (as described in BAM Subsection 4.3.2) • survey effort (i.e. number of vegetation integrity survey plots) as described in BAM Subsection 4.3.4(1–2.	Section 3.1.2

Information requirement for BDAR (DPIE 2020a)		Section of report
Where use of more appropriate local benchmark data is proposed (as described in BAM Subsection 1.4.2, BAM Subsection 4.3.3(5.) and BAM Appendix A):	• use of relevant benchmark data from BioNet Vegetation Classification (as described in BAM Subsection 4.3.3(5.)	Not applicable
	• identify the PCT or vegetation class for which local benchmark data will be applied	Not applicable
	• identify published sources of local benchmark data (if benchmarks obtained from published sources)	Not applicable
	• describe methods of local benchmark data collection (if reference plots used to determine local benchmark data)	Not applicable
	• provide justification for use of local data rather than BioNet Vegetation Classification benchmark values	Not applicable
	• provide written confirmation from the decision-maker that they support the use of local benchmark data	Not applicable
Identify species credit species likely to occur on the subject land, including:	• List of species credit species derived from the BAM-C	Table 2
	• justification and supporting evidence for exclusions based on geographic limitations, habitat constraints or vagrancy (as described in BAM Subsections 5.2.1 and 5.2.2)	Section 2.2.4
	• justification and supporting evidence for exclusions based on degraded habitat constraints and/or microhabitats on which the species depends (as described in BAM Subsection 5.2.2)	Section 2.2.4 Appendix B
	• justification for addition of any species credit species to the list	Table 3
From the list of threatened flora species, identify:	• species assumed present within the subject land (if relevant) (as described in BAM Subsection 5.2.4(2.a.))	Not applicable
	• species present within the subject land on the basis of being identified on an important habitat map for a species (as described in BAM Subsection 5.2.4(2.d.))	Not applicable

Information requirement for BDAR (DPIE 2020a)		Section of report
	• species for which targeted surveys are to be completed to determine species presence (Subsection 5.2.4(2.b.))	Table 6
	• species for which an expert report is to be used to determine species presence (Subsection 5.2.4(2.c.))	Not applicable
	• threatened species survey (as described in BAM Section 5.2.4)	Section 3.4
Present the outcomes of species credit species assessments from:	• expert reports (if relevant) including justification for presence of the species and information used to make this determination (as described in BAM Section 5.2.4 and 5.3, Box 3)	Not applicable
	• survey method and effort, (as described in BAM (Section 5.3)	Section 3.4
	• justification of survey method and effort (e.g. citation of peer-reviewed literature) if approach differs from the • Department's taxa-specific survey guides or where no relevant guideline has been published	Not applicable
Where survey has been undertaken include detailed information on:	• timing of survey in relation to requirements in the TBDC or the Department's taxa-specific survey guides. Where survey was undertaken outside these guides include justification for the timing of surveys	Section 3.4
	• survey personnel and relevant experience	Appendix F3
	• describe any limitations to surveys and how these were addressed/overcome	Not applicable
	• justification of the use of an expert report	Not applicable
Where an expert report has been used in place of survey (as described in BAM Section 5.3, Box 3), include:	• identify the expert, provide evidence of their expert credentials and Departmental approval of expert status	Not applicable
	• all requirements of Box 3 have been addressed in the expert report	Not applicable
	• identify relevant species	Not applicable

Information requirement for BDAR (DPIE 2020a)		Section of report
Where use of local data is proposed (BAM Subsection 1.4.2):	• identify data to be amended	Not applicable
	• identify source of information for local data, e.g. published literature, additional survey data, etc.	Not applicable
	• justify use of local data in preference to VIS Classification or TBDC data	Not applicable
	• provide written confirmation from the decision-maker that they support the use of local data	Not applicable
Species polygon completed for species credit species present within the subject land (assumed present or determined on the basis of survey, expert report or important habitat map) ensuring that:	• the unit of measure for each species is documented	Section 3.4
	• for species assessed by area: o the polygon includes the extent of suitable habitat for the target species within the subject land (as described in BAM Subsection 5.2.5) o a description of, and evidence-based justification for, the habitat constraints, features or microhabitats used to map the species polygon including reference to information in the TBDC for that species and any buffers applied	Section 3.4
	• for species assessed by counts of individuals: o the number of individual plants present on the subject land (as described in BAM Subsection 5.2.5(3.)) o the method used to derive this number (i.e. threatened species survey or expert report) and evidence-based justification for the approach taken o the polygon includes all individuals located on the subject land with a buffer of 30 m around the individuals or groups of individuals on the subject land	Not applicable
	• identify the biodiversity risk weighting for each species credit species identified as present within	Section 3.4

Information requirement for BDAR (DPIE 2020a)			Section of report
		the subject land (as described in BAM Section 5.4)	
Maps and tables	• Map of native vegetation extent within the subject land at scale not greater than 1:10,000 including identification of cleared areas (as described in BAM Section 4.1(1–3.)) and all parts of the subject land that do not contain native vegetation (BAM Subsection 4.1.2)		Section 3.1.2
	• Map of PCTs within the subject land (as described in BAM Section 4.2(1.))		Figure 8 to Figure 10
	• Map of vegetation zones within the subject land (as described in BAM Subsection 4.3.1).		Figure 8 to Figure 10
	• Map the location of floristic vegetation survey plots and vegetation integrity survey plots relative to PCTs boundaries.		Figure 5 and Figure 6
	• Map of TEC distribution on the subject land and table of TEC listing, status and area (ha).		Figure 49 and Figure 50
	• Map of patch size locations for each native vegetation zone and table of patch size areas (as described in BAM Subsection 4.3.2.		Figure 8 to Figure 10
	Table of current vegetation integrity scores for each vegetation zone within the site and including:	• composition condition score	Not applicable – out of scope for this report.
		• structure condition score	Not applicable – out of scope for this report.
		• function condition score	Not applicable – out of scope for this report.
		• presence of hollow bearing trees:	Not applicable – out of scope for this report.
	Table showing ecosystem credit species in accordance with BAM Section 5.1.1, and identifying:	• the ecosystem credit species removed from the list • the sensitivity to gain class of each species	Not applicable.
	Table detailing species credit species in accordance with BAM section 5.2 and identifying:	• the species credit species removed from the list of species because the species is considered vagrant, out of geographic range or the habitat or micro habitat features are not present • the threatened flora species credit species not recorded on the subject land as determined by targeted survey, expert report or important habitat map	Table 2 and Table 3
	Table detailing species credit species recorded or assumed as present within the subject land, habitat constraints or microhabitats associated with the species, counts of individuals (flora)/extent of suitable habitat (flora and fauna) (as described in BAM Subsection 5.2.6) and biodiversity risk weighting (BAM Section 5.4)		Section 3.4

Information requirement for BDAR (DPIE 2020a)		Section of report
	Map indicating the GPS coordinates of all individuals of each species recorded within the subject land and the species polygon for each species (as described in BAM Subsection 5.2.5)	Figure 55
Data	• All report maps as separate jpeg files.	Provided to MCO.
	• Plot field data (MS Excel format).	Provided to MCO.
	• Plot field data sheets.	Provided to MCO.
	• PCT boundaries within subject land.	Provided to MCO.
	• TEC boundaries within subject land.	Provided to MCO.
	• vegetation zone boundaries within subject land.	Provided to MCO.
	• floristic vegetation survey and vegetation integrity plot locations.	Provided to MCO.
	• Digital shape files of suitable habitat identified for survey for each threatened flora species credit species	Provided to MCO.
	• Survey locations including GPS coordinates of any plots, transects, grids	Provided to MCO.
	• Digital shape files of each species polygon including GPS coordinates of located individuals	Provided to MCO.
	• Species polygon map in jpeg format	Provided to MCO.
	• Expert reports and any supporting data used to support conclusions of the expert report	Not applicable
	• Field data sheets detailing survey information including prevailing conditions, date, time, equipment used, etc.	Not applicable.

Appendix B Refinement of suitable Dichanthium setosum and Euphrasia arguta habitat

Further refinement of 'suitable habitat' within the Threatened Flora Study Area was possible for *Dichanthium setosum* and *Euphrasia arguta*. These species are not associated with the Kerrabee IBRA Subregion and therefore do not require survey in accordance with the BAM (DPIE 2020a) and the Threatened Flora Survey Guideline (DPIE 2020b). However, given the close proximity to the Inland Slopes IBRA subregion (1 km to the west), of which both species are associated and the presence of suitable habitat both species were added.

Dichanthium setosum and *Euphrasia arguta* have not been previously recorded within 30 km of the Study Area (Table B1). A precautionary approach to the assessment of these species was undertaken given the cryptic nature of these species, sporadic regional records, and the presence of suitable habitat within the Study Area.

Therefore, both species were surveyed for in areas of suitable habitat within BAM-C associated PCTs listed in the TBDC (PCT 281, PCT 481, PCT 266 and PCT 483). The refinement of suitable habitat for these species, and justification for survey effort, is discussed in Table B2and Table B3 below. Suitable habitat for these species is shown in Figure B1.

Table B1: Nearby records of *Dichanthium setosum* and *Euphrasia arguta*.

Species	Source	Nearby records
Dichanthium setosum	Occurrence records for *Dichanthium setosum* [6][7](AVH 2022;)	• Near Krui River, approximately 32 km north-east of the Study Area (2019). • Near Mudgee, approximately 32 km south-west of the Study Area (1911).
Euphrasia arguta	Early Explorers in Australia (Lee 1925)	*Euphrasia arguta* has been historically recorded near the Cudgegong River at Rylstone (approximately 32 km south of the Study Area) by botanist explorer Allan Cunningham during 1822[8].
	Occurrence records for Euphrasia arguta (AVH 2022)	• Near Mudgee, approximately 32 m southwest of the Study Area during 1870. • Near Rylstone, approximately 40 km southeast of the Study Area during 1890.

Table B2: Suitable habitat for *Dichanthium setosum.*

Reference	Habitat	Notes on habitat within Study Area
Dichanthium setosum profile (DPE 2022c)	'Associated with heavy basaltic black soils and red-brown loams with clay subsoil.' 'Often found in moderately disturbed areas such as cleared woodland, grassy roadside remnants, and	

[6] Department of Planning and Environment (DPE) 2022. BioNet Threatened Species Records. Accessed during February 2022 from NSW BioNet | NSW Environment and Heritage

[7] Australasian Virtual Herbarium (AVH) 2022. Australasian Virtual Herbarium. Accessed during February 2022 from Search for records | The Australasian Virtual Herbarium

[8] Lee 1925. *Early Explorers in Australia.*

Reference	Habitat	Notes on habitat within Study Area

	highly disturbed pasture. (Often collected from disturbed open grassy woodlands on the northern tablelands, where the habitat has been variously grazed, nutrient-enriched, and water-enriched). It is open to question whether the species tolerates or is promoted by a certain amount of disturbance, or whether this is indicative of the threatening processes behind its depleted habitat.'
	
	'Associated species include *Eucalyptus albens, Eucalyptus melanophloia, Eucalyptus melliodora, Eucalyptus viminalis, Myoporum debile, Aristida ramosa, Themeda triandra, Poa sieberiana, Bothriochloa ambigua, Medicago minima, Leptorhynchos squamatus, Lomandra* aff. *longifolia, Ajuga australis, Calotis hispidula* and *Austrodanthonia, Dichopogon, Brachyscome, Vittadinia, Wahlenbergia* and *Psoralea* species.'
	
	'Locally common or found as scattered clumps in broader populations. The extensive distribution and wide environmental tolerances make predictions about suitable habitat difficult.'
		• MineSoils[9] (2021) soil mapping indicates that Dermosols/Rudosols are present in the southwest corner of the Study Area.
		  ○ Dermosols are soils with uniform or gradational soil texture with good soil structure. When found on basalt they are typically red to brown in colour.
		  ○ Rudosols are associated with rocky areas with shallow, poorly developed soil profiles on basalt geologies.
		• Furthermore, this area is mapped as Cenozoic basalt on the Surface Geology of Australia 1:1 million scale dataset[10] .
		• RDPs indicate that red/brown loams are also present throughout the southeast section of the Study Area.
		• There has been widespread, historical and ongoing disturbance throughout the Study Area in the form of agricultural grazing.
		• The following species were present throughout the southwest and southeast sections of the Study Area:
		  ○ *Eucalyptus albens, Aristida ramosa, Themeda triandra, Poa sieberiana, Ajuga australis* and *Austrodanthonia (*synonym *Rytidosperma), Dichopogon, Brachyscome, Vittadinia* and *Wahlenbergia* species were present throughout this area.
		
		The following areas have been included in the area of suitable habitat for *Dichanthium setosum* (Figure B1 below):
		• The basalt intrusion which is present in the southwest section of the Study Area.
		• Areas surrounding the basalt intrusion where soil type has been influenced by the basalt.

Grasses of the NSW Tablelands (DPI 2013)	'Occurs on heavy basaltic black soils and red brown loams with clay subsoil … often where the habitat has been variously grazed, nutrient enriched and water enriched.'[11]	
Approved conservation advice for *Dichanthium setosum* (TSSC 2008)	'*Dichanthium setosum* is associated with heavy basaltic black soils and stony red-brown hard setting loam with clay subsoil (Ayers *et al*. 1996) and is found in moderately disturbed areas such as cleared woodland, grassy roadside remnants, grazed land and highly disturbed pasture. The extent to which this species tolerates disturbance is unknown.'[12]	

[9] MineSoils 2021. MCM-*20-18 OC Ect EIS SVC_Figure 3a-a*.

[10] Raymond, Liu, Gallagher, Zhang and Highet 2012. *Surface Geology of Australia 1:1 million scale dataset*.

[11] Department of Primary Industries (DPI). *Grasses of the NSW Tablelands.*

[12] Threatened Species Scientific Committee (TSSC) 2008. *Approved conservation advice for Dichanthium setosum*.

Reference	Habitat	Notes on habitat within Study Area
		• The areas of red-brown clay loams present in the south-eastern section of the Study Area. RDPs indicate that the remaining sections of the Study Area contain sandy soils that are unlikely to support *Dichanthium setosum*.

Table B3: Suitable habitat for *Euphrasia arguta*

Source	Habitat	Notes on habitat within Study Area
Approved Conservation Advice for *Euphrasia arguta* (a herb) (Commonwealth of Australia 2011)	The species' habitat consisted of grassy areas near rivers at elevations up to 700 m ASL, with an annual rainfall of 600 mm. The recently discovered populations are in grassy forests or regrowth vegetation[13]	Grassy areas are present along Moolarben Creek (PCT 281): • The southern section of PCT 281 along Moolarben Creek contains grassy areas with high species richness, and presence of several Orchidaceae and lily species. Given the high condition of the seed bank, these areas are considered to be potential habitat. • The northern section of PCT 281 along Moolarben Creek has a low native species richness; indicating that the seed bank is depleted so is unlikely to support this species. The Study Area is less than 70 m ASL. Annual rainfall Is 640 mm[14]. Grassy woodlands and regrowth vegetation are present throughout the Study Area: • Grassy woodlands, and derived native grasslands with high native species richness are present throughout the southern section of the Study Area in PCT 266, PCT 483 and PCT 281. • Whilst grassy woodlands are present within the northern section of the Study Area, the soil seed bank is considered to be depleted due to higher intensity agricultural land use and weed incursion, and therefore not likely to support this species. Whilst this species responds favourably to limited disturbance, and can tolerate grazing by sheep or cattle, extended periods of disturbance results in decline for this species, such as that present in the northern section of the Study Area. As such, the suitable habitat of *Euphrasia arguta* is delineated in Figure B1 below.
Euphrasia arguta profile (DPE 2022c)	Historic records of the species noted the following habitats: 'in the open forest country around Bathurst in sub humid places', 'on the grassy country near Bathurst', and 'in meadows near rivers'. Plants from the Nundle area have been reported from eucalypt forest with a mixed grass and shrub understorey; here, plants were most dense in an open disturbed area and along the roadside, indicating the species had regenerated following disturbance. The number of plants at a given site may vary over time depending on the season and disturbance history. Near Nundle, local populations had apparently declined at sites that had been disturbed twice within three years, in contrast with sites that were disturbed only once. *Euphrasia arguta* has an annual habit and has been observed to die off over the winter months, with active growth and flowering occurring between January and April. As with other species of *Euphrasia*, this species is semi-parasitic and attaches to the roots of other associated plants.	
Euphrasia arguta R. Br. – Critically endangered species listing NSW Scientific Committee – Final determination (TSSC 2012)	*Euphrasia arguta* R. Br. was rediscovered in the Nundle area of the NSW north-western slopes and tablelands in 2008. Prior to this, it had not been collected for 100 years. Historically, *Euphrasia arguta* has only been recorded from relatively few places within an area extending from Sydney to Bathurst and north to Walcha (Barker 1982; Barker 1987; Barker 1992; records from National Herbarium of NSW, Sydney[7]). There are no known occurrences of *Euphrasia arguta* in a conservation reserve. The majority of *E. arguta* plants are located in Nundle State Forest. A small part of the largest population of *E. arguta* is located on private land that is currently used for rough grazing by sheep or cattle (D. Binns pers. comm. June 2009). D. Binns (pers. comm. June 2009) notes that all sites where *E. arguta* is	

[13] Commonwealth of Australia 2011. *Approved Conservation Advice for Euphrasia arguta (a herb)*

[14] Bureau of Meteorology (BoM) 2022. Climate data online. Accessed during February 2022 from Australia's official weather forecasts & weather radar - Bureau of Meteorology (bom.gov.au).

Source	Habitat	Notes on habitat within Study Area
	found, have been either logged in the last few decades, or appear to have regrown from past clearing. Clearing for a fire break resulted in good germination of the species in the largest population in 2007. When the same area was again cleared in December 2009, however, there was a reduced level of regeneration of *E. arguta*. This may suggest a decline in the species at this site as a result of repeated clearing.	

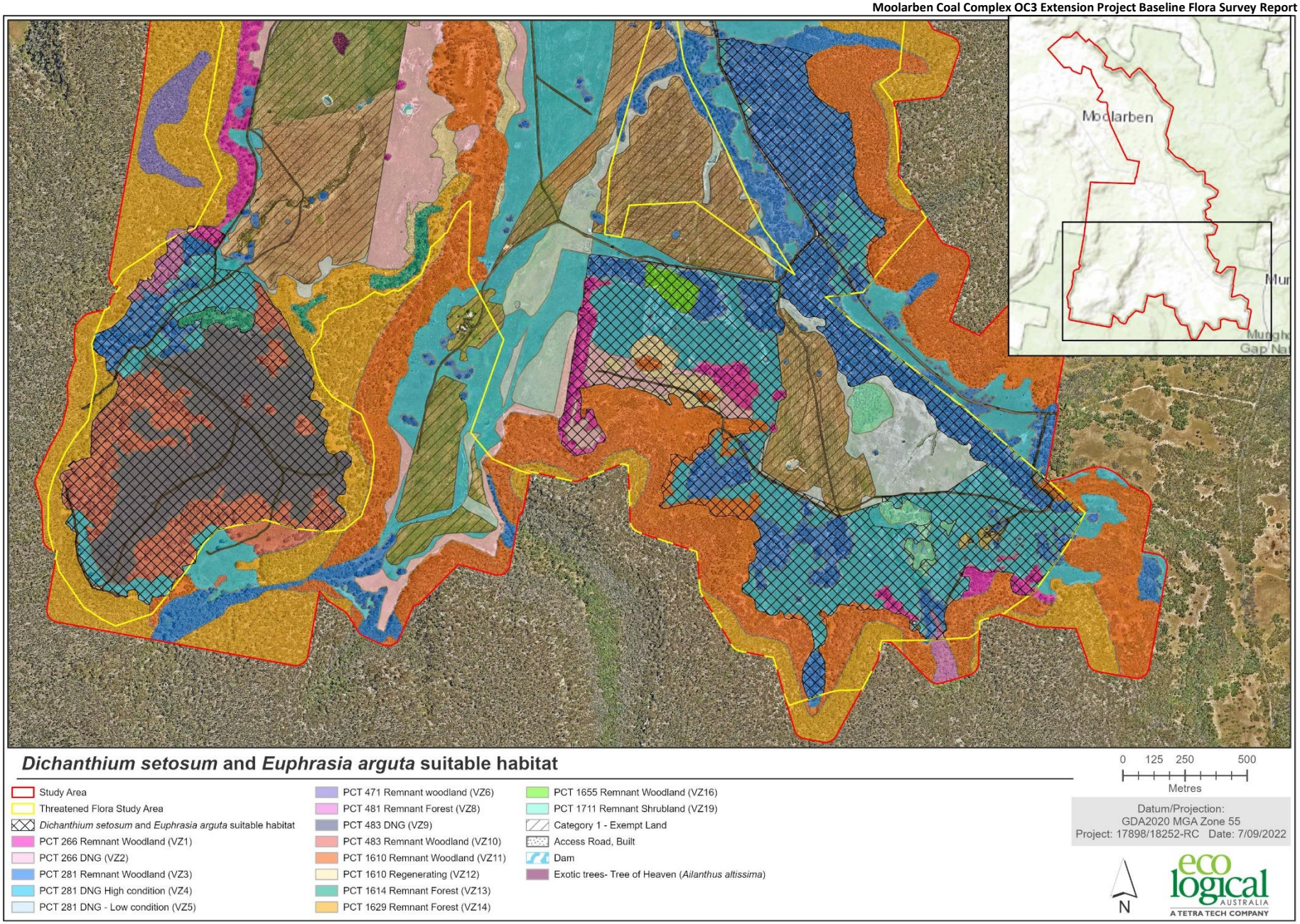


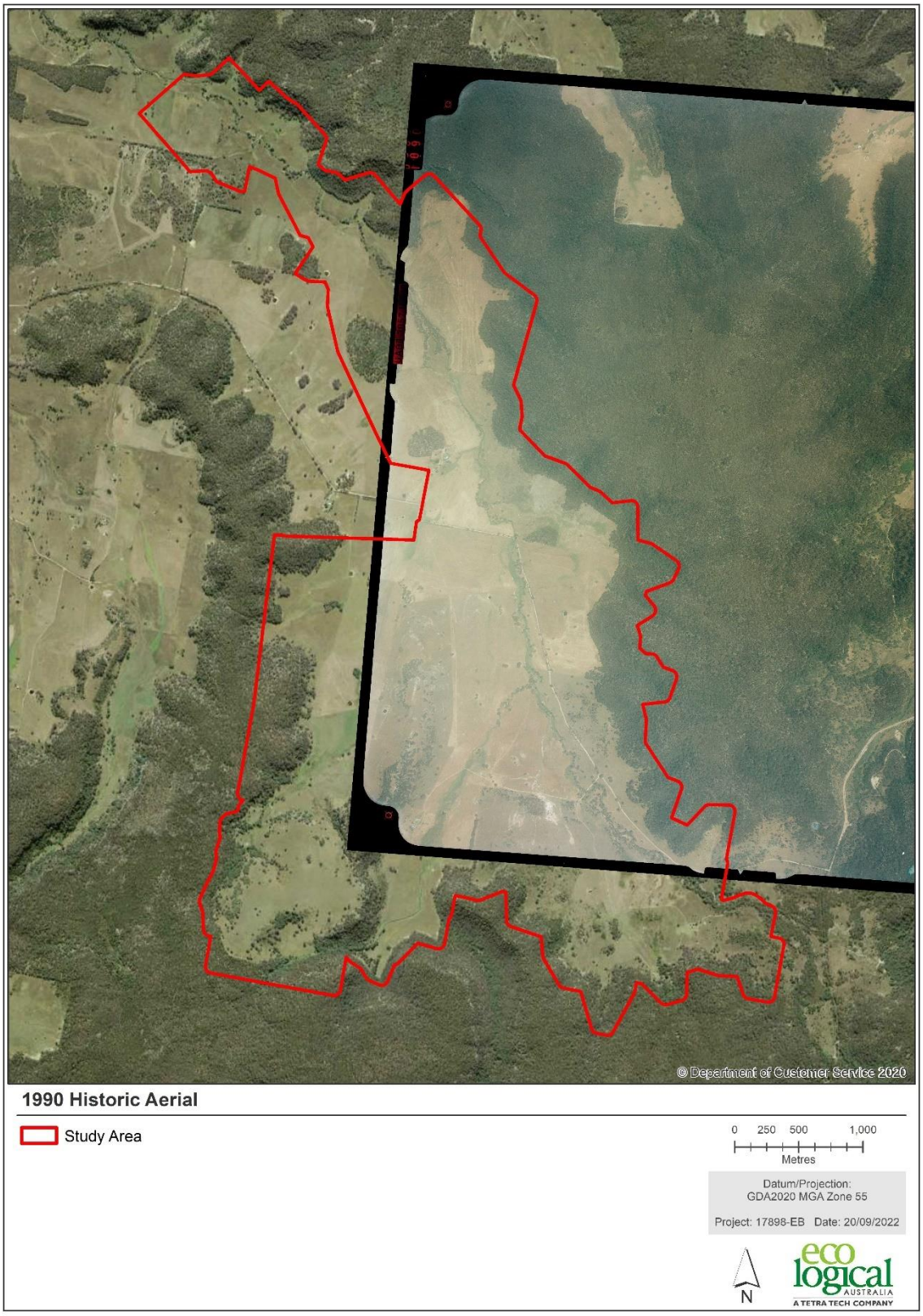
Figure B1: Suitable habitat for *Dichanthium setosum* and *Euphrasia arguta*

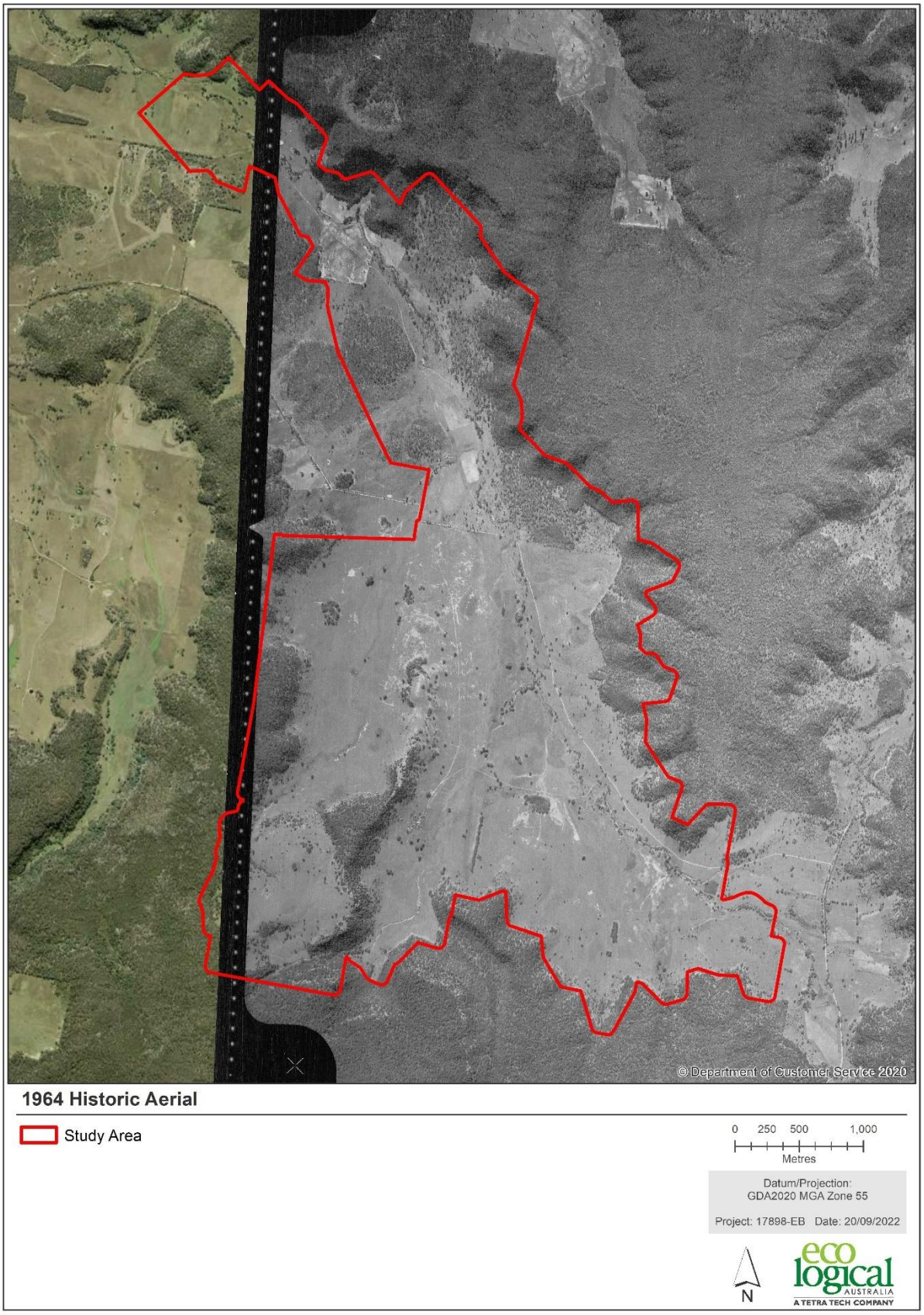
Appendix C Category 1 – Exempt Land Assessment

C1 IGGAM data

Provided as separate excel document to Resource Strategies.

C2 Historic aerial imagery




© Department of Customer Service 2020
1964 Historic Aerial
Study Area
0 250 500 1,000
Metres
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GDA2020 MGA Zone 55
Project: 17898-EB Date: 20/09/2022
N
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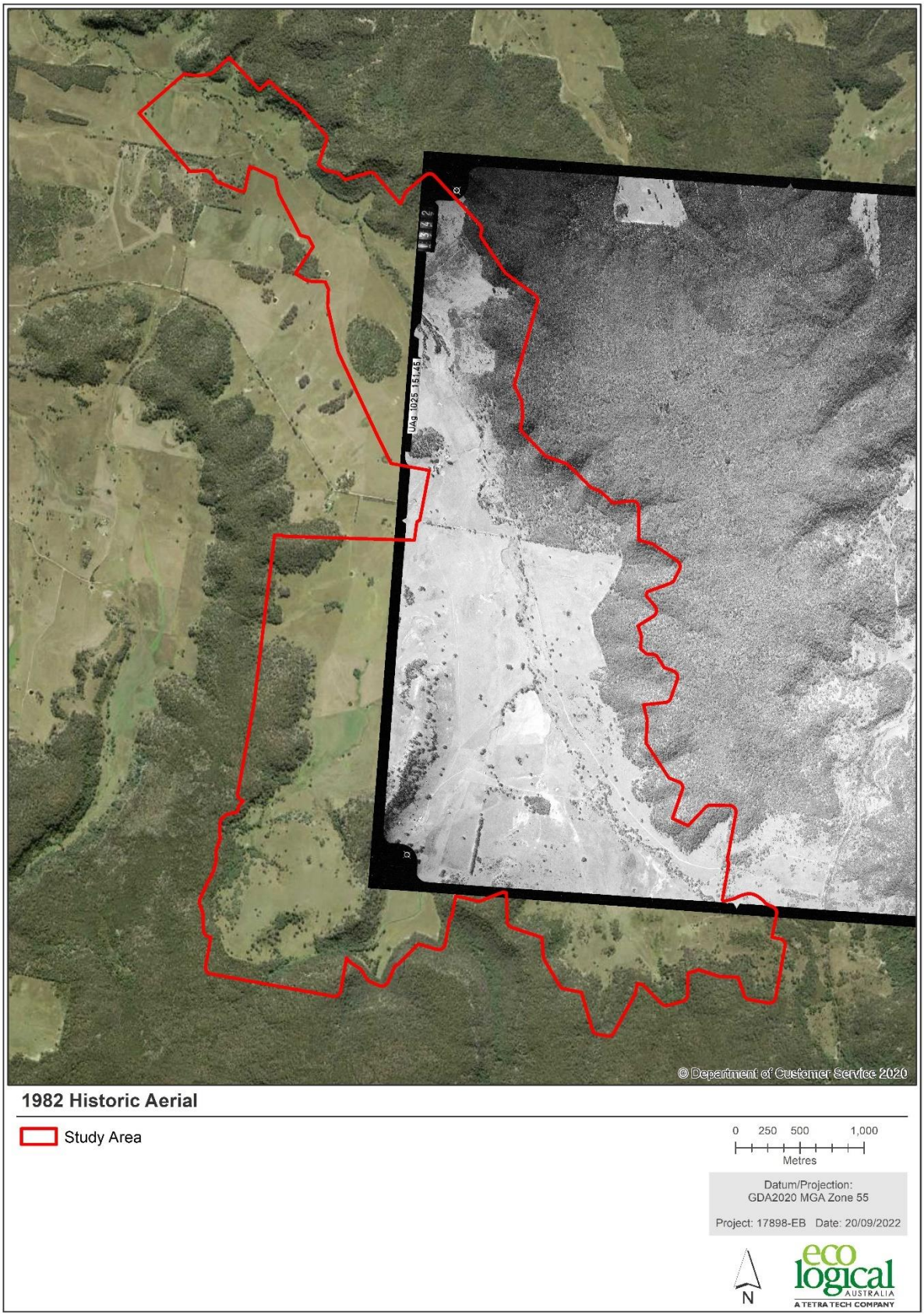
UAg 1025 151.45
© Department of Customer Service 2020
1982 Historic Aerial
Study Area
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GDA2020 MGA Zone 55
Project: 17898-EB Date: 20/09/2022
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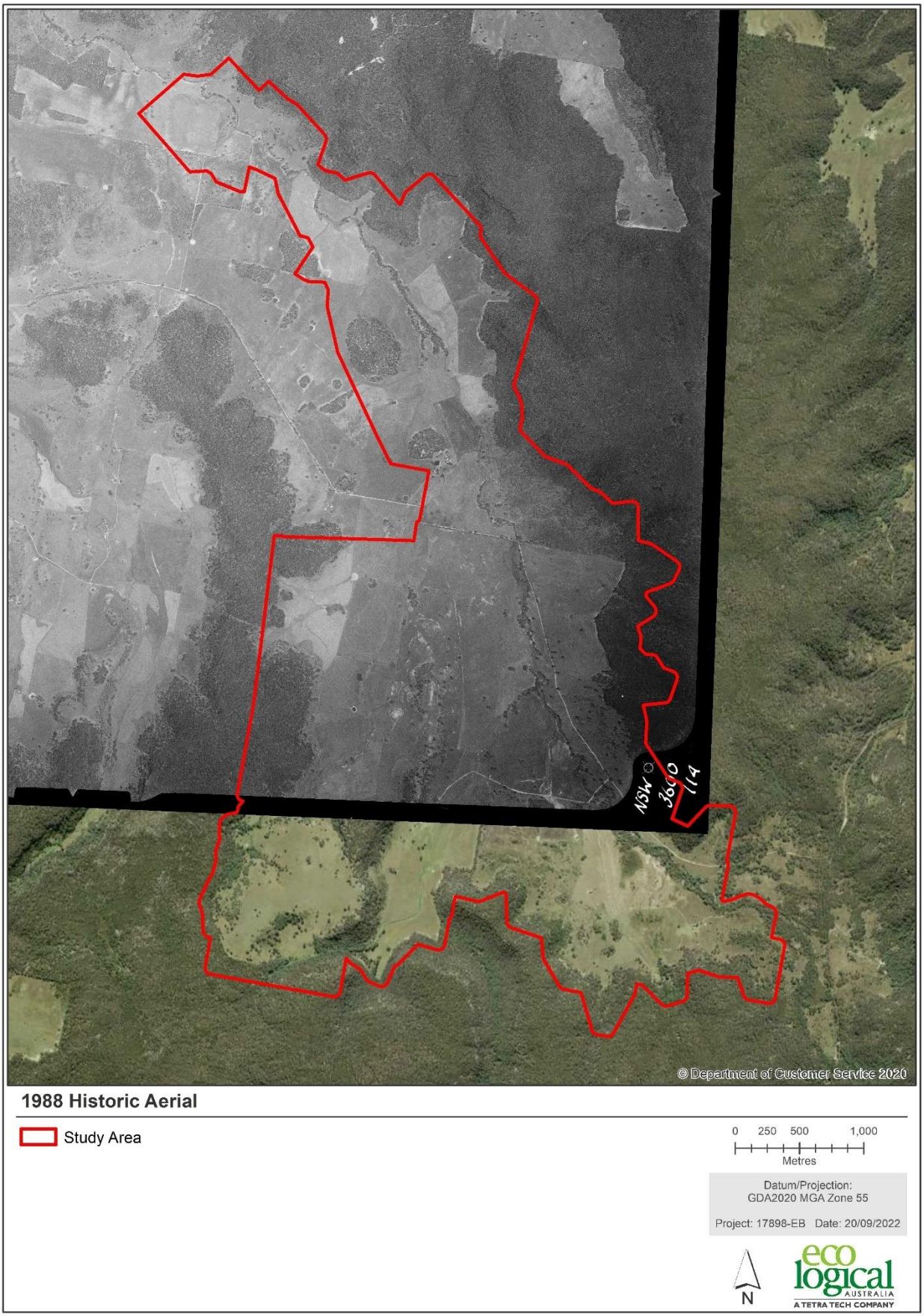
© Department of Customer Service 2020
1988 Historic Aerial
Study Area
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Metres
Datum/Projection:
GDA2020 MGA Zone 55
Project: 17898-EB Date: 20/09/2022
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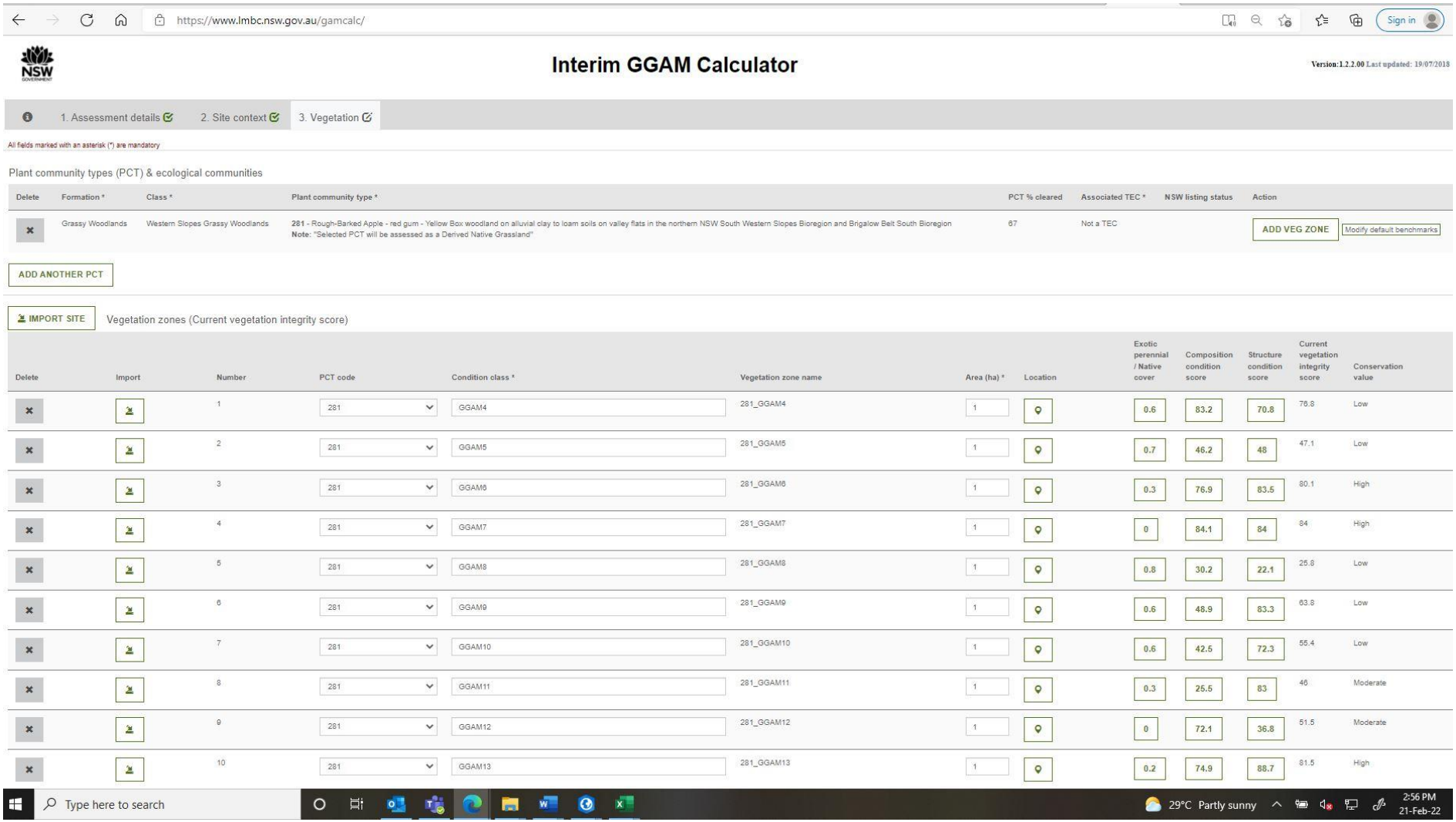
C3 IGGAM Calculator outputs



https://www.lmbc.nsw.gov.au/gamcalc/

Sign in

Interim GGAM Calculator

Version:1.2.2.00 Last updated: 19/07/2018

1. Assessment details ✓ 2. Site context ✓ 3. Vegetation ✓

All fields marked with an asterisk (*) are mandatory

Plant community types (PCT) & ecological communities

Delete	Formation *	Class *	Plant community type *	PCT % cleared	Associated TEC *	NSW listing status	Action
×	Grassy Woodlands	Western Slopes Grassy Woodlands	**281** - Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion **Note:** "Selected PCT will be assessed as a Derived Native Grassland"	67	Not a TEC		ADD VEG ZONE Modify default benchmarks

ADD ANOTHER PCT

IMPORT SITE Vegetation zones (Current vegetation integrity score)

Delete	Import	Number	PCT code	Condition class *	Vegetation zone name	Area (ha) *	Location	Exotic perennial / Native cover	Composition condition score	Structure condition score	Current vegetation integrity score	Conservation value
×		1	281	GGAM4	281_GGAM4	1		0.6	83.2	70.8	76.8	Low
×		2	281	GGAM5	281_GGAM5	1		0.7	46.2	48	47.1	Low
×		3	281	GGAM6	281_GGAM6	1		0.3	76.9	83.5	80.1	High
×		4	281	GGAM7	281_GGAM7	1		0	84.1	84	84	High
×		5	281	GGAM8	281_GGAM8	1		0.8	30.2	22.1	25.8	Low
×		6	281	GGAM9	281_GGAM9	1		0.6	48.9	83.3	63.8	Low
×		7	281	GGAM10	281_GGAM10	1		0.6	42.5	72.3	55.4	Low
×		8	281	GGAM11	281_GGAM11	1		0.3	25.5	83	46	Moderate
×		9	281	GGAM12	281_GGAM12	1		0	72.1	36.8	51.5	Moderate
×		10	281	GGAM13	281_GGAM13	1		0.2	74.9	88.7	81.5	High

Type here to search

29°C Partly sunny

2:56 PM
21-Feb-22

✖		10	281	GGAM13	281_GGAM13	1		0.2	74.9	88.7	81.5	High		
✖		11	281	GGAM14	281_GGAM14	1		0.1	87.3	86.4	86.8	High		
✖		12	281	GGAM15	281_GGAM15	1		1	19.9	15.1	17.3	Low		
✖		13	281	GGAM16	281_GGAM16	1		0.7	49.2	67.1	57.4	Low		
✖		14	281	GGAM17	281_GGAM17	1		0	83.9	85.2	84.5	High		
✖		15	281	GGAM18	281_GGAM18	1		0.1	72.8	48.3	59.3	Moderate		
✖		16	281	GGAM19	281_GGAM19	1		0	46.2	83.1	61.9	High		
✖		17	281	GGAM20	281_GGAM20	1		0.6	74.5	83.7	79	Low		

CLEAR

Appendix D BC Act listed TECs

D1 White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland

NSW BC Act Final Determination	PCT 266		PCT 281			PCT 483	
	Remnant woodland (VZ1)	DNG (VZ2)	Remnant woodland (VZ3)	DNG (VZ4)	DNG – Low condition (VZ5)	Remnant woodland (VZ10)	DNG (VZ9)
Part 1: Assemblage of species							
Part 1.1: White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is characterised by the assemblage of species in Part 1.1 of the Determination.	The species assemblage recorded was consistent with the species listed in Part 1.1 of the Determination, and included 27 of the species listed in Part 1.1: *Acacia implexa, Acaena ovina , Aristida ramosa, Asperula conferta, Bothriochloa macra, Cheilanthes sieberi subsp. sieberi, Chloris ventricosa, Cymbonotus lawsonianus, Cynoglossum suaveolens, Einadia nutans subsp. nutans, Eucalyptus albens, Euchiton sphaericus, Euphorbia drummondii, Geranium solanderi var. solanderi, Hydrocotyle laxiflora, Lomandra multiflora subsp. multiflora, Microlaena stipoides var. stipoides, Oxalis perennans, Panicum effusum, Plantago debilis, Sida corrugata, Sporobolus creber, Stellaria pungens, Swainsona galegifolia, Themeda triandra, Veronica plebeia, Wahlenbergia communis*	The species assemblage recorded was consistent with the species listed in Part 1.1 of the Determination, and included 19 of the species listed in Part 1.1: *Aristida ramosa, Bothriochloa macra, Cheilanthes sieberi subsp. sieberi, Chloris ventricosa, Cymbonotus lawsonianus, Einadia nutans subsp. nutans, Euphorbia drummondii, Hydrocotyle laxiflora, Lomandra filiformis subsp. filiformis, Lomandra multiflora subsp. multiflora, Microlaena stipoides var. stipoides, Oxalis perennans, Panicum effusum, Plantago debilis, Rumex brownii, Sida corrugata, Sporobolus creber, Themeda triandra, Veronica plebeia*	The species assemblage recorded was consistent with the species listed in Part 1.1 of the Determination, and included 31 of the species listed in Part 1.1: *Acacia implexa, Acaena ovina, Angophora floribunda, Aristida ramosa, Asperula conferta, Austrostipa aristiglumis, Bothriochloa macra, Cheilanthes sieberi subsp. sieberi, Chrysocephalum apiculatum, Cymbonotus lawsonianus, Einadia nutans subsp. nutans, Eucalyptus blakelyi, Eucalyptus bridgesiana, Eucalyptus melliodora, Euchiton sphaericus, Galium spp., Geranium solanderi var. solanderi, Hydrocotyle laxiflora, Lomandra filiformis subsp. filiformis, Lomandra multiflora subsp. multiflora, Microlaena stipoides var. stipoides, Oxalis perennans, Panicum effusum, Plantago debilis, Rumex brownii, Sporobolus creber, Stellaria pungens, Swainsona galegifolia, Themeda triandra, Veronica plebeia, Wahlenbergia communis*	The species assemblage recorded was consistent with the species listed in Part 1.1 of the Determination, and included 19 of the species listed in Part 1.1: *Aristida ramosa, Bothriochloa macra, Cheilanthes sieberi subsp. sieberi, Chrysocephalum apiculatum, Cymbonotus lawsonianus, Eucalyptus blakelyi, Euchiton sphaericus, Geranium solanderi var. solanderi, Hypericum gramineum, Lomandra multiflora subsp. multiflora, Microlaena stipoides var. stipoides, Oxalis perennans, Panicum effusum, Plantago debilis, Rumex brownii, Sida corrugata, Sporobolus creber, Themeda triandra, Veronica plebeia*	The species assemblage recorded was consistent with the species listed in Part 1.1 of the Determination, and included 19 of the species listed in Part 1.1: *Bothriochloa macra, Einadia nutans* subsp. *nutans, Geranium solanderi, Hypericum gramineum, Microlaena stipoides* var. *stipoides, Oxalis perennans, Panicum effusum, Rumex brownii, Sporobolus creber, Wahlenbergia communis.*	The species assemblage recorded was consistent with the species listed in Part 1.1 of the Determination, and included 24 of the species listed in Part 1.1: *Acacia implexa, Acaena ovina, Angophora floribunda, Aristida ramosa, Asperula conferta, Bothriochloa macra, Cheilanthes sieberi subsp. sieberi, Chloris ventricosa, Cymbonotus lawsonianus, Cymbopogon refractus, Cynoglossum suaveolens, Einadia nutans subsp. nutans, Eucalyptus albens, Geranium solanderi var. solanderi, Hydrocotyle laxiflora, Lomandra filiformis subsp. filiformis, Lomandra multiflora subsp. multiflora, Microlaena stipoides var. stipoides, Oxalis perennans, Rumex brownii, Sporobolus creber, Swainsona galegifolia, Themeda triandra, Veronica plebeia.*	The species assemblage recorded was consistent with the species listed in Part 1.1 of the Determination, and included:25 of the species listed in Part 1.1: *Acacia implexa, Angophora floribunda, Aristida ramosa, Asperula conferta, Bothriochloa macra, Cheilanthes sieberi subsp. sieberi, Chloris ventricosa, Cymbonotus lawsonianus, Eucalyptus albens, Euphorbia drummondii, Geranium solanderi var. solanderi, Hydrocotyle laxiflora, Lomandra filiformis subsp. filiformis, Lomandra multiflora subsp. multiflora, Microlaena stipoides var. stipoides, Oxalis perennans, Panicum effusum, Plantago debilis, Rumex brownii, Rytidosperma setaceum, Sida corrugata, Sporobolus creber, Themeda triandra, Veronica plebeia, Wahlenbergia communis.*
Part 1.2: The total species list of the community across all occurrences is likely to be considerably larger than that given above.	A further 34 native species were recorded in addition to those listed in Part 1.1 of the Determination. Floristic assemblage across plots throughout the same VZ also varied.	A further 35 native species were recorded in addition to those listed in Part 1.1 of the Determination. Floristic assemblage across plots throughout the same VZ also varied.	A further 56 native species were recorded in addition to those listed in Part 1.1 of the Determination. Floristic assemblage across plots throughout the same VZ also varied.	A further 47 native species were recorded in addition to those listed in Part 1.1 of the Determination. Floristic assemblage across plots throughout the same VZ also varied.	A further 32 native species were recorded in addition to those listed in Part 1.1 of the Determination.	A further 34 native species were recorded in addition to those listed in Part 1.1 of the Determination. Floristic assemblage across plots throughout the same VZ also varied.	A further 50 native species were recorded in addition to those listed in Part 1.1 of the Determination. Floristic assemblage across plots throughout the same VZ also varied.
Part 2: Particular area occupied by the ecological community							
Part 2.1 The assemblage of species listed in Part 1.1 above which characterises White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland occurs within NSW in the Brigalow Belt South, Nandewar, New England Tableland, Sydney Basin, NSW North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes and Riverina Bioregions.	The Study Area is located within the Sydney Basin IBRA region.	The Study Area is located within the Sydney Basin IBRA region.	The Study Area is located within the Sydney Basin IBRA region.	The Study Area is located within the Sydney Basin IBRA region.	The Study Area is located within the Sydney Basin IBRA region.	The Study Area is located within the Sydney Basin IBRA region.	The Study Area is located within the Sydney Basin IBRA region.

NSW BC Act Final Determination	PCT 266		PCT 281			PCT 483	
	Remnant woodland (VZ1)	DNG (VZ2)	Remnant woodland (VZ3)	DNG (VZ4)	DNG – Low condition (VZ5)	Remnant woodland (VZ10)	DNG (VZ9)
Part 2.2 It is the intent of the NSW Threatened Species Scientific Committee that all occurrences of the ecological community (both recorded and as yet unrecorded, and independent of their condition) that occur within these bioregions be covered by this Determination.	Two (2) condition states		Three (3) condition states			Two (2) condition states	
Outcome against Part 1 and Part 2 of the Determination	**PCT 266 remnant woodland meets the listing criteria and is therefore part of the CEEC *White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin*.**	**PCT 266 DNG meets the listing criteria and is therefore part of the CEEC *White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin*.**	**PCT 281 remnant woodland meets the listing criteria and is therefore part of the CEEC *White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin*.**	**PCT 281 DNG meets the listing criteria and is therefore part of the CEEC *White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin*.**	**PCT 281 DNG – low condition meets the listing criteria and is therefore part of the CEEC *White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin*.**	**PCT 483 remnant woodland meets the listing criteria and is therefore part of the CEEC *White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin*.**	**PCT 483 DNG meets the listing criteria and is therefore part of the CEEC *White Box – Yellow Box –Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the Sydney Basin*.**
Part 4: Additional information about the ecological community							
Part 4.1. In New South Wales, the community corresponds broadly with Keith's (2004) Western Slopes Grassy Woodlands, Southern Tableland Grassy Woodlands and New England Grassy Woodlands classes	Consistent with Keith's (2004) Western Slopes Grassy Woodland vegetation class: *'typically dominated by box and gum eucalypt species up to 20 m tall, on fertile soils on slopes on the western side of the Great Dividing Range'*	Consistent with Keith's (2004) Western Slopes Grassy Woodland vegetation class: *'typically dominated by box and gum eucalypt species up to 20 m tall, on fertile soils on slopes on the western side of the Great Dividing Range'*	Consistent with Keith's (2004) Western Slopes Grassy Woodland vegetation class: *'typically dominated by box and gum eucalypt species up to 20 m tall, on fertile soils on slopes on the western side of the Great Dividing Range'*	Consistent with Keith's (2004) Western Slopes Grassy Woodland vegetation class: *'typically dominated by box and gum eucalypt species up to 20 m tall, on fertile soils on slopes on the western side of the Great Dividing Range'*	Consistent with Keith's (2004) Western Slopes Grassy Woodland vegetation class: *'typically dominated by box and gum eucalypt species up to 20 m tall, on fertile soils on slopes on the western side of the Great Dividing Range'*	Consistent with Keith's (2004) Western Slopes Grassy Woodland vegetation class: *'typically dominated by box and gum eucalypt species up to 20 m tall, on fertile soils on slopes on the western side of the Great Dividing Range*'	Consistent with Keith's (2004) Western Slopes Grassy Woodland vegetation class: *'typically dominated by box and gum eucalypt species up to 20 m tall, on fertile soils on slopes on the western side of the Great Dividing Range*'
Part 4.2 Characterised by widely spaced trees with canopies not touching and projected foliage cover generally less than 30%	*Eucalyptus albens* present throughout PCT 266. Canopy cover was generally less than 30% across PCT 266 remnant woodland.	*Eucalyptus albens* present throughout PCT 266. Canopy cover was generally less than 5% across PCT 266 DNG.	PCT 281 remnant woodland has a mean canopy cover of 17.5%, median of 15.5% with a range of 28%-15% across monitoring plots	*Eucalyptus melliodora* and *Eucalyptus blakelyi* were present throughout PCT 281 DNG as paddock trees. Canopy cover was less than 5% across PCT 281 DNG.	*Eucalyptus melliodora* and *Eucalyptus blakelyi* were present throughout PCT 281 DNG – Low condition as paddock trees. Canopy cover was less than 5% across PCT 281 DNG.	Canopy cover was generally less than 30% across PCT 483 remnant woodland.	Canopy cover was generally less than 5% across PCT 483 DNG.
Part 4.2 Tree height ranges from approximately 15 – 30 m and declines with increasing aridity from east to west	Structural data collected throughout PCT 266 indicates that mature trees ranged from 15 to 25 m.	Structural data collected throughout PCT 266 indicates that mature trees ranged from 15 to 25 m.	Structural data collected throughout PCT 281 indicates that mature trees ranged from 15 to 25 m.	Structural data collected throughout PCT 281 DNG indicates that mature trees ranged from 15 to 25 m.	Structural data collected throughout PCT 281 DNG – low condition indicates that mature trees ranged from 15 to 25 m.	Structural data collected throughout PCT 483 remnant woodland indicates that mature trees ranged from 15 to 25 m.	Structural data collected throughout PCT 483 DNG indicates that mature trees ranged from 15 to 25 m.
Part 4.2 The groundcover is dominated by perennial tussock grasses interspersed with a diverse range of forb species with the families Asteraceae and Fabaceae, and the orders Liliales and Asparagales well represented Part 4.3 A number of understorey species are typically found throughout almost the entire range of the community (with the exception of the extreme north of its distribution and areas where they have been excluded by grazing). These include: "the dominant tussock grasses *Themeda triandra* and *Poa sieberiana* and a range of other forbs and grasses such as *Chrysocephalum apiculatum*, *Hypericum gramineum, Geranium solanderi, Glycine clandestina, Dianella revoluta*, *D. longifolia, Asperula conferta, Leptorhynchos squamatus, Goodenia pinnatifida, Pimelea curviflora, Stackhousia monogyna,*	PCT 266 is dominated by perennial native tussock grasses including, but not limited to, *Sporobolus creber, Themeda triandra, Austrostipa verticillata* and *Austrostipa scabra.* Asteraceae species *Calotis cuneifolia*, *Calotis lappulacea, Vittadinia cuneifolia* and *Vittadinia muelleri.* Fabaceae – Faboideae species *Desmodium varians* and *Glycine tabacina* were also consistently present throughout PCT 266 remnant woodland. Orchidaceae species *Pterostylis mutica*, *Pterostylis bicolor, Microtis unifolia* and *Thelymitra ixioides* and lily (Asphodelaceae) species *Bulbine bulbosa,*	PCT 266 DNG is dominated by perennial native tussock grasses including, but not limited to, *Sporobolus creber, Themeda triandra, Austrostipa verticillata* and *Austrostipa scabra.* Asteraceae species *Calotis cuneifolia*, *Calotis lappulacea, Vittadinia cuneifolia* and *Vittadinia muelleri.* Fabaceae – Faboideae species *Desmodium varians* and *Glycine tabacina* were also consistently present throughout PCT 266 remnant woodland. Orchidaceae species *Pterostylis mutica*, *Pterostylis bicolor, Microtis unifolia* and *Thelymitra ixioides* and lily (Asphodelaceae) species *Bulbine bulbosa,*	Dominated by native perennial grass species including *Austrostipa scabra subsp. scabra, Microlaena stipoides, Rytidosperma caespitosum and Sporobolus creber.* Asteraceae species Calotis cuneifolia, Calotis lappulacea and Vittadinia muelleri. Fabaceae – Faboideae species Desmodium varians and Glycine tabacina were also consistent throughout PCT 281 remnant woodland. Orchidaceae species *Pterostylis mutica, Pterostylis bicolor, Microtis unifolia* and *Thelymitra ixioides* and lily (Asphodelaceae) species *Bulbine bulbosa, Dichopogon fimbriatus, Dianella revoluta* and *Dianella longifolia*	Dominated by perennial native tussock grasses including *Sporobolus creber, Themeda triandra and Austrostipa scabra.* Asteraceae species Calotis cuneifolia, Calotis lappulacea and Vittadinia muelleri. Fabaceae – Faboideae species Desmodium varians and Glycine tabacina were also consistently present throughout PCT 281 DNG. Orchidaceae species *Pterostylis mutica, Pterostylis bicolor, Microtis unifolia* and *Thelymitra ixioides* and lily (Asphodelaceae) species *Bulbine bulbosa, Dichopogon fimbriatus, Dianella revoluta* and *Dianella longifolia* were recorded during October 2020 (ELA 2020).	Dominated by perennial native tussock grasses including *Eragrostis leptostachya* and *Sporobolus creber.* Asteraceae species *Calotis cuneifolia, Calotis lappulacea* and *Euchiton sphaericus,* and Fabaceae species *Glycine clandestina* and *Glycine tabacina,* were interspersed between tussocks. Orchidaceae species and Liliaceae species were generally absent, likely due to timing of survey (mid to late summer). These species groups are considered likely to be present.	Dominated by perennial native tussock grasses including, but not limited to, *Sporobolus creber, Themeda triandra, Austrostipa verticillata* and *Austrostipa scabra.* Asteraceae species *Calotis cuneifolia*, *Calotis lappulacea, Vittadinia cuneifolia* and *Vittadinia muelleri.* Fabaceae – Faboideae species *Desmodium varians* and *Glycine tabacina* were also consistently present throughout PCT 266 remnant woodland. Orchidaceae species *Pterostylis mutica*, *Pterostylis bicolor, Microtis unifolia* and *Thelymitra ixioides* and lily (Asphodelaceae) species *Bulbine bulbosa,*	Dominated by perennial native tussock grasses including, but not limited to, *Sporobolus creber, Themeda triandra, Austrostipa verticillata* and *Austrostipa scabra.* Asteraceae species *Calotis cuneifolia*, *Calotis lappulacea, Vittadinia cuneifolia* and *Vittadinia muelleri.* Fabaceae – Faboideae species *Desmodium varians* and *Glycine tabacina* were also consistently present throughout PCT 266 remnant woodland. Orchidaceae species *Pterostylis mutica*, *Pterostylis bicolor, Microtis unifolia* and *Thelymitra ixioides* and lily (Asphodelaceae) species *Bulbine bulbosa,*

NSW BC Act Final Determination	PCT 266		PCT 281			PCT 483	
	Remnant woodland (VZ1)	DNG (VZ2)	Remnant woodland (VZ3)	DNG (VZ4)	DNG – Low condition (VZ5)	Remnant woodland (VZ10)	DNG (VZ9)
Cheilanthes sieberi, Austrostipa scabra, Bulbine bulbosa, Lomandra filiformis and *Oxalis perennans* occupying the inter-tussock spaces"	*Dichopogon fimbriatus, Dianella revoluta* and *Dianella longifolia* were recorded during October 2020 (ELA 2021). *Geranium solanderi, Cheilanthes sieberi, Lomandra filiformis* and *Oxalis perennans* were consistently recorded across most vegetation integrity plots within PCT 266 remnant woodland.	*Dichopogon fimbriatus, Dianella revoluta* and *Dianella longifolia* were recorded during October 2020 (ELA 2020). *Geranium solanderi, Cheilanthes sieberi, Lomandra filiformis* and *Oxalis perennans* were consistently recorded across most vegetation integrity plots within PCT 266 remnant woodland.	were recorded during October 2020 (ELA 2020). .			*Dichopogon fimbriatus, Dianella revoluta* and *Dianella longifolia* were recorded during October 2020 (ELA 2020). *Geranium solanderi, Cheilanthes sieberi, Lomandra filiformis* and *Oxalis perennans* were consistently recorded across most vegetation integrity plots within PCT 483 remnant woodland.	*Dichopogon fimbriatus, Dianella revoluta* and *Dianella longifolia* were recorded during October 2020 (ELA 2020). *Geranium solanderi, Cheilanthes sieberi, Lomandra filiformis* and *Oxalis perennans* were consistently recorded across most vegetation integrity plots within PCT 483 DNG.
Part 4.4 In the western parts of its range, generally the western slopes below 700 m ASL, is typically dominated by *Eucalyptus albens*, although *E. melliodora* and *E. blakelyi* may be co-dominant or dominant in localised areas such as along non-permanent water courses and in deeper soils associated with valley floors Part 4.5 Characteristically dominated by one or more of the species *Eucalyptus albens* (White Box), *E. melliodora* (Yellow Box) *and E. blakelyi* (Blakely's Red Gum). Part 4.6 Upper Hunter and Goulburn River Valleys typically dominated by *Eucalyptus 'albemol*' (a presumed intergrade between *E. albens* and *E. moluccana*), although *E. melliodora* and *E. blakelyi* may be co-dominant or dominant in localised areas along non-permanent creeks	*Eucalyptus albens* was the dominant canopy species throughout PCT 266 remnant woodland. *Brachychiton populneus* subsp. *populneus* was also recorded throughout PCT 266 remnant woodland.	*Eucalyptus albens* was the dominant canopy species, occurring as remnant paddock trees throughout PCT 266 DNG	*Eucalyptus blakelyi, Eucalyptus melliodora* were the dominant canopy species throughout PCT 281 remnant woodland. *Eucalyptus albens, Angophora floribunda* and *Eucalyptus bridgesiana* were also present; however, were never the dominant canopy species.	*Eucalyptus blakelyi* and *Eucalyptus melliodora* were the dominant canopy species, present as paddock trees throughout PCT 281 DNG. The DNG form of PCT 281 is present within surrounding remnant woodland patches of PCT 281. Prior to clearing, the DNG areas would likely have been floristically similar to the remnant woodland patches.	*Eucalyptus blakelyi* and *Eucalyptus melliodora* were the dominant canopy species, present as paddock trees. The DNG form of PCT 281 is present within surrounding remnant woodland patches of PCT 281. Prior to clearing, the DNG areas would likely have been floristically similar to the remnant woodland patches.	*Angophora floribunda* was the dominant canopy species throughout PCT 483 remnant woodland due to prolific regeneration; however, *Brachychiton populneus* subsp. *populneus* and *Eucalyptus albens* were also recorded.	*Eucalyptus albens* was the dominant canopy species throughout PCT 483 DNG. This species was present as widely spaced paddock trees. Due to landscape position and deeper soils with lower rock content, this VZ would have been dominated by *Eucalyptus albens* prior to clearing and there is no evidence supporting the historical presence or dominance of *Angophora floribunda* within this VZ.
Part 4.2 Understorey shrubs are typically sparse or absent			Four of six plots contain a shrub midstorey with plots containing understorey species returning a shrub species richness of 9 species, and an average cover of <1%. Shrub species included: • *Acacia implexa* • *Daviesia ulicifolia* subsp. *ulicifolia* • *Persoonia linearis* • *Styphelia triflora*				
Part 4.4 Shrub and sub-shrub species such as *Bursaria spinosa* (Blackthorn), *Cassinia sifton* (Sifton Bush), *Eremophila debilis* (Winter Apple), *Notelaea microcarpa* (Native Olive), *Pimelea curviflora* (Curved Rice Flower) and *Templetonia stenophylla* (Leafy Templetonia) may be observed in the western parts of the range although generally with low cover and abundance	Shrubs recorded within PCT 266 included *Acacia decora* and *Acacia implexa.* Midstorey cover was generally sparse (<1% cover across vegetation integrity plots).	Due to clearing, shrubs are absent from PCT 266 DNG.	Due to clearing, shrubs are absent.	Due to clearing, shrubs are absent.	Shrubs included *Bursaria spinosa.* Midstorey cover was generally sparse (average of 7% cover across vegetation integrity plots).	Shrubs are absent.	
Part 4.6 May occur in the upper Hunter and Goulburn River Valleys where the Great Dividing Range is low, and the climate is suitable for the incursion of species from the west of the divide. Part 4.9 Known to occur on hilly to undulating landscapes in areas with soils of moderate fertility derived from a range of lithologies, including alkaline and acid volcanics, granites, sediments, serpentinites and metamorphic.	Location within areas of colluvial and alluvial clay loam soils in valley floor landscape positions. The Study Area is located within the Upper Goulburn River Valley and Escarpments NSW Landscape.		Location within areas of colluvial and alluvial clay loam soils in valley floor landscape positions. The Study Area is located within the Upper Goulburn River Valley and Escarpments NSW Landscape.			Located within areas of clay loam soils derived from basalt in hilly to undulating landscapes. The Study Area is located within the Upper Goulburn River Valley NSW Landscape.	

NSW BC Act Final Determination	PCT 266		PCT 281			PCT 483	
	Remnant woodland (VZ1)	DNG (VZ2)	Remnant woodland (VZ3)	DNG (VZ4)	DNG – Low condition (VZ5)	Remnant woodland (VZ10)	DNG (VZ9)
Part 4.9. The topography on which the community occurs ranges from flat in the west of its range to hilly and undulating in the east							
Part 4.10 Annual rainfall across its distribution increases from west to east and is generally within the range 500 – 800 mm, although the community may occur in areas receiving as little as 400 mm/annum on the western slopes, and in some areas of the Southern Tablelands of NSW rainfall may be as high as 900 mm/annum	Average annual rainfall for the Ulan region is 640 mm.						
Part 4.10 Rainfall season varies from summer dominant in the north to weakly winter dominant in the south	Summer dominance of mean monthly rainfall with December and Jan recording highest average rainfall, with reduced precipitation over autumn and winter seasons (BOM 2021).						

D2 Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion

NSW BC Act Final Determination[15]	PCT 1655
Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion is the name given to the ecological community that generally occurs at the interface of Narrabeen Sandstone and Permian sediments in the Hunter Valley and is characterised by the assemblage of species as listed below. The community typically forms a low to mid-high woodland. All sites are within the Sydney Basin Bioregion.	The occurrence of PCT 1655 broadly corresponds to the geological interface between Permian sediments and Narrabeen Sandstone. The Study Area is located in the Hunter River catchment.
Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion is characterised by the following assemblage of species: *Acacia cultriformis , Acacia decora, Acacia salicina, Allocasuarina luehmannii, Aristida ramosa, Brachychiton populneus subsp. populneus, Brunoniella australis, Bursaria spinosa subsp. spinosa, Callitris endlicheri , Canthium odoratum, Cheilanthes sieberi subsp. sieberi, Cymbopogon refractus, Desmodium brachypodum, Dichondra repens, Dodonaea viscosa subsp. cuneata, Eremophila debilis, Eucalyptus crebra, Eucalyptus dawsonii, Eucalyptus moluccana, Eucalyptus punctata, Fimbristylis dichotoma, Geijera salicifolia var. salicifolia, Glycine latifolia, Lomandra multiflora subsp. multiflora, Myoporum montanum, Notelaea microcarpa var. microcarpa, Olearia elliptica, Sida corrugata, Solanum brownii*	PCT 1655 was dominated by *Eucalyptus moluccana. Eucalyptus crebra, Brachychiton populneus* subsp. *populneus* and *Callitris endlicheri* were also recorded throughout the VZ. *Aristida ramosa, Dichondra repens* and *Sida corrugata* were also recorded throughout PCT 1655.
Hunter Valley Footslopes Slaty Gum Woodland typically forms a woodland, or occasionally forest, comprising a sparse to moderately dense tree stratum, occasional low tree stratum, and moderately dense to dense shrub stratum. The tree canopy is typically dominated by *Eucalyptus dawsonii* (Slaty Gum) and/or *Eucalyptus moluccana* (Grey Box). *Acacia salicina* (Cooba) and *Allocasuarina luehmannii* (Bulloke) may form a low tree stratum or may be part of the upper-most canopy. Other trees which may be present include *Brachychiton populneus* subsp. *populneus* (Kurrajong), *Callitris endlicheri* (Black Cypress Pine), *Eucalyptus crebra* (Narrow-Leaved Ironbark) and *Eucalyptus punctata* (Grey Gum). The shrub layer may include *Olearia elliptica* (Sticky Daisy Bush), *Acacia cultriformis* (Knife-leaved Wattle), *Canthium odoratum* (Shiny-leaved Canthium), *Notelaea microcarpa* var. *microcarpa* (Native Olive), *Dodonaea viscosa* subsp. *cuneata* (Wedge-leaf Hopbush), *Acacia decora* (Western Golden Wattle), *Bursaria spinosa* subsp. *spinosa* (Native Blackthorn), *Myoporum montanum* (Water Bush) and *Solanum brownii* (Violet Nightshade). The groundcover is typically sparse to very sparse and is relatively species poor. It may include *Dichondra repens* (Kidney Weed), *Lomandra multiflora* subsp. *multiflora* (Many-Flowered Mat-rush), *Aristida ramosa* (Wire Grass), *Brunoniella australis* (Blue Trumpet), *Cymbopogon refractus* (Barbed Wire Grass), *Desmodium brachypodum* (Large Tick-trefoil), *Eremophila debilis* (Winter Apple), *Fimbristylis dichotoma* (Common Fringe-rush) and *Sida corrugata* (Corrugated Sida)[16].	PCT 1655 was dominated by *Eucalyptus moluccana. Eucalyptus crebra, Brachychiton populneus* subsp. *populneus* and *Callitris endlicheri* were also recorded throughout the VZ. *Aristida ramosa, Dichondra repens* and *Sida corrugata* were also recorded throughout PCT 1655. PCT 1655 formed a woodland to open forest vegetation structure. Shrub cover was very sparse (<1% cover across vegetation integrity plots); however, this may be a result of prolonged livestock grazing.
Hunter Valley Footslopes Slaty Gum Woodland typically occurs in colluvial soils on exposed footslopes associated with the interface of Triassic Narrabeen sandstone and Permian sediments.	PCT 1655 occurs on the Permian period Sydney Basin Illawarra Coal Measures associated with the interface of the Triassic Narrabeen sandstone (generally occurring upslope from occurrences of PCT 1655).

[15] NSW Threatened Species Scientific Committee 2010. *Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion - vulnerable ecological community listing*.

[16] Peake TC (2006) *The Vegetation of the Central Hunter Valley, New South Wales. A report on the findings of the Hunter Remnant Vegetation Projec*t. Hunter- Central Rivers Catchment Authority, Paterson.

NSW BC Act Final Determination[15]	PCT 1655
Hunter Valley Footslopes Slaty Gum Woodland has been recorded from the local government areas of Singleton and Muswellbrook but may occur elsewhere within the Sydney Basin Bioregion[17].	The Study Area is located within the Sydney Basin IBRA Region.
Outcome	**PCT 1655 within the Study Area conforms to the NSW TSSC Final Determination for the VEC *Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion.***

[17] Thackway R, Creswell ID (1995) *'An interim biogeographic regionalisation for Australia: a framework for setting priorities in the National Reserve System Cooperative Program*'. Version 4.0. ANCA, Canberra.

Appendix E EPBC Act TEC Assessments

E1 White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland

Criteria	PCT 281, PCT 266, PCT 483
1. Is, or was previously, at least one of the most common overstorey species White Box, Yellow Box or Blakely's Red Gum? 2. Does the patch have a predominately[1] native understorey? 3. Is the patch 0.1 ha or greater? 4. There are 12 or more native understorey species present (excluding grasses). There must be at least one 'important species'[3] a. If, not, is the patch 2 ha or greater in size? b. And, does the patch have an average of 20 or more mature trees per hectare, or is there natural regeneration of the dominant overstorey eucalypts?	In accordance with the EPBC Act Policy Statement, the patch is the larger of: • An area that covers five or more trees in which no tree is greater than 75 m from another tree, or, • The area over which the understorey is predominately native. The entire extent of PCT 281, PCT 266 and PCT 483 are continuous throughout the Study Area and the ground layer vegetation of all associated VZs (VZ1, VZ2, VZ3, VZ4, VZ5, VZ9 and VZ10) is dominated by native species; so therefore, the entire extent of these PCTs is considered as the 'patch' for the EPBC Act listed Box Gum Woodland. *1.* The most common overstorey species throughout the woodland forms of PCT 266 and PCT 281 is White Box, Yellow Box or Blakely's Red Gum. These species were present as paddock trees throughout the DNG forms of PCT 281 and PCT 266 indicating that they were once the dominant canopy species. White Box is one of the most common overstorey species throughout the woodland and DNG forms of PCT 483 (VZ9 and VZ10). *2.* All patches surveyed with a vegetation integrity plot or RDP exhibited a predominately native perennial understorey[1] dominated by *Aristida ramosa, Aristida vagans, Austrostipa scabra, Austrostipa verticillata* and *Microlaena stipoides* subsp. *stipoides.* Patches not surveyed with a vegetation integrity plot or RDP are considered the same VZ and condition class as those surveyed and are therefore likely to meet this criterion. 3. The patch is 856 ha in size. 4. There are greater than 12 native non-grass groundcover species across the patch, with several important species including *Glycine* spp, *Themeda triandra* and *Calotis lappulacea*.
'A remnant with a significant ground layer of tussock grasses, and where the distribution of shrubs is scattered or patchy, is part of the ecological community. In shrubby woodlands, the dominance of native tussock grasses in the ground layer of vegetation is lost. Therefore, a remnant with a continuous shrub layer, in which the shrub cover is greater than 30%, is considered to be a shrubby woodland and so is not part of the listed ecological community.'[4, 5]	Shrub cover was low (<5%) to absent across the patch.
Tree cover is generally discontinuous and consists of widely spaced trees of medium height in which the canopies are clearly separated'[4]	Tree cover is discontinuous, with the canopy rarely touching.
'This ecological community occurs in areas where rainfall is between 400 and 1200 mm per annum, on moderate to	Soil is fertile clay loams derived from basalt or sedimentary rock.

Criteria	PCT 281, PCT 266, PCT 483
highly fertile soils at altitudes of 170 metres to 1200 metres' [4]	
Outcome	**Outcome: All patches are likely to meet the listing criteria for the EPBC Act listed CEEC *White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland.***

[1] A predominately native ground layer is one where at least 50% of the perennial vegetation cover in the ground layer is made up of native species.

[2] Patches B and C are conservatively mapped based on condition of surrounding patches with similar historical land use. Patches B and C do not have connectivity to any other patches.

[3] Department of the Environment and Heritage (2006). *Species list for the EPBC Act policy statement – White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands*.

[4] Department of the Environment and Energy (DEE) 2006. *EPBC Act Policy Statement White Box – Yellow Box – Blakely's Red Gum grassy woodlands and derived native grasslands*.

[5] Remnant attributes, such as shrubbiness, should be measured on a scale of 0.1 hectares or greater

E2 Central Hunter Valley eucalypt forest and woodland

Commonwealth listing criteria	PCT 1655
In accordance with the EPBC Act *Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community*[1]*:* 1. It occurs in the Hunter River catchment (typically called the Hunter Valley region); AND 2. It typically occurs on lower hillslopes and low ridges, or valley floors in undulating country; on soils derived from Permian sedimentary rocks; AND 3. It does not occur on alluvial flats, river terraces, aeolian sands, Triassic sediments, or escarpments1; AND 4. It is woodland or forest, with a projected canopy cover of trees of 10% or more; or with a native tree density of at least 10 native tree stems per 0.5 ha (at least 20 native tree stems/ha) that are at least one metre in height; AND 5. The canopy of the ecological community is dominated by one or more of the following four eucalypt species: *Eucalyptus crebra* (narrow-leaved ironbark), *Corymbia maculata* (syn. *E. maculata*) (spotted gum), *E. dawsonii* (slaty gum) and *E. moluccana* (grey box); OR o a fifth species, *Allocasuarina luehmannii* (bull oak) dominates in combination with one or more of the above four eucalypt species, in sites previously dominated by one or more of the above four eucalypt species14; AND 6. *Allocasuarina torulosa* (forest oak/ she-oak, rose she-oak/oak), *Eucalyptus acmenoides* (white mahogany) and *E. fibrosa* (red/broad-leaved ironbark) are largely absent from the canopy of a patch; AND 7. A ground layer is present (although it may vary in development and composition), as a sparse to thick layer of native grasses and other native herbs and/or native shrubs.	1. Within the Study Area, the occurrence of PCT 1655 occurs on Permian sediment derived clay soil and broadly corresponds to the geological interface between Permian sediments and Narrabeen Sandstone. 2. PCT 1655 generally occurs lower hillslopes and low ridges, or valley floors in undulating country within The Study Area. 3. It does not occur on occur on alluvial flats, river terraces, aeolian sands, Triassic sediments, or escarpments within The Study Area. 4. Within The Study Area, PCT 1655 is a woodland / open forest structure, with a projected canopy cover of trees >10%. 5. The canopy of PCT 1655 within The Study Area is dominated by *Eucalyptus moluccana* and *Eucalyptus crebra*. 6. *Allocasuarina torulosa, Eucalyptus acmenoides* and *E. fibrosa* are absent from the canopy of a patch. 7. A ground layer is present (although it may vary in development and composition), as a sparse to thick layer of native grasses and other native herbs and/or native shrubs.
In accordance with the *Central Hunter Valley eucalypt forest and woodland: a nationally protected ecological community:* Is the patch at least 0.5 ha in size? 1. And, Is at least 50% of the perennial understorey vegetative cover of the patch (due to) native plants? 2. Are there at least 12 native understorey species in the whole patch? a. If not, is the patch at least 2 ha in size? b. If not, is the patch continuous with, or near (less than 100m) another area of native woody vegetation that is at least 1ha in size?	1. All patches of PCT 1655 within The Study Area are greater than 0.5ha in size (except patch E which is 0.1ha). 2. All patches surveyed with a vegetation integrity plot or RDP exhibited a predominately native perennial understorey dominated by *Aristida ramosa, Aristida vagans, Austrostipa scabra, Austrostipa verticillata* and *Microlaena stipoides* subsp. *stipoides.* Number of native species recorded in patches which were surveyed with a vegetation integrity plots is provided in the table below. Criteria 2 a – c is summarised in the table below.

Commonwealth listing criteria	PCT 1655

c. If not, does the patch have at least on, large, locally indigenous tree (at least 60 cm in diameter at breast height), or at least one tree with hollows?

Patch ID	VI plot	RDP	2.(native understorey species).	a. (Area (ha))	b.(Within 100m to native woody vegetation)	c. (>1 tree >60 cm DBH, or hollows)
A	No	Yes	-	1.9 ha	Yes	Yes
B	No	Yes	-	0.5 ha	Yes	Yes
C	No	Yes	-	2.11 ha	Yes	Yes
D	VI Plot 1	Yes	17	5.3 ha	Yes	Yes
E	No	No	-	0.2 ha[3]	Yes	-
F	VI Plot 4	Yes	24	1.75 ha	Yes	Yes
G	No	Yes	-	0.86 ha	Yes	Yes
H	VI Plot 19	Yes	23	2.5 ha	Yes	Yes

Outcome

Outcome: All patches of PCT 1655, except patch E which is less than 2 ha in size (Criteria 2.a), meet the listing criteria for the EPBC Act listed CEEC *Central Hunter Valley eucalypt forest and woodland.*

[1] TSSC 2015. EPBC Act Approved Conservation Advice (including listing advice) for the Central Hunter Valley eucalypt forest and woodland ecological community.

[2] DEH 2016. Central Hunter Valley eucalypt forest and woodland: a nationally protected ecological community.

[3] Patch E extends outside The Study Area. Total area of patch E is 0.2 ha, with 0.1 ha within The Study Area.

Appendix F Threatened flora survey details

F1 *Pomaderris cotoneaster* identification correspondence.

Provided digitally.

F2 Survey weather conditions

Survey date	Min temp (°C)	Ave temp (°C)	Max temp (°C)	Rainfall (mm)	Average wind speed (m/s)	Max wind speed (m/s)
01-09-21	4.5	15.7	23.7	0	1.5	3.3
02-09-21	3.7	14.0	24.4	0	1.6	3.6
06-09-21	2.9	9.4	15.2	0	2.4	4.2
07-09-21	-0.7	9.4	18.3	0	2.0	5
08-09-21	0.8	10.1	20.7	0.4	1.1	3
09-09-21	0.8	11.3	21.5	0	1.6	3.3
13-09-21	3.5	10.3	15.5	0	1.7	3.8
14-09-21	3.3	9.7	16.6	7.2	1.6	3.7
15-09-21	0	8.4	17.5	0	1.3	3.1
16-09-21	1.1	9.2	17.3	0	1.5	3.8
20-09-21	1.3	12.2	21.3	0.2	2.6	6.9
12-10-21	9	10.0	11	18.2	3.5	5.6
13-10-21	9.9	13.5	17.6	0.4	3.0	4.6
14-10-21	10.5	17.6	25.6	0	2.6	6.2
15-10-21	5.9	10.5	16.3	10.2	2.4	5.5
16-10-21	6.5	10.6	15.6	0.2	3.0	5.6
17-10-21	3.1	12.3	20.9	0	1.7	3.1
18-10-21	3.8	13.7	23.4	0	1.3	2.9
19-10-21	4.4	15.3	24.4	0	2.8	97.2
20-10-21	5.8	13.4	19.6	0	1.8	4
21-10-21	5.5	14.8	21.5	0	2.4	5.6
22-10-21	7.6	16.4	25.3	0	1.5	3.8
23-10-21	8.3	17.9	32.6	18.6	1.4	6.3
24-10-21	7.2	15.2	20.7	0.2	2.3	3.9
25-10-21	2.8	11.9	20.1	0	1.8	3.7
12-01-22	16.4	16.3	28.1	0	2.6	5.4
13-01-22	16.3	16.7	28.2	0	3.1	4.9
17-01-22	19.7	19.1	33.5	0	1.9	5.4
18-01-22	18.3	18.5	24.2	13.4	1.8	4.2
20-01-22	15.6	16.2	22.8	0	5.5	8.3
24-01-22	16.1	16.9	25.5	0	3.2	4.7
25-01-22	16.4	16.8	21.2	0.4	1.6	3.6
27-01-22	16.8	17.5	25.7	0	3.3	5.4

Survey date	Min temp (°C)	Ave temp (°C)	Max temp (°C)	Rainfall (mm)	Average wind speed (m/s)	Max wind speed (m/s)
Survey date	Min temp (°C)	Ave temp (°C)	Max temp (°C)	Rainfall (mm)	Average wind speed (m/s)	Max wind speed (m/s)
01-09-21	4.5	15.7	23.7	0	1.5	3.3
02-09-21	3.7	14.0	24.4	0	1.6	3.6
06-09-21	2.9	9.4	15.2	0	2.4	4.2
07-09-21	-0.7	9.4	18.3	0	2.0	5
08-09-21	0.8	10.1	20.7	0.4	1.1	3
09-09-21	0.8	11.3	21.5	0	1.6	3.3
13-09-21	3.5	10.3	15.5	0	1.7	3.8
14-09-21	3.3	9.7	16.6	7.2	1.6	3.7
15-09-21	0	8.4	17.5	0	1.3	3.1
16-09-21	1.1	9.2	17.3	0	1.5	3.8
20-09-21	1.3	12.2	21.3	0.2	2.6	6.9
12-10-21	9	10.0	11	18.2	3.5	5.6
13-10-21	9.9	13.5	17.6	0.4	3.0	4.6
14-10-21	10.5	17.6	25.6	0	2.6	6.2
15-10-21	5.9	10.5	16.3	10.2	2.4	5.5
16-10-21	6.5	10.6	15.6	0.2	3.0	5.6
17-10-21	3.1	12.3	20.9	0	1.7	3.1
18-10-21	3.8	13.7	23.4	0	1.3	2.9
19-10-21	4.4	15.3	24.4	0	2.8	5.3
20-10-21	5.8	13.4	19.6	0	1.8	4
21-10-21	5.5	14.8	21.5	0	2.4	5.6
22-10-21	7.6	16.4	25.3	0	1.5	3.8
23-10-21	8.3	17.9	32.6	18.6	1.4	6.3
24-10-21	7.2	15.2	20.7	0.2	2.3	3.9
25-10-21	2.8	11.9	20.1	0	1.8	3.7
12-01-22	16.4	20.3	28.1	0	2.6	5.4
13-01-22	16.3	22.5	28.2	0	3.1	4.9
17-01-22	19.7	25.1	33.5	0	1.9	5.4
18-01-22	18.3	21.0	24.2	13.4	1.8	4.2
20-01-22	15.6	19.0	22.8	0	5.4	8.3
24-01-22	16.1	20.8	25.5	0	3.2	4.7
25-01-22	16.4	19.0	21.2	0.4	1.6	3.6
27-01-22	16.8	21.2	25.7	0	3.3	5.4

F3 Field staff threatened flora experience

Surveyor	ELA Role	Qualifications	Threatened flora survey field experience
Dr Cheryl O'Dwyer	Senior Ecologist Field team lead	Ph.D Botany/Zoology, University of Melbourne 2010. Master of Science, University of Melbourne. Bachelor of Science, University of Melbourne. NSW Biodiversity Offsets Scheme Accredited Assessor (BAAS18153).	Cheryl has over 25 years experience as an ecologist, lecturer and manager working across VIC, NT and NSW. Chery has undertaken several biodiversity monitoring programs and fieldwork related to the BAM. Cheryl also has extensive experience in the design and implementation of threatened flora surveys in accordance with the Threatened Flora Survey Guideline (DPIE 2020b) and the BAM (DPIE 2020a). Threatened flora survey experience includes: • Survey for *Diuris tricolor* (Pine Donkey Orchid), *Prasophyllum petilum* / *Prasophyllum sp.* Wybong, MCO OC3 Extension Study Areas 1, 2 and 3, October 2020. • Survey for *Acacia ausfeldii* (Ausfeld's Wattle), Lue, NSW; November 2018. • Survey for *Pomaderris cotoneaster* and *Acacia meiantha*, Aarons Pass Rd, August 2019.
David Allworth	Senior Botanist Field team lead	Bachelor of Natural Resources (Honours), University of New England. NSW Biodiversity Offsets Scheme Accredited Assessor (BAAS18163).	David has over 25 years' experience in vegetation assessment and monitoring, having undertaken numerous biodiversity monitoring programs and field work related to the BAM. David has extensive experience in the design and implementation of threatened flora surveys in accordance with the Threatened Flora Survey Guideline (DPIE 2020b) and the BAM (DPIE 2020a). Threatened flora field survey method and identification experience includes: • Survey for *Lepidium monoplocoides* (Winged Peppercress) and *Lepidium aschersonii* (Spiny Peppercress); Narrabri, October 2018. • Survey for *Acacia ausfeldii* (Ausfeld's Wattle), Lue, NSW; November 2018. • Survey for *Acacia ausfeldii*, Highett Road, Ulan; 2015 to 2021. • Survey for *Pomaderris cotoneaster* and *Acacia meiantha*, Aarons Pass Rd, August 2019. • Survey for *Swainsona recta* (Small Purple-pea) and *Leucochrysum albicans* var. *tricolor* (Hoary Sunray); Mudgee, NSW September 2020. • Survey for *Pterostylis cobarensis* (Cobar Greenhood), *Bertya opponens* and *Tylophora linearis;* Pilliga State Forest, NSW, November 2020. • Survey for *Diuris tricolor* (Pine Donkey Orchid), *Prasophyllum petilum* / *Prasophyllum sp.* Wybong, MCO OC3 Extension Study Areas 1, 2 and 3, October 2020.
Rebecca Croake	Senior Ecologist Field team lead	Bachelor Environmental Science, University of New England. Bachelor of Geoscience, University of New England. NSW Biodiversity Offsets Scheme Accredited Assessor (BAAS21008).	Rebecca has over four years' experience in vegetation assessment and monitoring, having undertaken numerous biodiversity monitoring programs and field work related to the BAM. Rebecca also has extensive experience in the design and implementation of threatened flora surveys in accordance with the Threatened Flora Survey Guideline (DPIE 2020b) and the BAM (DPIE 2020a). Threatened flora field survey method and identification experience includes: • Survey for *Lepidium monoplocoides* (Winged Peppercress) and *Lepidium aschersonii* (Spiny Peppercress); Narrabri, October 2018. • Survey for *Acacia ausfeldii* (Ausfeld's Wattle), Lue, NSW; November 2018.

Surveyor	ELA Role	Qualifications	Threatened flora survey field experience
			• Survey for *Acacia ausfeldii*, Highett Road, Ulan; September 2018 to 2021. • Survey for *Rhodamnia rubescens* (Scrub Turpentine), Stroud, NSW; January 2019. • Survey for *Pomaderris cotoneaster* and *Acacia meiantha*, Aarons Pass Rd, August 2019. • Survey for *Swainsona recta* (Small Purple-pea) and *Leucochrysum albicans* var. *tricolor* (Hoary Sunray)*;* Mudgee, NSW September 2020. • Survey for *Pterostylis cobarensis* (Cobar Greenhood)*, Bertya opponens* and *Tylophora linearis;* Pilliga State Forest, NSW, November 2020. • Survey for *Diuris tricolor* (Pine Donkey Orchid)*, Prasophyllum petilum* / *Prasophyllum sp.* Wybong, MCO OC3 Extension Study Areas 1, 2 and 3, October 2020. • Survey for *Zieria obcordata,* Rock Forest, NSW, August 2021.
Elise Keane	Ecologist	Bachelor of Environmental Science (Wildlife and Conservation Biology), Deakin University 2013. Master of Environmental Management and Sustainability, Monash University 2017.	Elise has over four years' experience in vegetation assessment and monitoring, having undertaken numerous biodiversity monitoring programs and field work related to the BAM. also has extensive experience in the design and implementation of threatened flora surveys in accordance with the Threatened Flora Survey Guideline (DPIE 2020b) and the BAM (DPIE 2020a). Threatened flora field survey method and identification experience includes: Survey for *Acacia ausfeldii* (Ausfeld's Wattle), 2019.
Lachlan Metzler	Graduate Ecologist	Bachelor of Commerce with a Bachelor of Science, Macquarie University 2020	Lachlan joined ELA in 2021 and in that time has gained extensive survey experience in a range of ecological assessment techniques and has undertaken numerous biodiversity monitoring programs and field work related to the BAM.

F4 Flora species list

Species	Exotic
Acacia buxifolia subsp. buxifolia	Native
Acacia dawsonii	Native
Acacia decora	Native
Acacia doratoxylon	Native
Acacia implexa	Native
Acacia leucolobia	Native
Acacia linearifolia	Native
Acacia spp.	Native
Acacia ulicifolia	Native
Acaena ovina	Native
*Acetosella vulgaris^*	Exotic
Acianthus fornicatus	Native
Acrotriche rigida	Native
Aira cupaniana	Exotic
Ajuga australis	Native
Allocasuarina diminuta subsp. diminuta	Native
Alternanthera nana	Native
*Alternanthera pungens^*	Exotic
Amaranthus powellii	Exotic
Amaranthus spp.	Native
Amyema miquelii	Native
Angophora floribunda	Native
Anogramma leptophylla	Native
Anthosachne scabra	Native
Arctotheca calendula	Exotic
Aristida ramosa	Native
Aristida vagans	Native
Arundinella nepalensis	Native
Asperula conferta	Native
Astroloma humifusum	Native
Austrostipa aristiglumis	Native
Austrostipa bigeniculata	Native
Austrostipa densiflora	Native
Austrostipa scabra	Native
Austrostipa scabra subsp. falcata	Native
Austrostipa scabra subsp. scabra	Native
Austrostipa spp.	Native
Austrostipa verticillata	Native

Species	Exotic
Avena sativa	Exotic
Bidens pilosa var. pilosa	Exotic
Bidens spp.	Exotic
*Bidens subalternans^*	Exotic
Billardiera scandens	Native
Boerhavia dominii	Native
Bossiaea spp.	Native
Bothriochloa biloba	Native
Bothriochloa macra	Native
Brachychiton populneus subsp. *populneus*	Native
Brachyloma daphnoides subsp. *daphnoides*	Native
Brachyscome spp.	Native
Briza minor	Exotic
Bromus catharticus	Exotic
Bromus hordeaceus	Exotic
Bromus molliformis	Exotic
Bromus spp.	Native
Bursaria spinosa subsp. spinosa	Native
Callistemon pinifolius	Native
Callitris endlicheri	Native
Calocephalus citreus	Native
Calotis cuneifolia	Native
Calotis lappulacea	Native
Calytrix tetragona	Native
Capsella bursa-pastoris	Exotic
Cardamine spp.	Native
Carex appressa	Native
Carex inversa	Native
*Carthamus lanatus^*	Exotic
Cassinia cunninghamii	Native
Cassinia quinquefaria	Native
Cassinia sifton	Native
Cassinia spp.	Native
Cassytha pubescens	Native
Centaurea solstitialis	Exotic
Centaurium tenuiflorum	Exotic
Centaurum glomeratum	Exotic
Centella asiatica	Native

Species	Exotic
Centella spp.	Native
Chamaesyce drummondii	Native
Cheilanthes austrotenuifolia	Native
Cheilanthes distans	Native
Cheilanthes sieberi subsp. sieberi	Native
Chenopodium album	Exotic
Chenopodium spp.	Native
Chloris truncata	Native
Chloris ventricosa	Native
Chondrilla juncea	Exotic
Chrysocephalum apiculatum	Native
Chrysocephalum semipapposum	Native
Chrysocephalum sp.	Native
Cineraria lyratiformis	Exotic
Cirsium vulgare	Exotic
Cleistochloa rigida	Native
Clematis microphylla	Native
Clematis spp.	Native
Convolvulus erubescens	Native
Conyza bonariensis	Exotic
Cotula australis	Native
Crassula sieberiana	Native
Cucumis myriocarpus subsp. leptodermis	Exotic
Cucumis spp.	Native
Cyclospermum leptophyllum	Exotic
Cymbonotus lawsonianus	Native
Cymbopogon refractus	Native
Cynodon dactylon	Native
Cynoglossum australe	Native
Cynoglossum spp.	Native
Cynoglossum suaveolens	Native
Cyperus difformis	Native
Cyperus gracilis	Native
Cyperus sp.	Native
Cyperus spp.	Native
Dactilis glomerata	Exotic
Dactylis glomerata	Exotic
Dactyloctenium spp.	Native
Daviesia ulicifolia subsp. ulicifolia	Native
Desmodium spp.	Native

Species	Exotic
Desmodium varians	Native
Dianella longifolia var. longifolia	Native
Dianella revoluta var. revoluta	Native
Dichanthium sericeum subsp. sericeum	Native
Dichelachne crinita	Native
Dichelachne micrantha	Native
Dichondra repens	Native
Dichopogon fimbriatus	Native
Dichopogon spp.	Native
Digitaria ammophila	Native
Digitaria breviglumis	Native
Digitaria brownii	Native
Digitaria parviflora	Native
Digitaria sanguinalis	Exotic
Digitaria spp.	Native
Dodonaea viscosa subsp. cuneata	Native
Doodia spp.	Native
Drosera hookeri	Native
Drosera peltata	Native
Dysphania pumilio	Native
Echinochloa crus-galli	Exotic
Echinopogon caespitosus var. caespitosus	Native
Echinopogon ovatus	Native
Echinopogon spp.	Native
Echium plantagineum	Exotic
Echium vulgare	Exotic
Einadia hastata	Native
Einadia nutans subsp. nutans	Native
Einadia polygonoides	Native
Einadia spp.	Native
Einadia trigonos subsp. stellulata	Native
Einadia trigonos subsp. trigonos	Native
Eleocharis spp.	Native
Eleusine indica	Exotic
Eleusine tristachya	Exotic
Elymus repens	Exotic
Elymus scaber	Native
Enneapogon nigricans	Native
Enteropogon acicularis	Native
Entolasia stricta	Native

Species	Exotic
Eragrostis brownii	Native
Eragrostis cilianensis	Exotic
*Eragrostis curvula^*	Exotic
Eragrostis curvula var. consol	Exotic
Eragrostis leptostachya	Native
Eragrostis sp.	Native
Eriochloa crebra	Native
Erodium botrys	Exotic
Erodium cicutarium	Exotic
Erodium crinitum	Native
Eucalyptus albens	Native
Eucalyptus beyeriana	Native
Eucalyptus blakelyi	Native
Eucalyptus bridgesiana	Native
Eucalyptus crebra	Native
Eucalyptus dwyeri	Native
Eucalyptus fibrosa	Native
Eucalyptus melliodora	Native
Eucalyptus moluccana	Native
Eucalyptus punctata	Native
Eucalyptus sideroxylon	Native
Eucalyptus sparsifolia	Native
Euchiton sphaericus	Native
Euchiton spp.	Native
Eulalia aurea	Native
Euphorbia drummondii	Native
Euphorbia spp.	Native
Exocarpos strictus	Native
Facelis spp.	Exotic
Ficus rubiginosa	Native
Fimbristylis dichotoma	Native
Gahnia aspera	Native
Gahnia spp.	Native
Galium gaudichaudii subsp. gaudichaudii	Native
Galium leiocarpa	Native
Galium spp.	Native
Gamochaeta calviceps	Exotic
Geranium molle subsp. molle	Exotic
Geranium solanderi	Native
Geranium solanderi var. solanderi	Native

Species	Exotic
Glossocardia bidens	Native
Glycine clandestina	Native
Glycine tabacina	Native
Gomphocarpus fruticosus	Exotic
Gonocarpus elatus	Native
Gonocarpus spp.	Native
Goodenia hederacea subsp. hederacea	Native
Goodenia heterophylla subsp. heterophylla	Native
Goodenia spp.	Native
Grevillea sericea subsp. sericea	Native
Hakea decurrens subsp. decurrens	Native
Haloragis heterophylla	Native
Hardenbergia violacea	Native
Hibbertia obtusifolia	Native
Hibbertia riparia	Native
Hordeum leporinum	Exotic
Hordeum spp.	Exotic
Hovea linearis	Native
Hydrocotyle laxiflora	Native
Hypericum gramineum	Native
*Hypericum perforatum^*	Exotic
Hypochaeris glabra	Exotic
Hypochaeris radicata	Exotic
Hypoxis hygrometrica var. hygrometrica	Native
Hypoxis pratensis var. pratensis	Native
Imperata cylindrica	Native
Imperata spp.	Native
Isotoma axillaris	Native
Isotoma spp.	Native
Juncus acuminatus	Exotic
Juncus sp.	Native
Lachnagrostis filiformis	Native
Lachnagrostis spp.	Native
Lactuca serriola f. serriola	Exotic
Legnephora spp.	Native
Laxmannia gracilis	Native
Lepidium africanum	Exotic
Lepidium bonariense	Exotic
Lepidium spp.	Native

Species	Exotic
Lepidosperma laterale	Native
Leptorhynchos spp.	Native
Leptospermum arachnoides	Native
Leptospermum parvifolium	Native
Leptospermum polygalifolium subsp. transmontanum	Native
Leucopogon muticus	Native
Linum marginale	Native
Lissanthe strigosa subsp. subulata	Native
Lolium multiflorum	Exotic
Lolium perenne	Exotic
Lomandra confertifolia subsp. pallida	Native
Lomandra confertifolia subsp. rubiginosa	Native
Lomandra filiformis subsp. coriacea	Native
Lomandra filiformis subsp. filiformis	Native
Lomandra glauca	Native
Lomandra multiflora subsp. multiflora	Native
Lysimachia arvensis	Exotic
Lythrum hyssopifolia	Native
Macrozamia secunda	Native
Malva parviflora	Exotic
Marrubium vulgare	Exotic
Medicago sativa	Exotic
Medicago spp.	Exotic
Melaleuca thymifolia	Native
Mentha satureioides	Native
Microlaena stipoides	Native
Microlaena stipoides var. stipoides	Native
Microtis parviflora	Native
Modiola caroliniana	Exotic
Myoporum montanum	Native
Notothixos cornifolius	Native
Oenothera stricta subsp. stricta	Exotic
Olearia ramulosa	Native
Onopordum illyricum subsp. illyricum	Exotic
Opercularia aspera	Native
Opercularia hispida	Native
*Opuntia stricta var. stricta^*	Exotic
Oxalis perennans	Native
Oxytes brachypoda	Native

Species	Exotic
Panicum effusum	Native
Paronychia brasiliana	Exotic
Paronychia spp.	Exotic
Paspalidium distans	Native
Paspalidium gracile	Native
Paspalidium jubiflorum	Native
Paspalidium sp.	Native
Paspalidium spp.	Native
*Paspalum dilatatum^*	Exotic
Paspalum dilatatum	Exotic
Paspalum sp.	Exotic
Paspalum spp.	Native
Pelargonium australe	Native
Pelargonium inodorum	Native
Persicaria spp.	Native
Persoonia linearis	Native
Petrorhagia nanteuilii	Exotic
Petrorhagia spp.	Exotic
Phalaris aquatica	Exotic
Phebalium squamulosum subsp. lineare	Native
Phyllanthus hirtellus	Native
Phyllanthus occidentalis	Native
Pimelea linifolia subsp. linifolia	Native
Pimelea spp.	Native
Plantago debilis	Native
Plantago gaudichaudii	Native
Plantago lanceolata	Exotic
Plantago varia	Native
Poa sieberiana var. sieberiana	Native
Podolobium ilicifolium	Native
Polycarpon tetraphyllum	Exotic
Polygonum aviculare	Exotic
*Pomaderris cotoneaster**	Native
Pomax umbellata	Native
Poranthera corymbosa	Native
Poranthera ericifolia	Native
Poranthera microphylla	Native
Portulaca oleracea	Native
Pseudognaphalium luteoalbum	Native
Pseudognaphalium luteo-album	Native

Species	Exotic
Pteridium spp.	Native
Pterostylis spp.	Native
Pultenaea microphylla	Native
Ranunculus lappaceus	Native
Rapistrum rugosum	Exotic
*Rosa rubiginosa^*	Exotic
*Rubus fruiticosus spp. aggregate^*	Exotic
Rubus spp.	Native
Rumex brownii	Native
Rytidosperma bipartita	Native
Rytidosperma caespitosum	Native
Rytidosperma pallidum	Native
Rytidosperma racemosum var. racemosum	Native
Rytidosperma setaceum	Native
Rytidosperma sp.	Native
Rytidosperma spp.	Native
Salvia verbenaca	Exotic
Sannantha cunninghamii	Native
Santalum lanceolatum	Native
Schkuhria pinnata	Exotic
Schoenus apogon	Native
Schoenus spp.	Native
Scutellaria humilis	Native
*Senecio jacobaea^*	Exotic
Senecio quadridentatus	Native
Senecio spp.	Native
Senna artemisioides subsp. filifolia	Native
Setaria pumila	Exotic
Sida corrugata	Native
Sida cunninghamii	Native
Sida rhombifolia	Exotic
Sida spp.	Native
Sigesbeckia australiensis	Native
Sigesbeckia orientalis subsp. orientalis	Native
Solanum campanulatum	Native
Solanum cinereum	Native
Solanum nigrum	Exotic
Solanum spp.	Native
Solenogyne bellioides	Native
Solenogyne dominii	Native
Sonchus oleraceus	Exotic
Sonchus spp.	Native
Sorghum leiocladum	Native
Spergularia rubra	Exotic
Sporobolus creber	Native
Sporobolus spp.	Native
Stackhousia monogyna	Native
Stellaria media	Exotic
Stellaria pungens	Native
Stypandra glauca	Native
Styphelia triflora	Native
Swainsona galegifolia	Native
Tagetes minuta	Exotic
Taraxacum officinale	Exotic
Taraxacum spp.	Native
Themeda triandra	Native
Thysanotus patersonii	Native
Todea barbara	Native
Tolpis barbata	Exotic
Tragus australianus	Native
Tribulus terrestris	Exotic
Trifolium angustifolium	Exotic
Trifolium arvense	Exotic
Trifolium repens	Exotic
Trifolium sp.	Exotic
Trifolium spp.	Exotic
Trifolium subterraneum	Exotic
Urtica incisa	Native
Urtica urens	Exotic
Verbascum virgatum	Exotic
Verbena bonariensis	Exotic
Veronica plebeia	Native
Viola hederacea	Native
Vittadinia cuneata	Native
Vittadinia cuneata var. cuneata	Native
Vittadinia gracilis	Native
Vittadinia muelleri	Native
Vittadinia spp.	Native
Vulpia bromoides	Exotic

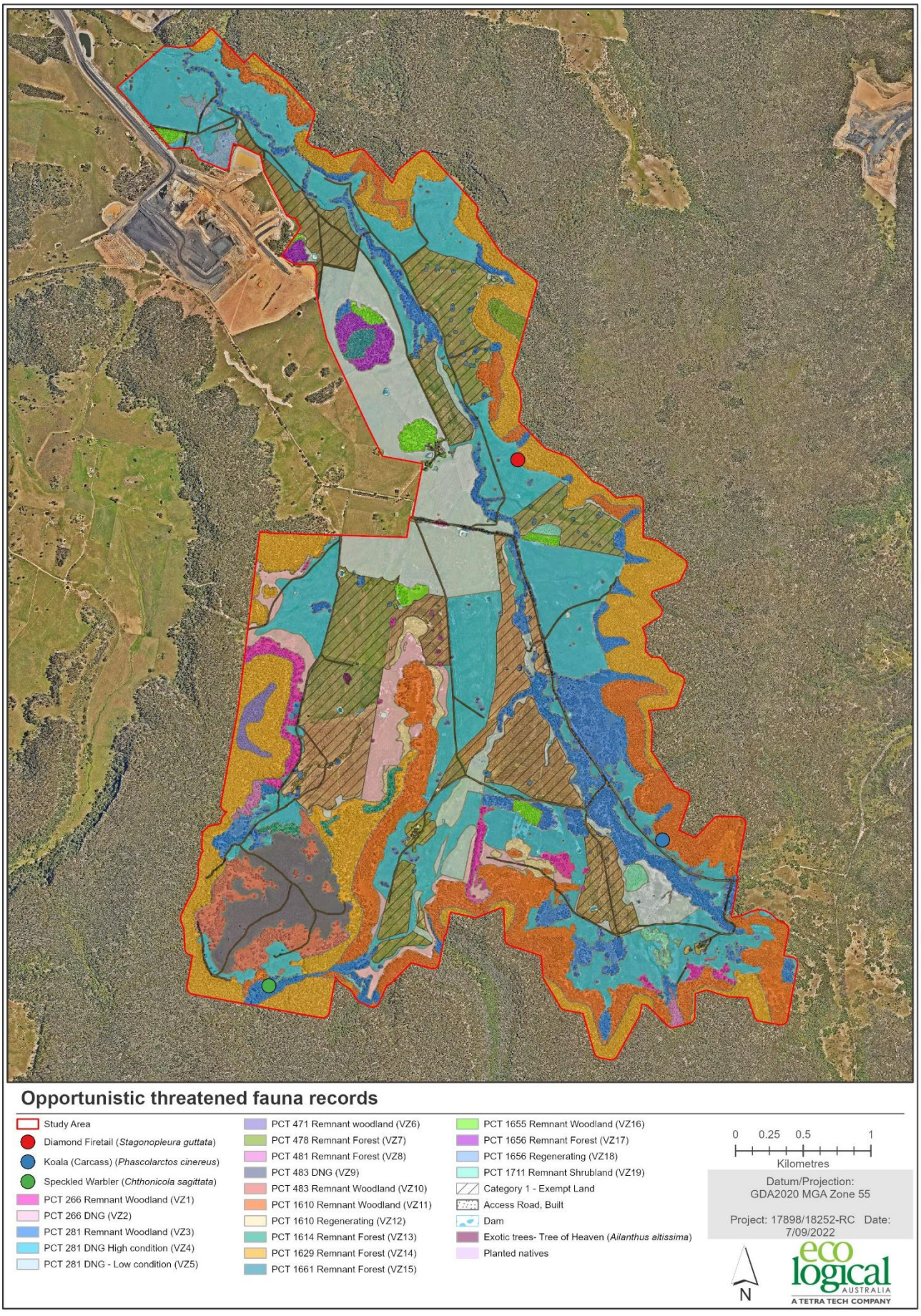
Species	Exotic
Wahlenbergia communis	Native
Wahlenbergia gracilis	Native
Wahlenbergia sp.	Native
Wahlenbergia spp.	Native
*Xanthium occidentale^*	Exotic
*Xanthium spinosum^*	Exotic
Xerochrysum bracteatum	Native

^ denotes HTE

** denotes species listed under the BC Act and / or EPBC Act*

Appendix G Opportunistic threatened fauna locations

Co-ordinates provided digitally to Resource Strategies.



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Appendix C. Moolarben Coal Complex OC3 Extension Project Baseline Fauna Survey Report

Moolarben Coal Complex OC3 Extension Project Baseline Fauna Survey Report

Prepared by AMBS Ecology & Heritage
for Moolarben Coal Operations Pty Ltd

Revised Final Report

October 2023

AMBS Reference: 20867

Document Information

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Recipient:	Trent Cini
Prepared by:	Mark Semeniuk, Matt Saunders, Lachlan Pettit, Corey O'Brien, Narawan Williams
Approved by:	Mark Semeniuk

Executive Summary

The Moolarben Coal Complex is located approximately 40 kilometres (km) north of Mudgee, New South Wales (NSW) (Figure 1.1). Moolarben Coal Operations Pty Ltd (MCO) is the operator of the Moolarben Coal Complex on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Yancoal Moolarben [YM] Pty Ltd and a consortium of Korean power companies). MCO, MCM and YM are wholly owned subsidiaries of Yancoal Australia Limited (Yancoal).

MCO is proposing an extension to the approved OC3 mining operations to allow for extraction of additional coal within existing mining and exploration tenements adjacent to approved operations at the Moolarben Coal Complex (the Project). Approval for the Project is being sought under Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

MCO (2022) prepared and submitted the Moolarben Coal Complex OC3 Extension Project Environmental Impact Statement (the EIS) for the Project to support the assessment process under the EP&A Act.

In response to submissions received on the Project EIS, MCO is proposing to amend the Project disturbance footprint which was described in the EIS. The amended Project disturbance footprint has been designed to incorporate additional avoidance measures relative to the EIS.

AMBS Ecology & Heritage Pty Ltd (AMBS) was commissioned by MCO to undertake fauna surveys for the Project. This Baseline Fauna Survey Report provides supporting information to the updated Biodiversity Development Assessment Report (BDAR) that has been prepared to accompany the Submissions Report for the Project. The scope of this study involved the survey and documentation of all fauna recorded in the Study Area, including threatened species and habitat, in accordance with the *Biodiversity Assessment Method* (BAM) as required under the *Biodiversity Conservation Act 2016* (NSW) (BC Act).

The field surveys included completing targeted searches for “Species Credit” fauna species in accordance with the BAM during the required survey season. Specifically, this involved targeted reptile surveys, diurnal bird surveys, harp trapping, Anabat detectors, habitat searches, pitfall trapping, Elliott trapping, call playback, tree hollow surveys and monitoring, spotlighting and remote cameras.

Two-hundred and thirteen species of vertebrate fauna were recorded during the surveys, comprising 10 frogs, 24 reptiles, 134 birds and 45 mammals of which thirteen species were introduced.

Twenty-two of the fauna species recorded are listed as threatened on the schedules of the BC Act and four are also listed as threatened on the schedules of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act):

- Pink-tailed Legless Lizard (*Aprasia parapulchella*) (BC Act – Vulnerable, EPBC Act – Vulnerable) (“Species Credit” species);
- Broad-headed Snake (*Hoplocephalus bungaroides*) (BC Act – Endangered, EPBC Act – Vulnerable) (dual-credit “Species/Ecosystem” species);
- Black Falcon (*Falco subniger*) (BC Act – Vulnerable) (“Ecosystem Credit” species);
- Little Eagle (*Hieraaetus morphnoides*) (BC Act – Vulnerable) (dual-credit “Species/Ecosystem” species);
- Little Lorikeet (*Glossopsitta pusilla*) (BC Act – Vulnerable) (“Ecosystem Credit” species);

- Masked Owl (*Tyto novaehollandiae*) (BC Act – Vulnerable) (dual-credit "Species/Ecosystem" species);
- Powerful Owl (*Ninox strenua*) (BC Act – Vulnerable) (dual-credit "Species/Ecosystem" species);
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*) (BC Act – Vulnerable, EPBC Act - Vulnerable) ("Ecosystem Credit" species);
- Speckled Warbler (*Chthonicola sagittata*) (BC Act – Vulnerable) ("Ecosystem Credit" species);
- Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*) (BC Act – Vulnerable) ("Ecosystem Credit" species);
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*) (BC Act – Vulnerable) ("Ecosystem Credit" species);
- Varied Sittella (*Daphoenositta chrysoptera*) (BC Act – Vulnerable) ("Ecosystem Credit" species);
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) (BC Act – Vulnerable) ("Ecosystem Credit" species);
- Diamond Firetail (*Stagonopleura guttata*) (BC Act – Vulnerable, EBPC Act - Vulnerable) ("Ecosystem Credit" species);
- Koala (*Phascolarctos cinereus*) (BC Act – Endangered, EPBC Act – Endangered) ("Species Credit" species);
- Squirrel Glider (*Petaurus norfolcensis*) (BC Act – Vulnerable) ("Species Credit" species);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) (BC Act – Vulnerable) ("Ecosystem Credit" species);
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) (BC Act – Vulnerable) ("Ecosystem Credit" species);
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*) (probable) (BC Act – Vulnerable) (dual-credit "Species/Ecosystem" species);
- Large-eared Pied Bat (*Chalinolobus dwyeri*) (BC Act – Vulnerable, EPBC Act – Vulnerable) ("Species Credit" species);
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) (BC Act – Vulnerable) ("Ecosystem Credit" species); and
- Eastern Cave Bat (*Vespadelus troughtoni*) (BC Act – Vulnerable) ("Species Credit" species).

Ten of the recorded threatened species and one species for which important habitat has been mapped in the Study Area (Regent Honeyeater), are classified as "Species Credit" species, or dual-credit "Species/Ecosystem" species. Of these, three species do not meet the requirements to prepare a species polygon, namely the Little Eagle (because no evidence was recorded of the species occupying a nest or breeding within the Study Area), Powerful Owl (because no signs of breeding, consistent with the requirements in the Threatened Biodiversity Data Collection, were recorded) and Large Bent-winged Bat (because it is unlikely to be breeding in the Study Area).

Eight "Species Credit" species or dual-credit "Species/Ecosystem" species meet the requirements to prepare a species polygon, including the Pink-tailed Legless Lizard, Broad-headed Snake, Masked Owl, Regent Honeyeater, Koala, Squirrel Glider, Large-eared Pied Bat and Eastern Cave Bat. One additional fauna species listed under the EPBC Act is considered likely to occur in the Study Area; namely, the Swift Parrot (*Lathamus discolor*).

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1 Introduction

1.1 Background

The Moolarben Coal Complex is located approximately 40 kilometres (km) north of Mudgee, New South Wales (NSW) (Figure 1.1). The Moolarben Coal Complex is operated by Moolarben Coal Operations Pty Ltd (MCO) on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Yancoal Moolarben Pty Ltd [YM] and a consortium of Korean power companies). MCO, MCM and YM are wholly owned subsidiaries of Yancoal Australia Limited (Yancoal).

Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038 with a combined coal production rate of 22 million tonnes per annum (Mtpa) in accordance with Project Approval (05_0117) (Stage 1) (as modified) and Project Approval (08_0135) (Stage 2) (as modified). The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities) (Figure 1.2).

MCO currently operates across multiple open cut mining areas and at current production rates, mining (i.e. run of mine [ROM] coal extraction) within the OC3 mining area will likely be completed in 2025. Mining of the remaining Stage 2 open cut mining area (OC4) would continue beyond 2025 within the currently approved mine life of the Moolarben Coal Complex (i.e. until 2038).

MCO has identified an opportunity to extend open cut mining operations immediately south of the approved OC3 open cut pit as well as develop four new open cut pits to the east and south-east of the approved OC3 mining area, within existing mining tenements (the Project).

The extended open cut mining operations would provide approximately 10 years of mining (from 2025 to 2034), maximise use of the existing mining fleet and maintain steady production of ROM coal at the Moolarben Coal Complex post-completion of mining within the approved OC3 mining area.

MCO (2022) prepared the Moolarben Coal Complex OC3 Extension Project Environmental Impact Statement (the EIS) for the Project to support the assessment process under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Project as presented in the EIS included the following activities:

- extension of open cut mining operations within mining lease (ML) 1691, exploration licence (EL) 6288, and EL 7073 to allow mining of additional coal resources;
- extraction of up to 9 Mtpa of ROM coal with a total of approximately 40 million tonnes (Mt) over the life of the Project;
- mining operations between approximately 2025 to 2034 (which is within the approved life of the Moolarben Coal Complex ending on 31 December 2038);
- extension of employment of existing open cut workforce;
- construction and operation of ancillary infrastructure, services, plant and equipment in support of mining operations;
- construction and operation of water management and water storage infrastructure in support of mining operations;
- development of an integrated final landform with the approved OC3 mining area;
- ongoing exploration activities in the Project area;
- construction of haul road creek crossings;

- quarrying and/or excavation of borrow pits within approved disturbance areas to retrieve construction materials;
- conventional open cut mining related activities such as drilling and blasting, and other associated activities; and
- rehabilitation, decommissioning and closure.

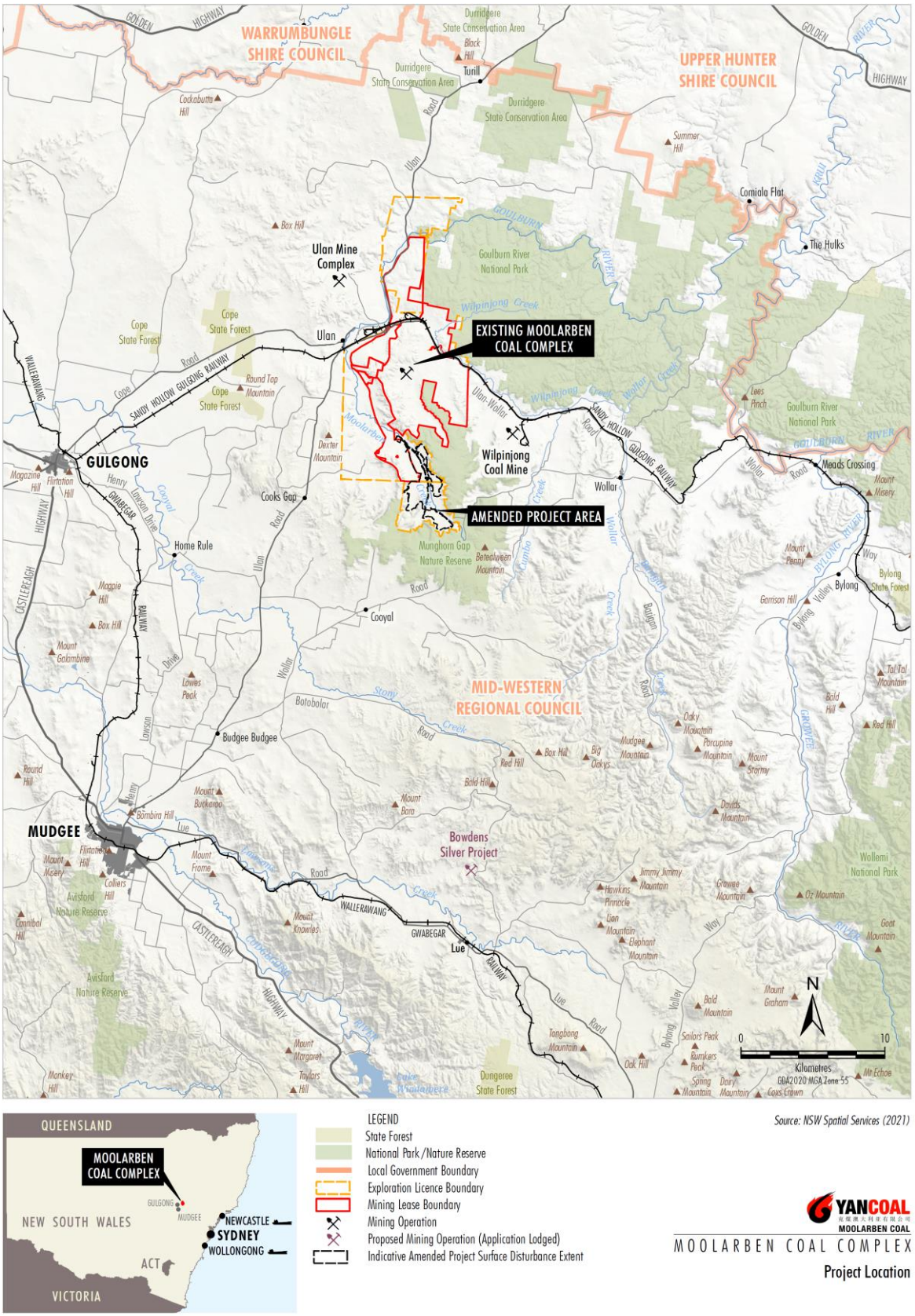
The Project EIS was placed on public exhibition by the Department of Planning and Environment (DPE) from 17 November to 14 December 2022. During this period, government agencies, organisations and members of the public were invited to provide submissions on the EIS to DPE.

In response to submissions received on the Project EIS, MCO is proposing to amend the Project disturbance footprint. The amended Project disturbance footprint has been designed to incorporate additional avoidance measures relative to the EIS.

When compared to the EIS, the proposed amendments to the Project include:

- a reduction in the extent of proposed open cut mining.
- a reduction in total resource extracted from 40 Mt to approximately 30 Mt over the life of the Project.
- a reduction in the peak annual ROM mining rate from 9 Mt to 8.5 Mt over the life of the Project.
- no change to the duration of the mine life (i.e. between approximately 2025 to 2034), peak workforce, or hours of operation of the mine.
- no change to the proposed integrated final landform with the approved OC3 mining area (including no final voids in the rehabilitated final landform).
- a revised conceptual post-mining land use which incorporates additional areas of native woodland and increases the proposed extent of the Habitat Enhancement Area.

The Project general arrangement is shown on Figure 1.3.

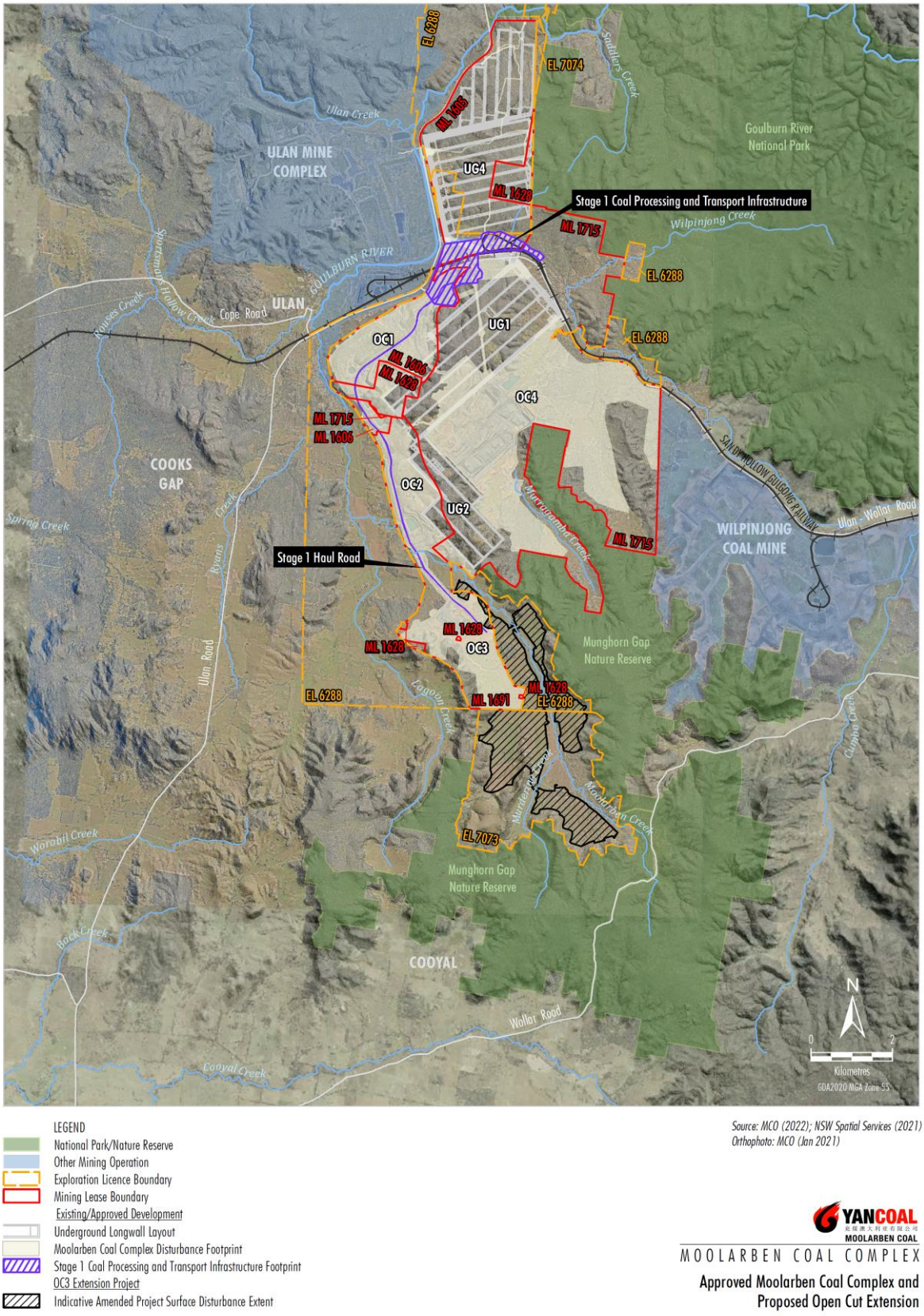


LEGEND
- State Forest
- National Park / Nature Reserve
- Local Government Boundary
- Exploration Licence Boundary
- Mining Lease Boundary
- Mining Operation
- Proposed Mining Operation (Application Lodged)
- Indicative Amended Project Surface Disturbance Extent

Source: NSW Spatial Services (2021)

YANCOAL
MOOLARBEN COAL
MOOLARBEN COAL COMPLEX
Project Location

Figure 1.1 Project location



LEGEND
- National Park/Nature Reserve
- Other Mining Operation
- Exploration Licence Boundary
- Mining Lease Boundary
- Existing/Approved Development
- Underground Longwall Layout
- Moolarben Coal Complex Disturbance Footprint
- Stage 1 Coal Processing and Transport Infrastructure Footprint
- OC3 Extension Project
- Indicative Amended Project Surface Disturbance Extent

Source: MCO (2022); NSW Spatial Services (2021)
Orthophoto: MCO (Jan 2021)

YANCOAL 兖煤澳大利亚有限公司 MOOLARBEN COAL

MOOLARBEN COAL COMPLEX

Approved Moolarben Coal Complex and Proposed Open Cut Extension

Figure 1.2 Approved Moolarben Coal Complex and proposed open cut extension

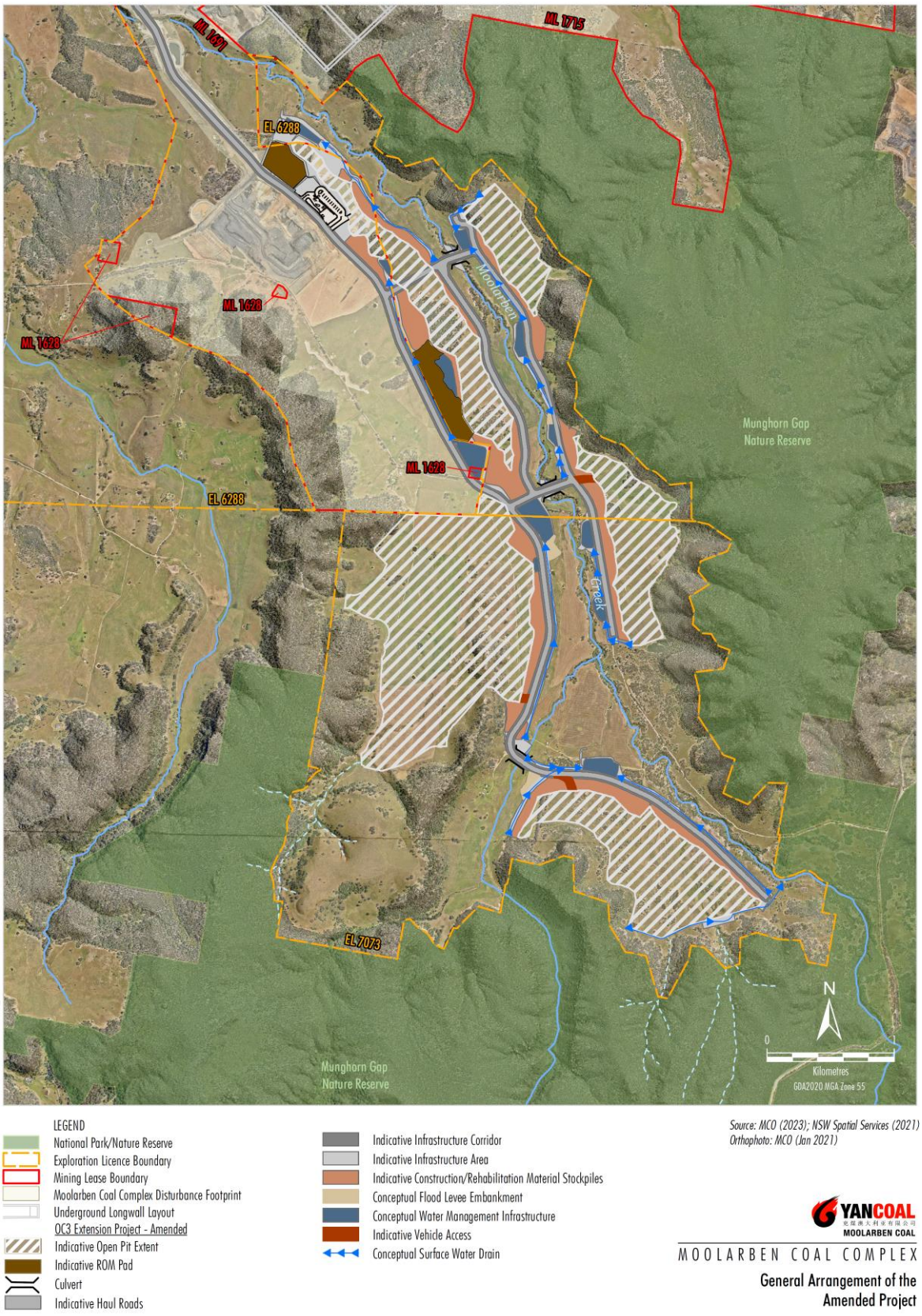


Figure 1.3 General arrangement of the amended Project

1.2 Scope and Objectives

AMBS Ecology & Heritage was engaged by MCO to undertake baseline fauna surveys for the Project EIS. This Baseline Fauna Survey Report provides supporting information to the Biodiversity Development Assessment Report (BDAR). The BDAR prepared for the EIS has now been updated and forms part of the Submissions Report.

The scope of work for this study involves collecting data to determine the presence and identity of threatened fauna and their habitats within the Study Area (Figure 1.2) and providing a report containing the results.

Specifically, the scope of work includes:

- threatened fauna species surveys according to Section 5 of the NSW *Biodiversity Assessment Method* (BAM) (Department of Planning, Industry and Environment [DPIE] 2020a);
- targeted surveys of all potentially occurring threatened fauna and migratory species listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act);
- documenting the presence of all native and introduced fauna species;
- description of fauna habitat features for threatened species that could potentially occur in the Study Area;
- mapping polygons showing suitable habitat for threatened fauna classified as "Species Credit" species or those potentially occurring threatened fauna listed under the EPBC Act; and
- preparation of a survey report documenting the survey methods and findings.

1.3 Location of the Study Area

The Study Area is shown on Figures 1.1 and 1.2. It occupies an area of approximately 1,680.6 hectares (ha) and occurs to the south of the existing Moolarben Coal Complex.

1.4 Bioregion and Landscape

The Study Area lies within the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) bioregion, and the Kerrabee IBRA subregion (Thackway & Cresswell 1995, Department of Agriculture, Water and the Environment [DAWE] 2021a).

The landscape surrounding the Study Area is a combination of land that has been cleared for agriculture, particularly on the flats, as well as large areas of native vegetation which mostly occur on the slopes, ridges, and nearby reserves (e.g. Munghorn Gap Nature Reserve).

1.5 Climate

Weather records were obtained from the nearby Commonwealth Bureau of Meteorology (BoM) weather stations. Rainfall data was obtained from Ulan Water (Station ID 062036), which is located approximately 8 km north-west of the Study Area, and temperature data was obtained from Gulgong Post Office (Station ID 062013), which is located approximately 22 km west of the Study Area. The Ulan Water weather station is situated 420 metres (m) above sea level (ASL), while the Gulgong Post Office is 475 m ASL. For comparison, elevation within the Study Area ranges from approximately 465-685 m ASL. Data displayed in Figure 1.4 below is taken from the Ulan Water Station. Please note data from 2002, 2004, 2005, 2007 and 2014 were incomplete and not included in the graph. Data from 2008 to 2013 was unavailable.

The locality receives an average of about 640.1 millimetres (mm) of rainfall per annum, based on the long-term average between 1906 and 2021 (BoM 2021). Higher rainfall tends to occur in spring and summer, with lower rainfall in winter. Rainfall varies widely from year to year, as shown in Figure 1.4 (complete data from 1953 to 2020), with the lowest recorded total annual rainfall of 325.2 mm (in 2019) and the highest of 1,157.0 mm (in 1973). The three years from 2017-2019 had below average annual rainfall.

Average monthly temperatures range between a minimum of 9.7 degrees Celsius (°C) and a maximum of 23.3°C. The warmest month is usually January (mean monthly maximum 31.3°C, mean minimum 16.9°C) and the coolest is usually July (mean maximum 14.9°C, mean minimum 2.6°C) (Gulgong Post Office, BoM 2021).

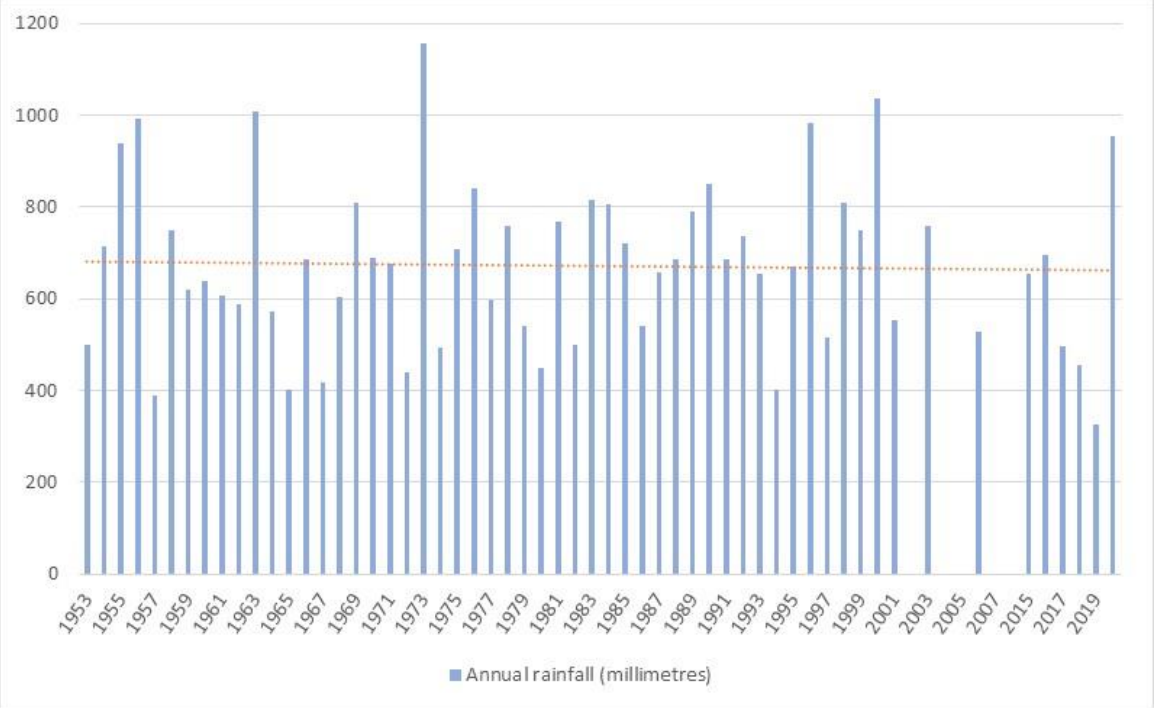


Figure 1.4 Annual average rainfall recorded at Ulan Water (1953-2020) (Source: BoM 2021)

1.6 Topography and Drainage

Natural drainage in the Study Area consists of several first-order and second-order ephemeral drainage lines, flowing generally from the higher elevated escarpment areas into the valley floor. Most of these ephemeral drainage lines were dry during the survey works and it is likely that flow only occurs during heavy rainfall events. Two named creeks, Murdering Creek and Spring Creek,

which contained water during the surveys, flow into Moolarben Creek, a fifth order stream. Moolarben Creek contained water during the majority of the fauna survey work, and eventually flows into the Goulburn River outside the Study Area.

1.7 Land Use and Disturbance

The Study Area is partially comprised of native forest and woodland, largely confined to the hilled country, escarpment, and riparian strips. Much of the Study Area has been subject to historical vegetation removal, particularly on the valley flats. This mostly occurred for the purposes of livestock grazing, as well as likely logging. Several roads and trails intersect the Study Area, with most remnant vegetation in the interior exhibiting limited connectivity to other remnant patches. The vegetation on the slopes and ridges are well-connected within the Study Area and have been less disturbed over time.

1.8 Plant Community Types and Vegetation

Flora surveys undertaken by Eco Logical Australia (ELA 2022) within the Study Area identified thirteen plant community types (PCTs) (Figure 1.5):

- PCT 266: White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion;
- PCT 281: Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion;
- PCT 471: Dwyer's Red Gum - Black Cypress Pine - ironbark low woodland on sandstone hillcrests in the Dubbo - Gilgandra region, south-western Brigalow Belt South Bioregion;
- PCT 478: Red Ironbark - Black Cypress Pine - stringybark +/- Narrow-leaved Wattle shrubby open forest on sandstone in the Gulgong - Mendooran region, southern Brigalow Belt South Bioregion;
- PCT 481: Rough-barked Apple - Blakely's Red Gum - Narrow-leaved Stringybark +/- Grey Gum sandstone riparian grass fern open forest on in the southern Brigalow Belt South Bioregion and Upper Hunter region;
- PCT 483: Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley;
- PCT 1610: White Box - Black Cypress Pine shrubby woodland of the Western Slopes;
- PCT 1614: Grey Gum - Grey Myrtle - Narrow-leaved Stringybark - Rusty Fig open forest on ranges of the Upper Hunter;
- PCT 1629: Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin;
- PCT 1655: Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin;
- PCT 1656: Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin;
- PCT 1661: Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin; and
- PCT 1711: Tantoon - *Lepyrodia leptocaulis* shrubland on sandstone drainage lines of the Sydney Basin.

The PCTs and vegetation zones were used to inform the stratification of the Study Area and the areas of habitat that required targeted fauna surveys.

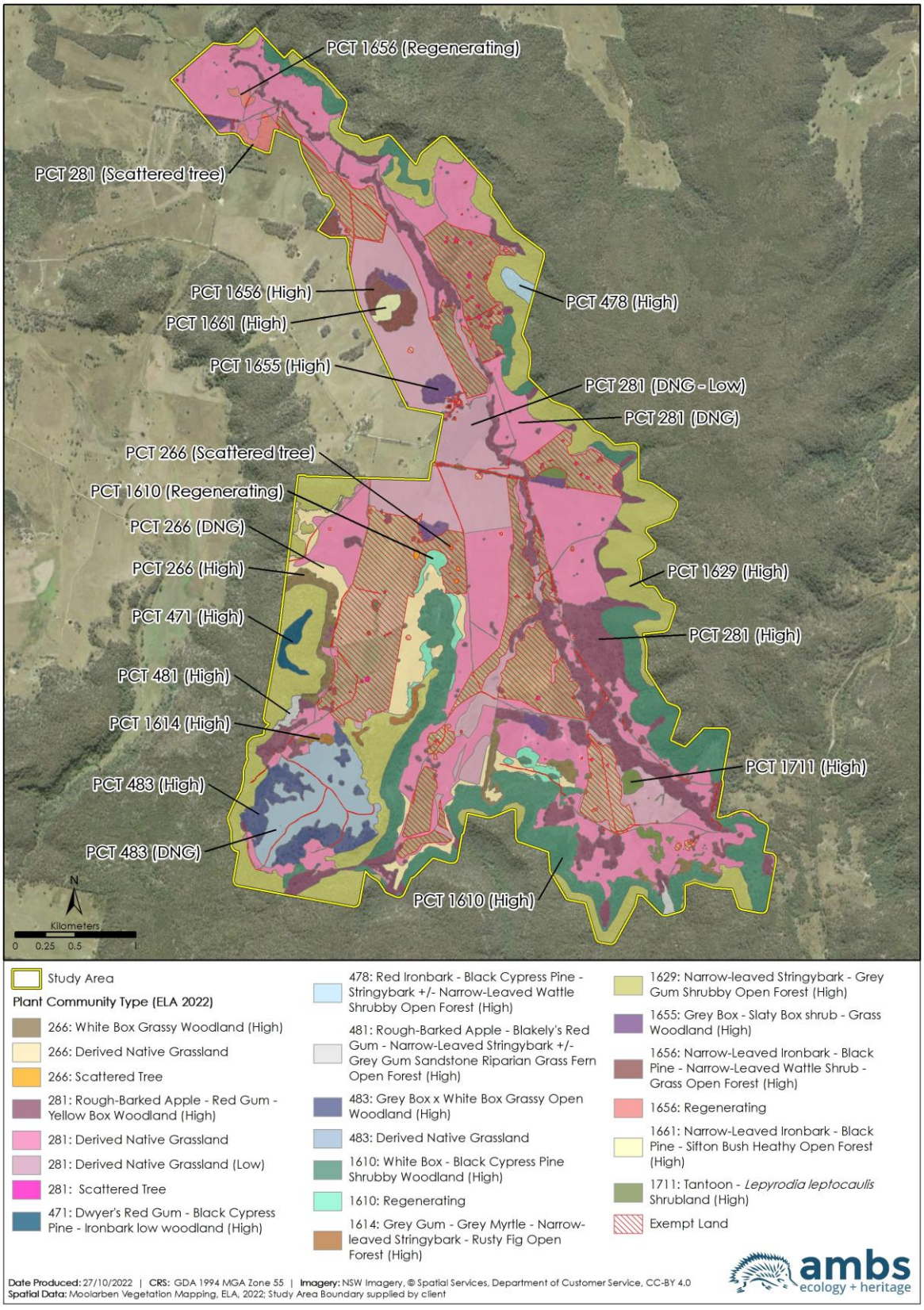


Figure 1.5 PCTs within the Study Area (ELA 2022)

2 Methods

2.1 Nomenclature

The nomenclature of threatened species follows that used in the NSW *Biodiversity Conservation Act 2016* (BC Act) and EPBC Act threatened species lists. For non-threatened species the following applies:

- frog species nomenclature follows *Reptiles and Amphibians of Australia* (Cogger 2018);
- reptile species nomenclature follows *A Complete Guide to Reptiles of Australia* (Wilson & Swan 2021);
- mammal species nomenclature follows *Field Companion to the Mammals of Australia* (Van Dyck *et al.* 2013), with the exception of the free-tail bat genus *Mormopterus*, which follows Reardon *et al.* (2014); and
- bird species nomenclature follows the *BirdLife Australia Working List v3* (BirdLife Australia 2019).

2.2 Desktop Review

A desktop study of ecological information and local reports was conducted prior to undertaking field surveys, which included review of:

- PCT mapping for the Study Area (ELA 2022);
- DPE *BioNet Atlas* records (DPE 2022a);
- EPBC Act Protected Matters Search Tool (Department of Climate Change, Energy, the Environment and Water [DCCEEW] 2022a); and
- previous records and species profiles for predicted threatened species available in the *Threatened Biodiversity Data Collection* (TBDC) (DPE 2022a) and *Threatened Species Profile Database* (DPE 2022b).

Utilising information from the desktop review, threatened fauna known or predicted to occur in the locality are summarised in Table 2.1. The list includes "Species Credit" species and dual-credit "Species/Ecosystem" species, that are required to be surveyed in accordance with the BAM (DPIE 2020a). Twenty-six other threatened species are included in Table 2.1 for completeness. These species are "Ecosystem Credit" species which are not the subject of targeted surveys, and instead will be covered in the BDAR.

Table 2.1 Threatened fauna known or predicted to occur in the locality

Common Name	Scientific Name	Credit Type	Conservation Listing	
			BC Act[1]	EPBC Act[2]
Giant Burrowing Frog	*Heleioporus australiacus*	Species	V	V
Red-crowned Toadlet	*Pseudophryne australis*	Species	V	-
Pink-tailed Legless Lizard	*Aprasia parapulchella*	Species	V	V
Striped Legless Lizard	*Delma impar*	Species	V	V
Rosenberg's Goanna	*Varanus rosenbergi*	Ecosystem	V	-
Pale-headed Snake	*Hoplocephalus bitorquatus*	Species	V	-
Broad-headed Snake	*Hoplocephalus bungaroides*	Species/Ecosystem	E	V
Malleefowl	*Leipoa ocellata*	Ecosystem	E	V
Black Falcon	*Falco subniger*	Ecosystem	V	-
Square-tailed Kite	*Lophoictinia isura*	Species/Ecosystem	V	-
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Species/Ecosystem	V	-
Spotted Harrier	*Circus assimilis*	Ecosystem	V	-
Little Eagle	*Hieraaetus morphnoides*	Species/Ecosystem	V	-
Bush Stone-curlew	*Burhinus grallarius*	Species	E	-

Common Name	Scientific Name	Credit Type	Conservation Listing	
			BC Act[1]	EPBC Act[2]
South-eastern Glossy Black-Cockatoo	*Calyptorhynchus lathami lathami*	Species/Ecosystem	V	V
Gang-gang Cockatoo	*Callocephalon fimbriatum*	Species/Ecosystem	V	E
Little Lorikeet	*Glossopsitta pusilla*	Ecosystem	V	-
Turquoise Parrot	*Neophema pulchella*	Ecosystem	V	-
Swift Parrot	*Lathamus discolor*	Species/Ecosystem	E	CE
Superb Parrot	*Polytelis swainsonii*	Species/Ecosystem	V	V
Masked Owl	*Tyto novaehollandiae*	Species/Ecosystem	V	-
Powerful Owl	*Ninox strenua*	Species/Ecosystem	V	-
Barking Owl	*Ninox connivens*	Species/Ecosystem	V	-
White-throated Needletail	*Hirundapus caudacutus*	Ecosystem	-	V
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	Ecosystem	V	V
Speckled Warbler	*Chthonicola sagittata*	Ecosystem	V	-
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	Ecosystem	V	-
Regent Honeyeater	*Anthochaera phrygia*	Species/Ecosystem	CE	CE
Painted Honeyeater	*Grantiella picta*	Ecosystem	V	V
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	Ecosystem	V	E
Flame Robin	*Petroica phoenicea*	Ecosystem	V	-
Scarlet Robin	*Petroica boodang*	Ecosystem	V	-
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	Ecosystem	V	-
Varied Sittella	*Daphoenositta chrysoptera*	Ecosystem	V	-
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	Ecosystem	V	-
Diamond Firetail	*Stagonopleura guttata*	Ecosystem	V	V
Spotted-tailed Quoll	*Dasyurus maculatus*	Ecosystem	V	E
Brush-tailed Phascogale	*Phascogale tapoatafa*	Species	V	-
Koala	*Phascolarctos cinereus*	Species	E	E
Eastern Pygmy-possum	*Cercartetus nanus*	Species	V	-
Yellow-bellied Glider	*Petaurus australis*	Ecosystem	V	V
Squirrel Glider	*Petaurus norfolcensis*	Species	V	-
Greater Glider	*Petauroides volans*	Species	E	E
Brush-tailed Rock-wallaby	*Petrogale penicillata*	Species	E	V
Grey-headed Flying-fox	*Pteropus poliocephalus*	Species/Ecosystem	V	V
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	Ecosystem	V	-
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	Ecosystem	V	-
Little Bent-winged Bat	*Miniopterus australis*	Species/Ecosystem	V	-
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	Species/Ecosystem	V	-
Corben's Long-eared Bat	*Nyctophilus corbeni*	Ecosystem	V	V
Large-eared Pied Bat	*Chalinolobus dwyeri*	Species	V	V
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	Ecosystem	V	-
Greater Broad-nosed Bat	*Scoteanax rueppellii*	Ecosystem	V	-
Eastern Cave Bat	*Vespadelus troughtoni*	Species	V	-
New Holland Mouse	*Pseudomys novaehollandiae*	Ecosystem	-	V

Note:

[1] Conservation status under the BC Act (current as of October 2023). V = Vulnerable, E = Endangered, CE = Critically Endangered.

[2] Conservation status under the EPBC Act (current as of October 2023). V = Vulnerable, E = Endangered, CE = Critically Endangered.

2.3 Field Surveys

2.3.1 Overview

A range of targeted fauna surveys were undertaken between December 2020 and March 2022 within the Study Area (Table 2.2). Survey timing and duration was designed in accordance with relevant survey guidelines for threatened fauna species that could potentially occur in the Study Area. This report includes the methods and results for the purposes of informing the BDAR. In addition to the targeted survey techniques documented in Table 2.2, opportunistic sightings were also recorded as required during the survey periods.

Table 2.2 Survey dates and tasks

Date	Season	Task
December 2020 – January 2021	Summer	Harp traps, Anabats.
12-16 April 2021	Autumn	Remote camera deployment, habitat assessment, diurnal bird surveys.
3-10 May 2021	Autumn	Call playback, diurnal bird surveys, remote camera maintenance.
20-23 May 2021	Autumn	Call playback, remote camera collection and redeployment.
31 May - 6 June 2021	Winter	Diurnal bird surveys, remote camera maintenance.
14-20 June 2021	Winter	Diurnal bird surveys, remote camera collection.
12-18 July 2021	Winter	Hollow-bearing tree surveys.
26-31 July 2021	Winter	Hollow-bearing tree surveys, hollow monitoring, call playback.
9-15 August 2021	Winter	Hollow monitoring, call playback.
23-29 August 2021	Winter	Call playback, reptile surveys.
13-17 September 2021	Spring	Reptile surveys, diurnal bird surveys.
8-13 November 2021	Spring	Diurnal bird surveys, habitat assessments, pitfall trap installation, remote camera deployment.
5-10 December 2021	Summer	Pitfall and funnel traps, pitfall trap collection, Elliott traps, diurnal bird surveys, habitat assessments, scat transects, spotlighting, remote camera collection.
7-11 March 2022	Autumn	Habitat assessments, spotlighting.

Fauna surveys and related tasks were undertaken by personnel listed in Table 2.3. All surveys were designed to ensure teams were led by experienced ecologists.

Table 2.3 Experience of survey team personnel

Name	Qualifications	Experience	Task
Mark Semeniuk	Bachelor of Science Master of Applied Science (Wildlife Health and Population Management) Accredited BAM assessor	15 years	Survey planning, reporting, harp traps, Anabats.
Narawan Williams	Certificate II in Conservation and Land Management	24 years	Harp traps, Anabats, reptile surveys, diurnal bird surveys, Elliott traps, pitfall traps, funnel traps, remote cameras, call playback, hollow-bearing tree surveys, hollow monitoring, spotlighting, habitat assessment, scat transects, identification of Anabat sequence files.
Chris Jackson	Bachelor of Science Master of Applied Science	15 years	Harp traps, Anabats.
David James	Bachelor of Science	35 years	Harp traps, Anabats, diurnal bird surveys, call playback, remote cameras.
Henry Cook	Bachelor of Science Master of Applied Science	15 years	Harp traps, Anabats.
Dion Hobcroft	Certificate in Zoology 1998	30+ years	Harp traps, Anabats, diurnal bird surveys, call playback, remote cameras.
Lachlan Pettit	BSc (Advanced) Biology and Marine Science) BSc (Advanced) (Honours Class I and University Medal) PhD in Invasion Biology	9 years	Call playback, remote cameras.

Name	Qualifications	Experience	Task
Michael Sebastian	Bachelor of Science	3 years	Reptile surveys, diurnal bird surveys, call playback, hollow-bearing tree surveys, hollow monitoring.
Max Breckenridge	Bachelor of Biodiversity & Conservation	6 years	Diurnal bird surveys, call playback, hollow-bearing tree surveys, hollow monitoring.
Ross Crates	Bachelor of Science PhD	10 years	Diurnal bird surveys, remote cameras.
Adam Greenhalgh	Bachelor of Applied Science Diploma in Applied Science	10 years	Reptile surveys, diurnal bird surveys, Elliott traps, pitfall traps, funnel traps, remote cameras, call playback, hollow-bearing tree surveys, hollow monitoring, spotlighting, habitat assessment, scat transects.
Carl Corden	Bachelor of Environmental Management Accredited BAM assessor	18 years	Remote cameras, diurnal bird surveys, identification of Anabat sequence files.
Greg Ford	Bachelor of Applied Science Graduate Diploma in Resource Management	30+ years	Identification of Anabat sequence files.

The survey effort applied throughout the Study Area was determined by considering the total area of potential habitat for each species, and the PCT associations documented in the TBDC (DPE 2022a). Sampling intensity was determined in accordance with relevant fauna survey guidelines, including the:

- *Threatened Species Survey and Assessment: Guidelines for Developments and Activities* (Department of Environment and Conservation [DEC] 2004);
- *'Species Credit' Threatened Bats and Their Habitats* survey guide (Office of Environment and Heritage [OEH] 2018);
- *Survey Guidelines for Australia's Threatened Reptiles* (Department of Sustainability, Environment, Water, Population and Communities [DSEWPaC] 2011a); and
- *Survey Guidelines for Australia's Threatened Mammals* (DSEWPaC 2011b);
- *Survey Guidelines for Australia's Threatened Birds* (Department of Environment, Water, Heritage and the Arts [DEWHA] 2010a);
- *EPBC Act Referral Guidelines for the Vulnerable Striped Legless Lizard, Delma impar* (DSEWPaC 2011c);
- *A review of koala habitat assessment criteria and methods* (Youngentob *et al.* 2021);
- *Conservation Advice for Phascolarctos cinereus (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory* (DAWE 2022a);
- *National Recovery plan for the Koala: Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (DAWE 2022b); and
- any other species-specific guidance contained in the TBDC (DPE 2022a) and Commonwealth *Species Profile and Threats Database* (SPRAT) profiles (DCCEEW 2022b).

The *Koala (Phascolarctos cinereus) Biodiversity Assessment Method Survey Guide* (DPE, 2022f) was released after the surveys were complete. However, the koala was recorded during the surveys undertaken in the Study Area and a species polygon has been prepared in accordance with the BAM (DPIE 2020a).

The survey methods undertaken are described below. Survey locations are shown in Figures 2.1 to 2.6. Weather conditions during the survey period are outlined in Section 2.5. Site coordinates are documented in Appendix A.

2.3.2 Diurnal Active Searches for Reptiles

Diurnal active searches for reptiles were undertaken at 13 locations targeting the Pink-tailed Legless Lizard (*Aprasia parapulchella*) and the Striped Legless Lizard (*Delma impar*) (Sites RS01-13), and three locations targeting the Broad-headed Snake (*Hoplocephalus bungaroides*) (Sites RS14-16) (16 sites in total) (Figure 2.1). Approximately 25.5 person-hours were invested in areas targeting the Pink-tailed Legless Lizard and Striped Legless Lizard, and approximately 4 person-hours targeting the Broad-headed Snake.

The active searches for Pink-tailed Legless Lizard and Striped Legless Lizard were undertaken in potential habitat containing surface rock within native grassland or woodland. These species are generally recorded sheltering under shallowly embedded rocks. Survey effort involved flipping 150 – 200 rocks at each site (DSEWPaC 2011a), during spring and early summer whilst avoiding hot days (DPE 2022a).

The active searches for Pink-tailed Legless Lizard and Striped Legless Lizard were targeted in the south-west of the Study Area due to early detection of the Pink-tailed Legless Lizard and more likely potential habitat for the Striped Legless Lizard.

Further active searches were not undertaken as the Pink-tailed Legless Lizard was detected and staff were limited as a result of a COVID-19 lockdown enforced on Greater Sydney. Instead, pitfall trapping was also undertaken as described in Section 2.3.8.

The active searches for the Broad-headed Snake were undertaken during the day and involved searching suitable sheltering habitat by turning over rocks on top of sandstone to check for individuals sheltering beneath them, and also using a torch to inspect crevices within the outcrops (DPE 2021).

Further active searches were not undertaken as the Broad-headed Snake was detected and staff were limited as a result of a COVID-19 lockdown enforced on Greater Sydney. However, spotlighting was also undertaken as described in Section 2.3.10.

2.3.3 Diurnal Bird Surveys

Diurnal Bird Surveys (Autumn/Winter) targeting the Swift Parrot (*Lathamus discolor*) were undertaken in April-May 2021. The surveys targeted areas with heavily flowering eucalypts in woodland, forest or paddock trees, and flocks of other blossom feeders. While not specifically targeting the species, the surveys had potential to record the Regent Honeyeater (*Anthochaera phrygia*). Approximately 23.5 person-hours survey effort was undertaken over 9 days, across 66 sites (Figure 2.1). Surveys for the Glossy Black-Cockatoo (*Calyptorhynchus lathami*) were undertaken concurrently, as well as while setting up, maintaining and collecting remote monitoring cameras.

Diurnal Bird Surveys (Spring/Summer) targeting the Gang-gang Cockatoo (*Callocephalon fimbriatum*) and Superb Parrot (*Polytelis swainsonii*) were completed at 16 sites in November-December 2021. The surveys focused on forested areas (or paddock trees) which support trees with hollows that appeared to have entrances over 5 centimetres (cm) wide. Approximately 22.8 person-hours of surveys targeting the Superb Parrot were undertaken over the course of at least four days, consistent with the national *Survey Guidelines for Australia's Threatened Birds* (DEWHA 2010a). Approximately 8 person-hours were invested targeting the Gang-gang Cockatoo.

Diurnal Bird Surveys (Spring) targeting the Square-tailed Kite (*Lophoictinia isura*), White-bellied Sea-Eagle (*Haliaeetus leucogaster*), and Little Eagle (*Hieraaetus morphnoides*) birds of prey were

undertaken at 17 sites during September 2021, accumulating approximately 15.8 person-hours over the course of 5 days. While not specifically targeting these species, the surveys had potential to record the Black Falcon (*Falco subniger*) and Spotted Harrier (*Circus assimilis*). Surveys for these raptor species involved searching for their nests in woodland, forest or paddock trees, including the presence of a male and female; female with nesting material; or an individual on a large stick nest in the top half of the tree canopy. Additional survey effort undertaken in November 2021 included approximately 12.4 person-hours, which overlapped with the surveys targeting the Superb Parrot and Gang-gang Cockatoo.

A summary of the Diurnal Bird Survey hours is provided in Table 2.4.

Table 2.4 Diurnal Bird Survey Effort Summary

Survey Type	Species	Hours
Autumn/Winter	Swift Parrot, Regent Honeyeater, Glossy Black-Cockatoo	23.5
	Diurnal Bird Survey effort subtotal (Autumn/Winter)	**23.5**
Spring	Bird of Prey, Superb Parrot (September 2021)	15.8
	Bird of Prey (November 2021)	12.4
	Superb Parrot, Gang-gang Cockatoo (November 2021)	**7.0***
	Diurnal Bird Survey effort subtotal (Spring)	**28.2**
Summer	Gang-gang Cockatoo (December 2021)	1.0
	Diurnal Bird Survey effort subtotal (Summer)	**1.0**
	Diurnal Bird Survey effort TOTAL	**52.7**

Note: *overlaps with the 12.4 hours targeting Birds of Prey in November and was therefore not included in totals.

2.3.4 Harp Traps and Anabats

Targeted threatened bat surveys were undertaken for the five "Species Credit" species or dual-credit "Species/Ecosystem" species known or predicted to occur in the locality, being the Grey-headed Flying-fox (*Pteropus poliocephalus*), Little Bent-winged Bat (*Miniopterus australis*), Large Bent-winged Bat (*Miniopterus orianae oceanensis*), Large-eared Pied Bat (*Chalinolobus dwyeri*) and Eastern Cave Bat (*Vespadelus troughtoni*). While targeted threatened bat surveys are not required for "Ecosystem Credit" species, the survey techniques and effort carried out have potential to detect these species.

Harp trapping and Anabat surveys within the Study Area were undertaken in December 2020 and January 2021 (Figure 2.2). Survey timing and duration was designed with respect to the recommended survey months in the TBDC (DPE 2022a) for the target threatened bats that are known or predicted to occur in the Study Area.

The overall survey effort applied was determined by assuming potential habitat for the target threatened bat species throughout the entire Study Area, although targeted survey effort focussed on locations with rocky habitat for cave dwelling bats. The sampling intensity was determined in accordance with the NSW *'Species Credit' Threatened Bats and Their Habitats Survey Guide* (OEH 2018). Almost seven 50 ha stratification units were applied within the Study Area.

Harp trapping was undertaken within the Study Area during January 2021, with a total of 110 harp trap nights achieved. For the majority of harp trapping nights, the location of harp traps was changed each morning after the bats had been collected. At four locations where small cave entrances were observed and harp trapping was considered feasible, the harp trap was left in the same location for two consecutive nights.

Anabat surveys were undertaken within the Study Area during January 2021, with a total of 92 Anabat nights achieved at 38 locations. Each detector was deployed for between one and five nights, within flyways, or near potential foraging areas, watercourses, or cave entrances.

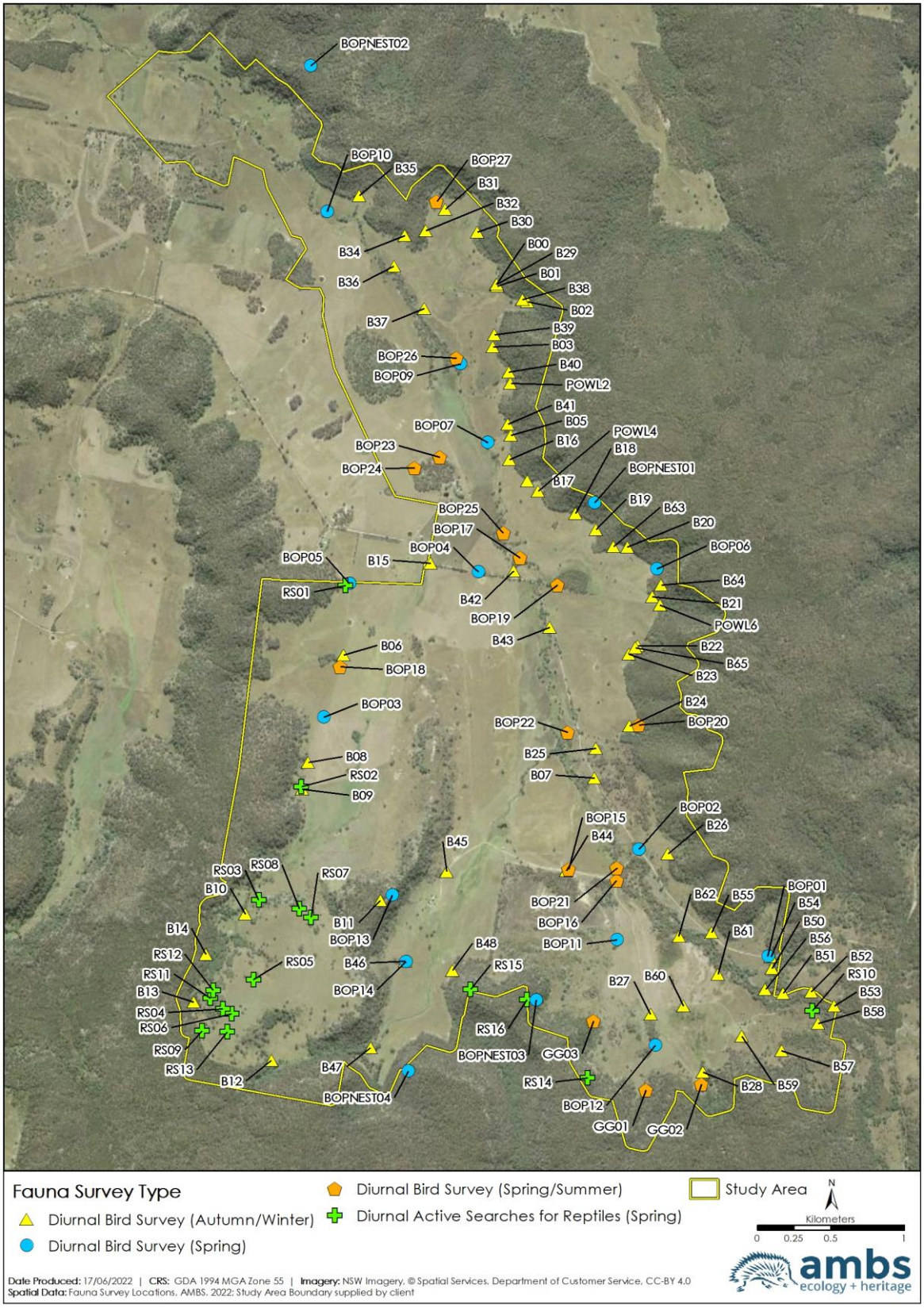


Figure 2.1 Location of bird and reptile surveys

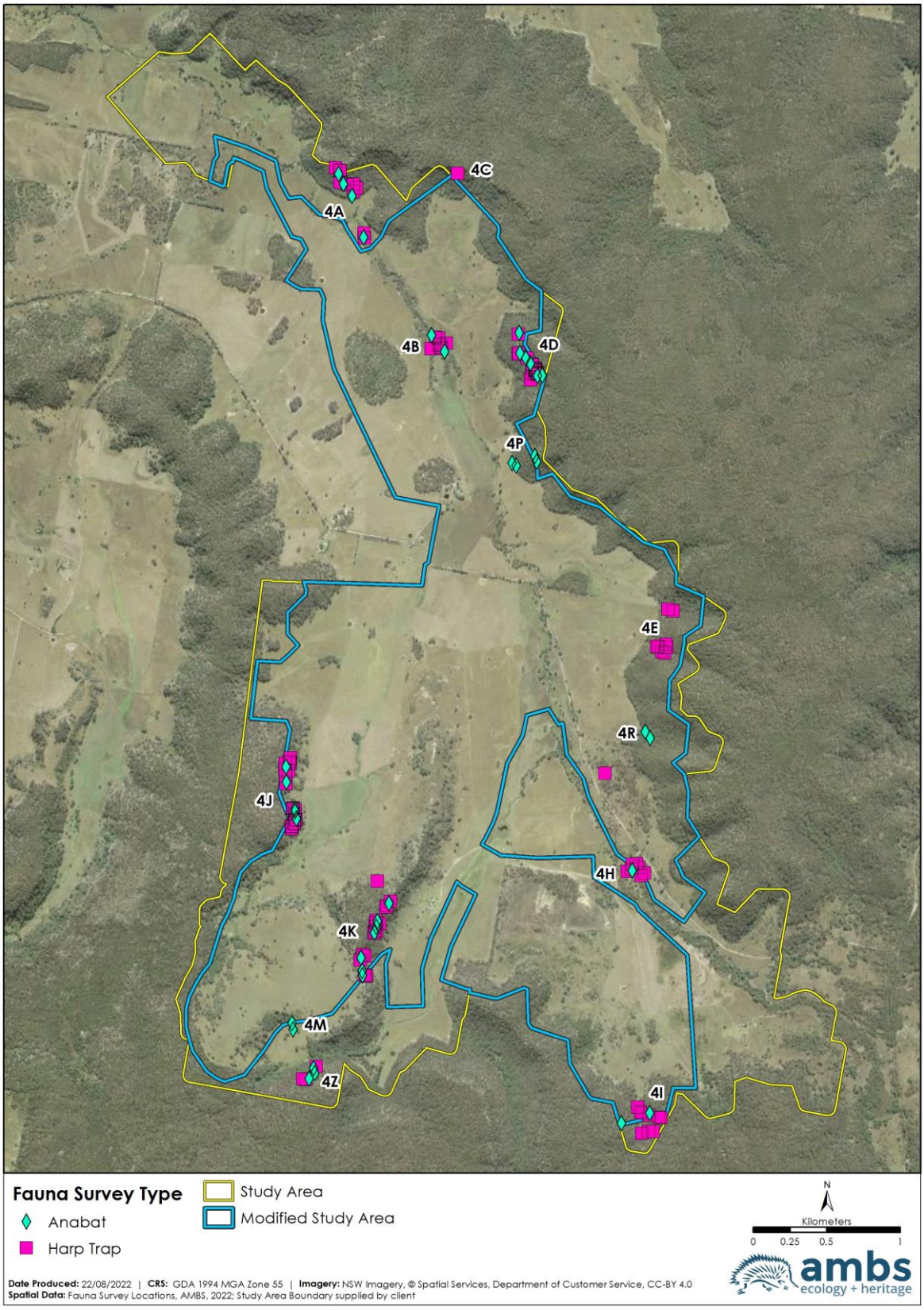


Figure 2.2 Location of Anabats and harp traps

2.3.5 Remote Cameras

Remote cameras were deployed within the Study Area during two survey periods, in April-June 2021, and November-December 2021.

The methodology used to target the Brush-tailed Phascogale (*Phascogale penicillata*) was provided to Biodiversity, Conservation and Science (BCS) in March 2022. BCS confirmed the adequacy of the survey effort undertaken to determine the presence/absence of the Brush-tailed Phascogale within the Study Area.

A total of 60 Remote Cameras (Autumn/Winter) were deployed in April-June 2021 targeting the Spotted-tailed Quoll (*Dasyurus maculatus*) and Brush-tailed Phascogale (*Phascogale penicillata*) (Figure 2.3). Each camera was focussed on a sardine tin which was screwed onto a tree trunk or branch, at a height of 1.5-2 m or above, and had multiple holes drilled into the exposed side of the tin. Honey-water was sprayed on the trunk in front of each camera. Each camera was deployed and left in-situ for a minimum of 4 weeks, with cameras checked, honey-water resprayed, and baits replaced after approximately 2 weeks (total of 2,280 camera trap nights).

Forty-eight of the cameras deployed were located within PCTs associated with these species (within an area of approximately 395 ha), and 12 were located within PCTs not associated with these species. The survey effort included four cameras installed for the first 1 ha of potential habitat, then an additional two cameras for each ha of potential habitat up to 10 ha (i.e. 22 cameras), consistent with the TBDC (DPE 2022a) guidelines. An additional 26 cameras were installed in remaining areas of PCTs associated with these species to increase the potential of detection. The overall survey effort equates to approximately one camera per 8 ha of potential habitat. Cameras were distributed relatively evenly throughout the Study Area, and if any malfunctioned, they were replaced. General observations of vegetation within the Study Area indicate that the majority of the 395 ha would represent potential habitat for the Brush-tailed Phascogale and Spotted-tailed Quoll, given the presence of logs and hollow-bearing trees.

During November 2021, two Remote Cameras (Spring/Summer) were deployed at each of 14 sites (28 cameras total), targeting the Eastern Pygmy Possum (*Cercartetus nanus*), Yellow-bellied Glider (*Petaurus australis*), Squirrel Glider (*Petaurus norfolcensis*), Greater Glider (*Petauroides volans*) and Brush-tailed Rock-Wallaby (*Petrogale penicillata*). At each site, one camera was placed on the ground, while another was attached to a bracket about 3 m high in a tree. Both cameras were baited with universal bait and in both instances, the bait was positioned approximately 1-3 m from the camera. These cameras were deployed and left in-situ for a minimum of 14 nights, then were collected in December 2021.

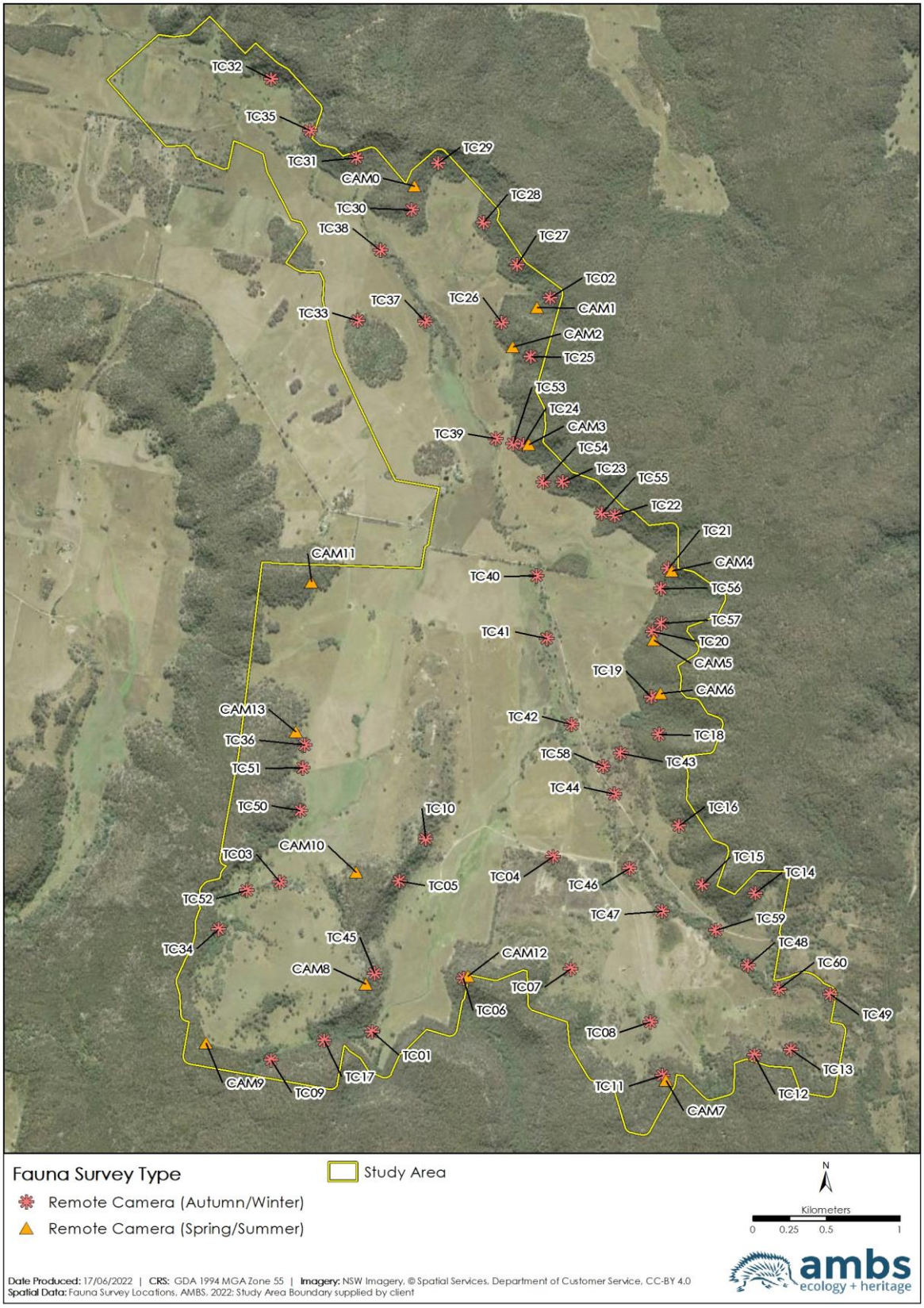


Figure 2.3 Location of remote cameras

2.3.6 Call Playback

Call playback surveys were undertaken throughout the Study Area during May, July and August 2021. Twelve sites were initially selected, with each site separated by 800-1,000 m within woodland/forested areas, but some sites were relocated to improve site access efficiency. This resulted in a total of 14 standard call playback sites in which a standard cycle of call broadcast was undertaken (Figure 2.4). The intention was to complete call playback for a total of 8 nights across the equivalent of 12 sites for the Masked Owl (*Tyto novaehollandiae*), and 5 nights for the Powerful Owl (*Ninox strenua*) and Barking Owl (*Ninox connivens*), at each site (DEC 2004). No call playback was undertaken targeting the koala given the early detection of the species in the Study Area.

Consistent with DEC (2004) survey guidelines, each standard call playback site was separated by 800-1,000 m within woodland/forested areas. Standard call playback surveys were structured as follows: an initial listening period of 10-15 minutes, followed by a 10-minute spotlight. Calls of the target owl species were played intermittently for 5 minutes, followed by a 10-minute listening period. After all the calls were played, a final 10-minute spotlight was undertaken.

At sites where Bush Stone-Curlew (*Burhinus grallarius*) call playback was undertaken, calls for the species were broadcast for 30 seconds, followed by 4.5 minutes of listening, with this 5-minute cycle repeated three times.

A summary of the survey effort achieved at standard call playback sites for each species within the Study Area is provided in Table 2.5.

Table 2.5 Standard call playback survey effort summary

Species	Survey effort				
	1-night	2-nights	3-nights	4-nights	5-nights
Bush Stone-Curlew	1	0	3	2	6
Masked Owl	8	3	2	0	0
Powerful Owl	0	0	0	0	12
Barking Owl	0	0	0	0	12

In addition to the 14 standard call playback surveys, seven non-standard (or opportunistic) call playbacks surveys were also undertaken (Figure 2.4). These were a result of detections of the Masked Owl or Powerful Owl during standard call playback surveys, and these additional non-standard call playback surveys were targeted towards these two species with the intention of finding nest trees that may be present.

2.3.7 Forest Owl Targeted Surveys

The below methodology was provided to BCS in February 2022. BCS confirmed the adequacy of the survey effort undertaken to determine the presence/absence of the Masked Owl within the Study Area.

Step 1 – Signs of Breeding

Call playback surveys were undertaken throughout the Study Area between May and August 2021, consistent with guidelines prepared by the DEC (2004). A total of 12 sites were initially selected, with each site separated by 800-1,000 m within woodland/forested areas, but some sites were relocated to improve site access efficiency (Figure 2.4). The intention was to complete call playback for a total of 8 nights for the Masked Owl, and 5 nights for the Powerful Owl and Barking Owl, at each site.

In May 2021, a pair of Masked Owls responded rapidly to call playback in the north-eastern section of the Study Area (Figure 2.4). The response was suggestive of territorial defensive behaviour.

Subsequent visits to the general area recorded a male Masked Owl, continuing territorial defensive / investigatory behaviour, indicating there is likely a female Masked Owl sitting on eggs in a nesting hollow.

The above encounter was considered to constitute signs of breeding, and call playback for the Masked Owl was ceased within the Study Area. Call playback for the Powerful Owl and Barking Owl continued within the Study Area, but no evidence of breeding consistent with the criteria outlined in the TBDC was detected.

Prior to the pair of Masked Owls being recorded within the Study Area the following had been undertaken:

- one night of Masked Owl call playback at eight sites (Sites CPB01, CPB03, CPB06, CPB08, CPB09, CPB10, CPB11, CPB12);
- two nights of Masked Owl call playback at three sites (Sites CPB04, CPB05, CPB07); and
- three nights of Masked Owl call playback at two sites (Sites CPB01b, CPB02).

Step 2 – Identification of Potential Nest Trees

The TBDC identifies potential nest trees for the Masked Owl as *"Living or dead trees with hollows greater than 20cm diameter"*. Given signs of breeding were detected within the Study Area, AMBS undertook hollow-bearing tree surveys instead of continuing the forest owl call playback for the Masked Owl. Hollow-bearing tree surveys were undertaken during 12-18 July 2021 by three people, and 26-31 July 2021 by four people.

In accordance with the BAM (DPIE 2020a), the hollow surveys occurred in PCTs associated with the Masked Owl, searching for tree hollows that meet the criteria outlined in the TBDC (DPE 2022a) (i.e. Living or dead trees with hollows greater than 20cm diameter). For each potential nest tree found (Figure 2.5), the following was recorded:

- tree GPS location;
- tree species;
- estimate of tree DBH and height;
- estimate of hollow height and angle; and
- estimate of hollow diameter (at least 20 cm).

A total of 265 potential nest trees were recorded within the Study Area.

Step 3 – Identification of Actual Nest Trees

Masked Owls are monogamous, sedentary, and occupy large home ranges, but there is limited published information on the behaviour of the species at actual nest trees. Young are altricial; the nestling period is 2 months and the breeding cycle occupies 3 months from laying to fledging (DEC 2006). During this time, the male provides food, while the female provides parental care in the egg and chick stages; both sexes provide food from the late nestling stage to independence of the young (DEC 2006). Juveniles are dependent for 1-3 months post-fledging; thereafter some disperse to marginal habitats, which can be 80+ km over partly open country (DEC 2006).

Considering the dependence of young Masked Owls on their parents (from laying to fledging, and post-fledging), in conjunction with survey recommendations outlined for the Powerful Owl within the TBDC (DPE 2022a), hollow watching was undertaken at each potential hollow (Figure 2.5) to determine if they were being used for nesting or roosting. Each evening an ecologist would start the hollow watch in the vicinity of one or more hollows 30 min before sunset and continue to 1.5 hours after sunset. During each hollow watch, the ecologist quietly observed the entrance of the hollow to record any signs of the species (e.g. dusk calls, an owl exiting a hollow, male providing

food for female/chicks). Particular attention was paid to regular owl calls if they were heard nearby from a consistent direction and distance (but not from the target nest tree).

Hollow watching was undertaken during 27-31 July 2021 by four people, 10-15 August 2021 by two people, and 24-29 August by five people, resulting in a total of 56 hollows being watched on one occasion each (i.e. 209 potential hollows within the Study Area did not have a watch undertaken). During the hollow watching surveys, two Masked Owl records were obtained in the south of the Study Area, with each sighting consisting of one Masked Owl heard calling to the east of the ecologist. These records did not include the presence of a male and female, or two individuals calling to each other (duetting), and therefore did not constitute signs of breeding consistent with the criteria outlined in the TBDC.

One nest tree was recorded on 25 August 2021 as being in use. One Masked Owl was observed in the entrance of the hollow calling. A second owl was heard calling nearby. The nest tree occurs approximately 100 m outside the Study Area (Figure 2.5).

Step 4 – Species Polygon

Where a breeding site has been identified in accordance with the BAM (DPIE 2020a), the species polygon would be established by providing a circular buffer with a 100 m radius around the nest tree. See Figure 2.5 for known nest tree location.

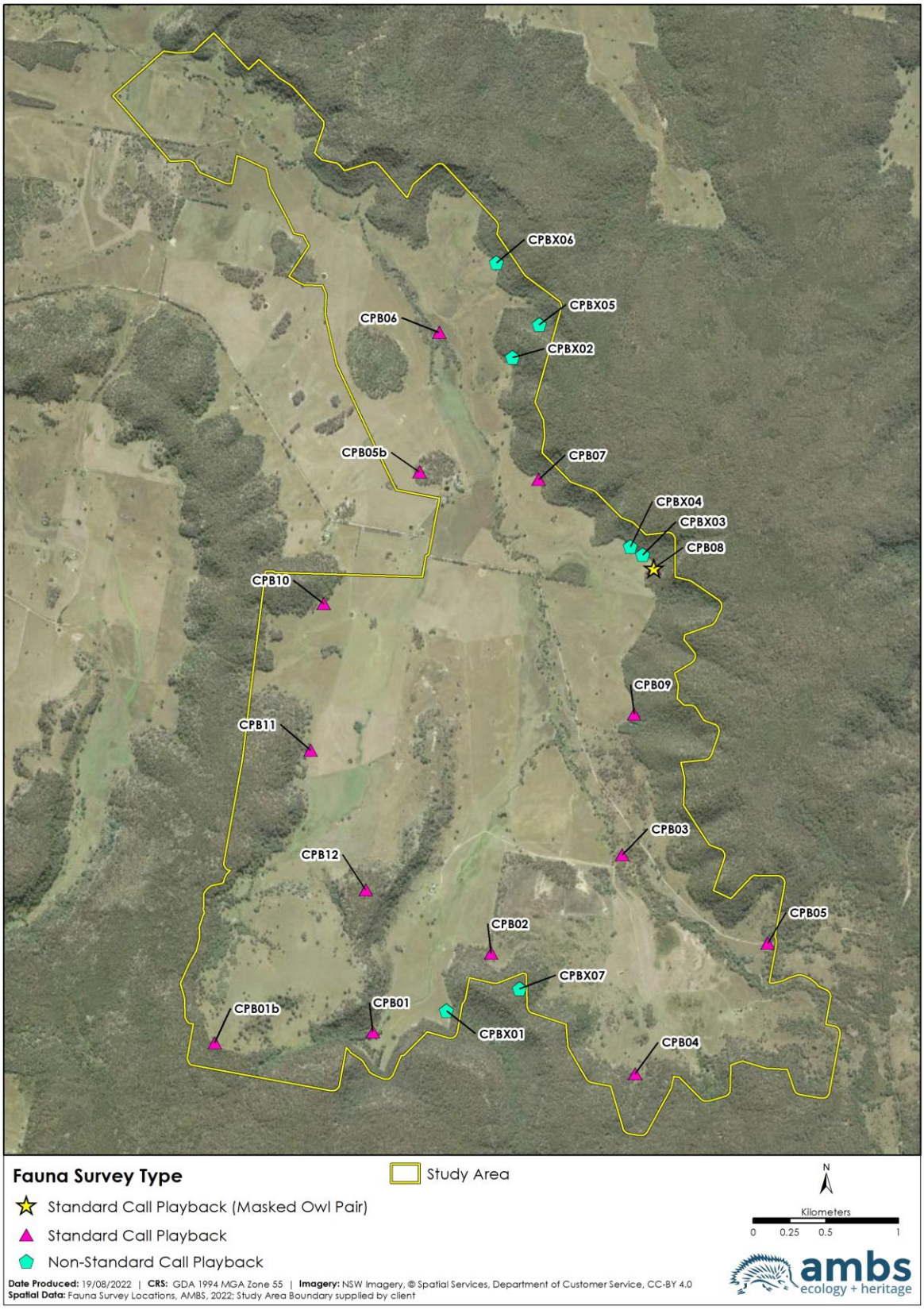


Figure 2.4 Location of nocturnal call playback surveys

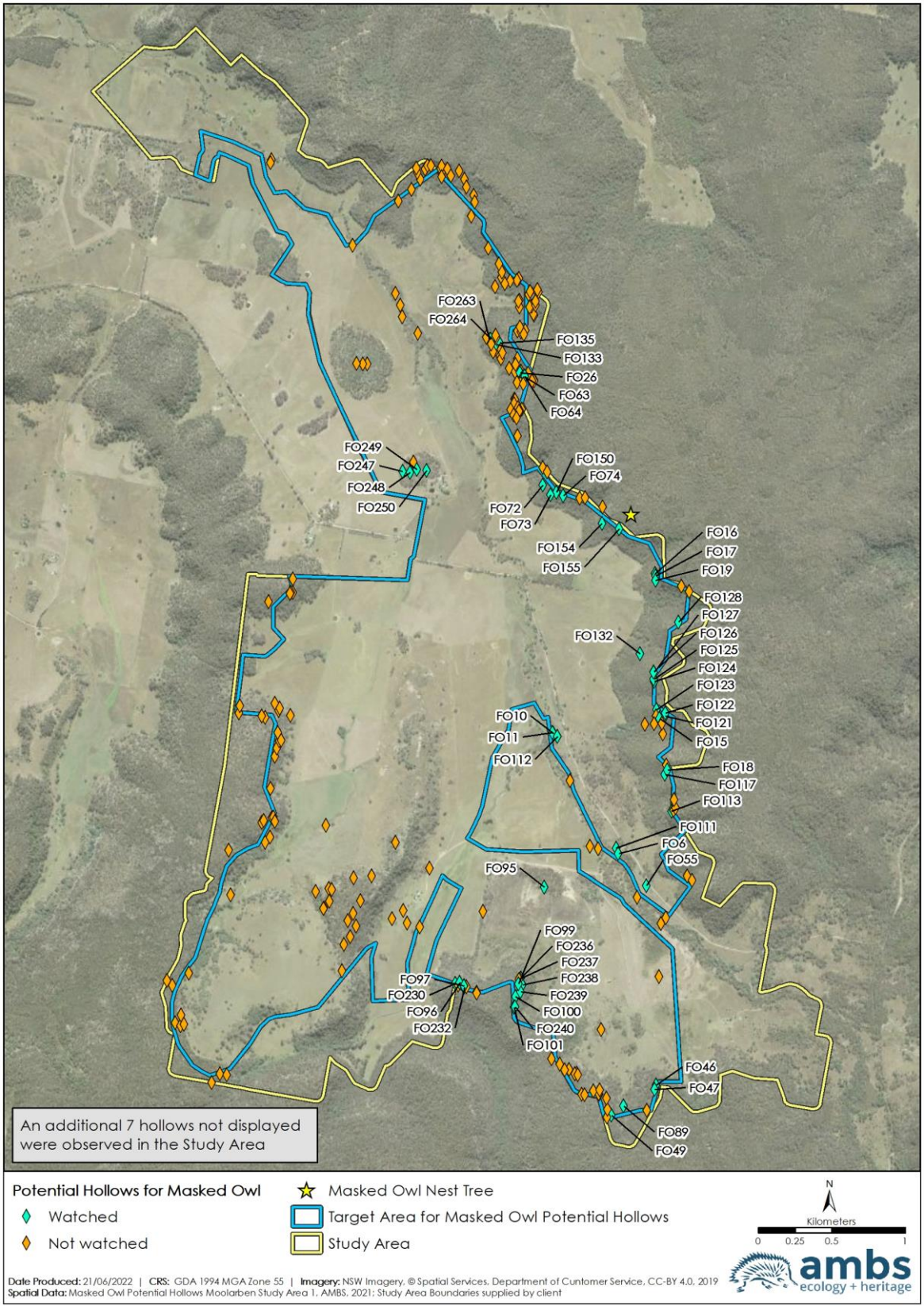


Figure 2.5 Location of potential nest trees for hollow watching

2.3.8 Pitfall and Funnel Traps

In December 2021, six pitfall traps were deployed for four nights at each of two sites (i.e. 24 pitfall trap-nights total per site), targeting the Eastern Pygmy Possum and reptiles (Figure 2.6). Traps were checked each morning within three hours of dawn. Each pit was a 20-litre bucket spaced approximately 5 m apart along a 30 m or 40 m drift fence. A small sheet of styrofoam was placed within each bucket to provide cover for any trapped animals and to act as a float in the event of heavy rainfall.

A total of four funnel traps were placed in pairs approximately 5 m from each end of the pitfall trap drift fences (i.e. two pairs of two funnel traps at each site). Traps were checked each morning within three hours of dawn.

2.3.9 Elliott Traps

Elliott trapping was undertaken in December 2021 at the same two sites the pitfall and funnel trapping was completed (Figure 2.6). At each site, 25 Elliott A Traps (on ground) were deployed for four nights (i.e. 100 Elliott trap-nights total per site). Traps were checked each morning within three hours of dawn. Each trap contained cotton wool and universal bait (peanut butter, rolled oats and honey). Each trap was placed in a plastic bag for weather protection, and spacing between traps was 10 m.

2.3.10 Spotlighting

Spotlighting surveys were undertaken at four locations in December 2021 and March 2022, targeting the Pale-headed Snake (*Hoplocephalus birtorquatus*), Broad-headed Snake, Bush Stone-curlew, Spotted-tailed Quoll, Brush-tailed Phascogale, Koala (*Phascolarctos cinereus*) (Youngentob *et al.* 2021), Eastern Pygmy Possum, Yellow-bellied Glider, Squirrel Glider, Greater Glider, Brush-tailed Rock-wallaby and Grey-headed Flying-fox (Figure 2.6). Each site was surveyed for at least 60 person-minutes, accumulating approximately 7 person-hours survey effort within the Study Area, consistent with the survey guidelines prepared by the DEC (2004). Using head-torches, two people meandered through potential habitat searching for eye-shine while listening for potential vocalisations. These species were also targeting using other methods.

2.3.11 Scat Transects

Scat transects targeting the Brush-tailed Rock-wallaby were undertaken in four locations during December 2021 and March 2022. At each of the four sites, 30 person-minutes were invested surveying potential habitat for scats or other signs of the species (Figure 2.6). Sites were located in areas close to rocky habitat and cliffs. This technique also has potential to detect other threatened species, such as the Koala (Youngentob *et al.* 2021).

Camera traps and spotlighting were also undertaken to target the Brush-tailed Rock-wallaby.

2.3.12 Incidental Observations

Searches for scats, tracks and signs (e.g. diggings, sap feeding marks, chewed *Allocasuarina* cones, large stick nests) were undertaken concurrently with all other survey techniques, along with observations of non-target fauna. In particular, records were made of species that are not detected frequently by other survey techniques, for example Koala scats (Youngentob *et al.* 2021).

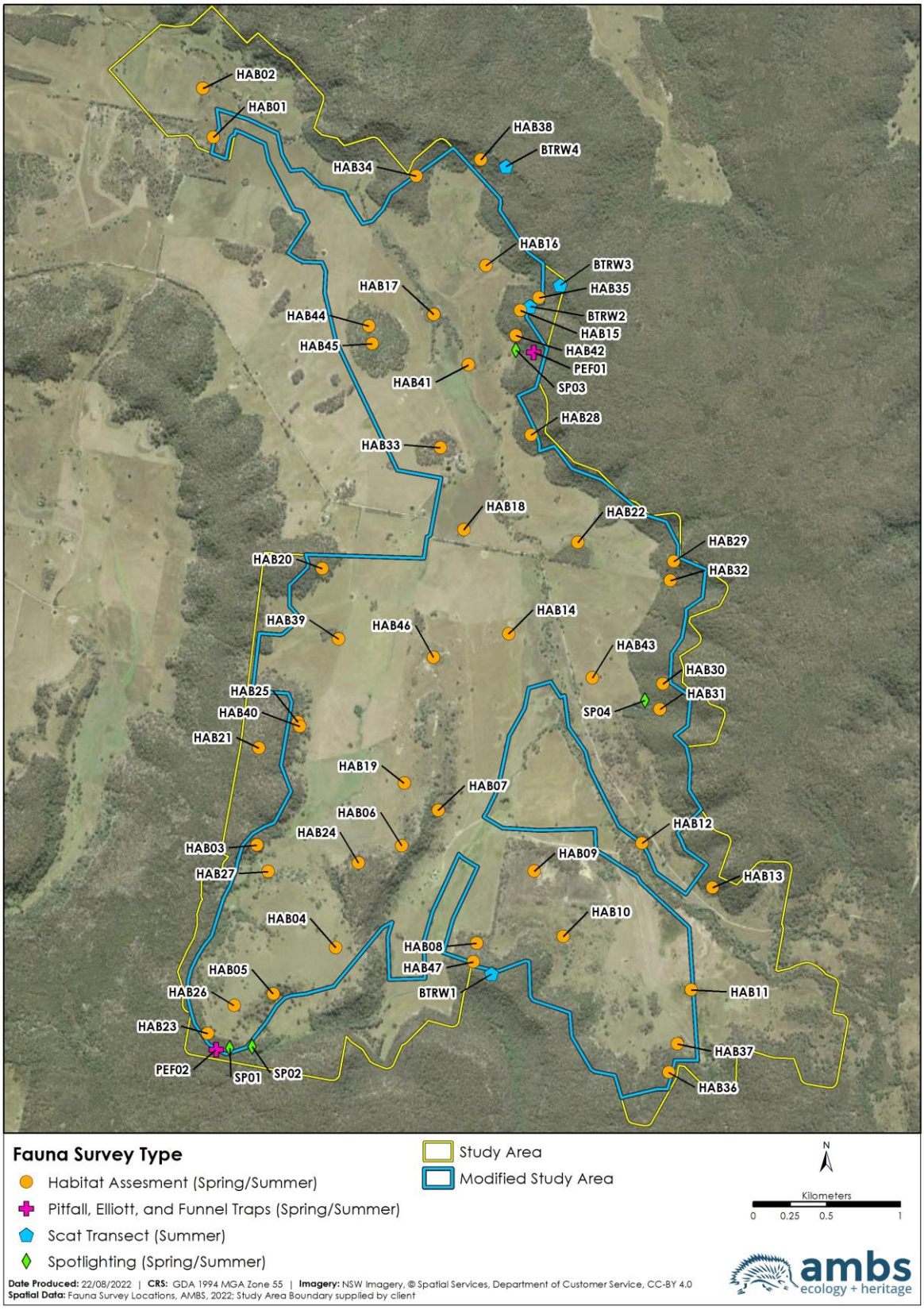


Figure 2.6 Location of Habitat Assessments, Elliott traps, pitfall traps, funnel traps, scat transects and spotlighting

2.3.13 Habitat Assessment

Habitat assessments were undertaken at 47 sites throughout the Study Area in January 2021, November 2021 and March 2022 (Figure 2.6). Data was collected on:

- vegetation structure and age;
- site condition;
- dominant flora species;
- presence of livestock;
- evidence of feral animals;
- hollow-bearing trees (DPE 2022a) and decorticating bark;
- nectar or fruit resources;
- rocky areas, including escarpments, outcrops and pagodas (DPE 2022a);
- paddock trees;
- the abundance of potential roosting habitat, including caves, tunnels, mines, culverts, overhangs, escarpments, outcrops, crevices or boulder piles (DPE 2022a);
- logs, fallen timber and leaf litter;
- ephemeral and permanent waterbodies;
- evidence of disturbance (e.g. grazing, fire, tracks, logged stumps, erosion);
- important feed trees and shrubs (e.g. feed trees for Koala, *Allocasuarina* sp. *and Acacia* sp.);
- abundance of ground or arboreal termite mounds; and
- mistletoe.

Where possible, bat habitat features (e.g. caves, overhangs, escarpments, outcrops, crevices, boulder piles) were inspected to determine potential suitability for roosting bats. The GPS location of notable habitat features with potential to support roosting bats was recorded when observed.

2.3.14 Species Polygons

Threatened species that are "Ecosystem Credit" species and/or "Species Credit" species are pre-determined by DPE in the TBDC (DPE 2022a). The BAM (DPIE 2020a) sections 5.1.1 and 5.1.2 state (emphasis added):

> *<u>Ecosystem credit species</u> are threatened species whose occurrence can generally be predicted by vegetation surrogates and/or landscape features, or that have a low probability of detection using targeted surveys. The TBDC identifies the threatened species assessed for ecosystem credits. A targeted survey is not required to identify or confirm the presence of ecosystem credit species.*
> …
> *<u>Species credit species</u> are threatened species for which vegetation surrogates and/or landscape features cannot reliably predict the likelihood of their occurrence or components of their habitat. These species are identified in the TBDC. A targeted survey or an expert report is required to confirm the presence of these species on the subject land*.

Species polygons were prepared for a number of threatened fauna species within the Study Area. This included mapping of habitat for "Species Credit" or dual-credit "Species/Ecosystem" species.

The BAM (DPIE 2020a) defines a "species polygon" as an area of land that contains habitat or is occupied by a threatened species. The BAM (DPIE 2020a) also defines "habitat" as an area or areas occupied, or periodically or occasionally occupied, by a species or ecological community, including any biotic or abiotic components.

A variety of information was considered to prepare species polygons for the purpose of quantifying and mapping the species extent (i.e. where the species was present), as well as the potential habitat (i.e. areas that contain similar habitat where the species could be, but was not observed on this occasion).

When mapping species polygons for each threatened species, consideration was given to:

- requirements in the BAM (DPIE 2020a);
- all current and previous records of the species within the Study Area and adjoining habitat;
- the PCTs mapped within the Study Area (ELA 2022);
- PCT associations, habitat constraints and buffers for each threatened species, as identified in the TBDC (DPE 2022a);
- the NSW survey guide for *'Species Credit' Threatened Bats and Their Habitat* (OEH 2018);
- habitat data collected by AMBS within the Study Area;
- satellite imagery, contour and drainage lines; and
- relevant scientific literature.

2.4 Survey Guidelines and Effort

A reconciliation of survey effort against relevant guidelines is provided in Table 2.6, pertaining to the threatened species that were (prior to the survey) conservatively considered to have potential to occur in the Study Area.

Table 2.6 Summary of survey guidelines for threatened species potentially found in the Study Area

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
Amphibians									
Giant Burrowing Frog	*Heleioporus australiacus*	V	V	S	Aural-visual searches are completed as transects running through areas of native vegetation located within 300 m of suitable breeding habitat. Recommended survey effort is 960 minutes per 500 m transect with 8 repeats required. These are completed within a week of heavy rainfall (e.g. >50 mm in 24 hours, >100 mm over three days) (DPIE 2020b).	250.2	January, February, March, April, May September, October, November and December	No surveys were undertaken due to no suitable habitat present in the Study Area (i.e. no ephemeral flowing streams that have permanent pools, or in upland swamps, and are located within PCTs associated with the species).	N/A
Red-crowned Toadlet	*Pseudophryne australis*	V	-	S	Aural-visual surveys must be completed within areas of potential habitat. Call playback involving loud sounds to which the male responds can be undertaken any time of the year if there has been sufficient recent rainfall to stimulate activity. Recommended survey effort is 480 minutes per 500 m transect with 4 repeats. Surveys should not be conducted if three significant rain events (>50 mm of rain in 24 hours) have occurred in the previous two months, nor during periods of heavy rainfall (DPIE 2020b).	257.6	All year	No surveys were undertaken. The Study Area does not occur on Triassic sandstones (Raymond *et al.* 2012), and therefore does not represent potential habitat for the species.	N/A
Reptiles									
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	S	Active search of potential habitats (which includes overturning rocks), aiming to search under 150–200 rocks in spring and early summer (DSEWPaC 2011a).	887.2	January, February, March, April, May September, October,	Active diurnal reptile searches of Pink-tailed Legless Lizard potential habitat were undertaken at 13 locations in September 2021 targeting areas with native grasses, surface rock	More than 2,000 rocks flipped within the Study Area, however surveys were not able to be

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
					Survey in spring, avoiding hot days in November (DPE 2022a).		November and December	and fallen timber. Survey effort was defined by flipping between 150 – 200 rocks at each site. A total of 25.5 person-hours was applied at these 13 locations. Six pitfall traps were deployed for four nights at 2 sites in December 2021 (24 trap-nights per site).	undertaken throughout the entire Study Area.
Striped Legless Lizard	*Delma impar*	V	V	S	Commonwealth Reptile Survey Guidelines (DSEWPaC 2011a): In areas with surface rock, artificial shelter site surveys or rock turning should be the primary techniques (with supplementary techniques employed as appropriate). Rock turning can be detrimental to striped legless lizard populations, especially when undertaken regularly. Therefore, this method should be used only when other methods are unavailable and it should never be employed for long-term monitoring. Commonwealth Referral Guidelines (DSEWPaC 2011c): Rock turning can be detrimental to striped legless lizard populations, especially when undertaken regularly. Therefore, this method should be used only when other methods are unavailable and it should never be employed for long-term monitoring.	100	September, October, November and December	Active diurnal reptile searches of Striped Legless Lizard potential habitat were undertaken at 13 locations in September 2021 targeting areas with native grasses, surface rock and fallen timber. Survey effort was defined by flipping between 150 – 200 rocks at each site. A total of 25.5 person-hours was applied across at these 13 locations across 6 days.	Yes – while acknowledging this technique has a low success rate, more than 2,000 rocks were flipped within the Study Area in PCTs associated with the species.

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
					Active Searches: Active searching (checks under surface rock and debris and around tussocks) can generally be undertaken throughout the year as long as any limitations with respect to this survey technique are clearly outlined (DSEWPaC 2011a, 2011c). Surveyors need to ensure that rocks, logs and other refugia are placed back in the same position (DSEWPaC 2011a, 2011c). This technique has a low success rate and usually leads to disturbance of refuge sites (DSEWPaC 2011a, 2011c). It should only be used where necessary. Dorrough *et al.* (1996) reported a success rate for locating the species of approximately one individual per 150 rocks.				
Rosenberg's Goanna	*Varanus rosenbergi*	V	-	E	No species-specific survey requirements defined (DEC 2004; DPE 2022a). Broad-ranging species that is difficult to survey - very transient (DPE 2022a).	427.6	N/A	Opportunistic observations while undertaking other diurnal fauna surveys techniques, including (but not necessarily limited to) bird and reptile surveys. Approximately 50-days invested undertaking diurnal fauna survey tasks.	Yes
Pale-headed Snake	*Hoplocephalus bitorquatus*	V	-	S	NSW guidelines: Nocturnal spotlighting, 30-minute searches on 2 separate nights should be undertaken per stratification unit up to 100 ha (DEC 2004).	273.8	January, February, March, November and December	Spotlighting was undertaken at four sites in December 2021 and March 2022, after rainfall, totalling approximately 7 person-hours.	Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
					Survey should be undertaken 1-2 days after rainfall and on humid nights (DPE 2022a).			3 hours spotlighting would be required across 300 ha of potential habitat in accordance with DEC (2004).	
Broad-headed Snake	*Hoplocephalus bungaroides*	E	V	S/E	Habitat surveys for this species require turning over pieces of sandstone located on top of sandstone outcrops and crevices within the outcrops. Surveyors should use a torch to inspect the crevices (DPIE 2021). Searching suitable sheltering sites at night with torches during winter to detect the presence of the species is recommended. Searching rock outcrops by day will only sample a subset of rocky sheltering sites; in particular deep crevices will not be thoroughly examined (DSEWPaC 2011a). Survey in dry weather only, to minimise damage to sandstone, must not be too warm with survey restricted to August and September only, late Aug and early Sep optimal (DPE 2022a).	257.6	August and September	Active diurnal reptile searches of Broad-headed Snake suitable sheltering sites (under rocks or in crevices) were undertaken in August 2021. Applied effort involved 4 person-hours at three locations. Spotlighting was undertaken at four sites in December 2021 and March 2022, totalling approximately 7 person-hours.	Survey effort was met in the location the species was recorded; however, surveys were not able to be undertaken throughout the entire Study Area.
Birds									
Malleefowl	*Leipoa ocellata*	E	V	E	Area searches in suitable habitat for active mounds, tracks, and sightings are the best detection methods. (DEWHA 2010a).	5.6	N/A	Opportunistic observation of Malleefowl or signs of the species during diurnal survey work including in particular bird surveys and habitat	Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
								assessments. Approximately 50-days invested undertaking diurnal fauna survey tasks. Total diurnal bird survey effort undertaken within the Study Area included approximately 23.5 person-hours in Autumn/Winter and approximately 29 person-hours in Spring/Summer (i.e. approximately 52.7 person-hours total). Searches for scats and tracks were undertaken concurrently with all other survey techniques.	
Black Falcon	*Falco subniger*	V	-	E	No species-specific survey requirements or stratification defined (DEC 2004; DPE 2022a). Diurnal bird surveys would be appropriate for this species (DEC 2004).	198.5	N/A	Diurnal bird surveys (Spring) targeting threatened raptor species were undertaken in September and November 2021 for a total survey effort of approximately 28 person-hours. Opportunistic observations while undertaking other diurnal fauna surveys techniques, including (but not necessarily limited to) bird and reptile surveys. Approximately 50-days invested undertaking diurnal fauna survey tasks.	Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
Square-tailed Kite	*Lophoictinia isura*	V	-	S/E	Breeding habitat is live large old trees within suitable vegetation AND the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy (DPE 2022a).	645.4	January, September, October, November and December	Diurnal bird surveys (Spring) targeting threatened raptor species were undertaken in September and November 2021 for a total survey effort of approximately 28 person-hours.	Yes
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	V	-	S/E	Breeding habitat is live large old trees within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines AND the presence of a large stick nest within tree canopy; or an adult with nest material; or adults observed duetting within breeding period. Due to the similarities in nest structure and use of the same nests by White-belled Sea-Eagles and Wedge-tailed Eagles, where a nest is observed without a bird present, searches for prey remains/feathers below the structure should be undertaken. Where prey items/feathers are absent, repeat visits to the nest until a bird is observed should be undertaken (DPE 2022a).	183	July, August, September, October, November and December	Diurnal bird surveys (Spring) targeting threatened raptor species were undertaken in September and November 2021 for a total survey effort of approximately 28 person-hours.	Yes
Spotted Harrier	*Circus assimilis*	V	-	E	No species-specific survey requirements or stratification defined (DEC 2004; DPE 2022a). Diurnal bird surveys would be appropriate for this species (DEC 2004).	188.6	N/A	Diurnal bird surveys (Spring) targeting threatened raptor species were undertaken in September and November 2021 for a total survey effort of approximately 28 person-hours. Opportunistic observations while undertaking other diurnal fauna surveys techniques,	Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
								including (but not necessarily limited to) bird and reptile surveys. Approximately 50-days invested undertaking diurnal fauna survey tasks.	
Little Eagle	*Hieraaetus morphnoides*	V	-	S/E	Breeding habitat is live (occasionally dead) large old trees within suitable vegetation AND the presence of a male and female; or female with nesting material; or an individual on a large stick nest in the top half of the tree canopy (DPE 2022a).	456.8	August, September and October	Diurnal bird surveys (Spring) targeting threatened raptor species were undertaken in September 2021 for a total survey effort of approximately 15 person-hours.	Yes
Bush Stone-curlew	*Burhinus grallarius*	E	-	S	NSW guidelines: Call-playback should consist of playing calls for 30 seconds, followed by 4.5 minutes of listening, repeated up to three times. Sites for this species should be 2-4 km apart and conducted during the breeding season. Spotlighting should be done by foot or from a slow-moving vehicle (DEC 2004). It may be easier to detect during breeding season, possibly calls all year, but it is unclear how well it responds to playback (DPE 2022a).	456.8	All year	Call playback surveys incorporating quiet listening, call playback and spotlighting were undertaken at 14 sites during May, July and August 2021. Bush Stone-curlew call playback involved 5 nights at 6 sites, 4 nights at 2 sites, 3 nights at 3 sites, and 1 night at 1 site. Spotlighting was undertaken at four sites in December 2021 and March 2022, totalling approximately 7 person-hours.	Yes
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	V	-	S/E	Survey techniques for Glossy Black-Cockatoo (Kangaroo Island) are also relevant to this species wherever it occurs. Diurnal surveys for all species are most appropriate along with searches for chewed Casuarina cones under trees (DEWHA 2010a).	297.4	January, February, March, April, May, June, July, August, and September	Diurnal bird surveys for the Glossy Black-Cockatoo ran concurrently with the Swift Parrot surveys from April and May 2021 which involved a total survey effort of 23.5 hours, over 9 days, across 66 locations.	Yes – no signs of breeding were identified during the field survey and therefore potential nest trees were not mapped.

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
					Assessors should look for signs of breeding on site. Where signs of breeding on site are present potential nest trees should be identified. Potential nest trees contain hollows that are; (i) at least 8 m above the ground; and (ii) in stems with a diameter of at least 30 cm; and (iii) hollow diameter is at least 15 cm; and (iv) stem angle is at least 45 degrees and may be near-vertical or vertical. Where potential nest trees are identified on site, they should be monitored during the breeding season (April – August) to confirm the presence of any actual nest trees on site (DPE 2022a).				
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	E	S/E	Assessors should look for signs of breeding on site. Where signs of breeding on site are present potential nest trees should be identified. Potential nest trees contain hollows that are; (i) at least 9 m above the ground; and (ii) in stems with a diameter of at least 10 cm or larger. Where potential nest trees are identified on site, they should be monitored during the breeding season (October – January) to confirm the presence of any actual nest trees on site (DPE 2022a).	451.2	January, October, November and December	Diurnal bird surveys targeting the Gang-gang Cockatoo were undertaken within the Study Area in November and December 2021 focusing on forested areas which support trees with hollows. Survey effort included approximately 8 person-hours.	Yes – no signs of breeding were identified during the field survey and therefore potential nest trees were not mapped.
Little Lorikeet	*Glossopsitta pusilla*	V	-	E		687.4	N/A	Opportunistic observation of these species during diurnal	Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
Turquoise Parrot	*Neophema pulchella*	V	-	E	No species-specific survey requirements or stratification defined (DEC 2004; DPE 2022a). Diurnal surveys for these species would be appropriate (DEC 2004).	697.9	N/A	survey work including in particular bird surveys and habitat assessments. Total diurnal bird survey effort undertaken within the Study Area included approximately 23.5 person-hours in Autumn/Winter and approximately 29 person-hours in Spring/Summer (i.e. approximately 52.7 person-hours total). Approximately 50-days invested undertaking diurnal fauna survey tasks.	Yes
Swift Parrot	*Lathamus discolor*	E	CE	S/E	Diurnal bird surveys undertaken for 20 hours over 8 days targeting areas of heavily flowering eucalypts (DEWHA 2010a). Surveys on mainland Australia should be conducted between March and July (DEWHA 2010a). If the subject land is within a mapped area, no survey is required for that species, and it is assumed present (DPE 2022a).	456.8	N/A	Diurnal bird surveys for the Swift Parrot targeting flowering eucalypts were undertaken in April and May 2021. A total survey effort of 23.5 hours, over 9 days and across 66 locations, was undertaken within the Study Area.	Yes
Superb Parrot	*Polytelis swainsonii*	V	V	S/E	Diurnal bird surveys undertaken for 12 hours over 4 days targeting areas of hollow-bearing trees during breeding season (DEWHA 2010a). Breeding habitat can be identified by the presence of habitat features and observed nest OR two or more birds	188.6	September, October and November	Diurnal bird surveys targeting the Superb Parrot were undertaken within the Study Area in November and December 2021 focusing on forested areas which support trees with hollows. Survey effort included at least 12 hours	Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
					seen on site (DPE 2022a). Where a breeding site is identified, the species polygon should be established by a circular buffer with a 100 m radius around the nest tree (DPE 2022a).			of targeted surveys over the course of at least 4 days, consistent with national survey guidelines (DEWHA 2010a).	
Masked Owl	*Tyto novaehollandiae*	V	-	S/E	DEC (2004) requires nocturnal surveys for all species to incorporate quiet listening, spotlighting and call-playback. A minimum of eight visits per site is suggested for Masked Owl. DEC (2004) states that the surveys can occur any time of year. Potential nest trees for the Masked Owl are "Living or dead trees with hollows greater than 20cm diameter" (DPE 2022a). Where a breeding site has been identified in accordance with the BAM (DPIE 2020a) the species polygon should be established by providing a circular buffer with a 100 m radius around the nest tree (DPE 2022a).	456.8	May, June, July and August	Call-playback surveys were performed for 3 nights at 2 sites, 2 nights at 3 sites, and 1 night at 8 sites. Opportunistic call playback was also undertaken at 6 sites. In May 2021, a pair of Masked Owl's responded rapidly to call playback in a way that constituted signs of breeding. Call playback for the species was then ceased within the Study Area and hollow-bearing tree surveys commenced. Hollow-bearing tree surveys were undertaken during 12-18 July 2021 by three people, and 26-31 July 2021 by four people. Hollow watching was undertaken during 27-31 July 2021 by four people, 10-15 August 2021 by two people, and 24-29 August 2021 by five people, resulting in a total of 56 hollows being watched on one occasion each (i.e. there were 202 potential hollows remaining	BCS confirmed the adequacy of the survey effort undertaken to determine the presence/absence of the Masked Owl within the Study Area.

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
								within the Study Area that were not monitored). Spotlighting was undertaken at 4 sites within the Study Area in December 2021 and March 2022, totalling 7 person-hours.	
Powerful Owl	*Ninox strenua*	V	-	S/E	DEC (2004) requires nocturnal surveys for all species to incorporate quiet listening, spotlighting and call-playback. A minimum of five visits per site is suggested for both Powerful Owl and Barking Owl. For Powerful Owl and Barking Owl where there are no known nest trees on site, assessors should apply the following process: Look for signs of breeding on site, where signs of breeding are present, potential nest trees should be identified. Potential nest trees are living or dead trees with hollows greater than 20 cm diameter. Night monitoring of potential nest trees for a minimum of 2 nights should be undertaken to detect the presence of the species (DPE 2022a).	427.6	May, June, July and August	Call-playback surveys were performed across 5 nights at 12 sites for both the Powerful Owl and Barking Owl. Hollow-bearing tree surveys were undertaken during 12-18 July 2021 by three people, and 26-31 July 2021 by four people. Hollow watching was undertaken during 27-31 July 2021 by four people, 10-15 August 2021 by two people, and 24-29 August 2021 by five people, resulting in a total of 56 hollows being watched on one occasion each (i.e. there were 202 potential hollows remaining within the Study Area that were not monitored). Spotlighting was undertaken at 4 sites within the Study Area in December 2021 totalling 7 person-hours.	Yes
Barking Owl	*Ninox connivens*	V	-	S/E		702.9	May, June, July, August, September, October, November and December		Yes
White-throated Needletail	*Hirundapus caudacutus*	-	V	E		710.3	N/A	Opportunistic observation of these species during diurnal	Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	V	E	No species-specific survey requirements or stratification defined (DEC 2004; DPE 2022a). Diurnal bird surveys would be appropriate for these species (DEC 2004).	662.2	N/A	survey work including in particular bird surveys and habitat assessments. Total diurnal bird survey effort undertaken within the Study Area included approximately 23.5 person-hours in Autumn/Winter and approximately 29 person-hours in Spring/Summer (i.e. approximately 52.7 person-hours total). Approximately 50-days invested undertaking diurnal fauna survey tasks.	Yes
Speckled Warbler	*Chthonicola sagittata*	V	-	E		662.2	N/A		Yes
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	V	-	E		451.2	N/A		Yes
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	S/E	Diurnal bird surveys undertaken for 20 hours over 5 days targeting areas of heavily flowering trees and flocks of other blossom feeders (DEWHA 2010a). The species is most conspicuous in the breeding season (primarily between September and November) (DEWHA 2010a). If the subject land is within a mapped area, no survey is required for that species, and it is assumed present (DPE 2022a).	422.2	N/A	Specific diurnal bird surveys targeting flowering eucalypts were undertaken in April and May 2021. A total survey effort of 23.5 hours, over 9 days, across 66 locations was undertaken within the Study Area.	Yes
Painted Honeyeater	*Grantiella picta*	V	V	E	No species-specific survey requirements or stratification defined (DEC 2004; DPE 2022a). Diurnal bird surveys would be appropriate for these species (DEC 2004).	682.4	N/A	Opportunistic observation of these species during diurnal survey work including in particular bird surveys and habitat assessments. Total diurnal bird survey effort undertaken within the Study	Yes
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	V	E	E		662.2	N/A		Yes
Flame Robin	*Petroica phoenicea*	V	-	E		471.7	N/A		Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
Scarlet Robin	*Petroica boodang*	V	-	E		477.3	N/A	Area included approximately 23.5 person-hours in Autumn/Winter and approximately 29 person-hours in Spring/Summer (i.e. approximately 52.7 person-hours total). Approximately 50-days invested undertaking diurnal fauna survey tasks.	Yes
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-	E		451.2	N/A		Yes
Varied Sittella	*Daphoenositta chrysoptera*	V	-	E		662.2	N/A		Yes
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	E		193	N/A		Yes
Diamond Firetail	*Stagonopleura guttata*	V	V	E		206.6	N/A		Yes
Mammals									
Spotted-tailed Quoll	*Dasyurus maculatus*	V	E	E	Habitat surveys (for potentially suitable habitat resources and signs of activity, scats and latrines), hair tubes and camera trapping (DSEWPaC 2011b). May to August is the optimal survey period for this species as it is during breeding season (DSEWPaC 2011b). Whilst survey is not required for this species if survey is undertaken cameras can be used throughout the year, however trapping should be limited to Dec to Oct, post breeding months (Sept to Nov) where females that have dependent young should be avoided (DPE 2022a). Recommend survey effort is 40 hair tubes (funnels) per 100 ha sampling	669.6	N/A	A total of 60 remote camera traps were deployed in April through to June 2021 (Autumn/Winter). Each camera was left in-situ for a minimum of 4 weeks, and bait was replaced after approximately 2 weeks (total of 2,280 camera trap nights). During November 2021, two remote camera (Spring/Summer) traps (one terrestrial and one arboreal) were deployed at 14 sites in the Study Area. All cameras were deployed for a minimum of 14 nights and were collected in December 2021.	Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
					units spread 100 m apart (DSEWPaC 2011b).			Spotlighting was undertaken at 4 sites in December 2021 and March 2022, totalling 7 person-hours.	
Brush-tailed Phascogale	*Phascogale tapoatafa*	V	-	S	Survey must be undertaken using baited cameras. The bait type used must remain as an effective attractant until replaced. Cameras must remain in place for a minimum of 4 weeks with cameras checked and baits replaced after 2 weeks. Modified camera approach for sites over 10 ha (DPE 2022a).	433.2	January, February, March, April, May, June and December	A total of 60 remote camera traps were deployed in April through to June 2021 (Autumn/Winter). Each camera was left in-situ for a minimum of 4 weeks, and bait was replaced after approximately 2 weeks (total of 2,280 camera trap nights). During November 2021, two remote camera (Spring/Summer) traps (one terrestrial and one arboreal) were deployed at 14 sites in the Study Area. All cameras were deployed for a minimum of 14 nights and were collected in December 2021. Elliott Trapping was undertaken at two sites in December 2021. At each site, 25 Elliott traps were deployed for four nights (i.e. 100 Elliott trap-nights per site). Spotlighting was undertaken at 4 sites in December 2021 and	BCS confirmed the adequacy of the survey effort undertaken to determine the presence/absence of the Brush-tailed Phascogale within the Study Area.

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
								March 2022, totalling 7 person-hours.	
Koala	*Phascolarctos cinereus*	E	E	S	NSW BAM Survey Guide (DPE 2022): A range of techniques can be used, including the Spot Assessment Technique, Detection Dogs, Spotlighting, Passive acoustic, and Drones. The EPBC Act referral guidelines for the vulnerable Koala are no longer current (Department of the Environment [DotE] 2014). Youngentob *et al.* (2021): survey techniques can include direct observation, transect and point surveys, spotlighting, trained detection dogs, thermal detection drones, camera traps, scat surveys, call playback and passive acoustic devices. Spotlighting (DEC 2004): 2 x 1 hour and 1 km up to 200 ha of stratification unit, walking at approximately 1 km per hour on 2 separate nights.	710.3	All year	Spotlighting was undertaken at 4 sites in December 2021 and March 2022, totalling 7 person-hours. Searches for scats, tracks and scratches on tree trunks were also undertaken concurrently with all other survey techniques. Approximately 50-days invested undertaking diurnal fauna survey tasks. 8 hours spotlighting would be required across 800 ha of potential habitat in accordance with DEC (2004).	Yes
Eastern Pygmy-possum	*Cercartetus nanus*	V	-	S	No species-specific survey requirements defined (DPE 2022a). The Eastern Pygmy-possum is very difficult to detect, especially via spotlighting (DPE 2022a).	273.8 137 ha within the modified Study Area	January, February, March, October, November and December	During November 2021, two remote camera (Spring/Summer) traps (one terrestrial and one arboreal) were deployed at 14 sites in the Study Area. All cameras were deployed for a minimum of 14	Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
					Pitfall Trapping (DEC 2004): 24 trap nights over 3-4 consecutive nights per stratification unit up to 50 ha plus an additional effort for every additional 100 ha. Elliott Trapping (DEC 2004): 100 trap nights over 3-4 consecutive nights per stratification unit up to 50 ha plus an additional effort for every additional 100 ha. Spotlighting (DEC 2004): 2 x 1 hour and 1 km up to 200 ha of stratification unit, walking at approximately 1 km per hour on 2 separate nights.			nights and were collected in December 2021. Six pitfall traps were deployed for four nights at 2 sites in December 2021 (24 trap-nights per site). Elliott Trapping was undertaken at 2 sites in December 2021. At each site, 25 Elliott traps were deployed for four nights (i.e. 100 Elliott trap-nights per site). Spotlighting was undertaken at 4 sites in December 2021 and March 2022, totalling 7 person-hours. 48 pitfall trap nights and 48 Elliott trap nights would be required across 150 ha in accordance with DEC (2004) (i.e. the modified Study Area). Four hours spotlighting, would be required across 400 ha of potential habitat in accordance with DEC (2004).	
Yellow-bellied Glider	*Petaurus australis*	V	V	E	No species-specific survey requirements defined (DPE 2022a; DSEWPaC 2011b).	250.2	N/A	During November 2021, two remote camera (Spring/Summer) traps (one terrestrial and one arboreal) were deployed at 14 sites in the	Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
					Spotlighting (DEC 2004): 2 x 1 hour and 1 km up to 200 ha of stratification unit, walking at approximately 1 km per hour on 2 separate nights.			Study Area. All cameras were deployed for a minimum of 14 nights and were collected in December 2021. Spotlighting was undertaken at 2 sites in December 2021 and March 2022, totalling 7 person-hours. 4 hours spotlighting would be required across 400 ha of potential habitat in accordance with DEC (2004).	
Squirrel Glider	*Petaurus norfolcensis*	V	-	S	No species-specific survey requirements defined (DPE 2022a). Spotlighting (DEC 2004): 2 x 1 hour and 1 km up to 200 ha of stratification unit, walking at approximately 1 km per hour on 2 separate nights. Survey year round but sites with bipinnate acacia, autumn winter flowering trees and shrubs such as *Eucalyptus robusta* and *Banksia sp.* (*integrifolia* etc.) should be subject to a more retracted survey period of between March-August. Squirrel Gliders rely on large old trees with hollows for breeding and nesting, as well as for movement (DPE 2022a).	456.8	All year	During November 2021, two remote camera (Spring/Summer) traps (one terrestrial and one arboreal) were deployed at 14 sites in the Study Area. All cameras were deployed for a minimum of 14 nights and were collected in December 2021. Spotlighting was undertaken at 2 sites in December 2021 and March 2022, totalling 7 person-hours. 6 hours spotlighting would be required across 600 ha of potential habitat in accordance with DEC (2004).	Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
Greater Glider	*Petauroides volans*	E	E	S	No species-specific survey requirements defined (DPE 2022a).	268.2	All year	During November 2021, two remote camera (Spring/Summer) traps (one terrestrial and one arboreal) were deployed at 14 sites in the Study Area. All cameras were deployed for a minimum of 14 nights and were collected in December 2021. Spotlighting was undertaken at 2 sites in December 2021 and March 2022, totalling 7 person-hours. 4 hours spotlighting would be required across 400 ha of potential habitat in accordance with DEC (2004).	Yes
Brush-tailed Rock-wallaby	*Petrogale penicillata*	E	V	S	The following survey techniques are recommended to detect the presence of the Brush-tailed Rock-Wallaby in areas up to 5 ha in size: Daytime searches for potential habitat resources (caves, rock boulders and rock ledges); Daytime searches for signs of activity (tracks, scats, rocks worn smooth from resting); Looking for rock wallabies basking during the day, or becoming active at dusk; Baited camera traps; and	456.8	All year	During November 2021, one baited terrestrial camera trap was deployed at 14 sites in the Study Area. All cameras were deployed for a minimum of 14 nights and were collected in December 2021. Spotlighting was undertaken at 2 sites in December 2021 and March 2022, totalling 7 person-hours. Targeted scat searches were undertaken at 4 locations within	Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
					Possibly the collection of predator scat for hair identification (DSEWPaC 2011b). Systematic faecal pellet surveys and time lapse cameras should be considered as appropriate methods of survey (DPE 2022a).			the Study Area, and searches for scats were also undertaken concurrently with all other survey techniques.	
Grey-headed Flying-fox	*Pteropus poliocephalus*	V	V	S/E	Prior to the survey, a review of known flying fox camps should be conducted for the project area, and the wider general area. The primary method for determining the presence of day roosts is to conduct daytime field surveys. Night-time field surveys should also be conducted by walking transects (100 m apart) and looking for feeding and flying bats (DEWHA 2010b). Surveys must be undertaken as per the Threatened Bat Survey Guide to confirm breeding habitat (OEH 2018).	456.8	October, November and December	Spotlighting was undertaken at 2 sites in December 2021 and March 2022, totalling 7 person-hours. Searches for camps were undertaken concurrently with all other survey techniques. Approximately 50-days invested undertaking diurnal fauna survey tasks.	Yes
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	E	No species-specific survey requirements defined (DPE 2022a). Harp Traps (DEC 2004): Four trap nights over two consecutive nights (with one trap placed outside the flyways for one night), per 100 ha (or portion thereof) of stratification unit targeting preferred habitat. Anabats (DEC 2004): Two sound activated recording devices utilised for	456.8	N/A	Harp trapping was undertaken within the Study Area during January 2021, with a total of 110 harp trap nights achieved. Anabat surveys were undertaken within the Study Area during January 2021, with a total of 92 Anabat nights achieved.	Yes
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V	-	E		250.2	N/A		Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
					the entire night (a minimum of four hours), starting at dusk for two nights, per 100 ha (or portion thereof) of stratification unit targeting preferred habitat.			12 harp trap nights and 12 Anabat nights would be required across 300 ha of potential habitat in accordance with DEC (2004).	
Little Bent-winged Bat	*Miniopterus australis*	V	-	S/E	At a minimum, two harp traps per night over two nights, repeated at least two weeks later is required, per cave/mine/tunnel (OEH 2018).	250.2	January, February and December	Harp trapping was undertaken within the Study Area during January 2021, with a total of 110 harp trap nights achieved. Anabat surveys were undertaken within the Study Area during January 2021, with a total of 92 Anabat nights achieved. 8 harp trap nights would be required to be placed close to exits of caves, mines or tunnels identified as survey habitat (OEH 2018). No roost features were identified as being suitable breeding habitat.	Yes
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	V	-	S/E		456.8	January, February and December		Yes
Corben's Long-eared Bat	*Nyctophilus corbeni*	V	V	E	Calls are not distinguishable reliably from other sympatric *Nyctophilus* species using Anabat detectors. Harp traps and mist nets are more effective for this species, although harp traps have been employed successfully on a large scale in the past. Recommended harp trap survey effort includes 20 trap nights for a minimum of 5 nights for project areas <50 ha (DEWHA 2010b).	160.95 within modified Study Area	N/A	Harp trapping was undertaken within the Study Area during January 2021, with a total of 80 harp trap nights achieved within the modified Study Area. 80 harp trap nights would be required across 200 ha of potential habitat in accordance with DEWHA (2010b).	Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	S	The survey may use harp traps or a combination of harp traps and mist nets placed in areas of potential breeding habitat on the subject land. Age, sex and reproductive status of captured bats must be assessed and recorded. Acoustic detectors may be used; however, this method does not allow for reproductive status to be identified (OEH 2018). Survey effort should include at least 16 harp trap or Anabat nights over at least 4 nights, for areas up to 50 ha (OEH 2018).	433.2	January, November and December	Harp trapping was undertaken within the Study Area during January 2021, with a total of 110 harp trap nights achieved. Anabat surveys were undertaken within the Study Area during January 2021, with a total of 92 Anabat nights achieved. 144 harp trap nights and 144 Anabat nights would be required across 450 ha of potential habitat in accordance with OEH (2018).	No, however the species was recorded regularly throughout the Study Area, indicating the survey effort was appropriate.
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	V	-	E	No species-specific survey requirements defined (DPE 2022a). Harp Traps (DEC 2004): Four trap nights over two consecutive nights (with one trap placed outside the flyways for one night), per 100 ha (or portion thereof) of stratification unit targeting preferred habitat. Anabats (DEC 2004): Two sound activated recording devices utilised for the entire night (a minimum of four hours), starting at dusk for two nights, per 100 ha (or portion thereof) of stratification unit targeting preferred habitat.	291.8	N/A	Harp trapping was undertaken within the Study Area during January 2021, with a total of 110 harp trap nights achieved. Anabat surveys were undertaken within the Study Area during January 2021, with a total of 92 Anabat nights achieved. 12 harp trap nights and 12 Anabat nights would be required across 300 ha of potential habitat in accordance with DEC (2004).	Yes
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-	E		268.2	N/A		Yes

Common Name	Scientific Name	Conservation Status		Credit Class[3]	Survey Guideline Requirements	Associated PCTs in the Study Area (ha)	Relevant Survey Period (DPE, 2022a)	Survey Method and Applied Effort	Suggested Effort Met
		BC Act[1]	EPBC Act[2]						
Eastern Cave Bat	*Vespadelus troughtoni*	V	-	S	The survey may use harp traps or a combination of harp traps and mist nets placed in areas of potential breeding habitat on the subject land. Age, sex and reproductive status of captured bats must be assessed and recorded. Acoustic detectors may be used; however, this method does not allow for reproductive status to be identified (OEH 2018). Survey effort should include at least 16 harp trap or Anabat nights over at least 4 nights, for areas up to 50 ha (OEH 2018).	433.2	January, November and December	Harp trapping was undertaken within the Study Area during January 2021, with a total of 110 harp trap nights achieved. Anabat surveys were undertaken within the Study Area during January 2021, with a total of 92 Anabat nights achieved. 144 harp trap nights and 144 Anabat nights would be required across 450 ha of potential habitat in accordance with OEH (2018).	No, however the species was recorded regularly throughout the Study Area, indicating the survey effort was appropriate.
New Holland Mouse	*Pseudomys novaehollandiae*	-	V	E	Pitfall Trapping (DEC 2004): 24 trap nights over 3-4 consecutive nights per stratification unit up to 50 ha plus an additional effort for every additional 100 ha. Elliott Trapping (DEC 2004): 100 trap nights over 3-4 consecutive nights per stratification unit up to 50 ha plus an additional effort for every additional 100 ha.	5.6	N/A	Six pitfall traps were deployed for four nights at 2 sites in December 2021 (24 trap-nights per site). Elliott trapping was undertaken at two sites in December 2021. At each site, 25 Elliott traps were deployed for four nights (i.e. 100 Elliott trap-nights per site). 100 Elliott trap-nights and 24 pitfall trap-nights would be required across 50 ha of potential habitat in accordance with DEC (2004).	Yes

[1] Threatened species status under the BC Act (current as at October 2023). CE = Critically Endangered, E = Endangered, V = Vulnerable.

[2] Threatened species status under the EPBC Act (current as at October 2023). CE = Critically Endangered, E = Endangered, V = Vulnerable.
[3] Biodiversity credit class under the TBDC (DPE 2022a) (current as at August 2022). E = Ecosystem, S = Species.

A list of threatened fauna species required to be surveyed in accordance with the BAM (DPIE 2020a), was identified from the TBDC (DPE 2022a) based on the PCT mapping provided by ELA (2022). The list of species included "Species Credit" species and dual-credit "Species/Ecosystem" species that were predicted to occur based on associated PCTs within the Study Area, in the Kerrabee IBRA subregion (Table 2.7). Also included were select threatened fauna listed under the EPBC Act that are known or predicted to occur from the EPBC Act Protected Matters Search Tool that required additional survey effort (DCCEEW 2022a) (Table 2.7).

Table 2.7 Threatened fauna known or predicted to occur in the locality and associated with PCTs in the Study Area

Common Name	Scientific Name	PCTs	Biodiversity Credit Class[1]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Survey Technique
Giant Burrowing Frog	*Heleioporus australiacus*	1629	Species	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	No surveys undertaken due to no suitable habitat present in the Study Area.
Red-crowned Toadlet	*Pseudophryne australis*	1629, 1711	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No surveys undertaken due to no suitable habitat present in the Study Area
Pink-tailed Legless Lizard	*Aprasia parapulchella*	266, 281, 471, 483, 1655	Species	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	RS, PT
Striped Legless Lizard	*Delma impar*	483, 1655	Species	No	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	RS
Rosenberg's Goanna	*Varanus rosenbergi*	281, 1629, 1655	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	OPP
Pale-headed Snake	*Hoplocephalus bitorquatus*	471, 1629, 1655	Species	Yes	Yes	Yes	No	No	No	No	No	No	No	Yes	Yes	SL
Broad-headed Snake	*Hoplocephalus bungaroides*	1629, 1711	Species/ Ecosystem	No	No	No	No	No	No	No	Yes	Yes	No	No	No	RS, SL
Malleefowl	*Leipoa ocellata*	471	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, SC, OPP
Black Falcon	*Falco subniger*	266, 281, 1656, 1661	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Square-tailed Kite	*Lophoictinia isura*	266, 281, 471, 1610, 1629, 1655, 1661	Species/ Ecosystem	Yes	No	No	No	No	No	No	No	Yes	Yes	Yes	Yes	DB
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	266, 281	Species/ Ecosystem	No	No	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	DB
Spotted Harrier	*Circus assimilis*	266, 281, 471	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Little Eagle	*Hieraaetus morphnoides*	266, 281, 471, 1629, 1655	Species/ Ecosystem	No	No	No	No	No	No	No	Yes	Yes	Yes	No	No	DB
Bush Stone-curlew	*Burhinus grallarius*	266, 281, 471, 1629, 1655	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	CP, SL

Common Name	Scientific Name	PCTs	Biodiversity Credit Class[1]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Survey Technique
Glossy Black-Cockatoo	*Calyptorhynchus lathami*	266, 471, 1629, 1655	Species/ Ecosystem	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	DB
Gang-gang Cockatoo	*Callocephalon fimbriatum*	266, 281, 1629, 1655	Species/ Ecosystem	Yes	No	No	No	No	No	No	No	No	Yes	Yes	Yes	DB
Little Lorikeet	*Glossopsitta pusilla*	266, 281, 471, 478, 481, 483, 1610, 1614, 1629, 1655	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Turquoise Parrot	*Neophema pulchella*	266, 281, 471, 478, 481, 483, 1610, 1629, 1655, 1656, 1661	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Swift Parrot	*Lathamus discolor*	266, 281, 471, 1629, 1655	Species/ Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB
Superb Parrot	*Polytelis swainsonii*	-	Species/ Ecosystem	No	No	No	No	No	No	No	No	Yes	Yes	Yes	No	DB
Masked Owl	*Tyto novaehollandiae*	266, 281, 471, 1629, 1655	Species/ Ecosystem	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	CP, HW, SL
Powerful Owl	*Ninox strenua*	281, 1629, 1655	Species/ Ecosystem	No	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	CP, HW, SL
Barking Owl	*Ninox connivens*	266, 281, 471, 478, 481, 483, 1610, 1614, 1629, 1655, 1656, 1661	Species/ Ecosystem	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	CP, HW, SL
White-throated Needletail	*Hirundapus caudacutus*	266, 281, 471, 478, 481, 483, 1610, 1614, 1629, 1655, 1656, 1661, 1711	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	266, 281, 471, 1610, 1614, 1629, 1655, 1656, 1661	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP

Common Name	Scientific Name	PCTs	Biodiversity Credit Class[1]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Survey Technique
Speckled Warbler	*Chthonicola sagittata*	266, 281, 471, 1610, 1614, 1629, 1655, 1656, 1661	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	266, 281, 1629, 1655	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Regent Honeyeater	*Anthochaera phrygia*	266, 281, 481, 483, 1610, 1655	Species/ Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB
Painted Honeyeater	*Grantiella picta*	266, 281, 471, 478, 481, 483, 1610, 1629, 1655	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Hooded Robin (south-eastern form)	*Melanodryas cucullata cucullata*	266, 281, 471, 1610, 1614, 1629, 1655, 1656, 1661	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Flame Robin	*Petroica phoenicea*	266, 281, 1614, 1629, 1655, 1656, 1661	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Scarlet Robin	*Petroica boodang*	266, 281, 471, 1614, 1629, 1655, 1656, 1661	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	266, 281, 1629, 1655	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Varied Sittella	*Daphoenositta chrysoptera*	266, 281, 471, 1610, 1614, 1629, 1655, 1656, 1661	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	266, 281, 471, 478	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP
Diamond Firetail	*Stagonopleura guttata*	266, 281, 471, 1655	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	DB, OPP

Common Name	Scientific Name	PCTs	Biodiversity Credit Class[1]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Survey Technique
Spotted-tailed Quoll	*Dasyurus maculatus*	266, 281, 471, 1610, 1614, 1629, 1655, 1656, 1661, 1711	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	CA, SL
Brush-tailed Phascogale	*Phascogale tapoatafa*	266, 281, 1629	Species	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	CA, ET, SL, OPP
Koala	*Phascolarctos cinereus*	266, 281, 471, 1629, 1655	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	SL, SC, OPP
Eastern Pygmy-possum	*Cercartetus nanus*	471, 1629, 1655	Species	Yes	Yes	Yes	No	No	No	No	No	No	Yes	Yes	Yes	CA, PT, ET, SL
Yellow-bellied Glider	*Petaurus australis*	1629	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	CA, SL
Squirrel Glider	*Petaurus norfolcensis*	266, 281, 471, 1629, 1655	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	CA, SL
Greater Glider	*Petauroides volans*	1629, 1655	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	CA, SL
Brush-tailed Rock-wallaby	*Petrogale penicillata*	266, 281, 471, 1629, 1655	Species	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	CA, SL, SC
Grey-headed Flying-fox	*Pteropus poliocephalus*	266, 281, 471, 1629, 1655	Species/ Ecosystem	No	No	No	No	No	No	No	No	No	Yes	Yes	Yes	SL, OPP
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	266, 281, 471, 1629, 1655	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	HTr, AN
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	1629	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	HTr, AN
Little Bent-winged Bat	*Miniopterus australis*	1629	Species/ Ecosystem	Yes	Yes	No	No	No	No	No	No	No	No	No	Yes	HTr, AN
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	266, 281, 471, 1629, 1655	Species/ Ecosystem	Yes	Yes	No	No	No	No	No	No	No	No	No	Yes	HTr, AN
Corben's Long-eared Bat	*Nyctophilus corbeni*	266, 471, 1629, 1655, 1661	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	HTr
Large-eared Pied Bat	*Chalinolobus dwyeri*	281, 471, 1629, 1655	Species	Yes	No	No	No	No	No	No	No	No	No	Yes	Yes	HTr, AN
Eastern False Pipistrelle	*Falsistrellus tasmaniensis*	266, 1629, 1655	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	HTr, AN
Greater Broad-nosed Bat	*Scoteanax rueppellii*	1629, 1655	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	HTr, AN

Common Name	Scientific Name	PCTs	Biodiversity Credit Class[1]	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Survey Technique
Eastern Cave Bat	*Vespadelus troughtoni*	281, 471, 1629, 1655	Species	Yes	No	No	No	No	No	No	No	No	No	Yes	Yes	HTr, AN
New Holland Mouse	*Pseudomys novaehollandiae*	471	Ecosystem	-	-	-	-	-	-	-	-	-	-	-	-	PT, ET

Note:

[1] Biodiversity credit class under the TBDC (DPE 2022a) (current as at August 2022).

Highlighted months are months surveyed by AMBS.

RS = reptile search, SL = spotlight, CP = call playback, HW = hollow watch, DB = diurnal bird survey, HTr = harp trap, AN = Anabat, CA = remote camera, ET = Elliott trap, PT = pitfall trap, FT = funnel trap, SC = scat search, OPP = opportunistic searches/observation while undertaking other survey techniques.

2.5 Weather Conditions

Rainfall and temperature data were sourced from an MCO weather station (MCO 2021) and are displayed in Table 2.8. Day and night-time temperatures during the trapping surveys varied significantly, with temperatures reaching minimums below freezing and maximums in the high 20s. Rainfall occurred sporadically, with generally dry conditions throughout autumn and winter, followed by wetter periods during spring and early summer.

Table 2.8 Weather conditions during the survey period

Date	Temp °C (minimum)	Temp °C (maximum)	Rainfall (mm)	Date	Temp °C (minimum)	Temp °C (maximum)	Rainfall (mm)
17/12/2020	17.9	32.1	7.6	14/06/2021	-3.6	14.1	0.0
11/01/2021	9.4	28.2	0.0	15/06/2021	-2.7	15.3	0.0
12/01/2021	9.6	30.6	0.0	16/06/2021	-2.4	17.9	2.2
13/01/2021	11.3	30.0	0.0	17/06/2021	3.9	13.2	0.8
14/01/2021	12.8	33.9	0.0	18/06/2021	6.9	12.6	4.4
15/01/2021	11.8	30.8	0.0	19/06/2021	2.4	15.1	0.0
16/01/2021	6.6	24.7	0.0	20/06/2021	1.0	15.9	0.0
17/01/2021	4.5	27.2	0.0	12/07/2021	-1.4	15.6	1.6
25/01/2021	13.2	34.4	0.0	13/07/2021	0.9	15.9	2.6
26/01/2021	14.0	35.1	0.0	14/07/2021	-0.1	15.5	1.4
27/01/2021	18.2	31.3	0.0	15/07/2021	4.9	17.9	4.6
28/01/2021	19.2	25.4	0.0	16/07/2021	3.1	14.1	5.2
29/01/2021	18.5	26.1	0.0	17/07/2021	6.4	10.8	3.4
30/01/2021	20.0	29.8	4.6	18/07/2021	2.8	12.1	0.0
31/01/2021	15.6	30.6	0.4	26/07/2021	1.7	13.6	0.0
12/04/2021	-1.5	18.5	0.0	27/07/2021	-0.7	17.3	0.0
13/04/2021	-1.8	21.7	0.0	28/07/2021	0.0	19.2	2.4
14/04/2021	1.2	24.1	0.0	29/07/2021	-2.5	13.0	0.2
15/04/2021	1.7	23.6	0.0	30/07/2021	-6.2	16.6	0.0
16/04/2021	8.6	19.9	0.0	31/07/2021	-2.3	20.6	0.0
17/04/2021	4.2	16.6	1.2	9/08/2021	2.7	17.4	0.0
18/04/2021	3.2	20.0	0.2	10/08/2021	0.4	19.0	0.0
19/04/2021	-0.3	21.2	0.0	11/08/2021	2.9	20.1	0.0
20/04/2021	-1.6	20.7	0.0	12/08/2021	-0.4	17.4	2.2
21/04/2021	-0.3	17.6	0.0	13/08/2021	-2.9	16.7	0.0
22/04/2021	-3.5	16.1	0.0	14/08/2021	-3.4	18.3	0.2
23/04/2021	-3.6	18.4	0.0	15/08/2021	-2.7	18.0	0.0
24/04/2021	-1.2	19.9	0.0	23/08/2021	7.4	18.6	12.0
25/04/2021	-1.8	20.2	0.0	24/08/2021	6.5	12.0	11.4
26/04/2021	0.2	20.8	0.0	25/08/2021	0.8	12.5	0.2
27/04/2021	-0.4	21.3	0.0	26/08/2021	-2.9	15.7	0.0
28/04/2021	1.9	20.3	0.0	27/08/2021	-1.9	13.8	0.0
29/04/2021	1.8	22.2	0.0	28/08/2021	-4.1	14.2	0.0
30/04/2021	1.5	21.1	0.0	29/08/2021	-3.3	18.5	0.0
1/05/2021	4.5	22.0	0.0	13/09/2021	1.5	15.4	0.0
2/05/2021	5.5	22.3	0.0	14/09/2021	1.9	16.2	7.2
3/05/2021	3.6	23.3	0.0	15/09/2021	-1.8	16.6	0.0
4/05/2021	8.5	14.9	10.6	16/09/2021	-0.8	17.0	0.0
5/05/2021	9.6	18.2	0.0	17/09/2021	-0.9	21.5	0.0
6/05/2021	8.3	21.0	0.0	8/11/2021	11.6	26.6	0.2
7/05/2021	8.9	23.0	0.8	9/11/2021	11.4	28.0	0.0
8/05/2021	10.2	22.4	0.2	10/11/2021	14.6	29.0	19.6
9/05/2021	10.8	18.2	0.4	11/11/2021	15.4	23.3	15.4
10/05/2021	4.2	20.7	0.0	12/11/2021	11.6	22.8	9.8
11/05/2021	4.4	17.9	0.4	13/11/2021	9.3	13.1	2.6
12/05/2021	-0.3	18.3	0.0	14/11/2021	6.0	18.4	3.8
13/05/2021	2.7	19.6	0.0	15/11/2021	5.3	18.4	0.0

Date	Temp °C (minimum)	Temp °C (maximum)	Rainfall (mm)	Date	Temp °C (minimum)	Temp °C (maximum)	Rainfall (mm)
14/05/2021	2.1	15.3	0.0	16/11/2021	1.6	20.4	0.0
15/05/2021	2.5	14.4	0.0	17/11/2021	3.8	22.3	0.0
16/05/2021	-6.1	15.0	0.0	18/11/2021	7.5	26.2	0.0
17/05/2021	-1.1	17.4	0.0	19/11/2021	10.7	26.9	0.6
18/05/2021	-3.8	16.8	0.0	20/11/2021	14.7	26.8	1.0
19/05/2021	-4.4	19.5	0.0	21/11/2021	13.6	17.7	22.8
20/05/2021	-3.3	19.7	0.0	22/11/2021	13.8	20.5	1.0
21/05/2021	-0.2	18.9	0.0	23/11/2021	14.8	24.1	0.0
22/05/2021	0.9	18.4	0.0	24/11/2021	16.9	23.5	0.2
23/05/2021	-0.4	18.9	0.0	25/11/2021	18.5	24.2	12.2
24/05/2021	0.0	18.2	0.0	26/11/2021	15.5	19.9	13.0
25/05/2021	2.1	20.5	0.0	27/11/2021	12.7	17.0	2.8
26/05/2021	1.8	18.0	0.0	28/11/2021	12.7	18.4	0.6
27/05/2021	-3.6	16.4	0.0	29/11/2021	12.5	18.9	5.4
28/05/2021	-1.2	16.4	0.0	30/11/2021	12.5	17.5	18.6
29/05/2021	-5.7	16.5	0.0	1/12/2021	17.2	25.9	0.2
30/05/2021	-4.7	16.9	0.0	2/12/2021	12.9	27.8	0.0
31/05/2021	-4.2	17.7	0.0	3/12/2021	12.7	31.8	0.0
1/06/2021	-3.0	18.2	0.0	4/12/2021	17.4	27.6	0.0
2/06/2021	2.4	21.0	0.0	5/12/2021	13.6	22.2	0.0
3/06/2021	4.4	12.6	18.0	6/12/2021	13.0	20.0	5.0
4/06/2021	8.1	14.8	1.0	7/12/2021	15.2	24.0	26.6
5/06/2021	-1.7	14.2	0.0	8/12/2021	13.8	25.5	7.2
6/06/2021	-4.0	16.9	0.0	9/12/2021	12.8	23.3	3.8
7/06/2021	-3.3	18.1	0.0	10/12/2021	4.7	20.6	0.0
8/06/2021	-1.6	16.0	8.0	7/03/2022	18.7	24.9	9.8
9/06/2021	2.3	7.5	4.8	8/03/2022	18.0	24.4	40.6
10/06/2021	2.7	6.0	29.8	9/03/2022	16.4	25.3	0.2
11/06/2021	2.0	10.5	0.0	10/03/2022	14.4	23.6	0.0
12/06/2021	1.6	12.6	0.0	11/03/2022	11.8	24.1	0.0
13/06/2021	0.5	13.8	0.0				

3 Results

3.1 Broad Fauna Habitat Types and Condition

Five broad habitat types were identified in the Study Area (Table 3.1; Figure 3.1). The Study Area comprises remnant dry woodland or forest habitats, parts of which have a history of agricultural disturbance. Much of the habitat in the valley floor has been previously cleared, although small woodland patches and riparian vegetation provide connectivity across the valley. Woodland on the slopes, rises and ridges are well-connected with surrounding habitats, including the adjacent Munghorn Gap Nature Reserve. Within these broad habitat types, several parts of the Study Area contain rocky areas suitable for a number of threatened species.

Descriptions of each broad habitat type are described in Section 3.1.1 to Section 3.1.6, with floristic descriptions informed from data collected by ELA (2022).

Table 3.1 Broad habitat types

Broad Habitat Type (AMBS)	PCT (ELA 2022)
Open Forest and Woodland on Slopes	• White Box Grassy Woodland (PCT 266 – VZ1) • Rough-barked Apple – Blakely's Red Gum – Narrow-leaved Stringybark Riparian Open Forest (PCT 481 – VZ8) • Grey Box x White Box Grassy Open Woodland (PCT 483 – VZ10) • White Box – Black Cypress Pine Shrubby Woodland (PCT 1610 – VZ11) • Regenerating White Box – Black Cypress Pine Shrubby Woodland (PCT 1610 – VZ12) • Grey Gum – Grey Myrtle – Narrow-leaved Stringybark – Rusty Fig Open Forest (PCT 1614 - VZ13) • Narrow-leaved Stringybark – Grey Gum Shrubby Open Forest (PCT 1629 - VZ14)
Valley Woodlands (flats)	• Rough-barked Apple – Red Gum – Yellow Box Woodland (PCT 281 – VZ3) • Tantoon – *Leyrodia leptocaulis* Shrubland (PCT 1711 – VZ19)
Valley Woodlands (small rises)	• Narrow-leaved Ironbark – Black Pine – Sifton Bush Heathy Open Forest (PCT 1661 – VZ15) • Grey Box – Slaty Box Shrub-Grass Woodland (PCT 1655 – VZ16) • Narrow-leaved Ironbark – Black Pine – Narrow-leaved Wattle Shrub-Grass Open Forest (PCT 1656 – VZ17) • Regenerating Narrow-leaved Ironbark – Black Pine – Narrow-leaved Wattle Shrub-Grass Open Forest (PCT 1656 - VZ18)
Open Forest and Woodland on Ridges	• Dwyer's Red Gum – Black Cypress Pine – Ironbark Woodland (PCT 471 – VZ6) • Red Ironbark – Black Cypress Pine – Stringybark Open Forest (PCT 478 – VZ7)
Grasslands	• Derived Native Grasslands (DNG) White Box Grassy Woodland (PCT 266 – VZ2) • DNG Rough-barked Apple – Red Gum – Yellow Box Woodland (PCT 281 – VZ4 [high condition]) • DNG Rough-barked Apple – Red Gum – Yellow Box Woodland (PCT 281 – VZ5 [low condition]) • DNG Grey Box x White Box Grassy Open Woodland (PCT 483 – VZ9)

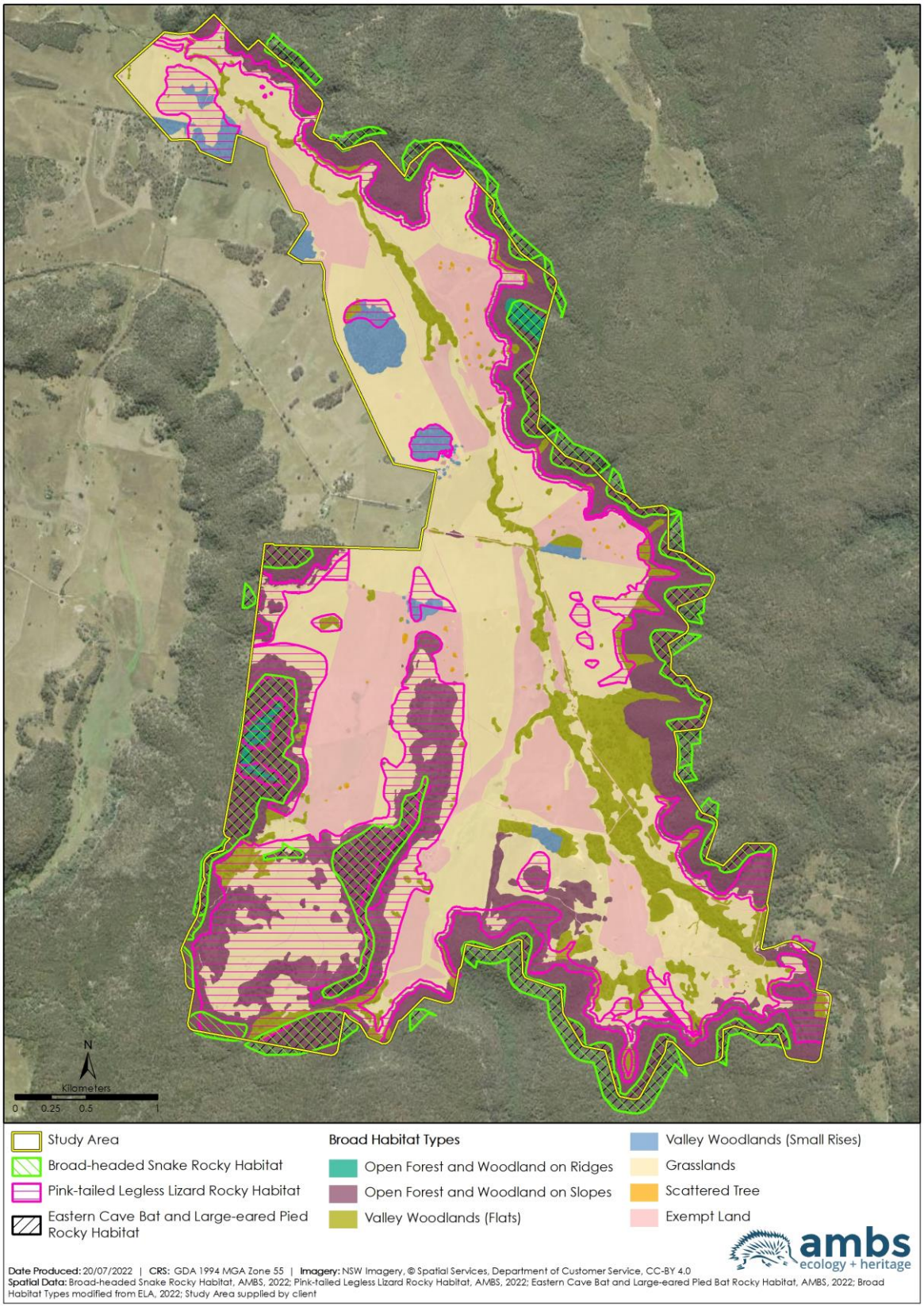


Figure 3.1 Broad habitat types in the Study Area

3.1.1 Open Forest and Woodland on Slopes

This habitat type is the most extensive habitat type, broadly occurring around the slopes along the perimeter of the Study Area. The habitat type incorporates the following PCTs:

- White Box Grassy Woodland (PCT 266 – VZ1)
- Rough-barked Apple – Blakely's Red Gum – Narrow-leaved Stringybark Riparian Open Forest (PCT 481 – VZ8)
- Grey Box x White Box Grassy Open Woodland (PCT 483 – VZ10)
- White Box – Black Cypress Pine Shrubby Woodland (PCT 1610 – VZ11)
- Regenerating White Box – Black Cypress Pine Shrubby Woodland (PCT 1610 – VZ12)
- Grey Gum – Grey Myrtle – Narrow-leaved Stringybark – Rusty Fig Open Forest (PCT 1614 - VZ13)
- Narrow-leaved Stringybark – Grey Gum Shrubby Open Forest (PCT 1629 - VZ14)

This habitat type is characterised by an open woodland or open forest formation, with common canopy trees including White Box (*Eucalyptus albens*), Grey Gum (*Eucalyptus punctata*), Rough-barked Apple (*Angophora floribunda*), Black Cypress Pine (*Callitris endlicheri*), Narrow-leaved Stringybark (*Eucalyptus sparsifolia*), Port Jackson fig (*Ficus rubiginosa*) and Kurrajong (*Brachychiton populneus*). The shrub layer is variable, sometimes absent, dense or structurally diverse, with common species including wattles, ferns, *Bursaria spinosa*, Sifton Bush (*Cassinia sifton*) and geebungs. Ground cover species are predominantly native.

Canopy height generally ranges from 15-30 m. Hollow-bearing trees are scattered throughout, being rare in some areas and common in others. Trees with large hollows are rare. *Acacia* sp. range from absent to common, and mistletoe is scattered throughout. Nectar producing trees (e.g. White Box) are common but shrubs are rare. *Allocasuarina* sp. and termite mounds are rare. Other fauna habitat features such as surface rock and outcropping rocks (e.g. cliffs, boulders), fallen logs, leaf litter and tussock grasses are generally common.

Evidence of previous disturbance, such as clearing, grazing and fire, was uncommon at the time of survey, but noted in some locations. Evidence of Feral Goat (*Capra hircus*) was observed. No permanent water sources were observed. Due to the steep terrain, it is likely that drainage lines (or tributaries) would not hold water for long periods of time after rainfall.

Examples of Open Forest and Woodland on Slopes habitat are shown in Plates 1-2.

Plate 1 Examples of Open Forest and Woodland on Slopes habitat

Plate 2 Examples of Open Forest and Woodland on Slopes habitat

3.1.2 Valley Woodlands (flats)

This habitat type occurs throughout alluvial areas of the valley floor in the Study Area, and in many places comprises riparian vegetation. The habitat type incorporates the following PCTs:

- Rough-barked Apple – Red Gum – Yellow Box Woodland (PCT 281 – VZ3)
- Tantoon – *Leyrodia leptocaulis* Shrubland (PCT 1711 – VZ19)

This habitat type is characterised by an open woodland or open forest formation, with common canopy trees including Blakely's Red Gum (*Eucalyptus blakelyi*), Yellow Box (*Eucalyptus melliodora*) and Rough-barked Apple (*Angophora floribunda*). The mid-storey is generally sparse, but small sections contain denser patches including Cypress Pine, Geebungs, *Bursaria spinosa*, Pine-leaved Bottlebrush (*Callistemon pinifolius*), *Leptospermum arachnoides* and Thyme Honey-myrtle (*Melaleuca thymifolia*). Ground cover species are predominantly native.

Canopy height generally ranges from 12-25 m. Hollow-bearing trees are scattered throughout, being rare in some areas and common in others, although trees with large hollows are rare. *Acacia* sp. are generally uncommon, while *Allocasuarina* sp. are rare. Mistletoe ranges from scattered to common, nectar trees are common, but nectar shrubs and termite mounds are generally rare. Other fauna habitat features such as surface rock and outcropping rocks (e.g. cliffs, boulders) are absent or rare, while leaf litter and tussock grasses are common.

Evidence of previous disturbance, such as clearing and grazing was common at the time of survey. Signs of Feral Pigs (*Sus scrofa*) were common. There was little evidence of previous fire. Some of this habitat type comprises riparian habitat adjacent to Moolarben Creek, which contained water during most of the surveys.

Examples of Valley Woodland (flats) habitat is shown in Plate 3.

Plate 3 Examples of Valley Woodlands habitat

3.1.3 Valley Woodlands (small rises)

This habitat type occurs in a few discrete locations in the valley, where small changes in topography influences soil type and subsequent flora species and fauna habitat type. The habitat type incorporates the following PCTs:

- Narrow-leaved Ironbark – Black Pine – Sifton Bush Heathy Open Forest (PCT 1661 – VZ15)
- Grey Box – Slaty Box Shrub-Grass Woodland (PCT 1655 – VZ16)
- Narrow-leaved Ironbark – Black Pine – Narrow-leaved Wattle Shrub-Grass Open Forest (PCT 1656 – VZ17)
- Regenerating Narrow-leaved Ironbark – Black Pine – Narrow-leaved Wattle Shrub-Grass Open Forest (PCT 1656 –VZ18)

This habitat type in the Study Area is generally characterised by a grassy woodland or open forest formation. Dominant canopy trees include Grey Box (*Eucalyptus moluccana*) and Narrow-leaved Ironbark (*Eucalyptus crebra*), Rough-barked Apple (*Angophora floribunda*), with other common species including Black Cypress Pine (*Callitris endlicheri*), Blakely's Red Gum (*Eucalyptus blakelyi*) and Mugga Ironbark (*Eucalyptus sideroxylon*). The mid-storey is sparse, with native species including Sifton Bush (*Cassinia sifton*), *Acacia decora* and Gorse Bitter Pea (*Daviesia ulicifolia*). Ground cover species were predominantly native at the time of survey.

Canopy height generally ranges from 5-18 m. *Acacia* sp. are rare while *Allocasuarina* sp. are mostly absent. Hollow-bearing trees are scattered without being common. Old growth trees are rare. Mistletoe is scattered, nectar tree abundance varies from rare to common, but nectar shrubs and termite mounds are rare or absent. Other fauna habitat features such as medium rocks and outcropping rocks (e.g. cliffs, boulders) are absent, small rocks range from scattered to common, while logs, leaf litter and tussock grasses were common at the time of survey.

Evidence of previous disturbance, such as clearing, grazing and fire, was not commonly observed but noted in some locations.

Examples of Valley Woodlands (small rises) habitat is shown on Plate 4.

Plate 4 Examples of Valley Woodlands (small rises)

3.1.4 Open Forest and Woodland on Ridges

This habitat type occurs in two discrete locations on ridges, and incorporates the following PCTs:

- Dwyer's Red Gum – Black Cypress Pine – Ironbark Woodland (PCT 471 – VZ6)
- Red Ironbark – Black Cypress Pine – Stringybark Open Forest (PCT 478 – VZ7)

This habitat type is generally characterised by a shrubby open forest formation. Dominant canopy trees include Ironbarks (*Eucalyptus beyeriana, Eucalyptus fibrosa*), Narrow-leaved Stringybark (*Eucalyptus sparsifolia*), Grey Gum (*Eucalyptus punctata*) and Black Cypress Pine (*Callitris endlicheri*). The mid-storey ranges from sparse to dense, with common species including Blunt Beard-heath (*Leucopogon muticus*), Scaly Phebalium (*Phebalium squamulosum*) and Narrow-leaved Geebung (*Persoonia linearis*). Ground cover species were predominantly native at the time of survey.

Hollow-bearing trees range from rare to common. Mistletoe ranges from scattered to absent, while *Allocasuarina* sp. and *Acacia* sp. are absent. Nectar trees are common, while nectar shrubs are absent. Termite mounds are rare. Other fauna habitat features such as small and medium rocks, and outcropping rocks (e.g. cliffs, boulders) are generally common, logs and leaf litter are common, while tussock grasses are scattered.

Evidence of previous clearing was not observed, while evidence of grazing was rare. Fire scars and burnt logs were observed with some frequency.

Examples of Open Forest and Woodland on Ridges habitat is shown in Plate 5.

Plate 5 Examples of Open Forest and Woodland on Ridges

3.1.5 Grasslands

Grasslands were extensive throughout the valley floor and the lower footslopes within the Study Area. The habitat type incorporates the following PCTs:

- Derived Native Grasslands (DNG) White Box Grassy Woodland (PCT 266 – VZ2)
- DNG Rough-barked Apple – Red Gum – Yellow Box Woodland (PCT 281 – VZ4 [high condition])
- DNG Rough-barked Apple – Red Gum – Yellow Box Woodland (PCT 281 – VZ5 [low condition])
- DNG Grey Box x White Box Grassy Open Woodland (PCT 483 – VZ10)

Grasslands in the Study Area are characterised by very sparse to absent canopy trees and mid-storey shrubs, typically dominated by native and exotic ground cover species which vary depending on the PCT from which they are derived. In locations with DNG, regularly recorded species include Purple Wiregrass (*Aristida ramosa*), Rough Spear Grass (*Austrostipa scabra* subsp. *scabra*), Red Grass (*Bothriochloa macra*), Weeping Grass (*Microlaena stipoides*), Purple Burr Daisy (*Calotis cuneifolia*), Yellow Burr Daisy (*Calotis lappulacea*), *Cymbonotus lawsonianus*, *Cynoglossum austral*, Slender Tick-trefoil (*Desmodium varians* [synonym *Grona varians*]), *Oxalis perennans*, and *Glycine tabacina.* In low condition areas of DNG, Western Rat-tail Grass (*Sporobolus creber*), *Eragrostis leptostachya* and *Dysphania pumilo* are frequently recorded. Other areas are dominated by exotic pasture grasses.

Occasional paddock trees include White Box (*Eucalyptus albens*), Yellow Box (*Eucalyptus melliodora*), Rough-barked Apple (*Angophora floribunda*) and Blakely's Red Gum (*Eucalyptus blakelyi*), some of which contain tree hollows. Infrequently recorded shrub species include *Acacia* sp. and *Bursaria spinosa*.

This habitat type was characterised by heavy disturbance, particularly clearing and grazing. Hollow-bearing trees, mistletoe, nectar trees, nectar shrubs and *Acacia* sp. are rare or absent. *Allocasuarina* sp. and termite mounds were not observed. Other fauna habitat features such as small and medium rocks range from rare to common, while outcropping rocks (e.g. cliffs, boulders) are rare. Logs and leaf litter are rare, while tussock grasses range from rare to common. There was no evidence of previous fire at the time of survey.

Examples of Grassland habitat are shown in Plate 6.

Rocky areas

Rocky areas providing potential habitat for reptiles occur widely throughout DNG in the Study Area. Rocky areas considered suitable for reptiles are those that contain surface rock within DNG (with either *Themida* sp., *Lomandra* sp., and/or other native species), but not within areas that have been heavily grazed or where there is obvious soil disturbance from crops.

There is evidence of rock piles in some parts of the Study Area which indicates the farming practice of removing surface rocks off paddocks, therefore habitat would have likely been greater prior to farming. A contour trench that had been dug in one location showed that there were rocks just below the surface as well as on top, and therefore dense grassland which occurred due to wet conditions may have hidden some surface rock habitat.

Around much of the outer perimeter of the grassland paddocks adjoining PCT 1629 or 1610, there is evidence of surface rock of various densities within a 20-30 m strip of PCT 281 DNG. There is also some surface rock patches with reasonable ground cover that extended further into PCT 281 DNG.

Two creeks extend through grassland habitats and contained water during some of the survey period.

Plate 6 Examples of Grassland habitats

3.1.6 Rocky Areas – Threatened Bats

Habitat for "Species Credit" bat species in the Study Area includes locations with outcropping sandstone and adjacent woodlands or forests. The landforms range from small isolated stony hills with limited outcropping rock to larger, steeper sandstone hills and ridgetops with extensive outcropping rock, caves, crevices, overhangs, cliff faces and boulders. Grassland and woodland habitats in the valley flats lacked potential roosting habitat for threatened bats.

Within the Study Area, potential roosting and breeding habitat for the Large-eared Pied Bat and Eastern Cave Bat is extensive and highly variable. A variety of habitat features are present including tall sandstone rocks and boulders (some with small cavities), small and large cavities and crevices within rocks, cavities between rocks and boulders, low entry caves (some of which extend further than can be accessed), small domes, low and high overhangs, overhangs with small holes and crevices, and Fairy Martin (*Petrochelidon ariel*) nests (which are known to be used by the Large-eared Pied Bat for roosting). Two Large-eared Pied Bats were found roosting in Fairy Martin nests during a daytime habitat search, four Large-eared Pied Bats were found roosting in a large cave, and one Eastern Cave Bat was also recorded roosting. Microbat scats were recorded in multiple locations.

In summary, any overhangs with Fairy Martin nests, or rock outcrops with small crevices or cavities provide potential habitat for roosting bat species individuals or small groups during the breeding and non-breeding season. Further, Fairy Martins may build new nests in overhangs that are currently unoccupied.

Three broad areas contain roosting habitat for "Species Credit" bat species in the Study Area, including the eastern slopes and ridges, southern slopes, and western slopes and ridges. In general, roosting habitat was most extensive and variable in the north, west and south western sections of the Study Area. Roosting habitat was not as extensive in the south eastern section of the Study Area (i.e. smaller rock outcrops, lower cliffs etc), but potential habitat was still present within the extent that has been mapped.

Examples of roosting features within these three general localities of the Study Area, are shown in Plates 7-9.

Plate 7 Roosting habitat features in the eastern slopes and ridges

Plate 8 Roosting habitat features in the southern slopes and ridges

Plate 9 Roosting habitat features in the western slopes and ridges

3.2 Native and Introduced Fauna Species

Two-hundred and thirteen species of vertebrate fauna were recorded during the surveys, comprising 10 frogs, 24 reptiles, 134 birds and 45 mammals (Appendix B).

Thirteen of the species recorded are introduced including the: Common Starling (*Sturnus vulgaris*), House Sparrow (*Passer domesticus*), House Mouse (*Mus musculus*), Black Rat (*Rattus rattus*), Red Fox (*Vulpes vulpes*), Feral Cat (*Felis catus*), European Brown Hare (*Lepus europaeus*), European Rabbit (*Oryctolagus cuniculus*), Pig (*Sus scrofa*), Cattle (*Bos taurus*), Goat (*Capra hircus*), Sheep (*Ovis aries*) and Fallow Deer (*Dama dama*). It is unknown if the *Canis* sp. recorded within the Study Area are Dingoes (*Canis lupus dingo*) or Feral Dogs (*Canis lupus familiaris*).

3.3 Threatened Fauna Species Recorded

Twenty-two of the fauna species recorded are listed as threatened on the schedules of the BC Act and four of these are also listed as threatened on the schedules of the EPBC Act (Table 3.2). The locations of these threatened species recorded during surveys for the Project are shown on Figures 3.1 toto 3.4. Additional details regarding the threatened species records are provided below in Table 3.2.

Table 3.2 Threatened fauna recorded in the Study Area

Common Name	Scientific name	Conservation Status		Biodiversity Credit Class[3]	Description of AMBS Records
		BC Act[1]	EPBC Act[2]		
REPTILES					
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	Species	Recorded on one occasion in 2021, during a diurnal reptile survey, in grassland at the edge of woodland in the south-west of the Study Area. The juvenile individual was found when shifting a small stick with exfoliating bark rather than under a rock.
Broad-headed Snake	*Hoplocephalus bungaroides*	E	V	Species/ Ecosystem	Recorded on one occasion in 2021, during a targeted reptile survey, in woodland in the south of the Study Area. The individual was recorded beneath a sandstone rock.
BIRDS					
Black Falcon	*Falco subniger*	V	-	Ecosystem	Recorded on two occasions within the Study Area in 2021. The species was observed once during a diurnal bird survey, and once opportunistically.
Little Eagle	*Hieraaetus morphnoides*	V	-	Species/ Ecosystem	Recorded in three locations during surveys in 2021. For two sightings, two individuals were recorded opportunistically flying over the canopy. The third sighting was classified as "possible", with one individual observed during a Diurnal Bird Survey.
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	E	Species/ Ecosystem	Recorded in five locations during surveys in June-July 2021. The species was observed and heard during diurnal bird surveys as well as opportunistically, in numbers ranging from 2 to 15.
Little Lorikeet	*Glossopsitta pusilla*	V	-	Ecosystem	Recorded in 35 locations throughout the Study Area. The species was observed and heard during diurnal bird surveys as well as opportunistically sighted, in numbers ranging from 1 to 100 individuals.
Masked Owl	*Tyto novaehollandiae*	V	-	Species/ Ecosystem	Recorded in seven locations in the Study Area in 2021, during forest owl call playback

Common Name	Scientific name	Conservation Status		Biodiversity Credit Class[3]	Description of AMBS Records
		BC Act[1]	EPBC Act[2]		
					and hollow monitoring. The range of sightings included a pair responding to call broadcasts (two birds were observed and heard), an individual bird heard responding to call broadcasts, and an individual bird heard and observed flying over the call broadcast location. In addition, a Masked Owl nest tree was recorded just outside the Study Area. A more detailed summary of these sightings is provided in Appendix C. One individual was also heard during a spotlight survey in 2022.
Powerful Owl	*Ninox strenua*	V	-	Species/ Ecosystem	Recorded in nine locations in 2021, during forest owl call playback. For each sighting, an individual was heard responding to call broadcasts.
Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	V	Ecosystem	Recorded in 35 locations widely throughout the Study Area. The species was observed and heard during diurnal bird surveys as well as opportunistic sightings.
Speckled Warbler	*Chthonicola sagittata*	V	-	Ecosystem	Recorded in 20 locations widely throughout the Study Area. The species was observed and heard, during diurnal bird surveys, opportunistic sightings, and once during a spotlight survey.
Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	V	-	Ecosystem	Recorded opportunistically in nine locations in 2021. The species was observed and heard mostly opportunistically, but also during diurnal bird surveys. The number of individuals ranged from one to eight.
Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-	Ecosystem	Recorded opportunistically on three occasions in 2021. The species was observed and heard opportunistically, with numbers of individuals ranging from two to ten.
Varied Sittella	*Daphoenositta chrysoptera*	V	-	Ecosystem	Recorded in 10 locations in 2021. The species was observed and heard during diurnal bird surveys as well as opportunistic sightings.
Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-	Ecosystem	Recorded on 12 occasions in 2021. The species was observed and heard during diurnal bird surveys as well as opportunistic sightings.
Diamond Firetail	*Stagonopleura guttata*	V	V	Ecosystem	Recorded in four locations in 2021. The species was observed and heard during diurnal bird surveys as well as opportunistic sightings.
MAMMALS					
Koala	*Phascolarctos cinereus*	E	E	Species	Recorded on seven occasions in 2021. Two Koalas were heard during call playback surveys in July and August, two were heard during nocturnal surveys in December, two were observed opportunistically during a daytime survey in September, and scats were found at the base of a tree in August.
Squirrel Glider	*Petaurus norfolcensis*	V	-	Species	Recorded opportunistically on one occasion in 2021, while spotlighting during transit between call playback locations. The individual was observed foraging in riparian vegetation.

Common Name	Scientific name	Conservation Status		Biodiversity Credit Class[3]	Description of AMBS Records
		BC Act[1]	EPBC Act[2]		
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-	Ecosystem	Recorded on Anabat detectors at six locations. At least two of these records were classified as definite.
Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V	-	Ecosystem	Recorded (definite) on Anabat detectors at one location.
Large Bent-winged Bat (probable)	*Miniopterus orianae oceanensis*	V	-	Species/ Ecosystem	Recorded on Anabat detectors at eleven locations. Analysis of the calls concluded the identification of the species as "probable".
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	Species	During January 2021, 13 individuals were caught in harp traps and six were observed (or hand caught) during habitat searches. Of these, one adult female was lactating (later stages) and two males were immature. One additional female was non-breeding at the time of the survey but may have bred in the past (indicated by black nipples). The species was recorded on Anabat detectors at 30 locations.
Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-	Ecosystem	Recorded (definite) on Anabat detectors at seven locations.
Eastern Cave Bat	*Vespadelus troughtoni*	V	-	Species	During January 2021, six individuals were caught in harp traps. Of these, one adult female was post-lactating and three males were immature. The species was recorded on Anabat detectors at 15 locations. One roost was recorded during habitat searches.

Note:

[1] Conservation status under the BC Act (current as at October 2023). E = Endangered, V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at October 2023). E = Endangered, V = Vulnerable.

[3] Biodiversity credit class under the TBDC (DPE 2022a) (current as at August 2022).

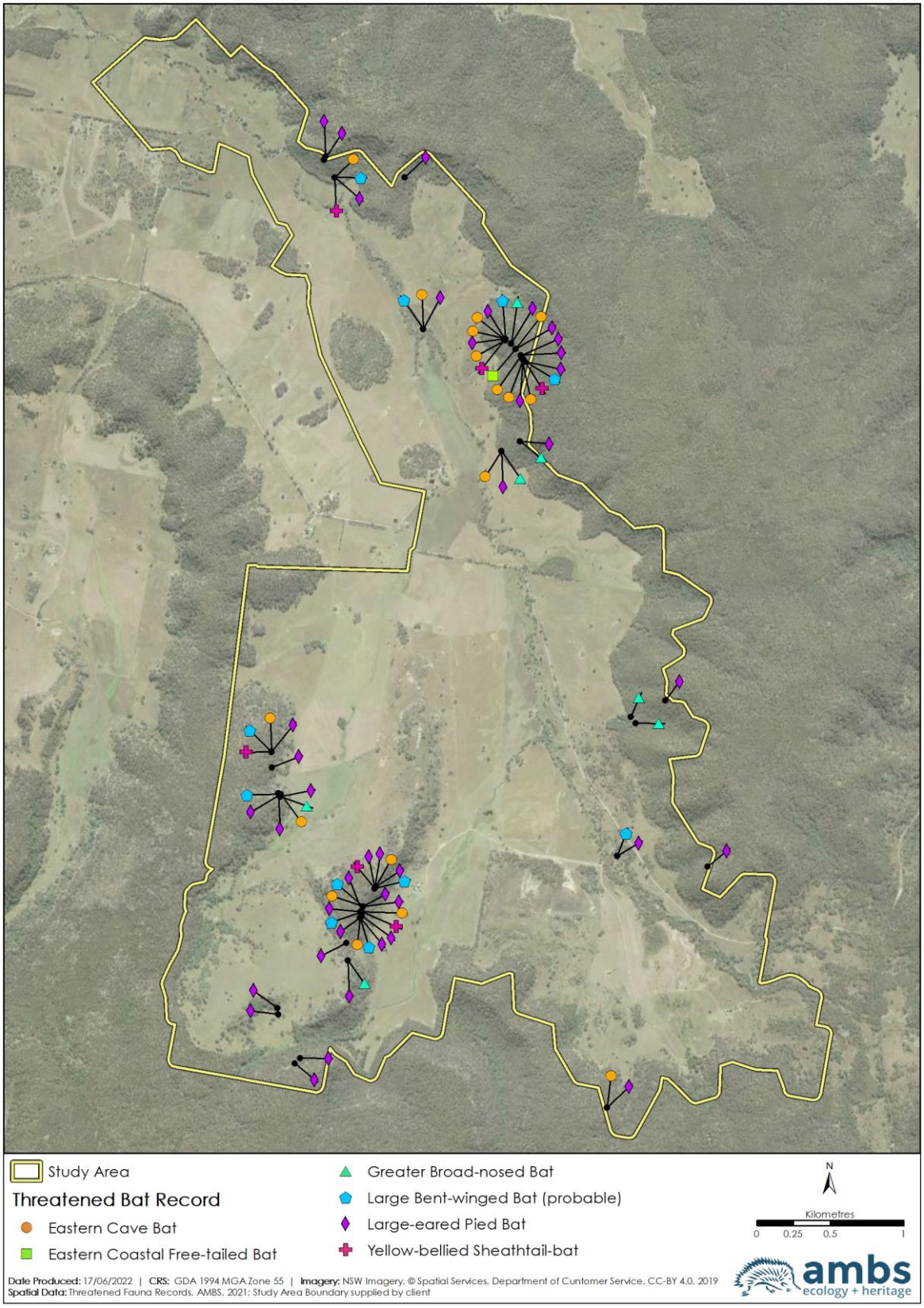


Figure 3.2 Location of threatened microbats

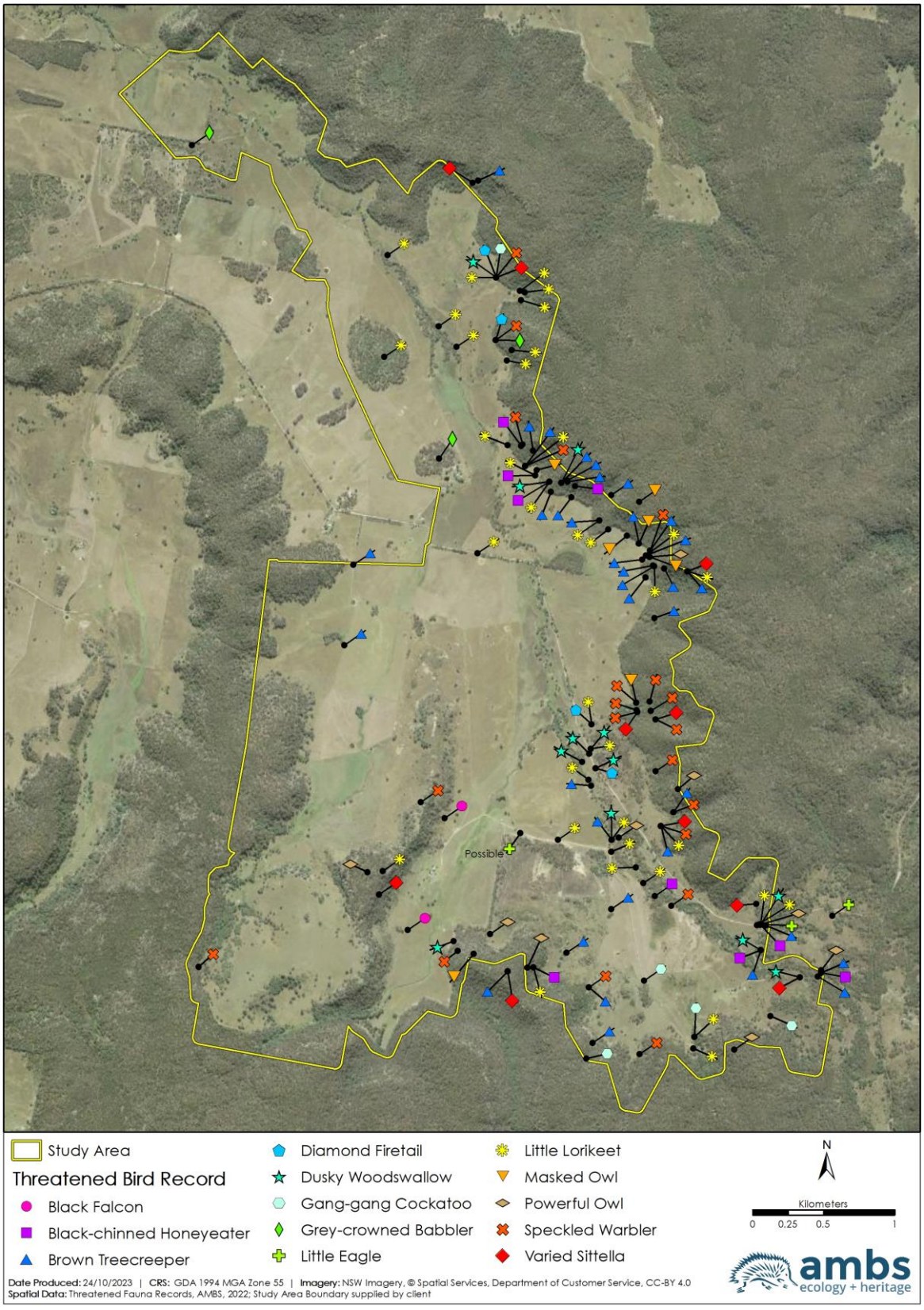


Figure 3.3 Location of threatened birds

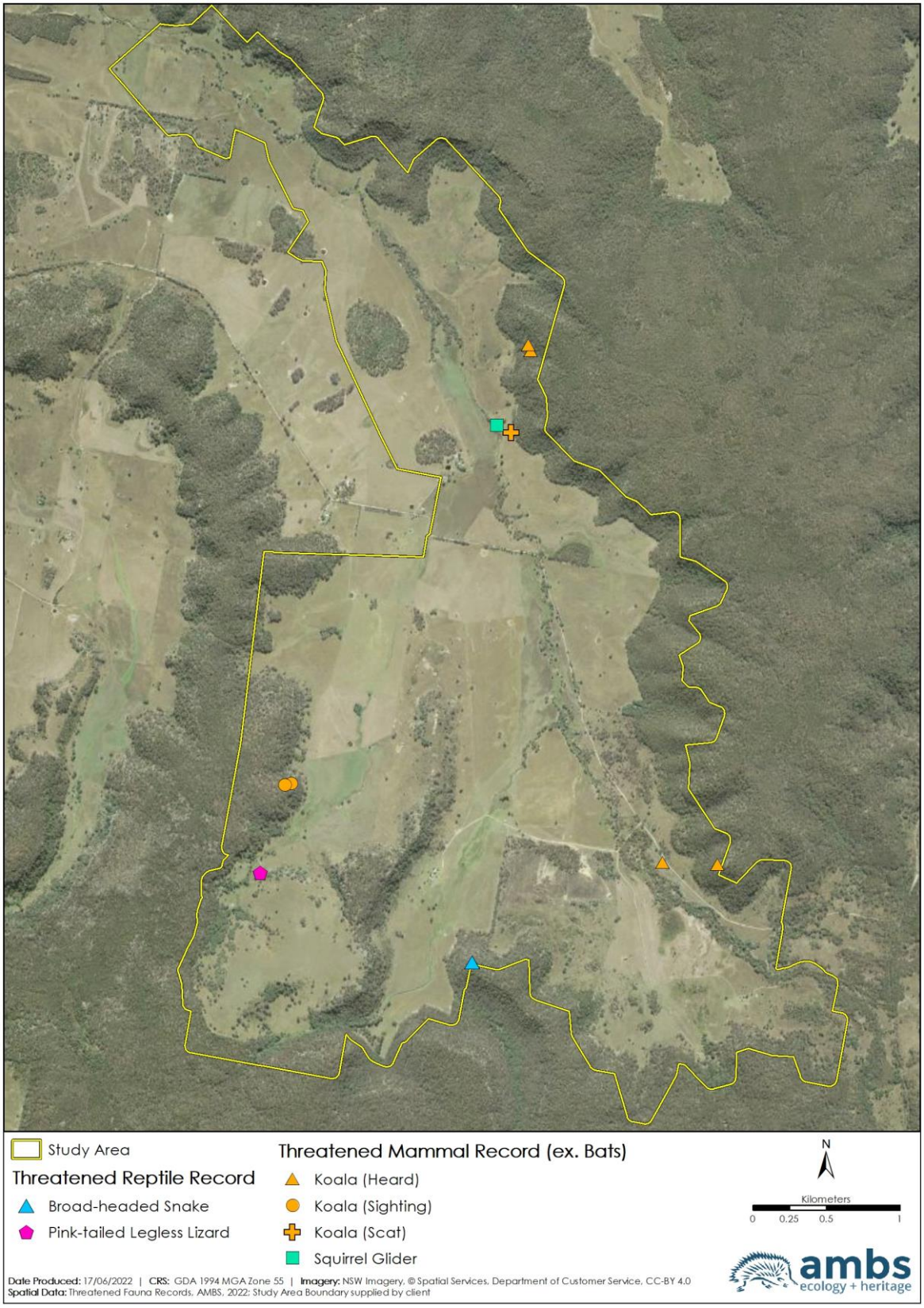


Figure 3.4 Location of threatened mammals and reptiles

3.4 Summary of Fauna "Species Credit" Species

Threatened species that are "Ecosystem Credit" species and/or "Species Credit" species are pre-determined by DPE in the TBDC (DPE 2022a).

In accordance with Section 5.2.2 of the BAM (DPIE 2020a), the habitat constraints for each "Species Credit" or dual-credit "Species/Ecosystem" species that was recorded, were investigated (Table 3.3). Table 3.3 provides a discussion as to whether or not suitable habitat for each species occurs within the Study Area and whether the species is classified as a serious and irreversible impacts (SAII) entity. A summary of this information is provided below.

A total of five "Species Credit" species and five dual-credit "Species/Ecosystem" species were recorded[1] during the surveys between 2020 and 2021. One of these was probable records of the Large Bent-winged Bat.

Of these, three dual-credit "Species/Ecosystem" species do not meet the requirements to prepare a species polygon (Table 3.3):

- Little Eagle – no evidence was recorded of the species occupying a nest or breeding within the Study Area;
- Powerful Owl – no signs of breeding, consistent with the requirements in the TBDC (DPE 2022a) were recorded in the Study Area; and
- Large Bent-winged Bat (probable) – no individuals were captured in harp traps and only a small number of records were obtained from Anabats. No caves or crevices that would likely be suitable for a maternity/breeding roost were observed in the Study Area.

Eight species meet the requirements to prepare a species polygon (Table 3.3), and these are discussed in more detail in Sections 3.4.1 to 3.4.8:

- Pink-tailed Legless Lizard (*Aprasia parapulchella*) (BC Act – Vulnerable, EPBC Act – Vulnerable) ("Species Credit" species);
- Broad-headed Snake (*Hoplocephalus bungaroides*) (BC Act – Endangered, EPBC Act – Vulnerable) (dual-credit "Species/Ecosystem" species);
- Masked Owl (*Tyto novaehollandiae*) (BC Act – Vulnerable) (dual-credit "Species/Ecosystem" species);
- Regent Honeyeater (*Anthochaera phrygia*) (BC Act – Critically Endangered, EPBC Act – Critically Endangered) (dual-credit "Species/Ecosystem" species);
- Koala (*Phascolarctos cinereus*) (BC Act – Endangered, EPBC Act – Endangered) ("Species Credit" species);
- Squirrel Glider (*Petaurus norfolcensis*) (BC Act – Vulnerable) ("Species Credit" species);
- Large-eared Pied Bat (*Chalinolobus dwyeri*) (BC Act – Vulnerable, EPBC Act – Vulnerable) ("Species Credit" species);
- Eastern Cave Bat (*Vespadelus troughtoni*) (BC Act – Vulnerable) ("Species Credit" species).

A summary of the vegetation zones associated with these "Species Credit" species that form their species polygons within the Study Area is provided in Table 3.4.

[1] Note: The Large Bent-winged Bat was recorded with a probable level of confidence.

Table 3.3 "Species Credit" species recorded in the Study Area

Common Name	Scientific Name	Conservation Status		Biodiversity Credit Class[3]	Potential SAII Entity (DPE 2022a)	Habitat Constraint (DPE 2022a)	Survey Result
		BC Act[1]	EPBC Act[2]				
No species polygon generated							
Little Eagle	*Hieraaetus morphnoides*	V	-	Species/ Ecosystem	No	*Nest trees - live (occasionally dead) large old trees within vegetation.*	Two individuals were observed on two occasions near the Study Area boundary, and one "possible" sighting occurred during a diurnal bird survey in the centre of the Study Area towards the south. Despite monitoring of potential raptor nests within the Study Area, no evidence was recorded of the species occupying a nest. As a result, no species polygon is required.
Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	E	Species/ Ecosystem	No	*Eucalypt tree species with hollows at least 3 m above the ground and with hollow diameter of 7 cm or larger*	Recorded on five occasions during June-July 2021, which is outside the breeding season as specified in the TBDC (DPE 2022a). The species was not recorded during the breeding species, and therefore no signs of breeding were recorded consistent with the requirements in the TBDC (DPE 2022a) [i.e. (a) lone adult males identified during the breeding season (October to January); or (b) an occupied nest].
Powerful Owl	*Ninox strenua*	V	-	Species/ Ecosystem	No	*Living or dead trees with hollow greater than 20cm diameter*	Recorded on multiple occasions during call playback surveys. No signs of breeding, consistent with the requirements in the TBDC (DPE 2022a) [i.e. suitable habitat AND (a) presence of male and female OR (b) calling to each other (duetting) OR (c) find nest], were recorded in the Study Area. As a result, no species polygon is required.
Large Bent-winged Bat (probable)	*Miniopterus orianae oceanensis*	V	-	Species/ Ecosystem	Yes	*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.*	Probable Anabat recordings for the species were identified in the Study Area, but no animals were captured in harp traps. No caves or crevices that would likely be suitable for a maternity/breeding roost were observed in the Study Area. The small number of calls, no animals captured in harp traps, and the lack of suitable habitat observed suggests it is unlikely for there to be breeding caves in the Study Area. As a result, no species polygon is required.
Species polygon generated							
Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V	Species	No	*Rock areas, or within 50m of rocky areas*	Recorded on one occasion in 2021, during a targeted reptile survey.

Common Name	Scientific Name	Conservation Status		Biodiversity Credit Class[3]	Potential SAII Entity (DPE 2022a)	Habitat Constraint (DPE 2022a)	Survey Result
		BC Act[1]	EPBC Act[2]				
Broad-headed Snake	*Hoplocephalus bungaroides*	E	V	Species/Ecosystem	Yes	*Rock areas, including escarpments, outcrops and pagodas within the Sydney Sandstone geologies*	Recorded on one occasion in 2021, during a targeted reptile survey. As a result, a species polygon was prepared for this species.
Masked Owl	*Tyto novaehollandiae*	V	-	Species/Ecosystem	No	*Living or dead trees with hollows greater than 20cm diameter.*	A Masked Owl nest tree was recorded just outside the Study Area. As a result, a species polygon was prepared for this species.
Regent Honeyeater	*Anthochaera phrygia*	CE	CE	Species/Ecosystem	Yes	*As per mapped areas*	No records of the species were obtained during the surveys. The Study Area is within the mapped important areas for the Regent Honeyeater and as a result, a species polygon was prepared.
Koala	*Phascolarctos cinereus*	E	E	Species	No	*Areas identified via survey as important habitat ("important" habitat is defined by the density of koalas and quality of habitat determined by on-site survey).*	Recorded in three general locations in 2021. Two Koalas were heard during call playback surveys, two were observed opportunistically in the daytime, and scats were found at the base of a tree. As a result, a species polygon was prepared for this species.
Squirrel Glider	*Petaurus norfolcensis*	V	-	Species	No	-	Recorded opportunistically on one occasion in 2021 during transit between call playback locations. As a result, a species polygon was prepared for this species.
Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V	Species	Yes	*Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels.*	The species was recorded within 100 m of habitat containing rocky areas, caves, overhangs, outcrops and crevices. Of these recorded, one adult female was lactating (later stages) and two males were immature. One additional female was non-breeding at the time of the survey but may have bred in the past (indicated by black nipples). As a result, a species polygon was prepared for this species.
Eastern Cave Bat	*Vespadelus troughtoni*	V	-	Species	Yes	*Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds.*	The species was recorded within 100 m of habitat containing rocky areas, caves, overhangs, escarpments, outcrops or boulder piles. Of these recorded, one adult female was post-lactating and at least three males were immature. As a result, a species polygon was prepared for this species.

Note:

[1] Conservation status under the BC Act (current as at October 2023). CE = Critically Endangered, E = Endangered, V = Vulnerable.

[2] Conservation status under the EPBC Act (current as at October 2023). CE = Critically Endangered, E = Endangered, V = Vulnerable.

[3] Biodiversity credit class under the TBDC (DPE 2022a) (current as at August 2022).

Table 3.4 Vegetation Zones Associated with Species Credit Species Polygons within the Study Area

Vegetation Zone	Area (ha)	Pink-tailed Legless Lizard	Broad-headed Snake	Regent Honeyeater	Koala	Squirrel Glider	Large-eared Pied Bat	Eastern Cave Bat
266	23	16.4	11.7	16.6	23	23	23	23
266 Scattered tree	0.6	0.1	-	0.2	0.6	0.6	0.6	0.6
266 DNG	48.3	43.2	-	4.8	-	-	-	-
281	157.8	53.9	17.6	123.2	157.8	157.8	157.8	157.8
281 Scattered tree	1.6	-	-	1	1.6	1.6	1.6	1.6
281 DNG	381.3	176.7	-	32.4	-	-	-	-
281 DNG - Low	169	21.5	-	6.3	-	-	-	-
471	5.6	5.4	5.6	5.6	5.6	5.6	5.6	5.6
478	4.4	-	4.4	4.4	4.4	4.4	4.4	4.4
481	4.2	1.7	3.2	4.2	4.2	4.2	4.2	4.2
483	32.1	32.1	6.3	22.2	32.1	32.1	32.1	32.1
483 DNG	49.9	49.9	-	2.6	-	-	-	-
1610	184.9	138.8	90.2	165	184.9	184.9	184.9	184.9
1610 Regenerating	13.1	11.8	-	2.2	13.1	13.1	13.1	13.1
1614	5	5	5	4.6	5	5	5	5
1629	250.2	128.7	220.2	246.5	250.2	250.2	250.2	250.2
1655	18	11.4	-	15.6	18	18	18	18
1656	11.8	2.2	-	11.3	11.8	11.8	11.8	11.8
1656 Regenerating	7.3	7.3	-	4	7.3	7.3	7.3	7.3
1661	3.7	0.3	-	3.7	3.7	3.7	3.7	3.7
1711	7.4	0.4	-	4.3	7.4	7.4	7.4	7.4
Exempt land	302.2	42.7	-	1.8	-	-	-	-
Total	**1681.4**	**749.5**	**364.2**	**682.5**	**730.7**	**730.7**	**730.7**	**730.7**

Note: Green = PCT Association in BioNet (DPE 2022a)

3.4.1 Pink-tailed Legless Lizard (Aprasia parapulchella)

Within NSW, the Pink-tailed Legless Lizard has a patchy distribution from Gunnedah in the north, to Albury in the south (DPE 2022a). The highest abundance of the species appears to be in the ACT between Yass and Cooma (Lane 2017). The nearest database record to the Study Area is within the Goulburn River National Park (DPE 2022a).

The species inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly sites with low levels of disturbance dominated by large tussock-forming grasses, such as Kangaroo Grass (*Themeda australis*) (Wong *et al.,* 2021). Sites in which the Pink-tailed Legless Lizard are found are also generally well-drained, possessing surface or partially-buried rocks (DPE 2022b; Wong *et al.,* 2021). The Pink-tailed Legless Lizard is sensitive to alteration of the ground-layer vegetation (particularly tussock grasses) (Wong *et al.,* 2021).

The Pink-tailed Legless Lizard is usually found beneath small, partially-embedded rocks and appear to spend considerable time in burrows beneath these rocks. These burrows are constructed by, and are often still inhabited by, small black ants and termites (DPE 2022b). The Pink-tailed Legless Lizard feeds on the larvae and eggs of the ants with which it shares its burrows (DPE 2022b).

One juvenile individual of the species was found on a north-west facing moderate slope just below sandstone outcropping, within PCT 1614 (a PCT not recognised by DPE [2022b] as associated with the species). This individual was recorded under a small stick with exfoliating bark rather than under a rock (Plate 10). Habitat near this record includes native grasses, *Lomandra* sp. tussocks, numerous and varied sizes of sandstone surface and embedded rock, as well as log debris (Plate 11). There is a small rocky sandstone outcrop and a tree canopy just upslope. This sandstone outcrop sits just below the edge of a basalt hill, which also contains many surface and embedded rocks.

Plate 10 Location where the species was recorded

Surveys targeting this species were not able to be undertaken throughout the potential habitat in the entire Study Area as described in the methods section. Consequently, while only a single record was found there are larger areas of potential habitat. Given the reasonably good connectivity of these areas of potential habitat throughout the Study Area, with the area in which the species was recorded, it is considered likely that the species could utilise other areas of potential habitat throughout the Study Area, rather than being restricted only to the rocky areas in which it was recorded. Smaller sections of potential habitat also occur in more isolated patches of vegetation in the Study Area that were not able to have targeted surveys undertaken. Given the above, as required by the BAM (DPIE 2020a), the species polygon for the Pink-tailed Legless Lizard includes areas where the survey has confirmed the species is present or likely to use suitable habitat as well as other areas where the species has been assumed present.

A species polygon for the Pink-tailed Legless Lizard is shown on Figure 3.5. Rocky areas suitable for this species included locations with surface rock and native grasses (e.g. *Themeda* sp., *Lomandra* sp. etc), mostly within PCTs associated with the species, including PCT 266, 281, 471, 483 and 1655. The vast majority of the species polygon was comprised of PCTs associated with the species, however, there were also smaller sections of suitable rocky habitat within areas of PCTs not

associated with the species, including PCTs 1610, 1614 and 1629 and 1656. These locations were also included in the species polygon because they were adjacent to or surrounded by suitable rocky areas comprised of PCTs associated with the species, and because they contain suitable surface rock and good quality native groundcover (Plates 12-18).

DPE (2022b) recognise rocky areas or within 50 m of rocky areas as a habitat constraint for this species. In accordance with the TBDC (DPE 2022b), a 50 m buffer was applied to the 'rocky areas suitable for this species' and any suitable potential habitat in the buffer was included in the species polygon. Locations that were heavily degraded or subject to soil disturbance from crops, were excluded (Wong *et al.* 2021) though rocky areas in areas with predominantly weeds (Category 1 Exempt Land) was included. Further, areas that did not contain surface rocks and logs were excluded.

The Pink-tailed Legless Lizard species polygon occupies an area of 668 ha and is shown on Figure 3.5.

Plate 11 Examples of suitable habitat in the general locality where the species was recorded

Plate 12 Examples of potential habitat on the northern part of the central ridge in the Study Area (PCT 1610).

Plate 13 Examples of potential habitat on the central ridge (PCT 1614)

Plate 14 Examples of suitable habitat on the western side of the central ridge in the Study Area (top left, top right and lower right images are PCT 1629)

Plate 15 Examples of suitable habitat in the western section of the Study Area (lower right image is PCT 1629)

Plate 16 Examples of potential habitat in the eastern section of the Study Area (top right image is PCT 1629)

Plate 17 Examples of suitable habitat in the southern section of the Study Area

Plate 18 Examples of suitable habitat in the northern section of the Study Area (lower right and top centre images are PCT 1656)

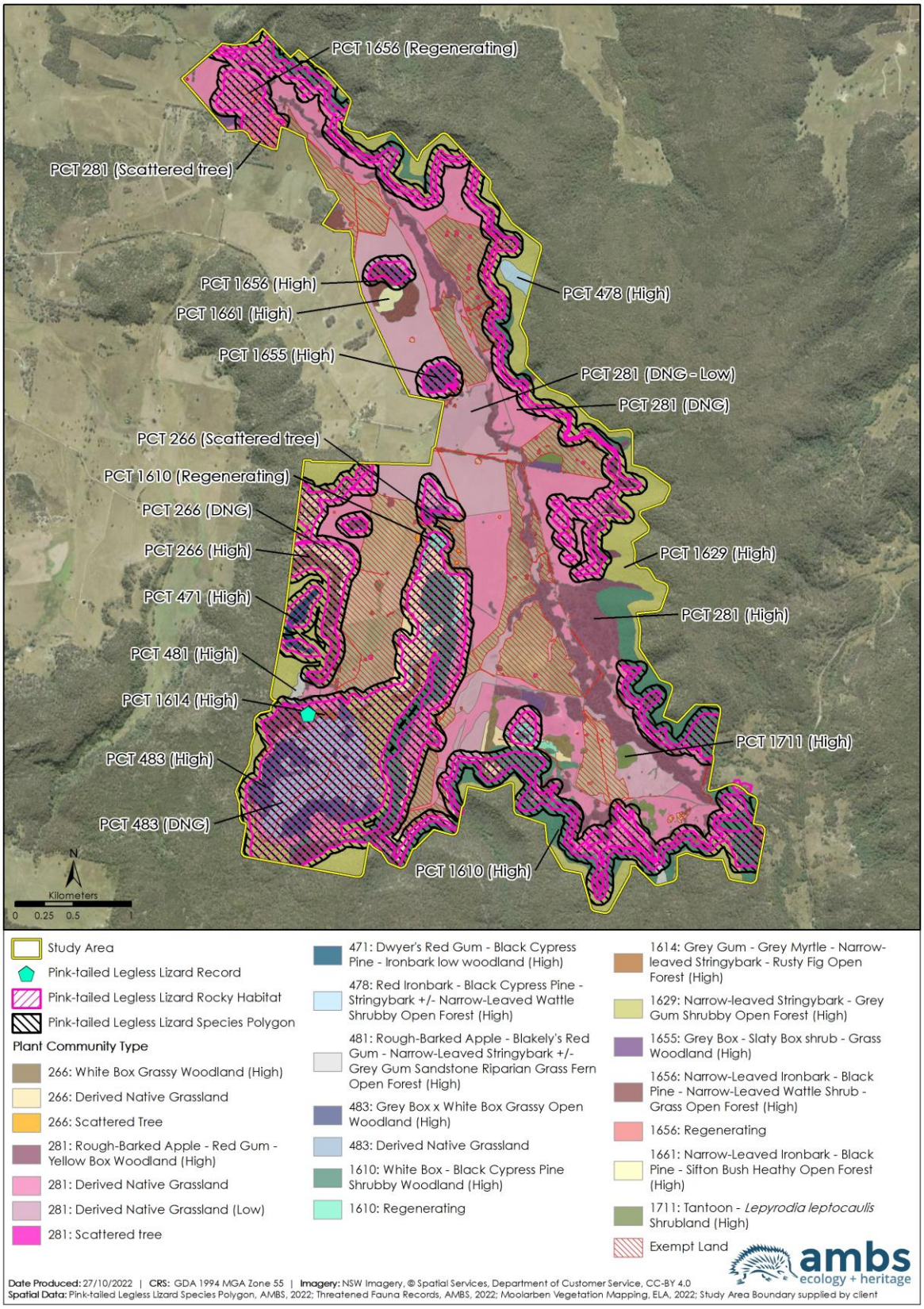


Figure 3.5 Pink-tailed Legless Lizard species polygon

3.4.2 Broad-headed Snake (Hoplocephalus bungaroides)

The Broad-headed Snake is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, in the coast and ranges within approximately 250 km of Sydney (DPE 2022b). This species is nocturnal, sheltering during the day in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring (DPE 2022b). In summer, the Broad-headed Snake moves from the sandstone rocks to shelter in crevices or hollows in large trees within 500 m of escarpments (DPE 2022b). This species diet consists primarily of geckos and small skinks, but also occasionally includes frogs and small mammals (DPE 2022b). Females produce between four and twelve live young from January to March, which is considered a relatively low level of fecundity (DPE 2022b).

One Broad-headed Snake was recorded during a targeted survey by AMBS in 2021. The individual was recorded approximately 30 m outside the Study Area boundary, at the edge of the escarpment under a large sandstone rock. The habitat in which the individual was recorded is contiguous with potential habitat that occurs within the Study Area.

Surveys targeting this species were not able to be undertaken throughout the potential habitat in the entire Study Area as described in the methods section. Consequently, while only a single record was found there are larger areas of potential habitat. Given the reasonably good connectivity of these areas of potential habitat throughout the Study Area, with the area in which the species was recorded, it is considered likely that the species uses areas of potential habitat throughout the Study Area, rather than being restricted only to the rocky areas in which it was recorded. Given the above, as required by the BAM (DPIE 2020a), the species polygon for the Broad-headed Snake includes areas where the survey has confirmed the species is present or likely to use suitable habitat as well as other areas where the species has been assumed present.

For the Broad-headed Snake, the TBDC (DPE 2022a) documents habitat constraints to be '*rocky areas, including escarpments, outcrops and pagodas within the Sydney Sandstone geologies'.* The draft Reptile Survey Guideline (as of July 2021) states "*the species polygon boundary should cover the extent of mapped suitable sandstone and adjacent habitat forested habitats with hollows located within the designated PCTs on the subject land, or extent of identified population if the surveys can adequately determine this. A 100 m buffer around rock outcrops should be included as part of the polygon to ensure areas of hollow-bearing trees adjacent to the rock outcrops are left to complement the areas of rock outcrop*" (DPE 2021).

Within the Study Area, the species is associated with PCTs 1629 and 1711. No suitable sandstone habitat was observed in PCT 1711 and therefore this area was not included in the species polygon. Within PCT 1629, suitable sandstone habitat including rocky areas, escarpments, outcrops or pagodas were mapped and a 100 m buffer was applied. Smaller area of PCTs not associated with the species were also considered to provide suitable habitat where they occurred nearby to PCT 1629 and contain hollow-bearing trees and suitable sandstone habitat, as described above. This included:

- PCT 1610 in the south, east and north of the Study Area, where it occurs in small patches surrounded by larger sections of PCT 1629, or is within 100 m of suitable rocky habitat;
- PCT 478 in the east of the Study Area, where it occurs as a small patch surrounded by a larger section of PCT 1629 and is within 100 m of suitable rocky habitat;
- several small patches of PCT 281, where it is surrounded by larger sections of PCT 1629 or 1610 and within 100 m of suitable rocky habitat;
- PCT 1614 in the west of the Study Area, where it occurs in small patches surrounded by larger sections of PCT 1629, and is within 100 m of suitable rocky habitat;
- PCT 471 in the west of the Study Area, where it occurs as a small patch surrounded by a larger section of PCT 1629 and is within 100 m of suitable rocky habitat;

- PCT 266 in the west and south of the Study Area, where it occurs adjacent to larger sections of PCT 1610 and within 100 m of suitable rocky habitat;
- PCT 481 in the west and south of the Study Area, where it occurs in close proximity to larger sections of PCT 1610 and within 100 m of suitable rocky habitat; and
- PCT 483 in the west of the Study Area, where it occurs adjacent to larger sections of PCT 1610 and within 100 m of suitable rocky habitat.

These areas of habitat also had a 100 m buffer applied. The resulting area represents the Broad-headed Snake species polygon which has been mapped to occupy an area of 348.81 ha as shown on Figure 3.6.

The Broad-headed Snake is a dual-credit "Species/Ecosystem" species, meaning that there is a component of this species habitat which is an 'Ecosystem credit'. This species is known to use suitable habitat within 780 m of rocky habitat (Webb and Shine 1997). All other PCTs in the Study Area that are associated with the species (i.e. PCT 1629, 1711) (DPE 2022a) are considered potential habitat for the purpose of 'Ecosystem credits'.

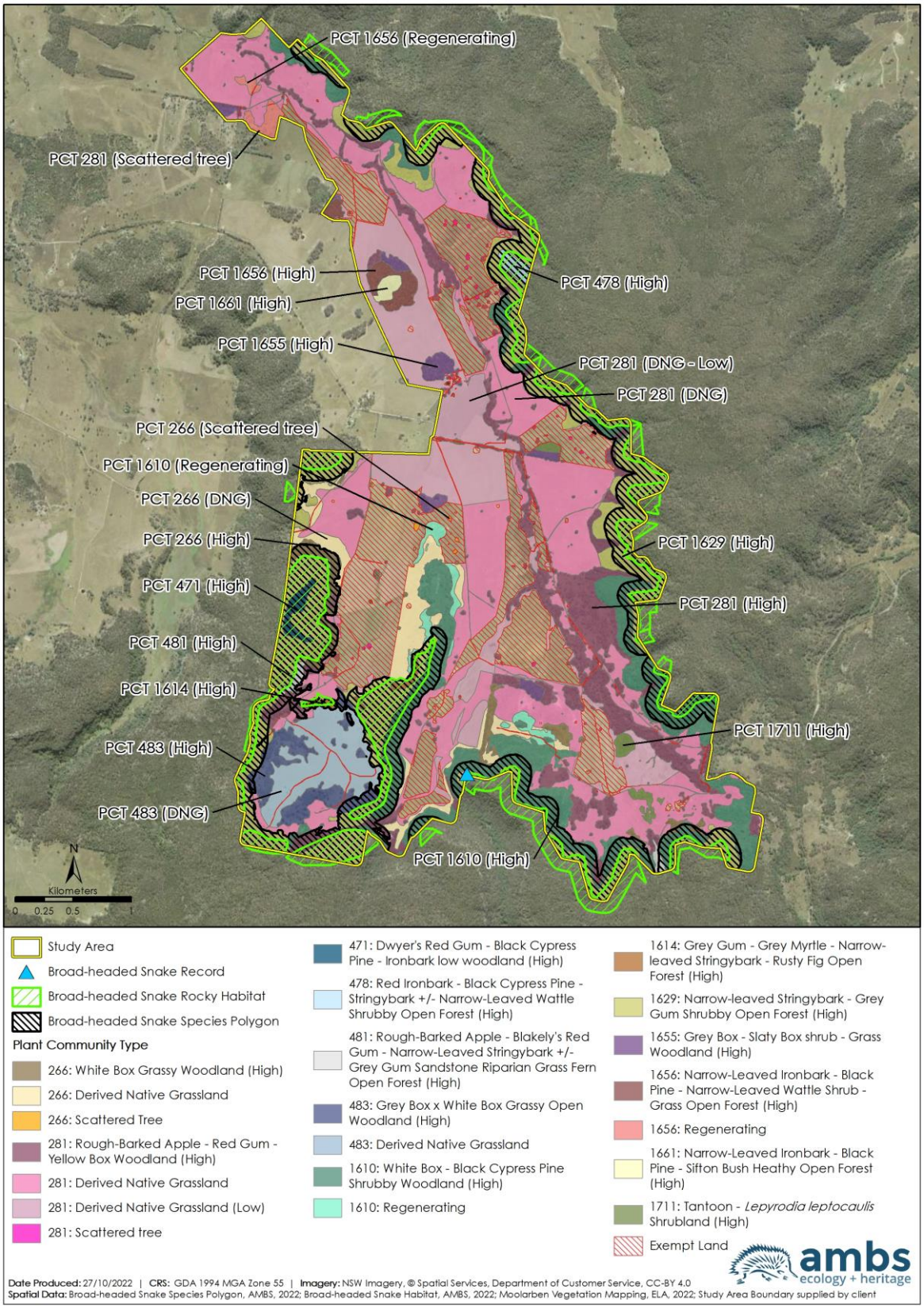


Figure 3.6 Broad-headed Snake species polygon

3.4.3 Masked Owl (Tyto novaehollandiae)

The Masked Owl is distributed from the NSW coast, where it is most abundant, to the western plains (DPE 2022b). Records indicate that the species is distributed across approximately 90 per cent (%) of NSW, excluding only the most arid north-western corner (DPE 2022b). The species inhabits dry eucalypt forests and woodlands from sea level to 1,100 m (DPE 2022b). There is no seasonal variation in its distribution. Although the species is considered to be a forest species, it will often hunt along forest edges, including along roads (DPE 2022b). The diet of the Masked Owl typically consists of tree-dwelling and ground mammals, especially rats (DPE 2022b). A Masked Owl pair will occupy a large home-range of 500 to 1,000 ha, where they roost and breed in protected eucalypt gullies, using large tree hollows or sometimes caves for nesting (DPE 2022b).

The Masked Owl was recorded on nine occasions by AMBS in 2021 (additional detail on these sightings is provided in Appendix C). In May 2021, a pair of Masked Owl's responded rapidly to call playback in the north-eastern section of the Study Area. The response was considered to constitute signs of breeding.

One nest tree was recorded on 25 August 2021 as being in use. A Masked Owl was observed in the entrance of the hollow calling. A second owl was heard calling nearby. The nest tree occurs approximately 100 m outside the Study Area. In accordance with the BAM (DPIE 2020a), a species polygon has been prepared which comprises a 100 m buffer around the identified nest tree, as shown on Figure 3.7.

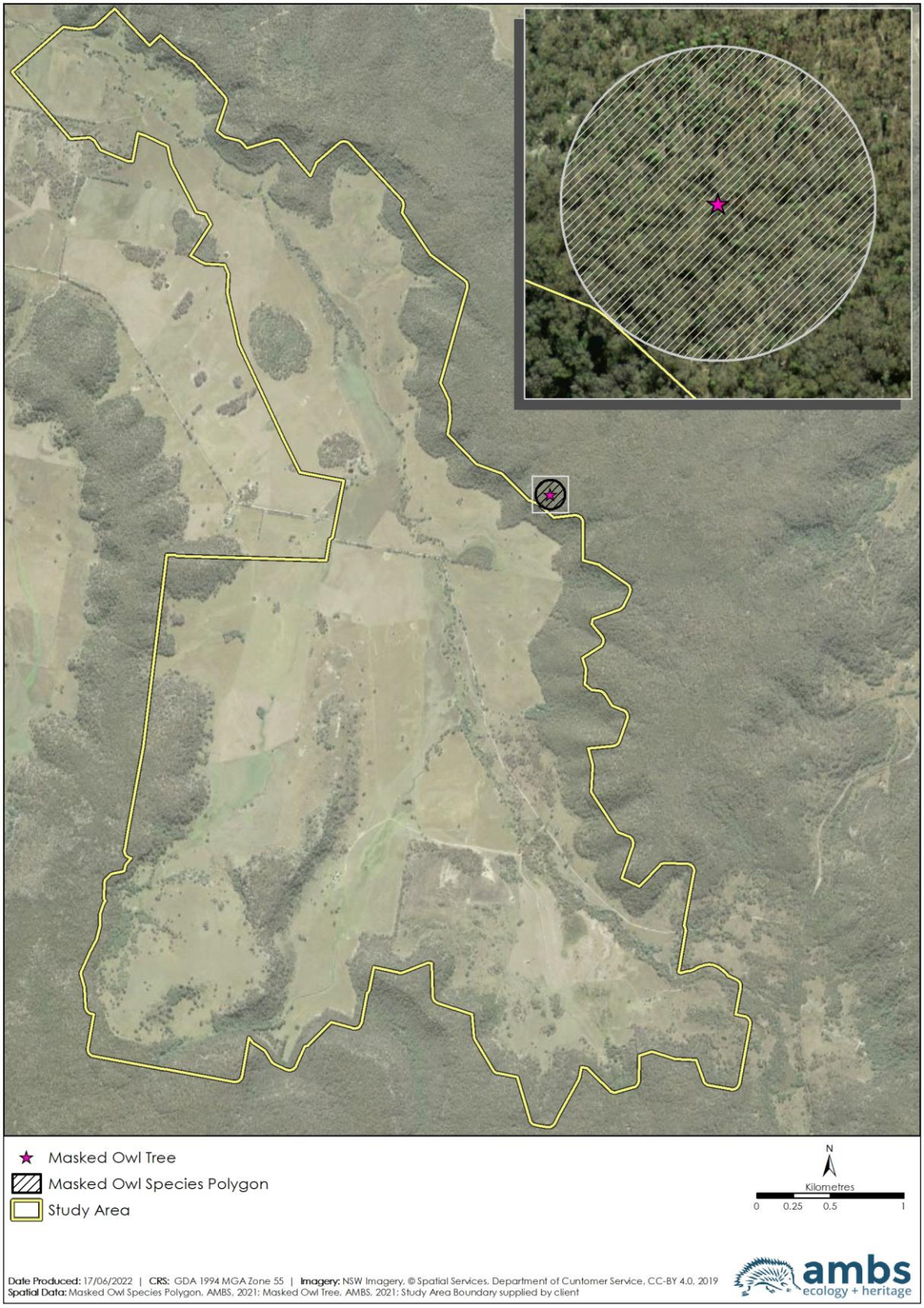


Figure 3.7 Masked Owl species polygon

3.4.4 Regent Honeyeater (Anthochaera phrygia)

The Regent Honeyeater tends to occur in woodlands and open forests within the inland slopes of south-east Australia, with individuals sometimes found in drier coastal woodlands and forests (DPE 2022b). The species range has contracted dramatically and now only occurs between north-eastern Victoria and south-eastern Queensland (DPE 2022b). There are only four known key breeding regions where the species is regularly recorded: north-east Victoria (Chiltern-Albury), the Capertee Valley, Hunter Valley, and the Bundarra-Barraba region in NSW (DotE 2016). Breeding is occasionally recorded elsewhere, for example in the Mudgee-Wollar area, a breeding pair were detected in Mulgoa in the 2019 breeding season, and the Lower Hunter Spotted Gum forests have recently been demonstrated to support regular breeding events (DPE 2022b). In NSW, the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands, although in some years flocks converge on flowering coastal woodlands and forests (DPE 2022b).

Habitat for the species is mainly dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak (DPE 2022b). Woodlands where the species occurs usually have large numbers of mature trees, high canopy cover and an abundance of mistletoes (DPE 2022b). The Regent Honeyeater is a generalist forager, but primarily feeds on the nectar from a relatively small number of eucalypts that produce high volumes of nectar (DPE 2022b). Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany (DPE 2022b). Flowering of other species such as *Eucalyptus fibrosa* (Red Ironbark), *Eucalyptus eugenioides* (Thin-leaved Stringybark) and other Stringybark species can also contribute important nectar flows at times (DPE 2022b). Nectar and fruit from the mistletoes are also utilised (DPE 2022b). When nectar is scarce lerp and honeydew can comprise a large proportion of the diet, while insects make up about 15% of the total diet and are important components of the diet of nestlings (DPE 2022b).

The species has not been previously recorded in the Study Area. However, parts of the Study Area are included on the Regent Honeyeater important habitat maps. The important habitat map identifies land that is considered important by DPE (2022g) to support critical life stages of the species and are classed as species credits. Consequently, a species polygon has been mapped that occupies an area of 682.39 ha in the Study Area and is shown on Figure 3.8. This area corresponds with the extent of the important habitat map within the Study Area.

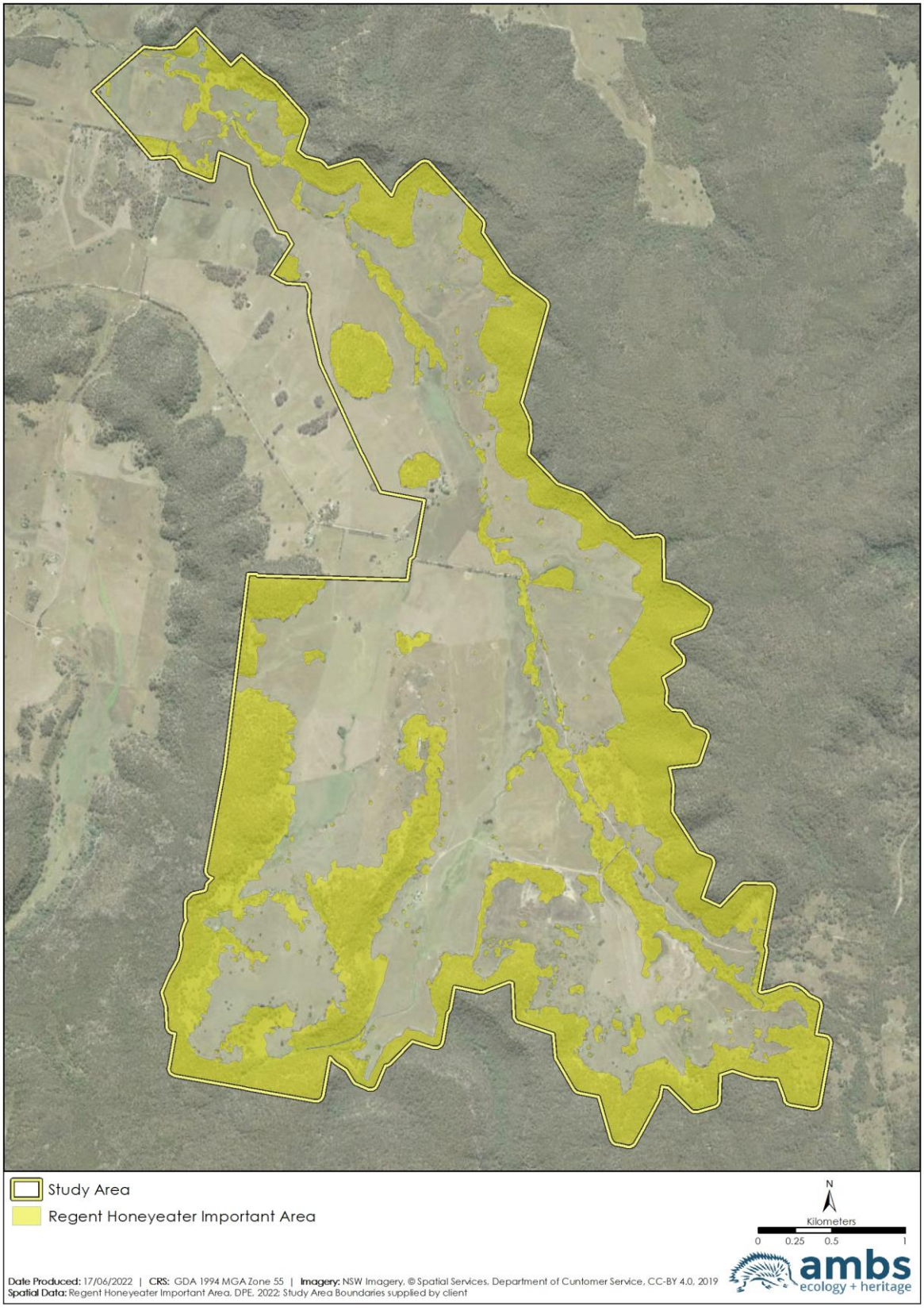


Figure 3.8 Regent Honeyeater species polygon

3.4.5 Koala (Phascolarctos cinereus)

The Koala inhabits eucalypt woodlands and forests throughout eastern Australia, from north-east Queensland to South Australia. In NSW, Koala populations are found along the coast and the Great Dividing Range, with smaller populations on the plains west of the range. The Study Area is not located in an area of a 'genetically important population' or a 'climate sensitive population' as defined by DAWE (2022a).

The species feeds on the foliage of over 120 species of Eucalyptus, Corymbia and Angophora, with preferred browse species varying throughout their range (DPE 2022b; DAWE 2022b). Primary food species differ across habitats, with preferences influenced by the chemical profiles and water content of different target food leaves (DAWE 2022a). Various additional tree species are also used by the Koala for shelter (DAWE 2022b).

Th Koala home range-size varies according to life history stage, soil fertility, habitat quality and nutritional requirements and can range from less than 2 ha to several hundred hectares in size (DPE 2022b; DAWE, 2022a).

Prior to the current surveys the Koala had not been recorded using habitat in the Study Area (DPE 2022a), however, the species was recently recorded in contiguous habitat during surveys in a different Study Area to the north (AMBS 2021). There are records of the Koala in the wider locality, including within the nearby Munghorn Gap Nature Reserve (DPE 2022a).

Koalas were recorded by AMBS in three general locations within the Study Area, and a further location by ELA (Figure 3.9). Four Koalas were heard during call playback surveys, two were observed opportunistically in the daytime, and scats were found at the base of a tree.

Six tree species that occur in the Study Area are considered key food trees for the Koala, including White Box (*Eucalyptus albens*), Grey Gum (*E. punctata*), Blakely's Red Gum (*E. blakelyi*), Yellow Box (*E. melliodora*), Grey Box (*E. moluccana*) and Narrow-leaved Stringybark (*E. sparsifolia*) (Department of Environment and Climate Change [DECC] 2008).

The *State Environmental Planning Policy (Biodiversity and Conservation) 2021* (SEPP 2021) and *Koala (Phascolarctos cinereus) Biodiversity Assessment Method Survey Guide* (DPE 2022f) also documents "Koala use tree species". For the purposes of the BAM (DPIE 2020a), suitable Koala habitat is any PCT containing one or more Koala use trees (DPE 2022c; DPE 2022f). Koala use trees of relevance are those that are listed within the Koala modelling region (KMR) that the subject land occurs within, or adjacent KMRs if the subject land occurs near a KMR border. The Study Area occurs within the Northwest Slopes KMR, but is close to the border of the Central Coast KMR and Central & Southern Tablelands KMR (DPE 2022d). Within the three KMRs described above, SEPP (2021) and DPE (2022f) lists the previously mentioned key food trees also as "Koala use tree species", as well as Rough-barked Apple (*Angophora floribunda*), Beyer's Ironbark (*E. beyeriana*), Narrow-leaved Ironbark (*E. crebra*), Broad-leaved Ironbark (*E. fibrosa*) and Mugga Ironbark (*E. sideroxylon*) which are all present in the Study Area. The TBDC (DPE 2022a) identifies the Koala as being known to use Paddock Trees.

The Koala is associated with PCTs 266, 281, 471, 1629 and 1655 according to the TBDC (DPE 2022a), and in the Study Area these PCTs also contain one or more of the key food tree species outlined above (DECC 2008; SEPP 2021; DPE 2022f). In addition, a number of PCTs within the Study Area which are not recognised by DPE (2022a) as being associated with the Koala, also contain suitable habitat in the form of one or more of the key "food tree species" (DECC 2008) or "Koala use tree species" (SEPP 2021; DEP 2022f) outlined above, including:

- PCT 478, which contains key food trees *E. sparsifolia* and *E. punctata*, as well as the "Koala use tree species" *E. fibrosa*.
- PCT 481, which contains key food trees *E. punctata*, *E, blakelyi* and *E. sparsifolia*, as well as the "Koala use tree species" *A. floribunda*.
- PCT 483, which contains the key food tree *E. albens*, as well as the "Koala use tree species" *A. floribunda*.
- PCT 1610, which contains the key food tree *E. albens*;
- PCT 1614, which contains key food trees *E. punctata* and *E. sparsifolia*, as well as the "Koala use tree species" *A. floribunda*.
- PCT 1656, which contains key food trees *E. blakelyi* and *E. melliodora*, as well as "Koala use tree species" *E. crebra*, *E. sideroxylon* and *A. floribunda*.
- PCT 1661, which contains the "Koala use tree species" *E. crebra*; and
- PCT 1711, which contains the key food trees *E. blakelyi*.

Based on the information outlined above, suitable habitat for the species occurs widely throughout the Study Area, including all woodland PCTs and scattered trees. A species polygon for the Koala has been mapped on this basis, which occupies an area of 666.42 ha and is shown on Figure 3.9.

The koala habitat is considered to be continuous. The majority of the Koala habitat is well-connected, particularly around the perimeter of the Study Area. Habitat on the valley flats is more fragmented, but riparian habitat along Moolarben Creek and Murdering Creek provides connectivity throughout the Study Area. Habitats within the Study Area were broadly in good condition. The majority of the Study Area has been unburnt for some time with only two small wildfires on record in the past 10 years (DPE 2022e); a 1 ha wildfire in 2011-12 and a 2 ha wildfire in 2013-14. Larger wildfires have occurred to the east and north, as well as several prescribed burns (DPE 2022e), but most were more than 10 years ago. Finally, sightings of feral predators (e.g. dogs) were rare, with only 5 records obtained during these surveys in 2021.

The *Conservation Advice for Phascolarctos cinereus (Koala) Combined Populations of Queensland, New South Wales and the Australian Capital Territory* (DAWE 2022a) defines *'Habitat critical to the survival of a species'* as: the areas that the species relies on to avoid or halt decline and promote the recovery of the species. A number of factors may be considered when identifying habitat that is critical to the survival of a species:

(a) whether the habitat is used during periods of stress (examples: flood, drought or fire);

Koala population declines across NSW have been driven by a number of factors including habitat loss, temperature increase and drought (DAWE 2022a). In particular, Koalas at the western edge of their range are being impacted by shifts in rainfall patterns and increasing frequency of drought and heat stress (DAWE 2022a). Lane *et al.* (2020) estimates that the NSW koala population has declined by between 28.52% to 65.95% over the preceding three koala generations (i.e. between 2001-2018), and highlighted in particular that in five Areas of Regional Koala Significance there are no records for the species in 2019 or the most recent koala generation (2013-2018). For example, Lunney *et al.* (2017) documented a 79% reduction in the koala population in the Pilliga forests between the 1990's and 2014. A 2019 study reassessed 97 sites across the Pilliga, Warrambungles and (part) Gilgandra LGAs using scat surveys and found no evidence of koalas (Lane *et al.* 2020). The Lane *et al.* (2020) study did not take into account fire events since 10 December 2019.

Considering the number of records obtained within the Study Area in 2021, it is plausible that individuals have survived the recent and historical temperature increases and drought comparably better than some other populations within NSW (see Lane *et al.* 2020). It is likely the habitat (particularly the habitat along Moolarben Creek and sheltered habitat on the slopes) would have

been used during the drought, a period of stress. Further, the Study Area was not burnt during the 2019-20 fires.

(b) whether the habitat is used to meet essential life cycle requirements (examples: foraging, breeding, nesting, roosting, social behaviour patterns or seed dispersal processes);

Male Koalas were heard bellowing on multiple occasions within the Study Area. It is likely that the habitat is used to meet essential life cycle requirements.

(c) the extent to which the habitat is used by important populations;

The population in the Study Area has not been listed as a 'genetically important population' or 'climate sensitive population'.

DAWE (2022a) discusses "Other important populations" as those that have the potential to act as source populations for adjacent areas of suitable habitat and/or potentially suitable habitat. This includes climate-robust populations, large populations that exist in contiguous habitats, and populations that may link two larger populations (DAWE 2022a). The population in the Study Area could be considered climate-robust (see Section a) and it occurs within contiguous habitats, but is unlikely to be a population that links two larger populations. On the basis of the information provided in DAWE (2022a), it is possible that the population would fit the description of 'Other important population'.

(d) whether the habitat is necessary to maintain genetic diversity and long-term evolutionary development;

The population in the Study Area has not been listed as a 'genetically important population'. Considering this, and that the koala habitat within the Study Area is contiguous with large areas of native vegetation in the surrounding landscape (including Munghorn Gap Nature Reserve), the habitat within the Study Area is unlikely to be necessary to maintain genetic diversity and long-term evolutionary development.

(e) whether the habitat is necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements;

Habitats on the valley flats are relatively fragmented, but forested areas around the perimeter of the Study Area are well connected with adjacent areas of potential habitat. If the Project is approved, it is likely Koalas will still be capable of moving freely throughout other areas of potential habitat in the locality.

(f) whether the habitat is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation;

Given the Koala occurs from north-east Queensland to South Australia, it is considered unlikely that the habitat is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation.

In summary, of the six factors discussed above:

- three (a, b, c) suggest there is potential for the habitat to be considered critical to the survival of the species; and
- three (d, e, f) suggest the habitat is not necessarily critical to the survival of the species.

Considering the recent large declines that have been recorded throughout the species range (DAWE 2022a), and that there is evidence to suggest the population within the Study Area has survived the recent and historical temperature increases (see Lane *et al.* 2020), drought and bushfires comparably well, there is evidence to suggest habitats within the Study Area could be critical to the survival of the species.

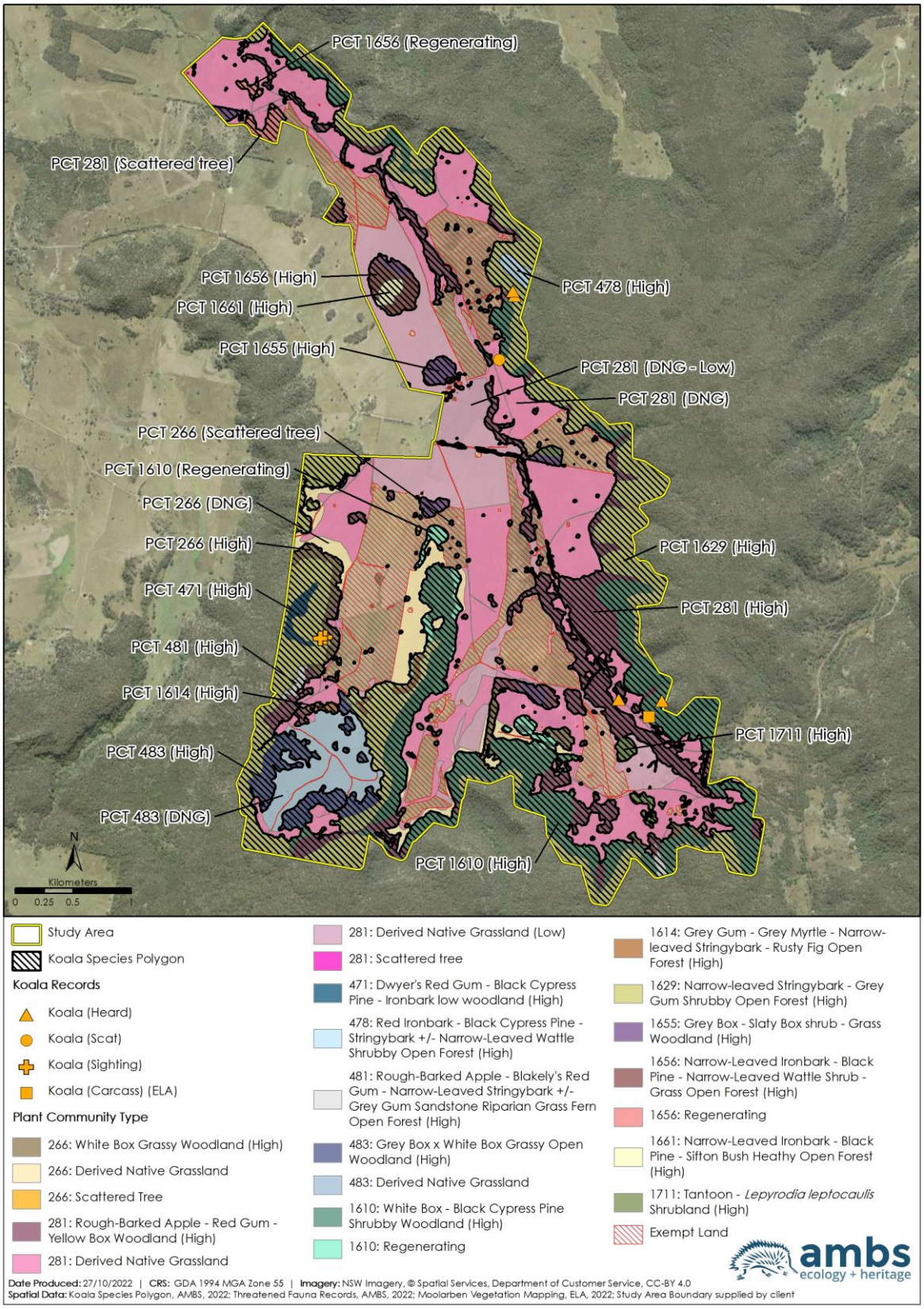


Figure 3.9 Koala species polygon

3.4.6 Squirrel Glider (Petaurus norfolcensis)

The Squirrel Glider is found across eastern Australia from North Queensland to Western Victoria. In NSW, the species occupies forests and woodlands from the coast to the western slopes and along the Murray River. West of the Great Dividing Range they are most commonly recorded in forests dominated by River Red Gum (*Eucalyptus camaldulensis*). Old growth forest is preferred (presumably due to the higher availability of roosting resources), but they are occasionally detected in younger forests. They roost in hollows, building a leaf or bark nest at the bottom of the hollow and may occupy several hollows within a loosely defined territory. They feed primarily on nectar, flowers, and sap, however invertebrates will seasonally form a component of their diet. The TBDC (DPE 2022a) identifies the species as being known to use Paddock Trees.

The Squirrel Glider was recorded in one location within the Study Area. While only a single individual was found there are larger areas of potential habitat. Given the mobility of the species and reasonably good connectivity of these areas of potential habitat throughout the Study Area, with the area in which the species was recorded, it is considered likely that the species uses areas of potential habitat throughout the Study Area.

The species is associated with PCTs 266, 281, 471, 1629 and 1655 (DPE 2022a), and these PCTs contain suitable habitat including hollow-bearing trees, nectar resources, and sap. In addition to these, a number of other PCTs within the Study Area that according to the TBDC (DPE 2022a) are not associated with the species, also contain suitable habitat resources. These areas of non-associated PCTs occur in close proximity to areas of potential habitat that are associated with the species and are therefore considered likely to be utilised. The additional areas of PCTs not associated with the species but are likely to be utilised by the species include:

- PCT 478, which occurs in the north east of the Study Area and is surrounded by PCT 1629;
- PCT 481, which occurs in two small patches in the south of the Study Area in close proximity to PCT 1629 and 281;
- PCT 483, which occurs in the south west of the Study Area in close proximity to PCT 1629;
- PCT 1610, which occurs widely throughout the Study Area in close proximity to PCT 1629;
- PCT 1614, which occurs in small patches in the south west of the Study Area in close proximity to PCT 1629;
- PCT 1656, which occurs in the north of the Study Area in close proximity to PCT 1655;
- PCT 1661, which occurs in the north of the Study Area in close proximity to PCT 1655; and
- PCT 1711, which occurs in the south of the Study Area in close proximity to PCT 281.

Overall, hollow-bearing trees occurred broadly throughout the Study Area, within woodland habitat on the slopes, ridges, valley flats, and small rises. With the exception of grassland habitat, there were only a small number of scattered locations within the Study Area where hollow-bearing trees were classified as rare. Most PCTs contained nectar resources, and *Acacia* sp. were frequently recorded which would also provide foraging substrate for invertebrates depending on the season and conditions.

The BAM (DPIE, 2020a) requires the area of suitable habitat (habitat where the species is expected to occur or periodically use) to be included in the species polygon. Based on the information outlined above, suitable habitat for the species occurs widely throughout the Study Area, including all woodland PCTs and scattered trees. A species polygon for the Squirrel Glider has been mapped on this basis, which occupies an area of 666.42 ha and is shown on Figure 3.10.

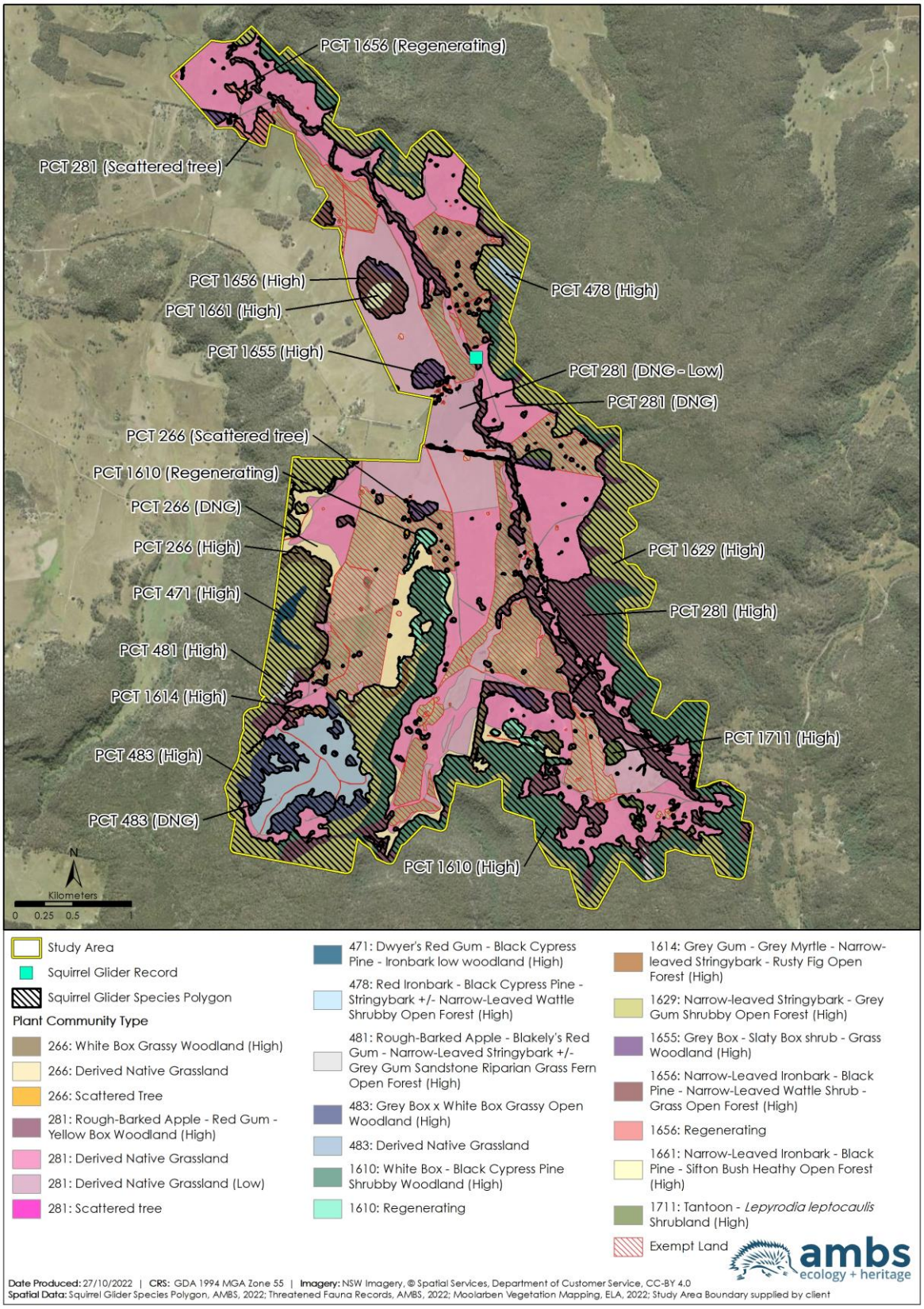


Figure 3.10 Squirrel Glider species polygon

3.4.7 Large-eared Pied Bat (Chalinolobus dwyeri)

The Large-eared Pied Bat occurs from Rockhampton in Queensland to Bungonia in the NSW Southern Highlands (DPE 2022b). It is generally rare with a patchy distribution in NSW, occurring mainly in areas with extensive cliffs and caves (DPE 2022b). There are scattered records from the New England Tablelands and North West Slopes. The species roosts in caves (near the entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (DPE 2022b). They generally inhabit low to mid-elevation dry open forest and woodland close to roosting features, but also well-timbered areas containing gullies (DPE 2022b). Females are known to raise young in maternity roosts from November through to January, often in roof domes of sandstone caves and overhangs (DPE 2022b). The species is known to show site fidelity to the same cave over many years (DPE 2022b).

The Large-eared Pied Bat was regularly recorded by AMBS on Anabat detectors, in harp traps, and also roosting in caves or martin nests during daytime habitat searches within the Study Area. The majority of records were within 100 m of potential roosting habitat, given that this was the focus of the targeted survey effort, although some records were also obtained from the lower slopes and valley woodland habitat. Fourteen individuals were caught in harp traps, eleven of which were adult males or non-breeding females. Two individuals were juvenile males, identified by their elongated wing joints with visible bands of cartilage, and their smaller size. One individual was a lactating adult female. Given juvenile animals and a lactating female have been recorded, roosting habitat within the Study Area is considered breeding habitat.

On the basis of the information outlined above, breeding and foraging habitat for the Large-eared Pied Bat occurs within the Study Area and nearby surrounds (Figure 3.11). Breeding habitat has been mapped outside the Study Area where it occurs within 100 m of the Study Area boundary.

In accordance with the NSW survey guide for *'Species Credit' Threatened Bats and Their Habitat* (OEH 2018), a species polygon is woodland habitat of associated PCTs as per the TBDC (DPE 2022a) (i.e. PCTs 281, 471, 1629, 1655) within a 2 km radius of identified roosting habitat. This species polygon occupies an area of 666.42 ha in the Study Area as shown on Figure 3.11. The species polygon includes PCTs associated with the species, as well as non-associated:

- PCTs 266, 483, 1610 because the species was recorded within these during the surveys; and
- PCTs 478, 481, 1614, 1656, 1661 and 1711 because of their close proximity to roosting habitat and other areas of suitable habitat (i.e. PCTs associated with the species and habitat which contains species records), it is likely the species would utilise these areas of habitat for foraging and movement throughout the Study Area.

It is likely the species would forage or move through woodland habitat of all PCTs in the Study Area.

3.4.8 Eastern Cave Bat (Vespadelus troughtoni)

The Eastern Cave Bat occurs 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 (DPE 2022b). The species is uncommon, and little is known about its behaviour, or feeding and breeding requirements (DPE 2022b). The Eastern Cave Bat roosts in caves, cliffs, and rocky overhangs, which are usually found in dry open forest or woodland, and occasionally wet eucalypt forest and rainforest (DPE 2022b). They have also been recorded roosting in disused mine workings, occasionally in colonies of up to 500 individuals (DPE 2022b).

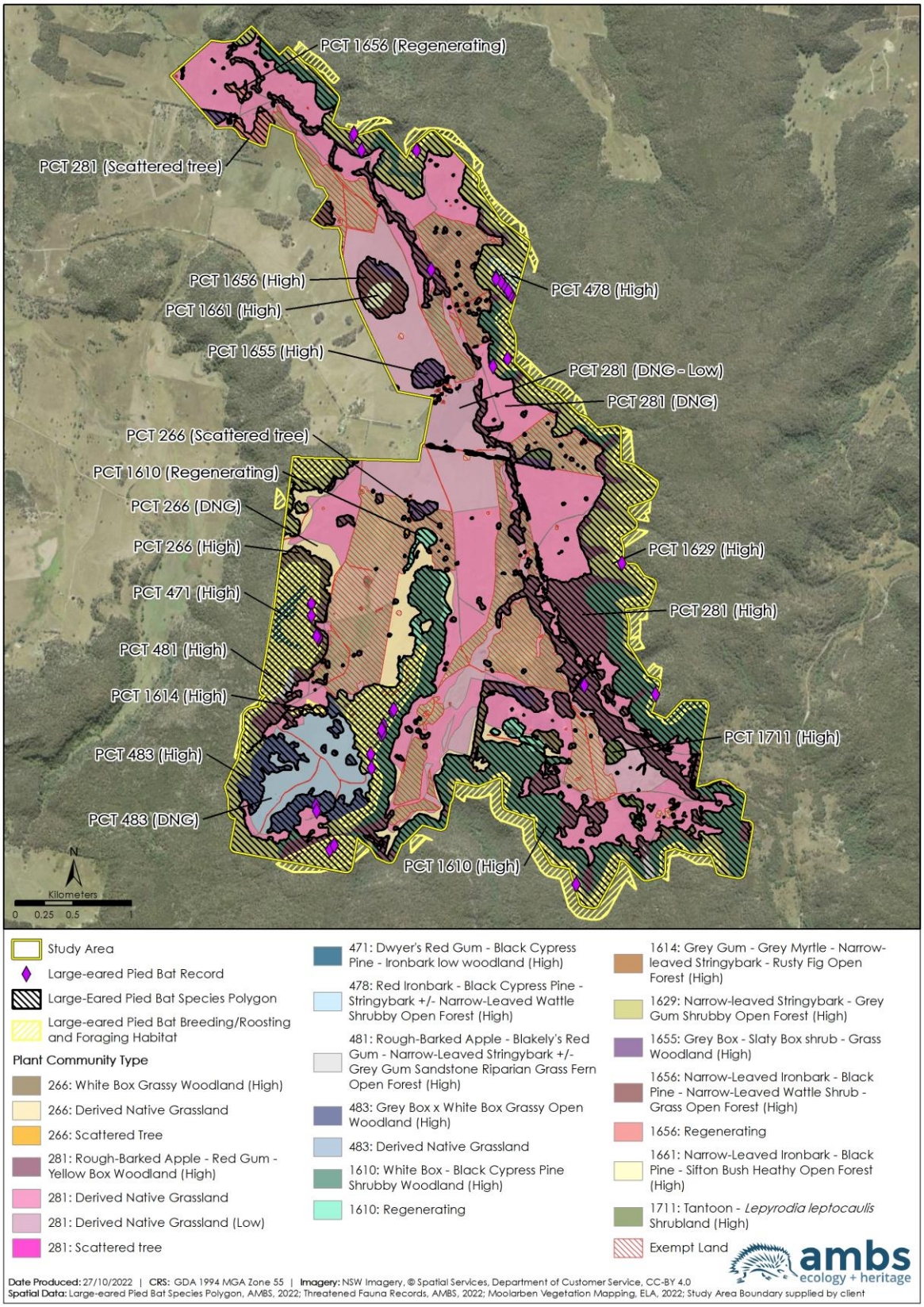


Figure 3.11 Large-eared Pied Bat species polygon

The Eastern Cave Bat was regularly recorded by AMBS on Anabat detectors, in harp traps, and was also found roosting in a cave during a daytime habitat search within the Study Area. The majority of records were within 100 m of potential roosting habitat, given that this was the focus of the targeted survey effort, although some records were also obtained from the lower slopes and valley woodland habitat. Six individuals were caught in harp traps, one of which was an adult male. Three individuals were juvenile males, identified by their elongated wing joints with visible bands of cartilage, and smaller size, and one individual was potentially juvenile, given it had fused wing joints but no visible scarring. One individual was a post-lactating adult female. Given juvenile animals and a post-lactating female have been recorded, roosting habitat within the Study Area is considered breeding habitat.

On the basis of the information outlined above, breeding and foraging habitat for the Eastern Cave Bat occurs within the Study Area and nearby surrounds (Figure 3.12). Breeding habitat has been mapped outside the Study Area where it occurs within 100 m of the Study Area boundary. In accordance with the NSW survey guide for *'Species Credit' Threatened Bats and Their Habitat* (OEH 2018), a species polygon is woodland habitat associated with PCTs as per the TBDC (DPE 2022a) (i.e. PCTs 281, 471, 1629, 1655) within a 2 km radius of identified roosting habitat. A species polygon has been mapped for the Study Area that occupies an area of 666.42 ha and is shown on Figure 3.12. The species polygon includes PCTs associated with the species, as well as non-associated:

- PCTs 266, 483, 1610 because the species was recorded within these during the surveys; and
- PCTs 478, 481, 1614, 1656, 1661 and 1711, because of their close proximity to roosting habitat and other areas of suitable habitat (i.e. PCTs associated with the species and habitat which contains species records), it is likely the species would utilise these areas of habitat for foraging and movement throughout the Study Area.

It is likely the species would forage or move through woodland habitat of all PCTs in the Study Area.

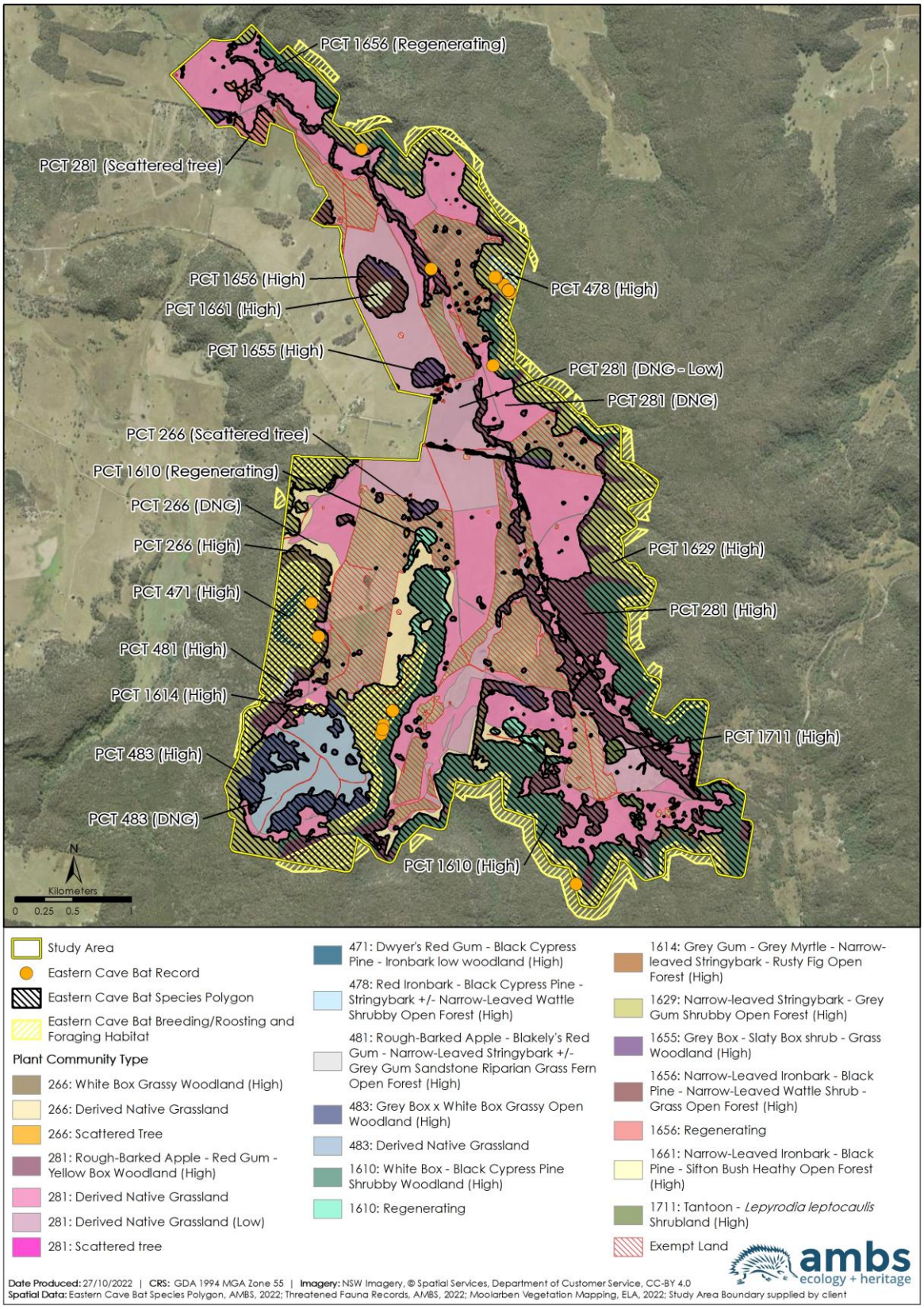


Figure 3.12 Eastern Cave Bat species polygon

3.5 Summary of EPBC Act Species

One threatened fauna species listed under the EPBC Act which has not been addressed in Section 3.4 but is likely to occur in the Study Area is the Swift Parrot (*Lathamus discolor*).

The Swift Parrot breeds in Tasmania during the summer in tree-hollows in old-growth or other forest with suitable hollows, within relatively close proximity to their main food source; flowering Tasmanian Blue Gum (Saunders & Tzaros 2011, Tzaros *et. al.* 2009). The entire population migrates north across Bass Strait in autumn and disperses across mainland South-eastern Australia for the winter (Saunders & Tzaros 2011, Tzaros *et. al.* 2009). On the mainland, it can utilise habitats from the south-east corner of South Australia to south-east Queensland. In NSW it occurs in the coastal districts and the western slopes but reaches the mountains and western plains in some years (Cooper *et. al.* 2016).

On the mainland, the Swift Parrot can be described as a blossom nomad, because individuals wander widely across the range seeking seasonally variable nectar resources. As such, records of the species are spatially and temporally inconsistent. The primary food source on the mainland are flowers and psyllid lerps in Eucalypt species. In NSW, coastal regions tend to support larger numbers of birds when inland habitats are subjected to drought.

Favoured feed trees include winter flowering species such as Swamp Mahogany *(E. robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Forest Red Gum (*E. tereticornis*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*) (DPE 2022b). Commonly used lerp infested trees include Inland Grey Box (*E. macrocarpa*), Grey Box (*E. moluccana*), Blackbutt (*E. pilularis*) and Yellow Box (*E. melliodora*) (DPE 2022b).

The Swift Parrot was not recorded by AMBS during targeted surveys and has not been previously recorded within the Study Area. However, the species has been recorded in contiguous habitat during surveys to the north in 2021. There are also records in the wider locality, including within the nearby Munghorn Gap Nature Reserve (DPE 2022a). The Study Area is not included on the Swift Parrot important habitat maps.

Two tree species that are considered favoured feed trees occur in the Study Area, White Box and Mugga Ironbark. Further, there are another six tree species that are known to flower in autumn or winter, and therefore can provide potential foraging habitat for the species; Broad-leaved Ironbark (*Eucalyptus fibrosa*), Narrow-leaved Stringybark (*Eucalyptus sparsifolia*), Grey Gum (*Eucalyptus punctata*), Narrow-leaved Ironbark (*Eucalyptus crebra*), Mugga Ironbark (*Eucalyptus sideroxylon*) and Yellow Box (*Eucalyptus melliodora*) (EUCLID 2022).

The Swift Parrot is associated with PCTs 266, 281, 471, 1629 and 1655, according to the TBDC (DPE 2022a), and in the Study Area these PCTs also contain one or more of the winter flowering food tree species outlined above (EUCLID 2022). In addition, a number of PCTs within the Study Area which are not recognised by DPE (2022a) as being associated with the Swift Parrot, also contain potential habitat in the form of one or more of the winter flowering food tree species, including:

- PCT 478, which contains potential winter flowering food trees *E. fibrosa*, *E. sparsifolia* and *E. punctata*;
- PCT 481, which contains potential winter flowering food trees *E. punctata* and *E. sparsifolia*;
- PCT 483, which contains the potential winter flowering food trees *E. albens*;
- PCT 1610, which contains the potential winter flowering food tree *E. albens*;
- PCT 1614, which contains potential winter flowering food trees *E. punctata* and *E. sparsifolia*;

- PCT 1656, which contains potential winter flowering food trees *E. crebra*, *E. sideroxylon* and *E. melliodora*; and
- PCT 1661, which contains the potential winter flowering food tree *E. crebra*.

Given that there are nearby recent records in contiguous habitat, and considering the ecology of the species (i.e. blossom nomad, with spatially and temporally inconsistent species records), it is likely the species would occur in the Study Area despite not having been recorded during the surveys between 2020-2021. Potential habitat for the species occurs widely throughout the Study Area, including all woodland PCTs and scattered trees with the exception of PCT 1711. Potential foraging habitat for the Swift Parrot has been mapped on this basis as occupying an area of 666.34 ha and is shown on Figure 3.13.

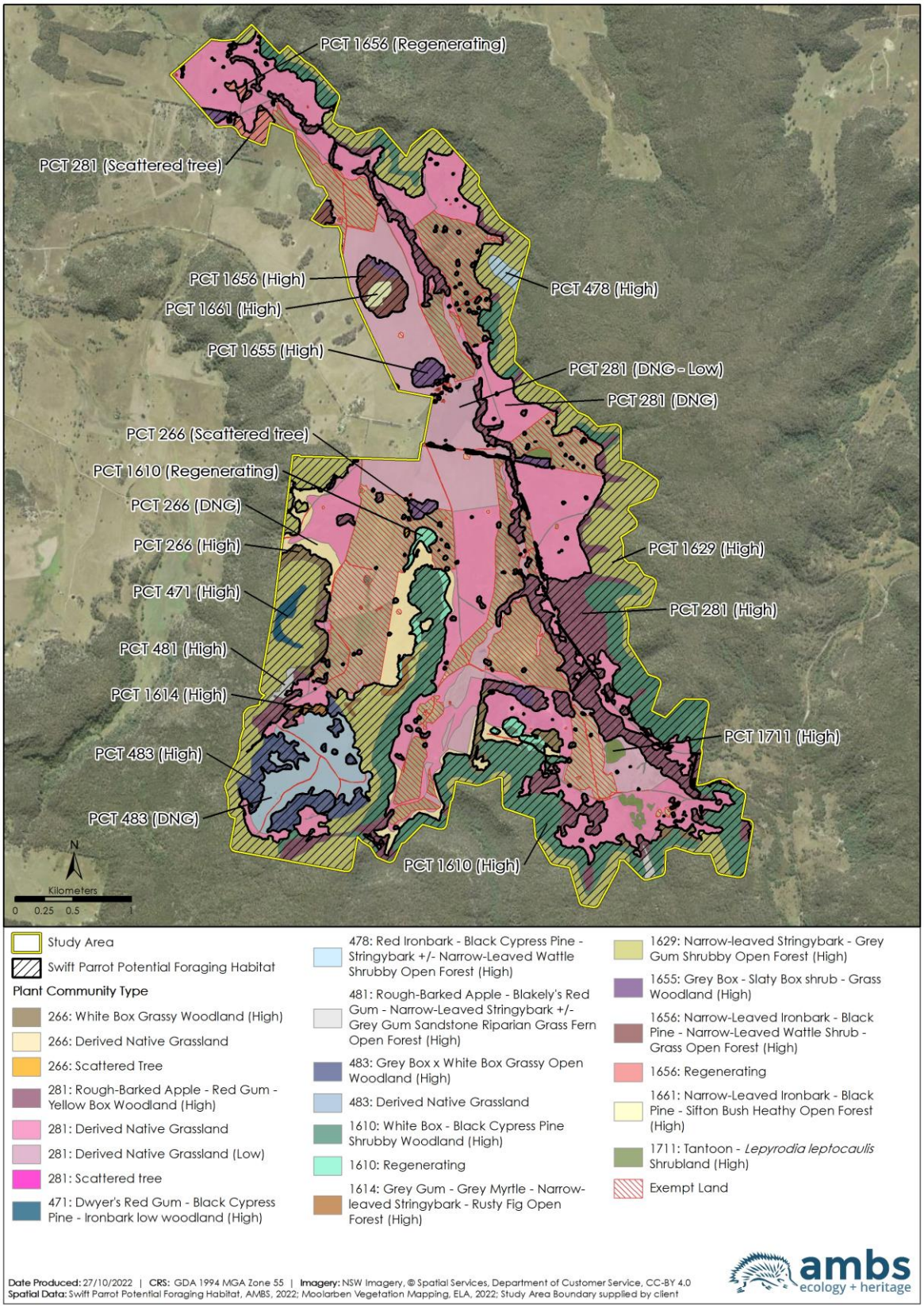


Figure 3.13 Swift Parrot potential foraging habitat

4 Conclusion

Eight "Species Credit" or dual-credit "Species/Ecosystem" species were recorded during the surveys, or have important habitat mapped within the Study Area, and meet the requirements to prepare a species polygon:

- Pink-tailed Legless Lizard (*Aprasia parapulchella*);
- Broad-headed Snake (*Hoplocephalus bungaroides*);
- Masked Owl (*Tyto novaehollandiae*);
- Regent Honeyeater (*Anthochaera phrygia*);
- Koala (*Phascolarctos cinereus*);
- Squirrel Glider (*Petaurus norfolcensis*);
- Large-eared Pied Bat (*Chalinolobus dwyeri*); and
- Eastern Cave Bat (*Vespadelus troughtoni*).

One additional dual-credit "Species/Ecosystem" species listed under the EPBC Act is considered likely to occur in the Study Area, the Swift Parrot (*Lathamus discolor*).

Three dual-credit "Species/Ecosystem" species were recorded during the surveys but do not meet the requirements to prepare a species polygon:

- Little Eagle (*Hieraaetus morphnoides*);
- Powerful Owl (*Ninox strenua*); and
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*) (probable).

Twelve other fauna species that were recorded during the surveys are listed as threated under the BC Act, and are classified as "Ecosystem Credit" species under the BAM (DPIE 2020a):

- Black Falcon (*Falco subniger*);
- Little Lorikeet (*Glossopsitta pusilla*);
- Brown Treecreeper (eastern subspecies) (*Climacteris picumnus victoriae*);
- Speckled Warbler (*Chthonicola sagittata*);
- Black-chinned Honeyeater (eastern subspecies) (*Melithreptus gularis gularis*);
- Grey-crowned Babbler (eastern subspecies) (*Pomatostomus temporalis temporalis*);
- Varied Sittella (*Daphoenositta chrysoptera*);
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*);
- Diamond Firetail (*Stagonopleura guttata*);
- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*);
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*); and
- Greater Broad-nosed Bat (*Scoteanax rueppellii*).

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Appendix A: Fauna survey locations

AMBS survey locations (MGA Zone 55, GDA 94)

Technique	Season	Site	Easting	Northing
Diurnal Active Searches for Reptiles	Spring	RS01	762985	6415313
Diurnal Active Searches for Reptiles	Spring	RS02	762685	6413941
Diurnal Active Searches for Reptiles	Spring	RS03	762394	6413169
Diurnal Active Searches for Reptiles	Spring	RS04	762152	6412429
Diurnal Active Searches for Reptiles	Spring	RS05	762358	6412628
Diurnal Active Searches for Reptiles	Spring	RS06	762210	6412395
Diurnal Active Searches for Reptiles	Spring	RS07	762750	6413051
Diurnal Active Searches for Reptiles	Spring	RS08	762671	6413109
Diurnal Active Searches for Reptiles	Spring	RS09	762008	6412280
Diurnal Active Searches for Reptiles	Spring	RS10	766163	6412415
Diurnal Active Searches for Reptiles	Spring	RS11	762065	6412499
Diurnal Active Searches for Reptiles	Spring	RS12	762085	6412552
Diurnal Active Searches for Reptiles	Spring	RS13	762181	6412272
Diurnal Active Searches for Reptiles	Spring	RS14	764635	6411959
Diurnal Active Searches for Reptiles	Spring	RS15	763836	6412561
Diurnal Active Searches for Reptiles	Spring	RS16	764220	6412491
Diurnal Bird Survey	Autumn/Winter	B00	764011	6417361
Diurnal Bird Survey	Autumn/Winter	B01	764019	6417353
Diurnal Bird Survey	Autumn/Winter	B02	764223	6417246
Diurnal Bird Survey	Autumn/Winter	B03	763988	6416939
Diurnal Bird Survey	Autumn/Winter	B05	764112	6416335
Diurnal Bird Survey	Autumn/Winter	B06	762973	6414839
Diurnal Bird Survey	Autumn/Winter	B07	764680	6414002
Diurnal Bird Survey	Autumn/Winter	B08	762730	6414105
Diurnal Bird Survey	Autumn/Winter	B09	762689	6413926
Diurnal Bird Survey	Autumn/Winter	B10	762304	6413074
Diurnal Bird Survey	Autumn/Winter	B11	763222	6413165
Diurnal Bird Survey	Autumn/Winter	B12	762480	6412076
Diurnal Bird Survey	Autumn/Winter	B13	761952	6412474
Diurnal Bird Survey	Autumn/Winter	B14	762036	6412799
Diurnal Bird Survey	Autumn/Winter	B15	763564	6415465
Diurnal Bird Survey	Autumn/Winter	B16	764101	6416169
Diurnal Bird Survey	Autumn/Winter	B17	764225	6416023
Diurnal Bird Survey	Autumn/Winter	B18	764551	6415802
Diurnal Bird Survey	Autumn/Winter	B19	764689	6415692
Diurnal Bird Survey	Autumn/Winter	B20	764904	6415572
Diurnal Bird Survey	Autumn/Winter	B21	765073	6415235
Diurnal Bird Survey	Autumn/Winter	B22	764976	6414902
Diurnal Bird Survey	Autumn/Winter	B23	764914	6414846
Diurnal Bird Survey	Autumn/Winter	B24	764920	6414354
Diurnal Bird Survey	Autumn/Winter	B25	764692	6414201
Diurnal Bird Survey	Autumn/Winter	B26	765181	6413484

Technique	Season	Site	Easting	Northing
Diurnal Bird Survey	Autumn/Winter	B27	765063	6412392
Diurnal Bird Survey	Autumn/Winter	B28	765418	6411996
Diurnal Bird Survey	Autumn/Winter	B29	764016	6417365
Diurnal Bird Survey	Autumn/Winter	B30	763883	6417718
Diurnal Bird Survey	Autumn/Winter	B31	763663	6417874
Diurnal Bird Survey	Autumn/Winter	B32	763532	6417730
Diurnal Bird Survey	Autumn/Winter	B34	763389	6417697
Diurnal Bird Survey	Autumn/Winter	B35	763079	6417967
Diurnal Bird Survey	Autumn/Winter	B36	763315	6417488
Diurnal Bird Survey	Autumn/Winter	B37	763522	6417200
Diurnal Bird Survey	Autumn/Winter	B38	764189	6417258
Diurnal Bird Survey	Autumn/Winter	B39	763998	6417020
Diurnal Bird Survey	Autumn/Winter	B40	764096	6416765
Diurnal Bird Survey	Autumn/Winter	B41	764092	6416411
Diurnal Bird Survey	Autumn/Winter	B42	764132	6415412
Diurnal Bird Survey	Autumn/Winter	B43	764376	6415026
Diurnal Bird Survey	Autumn/Winter	B44	764490	6413369
Diurnal Bird Survey	Autumn/Winter	B45	763673	6413361
Diurnal Bird Survey	Autumn/Winter	B46	763392	6412751
Diurnal Bird Survey	Autumn/Winter	B47	763156	6412164
Diurnal Bird Survey	Autumn/Winter	B48	763714	6412688
Diurnal Bird Survey	Autumn/Winter	B50	765890	6412704
Diurnal Bird Survey	Autumn/Winter	B51	765965	6412532
Diurnal Bird Survey	Autumn/Winter	B52	766156	6412545
Diurnal Bird Survey	Autumn/Winter	B53	766313	6412448
Diurnal Bird Survey	Autumn/Winter	B54	765882	6412782
Diurnal Bird Survey	Autumn/Winter	B55	765480	6412946
Diurnal Bird Survey	Autumn/Winter	B56	765844	6412560
Diurnal Bird Survey	Autumn/Winter	B57	765954	6412143
Diurnal Bird Survey	Autumn/Winter	B58	766204	6412328
Diurnal Bird Survey	Autumn/Winter	B59	765685	6412242
Diurnal Bird Survey	Autumn/Winter	B60	765288	6412447
Diurnal Bird Survey	Autumn/Winter	B61	765520	6412663
Diurnal Bird Survey	Autumn/Winter	B62	765255	6412921
Diurnal Bird Survey	Autumn/Winter	B63	764810	6415576
Diurnal Bird Survey	Autumn/Winter	B64	765135	6415314
Diurnal Bird Survey	Autumn/Winter	B65	764958	6414888
Diurnal Bird Survey	Autumn/Winter	POWL2	764109	6416691
Diurnal Bird Survey	Autumn/Winter	POWL4	764296	6415956
Diurnal Bird Survey	Autumn/Winter	POWL6	765126	6415178
Diurnal Bird Survey	Spring/Summer	BOP15	764504	6413379
Diurnal Bird Survey	Spring/Summer	BOP16	764831	6413301
Diurnal Bird Survey	Spring/Summer	BOP17	764172	6415500
Diurnal Bird Survey	Spring/Summer	BOP18	762949	6414759
Diurnal Bird Survey	Spring/Summer	BOP19	764428	6415315
Diurnal Bird Survey	Spring/Summer	BOP20	764982	6414362

Technique	Season	Site	Easting	Northing
Diurnal Bird Survey	Spring/Summer	BOP21	764834	6413386
Diurnal Bird Survey	Spring/Summer	BOP22	764497	6414311
Diurnal Bird Survey	Spring/Summer	BOP23	763628	6416186
Diurnal Bird Survey	Spring/Summer	BOP24	763454	6416113
Diurnal Bird Survey	Spring/Summer	BOP25	764060	6415668
Diurnal Bird Survey	Spring/Summer	BOP26	763741	6416862
Diurnal Bird Survey	Spring/Summer	BOP27	763605	6417930
Diurnal Bird Survey	Spring/Summer	GG01	765033	6411873
Diurnal Bird Survey	Spring/Summer	GG02	765409	6411914
Diurnal Bird Survey	Spring/Summer	GG03	764675	6412345
Diurnal Bird Survey	Spring	BOP01	765861	6412785
Diurnal Bird Survey	Spring	BOP02	764981	6413514
Diurnal Bird Survey	Spring	BOP03	762835	6414415
Diurnal Bird Survey	Spring	BOP04	763888	6415406
Diurnal Bird Survey	Spring	BOP05	763013	6415325
Diurnal Bird Survey	Spring	BOP06	765105	6415425
Diurnal Bird Survey	Spring	BOP07	763953	6416286
Diurnal Bird Survey	Spring	BOP09	763767	6416821
Diurnal Bird Survey	Spring	BOP10	762860	6417860
Diurnal Bird Survey	Spring	BOP11	764832	6412898
Diurnal Bird Survey	Spring	BOP12	765094	6412180
Diurnal Bird Survey	Spring	BOP13	763303	6413202
Diurnal Bird Survey	Spring	BOP14	763396	6412749
Diurnal Bird Survey	Spring	BOPNEST01	764682	6415874
Diurnal Bird Survey	Spring	BOPNEST02	762748	6418853
Diurnal Bird Survey	Spring	BOPNEST03	764283	6412486
Diurnal Bird Survey	Spring	BOPNEST04	763413	6412004
Anabat	Summer	4A	762972	6418054
Anabat	Summer	4A	763028	6417973
Anabat	Summer	4A	763107	6417693
Anabat	Summer	4A	762937	6418123
Anabat	Summer	4B	763569	6417026
Anabat	Summer	4B	763660	6416916
Anabat	Summer	4D	764213	6416870
Anabat	Summer	4D	764166	6417041
Anabat	Summer	4D	764292	6416751
Anabat	Summer	4D	764323	6416752
Anabat	Summer	4D	764242	6416833
Anabat	Summer	4D	764172	6416906
Anabat	Summer	4H	764935	6413383
Anabat	Summer	4I	764863	6411666
Anabat	Summer	4I	765055	6411733
Anabat	Summer	4J	762582	6413985
Anabat	Summer	4J	762580	6414089
Anabat	Summer	4J	762640	6413784
Anabat	Summer	4J	762652	6413736

Technique	Season	Site	Easting	Northing
Anabat	Summer	4J	762642	6413802
Anabat	Summer	4K	763098	6412701
Anabat	Summer	4K	763090	6412789
Anabat	Summer	4K	763099	6412671
Anabat	Summer	4K	763280	6413161
Anabat	Summer	4K	763201	6413038
Anabat	Summer	4K	763195	6413000
Anabat	Summer	4K	763181	6412961
Anabat	Summer	4M	762620	6412346
Anabat	Summer	4M	762627	6412301
Anabat	Summer	4P	764118	6416157
Anabat	Summer	4P	764146	6416139
Anabat	Summer	4P	764272	6416205
Anabat	Summer	4P	764286	6416166
Anabat	Summer	4R	765025	6414329
Anabat	Summer	4R	765058	6414286
Anabat	Summer	4Z	762768	6412038
Anabat	Summer	4Z	762776	6412006
Anabat	Summer	4Z	762738	6411967
Harp Trap	Summer	4A	762996	6418049
Harp Trap	Summer	4A	763040	6418052
Harp Trap	Summer	4A	763060	6418028
Harp Trap	Summer	4A	763039	6418002
Harp Trap	Summer	4A	762948	6418065
Harp Trap	Summer	4A	762948	6418146
Harp Trap	Summer	4A	762948	6418144
Harp Trap	Summer	4A	763116	6417686
Harp Trap	Summer	4A	763110	6417720
Harp Trap	Summer	4A	762948	6418146
Harp Trap	Summer	4A	762918	6418165
Harp Trap	Summer	4B	763594	6417012
Harp Trap	Summer	4B	763622	6416963
Harp Trap	Summer	4B	763633	6416941
Harp Trap	Summer	4B	763639	6416933
Harp Trap	Summer	4B	763620	6417004
Harp Trap	Summer	4B	763624	6416956
Harp Trap	Summer	4B	763567	6416932
Harp Trap	Summer	4B	763672	6416972
Harp Trap	Summer	4C	763748	6418125
Harp Trap	Summer	4D	764276	6416781
Harp Trap	Summer	4D	764290	6416762
Harp Trap	Summer	4D	764278	6416791
Harp Trap	Summer	4D	764277	6416785
Harp Trap	Summer	4D	764293	6416764
Harp Trap	Summer	4D	764253	6416827
Harp Trap	Summer	4D	764291	6416769

Technique	Season	Site	Easting	Northing
Harp Trap	Summer	4D	764294	6416756
Harp Trap	Summer	4D	764256	6416824
Harp Trap	Summer	4D	764275	6416804
Harp Trap	Summer	4D	764272	6416768
Harp Trap	Summer	4D	764272	6416799
Harp Trap	Summer	4D	764255	6416763
Harp Trap	Summer	4D	764219	6416870
Harp Trap	Summer	4D	764161	6416905
Harp Trap	Summer	4D	764278	6416789
Harp Trap	Summer	4D	764163	6416895
Harp Trap	Summer	4D	764281	6416788
Harp Trap	Summer	4D	764245	6416722
Harp Trap	Summer	4D	764161	6417033
Harp Trap	Summer	4E	765113	6414903
Harp Trap	Summer	4E	765102	6414909
Harp Trap	Summer	4E	765171	6414900
Harp Trap	Summer	4E	765136	6414871
Harp Trap	Summer	4E	765156	6414860
Harp Trap	Summer	4E	765165	6414922
Harp Trap	Summer	4E	765214	6415148
Harp Trap	Summer	4E	765180	6415160
Harp Trap	Summer	4H	764903	6413375
Harp Trap	Summer	4H	764751	6414045
Harp Trap	Summer	4H	764930	6413391
Harp Trap	Summer	4H	764979	6413403
Harp Trap	Summer	4H	764937	6413425
Harp Trap	Summer	4H	765020	6413365
Harp Trap	Summer	4H	764966	6413430
Harp Trap	Summer	4H	764997	6413347
Harp Trap	Summer	4I	765001	6411593
Harp Trap	Summer	4I	764991	6411741
Harp Trap	Summer	4I	765052	6411717
Harp Trap	Summer	4I	765006	6411732
Harp Trap	Summer	4I	765130	6411700
Harp Trap	Summer	4I	765048	6411607
Harp Trap	Summer	4I	765078	6411607
Harp Trap	Summer	4I	764973	6411772
Harp Trap	Summer	4I	765115	6411702
Harp Trap	Summer	4J	762645	6413726
Harp Trap	Summer	4J	762626	6413805
Harp Trap	Summer	4J	762635	6413706
Harp Trap	Summer	4J	762581	6413973
Harp Trap	Summer	4J	762578	6414027
Harp Trap	Summer	4J	762572	6414070
Harp Trap	Summer	4J	762575	6414113
Harp Trap	Summer	4J	762603	6414122

Technique	Season	Site	Easting	Northing
Harp Trap	Summer	4J	762597	6414059
Harp Trap	Summer	4J	762648	6413729
Harp Trap	Summer	4J	762627	6413808
Harp Trap	Summer	4J	762638	6413705
Harp Trap	Summer	4J	762622	6413680
Harp Trap	Summer	4J	762611	6414148
Harp Trap	Summer	4J	762608	6414113
Harp Trap	Summer	4J	762628	6413803
Harp Trap	Summer	4J	762643	6413793
Harp Trap	Summer	4J	762637	6413766
Harp Trap	Summer	4J	762635	6413702
Harp Trap	Summer	4J	762615	6413683
Harp Trap	Summer	4J	762617	6413665
Harp Trap	Summer	4K	763194	6413041
Harp Trap	Summer	4K	763261	6413132
Harp Trap	Summer	4K	763183	6412962
Harp Trap	Summer	4K	763268	6413143
Harp Trap	Summer	4K	763192	6413029
Harp Trap	Summer	4K	763216	6413021
Harp Trap	Summer	4K	763179	6412955
Harp Trap	Summer	4K	763291	6413174
Harp Trap	Summer	4K	763186	6413001
Harp Trap	Summer	4K	763196	6412972
Harp Trap	Summer	4K	763114	6412674
Harp Trap	Summer	4K	763085	6412772
Harp Trap	Summer	4K	763124	6412669
Harp Trap	Summer	4K	763119	6412801
Harp Trap	Summer	4K	763127	6412663
Harp Trap	Summer	4K	763103	6412809
Harp Trap	Summer	4K	763202	6413310
Harp Trap	Summer	4Z	762718	6411960
Harp Trap	Summer	4Z	762785	6412048
Harp Trap	Summer	4Z	762694	6411965
Remote Camera	Autumn/Winter	TC01	763167	6412164
Remote Camera	Autumn/Winter	TC02	764380	6417161
Remote Camera	Autumn/Winter	TC03	762538	6413181
Remote Camera	Autumn/Winter	TC04	764400	6413353
Remote Camera	Autumn/Winter	TC05	763351	6413188
Remote Camera	Autumn/Winter	TC06	763788	6412526
Remote Camera	Autumn/Winter	TC07	764517	6412588
Remote Camera	Autumn/Winter	TC08	765062	6412230
Remote Camera	Autumn/Winter	TC09	762478	6411972
Remote Camera	Autumn/Winter	TC10	763532	6413477
Remote Camera	Autumn/Winter	TC11	765143	6411864
Remote Camera	Autumn/Winter	TC12	765768	6412004
Remote Camera	Autumn/Winter	TC13	766018	6412041

Technique	Season	Site	Easting	Northing
Remote Camera	Autumn/Winter	TC14	765775	6413106
Remote Camera	Autumn/Winter	TC15	765415	6413164
Remote Camera	Autumn/Winter	TC16	765256	6413566
Remote Camera	Autumn/Winter	TC17	762839	6412102
Remote Camera	Autumn/Winter	TC18	765119	6414188
Remote Camera	Autumn/Winter	TC19	765066	6414445
Remote Camera	Autumn/Winter	TC20	765076	6414888
Remote Camera	Autumn/Winter	TC21	765185	6415317
Remote Camera	Autumn/Winter	TC22	764818	6415677
Remote Camera	Autumn/Winter	TC23	764465	6415906
Remote Camera	Autumn/Winter	TC24	764196	6416163
Remote Camera	Autumn/Winter	TC25	764247	6416762
Remote Camera	Autumn/Winter	TC26	764048	6416993
Remote Camera	Autumn/Winter	TC27	764155	6417388
Remote Camera	Autumn/Winter	TC28	763926	6417675
Remote Camera	Autumn/Winter	TC29	763618	6418078
Remote Camera	Autumn/Winter	TC30	763437	6417760
Remote Camera	Autumn/Winter	TC31	763059	6418116
Remote Camera	Autumn/Winter	TC32	762479	6418652
Remote Camera	Autumn/Winter	TC33	763069	6417005
Remote Camera	Autumn/Winter	TC34	762121	6412861
Remote Camera	Autumn/Winter	TC35	762745	6418302
Remote Camera	Autumn/Winter	TC36	762707	6414117
Remote Camera	Autumn/Winter	TC37	763527	6417004
Remote Camera	Autumn/Winter	TC38	763222	6417486
Remote Camera	Autumn/Winter	TC39	764008	6416203
Remote Camera	Autumn/Winter	TC40	764285	6415267
Remote Camera	Autumn/Winter	TC41	764356	6414842
Remote Camera	Autumn/Winter	TC42	764523	6414256
Remote Camera	Autumn/Winter	TC43	764860	6414060
Remote Camera	Autumn/Winter	TC44	764816	6413781
Remote Camera	Autumn/Winter	TC45	763183	6412560
Remote Camera	Autumn/Winter	TC46	764920	6413276
Remote Camera	Autumn/Winter	TC47	765141	6412985
Remote Camera	Autumn/Winter	TC48	765728	6412615
Remote Camera	Autumn/Winter	TC49	766287	6412419
Remote Camera	Autumn/Winter	TC50	762676	6413668
Remote Camera	Autumn/Winter	TC51	762694	6413961
Remote Camera	Autumn/Winter	TC52	762312	6413126
Remote Camera	Autumn/Winter	TC53	764126	6416169
Remote Camera	Autumn/Winter	TC54	764332	6415907
Remote Camera	Autumn/Winter	TC55	764731	6415694
Remote Camera	Autumn/Winter	TC56	765134	6415181
Remote Camera	Autumn/Winter	TC57	765136	6414943
Remote Camera	Autumn/Winter	TC58	764741	6413971
Remote Camera	Autumn/Winter	TC59	765507	6412853

Technique	Season	Site	Easting	Northing
Remote Camera	Autumn/Winter	TC60	765937	6412453
Remote Camera	Spring/Summer	CAM0	763454	6417923
Remote Camera	Spring/Summer	CAM1	764288	6417094
Remote Camera	Spring/Summer	CAM10	763059	6413249
Remote Camera	Spring/Summer	CAM11	762753	6415225
Remote Camera	Spring/Summer	CAM12	763818	6412539
Remote Camera	Spring/Summer	CAM13	762648	6414205
Remote Camera	Spring/Summer	CAM2	764123	6416829
Remote Camera	Spring/Summer	CAM3	764234	6416161
Remote Camera	Spring/Summer	CAM4	765206	6415300
Remote Camera	Spring/Summer	CAM5	765084	6414830
Remote Camera	Spring/Summer	CAM6	765131	6414466
Remote Camera	Spring/Summer	CAM7	765167	6411830
Remote Camera	Spring/Summer	CAM8	763125	6412486
Remote Camera	Spring/Summer	CAM9	762035	6412087
Standard Call Playback	Autumn/Winter	CPB01	763161	6412176
Standard Call Playback	Autumn/Winter	CPB01b	762068	6412102
Standard Call Playback	Autumn/Winter	CPB02	763978	6412721
Standard Call Playback	Autumn/Winter	CPB03	764884	6413401
Standard Call Playback	Autumn/Winter	CPB04	764973	6411886
Standard Call Playback	Autumn/Winter	CPB05	765890	6412790
Standard Call Playback	Autumn/Winter	CPB05b	763483	6416046
Standard Call Playback	Autumn/Winter	CPB06	763620	6417009
Standard Call Playback	Autumn/Winter	CPB07	764306	6415993
Standard Call Playback	Autumn/Winter	CPB08	765102	6415380
Standard Call Playback	Autumn/Winter	CPB09	764967	6414372
Standard Call Playback	Autumn/Winter	CPB10	762821	6415136
Standard Call Playback	Autumn/Winter	CPB11	762731	6414123
Standard Call Playback	Autumn/Winter	CPB12	763112	6413157
Non-Standard Call Playback	Autumn/Winter	CPBX01	763670	6412322
Non-Standard Call Playback	Autumn/Winter	CPBX02	764126	6416838
Non-Standard Call Playback	Autumn/Winter	CPBX03	765026	6415474
Non-Standard Call Playback	Autumn/Winter	CPBX04	764942	6415530
Non-Standard Call Playback	Autumn/Winter	CPBX05	764311	6417065
Non-Standard Call Playback	Autumn/Winter	CPBX07	764174	6412475
Non-Standard Call Playback	Autumn/Winter	CPBX06	764015	6417492
Hollow Monitoring	Winter	FO1	765411	6413303
Hollow Monitoring	Winter	FO2	765443	6413277
Hollow Monitoring	Winter	FO6 #	764942	6413456
Hollow Monitoring	Winter	FO7	764805	6413490
Hollow Monitoring	Winter	FO8	764748	6413508
Hollow Monitoring	Winter	FO9	764612	6413955
Hollow Monitoring	Winter	FO10 #	764501	6414275
Hollow Monitoring	Winter	FO11 #	764494	6414283
Hollow Monitoring	Winter	FO12	765124	6414338
Hollow Monitoring	Winter*	FO13	-	-

Technique	Season	Site	Easting	Northing
Hollow Monitoring	Winter	FO14	765199	6414393
Hollow Monitoring	Winter	FO15 #	765221	6414376
Hollow Monitoring	Winter	FO16 #	765192	6415363
Hollow Monitoring	Winter	FO17 #	765196	6415347
Hollow Monitoring	Winter	FO18 #	765275	6414026
Hollow Monitoring	Winter	FO19 #	765194	6415319
Hollow Monitoring	Winter	FO20	764088	6416873
Hollow Monitoring	Winter	FO21	764129	6416855
Hollow Monitoring	Winter	FO22	764134	6416843
Hollow Monitoring	Winter	FO23	764142	6416830
Hollow Monitoring	Winter	FO24	764200	6416763
Hollow Monitoring	Winter	FO25	764238	6416738
Hollow Monitoring	Winter	FO26 #	764273	6416733
Hollow Monitoring	Winter	FO27	764292	6416702
Hollow Monitoring	Winter	FO28	764285	6416676
Hollow Monitoring	Winter	FO29	764251	6416667
Hollow Monitoring	Winter	FO30	764209	6416479
Hollow Monitoring	Winter	FO31	763140	6413290
Hollow Monitoring	Winter	FO32	763059	6412658
Hollow Monitoring	Winter	FO33	762936	6413086
Hollow Monitoring	Winter	FO34	762972	6413132
Hollow Monitoring	Winter	FO35	762514	6413669
Hollow Monitoring	Winter	FO36	762526	6413681
Hollow Monitoring	Winter	FO37	762583	6413701
Hollow Monitoring	Winter	FO38	762593	6413704
Hollow Monitoring	Winter	FO39	762602	6414121
Hollow Monitoring	Winter	FO40	762617	6414177
Hollow Monitoring	Winter	FO41	762632	6414227
Hollow Monitoring	Winter	FO42	762622	6414282
Hollow Monitoring	Winter	FO43	762537	6414385
Hollow Monitoring	Winter	FO44	762514	6414393
Hollow Monitoring	Winter	FO45	762629	6414431
Hollow Monitoring	Winter	FO46 #	765198	6411882
Hollow Monitoring	Winter	FO47 #	765187	6411852
Hollow Monitoring	Winter	FO48	765135	6411708
Hollow Monitoring	Winter	FO49 #	764894	6411674
Hollow Monitoring	Winter	FO50	764865	6411662
Hollow Monitoring	Winter	FO51	764866	6411715
Hollow Monitoring	Winter	FO52	764810	6411816
Hollow Monitoring	Winter	FO53	764806	6411821
Hollow Monitoring	Winter	FO54	764771	6411841
Hollow Monitoring	Winter	FO55 #	765132	6413240
Hollow Monitoring	Winter	FO56	765070	6413159
Hollow Monitoring	Winter	FO57	765187	6414341
Hollow Monitoring	Winter	FO58	765237	6414343
Hollow Monitoring	Winter	FO59	764075	6416928

Technique	Season	Site	Easting	Northing
Hollow Monitoring	Winter	FO60	764142	6416891
Hollow Monitoring	Winter	FO61	764153	6416869
Hollow Monitoring	Winter	FO62	764243	6416789
Hollow Monitoring	Winter	FO63 #	764302	6416706
Hollow Monitoring	Winter	FO64 #	764303	6416710
Hollow Monitoring	Winter	FO65	764356	6416677
Hollow Monitoring	Winter	FO66	764295	6416655
Hollow Monitoring	Winter	FO67	764227	6416443
Hollow Monitoring	Winter	FO68	764249	6416424
Hollow Monitoring	Winter	FO69	764254	6416300
Hollow Monitoring	Winter	FO70	764426	6416087
Hollow Monitoring	Winter	FO71	764457	6416058
Hollow Monitoring	Winter	FO72 #	764428	6415966
Hollow Monitoring	Winter	FO73 #	764479	6415902
Hollow Monitoring	Winter	FO74 #	764565	6415894
Hollow Monitoring	Winter	FO75	763098	6413000
Hollow Monitoring	Winter	FO76	763072	6412838
Hollow Monitoring	Winter	FO77	762934	6413083
Hollow Monitoring	Winter	FO78	762991	6413213
Hollow Monitoring	Winter	FO79	762536	6413532
Hollow Monitoring	Winter	FO80	762568	6413571
Hollow Monitoring	Winter	FO81	762603	6413675
Hollow Monitoring	Winter	FO82	762574	6413902
Hollow Monitoring	Winter	FO83	762645	6414230
Hollow Monitoring	Winter	FO84	762357	6414413
Hollow Monitoring	Winter	FO85	762364	6414464
Hollow Monitoring	Winter	FO86	762603	6414480
Hollow Monitoring	Winter	FO87	762636	6414448
Hollow Monitoring	Winter	FO88	762707	6414398
Hollow Monitoring	Winter	FO89 #	764976	6411739
Hollow Monitoring	Winter	FO90	764861	6411791
Hollow Monitoring	Winter	FO91	764816	6411849
Hollow Monitoring	Winter	FO92	764713	6411814
Hollow Monitoring	Winter	FO93	764666	6411950
Hollow Monitoring	Winter	FO94	764542	6412023
Hollow Monitoring	Winter	FO95 #	764437	6413229
Hollow Monitoring	Winter	FO96 #	763862	6412581
Hollow Monitoring	Winter	FO97 #	763892	6412558
Hollow Monitoring	Winter	FO98	764264	6412600
Hollow Monitoring	Winter	FO99 #	764261	6412570
Hollow Monitoring	Winter	FO100 #	764240	6412485
Hollow Monitoring	Winter	FO101 #	764232	6412412
Hollow Monitoring	Winter	FO102	765230	6412979
Hollow Monitoring	Winter	FO103	762560	6415171
Hollow Monitoring	Winter	FO104	763575	6416999
Hollow Monitoring	Winter	FO105	763470	6417112

Technique	Season	Site	Easting	Northing
Hollow Monitoring	Winter	FO106	763131	6417599
Hollow Monitoring	Winter	FO107	763532	6417982
Hollow Monitoring	Winter	FO108	763594	6418049
Hollow Monitoring	Winter	FO109	763739	6418097
Hollow Monitoring	Winter	FO110	765265	6413022
Hollow Monitoring	Winter	FO111 #	764926	6413493
Hollow Monitoring	Winter	FO112 #	764527	6414254
Hollow Monitoring	Winter	FO113 #	765303	6413744
Hollow Monitoring	Winter	FO114	765318	6413752
Hollow Monitoring	Winter	FO115	765330	6413768
Hollow Monitoring	Winter	FO116	765320	6413825
Hollow Monitoring	Winter	FO117 #	765258	6413996
Hollow Monitoring	Winter*	FO118	-	-
Hollow Monitoring	Winter	FO119	765268	6414060
Hollow Monitoring	Winter	FO120	765246	6414272
Hollow Monitoring	Winter	FO121 #	765260	6414394
Hollow Monitoring	Winter	FO122 #	765261	6414414
Hollow Monitoring	Winter	FO123 #	765202	6414438
Hollow Monitoring	Winter	FO124 #	765185	6414630
Hollow Monitoring	Winter	FO125 #	765183	6414647
Hollow Monitoring	Winter	FO126 #	765183	6414695
Hollow Monitoring	Winter	FO127 #	765183	6414692
Hollow Monitoring	Winter	FO128 #	765353	6415032
Hollow Monitoring	Winter*	FO129	-	-
Hollow Monitoring	Winter	FO130	765424	6415240
Hollow Monitoring	Winter	FO131	765369	6415279
Hollow Monitoring	Winter	FO132 #	765090	6414819
Hollow Monitoring	Winter	FO133 #	764114	6416923
Hollow Monitoring	Winter*	FO134	-	-
Hollow Monitoring	Winter	FO135 #	764134	6416934
Hollow Monitoring	Winter	FO136	764256	6416827
Hollow Monitoring	Winter	FO137	764279	6416743
Hollow Monitoring	Winter	FO138	764327	6416730
Hollow Monitoring	Winter	FO139	764359	6416687
Hollow Monitoring	Winter	FO140	764368	6416682
Hollow Monitoring	Winter	FO141	764367	6416674
Hollow Monitoring	Winter	FO142	764234	6416555
Hollow Monitoring	Winter	FO143	764238	6416546
Hollow Monitoring	Winter	FO144	764233	6416520
Hollow Monitoring	Winter	FO145	764257	6416494
Hollow Monitoring	Winter	FO146	764285	6416484
Hollow Monitoring	Winter	FO147	764273	6416472
Hollow Monitoring	Winter*	FO148	-	-
Hollow Monitoring	Winter	FO149	764264	6416469
Hollow Monitoring	Winter	FO150 #	764521	6415919
Hollow Monitoring	Winter	FO151	764677	6415879

Technique	Season	Site	Easting	Northing
Hollow Monitoring	Winter	FO152	764714	6415882
Hollow Monitoring	Winter	FO153	764833	6415817
Hollow Monitoring	Winter	FO154 #	764830	6415705
Hollow Monitoring	Winter	FO155 #	764947	6415668
Hollow Monitoring	Winter	FO156	763425	6413533
Hollow Monitoring	Winter	FO157	763186	6413135
Hollow Monitoring	Winter	FO158	763136	6413049
Hollow Monitoring	Winter	FO159	763157	6412964
Hollow Monitoring	Winter	FO160	763116	6412890
Hollow Monitoring	Winter	FO161	762880	6413199
Hollow Monitoring	Winter	FO162	762970	6413218
Hollow Monitoring	Winter	FO163	763263	6413305
Hollow Monitoring	Winter	FO164	762302	6413176
Hollow Monitoring	Winter	FO165	762016	6412643
Hollow Monitoring	Winter	FO166	761867	6412592
Hollow Monitoring	Winter*	FO167	-	-
Hollow Monitoring	Winter	FO168	761905	6412561
Hollow Monitoring	Winter	FO169	761925	6412304
Hollow Monitoring	Winter	FO170	761961	6412286
Hollow Monitoring	Winter	FO171	761983	6412295
Hollow Monitoring	Winter	FO172	762171	6411898
Hollow Monitoring	Winter	FO173	762227	6411958
Hollow Monitoring	Winter	FO174	762275	6411950
Hollow Monitoring	Winter	FO175	761963	6412358
Hollow Monitoring	Winter	FO176	763232	6416791
Hollow Monitoring	Winter	FO177	763203	6416792
Hollow Monitoring	Winter	FO178	763160	6416797
Hollow Monitoring	Winter	FO179	763574	6418098
Hollow Monitoring	Winter	FO180	763565	6418127
Hollow Monitoring	Winter	FO181	763626	6418119
Hollow Monitoring	Winter	FO182	763643	6418144
Hollow Monitoring	Winter	FO183	763730	6418123
Hollow Monitoring	Winter	FO184	763738	6418141
Hollow Monitoring	Winter	FO185	763778	6418120
Hollow Monitoring	Winter	FO186	763857	6418107
Hollow Monitoring	Winter	FO195	764109	6416970
Hollow Monitoring	Winter	FO196	764254	6417018
Hollow Monitoring	Winter	FO197	764279	6417009
Hollow Monitoring	Winter	FO198	764309	6417020
Hollow Monitoring	Winter	FO199	764297	6416995
Hollow Monitoring	Winter	FO200	762951	6413648
Hollow Monitoring	Winter	FO201	764369	6417124
Hollow Monitoring	Winter	FO202	764364	6417133
Hollow Monitoring	Winter	FO203	764351	6417185
Hollow Monitoring	Winter	FO204	764336	6417180
Hollow Monitoring	Winter	FO205	764377	6417192

Technique	Season	Site	Easting	Northing
Hollow Monitoring	Winter	FO206	764378	6417220
Hollow Monitoring	Winter	FO207	764397	6417282
Hollow Monitoring	Winter	FO208	764391	6417298
Hollow Monitoring	Winter	FO209	764264	6417374
Hollow Monitoring	Winter	FO210	764251	6417360
Hollow Monitoring	Winter	FO211	764206	6417359
Hollow Monitoring	Winter	FO222	764693	6411817
Hollow Monitoring	Winter	FO223	764660	6411959
Hollow Monitoring	Winter	FO224	764646	6411957
Hollow Monitoring	Winter	FO225	764607	6411988
Hollow Monitoring	Winter	FO226	764576	6411984
Hollow Monitoring	Winter	FO227	764487	6412058
Hollow Monitoring	Winter	FO228	764823	6412257
Hollow Monitoring	Winter	FO229	764020	6413062
Hollow Monitoring	Winter	FO230 #	763832	6412573
Hollow Monitoring	Winter	FO231	763850	6412561
Hollow Monitoring	Winter	FO232 #	763892	6412548
Hollow Monitoring	Winter	FO233	763906	6412550
Hollow Monitoring	Winter	FO234	763978	6412515
Hollow Monitoring	Winter	FO235	763978	6412507
Hollow Monitoring	Winter	FO236 #	764278	6412609
Hollow Monitoring	Winter	FO237 #	764270	6412604
Hollow Monitoring	Winter	FO238 #	764289	6412562
Hollow Monitoring	Winter	FO239 #	764275	6412516
Hollow Monitoring	Winter	FO240 #	764238	6412415
Hollow Monitoring	Winter	FO241	762724	6415329
Hollow Monitoring	Winter	FO242	762724	6415234
Hollow Monitoring	Winter	FO243	762711	6415235
Hollow Monitoring	Winter	FO244	762705	6415228
Hollow Monitoring	Winter*	FO245	-	-
Hollow Monitoring	Winter	FO246	763546	6416123
Hollow Monitoring	Winter	FO247 #	763472	6416059
Hollow Monitoring	Winter	FO248 #	763523	6416053
Hollow Monitoring	Winter	FO249 #	763569	6416073
Hollow Monitoring	Winter	FO250 #	763635	6416066
Hollow Monitoring	Winter	FO251	763457	6417193
Hollow Monitoring	Winter	FO252	763422	6417271
Hollow Monitoring	Winter	FO253	762578	6418181
Hollow Monitoring	Winter	FO254	762572	6418162
Hollow Monitoring	Winter	FO255	763443	6417902
Hollow Monitoring	Winter	FO256	763667	6418143
Hollow Monitoring	Winter	FO257	763803	6418073
Hollow Monitoring	Winter	FO258	763893	6418051
Hollow Monitoring	Winter	FO259	763939	6417800
Hollow Monitoring	Winter	FO260	764056	6417580
Hollow Monitoring	Winter	FO261	762288	6413481

Technique	Season	Site	Easting	Northing
Hollow Monitoring	Winter	FO263 #	764063	6416956
Hollow Monitoring	Winter	FO264 #	764073	6416961
Hollow Monitoring	Winter	FO265	764106	6416987
Hollow Monitoring	Winter	FO266	764272	6417042
Hollow Monitoring	Winter	FO267	765218	6412620
Hollow Monitoring	Winter	FO268	763590	6412955
Hollow Monitoring	Winter	FO269	763505	6412984
Hollow Monitoring	Winter	FO270	763654	6413358
Hollow Monitoring	Winter	FO271	763739	6418065
Hollow Monitoring	Winter	FO272	763908	6417996
Hollow Monitoring	Winter	FO273	763957	6417941
Hollow Monitoring	Winter	FO274	763963	6417893
Hollow Monitoring	Winter	FO275	764042	6416975
Hollow Monitoring	Winter	FO276	764269	6417227
Hollow Monitoring	Winter	FO277	763400	6413013
Hollow Monitoring	Winter	FO278	763477	6413069
Hollow Monitoring	Winter	FO279	764269	6417179
Hollow Monitoring	Winter	FO280	764261	6417219
Hollow Monitoring	Winter	FO281	764102	6417318
Hollow Monitoring	Winter	FO282	764147	6417380
Hollow Monitoring	Winter	FO300	764332	6417265
Hollow Monitoring	Winter	FO301	764342	6417286
Hollow Monitoring	Winter	FO302	764170	6417337
Hollow Monitoring	Winter	FO303	764150	6417417
Hollow Monitoring	Winter	FO304	764129	6417475
Pitfall - Elliott - Funnel Traps	Spring/Summer	PEF01	764254	6416725
Pitfall - Elliott - Funnel Traps	Spring/Summer	PEF02	762091	6411978
Spotlight	Spring/Summer	SP01	762185	6411989
Spotlight	Spring/Summer	SP02	762336	6411998
Spotlight	Summer	SP03	764131	6416738
Spotlight	Summer	SP04	765008	6414354
Scat Transect	Summer	BTRW1	763966	6412494
Scat Transect	Summer	BTRW2	764228	6417036
Scat Transect	Summer	BTRW3	764433	6417181
Scat Transect	Summer	BTRW4	764064	6417988
Habitat Assessment	Spring/Summer	HAB22	764552	6415428
Habitat Assessment	Spring/Summer	HAB23	762035	6412087
Habitat Assessment	Spring/Summer	HAB24	763059	6413249
Habitat Assessment	Spring/Summer	HAB25	762648	6414205
Habitat Assessment	Spring/Summer	HAB26	762213	6412277
Habitat Assessment	Spring/Summer	HAB27	762445	6413189
Habitat Assessment	Spring/Summer	HAB28	764234	6416161
Habitat Assessment	Spring/Summer	HAB29	765206	6415300
Habitat Assessment	Spring/Summer	HAB30	765131	6414466
Habitat Assessment	Spring/Summer	HAB31	765111	6414294
Habitat Assessment	Spring/Summer	HAB32	765183	6415170

Technique	Season	Site	Easting	Northing
Habitat Assessment	Spring/Summer	HAB33	763618	6416074
Habitat Assessment	Spring/Summer	HAB34	763454	6417923
Habitat Assessment	Spring/Summer	HAB35	764288	6417094
Habitat Assessment	Spring/Summer	HAB36	765171	6411824
Habitat Assessment	Spring/Summer	HAB37	765231	6412017
Habitat Assessment	Spring/Summer	HAB38	763893	6418034
Habitat Assessment	Spring/Summer	HAB39	762925	6414772
Habitat Assessment	Spring/Summer	HAB40	762661	6414176
Habitat Assessment	Spring/Summer	HAB41	763809	6416637
Habitat Assessment	Spring/Summer	HAB42	764131	6416838
Habitat Assessment	Spring/Summer	HAB43	764652	6414506
Habitat Assessment	Spring/Summer	HAB44	763131	6416901
Habitat Assessment	Spring/Summer	HAB45	763154	6416781
Habitat Assessment	Spring/Summer	HAB46	763570	6414648
Habitat Assessment	Spring/Summer	HAB01	762072	6418185
Habitat Assessment	Spring/Summer	HAB02	762001	6418519
Habitat Assessment	Spring/Summer	HAB03	762370	6413370
Habitat Assessment	Spring/Summer	HAB04	762905	6412672
Habitat Assessment	Spring/Summer	HAB05	762480	6412358
Habitat Assessment	Spring/Summer	HAB06	763355	6413366
Habitat Assessment	Spring/Summer	HAB07	763602	6413606
Habitat Assessment	Spring/Summer	HAB08	763864	6412702
Habitat Assessment	Spring/Summer	HAB09	764255	6413192
Habitat Assessment	Spring/Summer	HAB10	764453	6412747
Habitat Assessment	Spring/Summer	HAB11	765324	6412385
Habitat Assessment	Spring/Summer	HAB12	764989	6413383
Habitat Assessment	Spring/Summer	HAB13	765469	6413080
Habitat Assessment	Spring/Summer	HAB14	764082	6414808
Habitat Assessment	Spring/Summer	HAB15	764162	6417007
Habitat Assessment	Spring/Summer	HAB16	763927	6417312
Habitat Assessment	Spring/Summer	HAB17	763572	6416979
Habitat Assessment	Spring/Summer	HAB18	763777	6415515
Habitat Assessment	Spring/Summer	HAB19	763371	6413790
Habitat Assessment	Spring/Summer	HAB20	762814	6415250
Habitat Assessment	Spring/Summer	HAB21	762382	6414029
Habitat Assessment	Spring/Summer	HAB47	763841	6412575

Note: # indicates hollow-bearing tree was monitored for one night for the Masked Owl.
* indicates that GPS coordinates were not recorded for the potential nest tree (due to technical issues).

Appendix B: Fauna species list

Class	Family	Common Name	Scientific name	Conservation Status	
				BC Act[1]	EPBC Act[2]
Amphibia	Limnodynastidae	Eastern Banjo Frog	*Limnodynastes dumerilii*	-	-
		Spotted Grass Frog	*Limnodynastes tasmaniensis*	-	-
		Sudell's Frog	*Neobatrachus sudelli*	-	-
	Myobatrachidae	Common Eastern Froglet	*Crinia signifera*	-	-
		Brown Toadlet	*Pseudophryne bibronii*	-	-
		Smooth Toadlet	*Uperoleia laevigata*	-	-
		Wrinkled Toadlet	*Uperoleia rugosa*	-	-
	Hylidae	Eastern Dwarf Tree Frog	*Litoria fallax*	-	-
		Broad-Palmed Frog	*Litoria latopalmata*	-	-
		Peron's Tree Frog	*Litoria peronii*	-	-
Reptilia	Diplodactylidae	Lesueur's Velvet Gecko	*Amalosia lesueurii*	-	-
		Eastern Stone Gecko	*Diplodactylus vittatus*	-	-
	Carphodactylidae	Broad-tailed Gecko	*Phyllurus platurus*	-	-
		Southern Leaf-tailed Gecko	*Saltuarius swaini*	-	-
		Common Thick-tailed Gecko	*Underwoodisaurus milii*	-	-
	Pygopodidae	Pink-tailed Legless Lizard	*Aprasia parapulchella*	V	V
		Leaden Delma	*Delma plebeia*	-	-
	Scincidae	Red-throated Skink	*Acritoscincus platynotum*	-	-
		Two-clawed Worm-skink	*Anomalopus leuckartii*	-	-
		Eastern Striped Ctenotus	*Ctenotus robustus*	-	-
		Copper-tailed Skink	*Ctenotus taeniolatus*	-	-
		Grass Skink	*Lampropholis guichenoti*	-	-
		Bougainville's Slider	*Lerista bougainvillii*	-	-
		Tree-base Litter-skink	*Lygisaurus foliorum*	-	-
		Boulenger's Morethia	*Morethia boulengeri*	-	-
	Varanidae	Gould's Goanna	*Varanus gouldii*	-	-
		Lace Monitor	*Varanus varius*	-	-
	Typhlopidae	Blackish Blind Snake	*Anilios nigrescens*	-	-
	Elapidae	Yellow-faced Whipsnake	*Demansia psammophis*	-	-
		Broad-headed Snake	*Hoplocephalus bungaroides*	E	V
		Dwyer's Snake	*Suta dwyeri*	-	-
		Red-bellied Black Snake (Skin)	*Pseudechis porphyriacus*	-	-
		Eastern Brown Snake	*Pseudonaja textilis*	-	-
		Common Bandy Bandy	*Vermicella annulata*	-	-
Aves	Casuariidae	Emu	*Dromaius novaehollandiae*	-	-
	Phasianidae	Stubble Quail	*Coturnix pectoralis*	-	M
		Brown Quail	*Synoicus ypsilophorus*	-	-
	Anatidae	Grey Teal	*Anas gracilis*	-	-
		Pacific Black Duck	*Anas superciliosa*	-	-
		Australian Wood Duck	*Chenonetta jubata*	-	-
	Podicipedidae	Australasian Grebe	*Tachybaptus novaehollandiae*	-	-

Class	Family	Common Name	Scientific name	Conservation Status	
				BC Act[1]	EPBC Act[2]
	Ardeidae	White-necked Heron	*Ardea pacifica*	-	-
		White-faced Heron	*Egretta novaehollandiae*	-	-
	Falconidae	Brown Falcon	*Falco berigora*	-	-
		Nankeen Kestrel	*Falco cenchroides*	-	M
		Australian Hobby	*Falco longipennis*	-	-
		Peregrine Falcon	*Falco peregrinus*	-	-
		Black Falcon	*Falco subniger*	V	-
	Accipitridae	Brown Goshawk	*Accipiter fasciatus*	-	M
		Grey Goshawk	*Accipiter novaehollandiae*	-	-
		Wedge-tailed Eagle	*Aquila audax*	-	-
		Black-Shouldered Kite	*Elanus axillaris*	-	-
		Little Eagle	*Hieraaetus morphnoides*	V	-
	Rallidae	Buff-banded Rail	*Hypotaenidia philippensis*	-	M
	Turnicidae	Painted Button-quail	*Turnix varius*	-	-
	Charadriidae	Black-fronted Dotterel	*Elseyornis melanops*	-	-
		Masked Lapwing	*Vanellus miles*	-	-
	Columbidae	Bar-shouldered Dove	*Geopelia humeralis*	-	-
		Peaceful Dove	*Geopelia placida*	-	-
		Wonga Pigeon	*Leucosarcia melanoleuca*	-	-
		Crested Pigeon	*Ocyphaps lophotes*	-	-
		Common Bronzewing	*Phaps chalcoptera*	-	-
	Psittaculidae	Australian King-Parrot	*Alisterus scapularis*	-	-
	Cacatuidae	Sulphur-crested Cockatoo	*Cacatua galerita*	-	-
		Gang-gang Cockatoo	*Callocephalon fimbriatum*	V	E
		Galah	*Eolophus roseicapilla*	-	-
	Psittaculidae	Musk Lorikeet	*Glossopsitta concinna*	-	-
		Little Lorikeet	*Glossopsitta pusilla*	V	-
		Eastern Rosella	*Platycercus eximius*	-	-
		Red-rumped Parrot	*Psephotus haematonotus*	-	-
	Cacatuidae	Yellow-tailed Black-Cockatoo	*Zanda funereus*	-	-
	Cuculidae	Fan-tailed Cuckoo	*Cacomantis flabelliformis*	-	M
		Brush Cuckoo	*Cacomantis variolosus*	-	-
		Horsfield's Bronze-Cuckoo	*Chalcites basalis*	-	M
		Eastern Koel	*Eudynamys orientalis*	-	-
		Channel-billed Cuckoo	*Scythrops novaehollandiae*	-	M
	Tytonidae	Barn Owl	*Tyto alba*	-	-
		Masked Owl	*Tyto novaehollandiae*	V	-
	Strigidae	Southern Boobook	*Ninox boobook*	-	-
		Powerful Owl	*Ninox strenua*	V	-
	Podargidae	Tawny Frogmouth	*Podargus strigoides*	-	-
	Eurostopodidae	White-throated Nightjar	*Eurostopodus mystacalis*	-	M
	Aegothelidae	Australian Owlet-nightjar	*Aegotheles cristatus*	-	-
	Alcedinidae	Laughing Kookaburra	*Dacelo novaeguineae*	-	-
		Sacred Kingfisher	*Todiramphus sanctus*	-	M
	Meropidae	Rainbow Bee-eater	*Merops ornatus*	-	M
	Menuridae	Superb Lyrebird	*Menura novaehollandiae*	-	-

Class	Family	Common Name	Scientific name	Conservation Status	
				BC Act[1]	EPBC Act[2]
	Climacteridae	Red-browed Treecreeper	*Climacteris erythrops*	-	-
		Brown Treecreeper (eastern subspecies)	*Climacteris picumnus victoriae*	V	V
		White-throated Treecreeper	*Cormobates leucophaea*	-	-
	Maluridae	Superb Fairy-wren	*Malurus cyaneus*	-	-
	Pardalotidae	Spotted Pardalote	*Pardalotus punctatus*	-	-
		Striated Pardalote	*Pardalotus striatus*	-	-
	Acanthizidae	Yellow-rumped Thornbill	*Acanthiza chrysorrhoa*	-	-
		Striated Thornbill	*Acanthiza lineata*	-	-
		Yellow Thornbill	*Acanthiza nana*	-	-
		Brown Thornbill	*Acanthiza pusilla*	-	-
		Buff-rumped Thornbill	*Acanthiza reguloides*	-	-
		Speckled Warbler	*Chthonicola sagittata*	V	-
		White-throated Gerygone	*Gerygone olivacea*	-	-
		Rockwarbler	*Origma solitaria*	-	-
		White-browed Scrubwren	*Sericornis frontalis*	-	-
		Weebill	*Smicrornis brevirostris*	-	-
	Meliphagidae	Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*	-	-
		Eastern Spinebill	*Acanthorhynchus tenuirostris*	-	-
		Red Wattlebird	*Anthochaera carunculata*	-	-
		Yellow-faced Honeyeater	*Caligavis chrysops*	-	-
		Blue-faced Honeyeater	*Entomyzon cyanotis*	-	-
		Yellow-tufted Honeyeater	*Lichenostomus melanops*	-	-
		Noisy Miner	*Manorina melanocephala*	-	-
		Black-headed Honeyeater	*Melithreptus affinis*	-	-
		Brown-headed Honeyeater	*Melithreptus brevirostris*	-	-
		Black-chinned Honeyeater (eastern subspecies)	*Melithreptus gularis gularis*	V	-
		White-naped Honeyeater	*Melithreptus lunatus*	-	-
		Scarlet Honeyeater	*Myzomela sanguinolenta*	-	-
		White-eared Honeyeater	*Nesoptilotis leucotis*	-	-
		Little Friarbird	*Philemon citreogularis*	-	-
		Noisy Friarbird	*Philemon corniculatus*	-	-
		Striped Honeyeater	*Plectorhyncha lanceolata*	-	-
		Fuscous Honeyeater	*Ptilotula fusca*	-	-
		White-plumed Honeyeater	*Ptilotula penicillata*	-	-
	Petroicidae	Eastern Yellow Robin	*Eopsaltria australis*	-	-
		Jacky Winter	*Microeca fascinans*	-	-
		Rose Robin	*Petroica rosea*	-	-
	Pomatostomidae	White-browed Babbler	*Pomatostomus superciliosus*	-	-

Class	Family	Common Name	Scientific name	Conservation Status	
				BC Act[1]	EPBC Act[2]
		Grey-crowned Babbler (eastern subspecies)	*Pomatostomus temporalis temporalis*	V	-
	Neosittidae	Varied Sittella	*Daphoenositta chrysoptera*	V	-
	Falcunculidae	Crested Shrike-tit	*Falcunculus frontatus*	-	-
	Pachycephalidae	Grey Shrike-thrush	*Colluricincla harmonica*	-	-
		Golden Whistler	*Pachycephala pectoralis*	-	-
		Rufous Whistler	*Pachycephala rufiventris*	-	-
	Monarchidae	Magpie-lark	*Grallina cyanoleuca*	-	M
		Restless Flycatcher	*Myiagra inquieta*	-	-
		Leaden Flycatcher	*Myiagra rubecula*	-	-
	Rhipiduridae	Grey Fantail	*Rhipidura fuliginosa*	-	-
		Willie Wagtail	*Rhipidura leucophrys*	-	-
		Rufous Fantail	*Rhipidura rufifrons*	-	M
	Artamidae	Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	V	-
		Pied Butcherbird	*Cracticus nigrogularis*	-	-
		Grey Butcherbird	*Cracticus torquatus*	-	-
		Australian Magpie	*Gymnorhina tibicen*	-	-
		Pied Currawong	*Strepera graculina*	-	-
	Campephagidae	Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	-	M
		White-bellied Cuckoo-shrike	*Coracina papuensis*	-	M
		Cicadabird	*Edolisoma tenuirostris*	-	-
		White-winged Triller	*Lalage tricolor*	-	-
	Oriolidae	Olive-backed Oriole	*Oriolus sagittatus*	-	-
	Corvidae	Australian Raven	*Corvus coronoides*	-	-
		Little Raven	*Corvus mellori*	-	M
	Corcoracidae	White-winged Chough	*Corcorax melanorhamphos*	-	-
	Ptilonorhynchidae	Satin Bowerbird	*Ptilonorhynchus violaceus*	-	-
	Sturnidae	Common Starling*	*Sturnus vulgaris*	-	-
	Hirundinidae	Welcome Swallow	*Hirundo neoxena*	-	M
		Fairy Martin	*Petrochelidon ariel*	-	-
		Tree Martin	*Petrochelidon nigricans*	-	M
	Zosteropidae	Silvereye	*Zosterops lateralis*	-	M
	Acrocephalidae	Australian Reed-warbler	*Acrocephalus australis*	-	M
	Locustellidae	Brown Songlark	*Cincloramphus cruralis*	-	-
		Rufous Songlark	*Cincloramphus mathewsi*	-	-
	Cisticolidae	Golden-headed Cisticola	*Cisticola exilis*	-	-
	Alaudidae	Horsfield's Bushlark	*Mirafra javanica*	-	-
	Dicaeidae	Mistletoebird	*Dicaeum hirundinaceum*	-	-
	Passeridae	House Sparrow*	*Passer domesticus*	-	-
	Motacillidae	Australasian Pipit	*Anthus novaeseelandiae*	-	M
	Estrildidae	Plum-headed Finch	*Neochmia modesta*	-	-
		Red-browed Finch	*Neochmia temporalis*	-	-
		Diamond Firetail	*Stagonopleura guttata*	V	V
		Double-barred Finch	*Taeniopygia bichenovii*	-	-
Mammalia	Tachyglossidae	Short-beaked Echidna	*Tachyglossus aculeatus*	-	-
	Dasyuridae	Yellow-footed Antechinus	*Antechinus flavipes*	-	-
		Brown Antechinus	*Antechinus stuartii*	-	-
	Phascolarctidae	Koala (combined populations of Queensland, New	*Phascolarctos cinereus (combined populations*	E	E

Class	Family	Common Name	Scientific name	Conservation Status	
				BC Act[1]	EPBC Act[2]
		South Wales and the Australian Capital Territory)	*of Qld, NSW and the ACT)*		
	Vombatidae	Common Wombat	*Vombatus ursinus*	-	-
	Petauridae	Sugar Glider	*Petaurus breviceps*	-	-
		Squirrel Glider	*Petaurus norfolcensis*	V	-
	Pseudocheiridae	Common Ringtail Possum	*Pseudocheirus peregrinus*	-	-
	Acrobatidae	Feathertail Glider	*Acrobates sp.*	-	-
	Phalangeridae	Common Brushtail Possum	*Trichosurus vulpecula*	-	-
	Macropodidae	Eastern Grey Kangaroo	*Macropus giganteus*	-	-
		Common Wallaroo	*Macropus robustus*	-	-
		Red-necked Wallaby	*Macropus rufogriseus*	-	-
		Swamp Wallaby	*Wallabia bicolor*	-	-
	Rhinolophidae	Eastern Horseshoe Bat	*Rhinolophus megaphyllus*	-	-
	Emballonuridae	Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*	V	-
	Molossidae	White-Striped Free-tailed Bat	*Austronomus australis*	-	-
		Eastern Coastal Free-tailed Bat	*Micronomus norfolkensis*	V	-
		South-Eastern Free-tailed Bat	*Mormopterus (Ozimops) planiceps*	-	-
		Eastern Free-tailed Bat	*Mormopterus (Ozimops) ridei*	-	-
	Miniopteridae	Large Bent-winged Bat (probable)	*Miniopterus orianae oceanensis*	V	-
	Vespertilionidae	Large-eared Pied Bat	*Chalinolobus dwyeri*	V	V
		Gould's Wattled Bat	*Chalinolobus gouldii*	-	-
		Chocolate Wattled Bat	*Chalinolobus morio*	-	-
		Lesser Long-eared Bat	*Nyctophilus geoffroyi*	-	-
		Gould's Long-eared Bat	*Nyctophilus gouldi*	-	-
		Greater Broad-nosed Bat	*Scoteanax rueppellii*	V	-
		Inland Broad-nosed Bat	*Scotorepens balstoni*	-	-
		Little Broad-Nosed Bat	*Scotorepens greyii*	-	-
		Eastern Broad-Nosed Bat	*Scotorepens orion*	-	-
		Southern Forest Bat	*Vespadelus regulus*	-	-
		Eastern Cave Bat	*Vespadelus troughtoni*	V	-
		Little Forest Bat	*Vespadelus vulturnus*	-	-
	Muridae	House Mouse*	*Mus musculus*	-	-
		Black Rat*	*Rattus rattus*	-	-
	Canidae	Dog*	*Canis lupus*	-	-
		Red Fox*	*Vulpes vulpes*	-	-
	Felidae	Cat*	*Felis catus*	-	-
	Leporidae	European Brown Hare*	*Lepus europaeus*	-	-
		European Rabbit*	*Oryctolagus cuniculus*	-	-
	Suidae	Pig*	*Sus scrofa*	-	-
	Bovidae	Cattle*	*Bos taurus*	-	-
		Goat*	*Capra hircus*	-	-
		Sheep*	*Ovis aries*	-	-
	Cervidae	Fallow Deer*	*Dama dama*	-	-

Note: * indicates feral species.

[1] Conservation status under the BC Act (current as of October 2023). V = Vulnerable, E = Endangered.

[2] Conservation status under the EPBC Act (current as of October 2023). V = Vulnerable, E = Endangered, M = Marine/Migratory.

Appendix C: Masked Owl observations

Site	Easting	Northing	Date	Observer	Observational Details
CPB02	763978	6412721	6/05/2021	David James & Lachlan Pettit	Possible Masked Owls heard. During and after Masked Owl call playback (CPB), calls heard in two different directions > 500 m from wooded hills. Call to the south outside of Study Area but call from WSW possibly within.
CPB08	765102	6415380	7/05/2021	David James & Lachlan Pettit	Pair responded to CPB and came in to investigate.
CPB08	765102	6415380	7/05/2021	David James & Lachlan Pettit	Bird returned and flew overhead calling during Powerful Owl CPB.
CPBX03	765026	6415474	8/05/2021	David James & Lachlan Pettit	After 2 short bursts of Masked Owl called from forest edge. Flew off quickly. Heard calling three more times 100-200 m from east and south.
CPB07	764306	6415993	9/05/2021	David James & Lachlan Pettit	Heard calling to the south, possibly 500 m away. Halfway to CPB08.
CPBX03	765026	6415474	9/05/2021	David James & Lachlan Pettit	Passive listen at dusk for Masked Owl calls. First call at 17:56 heard to NW in gully approximately 300-400 m away (near remote camera [TC22]). Another four calls heard NNW 250 m, N 150 m, and NW 250 m.
CPBX04	764942	6415530	21/05/2021	David James & Dion Hobcroft	Dusk listen period for Masked Owl. One to two Masked Owls heard repeatedly, both before and after Masked Owl CPB. First bird heard calling while circling above. Second bird heard calling 300 m ESE. Interpretation: Male with female at nest in gully.
CPB07	764306	6415993	30/07/2021	Narawan Williams & Michael Sebastian	Heard 150 to 200 m SE. Called a few times in response to Narawan voice screeches. Moved around and called in flight.
Masked Owl Nest Tree	765028	6415770	26/08/2021	Narawan Williams	Masked Owl nest tree. Sheltered shallow drainage near ridge top. Tree on southeast slope. Dead tree, 80-90 cm DBH, 25 m high, with 3 entry holes. GPS point within 30 m of tree North of CPB08. Tree located via screech calls, likely of fledged young. Masked Owl observed calling in the entry of the hollow. Owl flew off and perched nearby upon approach. The other owl was heard calling nearby. After some time, the first owl flew back to the hollow, and both owls continued to call.

Appendix D: Bird of prey nests

Site	Easting	Northing	Date	Observer	Observational Details
BOPNEST01	764682	6415874	13/09/2021	Narawan Williams	No signs of bird of prey around nest.
			14/09/2021	Narawan Williams	No signs of bird of prey around nest.
			14/09/2021	Narawan Williams	Wedge-tailed Eagle pair observed flying above and nearby; no interaction with nest.
			14/09/2021	Narawan Williams	No signs of bird of prey around nest.
			17/09/2021	Narawan Williams	Nest not being used.
BOPNEST02	762348	6418853	15/09/2021	Narawan Williams	No birds observed.
			15/09/2021	Narawan Williams	Nest in good condition, but no evidence of use.
BOPNEST03	764283	6412486	16/09/2021	Narawan Williams	Wedge-tailed Eagle pair observed perched upslope of large stick nest.
			17/09/2021	Narawan Williams	Evidence of nest in use (whitewash). Likely that Wedge-tailed Eagles are using the nest.
BOPNEST04	763413	6412004	17/09/2021	Narawan Williams	Appears original nest had fallen out of the tree due to volume of stick around base of tree. New nest location showed no evidence of use.

Appendix D. EPBC Act Significant Impact Assessment

Assessments of Significance are presented for the following MNES in relation to the Project:

Threatened Ecological Communities:

- *White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland*
- *Central Hunter Valley eucalypt forest and Woodland*

Threatened flora:

- *Pomaderris cotoneaster*

Threatened Fauna:

- Regent Honeyeater
- Pink-tailed Legless Lizard
- Large-eared Pied Bat
- Broad-headed Snake
- Swift Parrot
- Koala.

Box-Gum Woodland CEEC

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Critically Endangered)	Likelihood of significant impact
Distribution: The National Recovery Plan for *White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland* (DECCW 2010) states that this community was formally widespread along western slopes and tablelands of the Great Dividing Range throughout Victoria, NSW, the ACT and southern QLD. Of this community, less than 5% remains of its pre-1750 NSW distribution, with only 0.05% in good condition (DECCW 2010). In NSW, the Box-Gum Woodland CEEC is found within the North Coast, New England Tablelands, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highlands, South East Corner and South Western Slopes bioregions. **Description:** This ecological community can occur as either a woodland or DNG. It has a ground layer of native tussock grasses and herbs, and a sparse, scattered shrub layer. White box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) or Blakely's Red Gum (*E. blakelyi*) dominate the ecological community where a tree layer still occurs. Other species of eucalypts including Apple Box (*E. bridgesiana*), Red Stringybark (*E. macrorhyncha*), Brittle Gum (*E. mannifera*), and Candlebark (*E. rubida*) are also associated with the community (DEH 2006). **Condition of the community within the Development Footprint:** PCTs which conform to the description of the CEEC within the Study Area are PCT 266, 281 and 483. The condition of these vegetation communities within the Study Area ranges from high condition (VI score of >80, woodland forms of the community) to moderate condition (scores of around 30-40) (DNG forms of the community). VI scores are as follows: • PCT 266 Derived Native Grassland = VI score of 39.8 • PCT 266 Woodland in High condition = VI score of 88.1 • PCT 266 Scattered Trees = VI score of 67.2 • PCT 281 Derived Native Grassland in Low condition = VI score of 32.7 • PCT 281 Derived Native Grassland = VI score of 33.3 • PCT 281 Woodland in High condition = 90.4 • PCT 281 Scattered Trees = VI score of 84.4 • PCT 483 Woodland in High condition = VI score of 83.4. **Potential impacts associated with the Project:** The Project would result in the removal of 401.12 ha of Box-Gum Woodland CEEC, comprising 34.22 ha of woodland and 366.9 ha of DNG (Figure 12). **Avoidance and mitigation measures:** Impacts from clearing native vegetation, including Box-Gum Woodland CEEC have been avoided or minimised through the Project design by: • Preferentially locating disturbance in areas lacking Box-Gum Woodland CEEC (e.g. Category 1 – exempt land) or where the vegetation/habitat is in the poorest condition (e.g. low quality DNG) • Avoiding open cut mining within 200 m of Moolarben Creek and Murdering Creek (which have a riparian zone comprising Box-Gum Woodland CEEC)	

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Critically Endangered)		Likelihood of significant impact
• Minimising infrastructure within the riparian zone of Moolarben Creek and Murdering Creek and locating creek crossings (three haul road creek crossings are proposed) within previously cleared areas, where practicable and feasible • Condensing the Development Footprint by locating infrastructure areas immediately adjacent to open cut mining areas and • Progressively back-filling open cut pits to minimise the required disturbance extent (i.e. reducing the need for large out-of-pit overburden emplacements) as far as practically possible, as well as removing residual pit voids from the final landform • Reduction of the Development Footprint post initial EIS submission to further avoid impacts to Box-Gum Woodland CEEC, particularly the relatively high-quality woodland areas. The amended Project Development Footprint will result in a 59.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha) and a 6.8% reduction in the area of DNG impacted (from 393.53 ha to 366.9 ha). (The total area of Box-Gum Woodland to be impacted has been reduced by 76.63 ha (16%). As a result of the above, areas of Box-Gum Woodland in the north, south-west and south-east of the Study Area would be avoided by the Project (Figure 12). Measures to mitigate indirect impacts of the Project on retained and adjacent areas of the CEEC would be implemented (e.g. weed and pest control). Dust suppression will also be implemented to mitigate potential indirect effects of dust on plant growth. The conceptual final landform for the Project (Figure 19b) would include rehabilitation of 535 ha of the Development Footprint to native woodland/open woodland and 140 ha to open grassland, including species characteristic of Box-Gum Woodland CEEC.		
Assessment of significance **An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it will:**		
Criteria (Critically endangered)	**Address of Criteria**	
Reduce the extent of an ecological community	Approximately 401.12 ha of Box-Gum Woodland CEEC was recorded within the Development Footprint, comprising 34.22 ha of woodland and 366.9 ha of DNG. As detailed above, Box-Gum Woodland CEEC has been heavily cleared across its range (about 95%), with the remaining extent of the ecological community being highly fragmented, occurring in small, isolated patches within a cleared environment, or within a landscape of other disturbed woodlands (DECCW 2010). This is also evident throughout the Development Footprint and within the wider Study Area. Note that this estimate was done in the year 2000, thus the current extent of clearance is likely to be greater. The quality and/or condition of the remnant woodland vegetation is unknown and therefore it is not possible to determine whether it aligns to the federally listed CEEC and/or the state listed EEC (DEH 2006). Therefore, it is unclear what the condition and security of the remaining Box-Gum Woodland CEEC is within the locality. It is likely that much of it is on private land and that it is similarly disturbed to the remnants with the Study Area. The Project would result in the removal of 401.12 ha of this CEEC within the Development Footprint. The Project is located within the overall extent of occurrence of this CEEC and the Project would not remove the CEEC at the known limits of its range. However, the loss of 401.12 ha of Box-Gum Woodland CEEC within the Development Footprint accounts for 0.6% of the known geographic extent in south-eastern NSW. This will reduce the extent of the CEEC by approximately 0.6%.	Likely

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Critically Endangered)		Likelihood of significant impact
Fragment or increase fragmentation of an ecological community	Box-Gum Woodland CEEC occurs as a highly fragmented ecological community (DECCW 2010). The Project would require the removal of 401.12 ha of Box-Gum Woodland CEEC, although the majority of Box-Gum Woodland to be cleared consists of DNG (366.9 ha, 91.5%) with a relatively smaller proportion of remnant woodland to be impacted (34.22 ha, 8.5%). Removal of this vegetation within the Development Footprint will result in further fragmentation of the community with smaller patches retained in the north, south-west and south-east of the Study Area and a strip along Moolarben and Murdering Creeks.	Likely
Adversely affect habitat critical to the survival of an ecological community	The Box-Gum Woodland CEEC that would be disturbed by the Project includes high-quality remnant woodland patches with hollow-bearing large trees, and DNG. The National Recovery Plan for the Box-Gum Woodland CEEC (DECCW 2010) notes that due to the fragmented and highly modified nature of the community, "all areas of Box-Gum Grassy Woodland which meet the minimum condition criteria" should be considered critical habitat for the survival of the community. The recently published Conservation Advice (DCCEEW 2023c) also states that given the highly fragmented and degraded state of this ecological community, all areas of the ecological community that meet the minimum condition criteria should be considered critical to the survival of this ecological community. No Critical Habitat as defined under section 207A of the EPBC Act has been identified or included in the Register of Critical Habitat at this time (DCCEEW 2023c).	Likely
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	The Project would result in the loss of Box-Gum Woodland CEEC within the Development Footprint. Impacts (including to drainage, nutrient levels and soil) to remaining Box-Gum Woodland CEEC within the surrounds are likely to be minimal due to proposed mitigation measures, such as drainage structures, erosion control dust suppression and weed control.	Unlikely
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	The Project would result in the loss of 401.12 ha of Box-Gum Woodland CEEC within the Development Footprint. The Project would likely result in an increase in edge effects to areas of Box-Gum Woodland CEEC located adjacent to the Project. Although much of the Development Footprint is already disturbed from previous land use (agriculture, clearing, pasture improvement) and edge effects, the Project would indirectly impact this community adjacent to the Development Footprint with the exposure of new edges to areas of woodland that were previously unaffected. Edges and areas of disturbance can provide opportunities for the invasion of natural vegetation by weeds. Weed incursion has the potential to substantially change the species composition of an occurrence of the adjoining CEEC, furthering the total area of impact beyond that of the area of direct impact. Mitigation measures would be actioned to manage the potential spread of weeds into the Study Area and surrounds, such as washing down vehicles and machinery.	Unlikely

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Critically Endangered)		Likelihood of significant impact
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: assisting invasive species, that are harmful to the listed ecological community, to become established, or	The Project is likely to indirectly impact retained/adjacent patches of Box-Gum Woodland CEEC through weed incursion at newly created edges as a result of the Project. Weed incursion has the potential to substantially change the species composition of an occurrence of the adjoining CEEC. *Phytophthora cinnamomi* is a plant pathogen that can spread via any activity that moves soil, water or plant material. Dieback caused by the root-rot fungus is listed as a key threatening process under the EPBC Act. Spread of pathogens would be managed as part of the weed control program implemented to mitigate the potential impacts of weed invasion as described in Section 5.7. The Project is not likely to result in the introduction of a disease that may lead to the decline of this species.	Unlikely
Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or	The Project would not involve any spraying of fertilizers, herbicides or other chemicals or pollutants that would kill or inhibit the growth of flora species within the Box-Gum Woodland CEEC. Herbicides and fertilizers may be required for weed management and revegetation purposes, but these would only be used in a manner that would not adversely impact on nearby Box-Gum Woodland CEEC.	Unlikely
Interfere with the recovery of an ecological community.	The National Recovery Plan for White Box–Yellow Box–Blakely's Red Gum Grassy Woodland and Derived Native Grassland (DECCW 2010) has been prepared under the provisions of the EPBC Act. The overall aim of the recovery plan is to promote the recovery and prevent the extinction of the CEEC. The specific objectives of the recovery plan are to minimise the risk of extinction of the ecological community through: **1.** achieving no net loss in extent and condition of the ecological community throughout its geographic distribution **2.** increasing transitional areas around remnants and linkages between remnants **3.** increasing landscape function of the community through management and restoration of degraded sites **4.** increasing transitional areas around remnants and linkages between remnants, and **5.** bringing about enduring changes in participating land manager attitudes and behaviours towards environmental protection and sustainable land management practices to increase extent, integrity and function of Box-Gum Grassy Woodland. The Project is likely to interfere with recovery of the Box-Gum Woodland CEEC given the area and quality of vegetation being removed for the Project. Under the BC Act, impacts to Box-Gum Woodland are required to be offset. Offsets as determined by the BAM-C will require in the order of three to five times the area of impact to be offset. As such, any offsets for the Project would result in the in-perpetuity conservation and management of a relatively larger area of this CEEC.	Likely

White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Critically Endangered)	Likelihood of significant impact
Conclusion: The Project is considered likely to result in a significant impact on Box-Gum Woodland. This community has been assessed in accordance with the BAM (DPIE 2020a) and would be offset under the BC Act for the removal of 401.12 ha of this CEEC.	

Central Hunter Valley Eucalypt Forest and Woodland CEEC

Central Hunter Valley Eucalypt Forest and Woodland (Critically Endangered)	Likelihood of significant impact
Distribution: This ecological community occurs in the Hunter Valley region (primarily in the Central Hunter). The Hunter Valley region is mostly in the north-east of the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion (SYB). The Hunter Valley region and the ecological community both continue to the north-east, into the NSW North Coast IBRA Bioregion (NNC). Within the Sydney Basin Bioregion the ecological community occurs mainly in the Hunter Valley IBRA subregion (SYB02). It also occurs in subregions adjacent to the Hunter Valley IBRA subregion; including in the Goulburn Valley in the Kerrabee IBRA subregion (SYB01) and in the Hunter Thrust Zone in the Upper Hunter IBRA subregion (NNC16) (DPE 2023e; DOE 2015a). **Description:** This ecological community can occur as either a woodland or forest; the community within the Development Footprint would be best defined as forest (DOE 2015a). The woodland or forest canopy is dominated by one or more of the following four eucalypt species: Narrow-leaved Ironbark (*Eucalyptus crebra*), Spotted Gum (*Corymbia maculata*), Slaty Gum (*Eucalyptus dawsonii*) and Grey Box (*Eucalyptus moluccana*) (DPE 2023e; DOE 2015a). Under certain circumstances a fifth species, *Allocasuarina luehmannii* (Bulloak or Buloke), may be part of the mix of dominants (DOE 2015a). A sparse sub-canopy layer may be present, typically with young eucalypts of upper canopy species, along with other species such as wattles (*Acacia* species) (DOE 2015a). An open-to-sparse mid-layer of shrubs such as wattles (*Acacia* species) and native blackthorn (*Bursaria spinosa subsp. spinosa*) may be present (TSSC 2021). A ground layer is present, although it may vary in development and composition, as a sparse-to-thick layer of native grasses and/or other predominantly native groundcover (small shrubs and ferns, daisies, lilies, orchids and other flowers) (DPE 2023e; DOE 2015a). **Condition of the community within the Development Footprint**: One PCT which conforms to the description of the CEEC within the Development Footprint is PCT 1655. The condition of this vegetation community within the Development Footprint is of a moderate to high condition (VI score of 48.3). Approximately 15.5 ha of Eucalypt Forest and Woodland CEEC was recorded within the Development Footprint, occurring within seven (7) small, discrete patches scattered throughout the Development Footprint (Figure 12). To understand the extent of CEEC within the Kerrabee IBRA subregion, the BioNet Vegetation Information System (DPE 2023b) was used to determine which PCTs in the Kerrabee IBRA subregion are associated with the EPBC listed Eucalypt Forest and Woodland CEEC. Five PCTs were identified: • PCT 3314 – Central Hunter Slopes Grey Box Forest • PCT 3431 – Central Hunter Ironbark Grassy Woodland • PCT 3485 – Central Hunter Slaty Gum Grassy Forest • PCT 3490 – Hunter Valley Footslopes Slaty Gum Forest	

Central Hunter Valley Eucalypt Forest and Woodland (Critically Endangered)		Likelihood of significant impact
• PCT 3497 – Western Hunter Escarpment Slaty Gum-Pine Forest. In addition to the above PCTs, ELA (2023) determined that PCT 3388 (Central West Valleys White Box Forest) and PCT 3402 (Western Blue Mountains White Box Forest) which were previously mapped within the Study Area (NSW State Vegetation Type Map, NSW DCCEEW 2022a) were actually PCT 1655 (Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin). ELA (2023) also determined that PCT 1655 within the Development Footprint is mostly commensurate with the EPBC listed Central Hunter Eucalypt Forest and Woodland CEEC. As such, GIS software was used to calculate the total area of PCTs 3314, 3431, 3485, 3490, 3497, 3388 and 3402 that have been mapped in the NSW State Vegetation Type Map in the Kerrabee IBRA subregion. A total of 65,806 ha of PCTs that may be associated with Central Hunter Eucalypt Forest and Woodland CEEC is remaining in the Kerrabee IBRA subregion. As such, the occurrence within the Development Footprint represents in the order of less than 0.02% of the likely extent of the CEEC in the Kerrabee subregion (DPE 2023b; NSW DCCEEW 2022b). **Potential impacts associated with the Project:** Approximately 15.5 ha of this community (with a quality that fits the EPBC Act description for listing) was recorded within the Development Footprint and would be removed as a result of the Project (ELA 2023). **Avoidance and mitigation measures:** No Eucalypt Forest and Woodland CEEC is able to be avoided by the Project. The conceptual final landform for the Project (Figure 19b) will include rehabilitation of 535 ha of the Development Footprint to native woodland/open woodland, including species characteristic of the Eucalypt Forest and Woodland CEEC.		
Assessment of significance An action is likely to have a significant impact on a critically endangered or endangered ecological community if there is a real chance or possibility that it would:		
Criteria (Critically endangered)	**Address of Criteria**	
Reduce the extent of an ecological community	Approximately 15.5 ha of Eucalypt Forest and Woodland CEEC that meets the threshold stipulated under the EPBC Act is located within the Development Footprint and would be removed by the Project. Three (3) of the patches within the Development Footprint occur partially outside the Development Footprint, thus these patches would be reduced in size. The Project is within the known distribution of this community, the community has been recorded and mapped in the surrounding region (DPE 2023e). As such the community within the Development Footprint is within a known area of extent of occurrence of this community. The EPBC Act Eucalypt Forest and Woodland CEEC guide (DEE 2016) states that this CEEC has been heavily cleared across its range, with the ecological community having declined by more than 70% in extent. The ecological community now occurs as highly fragmented patches, with many less than two ha in size. This is also evident throughout the Development Footprint where it was mapped as occurring within seven small, isolated areas distributed throughout the Development Footprint, each about 2 ha in size. The Project is located within the overall extent of occurrence of this CEEC and would not remove habitat at the limit of its range. The occurrence of this CEEC within the Development Footprint represents in the order of less than 0.02% of the likely extent of the CEEC in the Kerrabee subregion (estimated to be 65,806 ha) (DPE 2023; DPE 2023). As such the Project is considered unlikely to have a significant impact on the extent of this CEEC.	Unlikely

Central Hunter Valley Eucalypt Forest and Woodland (Critically Endangered)		Likelihood of significant impact
Fragment or increase fragmentation of an ecological community	The document 'Central Hunter Valley eucalypt forest and woodland: a nationally protected ecological community' (DEE 2016) states that this CEEC has been heavily cleared across its range, with the ecological community having declined by more than 70% in extent. The ecological community now occurs as highly fragmented patches, with many less than two ha in size. This is also evident throughout the Development Footprint. Three (3) of the patches within the Development Footprint extend beyond the Development Footprint, thus these patches would be further fragmented from extant stands of the CEEC. These stands would also be subject to potential edge effects which may reduce their viability, based on their relatively small size. The Project would require the removal of about 15.5 ha of Eucalypt Forest and Woodland CEEC and has the potential to lead to further fragmentation of Eucalypt Forest and Woodland CEEC in the local area by increasing the distance between other patches in the surrounding area.	Likely
Adversely affect habitat critical to the survival of an ecological community	The Project is considered unlikely to adversely affect habitat critical to the survival of Eucalypt Forest and Woodland CEEC as the occurrence of the community within the Development Footprint represents in the order of less than 0.02% of the likely extent of the CEEC in the Kerrabee subregion (estimated to be 65,806 ha).	
Modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	The Project would remove all 15.5 ha of the Eucalypt Forest and Woodland CEEC within the Development Footprint. Indirect impacts to Eucalypt Forest and Woodland CEEC in the surrounding landscape (including drainage, nutrient levels and soil) within are likely to be minimal due to implementation of proposed mitigation measures, such as drainage structures, erosion control, dust suppression and weed control.	Unlikely
Cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	The Project would require the removal of about 15.5 ha of Eucalypt Forest and Woodland CEEC and has the potential to lead to further fragmentation of Eucalypt Forest and Woodland CEEC in the local area by increasing the distance between patches in the surrounding area. The Project has the potential to result in a change in the species composition of this ecological community within adjacent patches due to edge effects and weed invasion. Implementation of proposed mitigation measures, such as drainage structures, erosion control, dust suppression and weed control will ensure impacts to adjacent vegetation are minimised. *Phytophthora cinnamomi* is a plant pathogen that can spread via any activity that moves soil, water or plant material. Dieback caused by the root-rot fungus is listed as a key threatening process under the EPBC Act. Spread of pathogens would be managed as part of the weed control program implemented to mitigate the potential impacts of weed invasion as described in Section 5.7. The Project is not likely to result in the introduction of a disease that may lead to the decline of this species.	Unlikely

Central Hunter Valley Eucalypt Forest and Woodland (Critically Endangered)		Likelihood of significant impact
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to: assisting invasive species, that are harmful to the listed ecological community, to become established, or	Although much of the Development Footprint is already disturbed from previous land use (agriculture) and edge effects, the Project may indirectly impact this community where is occurs adjacent to the Development Footprint with the exposure of new edges to areas of woodland that were previously unaffected. Edges and areas of disturbance provide opportunities for the invasion of natural vegetation by weeds. Mitigation measures would be actioned to manage the potential spread of weeds into adjacent areas of vegetation.	Unlikely
Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or	The Project would not involve any spraying of fertilizers, herbicides or other chemicals or pollutants that would kill or inhibit the growth of flora species within the Eucalypt Forest and Woodland CEEC. Herbicides and fertilisers may be required for weed management and revegetation purposes, but these would only be used in a manner that would not adversely impact on nearby Eucalypt Forest and Woodland CEEC.	
Interfere with the recovery of an ecological community.	There is no adopted or made Recovery Plan for this ecological community. Removal of areas of the CEEC is considered likely to be inconsistent with the recovery of the community. As the occurrence of Eucalypt Forest and Woodland CEEC within the Development Footprint represents in the order of less than 0.02% of the likely extent of the CEEC in the Kerrabee subregion (estimated to be 65,806 ha) (DPE 2023; DPE 2023b) and the patches of vegetation present are small, discontinuous (and likely less viable and thus of lower conservation value than larger remnants) it is considered unlikely that the Project would significantly interfere with the recovery of this ecological community. Under the BC Act, impacts to this community are required to be offset. Offsets as determined by the BAM-C will require in the order of three to five times the area of impact to be offset. As such, any offsets for the Project would result in the in-perpetuity conservation and management of a relatively larger area of this CEEC.	Unlikely
Conclusion: The Project is considered unlikely to result in a significant impact on Eucalypt Forest and Woodland CEEC. This community has been assessed in accordance with the BAM (DPIE 2020a) and would be offset under the BC Act for the removal of 15.5 ha of this community.		

Pomaderris cotoneaster

Pomaderris cotoneaster	**Endangered Species**	**Likelihood of significant impact**

Distribution and occurrence: *Pomaderris cotoneaster* is a shrub that grows to 4 m in height. *Pomaderris cotoneaster* has a very disjunct distribution, being known from the Nungatta area, northern Kosciuszko National Park (near Tumut), the Tantawangalo area in South-East Forests National Park and adjoining freehold land, Badgery's Lookout near Tallong, Bungonia State Conservation Area, the Yerranderie area, Kanangra-Boyd National Park, the Canyonleigh area and Ettrema Gorge in Morton National Park. The species has also been recorded along the Genoa River in Victoria (DPE 2023e). Populations tend to be isolated and range in size from a few individuals to many hundreds. Populations are not apparently influenced by local variations in habitat - it is not obvious why they are only growing where they are (DPE 2023e). Flowering occurs between October and November (DPE 2023e).

The population within the Study Area is located on the edge of the Development Footprint in the north-east of the Development Footprint. The species polygon for *Pomaderris cotoneaster* was generated based on detailed searches conducted by ELA in 2021 (ELA 2023) after the identification of mature plants, seedlings and saplings within the Study Area. The location in which it was recorded has the suitable microhabitats for the species. Within the Study Area, the species was found growing mostly within PCT 1629 (Remnant Forest), as well as PCT 281 (Remnant Woodland), PCT 478 (Remnant Forest) and PCT 1610 (Remnant Woodland). Based on the survey data, the species is expected to occur within the location it was recorded and is not expected to occur elsewhere. The suitable habitat is therefore considered to be the area that it was recorded and immediate adjoining areas where the species was not observed but is considered likely to occur.

A 30 m buffer has been included around the area of suitable habitat where the species was observed. This additional buffer is not required by the BAM (i.e. the species polygon could be reduced by 30 m around the outside of the area of suitable habitat), but it has been added to encompass all suitable habitat. A 30 m buffer is applied around 'individual' species credit species (according to the BAM), so it is considered a reasonable buffer. Areas of PCT 281 DNG (high and low condition) were removed from the 30 m buffered areas, as these areas were not considered suitable habitat. The species polygon (occupied and/or suitable habitat) includes 12.5 ha for the species within the Study Area, of which 0.07 ha (PCT 1629 Remnant Woodland) of the buffer area occurs within the Project Development Footprint.

Habitat: *Pomaderris cotoneaster* has been recorded in a range of habitats in predominantly forested country. The habitats include forest with deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs. Little is known about the ecology of the species. It is probably killed by fire, but plants have been observed to re-sprout from the stem following death of the crown from apparent drought.

Potential impacts associated with the Project: A total of 0.07 ha of buffer area around suitable habitat (PCT 1629 Remnant Forest) would be removed as a result of the Project. The Project also has the potential to indirectly impact retained habitat for this species through edge effects including altered light and nutrient regimes and weed incursion.

Avoidance and mitigation measures: *Pomaderris cotoneaster* would be managed by:

1. erecting a fence between the known plants and the adjacent Development Footprint
2. monitoring the *Pomaderris cotoneaster* population for a 2-year period following adjacent clearing
3. monitoring and controlling any weed outbreaks with a potential to impact *Pomaderris cotoneaster.*

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. lead to a long-term decrease in the size of an important population;

Pomaderris cotoneaster	**Endangered Species**	**Likelihood of significant impact**
The habitat requirements of this species are poorly understood, but this species has been observed in a wide range of habitats including in forest with deep friable soil, amongst rocks within the stream zone of riparian areas, on rocky steep slopes and ridge tops in dry sclerophyll forest and in steep gullies between sandstone cliffs (DECCW 2009). This species was recorded during targeted surveys undertaken in September and October 2021 (ELA 2023). Within the Study Area, *Pomaderris cotoneaster* was recorded: • On a range of sedimentary rock-derived substrates including sandy loam, sandy clay loam and sand, and with a range of associated outcropping sedimentary rock including shale/mudstone, coarse-grained sandstone and conglomerate • Across a range of landscape positions including colluvial sediments on valley floor/gully, on scree/talus slope, amongst clifflines and boulders positioned on the upper slope and on relatively exposed sandstone plateau • There was no evidence of recent fire history (i.e. charring on trees and logs was absent) • Generally, on south-west, west and north-west aspects • Growing mostly in association with *Eucalyptus punctata* (PCT 1629)*;* however, was also recorded growing in association with *Eucalyptus albens* and *Callitris endlicheri* (PCT 1610) and *Eucalyptus fibrosa* (PCT 478) • At altitudes between 520 m ASL and 580 m ASL. There are no records for the species within 30 km of the Study Area (DPE 2022d[4]). There are only 12 known populations for this species in NSW, all of which occur south of the Project with the nearest known population occurring at Yerranderie, NSW, approximately 210 km to the south-east. The site is not within the known distribution of this species, but it is within the predicted distribution of this species (DPE 2023e). Given the number of individuals recorded within the Study Area, and continuity of habitat adjacent to the Study Area, it is likely that *Pomaderris cotoneaster* also occurs within contiguous habitat within adjacent Munghorn Gap Nature Reserve. However, based on the lack of evidence of a wider occurrence of the species in the region, the population recorded within the Study Area is likely an important population for *Pomaderris cotoneaster*, based on its location outside of the known distribution of the species. A total of 12.5 ha of occupied habitat for this species occurs within the Study Area. The Project would directly impact this species by removing 0.07 ha (1.2 per cent) of the 30 m buffer area around suitable habitat. *Pomaderris cotoneaster* was recorded on the edge of the woodland/forest on slopes. Patykowski *et al*. (2014) describes flowering may not occur and growth may be poor under dense shade. Given this, this species may not be sensitive to edge effects. In consideration of factors described above, it is considered unlikely that the Project could result in a long-term decrease in the size of an important population of the species.		Unlikely
2. reduce the area of occupancy of an important population;		
Given the number of individuals recorded within the site, it is likely that *Pomaderris cotoneaster* also occurs within the wider local area; however, no BioNet records for this species occur within a 30 km search radius of the site (DPE 2022d[4]). Based on the lack of evidence of a wider population in the region outside of the Study Area, this		Likely

Pomaderris cotoneaster	Endangered Species	Likelihood of significant impact
assessment must consider the population recorded within the Study Area as likely being an important population for *Pomaderris cotoneaster* which would represent the only AOO in the region. The population is located just outside the predicted distribution of this species (DPE 2023e). The Project footprint has been designed to avoid the *Pomaderris cotoneaster* population, therefore no loss of individuals will occur and only parts of the 30 m buffer around the area of suitable habitat will be directly impacted. The amended Project design reduces clearance of this species habitat from 4.59 ha to 0.07 ha. With consideration of the above, the Project would not result in a reduction in the AOO of the local population of this species.		
3. **fragment an existing important population into two or more populations;**		
The population within the Study Area is located on the edge of the Development Footprint in the north-east of the Development Footprint. It consists of plants in two key locations: the majority of specimens being located in one patch, with a few individuals being recorded about one km to the north. The extent of the patches will not be directly impacted. As such, the Project would not fragment the population into two or more populations.		Unlikely
4. adversely affect habitat critical to the survival of a species;		
As stated in the National Recovery Plan for *Pomaderris cotoneaster* "all populations and the habitat they occupy are critical to the survival of *Pomaderris cotoneaster*" (DECCW 2009). Based on the lack of evidence of a wider occurrence of the species in the region, and the fact that this population occurs outside of the previously known distribution of the species, the removal of 0.07 ha of buffer area around suitable habitat for this species will not adversely affect 'habitat that is critical to the survival of a species' as defined by the National Recovery Plan for *Pomaderris cotoneaster* (DECCW 2009).		Likely
5. disrupt the breeding cycle of an important population		
Flowering occurs between October and November (DECCW 2009). Fruits mature in summer with seed being released predominantly in late January and early February (DECCW 2009). The time from recruitment to first flowering and the longevity of plants is unknown (DECCW 2009). As stated above, it is likely that the Project would impact an important population of *Pomaderris cotoneaster* and adversely affect habitat critical to the survival of the species through indirect impacts as a result of edge effect at newly created edges. However, only 1.2 per cent of the species' habitat will be impacted directly, thus the majority of the individuals in the local population are unlikely to be impacted. As such it is considered unlikely that the Project would disrupt the breeding cycle of the population through the direct loss of habitat and indirect impacts on this species as result of the Project.		Unlikely
6. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;		

Pomaderris cotoneaster	Endangered Species	Likelihood of significant impact
The Project would remove 0.07 ha of buffer area around suitable habitat, as well as potentially indirectly impact individuals through edge effects as detailed above. Monitoring would be undertaken during the construction and operational phases of the Project to monitor for indirect impacts on the population of *Pomaderris cotoneaster.* Of the 12 known populations, nine populations of the species have been recorded from five reserves: South East Forests National Park (three populations); Morton National Park (two populations); Kosciuszko National Park (one population), Bungonia State Conservation Area (two populations) and Coopracambra National Park (one population) (DECCW 2009). As stated in the National Recovery Plan for *Pomaderris cotoneaster* "all populations and the habitat they occupy are critical to the survival of *Pomaderris cotoneaster*" (DECCW 2009), however given the number of populations that occur in protected areas as described above, and the retention and management of two-thirds of the local population within the Study Area, the Project is not likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species would decline.		Unlikely
7. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;		
The Project would avoid the direct removal of the recorded population and the operational footprint would be located immediately adjacent to the buffer are around suitable habitat. Mitigation measures to manage the potential spread of weeds into the species habitat, would be implemented. Monitoring would also be conducted prior to clearing and during construction and operation to monitor for indirect impacts on the retained plants. Monitoring and management of the population would be detailed within the Biodiversity Monitoring Program for the Project to minimise the risk of establishment of invasive species within the population.		Unlikely
8. introduce disease that may cause the species to decline, or		
Phytophthora cinnamomi is a plant pathogen that can spread via any activity that moves soil, water or plant material. Dieback caused by the root-rot fungus is listed as a key threatening process under the EPBC Act. Spread of pathogens would be managed as part of the weed control program implemented to mitigate the potential impacts of weed invasion as described in Section 5.7. The Project is not likely to result in the introduction of a disease that may lead to the decline of this species.		Unlikely
9. Interfere substantially with the recovery of the species.		
The population within the Study Area represents a new population of the species and currently represents the northern-most extent of the species. Given the large number of individuals recorded within the Study Area, it is possible that *Pomaderris cotoneaster* also occurs within the wider local area (i.e. in contiguous habitat within Munghorn Gap Nature Reserve), however there are no other nearby BioNet records (DPE 2022d[4]) within 30 km of the Study Area. The occupied habitat within the Study Area will not be directly impacted by the Project, and potential indirect impacts would be monitored and managed as detailed within Biodiversity Monitoring Program. The post-mine		Unlikely

Pomaderris cotoneaster	Endangered Species	Likelihood of significant impact
landform includes a habitat restoration area within the extent of the population which should allow for future persistence of the species locally. As such, it is considered unlikely that the Project would interfere substantially with the recovery of the species. The amended Project Development Footprint avoids the *Pomaderris cotoneaster* population, therefore no loss of individuals will occur and only parts of the 30 m buffer around the area of suitable habitat will be directly impacted. The amended Project design reduces clearance of this species habitat from 4.59 ha to 0.07 ha. Furthermore, the management measures described above would ensure that the population is largely unaffected by the Project.		
Conclusion: The Project is considered not likely to result in a significant impact on *Pomaderris cotoneaster* due to individuals and their habitat being largely avoided by the Project design. Clearance of 0.07 ha of *Pomaderris cotoneaster* habitat would be offset in accordance with the BC Act.		

Regent Honeyeater

Regent Honeyeater (*Anthochaera phrygia)*	Critically Endangered Species	Likelihood of significant impact
Distribution is usually focused on breeding sites and surrounding fragmented woodlands containing foraging resources. The species is nomadic, following the flowering of specific Eucalypt species through the landscape. There are four known key breeding areas for this species in Australia, three of which are in NSW in the Capertee Valley, Bundarra-Barraba and Hunter Valley districts. All individuals occurring throughout the natural distribution of this species are considered a single population under the EPBC Act (DOE 2016). The species breeds between July and January in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak (DPE 2023e; Geering and French 1998). The species was not recorded within the Study Area during targeted surveys (AMBS 2023). This species has previously been recorded on several occasions immediately adjacent to the Development Footprint, within adjacent Munghorn Gap Nature Reserve. A total of 153 records within 30 km of the Study Area (DPE 2022d[4]), though the majority of records are greater than 15-20 years old (DPE 2022d[4]). **Habitat:** The species mostly inhabits inland slopes of the Great Dividing Range, in areas of low to moderate relief with moist, fertile soils. It is most commonly associated with box-ironbark eucalypt woodland and dry sclerophyll forest, but also inhabits riparian vegetation such as sheoak (*Casuarina spp*) where it feeds on needle-leaved mistletoe and sometimes breeds (DCCEEW 2023b; DOE 2015b). It also uses a range of other habitats including remnant patches of vegetation in farmland and urban areas, roadside reserves and travelling stock routes (DOE 2015b). Foraging habitat consists of dry sclerophyll forests and woodlands containing large numbers of mature trees, high canopy coverage and a moderate to high abundance of mistletoes. Regent Honeyeater primarily forages on nectar produced by a small number of favoured Eucalyptus in addition to the nectar and fruit of mistletoes, lerp and honeydew (DOE 2016). Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany (DPE 2023e). Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks (DPE 2023e; Geering and		

Regent Honeyeater (*Anthochaera phrygia)*	Critically Endangered Species	Likelihood of significant impact
French 1998). Regent Honeyeater non-breeding flocks may be seen foraging in flowering coastal Mahogany *Eucalyptus robusta* and Spotted Gum *Corymbia maculata* forests in coastal areas of NSW and have been recorded in urban areas containing Mugga Ironbark *Eucalyptus sideroxylon* and Yellow Box *Eucalyptus melliodora* (DOE 2016). Key areas of habitat for the species as identified on the Important Habitat Map for the species (DPE 2023g) are present within the Study Area (Figure 17f). All remnant native vegetation within the Study Area constitutes Important Habitat Mapping for the species (DPE 2023g) as shown in Figure 17f. **Potential impacts associated with the Project:** Large portions of the vegetation to be cleared, predominantly the intact areas of woodland within the Development Footprint, are Important Habitat Mapped for the species (DPE 2023g) and form part of the Mudgee-Wollar breeding area (DPE 2023g; DOE 2016). The Project would result in the removal of 80.5 ha of habitat for this species. Aggressive exclusion of birds from potential woodland and forest habitat by over-abundant Noisy Miners (*Manorina melanocephala*) is a key threatening process relevant to this species. They compete directly and aggressively for resources with the Regent Honeyeater and they are considered to have a negative effect on breeding success and survival of the species (DOE 2016). Crates *et al.* (2018) state that the presence of a single pair of Noisy Miners may pose a risk to Regent Honeyeater nest survival. Noisy Miners were recorded within the Development Footprint (AMBS 2023) and are known to occupy a variety of habitats including edge habitat, open forest areas and urban landscapes (Clarke and Oldland, 2007; Ley A., Oliver D. and Williams B.,1996). Noisy Miners may penetrate 150 m to 300 m into woodland remnants (Clarke and Oldland, 2007). A possible indirect impact of the Project is the is increased access of the Noisy Miner to habitat adjacent to the Development Footprint during operation and while the mine landform is being revegetated. Artificial light and noise may also indirectly impact the Regent Honeyeater in adjoining areas of habitat (Haddock *et.al*. 2019a; Haddock *et.al*. 2019b). **Avoidance and mitigation measures:** The Project would avoid areas of Important Habitat Mapping located around the periphery of the Study Area and some larger patches of remnant vegetation in the south-west of the Study Area. The amended Project Development Footprint will result in a 56.4% reduction to the area of woodland habitat impacted (from 184.4 ha to 80.5 ha. The majority of this is located in the south-east of the Development Footprint adjacent to Munghorn Gap Nature Reserve. Important Habitat Mapped along Moolarben and Murdering Creeks will also be retained and enhanced through revegetation. The Project conceptual final landform aims to provide a net increase in native vegetation and improving connectivity with adjacent woodland and forest communities at Munghorn Gap Nature Reserve. A Noisy Miner monitoring and management program would be implemented to mitigate the potential impacts from Noisy Miners as described in Section 5.7. Annual inspections of the south-east corner of the Study Area (1 km from the closest record on Figure 17f) would occur each breeding season (July-January) to search for the Regent Honeyeater to confirm if the species breeds in that location and, if it does, evaluate if there are additional measures that could be implemented to improve breeding success in that location.		
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it would:		
1. lead to a long-term decrease in the size of a population;		
The Regent Honeyeater comprises a single population (DOE 2016). While the species was not recorded within the Study Area, it supports suitable foraging resources (AMBS 2023) and the Study Area occurs within the Mudgee-Wollar important breeding area (DOE 2016). As such, the species may use the resources within the Development Footprint or surrounds for foraging and potentially breeding, or move through the area to key breeding areas. Given this, the direct and indirect impacts on the potential habitat as a result of the Project may possibly contribute to a decrease in the size of the population.		Possible

Regent Honeyeater (*Anthochaera phrygia)*	Critically Endangered Species	Likelihood of significant impact
The potential incursion of Noisy Miners 150 m into the surrounding habitat has the potential to impact 430 ha of adjacent habitat however Noisy Miner monitoring and management would be undertaken. However, the Project would be progressive over 10 years and would be followed by rehabilitation, resulting in net increase in native vegetation and improving connectivity with adjacent woodland and forest communities at Munghorn Gap Nature Reserve. Impacts to Regent Honeyeater habitat would also be offset in accordance with the BC Act.		
2. reduce the area of occupancy of the species;		
This species has previously been recorded on several occasions south-east of the Development Footprint (DPE 2022d[4]; Figure 17f). Foraging habitat in the form of mistletoe is available throughout the woodland communities within the Development Footprint (AMBS 2023; ELA 2023). Important Breeding Habitat Mapped for the Regent Honeyeater also occurs throughout the area of direct impact of the Project (DPE 2023g). A total of 80.5 ha of Important Habitat Mapping would be directly impacted by the Project. Given the evidence of species occurrence in the locality (DPE 2022d[4]; Figure 17f), the confirmation of suitable habitat within the Development Footprint (AMBS 2023; ELA 2023), and the Important Habitat Mapped within the Development Footprint (DPE 2023g; Figure 17f), the Project is considered to have the potential to reduce the AOO of this species.		Likely
3. fragment an existing important population into two or more populations;		
The Regent Honeyeater comprises a single population, estimated (in 2010) to be between 350-400 individuals (DOE 2016). The Regent Honeyeater is a highly mobile species that moves across the landscape to follow flowering resources and their abundance is such that that they occur only irregularly at most sites (DOE 2016). Given the above, it is considered unlikely that the removal of vegetation within the site would result in the fragmentation of the population into two or more populations.		Unlikely
4. adversely affect habitat critical to the survival of a species;		
The National Recovery Plan for the Regent Honeyeater (DOE 2016) describes habitat critical for the species survival as: • Any breeding or foraging areas where the species is likely to occur • Any newly discovered breeding or foraging locations. Based on the presence of foraging resources and the likely occurrence of the species within the Development Footprint, and the location of the Project within the Mudgee-Wollar important breeding area, the habitat within the Development Footprint is considered habitat critical for the survival of the species. The Project would result in the removal of 80.5 ha of habitat critical for the survival of the species. The Project would avoid areas of habitat critical for the survival of the species located around the periphery of the Study Area and some larger patches of remnant vegetation in the south-west of the Study Area. Habitat critical for the survival of the species along Moolarben and Murdering Creeks will also be retained and enhanced through revegetation. In the long-term, the Project aims to provide a net increase in native vegetation and improving connectivity with adjacent woodland and forest communities at Munghorn Gap Nature Reserve (Figure 17f).		Likely

Regent Honeyeater (*Anthochaera phrygia)*	Critically Endangered Species	Likelihood of significant impact
Impacts to Regent Honeyeater habitat would be offset in accordance with the BC Act (i.e. the offset would protect and enhance habitat critical for the survival of the species many more times the area which would be cleared).		
5. disrupt the breeding cycle of a population		
The Project is within the Regent Honeyeater Mudgee-Wollar breeding area (DPE 2023g; DOE 2016). It is unknown if the species utilises the habitat within the Development Footprint for breeding. The presence of Noisy Miners within the Development Footprint may preclude use of the area by Regent Honeyeater for breeding (due to competitive exclusion by the Noisy Miners), but rather they may breed within the more treed/less fragmented woodland/forest areas around the periphery of the cleared areas and also within adjacent Munghorn Gap Nature Reserve. The Project would result in the removal of 80.5 ha of potential Regent Honeyeater breeding habitat. Even if the species is not breeding within the Development Footprint, they may use the more dense, intact areas of habitat around the periphery of the Study Area. Some of these areas will not be directly impacted by the Project. However, a possible indirect impact resulting from the Project is increased access of the Noisy Miner to habitat adjacent to the Development Footprint during operation and while the mine landform is being revegetated. A Noisy Miner monitoring and management program would be implemented to minimise the potential impacts from Noisy Miners as described in Section 5.2.2. It is also uncertain how the Regent Honeyeater may be impacted by noise and artificial light from the Project. Artificial light as an edge effect has been studied in combination with traffic noise, mostly in the context of road ecology. In this context it has strong negative effects on many nocturnal taxa, mammal species richness increases at the point where light levels return to ambient darkness, and bird diversity increases with distance from the road (Haddock et.al. 2019a; Haddock et.al. 2019b). Haddock's (2019a) study suggests that birds are likely impacted by noise and artificial light, thus there is potential for the Project to further preclude the Regent Honeyeater from adjoining areas of habitat through noise and artificial light. Blasting may cause a temporary short-term behavioural change such that the animals may flee as a result of the noise. Should the species be breeding in close proximity, blasting may cause the parents to leave a nest either temporarily or possibly permanently deserting the nest.		Possible
6. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;		
All areas of native vegetation within the Study Area and Development Footprint are Important Habitat Mapped for the species (Figure 17f), it also occurs within the Mudgee-Wollar breeding area of the species (DPE 2023g). As detailed above, the habitat is also considered to be critical to the survival of the species (as defined by the National Recovery Plan [DOE 2016]) based on likely occurrence due to the presence of foraging resources and breeding habitat. Given the above, the removal of 80.5 ha of habitat and the potential indirect impacts from artificial light and noise, Noisy Miner incursion has the potential to modify, destroy, remove and decrease both the availability and quality habitat to the extent that the species may decline.		Likely
7. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;		

Regent Honeyeater (*Anthochaera phrygia)*	Critically Endangered Species	Likelihood of significant impact
As detailed above, Noisy Miners were recorded within the Development Footprint (AMBS 2023) and are known to occupy a variety of habitats including edge habitat, open forest areas and urban landscapes (Clarke and Oldland 2007). A possible indirect impact resulting from the Project is increased access of the Noisy Miner to habitat adjacent to the Development Footprint during operation and while the mine landform is being revegetated. A Noisy Miner monitoring and management program would be implemented to mitigate the potential impacts from Noisy Miners as described in Section 5.2.2.		Possible
8. introduce disease that may cause the species to decline, or		
The Project would not introduce any disease that would cause the Regent Honeyeater to decline.		Unlikely
9. Interfere with the recovery of the species.		
As detailed above, the Project would result in habitat loss and fragmentation, habitat degradation (through edge effects on adjacent habitat) and competition for resources (through expansion of Noisy Miners (into areas of Important Habitat Mapping). As such, the Project is considered to have the potential to interfere with the recovery of the species.		Likely
Conclusion: The Project is considered likely to result in a significant impact on the Regent Honeyeater. Impacts to Regent Honeyeater habitat would be offset in accordance with the BC Act.		

Pink-tailed Legless Lizard

Pink-tailed Legless Lizard *(Aprasia parapulchella)*	Vulnerable Species	Likelihood of significant impact
Distribution and occurrence: The Pink-tailed Legless Lizard is only known from the Central and Southern Tablelands, and the South Western Slopes. There is a concentration of populations in the Canberra/Queanbeyan Region. Other populations have been recorded near Cooma, Yass, Bathurst, Albury and West Wyalong (Osborne and Jones 1995; DOE 2015a). This species is also found in the Australian Capital Territory (Osborne and Jones 1995; DOE 2015a). The main reasons that the species is eligible for listing in the Vulnerable category are the restricted and highly fragmented nature of its distribution and the continuing loss, fragmentation and degradation of its habitat (DOE 2015a). One record from 2000 occurs approximately 20 km to the east of the site in Goulburn River National Park, though this record is over 20 years old (DPE 2022d[4]). Habitat for the Pink-tailed Legless Lizard in the Study Area includes locations with surface rock and native grass cover, mostly within PCTs associated with the species (AMBS 2023). As described by AMBS, "*one juvenile individual of the species was found on a north-west facing moderate slope just below sandstone outcropping… This individual was recorded under a small stick with exfoliating bark rather than under a rock. Habitat near this record includes native grasses, Lomandra sp. tussocks, numerous and varied sizes of sandstone surface and embedded rock, as well as log debris. There is a small rocky sandstone outcrop and a tree canopy just upslope. This sandstone outcrop sits just below the edge of a basalt hill, which also contains many surface and*		

Pink-tailed Legless Lizard *(Aprasia parapulchella)*	Vulnerable Species	Likelihood of significant impact
embedded rocks". Surveys targeting this species were not able to be undertaken throughout the entire extent of potential habitat in the Study Area due to the COVID-19 lockdown enforcements limiting the availability of staff and instead focused on the south-west of the Study Area due to early detection of the Pink-tailed Legless Lizard (AMBS 2023). However, given the reasonably good connectivity of areas of potential habitat throughout the Study Area, it was considered likely that the species could utilise other areas of potential habitat throughout the Study Area, rather than being restricted only to the rocky areas in which it was recorded (AMBS 2023). The extent of suitable habitat in the Study Area for the species was mapped based on the presence of surface rock, native grasses (e.g. *Themeda* sp., *Lomandra* sp. etc.), mostly within PCTs associated with the species, including PCTs 266, 281, 471, 483 and 1655 (AMBS 2023). Locations that have been heavily grazed or subject to soil disturbance from crops, were excluded. Further, areas that did not contain surface rocks and logs were excluded. However, some small sections of degraded habitat were included based on the abundance of surface rock, presence of ants under rocks, and considering that these areas adjoined better condition habitat, which included some areas of land within PCTs not associated with the species. Within the Study Area, some suitable habitat contiguous with the occupied habitat within the south-west of the Project would be avoided by the Project where practicable. It is unknown if the species occurs within the other areas of suitable habitat mapped including a large patch within the north of the Study Area, the isolated patches of remnant vegetation within the northern half of the Stage 1 area, and the potential habitat around the periphery along the eastern and southern boundaries of the Development Footprint. **Habitat:** The Pink-tailed Legless Lizard inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly those dominated by Kangaroo Grass (*Themeda australis*) (Osborne and Jones 1995; DOE 2015a; Wong *et al*. 2011). Sites are typically well-drained, with rocky outcrops or scattered, partially-buried rocks (Wong *et al*. 2011). They are commonly found beneath small, partially-embedded rocks and appear to spend considerable time in burrows below these rocks; the burrows have been constructed by and are often still inhabited by small black ants and termites (Wong *et al*. 2011). This species feeds on the larvae and eggs of the ants with which it shares its burrows. **Potential impacts associated with the Project:** Approximately 207.14 ha of known and potential habitat would be removed as a result of the Project, which includes approximately 25.3 ha of habitat that occurs with Category 1 – exempt land (Figure 17b). **Avoidance and mitigation measures:** The Project has been designed to avoid large areas of Pink-tailed Legless Lizard habitat within the Study Area, particularly within the south-west of the Project. The Vegetation Clearance Protocol would include searches of this species prior to vegetation clearance of relevant vegetation zones associated with the species (where possible) to relocate individuals to outside of the proposed disturbance. Access to the mine site would be restricted, eliminating potential further removal or disturbance of scattered rocks within the Development Footprint. The post-mining final landform (Figure 19b), will include an area of habitat restoration for the species with placement of surface rocks.		
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
• **lead to a long-term decrease in the size of an important population;**		
There is no formal definition of what constitutes an important population of Pink-tailed Legless Lizard in the conservation advice for this species (DOE 2015a) and there is no recovery plan for this species at this time (DCCEEW 2023b). According to the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013), an important population is defined as a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are: • key source populations either for breeding or dispersal		Likely

Pink-tailed Legless Lizard *(Aprasia parapulchella)*	Vulnerable Species	Likelihood of significant impact
	• populations that are necessary for maintaining genetic diversity, and/or • populations that are near the limit of the species range. Given that the individual recorded within the Study Area was a juvenile, it can be assumed that the species is breeding in the general area. It is uncertain if the population within the Study Area is necessary for maintaining genetic diversity. The individual recorded within the Study Area is located near the boundary between the known and predicted distribution of this species (DPE 2023e) suggesting its presence represents a record towards the edge of its range. Considering that a juvenile individual was recorded near the boundary of the known and predicted distribution of this species, the population within the Study Area may be considered as an important population. One juvenile individual of the species was found outside of the Development Footprint on a north-west facing moderate slope just below sandstone outcropping within the south-west of the Study Area (AMBS 2023). Approximately 207.14 ha of potential habitat would be removed as a result of the Project (Figure 17b). Reptiles have evolved with natural lighting cycles. Consequently, alteration of natural variation in diurnal and nocturnal light intensities and spectral properties has the potential to disrupt their physiology, behaviour, and ecology in areas of habitat adjoining the Development Footprint (Perry et.al. 2008). The Project has been designed to minimise clearance in locations of potential Pink-tailed Legless Lizard habitat, particularly in the south-west of the Study Area. However, as described above, surveys targeting this species were not able to be undertaken throughout the potential habitat in the entire Study Area. Given the reasonably good connectivity of areas of potential habitat throughout the Study Area, it is considered likely that the species could utilise other areas of potential habitat throughout the Study Area, rather than being restricted only to the rocky areas in which it was recorded (AMBS 2023). Based on the evidence of breeding in the Study Area (presence of a juvenile), and the limitations of habitat surveys for this species within the Study Area, it is presumed that this species does occurs throughout all potentially suitable habitat within the Development Footprint. Given that the Project would impact on 207.14 ha of potential habitat for this species and potentially indirectly impact adjoining habitat by alteration of natural variation, it is possible that the Project could lead to a lead to a long-term decrease in the size of an important population of the species.	
	• **reduce the area of occupancy of an important population;**	
	One juvenile individual of the species was found on a north-west facing moderate slope just below sandstone outcropping within the Study Area (AMBS 2023). As such, the Development Footprint is considered to be within an AOO of this species. As described above, considering that a juvenile individual was recorded (indicating a breeding population) near the boundary of the known and predicted distribution of this species (towards the northern extent of its known range), it is possible that the Project may reduce the AOO of an important population if the population does not persist. Access to the mine site would be restricted, eliminating potential removal or disturbance of scattered rocks within the Development Footprint. The post-mining final landform Figure 19b) will include an area of habitat restoration for the species with placement of surface rocks.	Likely
	• **fragment an existing important population into two or more populations;**	

Pink-tailed Legless Lizard *(Aprasia parapulchella)*	Vulnerable Species	Likelihood of significant impact
Only one individual was recorded within the south-west of the Study Area (AMBS 2023); it is unknown if they occur in other areas of potentially suitable habitat mapped across the Development Footprint. Within the Study Area, suitable habitat contiguous with the occupied habitat within the south-west of the Project would be avoided by the Project. It is unknown if the species occurs within the other areas of suitable habitat mapped including a large patch within the north of the Study Area, the isolated patches of remnant vegetation within the northern half of the Stage 1 area, and the potential habitat around the periphery along the eastern and southern boundaries of the Development Footprint. Removal of habitat within the Development Footprint will reduce/remove habitat, and thus connectivity, throughout the valley areas and through the central portion of the Development Footprint such that any population present in retained habitat patches adjacent to the Project in the north, south-west and south-east may become isolated. While little is known of movement patterns of the species (due to their fossorial nature) (Wong *et al*. 2011) observations of captured individuals outside of areas of suitable shelter habitat and within newly regenerating areas, indicate they may move in the order of 30 m and they are able to move across the landscape and occupy new areas to some extent (Wong *et al*. 2011). Given the relatively large distance between retained patches of habitat in the south-west, north and south-east of the Study Area, it is probably unlikely that connectivity and movement could be maintained by the species across the extent of these patches. As such, the Project is considered to have the potential to fragment the population into two or more populations.		Likely
• **adversely affect habitat critical to the survival of a species;**		
No critical habitat has been formally identified for this species in any Commonwealth documents (Osborne and Jones 1995; DOE 2015a). The conservation advice states that there is a "lack of information about the pink-tailed worm-lizard and its population decline" (DOE 2015a). The species inhabits sloping, open woodland areas with predominantly native grassy ground layers, particularly sites with low levels of disturbance dominated by large tussock-forming grasses, such as Kangaroo Grass (*Themeda australis*) (AMBS 2023; Wong *et al*. 2011). Sites in which the Pink-tailed Legless Lizard are found are also generally well-drained, possessing surface or partially-buried rocks (AMBS 2023; Wong *et al.* 2011). Pink-tailed Legless Lizard abundance is lower in land that has been subject to considerable pasture improvement or more intense livestock grazing (Osborne and Jones 1995). Within the Study Area, suitable habitat contiguous with the occupied habitat within the south-west of the Project would be avoided by the Project. It is unknown if the species occurs within the other areas of suitable habitat mapped including a large patch within the north of the Study Area, the isolated patches of remnant vegetation within the northern half of the Stage 1 area, and the potential habitat around the periphery along the eastern and southern boundaries of the Development Footprint. Given the presence and persistence of known populations of the species within numerous conservation reserves throughout its range (Wong *et al*. 2011) and considering the avoidance and mitigation measures to be undertaken, it is considered unlikely that the Project would adversely affect habitat critical to the survival of a species.		Unlikely
• **disrupt the breeding cycle of an important population**		

Pink-tailed Legless Lizard *(Aprasia parapulchella)*	Vulnerable Species	Likelihood of significant impact
The occupied and potential habitat within the Development Footprint constitutes suitable for foraging and breeding of the Pink-tailed Legless Lizard (AMBS 2023). One juvenile individual of the species was found by AMBS (2023) indicating that breeding is occurring in the Study Area. Removal of about 36% of the potential habitat within the Study Area has the potential to disrupt the breeding cycle of an important population.		Likely
• **modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;**		
The Project would result in the removal of 207.14 ha of potential breeding and foraging habitat for the species. The Development Footprint has been designed to minimise clearance in locations where the Pink-tailed Legless Lizard was recorded, namely in the south-west. Pre-clearing surveys would be conducted to minimise the impact on individuals and allow for the re-location of resident individuals. The Project would also include creation of new habitat within adjacent habitat as part of the post-mine landform. Given the presence of known populations of the species within numerous conservation reserves throughout its range (Wong *et al*. 2011) and considering the avoidance and mitigation measures to be undertaken it is considered unlikely that the Project would modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.		Unlikely
• **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;**		
The Project would involve clearance of native vegetation around the periphery of areas of known and potential habitat. Expanding the edge of cleared habitat may allow for the incursion of feral pests (such as foxes and feral cats) that may prey on the species (DCCEEW 2023b). Foxes and feral cats would be controlled and monitored as part of the Biodiversity Monitoring Program. The Project has the potential to indirectly impact adjacent habitat through edge effects (altered light and nutrient regimes, weed incursion) that may affect habitat quality for the species. Mitigation measures including and a ground disturbance procedure, weed control, drainage structures, erosion control and dust suppression would be implemented to avoid and mitigate potential indirect impacts to retained plants in adjacent habitat. As such, the Project is considered unlikely to result in establishment of invasive species within habitat of the Pink-tailed Legless Lizard.		Unlikely
• **introduce disease that may cause the species to decline, or**		
The Project is unlikely to introduce disease which may lead to declines of this species. No known diseases are recorded to impact upon this species (Osborne and Jones 1995; DOE 2015a).		Unlikely
• **Interfere substantially with the recovery of the species.**		
According to the approved conservation advice for the Pink-tailed Legless Lizard (DOE 2015a), habitat loss, fragmentation, habitat degradation and removal of rocks are considered to be the key threats to this species. While the Project has the potential to interfere with the recovery of the species through exposure of the local population to these threats, measures to avoid, mitigate and manage impacts and habitat into the future (though the retention of occupied habitat, implementation of measures to		Unlikely

Pink-tailed Legless Lizard *(Aprasia parapulchella)*	Vulnerable Species	Likelihood of significant impact
relocate resident individuals, and the protection and enhancement of areas of habitat for this species within the post-mine landform) will assist with the long-term persistence, and recovery, of the species.		
Conclusion: The Project is considered likely to have a significant impact on the Pink-tailed Legless Lizard. Impacts to 207.14 ha of potential Pink-tailed Legless Lizard habitat would be offset in accordance with the BC Act.		

Large-eared Pied Bat

Large-eared Pied Bat *(Chalinolobus dwyeri)*	Endangered Species	Likelihood of significant impact
The Large-eared Pied Bat is a medium-sized insectivorous bat measuring approximately 100 mm including the head and tail and weighing 7-12 g (Hoye and Dwyer 1995). Its relatively short, broad wings suggest it flies comparatively slowly with considerable manoeuvrability and forages predominantly below the canopy. **Distribution and occurrence:** The species' current distribution is poorly known (DCCEEW 2023b). Records exist from Shoalwater Bay, north of Rockhampton, Queensland, through to the vicinity of Ulladulla, NSW in the south (DCCEEW 2023b). Despite the large range, it has been suggested that the species is far more restricted within its range than previously understood (DCCEEW 2023b). Much of the known distribution of the Large-eared Pied Bat occurs in NSW. In the north east of the state at Coolah Tops, Mt Kaputar and Warrumbungle National Park it is present in areas of volcanic strata. It is more widely distributed, but still uncommon and patchy within its distribution, in the sandstone areas of the Sydney Basin and the western slopes and plains including Pilliga Nature Reserve (Hoye and Dwyer 1995; Schulz 1998). In relation to the Project, it has been recorded within Goulburn River National Park and Munghorn Gap Nature Reserve (DPE 2022d[4]). The species was also recorded within the Study Area on multiple occasions by AMBS (2023). **Habitat:** The Large-eared Pied Bat is dependent on the presence of diurnal roosts for shelter. Roosts are also utilised at night when not feeding, as well as when raising young. This species has been known to roost in disused mine shafts, caves, overhangs and abandoned Fairy Martin (*Petrochelidon ariel*) nests (Schultz 1998). Maternity roosts have been recorded at Pilliga scrub and Coonabarabran, and lactating females have been captured adjacent to sandstone cliffs near Ulan, NSW (Hoye 2005; DERM 2011). **Potential impacts associated with the Project:** Within the Study Area, potential roosting and breeding habitat for the Large-eared Pied Bat is extensive and highly variable. A variety of habitat features occur including tall sandstone rocks and boulders, small cavities and crevices within rocks, cavities between rocks, low entry caves, small domes, low and high overhangs, and Fairy Martin nests (AMBS 2023). On the basis of the information outlined above, breeding and foraging habitat for the Large-eared Pied Bat occurs within the Study Area and nearby surrounds as mapped in Figure 17i. Breeding habitat in the form of mapped rocky habitat has been mapped outside the Study Area where it occurs within 100 m of the Study Area boundary as per OEH (2018c). In accordance with the NSW survey guide for *'Species credit' Threatened Bats and Their Habitat* (DPIE 2021), a species polygon (occupied and/or suitable habitat) for the species includes woodland habitat of associated PCTs		

Large-eared Pied Bat *(Chalinolobus dwyeri)*	Endangered Species	Likelihood of significant impact
as per the TBDC (DPE 2023e) (i.e. PCTs 281, 471, 1629, 1655) within a 2 km radius of identified roosting habitat. The species polygon, shown on Figure 17i, includes PCTs associated with the species, as well as: • PCTs 266, 483, 1610 because the species was recorded within these during the surveys • PCTs 478, 481, 1656, 1661 and 1711 because of their close proximity to roosting habitat and other areas of suitable habitat (i.e. PCTs associated with the species and habitat which contains species records), it is likely the species would utilise these areas of habitat for foraging and movement throughout the Study Area. "It is likely the species would forage or move through woodland habitat of all PCTs in the Study Area" (AMBS 2023) as well as potentially disrupt important breeding habitat adjacent to the Project (such as indirect impacts from noise, blasting and lighting). Artificial light has been shown to impact bats (Haddock *et al*. (2019a); it markedly delays some species' emergence times from roosts, meaning that their foraging time is reduced and the health of the population may at risk (Haddock *et al*. 2019a; Haddock *et al*. 2019b). Blasting has the potential to disrupt bat roosting/breeding causing them to exit the roost during the day. The specific location of roosts was not able to be determined given the extent of the mapped rocky habitat around the outside of the Project (Figure 17i and Figure 17j) and ability for the bat species (including the threatened Large-eared Pied Bat and Eastern Cave Bat) to use small crevices. Further, if the ground vibration exceeds 460 mm/s as a result of blasting, it could potentially cause collapse of rocky structures (SLR 2022). The Project avoids all breeding habitat in the Study Area, but would directly impact 113.02 ha of potential foraging habitat. The Project Development Footprint has been designed to avoid mapped rocky habitat as shown in Figure 17i. **Avoidance and mitigation measures:** The Project Footprint has been designed to avoid mapped rocky habitat as shown in Figure 18b. The Project would include retention and revegetation of riparian vegetation along Moolarben and Murdering Creeks. The Project conceptual final landform aims to provide a net increase in native vegetation and improve connectivity with adjacent woodland and forest communities at Munghorn Gap Nature Reserve. Indirect impacts from light spill, noise and blasting would be mitigated, managed and monitored as detailed in Section 5.7. Monitoring and management of feral pests would be conducted as part of the Project. To maintain cliff habitat, a blast design vibration criterion of 50 mm/s would be applied to cliffs.		
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
1. lead to a long-term decrease in the size of an important population of a species;		
The Conservation Advice for the Large-eared Pied Bat states that there is insufficient information available to be able to describe, with spatial information, important populations of this species and that all populations of this species should be considered important (DCCEEW 2023e). During surveys conducted by AMBS (2023) in January 2021, "*13 individuals were caught in harp traps and six were observed (or hand caught) during habitat searches by AMBS (2023). Of these, one adult female was lactating (later stages) and two males were immature. One additional female was non-breeding at the time of the survey but may have bred in the past (indicated by black nipples). The species was recorded on Anabat detectors at 30 locations*". Three roosts were recorded during habitat searches. Within the Study Area, potential roosting and breeding habitat for the Large-eared Pied Bat is extensive and highly variable. A variety of habitat features occur including tall sandstone rocks and boulders, small cavities and crevices within rocks, cavities between rocks, low entry caves, small domes, low and high overhangs, and Fairy Martin (*Petrochelidon ariel*) nests (which are known to be used by the Large-eared Pied Bat for roosting) (AMBS 2023). Given the number of individuals observed,		Possible

Large-eared Pied Bat *(Chalinolobus dwyeri)*	Endangered Species	Likelihood of significant impact
the evidence of breeding and the presence of breeding and foraging habitat, the population within the Study Area is considered to be an important population for this species. 'Vegetation clearance in the proximity of roosts' and the 'destruction of and interference with maternity roosts and other roosts' have been identified as key threats to this species, with the level of risk being imposed by these threats considered as very high risk (DCCEEW 2023e). Although the Project has been designed to avoid clearance of mapped rocky habitat, the Project has the potential to impact the Large-eared Pied Bat through disruption of breeding (such as indirect impacts from noise [blasting and operational noise], lighting and vegetation clearance in proximity to roosts) and clearance of foraging habitat (direct impacts). Indirect impacts of light spill, noise and blasting would be mitigated, managed and monitored as part of the Project. The Project would be progressive over 10 years and would be followed by rehabilitation of a net increase in habitat. However, the direct removal of known and potential foraging habitat and the potential for deleterious indirect impacts on known and potential breeding and roosting habitat from noise and lighting from the Project are considered to have the potential to lead to a long-term decrease in the size of an important population of this species over the 10-year life span of the Project.		
2. reduce the area of occupancy of an important population;		
The species extent of occurrence is approximately 570,000 km² (Hoye and Dwyer 1995). The AOO is approximately 9,120 km². This is calculated from the extent of occurrence and the detection rate of echolocation calls of 1.6% at 3,154 sites across the range of the Large-eared Pied Bat (DCCEEW 2023e). Given the number of individuals recorded by AMBS (2023), the Study Area falls within the AOO of this species. The Project Footprint has been designed to avoid clearance of mapped rocky habitat (potential breeding habitat) and blasting controls, management and monitoring of habitat have been developed to ensure potential impacts are avoided/mitigated However, as detailed above, the Project has the potential to impact the Large-eared Pied Bat through disruption of breeding (such as indirect impacts from noise, lighting and vegetation clearance in the proximity of roosts) and clearance of up to 113.02 ha of foraging habitat (direct impacts). Given the presence and persistence of the species within the Study Area (despite previous and ongoing mining activity), and broader availability of breeding resources (for example in adjacent Munghorn Gap Nature Reserve), it is considered unlikely the Project would reduce the area of occupancy of the population.		Unlikely
3. fragment an existing important population into two or more populations;		
The Large-eared Pied Bat is a highly mobile species, capable of traversing and foraging over wide areas (Williams and Tomson B 2018). As such, the Project is considered unlikely to fragment an important population into two or more populations.		Unlikely
4. adversely affect habitat critical to the survival of a species;		

Large-eared Pied Bat *(Chalinolobus dwyeri)*	Endangered Species	Likelihood of significant impact
No Critical Habitat as defined under section 207A of the EPBC Act is identified in the Register of Critical Habitat or identified in any Commonwealth conservation documents (DCCEEW 2023e). The conservation advice (DCCEEW 2023e) for this species states that "*it is not practicable to describe habitat critical to the survival of this species. Large areas of potential habitat for this species are unsurveyed and confirmation as habitat can only be achieved through detection-based presence /absence field surveys. In the absence of confirmed occupancy, potential habitat can be identified as necessary to support the recovery of this species through verification of the presence of habitat attributes. The species eligibility for listing and key threat being the loss, degradation and fragmentation of habitat suggests that all habitat for the species either now or at some point in the near future is likely to be critical to the survival of the species".* The National Recovery Plan suggests that sandstone cliffs and fertile wooded valley habitat within close proximity of each other should be considered habitat critical to the survival of the Large-eared Pied Bat (DERM 2011). On its own, the potential foraging habitat to be removed by the Project is not considered to comprise habitat critical to the survival of the species, given the availability of potential foraging habitat (open wooded valley habitat) in the surrounding area. However, the foraging habitat to be removed is adjacent to potential breeding/roosting habitat and would, therefore, be considered to be important due to its proximity to the breeding/roosting habitat, as per the definition of habitat critical to the survival of the species above. According to the conservation advice, all habitat is considered critical to the survival of the species (DCCEEW 2023e). Therefore, critical habitat in the form of breeding or roosting habitat would be impacted as a result of the Project through indirect (noise and lighting) and some direct impacts (clearing), as well as the direct clearing of foraging habitat within close proximity to roost sites. As such, the Project has the potential to adversely affect habitat critical to the survival of the species.		Possible
5. disrupt the breeding cycle of an important population		
'Vegetation clearance in the proximity of roosts' and the 'destruction of and interference with maternity roosts and other roosts' have been identified as key threats to this species, with the level of risk being imposed by these threats considered as very high risk (DCCEEW 2023e). The Project has been designed to avoid rocky outcrops (potential breeding habitat). However, the Project has the potential to impact the Large-eared Pied Bat through disruption of a breeding cycle (via indirect impacts from noise and lighting) and the clearance of foraging habitat within close proximity to breeding and roosting sites (direct impacts). Therefore, the Project is considered to have the potential to disrupt the breeding cycle of an important population.		Possible
6. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline		
As described in the sections above, destruction of and interference with maternity roosts and other roosts, as well as clearing of foraging habitat within close proximity to breeding and roost sites, are threats to this species. The Project would interfere with maternity roosts and other roosts by creating artificial light and noise within close proximity to breeding and roost sites, as well as directly remove some potential breeding habitat. The Project would also impact on foraging habitat for the Large-eared Pied Bat through the clearing of native vegetation. Although similar foraging habitat is widely available in the surrounding area, the foraging habitat to be removed is within close proximity to the breeding and roosting habitat. As such, the combination of indirect impacts to the potential breeding habitat and the removal of foraging		Likely

Large-eared Pied Bat *(Chalinolobus dwyeri)*	Endangered Species	Likelihood of significant impact
habitat close to the breeding habitat is considered to modify, destroy, remove and decrease both the availability and quality of habitat to the extent that the species would be likely to decline.		
7. result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;		
According to the conservation advice (DCCEEW 2023e) invasive species that are considered a threat to this species are predation from feral cats and foxes, and roost disturbance from feral goats. Monitoring and management of feral pests would be conducted as part of the Project. As such, the Project is not likely to further result in the introduction of invasive species that may become established in habitat for the species.		Unlikely
8. introduce disease that may cause the species to decline, or		
It is considered unlikely that the Project would introduce disease that may cause the Large-eared Pied Bat to decline.		Unlikely
9. Interfere substantially with the recovery of the species.		
As described above, the population within the Study Area is considered to be an important population for this species and the habitat within the Study Area is considered to be habitat critical to the survival of the species. Further, the breeding and roosting habitat within the Study Area may be considered to support/be part of a priority roost and maternity site. Through the indirect and direct impacts as a result of the Project that have been described throughout this assessment for the Large-eared Pied Bat, the Project is considered to have the potential to interfere with the recovery of the species through impacts to 'priority roost and maternity sites'.		Possible
Conclusion: The Project is considered to have the potential to significantly impact the Large-eared Pied Bat. Impacts to Large-eared Pied Bat habitat would be offset in accordance with the BC Act.		

Broad-headed Snake

Broad-headed Snake (*Hoplocephalus bungaroides*)	Endangered species	Likelihood of significant impact
Distribution and occurrence: The Broad-headed Snake is distributed from Wollemi National Park south to the Clyde River catchment. Its easternmost occurrence is in the Royal National Park and its western limit is the upper Blue Mountains (DCCEEW 2023b). One Broad-headed Snake was recorded during targeted surveys by AMBS (2023) in 2021. The individual was recorded approximately 96 m outside the Development Footprint at the edge of the escarpment under a large sandstone rock. The habitat in which the individual was recorded is contiguous with potential		

Broad-headed Snake (*Hoplocephalus bungaroides*)	Endangered species	Likelihood of significant impact

habitat that occurs within the Development Footprint. No other records of the species occur within 30 km of the Project (DPE 2022d[4]), although the species has long been thought to occur in the Munghorn Gap Nature Reserve (NPWS, 2003).

Habitat: The Broad-headed Snake has a preferred habitat centred on the communities occurring on the Triassic sandstone of the Sydney Basin. The sites where they occur are typified by exposed sandstone outcrops and benching and in these locations the vegetation is mainly woodland, open woodland and/or heath. The Broad-headed Snake seasonally occupies distinctive microhabitats within these broader habitat types. They utilise rock crevices and exfoliating sheets of weathered sandstone during the cooler months and tree hollows during summer (Webb and Shine 1997a). As described by AMBS (2023), "*this species is nocturnal, sheltering during the day in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring* (DPE 2023a). *In summer, the Broad-headed Snake moves from the sandstone rocks to shelter in crevices or hollows in large trees within 500 m of escarpments* (DPE 2023a). *This species diet consists primarily of geckos and small skinks, but also occasionally includes frogs and small mammals* (DPE 2023a). *Females produce between four and twelve live young from January to March, which is considered a relatively low level of fecundity*" (DPE 2023a). Rocky areas, escarpments, outcrops and pagodas make up the primary habitat for this species in terms of breeding, hunting and sheltering, with individuals often spending long periods of inactivity in a retreat site (DPE 2023a). Gravid females and juveniles will remain in rocky habitat, using cooler, shaded rocks and crevices (DPE 2023a). The Broad-headed Snake is an ambush predator, spending up to four weeks in the same retreat site and preying on small reptiles and mammals that enter the retreat (Webb and Shine 1997b).

Potential impacts associated with the Project: As described in AMBS (2023), "*within the Study Area, the species is associated with PCTs 1629 and 1711. No suitable sandstone habitat was observed in PCT 1711 and therefore this area was not included in the species polygon. Within PCT 1629, suitable sandstone habitat including rocky areas, escarpments, outcrops or pagodas were mapped and a 100 m buffer was applied*", as per advice from DPE (DPE 2021a). "*Smaller area of PCTs not associated with the species were also considered to provide suitable habitat where they occurred nearby to PCT 1629 and contain hollow-bearing trees and suitable sandstone habitat, as described above. These areas of habitat also had a 100 m buffer applied*" (AMBS 2023). Potential habitat within the Study Area (as identified by the species polygon) does not occur within the Development Footprint and would not be directly impacted by the Project (cleared) (Figure 17c). Adjoining areas of habitat may potentially be indirectly impacted (noise, vibration and lighting impacts).

Avoidance and mitigation measures: The Development Footprint has been designed to avoid primary shelter habitat (i.e. mapped rocky habitat) as shown in Figure 18b. Indirect impacts from light, noise and vibration would be mitigated, managed and monitored as detailed in Section 5.7. To maintain cliff/rocky habitat, a blast design vibration criterion of 50 mm/s would be applied to cliffs/rocky areas. Targeted pre-clearance surveys would also be conducted within areas of suitable habitat to allow for relocation of resident individuals prior to clearance. Foxes and feral cats would be controlled and monitored as part of the Biodiversity Monitoring Program.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

1. Lead to a long-term decrease in the size of an important population of a species;

Broad-headed Snake (*Hoplocephalus bungaroides*)	Endangered species	Likelihood of significant impact
According to the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013), an important population is defined as: • key source populations either for breeding or dispersal • populations that are necessary for maintaining genetic diversity, and/or • populations that are near the limit of the species range. No important populations of the Broad-headed Snake have been formally identified in any Commonwealth conservation documents or webpages (DCCEEW 2023b; DCCEEW 2023f). One Broad-headed Snake was recorded during targeted survey within the Study Area by AMBS in 2021. The individual was recorded approximately 96 m outside the Development Footprint, at the edge of an escarpment under a large sandstone rock. The Broad-headed Snake was previously recorded in a nearby offset area to the west of the Development Footprint during monitoring surveys in 2018 (ELA 2018). This is the only other known record of the Broad-headed Snake near the Project. Due to the limited records within the vicinity of the Development Footprint (DPE 2022d[4]) it is uncertain if the population in the local area is an important population for breeding or maintaining genetic diversity. However, the Project is located near the north-western limit of the known distribution of this species (DPE 2023e), thus the population may possibly be an important population based on the definitions above. As described above, the area of suitable habitat for this species includes PCT 1629 and PCT 1711, which were both mapped by ELA (2023) in the Study Area; however, PCT 1711 within the Study Area was not mapped as part of the species polygon due to a lack of suitable sandstone habitat. PCT 1711 largely occurs around the perimeter of the Study Area and is contiguous with large extents of similar vegetation in adjacent Munghorn Gap Nature Reserve which includes 5,935 ha of protected sandstone pagoda formation country (NPWS 2003). It is likely that the suitable habitat adjacent to the Study Area within Munghorn Gap Nature Reserve would represent preferred and core habitat for the species in the vicinity of the Project. The habitat within the Study Area is largely being avoided by the Project and no habitat occurs within the Development Footprint. More intact habitat (with rocky habitat) is widely represented within Munghorn Gap Nature Reserve which surrounds the Project to the east, south and south-west (NPWS 2003). As no habitat for this species would be directly impacted, it is considered unlikely that the Project would lead to a long-term decrease in the size of the overall Broad-headed Snake population.		Unlikely
2. Reduce the area of occupancy of an important population;		
One Broad-headed Snake was recorded during targeted survey of the Study Area by AMBS (2023). The individual was recorded approximately 96 m outside the Development Footprint boundary, at the edge of the escarpment under a large sandstone rock. The Study Area is located near the north-western limit of the known distribution of the species (DPE 2023e). The species record near the Study Area represents the only record for the species within 30 km (DPE 2022d[4]), although the species has long been thought to occur in the Munghorn Gap Nature Reserve (NPWS, 2003). The Study Area supports only a small proportion of suitable habitat for this species with the majority of suitable habitat for this species occurring within the adjacent Munghorn Gap Nature Reserve.		Unlikely

Broad-headed Snake (*Hoplocephalus bungaroides*)	Endangered species	Likelihood of significant impact
As such, key areas of occupancy may be expected to occur within the rocky areas (completely being avoided by the Project), and also with Munghorn Gap Nature Reserve. As such, the Project is considered unlikely to reduce the AOO of an important population.		
3. Fragment an existing important population into two or more populations;		
It is noted that this species is highly mobile rather than sedentary, capable of dispersing over large distances according to Dubey *et al*. (2011), with their study indicating significant gene flow over relatively large spatial scales. The Project is located on the edge of suitable habitat for the species. As such, the Project would not reduce the area of habitat for the species, and it will not fragment habitat such that the population may also be fragmented into two or more populations.		Unlikely
4. Adversely affect habitat critical to the survival of a species;		
Habitat that is critical to the survival of a species is defined in the *Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (DEWHA 2013) as "*areas that are necessary:* • for activities such as foraging, breeding, roosting, or dispersal • for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators) • to maintain genetic diversity and long-term evolutionary development, or • for the reintroduction of populations or recovery of the species or ecological community". To date, no Critical Habitat as defined under section 207A of the EPBC Act has been identified within the Development Footprint or included in the Register of Critical Habitat, or identified in any Commonwealth conservation documents. However, habitat necessary for foraging, breeding and sheltering occurs within the Study Area (AMBS 2023). To minimise impact to the species, the Project has been designed to avoid mapped rocky habitat. This important habitat resource is also likely well represented within the adjacent Munghorn Gap Nature Reserve which includes 5,935 ha of protected sandstone pagoda formation country (NPWS 2003). Given all suitable mapped rocky habitat for the species would be avoided, and that mapped rocky habitat also occurs to a much greater extent in the adjacent Munghorn Gap Nature Reserve, it is considered unlikely that the Project would adversely affect habitat critical to the survival of the Broad-headed Snake.		Unlikely
5. Disrupt the breeding cycle of an important population		
Females produce between four and twelve live young from January to March (DPE 2023a). Gravid females and juveniles will remain in rocky habitat, using cooler, shaded rocks and crevices (DPE 2023a).		Unlikely

Broad-headed Snake (*Hoplocephalus bungaroides*)	Endangered species	Likelihood of significant impact
Given that suitable breeding habitat in the form of mapped rocky habitat within the Study Area is completely avoided by the Project, it is unlikely the Project would disrupt the breeding cycle of an important population.		
6. Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;		
To minimise impact to the species, the Project has been designed to avoid mapped rocky habitat suitable for the Broad-headed Snake. Extensive areas of similar habitat occurs widely in the surrounding landscape (5,935 ha of protected sandstone pagoda formation country in Munghorn Gap Nature Reserve [NPWS 2003]). No suitable habitat (with hollow bearing trees) for the species would be removed for the Project. Given the known mobility of the species, the avoidance of mapped rocky habitat within the Development Footprint and the availability of habitat in the wider area, it is considered unlikely that the Project would reduce the availability and quality of habitat to the extent that the species is likely to decline. Pre-clearing survey will also be conducted in areas of suitable habitat to enable re-location of resident individuals prior to clearance.		Unlikely
7. Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat;		
The Project would involve clearance of native vegetation around the periphery of areas of known and potential habitat. Expanding the edge of cleared habitat may allow for the incursion of feral pests (such as foxes and feral cats) that may prey on the species (DCCEEW 2023b). Foxes and feral cats would be controlled and monitored as part of the Biodiversity Monitoring Program. As such, the Project is considered unlikely to result in establishment of invasive species within habitat of the Broad-headed Snake.		Unlikely
8. Introduce disease that may cause the species to decline, or		
Disease has not been identified as a potential threat to this species (DCCEEW 2023b; DCCEEW 2023f). It is considered unlikely that the Project would introduce disease that may cause the Broad-headed Snake to decline.		Unlikely
9. Interfere substantially with the recovery of the species.		
A recovery plan has not yet been prepared for the species. Broad-headed Snake in NSW has been assigned as a site managed species under the Saving Our Species program (SOS n.d.). Three sites have been identified as management sites for this species; Woronora Plateau, Royal National Park and Morton National Park. The Project site is not within any of the three categorised management sites.		Unlikely

Broad-headed Snake (*Hoplocephalus bungaroides*)	Endangered species	Likelihood of significant impact
The Approved Conservation Advice (DCCEEW 2023f) for the species lists a number of priority actions that may be undertaken to assist the recovery of the species. Avoidance of key areas of habitat for the species through Project design aligns with the priority actions to "limit habitat loss, disturbance and modification" by largely avoiding potential habitat within the Study Area.		
Conclusion: **The Project is considered unlikely to have a significant impact on the Broad-headed Snake due to avoidance of key mapped rocky habitat and presence of large extents of protected rocky habitat adjacent to the Study Area. Direct impact to no Broad-headed Snake habitat would be offset in accordance with the BC Act.**		

Swift Parrot

Swift Parrot (*Lathamus discolor)*	Critically Endangered Species	Likelihood of significant impact
Distribution and occurrence: Swift Parrots breed in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes (DPE 2023e). This species was not recorded during targeted surveys, however the species has been recorded in contiguous habitat to the north of the Study Area with records in the wider locality, including with the nearby Munghorn Gap Nature Reserve (AMBS 2023). This species breeds only in Tasmania and therefore no breeding habitat occurs within the Development Footprint. **Habitat:** Swift Parrots migrate to the Australian south-east mainland between February and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations (DPE 2023e). Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Forest Red Gum *E. tereticornis*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens* (DPE 2023e). Commonly used lerp infested trees include Inland Grey Box *E. microcarpa*, Grey Box *E. moluccana*, Blackbutt *E. pilularis*, and Yellow Box *E. melliodora* (DPE 2023e). This species returns to some foraging sites on a cyclic basis depending on food availability (DPE 2023e). Following winter they return to Tasmania where they breed from September to January, nesting in old trees with hollows and feeding in forests dominated by Tasmanian Blue Gum *Eucalyptus globulus* (DPE 2023e). Key foraging areas for this species within NSW are identified within the Important Habitat Map for the species (DPE 2023g). The Important Habitat Map for the species includes "Areas with sightings of five or more birds recorded over any two or more years, or single sightings of 40 or more birds" and is defined by a 2 km radial buffer on all cleaned and checked Swift Parrot sighting records from 1990-2020. No areas of habitat identified on the Swift Parrot Important Habitat Map occur within the Development Footprint (DPE 2023g). This species is associated with PCTs 266, 281, 1629 and 1655 within the Development Footprint.		

Swift Parrot (*Lathamus discolor)*	Critically Endangered Species	Likelihood of significant impact
Potential impacts associated with the Project: Approximately 105.52 ha of potentially suitable habitat would be directly impacted (cleared), with adjoining areas of habitat potentially indirectly impacted (noise and lighting impacts). **Avoidance and mitigation:** The Project would avoid impact to some areas of potentially suitable habitat including retention of woodland habitat in the south-west of the Study Area and retention and revegetation of riparian vegetation along Moolarben and Murdering Creeks. The Project conceptual final landform aims to provide a net increase in native vegetation and improve connectivity with adjacent woodland and forest communities at Munghorn Gap Nature Reserve. Indirect impacts from light spill, noise and vibration within adjacent habitat would be mitigated, managed and monitored as detailed in Section 5.7. Feral cats would be controlled and monitored as part of the Biodiversity Monitoring Program.		
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it would:		
1. lead to a long-term decrease in the size of a population;		
The Swift Parrot comprises a single, migratory population (Saunders and Tzaros 2011). This species was not recorded during targeted surveys, however the species has been recorded in contiguous habitat to the north and there are also records in the wider locality, including with the nearby Munghorn Gap Nature Reserve (AMBS 2023). Associated PCTs and autumn/winter flowering food tree species are present within the Development Footprint. Given the highly mobile nature of this species, and wide occurrence of potential habitat for the species in the surrounding landscape, it is unlikely that the Project would lead to a long-term decrease in the size of a population.		Unlikely
2. reduce the area of occupancy of the species;		
This species was not recorded during surveys despite sufficient survey effort (AMBS 2023). The species has been previously recorded nearby on six occasions, with the nearest record located approximately 2 km to the east of the Development Footprint. No areas of habitat identified on the Swift Parrot Important Habitat Map occur within the Development Footprint (DPE 2023g). Foraging habitat in the Development Footprint has been mapped as the species associated PCTs as well as non-associated PCTs that contain one or more of the winter flowering species. A total of 105.52 ha of potential foraging habitat would be directly impacted by the Project, however given the highly mobile nature of this species and the fact that no breeding habitat would be impacted, it is unlikely to reduce the AOO of the species.		Unlikely
3. fragment an existing important population into two or more populations;		
The Swift Parrot comprises a single, migratory population (Saunders and Tzaros 2011). Given the highly mobile nature of the species, the abundance of habitat available in the surrounding area, and the fact that no breeding habitat or foraging habitat as identified on the Important Habitat Map would be impacted, the Project is considered unlikely to fragment an existing important population into two or more populations.		Unlikely
4. adversely affect habitat critical to the survival of a species;		

Swift Parrot (*Lathamus discolor)*	Critically Endangered Species	Likelihood of significant impact
The National Recovery Plan for the Swift Parrot (Saunders and Tzaros 2011) describes habitat critical for the species survival as: • Areas of priority habitat for which for which the Swift Parrot has a level of site fidelity or possess phenological characteristics likely to be of importance to the Swift Parrot • Areas otherwise identified by the recovery team. Key foraging areas for this species within NSW are identified within the Important Habitat Map for the species. The Important Habitat Map for the species includes "Areas with sightings of five or more birds recorded over any two or more years, or single sightings of 40 or more birds" and is defined by a 2 km radial buffer on all cleaned and checked Swift Parrot sighting records from 1990-2020. No areas of habitat identified on the Swift Parrot Important Habitat Mapping occur within the Development Footprint. Given that no areas of habitat identified on the Swift Parrot Important Habitat Map, and no breeding habitat occur within the Development Footprint, it is considered unlikely that the Development Footprint represents habitat critical to the survival of this species.		Unlikely
5. disrupt the breeding cycle of a population		
The Swift Parrot breeds only in Tasmania. As such, this species is only likely to utilise habitat within the site for foraging and therefore the Project would not impact the breeding cycle of this species.		Unlikely
6. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;		
Foraging habitat in the form of associated PCTs occurs within the Development Footprint. No areas of habitat identified on the Swift Parrot Important Habitat Mapping occur within the Development Footprint. A total of 105.52 ha of potential foraging habitat would be directly impacted by the Project, however given the highly mobile nature of this species and the fact that no breeding habitat would be impacted, it is unlikely that the removal of 105.52 ha of potential foraging habitat would cause the species to decline.		Unlikely
7. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;		
The Project would not introduce any invasive species that would be harmful to the Swift Parrot.		Unlikely
8. introduce disease that may cause the species to decline, or		
The Project would not introduce any disease that would cause the Swift Parrot to decline.		Unlikely
9. Interfere with the recovery of the species.		
The Project would directly impact on 105.52 ha of potential foraging habitat for the Swift Parrot. The Project is also likely to impact adjoining potential foraging habitat through indirect means such as noise and light. The Project has the potential to interfere with the recovery of the species through 'habitat loss and alteration',		Unlikely

Swift Parrot (*Lathamus discolor)*	Critically Endangered Species	Likelihood of significant impact
however this impact is likely to be minor given the highly mobile nature of the species and the fact that no breeding habitat or Important Habitat Mapping would be impacted.		
Conclusion: The Project is considered unlikely to result in a significant impact on the Swift Parrot.		

Koala

Koala (*Phascolarctos cinereus)*	Endangered Species	Likelihood of significant impact
Distribution and occurrence: The Koala is a wide-ranging marsupial endemic to Australia (DAWE 2022b). It typically occurs in eastern Australian forests and woodlands of predominantly Eucalyptus species. Its historical range extends over 22° of latitude and 18° of longitude (DAWE 2022b). The Koala's distribution is not continuous across this range and it occurs in several subpopulations that are separated by cleared land or unsuitable habitat (DAWE 2022b). The Koala's distribution includes Queensland, New South Wales, the Australian Capital Territory, Victoria and South Australia. The listed population of the Koala has a wide but patchy distribution that spans the coastal and inland areas of Queensland north to the Herberton area, extending westwards into hotter and dryer semi-arid climates of central Queensland, NSW and the Australian Capital Territory (DAWE 2022b). The Study Area is not located in an area of a 'genetically important population' or a 'climate sensitive population' as defined by DAWE (2022b). The Koala was recorded at three broad locations within the Study Area (AMBS 2023 and ELA 2023). Four Koalas were heard responding to call playback, two were observed opportunistically and Koala scats were also observed at the base of a tree (AMBS 2023). The species has also been recorded in contiguous habitat to the north of the Study Area (AMBS 2021) and there are records of the Koala in the wider locality, including within the nearby Munghorn Gap Nature Reserve (DPE 2023a). Koala records and habitat within the Study Area is shown on Figure 17g. Koala records within 5 km of the Study Area are shown on Figure 17g. **Habitat:** As discussed by AMBS (2023), the Koala inhabits eucalypt woodlands and forests feeding "*on the foliage of over 120 species of Eucalyptus, Corymbia and Angophora, with preferred browse species varying throughout their range* (DAWE 2022b; DAWE 2022c). *Primary food species differ across habitats, with preferences influenced by the chemical profiles and water content of different target food leaves*. *Various additional tree species are also used by the Koala for shelter* (DAWE 2022b)". Within the Study Area, the Koala was recorded in woodland/forest habitat around the periphery of the Study Area. **Potential impacts associated with the Project:** The Project would result in the clearing of approximately 113.02 ha of Koala habitat (Figure 17g). **Avoidance and mitigation measures:** The Project would avoid and/or minimise impacts on Koala habitat through Project design, including: preferentially locating disturbance in Category 1 – exempt land or where the vegetation/habitat is in the poorest condition (e.g. low quality DNG); avoiding disturbance in vegetation and habitat associated with the steeper terrain adjacent to the Munghorn Gap Nature Reserve, as far as practicable; avoiding open cut mining within 200 m of Moolarben Creek and Murdering Creek (allowing for retention and rehabilitation of this habitat as		

Koala (*Phascolarctos cinereus)*	Endangered Species	Likelihood of significant impact
a movement corridor/refuge habitat); minimising infrastructure within the riparian zone of Moolarben Creek and Murdering Creek and locating creek crossings (three haul road creek crossings are proposed) within previously cleared areas, where practicable and feasible; and progressive rehabilitation and revegetation of backfilled areas to provide flora and fauna habitat, including potential habitat for threatened species. Pre-clearance surveys would be conducted to avoid impact to resident Koalas.		
An action is likely to have a significant impact on a critically endangered or endangered species if there is a real chance or possibility that it will:		
1. lead to a long-term decrease in the size of a population;		
Koalas were recorded in three broad locations within the Study Area by AMBS (2023) which included an additional opportunistic record by ELA (2023). Four Koalas were heard responding to call playback, two were observed opportunistically and Koala scats were also observed at the base of a tree (AMBS 2023). The species has also been recorded in contiguous habitat to the north of the Study Area (AMBS 2021) and there are records of the Koala in the wider locality, including within the nearby Munghorn Gap Nature Reserve (DPE 2023a). Male Koalas were heard bellowing on multiple occasions (territorial calls made frequently during mating season) within the Study Area indicating the potential occurrence of breeding habitat within the Study Area that is used to meet essential life cycle requirements. According to criteria for defining habitat critical to the survival of the species (as defined in *Conservation Advice for Phascolarctos cinereus (Koala) Combined Populations of Queensland, New South Wales and the Australian Capital Territory* (DAWE 2022b), it was considered there was evidence to suggest that the habitat within the Study Area could be critical to the survival of the species based on meeting three of the six criteria (AMBS 2023), namely: (a) whether the habitat is used during periods of stress (examples: flood, drought or fire) (b) whether the habitat is used to meet essential life cycle requirements (examples: foraging, breeding, nesting, roosting, social behaviour patterns or seed dispersal processes) (c) the extent to which the habitat is used by important populations. In relation to criteria (a), considering the number of records obtained within the Study Area in 2021, it was considered plausible that individuals survived the recent drought comparably better than some other populations within NSW. It is likely the habitat would have been used during the drought, a period of stress. Further, the Study Area was not burnt during the 2019-20 fires and thus may have acted as a refuge at this time (AMBS 2023). In relation to criteria (b), male Koalas were heard bellowing on multiple occasions within the Study Area indicating that breeding is occurring, and the habitat is used to meet essential life cycle requirements. In relation to criteria(c), it is considered that the population in the Study Area constitutes an 'important population' based on the fact that it may be considered 'climate-robust' and is located within a relatively well-connected landscape. In relation to the quality of habitat within the Study Area, six tree species that occur in the Study Area are considered key food trees for the Koala, including White Box, Grey Gum, Blakely's Red Gum, Yellow Box (*Eucalyptus melliodora*), Grey Box (*Eucalyptus moluccana*) and Narrow-leaved Stringybark (AMBS 2023; DAWE 2022c). The		Likely

Koala (*Phascolarctos cinereus)*	Endangered Species	Likelihood of significant impact
TBDC (DPE 2023a) identifies the species as being known to use scattered trees. Suitable habitat for the species occurs widely throughout the Study Area, including all woodland PCTs and scattered trees (AMBS 2023). Potentially suitable habitat for the species occurs more widely throughout the landscape including about 5,000 ha of potential habitat within the adjacent Munghorn Gap Nature Reserve. Habitats on the valley flats are relatively fragmented, but forested areas around the perimeter of the Study Area (in which the species was recorded) are well connected with adjacent areas of potential habitat. These large tracts of connected vegetation around the Study Area allow for connectivity of habitat and movement of Koalas throughout other areas of potential habitat in the locality. Retention of the riparian vegetation and habitat along Moolarben and Murdering Creek would also allow for refuge/habitat connectivity across the landscape. However, the Project would result in removal of habitat across the valley floor, reducing the area of habitat and foraging resources available to the species. Movement across the Development Footprint from east to west will be restricted with the removal of isolated patches of habitat. The Project would require the clearing of approximately 113.02 ha of Koala habitat as shown on Figure 17g. Resident Koalas would be displaced and forced to move elsewhere to re-establish/adjust home ranges. Functional connectivity is known to influence habitat use in Koalas such that decreasing connectivity leads to longer and more direct movements by Koalas and an increase in core patches within an individual home range (Rus *et al*. 2020). Increased movements required to find sufficient habitat patches than would otherwise be required has the potential to increase their susceptibility to predation and also vehicle strike. Loss, modification and fragmentation of habitat, vehicle strike and predation by roaming or domestic dogs are identified as key threats to the species (DPE 2023e). Habitat fragmentation, forest fires, vehicle collision and dog-attacks are known to be anthropogenic induced environmental stressors that generate physiological stress in wild Koalas (Narayan and Vanderneut 2019). Given that the habitat within the Study Area may be considered as critical to the survival of the local population, and that the Project may result in increased mortality/physiological stress of the species through fragmentation of the landscape, stress and vehicle strike, it is considered that the Project has the potential to lead to a long-term decrease in the size of the population.		
2. reduce the area of occupancy of the species;		
Koalas have been recorded within the Study Area (AMBS 2023; ELA 2023) and are known to occur more broadly throughout the locality. They have been recorded within contiguous habitat to the north, south and east of the Study Area. Animals displaced by removal of habitat within the Study Area would likely move out into the other areas of suitable habitat. Thus while the Project would result in the removal of 113.02 ha of habitat, it is unlikely to substantially alter the AOO of the species within the locality.		Unlikely
3. fragment an existing important population into two or more populations;		

Koala (*Phascolarctos cinereus)*	Endangered Species	Likelihood of significant impact
Clearing of approximately 113.02 ha of known habitat would occur as a result of the Project. Connectivity would be retained throughout Munghorn Gap Nature Reserve around the periphery of the Project as well as the riparian corridor to be retained and rehabilitated along Moolarben and Murdering Creek within the Project. These landscape linkages will retain connectivity such that it is unlikely that the Project would fragment the existing population into two or more populations.		Unlikely
4. adversely affect habitat critical to the survival of a species;		
Habitat that is considered to be critical to the survival of Koalas is described in the National Recovery Plan for the *Koala Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory)* (DAWE 2022b) as: 1. whether the habitat is used during periods of stress (examples flood, drought or fire) 2. whether the habitat is used to meet essential life cycle requirements (e.g. foraging, breeding, social behaviour, dispersal) 3. the extent to which the habitat is used by important populations 4. whether the habitat is necessary to maintain genetic diversity and long-term evolutionary development 5. whether the habitat is necessary for use as corridors to allow the species to move freely between sites used to meet essential life cycle requirements 6. whether the habitat is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation g) any other way in which habitat may be critical to the survival of a listed threatened species or a listed threatened ecological community (EPBC Act). As discussed by AMBS (2023), "*considering the number of records obtained within the Study Area in 2021, it is plausible that individuals have survived the recent… drought comparably better than some other populations within NSW. It is likely the habitat… would have been used during the drought, a period of stress. Further, the Study Area was not burnt during the 2019-20 fires*". Males Koala were heard bellowing on multiple occasions within the Study Area indicating the Study Area is used to meet essential life cycle requirements (AMBS 2023). The population in the Study Area has not been listed as a "Genetically important population" or "Climate sensitive population". It is unknown if the population would fit the description of "Other important population". It is also unknown if the habitat is necessary to maintain genetic diversity and long-term evolutionary development. Habitats on the valley flats are relatively fragmented, but forested areas around the perimeter of the Study Area are well connected with adjacent areas of potential habitat. Presence of these areas means that Koalas would still be capable of moving freely throughout other areas of potential habitat in the locality (AMBS 2023). "Given *the Koala occurs from north-east Queensland to South Australia, it is considered unlikely that the habitat is necessary to ensure the long-term future of the species or ecological community through reintroduction or re-colonisation*" (AMBS 2023; DAWE 2022b). Considering the recent large declines that have been recorded throughout the species range (DAWE 2022b; DAWE 2022c), and that there is evidence to suggest that the population within the Study Area has survived 2019-20 drought and bushfires comparably well, there is evidence to suggest habitats within the Study Area could be critical to the survival of the species (AMBS 2023). The Project would result in the removal of 113.02 ha of habitat for the Koala. As such, the Project is considered likely to affect habitat that has the potential to be critical to the survival of the species.		Likely
5. disrupt the breeding cycle of a population		

Koala (*Phascolarctos cinereus)*	Endangered Species	Likelihood of significant impact
The Project would lead to the clearing of approximately 113.02 ha of habitat for the Koala. Adult males were heard calling across the Study Area and thus it is considered highly likely that the Study Area supports a breeding population of animals. As mentioned above, removal of 113.02 ha of habitat will result in displacement of individuals and larger movement distances to find suitable resources/mates. The open cut pits will present a physical barrier and prevent access from east to west across the valley (although animals may move through the forested areas around the periphery of the site). Greater movement distances will also make animals more susceptible to vehicle strike and predation. Access to mates may be affected which has the potential to affect the breeding cycle of the population. While this may affect a few individuals, in the vicinity of the Project, it is unlikely to affect all individuals within the local population.		Unlikely
6. modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline;		
Clearing of approximately 113.02 ha of Koala habitat would occur as a result of the Project (Figure 17g). As detailed above, the habitat removal will directly remove foraging and sheltering resources for resident individuals, cause displacement of resident individuals, restrict access to Moolarben and Murdering Creeks (which may be important refuge habitat in summer), expose Koalas to greater risk of vehicle strike and dog attack and possibly affect access to conspecifics/mating opportunities. As such, it is considered that the Project is likely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.		Likely
7. result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat;		
The Project is not likely to result in the introduction of invasive species that may become established in habitat for the species.		Unlikely
8. introduce disease that may cause the species to decline, or		
The main diseases affecting Koalas are chlamydial infections. The Project would not increase exposure to such infections as Koalas from the local population would not have increased contact with other Koala populations including infected populations.		Unlikely
9. interfere with the recovery of the species.		
To progress the long-term recovery goal for the species, the National Recovery Plan (DAWE 2022c) has three objectives that are set for the 10-year life of the recovery plan: • The AOO and estimated size of populations that are declining, suspected to be declining, or predicted to decline are instead stabilised then increased; and the AOO and estimated size of populations that are suspected and predicted to be stable are maintained or increased • Metapopulation processes are maintained or improved • Partners, communities and individuals have a greater role and capability in listed Koala monitoring, conservation and management.		Unlikely

Koala (*Phascolarctos cinereus)*	Endangered Species	Likelihood of significant impact
To meet these objectives, actions are grouped under strategies, or action areas, as a way of organising and implementing coordinated action (DAWE 2022c). Four supporting strategies and two on-ground (direct) strategies are identified: Supporting strategies: 1. Build and share knowledge 2. Engage and partner with the community in listed Koala conservation 3. Increase the area of protected habitat for the listed Koala 4. Integrate listed Koala conservation into policy, statutory and land use plans. On-ground strategies: 1. Strategically restore listed Koala habitat 2. Actively manage listed Koala metapopulations. While the Project would not specifically align with these, the Project would not directly interfere with the undertaking of any of these strategies.		
Conclusion: The Project is considered likely to result in a significant impact on the Koala. Impacts to Koala habitat would be offset in accordance with the BC Act.		

Appendix E. Plant Community Type Justification Tables

The method for determining potential PCTs is addressed in Section 3.1.1 and 3.1.2 of the ELA Baseline Vegetation Report (ELA 2023).

Table 43. PCT 266 Justification

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Mapped on the State Vegetation Map (Central NSW)									
796	Sydney Basin (Kerrabee subregion)	Grasslands	Western Slopes Grasslands	N/A	All lithologies	Footslopes, midslopes, upper slopes and crests	Grassland derived from the clearing of grassy woodland and open forest communities. The mid-storey may be present depending on disturbance and is dominated by Acacias, while the groundcover contains a high diversity of grasses and forbs.	Although the landscape position and geomorphology of PCT 796 are suitable for VZ1/VZ2/VZ20, these areas occur as grassy woodland formations dominated by White Box, whereas PCT 796 is a grassland formation and does not contain White Box as a characteristic overstorey species. Total number of species listed under PCT 796 occurring in V1/VZ2/VZ20 is 11. This would be hereafter referred to as the 'total number of characteristic species'. This includes: 5 grasses and 6 forbs. VZ1 contains three shrub species, none characteristic of PCT 796. PCT 796 is not suitable to describe zones VZ1/VZ2/VZ20 because it is a grassland formation whereas these vegetation zones are comprised of White Box woodlands.	Low
PCTs Identified on the BioNet Vegetation Classification Using Filters									
266	Refer to Appendix B Table 11 (ELA 2023)	Refer to Appendix B Table 10 (ELA 2023)	Refer to Appendix B Table 11 (ELA 2023)					VZ1 and VZ2 occur on fine-grained sedimentary rock on hillslopes and are dominated by White Box (average cover: 15%) trees to 25 m tall. Total number of characteristic species for PCT 266 in VZ1/VZ2/VZ20 is 22. This includes: 1 tree, 2 shrubs, 7 grasses, 2 graminoids, 9 forbs and 1 fern. PCT 266 is suitable to describe these vegetation zones due to matching characteristic and dominant species,	High

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
								suitable vegetation formation and structure, soils and landscape positions.	
268	Sydney Basin (Kerrabee subregion)	Grassy Woodlands	Western Slopes Grassy Woodlands	White Box, Blakely's Red Gum, *Eucalyptus macrorhyncha* (Red Stringybark), *Eucalyptus sideroxylon* (Mugga Ironbark), *Eucalyptus goniocalyx* (Bundy) and *Eucalyptus ortonii* (Large-flowered Bundy).	Soils: Shallow or loamy clay. Parent rocks: fine grained sedimentary, metamorphic or igneous rock	Hillcrests and hillslopes in low hill landform patterns	PCT 268 occurs as a tall open forest dominated by White Box, Blakely's Red Gum, Long-leaved Box and Red Stringybark. This community also contains a sparse mid-storey comprised of Acacias and heaths, and a mid-dense grassy groundcover. Understorey species vary depending on grazing history and intensity. Weeds are often abundant.	VZ1/VZ2/VZ20 occur on hillslopes with fine-grained sedimentary rock and clay-based soil, consistent with PCT 268. White Box is the dominant overstorey species in this area, commonly occurring in monospecific stands. Total number of characteristic species is 15. This includes: 1 tree, 2 shrubs, 2 grasses, 1 graminoid, 8 forbs and 1 fern. PCT 268 is unlikely to describe VZ1/VZ2/VZ20 since its characteristic overstorey species are mostly absent from these zones.	Low
272	Sydney Basin (Kerrabee subregion)	Grassy Woodlands	Western Slopes Grassy Woodlands	White Box, *Callitris endlicheri* (Black Cypress Pine), *Eucalyptus dealbata* (Tumbledown Red Gum), Blakely's Red Gum, Mugga Ironbark, Red Stringybark, *Acacia doratoxylon* (Currawang), *Eucalyptus microcarpa* (Western Grey Box) and *Callitris glaucophylla* (White Cypress Pine).	Soils: brown clay loams Parent rock: acid volcanics, igneous or sedimentary rocks	Gullies, hillslopes	Mid-high woodland dominated by White Box and Black Cypress Pine with variations of other listed dominant tree species. The sparse shrub layer contains Acacias, *Cassinia* spp. and heaths with regenerating Black Cypress Pine. The grassy groundcover is sparse and forbs are uncommon, however Rock Fern is often present.	PCT 272 is a grassy woodland found on brown-clay loams on gullies and hillslopes consistent with VZ1/VZ2/VZ20, however only one characteristic upper storey species (White Box) is present. Total number of characteristic species is 13. This includes: 1 tree, 2 shrubs, 2 grasses, 7 forbs and 1 fern. VZ1/VZ2/VZ20 are not likely to be PCT 272 due to the absence of characteristic trees, shrubs and grasses within the Development Footprint.	Nil

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
274	Sydney Basin (Kerrabee subregion)	Grassy Woodlands	Western Slopes Grassy Woodlands	White Box, *Angophora floribunda* (Rough-barked Apple), Red Stringybark and Blakely's Red Gum	Soils: alluvial or colluvial red clay soils Parent rock: shale	Valley bottoms and lower slopes in hill landscapes	Tall woodland dominated by White Box and Rough-barked Apple. Community contains a sparse shrub layer dominated by Acacias and heaths, while the groundcover is mid-dense to dense and contains a wide variety of grasses and forbs.	PCT 274 is a grassy woodland formation found on alluvial or colluvial red-clay soils in valley bottoms and lower slopes which is inconsistent with this vegetation zone. Total number of characteristic species is 6. This includes: 1 tree, 1 shrub, 3 grasses and 1 forb. VZ1/VZ2/VZ20 are very unlikely to be considered PCT 271 due to the difference in parent rock, landscape position and low number of characteristic species.	Nil
434	Sydney Basin (Kerrabee subregion)	Grassy Woodlands	Western Slopes Grassy Woodlands	White Box, Kurrajong, *Alectryon oleifolius subsp. Elongatus* (Western Rosewood) and Black Cypress Pine.	Soil: red to chocolate clay to loam Parent rock: basalt, fine grained metamorphic or sedimentary substrates	Hillslopes, hillcrests and footslopes	Tall to mid-high open woodland dominated by White Box with scattered Kurrajong trees. This community contains a sparse shrub layer and a mid-dense to dense groundcover with a high diversity of grasses, forbs, ferns and graminoids.	PCT 434 is a grassy woodland found on similar soils on hillslopes, hillcrests and footslopes to VZ1/VZ2/VZ20 and dominated by White Box trees with scattered Kurrajong trees. Total number of characteristic species is 23. This includes: 2 trees, 2 shrubs, 4 grasses, 1 graminoid, 13 forbs and 1 fern. VZ1/VZ2/VZ20 are unlikely to be considered PCT 434 due to the absence of characteristic trees, shrubs, graminoids and various peas.	Low
1383	Sydney Basin (Kerrabee subregion)	Grassy Woodlands	Western Slopes Grassy Woodlands	White Box, Rough-barked Apple, Kurrajong, White Cypress Pine, *Eucalyptus laevopinea* (Silver-top Stringybark), *Eucalyptus melanophloia* (Silver-leaved Ironbark), Yellow Box and *Eucalyptys pilligaensis*	Sedimentary substrates	Creek flats, lower slopes and alluvial plains	Grassy woodland dominated by White Box and Rough-barked Apple. PCT 1383 contains a very diverse mid-storey, whereas characteristic ground stratum species are limited and are predominately grasses.	PCT 1383 is a grassy woodland found on creek flats, lower slopes and alluvial plains which is inconsistent with VZ1/VZ2/VZ20. Total number of characteristic species is 8. This includes: 2 trees, 1 shrub, 4 grasses and 1 graminoid. VZ1/VZ2/VZ20 are very unlikely to be considered PCT 1383 due to its landscape position and absence of many of the characteristic canopy species. The groundcover species in PCT 1383 also do not reflect the dominant species in VZ1/VZ2/VZ20.	Nil

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
				(Narrow-leaved Grey Box)					
1609	Sydney Basin (Kerrabee subregion)	Grassy Woodlands	Western Slopes Grassy Woodlands	White Box, White Cypress Pine and Kurrajong	Sandstone	Flats, upper slopes	Woodlands strongly dominated by White Box in association with White Cypress Pine and the occasional Kurrajong. The mid-storey is an open shrub layer, while the groundcover contains a wide diversity of grasses, forbs and graminoides.	PCT 1609 is a grassy woodland found on sandstone on flats and upper slopes similar to VZ1/VZ2/VZ20. Total number of characteristic species is 4. This includes: 2 trees, 1 forb and 1 fern. VZ1/VZ2/VZ20 are very unlikely to be considered PCT 1609 due to the lack of characteristic and diagnostic species.	Nil

Table 44. PCT 281 Justification

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Mapped on the State Vegetation Map (Central NSW)									
796	Sydney Basin (Kerrabee subregion)	Grasslands	Western Slopes Grasslands	N/A	All lithologies	Footslopes, midslopes, upper slopes and crests	Grassland derived from the clearing of grassy woodland and open forest communities. The mid-storey may be present depending on disturbance and is dominated by Acacias, while the groundcover contains a high diversity of grasses and forbs.	PCT 796 is a grassland formation which is inconsistent with this vegetation community. Total number of characteristic species is 12. This includes: 5 grasses and 7 forbs. VZ4 and VZ5 could be considered PCT 796 as these vegetation zones are grasslands derived from a cleared grassy woodland, however the PCT is not specific enough to accurately describe the previous composition of these zones. It is unlikely that VZ3 and VZ21 would be PCT 796 due to the dominance of tree species not listed in the PCT.	Nil
PCTs Identified on the BioNet Vegetation Classification Using Filters									
281	Refer to Appendix B Table 12 (ELA 2023)	Refer to Appendix B Table 10 (ELA 2023)	Refer to Appendix B Table 12 (ELA 2023)					PCT 281 is a grassy woodland found on valley floors, flats and drainage lines, similar to VZ3/VZ4/VZ5/VZ21. Total number of characteristic species is 37. This includes: 3 trees, 1 shrub, 12 grasses, 3 graminoids, 17 forbs and 1 fern.	High

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
								VZ3/VZ4/VZ5/VZ21 are very likely to be considered PCT 281 due to the presence of many of the characteristic species, found on similar soil types in the same landform position.	
437	Sydney Basin (Kerrabee subregion)	Grassy Woodlands	Western Slopes Grassy Woodlands	Yellow Box, Rough-barked Apple, Kurrajong, *Casuarina cristata* (Belah) and White Cypress Pine	Soils: clay loam to light clay	Valley flats, plains and hillslopes	Tall woodland dominated by Yellow Box with occasional Rough-barked Apple or Kurrajong. Mid-storey is very sparse or absent depending on grazing pressure and is primarily Acacias. The dense groundcover usually contains a high exotic (>30% of species) component but is dominated by native grasses, forbs, sedges and climbers.	PCT 437 is a grassy woodland found on clay loams on valley flats, plains and hillslopes consistent with VZ3/VZ4/VZ5/VZ21. Total number of characteristic species is 25. This includes: 2 trees, 2 shrubs, 6 grasses, 2 graminoids, 12 forbs and 1 fern. VZ3/VZ4/VZ5/VZ21 are unlikely to be considered as PCT 437 as the dominant tree, Blakely's Red Gum, is not part of PCT 437 and other species Belah and White Cypress Pines are also absent. PCT 437 does not occur along drainage lines.	Low
599	Sydney Basin (Kerrabee subregion)	Grassy Woodlands	Western Slopes Grassy Woodlands	Blakely's Red Gum, Yellow Box, Rough-barked Apple, White Box, Silver-leaved Ironbark, Kurrajong, *Eucalyptus conica* (Fuzzy Box) and White Cypress Pine	Soils: brown, red to black sandy loam to clay loam soils Parent rock: fine-grained sedimentary or metamorphic substrates, volcanic rocks	Valley flats, hillslopes, low hills	Tall woodland dominated by Blakely's Red Gum and Yellow Box, often with Rough-barked Apple on flats. The mid-storey is absent or sparse, while groundcover is mid-dense to dense and contains a diversity of grasses, forbs and climbers. Graminoids often occur in drainage depressions.	PCT 599 is a grassy woodland found on valley flats, hillslopes and low hills, similar to the vegetation zones within the Development Footprint. Total characteristic species is 33. This includes: 3 trees, 1 shrub, 11 grasses, 3 graminoids, 14 forbs and 1 fern. VZ3/VZ4/VZ5/VZ21 are unlikely to be considered PCT 599 due to the lack of consistency with overstorey species and PCT 599 is not associated with drainage lines.	Low
1693	Sydney Basin (Kerrabee subregion)	Grassy Woodlands	Western Slopes Grassy Woodlands	Yellow Box and Rough-barked Apple	Soil: Unconsolidated Parent rock: bedrock	Valley flats and lower slopes Elevation: 300-750 m ASL	Open woodland or forest dominated by Yellow Box and Rough-barked Apple. The mid-storey is variable across this PCT, while the groundcover is dominated by grasses with diverse	PCT 1693 is a grassy woodland that occurs on valley flats and lower slopes between Coolah and Ellerston. This is consistent with the Development Footprint, except it is not generally known to occur in drainage lines. Total number of characteristic species is 5. This includes 2 trees, 1 grass, 1 graminoid and 1 forb.	Nil

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
							sub-shrubs and graminoids.	VZ3/VZ4/VZ5/VZ21 are not likely to be PCT 1693 as the dominant Blakely's Red Gum is not associated with this PCT.	
1695	Sydney Basin (Kerrabee subregion)	Grassy Woodlands	Western Slopes Grassy Woodlands	Yellow Box and Rough-barked Apple	Parent rock: sandstone and basalt	Flats and hillslopes Elevation: 300-400 m	Woodland dominated by Yellow Box and Rough-barked Apple. When present, the mid-storey contains scattered shrubs. The mid-dense groundcover is dominated by grasses with diverse forbs and sub-shrubs.	PCT 1695 is restricted to the lower slopes on the Merriwa plateau which is north of the Development Footprint. Total number of characteristic species is 7. This includes: 2 trees, 3 grasses and 2 forbs. VZ3/VZ4/VZ5/VZ21 are highly unlikely to be PCT 1695 due to the restricted geographic range of that PCT and the dominance of Blakely's Red Gum which is not part of this PCT.	Nil

Table 45. PCT 478 Justification

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Identified on the BioNet Vegetation Classification Using Filters									
477	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	*Eucalyptus rossii* (Inland Scribbly Gum), Red Stringybark, Black Cypress Pine, Red Ironbark, *Eucalyptus polyanthemos subsp. polyanthemos* (Red Box), and Currawang	Soil: sandy loam to clay-sand soils Parent rock: sandstone	Hillcrests and hillslopes	Mid-high open forest co-dominated by Inland Scribbly Gum, Red Stringybark and Black Cypress Pine. The shrub layer is sparse, while the groundcover is mid-dense to sparse with high leaf litter covers.	PCT 477 occurs in Dapper Nature Reserve and grades into PCT 478 which is dominated by Red Ironbark. Total number of characteristic species is 8. This includes: 1 tree, 2 shrubs, 2 graminoids and 3 forbs. PCT 477 is highly unlikely to occur across VZ7 due to its restricted distribution and the presence of only one characteristic canopy species.	Nil
478	Refer to Appendix B Table 14 (ELA 2023)	Refer to Appendix B Table 10 (ELA 2023)		Refer to Appendix B Table 14 (ELA 2023)				Within the Development Footprint VZ7 occurs as an open forest on shallow sand to sandy loam which is consistent with PCT 478. Total number of characteristic species is	High

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
								12. This includes: 5 trees, 2 shrubs, 2 graminoids and 3 forbs. PCT 478 is most likely to occur on VZ7 due to suitable soils, landscape positions and the presence of most dominant tree species.	
1669	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Red Ironbark, Grey Gum, Narrow-leaved Stringybark and *Corymbia trachyphloia* (White Bloodwood)	Parent rock: sandstone	Hillslopes Elevation: 250-600 m ASL	Open forest dominated by Red Ironbark with a moderately dense shrubby mid-storey and variable groundcover containing a mix of grasses, graminoids, ferns and forbs.	Soil and landscape position are consistent with VZ14. Total number of characteristic species is 7. This includes: 2 trees, 2 shrubs, 1 grass, 1 graminoid and 1 forb. PCT 1669 is unlikely to occur across VZ7 due to the absence of Black Cypress Pine which co-dominates this zone.	Low
1671	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	White Bloodwood, Red Ironbark, *Eucalyptus dwyeri* (Dwyer's Red Gum) and Black Cypress Pine	Parent rock: sandstone	Hills	Low open forest community dominated by White Bloodwood with a two-layered mid-stratum. The groundcover is dominated by grasses and graminoids.	The soil and landform positions of this PCT are consistent with VZ7. Total number of characteristic species is 5. This includes: 2 trees, 1 shrub, 1 grass and 1 graminoid. PCT 1671 is unlikely to occur across VZ7 due to the absence of White Bloodwood which dominates this PCT.	Nil
1672	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Red Ironbark, Grey Gum, Black Cypress Pine and Narrow-leaved Ironbark	Parent rock: sandstone plateau	Flats Elevation: 100-450 m ASL	Woodland dominated by Red Ironbark with a moderately dense and shrubby mid-stratum. The groundcover is dominated by graminoids.	Although VZ7 occurs on sandstone, it is located on hillslopes and crests rather than slopes. Total number of characteristic species is 6. This includes: 4 trees, 1 graminoid and 1 forb. Despite the presence of all four canopy species, PCT 1672 is unlikely	Nil

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
								to occur across VZ7 as it is known to occur on flats rather than hillslopes and crests.	
1674	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Red Ironbark, White Bloodwood and Black Cypress Pine	Parent rock: sandstone	Hillslopes Elevation: 250-550 m ASL	Open forest dominated by Red Ironbark with White Bloodwood and Black Cypress Pine co-dominating.	The soil and landscape position of this PCT are consistent with VZ7. Total number of characteristic species is 7. This includes: 2 trees, 2 shrubs, 1 grass, 1 graminoid and 1 forb. PCT 1674 is unlikely to occur across VZ7 due to the absence of White Bloodwood and most characteristic species.	Nil
1677	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	*Eucalyptus caleyi* (Caleyi's Ironbark) and Red Ironbark	Parent rock: sandstone	Elevation 250-450 m ASL	Open forest to woodland dominated by Ironbarks with a moderately dense two-layered mid-stratum. The groundcover is patchy and dominated by grasses with high forb diversity.	PCT 1677 occurs in the Denman/Sandy Hollow area within the north-western extent of Wollemi National Park. Total number of characteristic species is 5. This includes 1 tree, 1 shrub, 2 grasses and 1 graminoid. PCT 1677 is highly unlikely to occur across VZ7 due to its restricted distribution and the absence of Caleyi's Ironbark.	Nil

Table 46. PCT 481 Justification

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Identified on the BioNet Vegetation Classification Using Filters									

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
481	Refer to Appendix B Table 15 (ELA 2023)	Refer to Appendix B Table 10 (ELA 2023)		Refer to Appendix B Table 15 (ELA 2023)				Soil and landscape position are somewhat consistent with VZ8 which occurs as sandstone-derived colluvial sandy loams in sheltered gullies in hills. Total number of characteristic species is 18. This includes: 4 trees, 1 shrub, 3 grasses, 2 graminoids, 7 forbs and 1 fern PCT 481 is likely to occur across VZ8 due to the species composition and structure. The dominant tree species present are consistent with this PCT. The low abundances of Blakely's Red Gum are likely attributed to historical clearing.	High
621	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Hinterland Dry Sclerophyll Forests	Grey Gum, Rough-barked Apple, Forest Red Gum, Forest Oak (*Allocasuarina torulosa*), Narrow-leaved Ironbark and Sydney Blue Gum (*E. saligna*)	Soils: alluvial silty loams	Valley flats and footslopes adjoining rivers	Tall open forest dominated by Grey Gum and Rough-barked Apple. The shrub layer is sparse to mid-dense with a variety of tea trees, acacias and heaths. The mid-dense to dense groundcover contains a high diversity of grasses, forbs and scramblers and often contains Golden Spray.	The soil and landscape position of PCT 621 is inconsistent with that on VZ8, which occurs in sheltered gullies on colluvial sandy loams. Total number of characteristic species is 12. This includes: 2 trees, 2 grasses, 4 graminoids and 4 forbs. Unlikely to occur across VZ8 due to inconsistent soil, landscape position and dominant tree species composition. PCT 621 is also not associated with Narrow-leaved Stringybark, which is a dominant tree species in VZ8.	Nil
1623	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Coastal Dry Sclerophyll Forests	Narrow-leaved Ironbark, *Corymbia exima* (Yellow Bloodwood) and Rough-barked Apple	Parent rock: sandstone	Ridges and hillslopes	Open forests dominated by Narrow-leaved Ironbark with Yellow Bloodwood. The open shrub layer contains various Acacia and heath species, while the groundcover is	The soil and location of this PCT on hillslopes is consistent with VZ8. Total number of characteristic species is 2. This includes: 1 tree and 1 forb. Highly unlikely to occur across VZ8 due to the absence of all but one dominant tree species and characteristic groundcover species.	Nil

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
							dominated by grasses and graminoids.		
1658	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Sand Flats Dry Sclerophyll Forests	Rough-barked Apple, Narrow-leaved Ironbark and Blakely's Red Gum	Parent rock: Quaternary Aeolian sands	Flats and hillslopes Elevation: 50-400 m ASL	Open woodland to forest dominated by Rough-barked Apple and Eucalyptus. This PCT contains a two-layered mid-stratum, while the groundcover is a mix of graminoids and ferns.	The Development Footprint occurs within the Mid-Western Regional Council LGA, while this PCT is restricted to the following LGAs: Muswellbrook, Maitland, Singleton and Cessnock. Although the landscape position is consistent with that on VZ8, the soil does not align with the sandstone-derived sandy loams found in the area. Total number of characteristic species is 4. This includes: 2 trees, 1 graminoid and 1 fern. Highly unlikely to occur across VZ8 due to its restricted geographic distribution. Two major canopy species found in VZ8 (Grey Gum and Narrow-leaved Ironbark) are also not associated with this PCT.	Nil

Table 47. PCT 483 Justification

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Mapped on the State Vegetation Map (Central NSW)									
796	Sydney Basin (Kerrabee subregion)	Grasslands	Western Slopes Grasslands	N/A	All lithologies	Footslopes, midslopes, upper slopes and crests	Grassland derived from the clearing of grassy woodland and open forest communities. The mid-storey may be present depending on disturbance and is dominated by Acacias, while the groundcover contains a high	The landscape position and geomorphology of PCT 796 are suitable. Total number of characteristic species is 14. This includes: 2 trees, 6 grasses and 6 forbs. VZ9 is unlikely to be PCT 796 as it is a woodland formation. VZ10 is also unlikely to be PCT 796 as it is a DNG. The defining characteristic of VZ9/VZ10 is the presence of White Box and Rough-barked Apple trees, which are absent from this PCT.	Nil

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
							diversity of grasses and forbs.		
1330	NSW South Western Slopes	Grassy Woodland	Southern Tableland Grassy Woodlands	Yellow Box, Apple Box, Blakely's Red Gum, Broad-leaved Peppermint, Red Stringybark, *Eucalyptus rubida subsp. rubida* (Candlebark), *Eucalyptus pauciflora* (White Sally), *Eucalyptus mannifera* (Brittle Gum) and *Eucalyptus viminalis* (Ribbon Gum)	Soils: loams	Undulating terrain Elevation: 500-900 m ASL	Box woodland with a sparse shrub layer and dense grassy groundcover	The soil and landscape of PCT 1330 are consistent with VZ9/VZ10. Total number of characteristic species is 6. This includes: 1 tree, 3 grasses, 1 graminoid and 1 forb. PCT 1330 is highly unlikely to occur across VZ9/VZ10 due to the absence of almost all characteristic tree species. PCT 1330 also occurs as Southern Tableland Grassy Woodland, which is inconsistent with the Western Slopes Grassy Woodlands found in VZ9, from which VZ10 is derived.	Nil
PCTs Identified on the BioNet Vegetation Classification Using Filters									
483	Refer to Appendix B Table 16 (ELA 2023)	Refer to Appendix B Table 10 (ELA 2023)		Refer to Appendix B Table 16 (ELA 2023)				The soils and landscape position of PCT 483 are consistent with VZ9/VZ10. Total number of characteristic species is 11. This includes: 1 tree, 1 shrub, 4 grasses, 1 graminoid and 4 forbs. PCT 483 is considered most likely to occur across VZ9/VZ10 due to suitable soils, landscape positions and characteristic species. Although PCT 483 is not known to occur within the Sydney Basin IBRA region, it is considered likely to occur across VZ9/VZ10 due to their proximity to the South Western Slopes Bioregion.	High
590	Nandewar Brigalow Belt South	Grassy Woodlands	Western Slopes Grassy Woodlands	White Box and Rough-barked Apple	Soil; black earth and chocolate soils Parent rock: basalt	Flats, low hills	White Box-dominated woodland, sometimes with Rough-barked Apple, White Cypress Pine and Yellow Box. The shrub layer is	Although the vegetation formation/class, soil and landscape position are consistent with VZ9/VZ10, PCT 590 is restricted to the Nadewar and Brigalow Belt South Bioregions. Total number of	Low

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
							sparse or absent, while the dense groundcover is dominated by grasses and contains high forb diversity.	characteristic species is 17. This includes: 2 trees, 1 shrub, 5 grasses, 9 forbs PCT 590 is unlikely to occur across VZ9/VZ10 as it is restricted to Inverell basalts which are north of the Development Footprint near Armidale and Inverell.	

Table 48. PCT 1610 Justification

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Mapped on the State Vegetation Map (Central NSW)									
796	Sydney Basin (Kerrabee subregion)	Grasslands	Western Slopes Grasslands	N/A	All lithologies	Footslopes, midslopes, upper slopes and crests	Grassland derived from the clearing of grassy woodland and open forest communities. The mid-storey may be present depending on disturbance and is dominated by Acacias, while the groundcover contains a high diversity of grasses and forbs.	Although the landscape position and geomorphology of PCT 796 are suitable for VZ11/VZ12, these areas occur as grassy woodland formations dominated by White Box which is absent from this PCT description. Total number of characteristic species is 11. This includes: 1 shrub, 5 grasses, 5 forbs. Unlikely to occur across VZ11/VZ12 due to incorrect vegetation formation and the absence of all overstorey and most mid-storey species.	Nil
1661	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Narrow-leaved Ironbark and Black Cypress Pine	Parent rock: sandstone	Hills Elevation: 250-500 m	Open forests dominated by Narrow-leaved Ironbark with a sparse to mid-dense mid-storey and groundcover.	PCT 1661 is restricted to the Cassilis, Merriwa and Scone area which is north-east of the Development Footprint. VZ11/VZ12 also occur at elevations > 500 m. Total number of characteristic species is 7. This includes: 1 tree, 1 grass, 2 graminoids, 2 forbs and 1 fern. PCT 1661 is highly unlikely to occur across VZ11/VZ12 due to its	Nil

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Mapped on the State Vegetation Map (Central NSW)									
								restricted geographic range and unsuitable elevation. The dominant tree species (Narrow-leaved Ironbark) for this PCT is also absent from VZ11/VZ12.	
PCTs Identified on the BioNet Vegetation Classification Using Filters									
273	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	White Box and Red Stringybark	Soil: brown to red podzolic loamy clay soils Parent rock: shale, siltstone	Steep slopes	Mid-high open forest dominated by White Box with a dense heath and acacia dominated mid-dense mid-storey. The groundcover is usually sparse to mid-dense and is dominated by grasses and *Lomandra* spp.	PCT 273 occurs in hill landscapes around Mudgee. The clay loams associated with this PCT are present across VZ11/VZ12, however the landscape position is inconsistent (footslopes and shaley ridges). Total number of characteristic species is 16. This includes: 1 tree, 5 shrubs, 4 grasses, 5 forbs and 1 fern. PCT 273 is highly unlikely to occur across VZ11/VZ12 due to the absence of Red Stringybark in the area and the presence of other dominant species such as Rough-barked Apple, Blakely's Red Gum, Grey Gum and Narrow-leaved Ironbark.	Nil
458	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Yetman Dry Sclerophyll Forests	White Cypress Pine, *Allocasuarina leuhmannii* (Bulloke), White Box, Narrow-leaved Grey Box, Yellow Box, *Eucalyptus chloroclada* (Dirty Gum), *Acacia cheelii* (Motherumbah)	Soil: Red brown to orange brown sandy loam or clay loam Parent rock: sedimentary substrates	Hillslopes and hillcrests	Mid-high to tall open forest or woodland dominated by White Cypress Pine with Bulloke and White Box. The mid-storey is sparse to mid-dense and is dominated by *Acacia* spp. The sparse groundcover includes tussock-forming	The soil associated with PCT 458 is consistent with that across VZ11/VZ12, however unlike the PCT, these areas occur on footslopes. Total number of characteristic species is 28. This includes: 1 tree, 2 shrub, 6 grasses, 2 graminoids, 15 forbs and 2 ferns. PCT 458 is unlikely to occur across VZ11/VZ12 due to differences in landscape position and dominant tree species.	Low

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Mapped on the State Vegetation Map (Central NSW)									
				and Narrow-leaved Ironbark.			grasses and a variety of forbs.		
1610	Refer to Appendix B Table 17 (ELA 2023)	Refer to Appendix B Table 10 (ELA 2023)		Refer to Appendix B Table 17 (ELA 2023)				VZ11/VZ12 occur across footslopes which may include lower slopes. Total number of characteristic species is 11. This includes: 1 tree, 5 grasses and 5 forbs. PCT 1610 is highly likely to occur across VZ11/VZ12 as all components assessed are consistent. All characteristic species, apart from the one shrub species, occur in this vegetation zone.	High

Table 49. PCT 1629 Justification

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Mapped on the State Vegetation Map (Central NSW)									
796	Sydney Basin (Kerrabee subregion)	Grasslands	Western Slopes Grasslands	N/A	All lithologies	Footslopes, midslopes, upper slopes and crests	Grassland derived from the clearing of grassy woodland and open forest communities. The mid-storey may be present depending on disturbance and is dominated by Acacias, while the groundcover contains a high diversity of grasses and forbs.	Although the landscape position and geomorphology of PCT 796 are consistent with VZ14, these areas occur as dry sclerophyll forest formations dominated by Grey Gum, White Box and Narrow-leaved Stringybark, which are absent from this PCT description. Total number of characteristic species is 13. This includes 2 shrubs, 5 grasses, 6 forbs. Highly unlikely to occur across VZ14 due to incorrect vegetation formation and the absence of overstorey species.	Nil
1661	Sydney Basin	Dry Sclerophyll Forests	Western Slopes Dry	Narrow-leaved Ironbark and	Parent rock: sandstone	Hills	Open forests dominated by Narrow-leaved Ironbark with a	PCT 1661 is restricted to the Cassilis, Merriwa and Scone area, which is north-east of the Development Footprint. VZ14 also occurs at	Nil

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
	(Kerrabee subregion)	(Shrubby sub-formation)	Sclerophyll Forests	Black Cypress Pine		Elevation: 250-500 m	sparse to mid-dense mid-storey and groundcover.	elevations > 500 m. Total number of characteristic species is 10. This includes: 1 tree, 2 shrubs, 2 grasses, 2 graminoids, 2 forbs and 1 fern. PCT 1661 is unlikely to occur across VZ14 due to its restricted geographic range and unsuitable elevation. VZ14 is also dominated by Grey Gum and White Box with high abundances of Blakely's Red Gum, Narrow-leaved Ironbark and Grey Box which are absent from PCT 1661.	
PCTs Identified on the BioNet Vegetation Classification Using Filters									
673	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Black Cypress Pine, Red Ironbark, Narrow-leaved Stringybark, Grey Gum, Red Box, Mugga Ironbark, Red Stringybark and Blakley's Red Gum	N/A	N/A	Woodland dominated by Black Cypress Pine, Red Ironbark and Narrow-leaved Stringybark. The mid-storey contains *Brachyloma daphnoides* (Daphne Heath) and *Cassinia laevis* (Cough Bush), while the groundcover contains graminoids and forbs.	The soil and landscape positions associated with PCT 673 are unknown. Total number of characteristic species is 10. This includes: 5 trees, 1 shrub, 2 graminoids, 2 forbs. PCT 673 is unlikely to occur across VZ14 due to the absence of four other canopy species which are scattered throughout VZ14. The vegetation structure of PCT 673 is also inconsistent with VZ14 as Black Cypress Pine is not a dominant species in this area. This PCT is also dominated by Red Ironbark which is absent from the area.	Nil
1629	Refer to Appendix B Table 19 (ELA 2023)	Refer to Appendix B Table 10 (ELA 2023)		Refer to Appendix B Table 19 (ELA 2023)				The soils and landscape position of VZ14 are consistent with PCT 1629. Total number of characteristic species is 8. This includes: 2 trees, 3 shrubs, 2 graminoids and 1 forb. PCT 1629 contains relatively low species diversity; however, most characteristic species are present in VZ14, including all upper and middle stratum species. The presence of seven other species not associated with PCT 1629 is likely attributed to the merging boundaries of PCT 1629, PCT 281 and PCT 1610 which have created ecotones throughout VZ14.	High

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
1669	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Red Ironbark, Grey Gum, Narrow-leaved Stringybark and White Bloodwood	Parent rock: sandstone	Hillslopes Elevation: 250-600 m ASL	Open forest dominated by Red Ironbark with a moderately dense shrubby mid-storey and variable groundcover containing a mix of grasses, graminoids, ferns and forbs.	Soil and landscape position are consistent with VZ14. Total number of characteristic species is 11. This includes: 2 trees, 3 shrubs, 1 grass, 2 graminoids, 2 forbs and 1 fern. PCT 1669 is unlikely to occur across VZ14 due to the absence of Red Ironbark which dominates this PCT and numerous other non-associated canopy species.	Nil

Table 50. PCT 1655 Justification

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Identified on the BioNet Vegetation Classification Using Filters									
403	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Mugga Ironbark, Red Stringybark, Western Grey Box, Blakely's Red Gum, Black Cypress Pine and Inland Scribbly Gum	Soils: Brown sandy loam or gravelly sandy loam Parent Rock: sandstone	Hillcrests and hillslopes	Mid-high to tall open woodland or forest dominated by Mugga Ironbark with sparse shrub and groundcover layers. Groundcover is dominated by grasses, graminoids and forbs.	VZ16 occurs on clay loams derived from fine grained sedimentary rock on footslopes and small rises which is inconsistent with PCT 403 soils. The landscape position of VZ16 is consistent with PCT 403). Total number of characteristic species is 16. This includes: 4 trees, 1 shrub, 6 grasses, 1 graminoid, 3 forbs and 1 fern. PCT 403 is not considered the most suitable PCT due to the absence of characteristic tree species, Mugga Ironbark, Red Stringybark, Western Grey Box and Inland Scribbly Gum.	Low
483	NSW South Western Slopes Brigalow Belt South	Grassy Woodlands	Western Slopes Grassy Woodlands	Grey Box, White Box, Rough-barked Apple, and Yellow Box	Soils: brown to black earth, chocolate loam to clay soils	Footslope, Hillcrest, Hillslope, Valley flat	Mid-high to tall open woodland or woodland dominated by a Grey Box x White Box hybrid. Shrubs are absent or very sparse.	*Eucalyptus moluccana, Angophora floribunda* and *Eucalyptus melliodora* present, however the middle stratum for PCT 483 is inconsistent with the plot data (e.g., *Sclerolaena muricata*).	Low

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
					Parent Rock: Basalt		The ground cover is dense after rain but mid-dense to sparse in dry times.		
617	Brigalow Belt South	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Narrow-leaved Ironbark, Grey Box, Rough-barked Apple, Black Cypress Pine	Soils: loam soils Parent Rock: Basalt, conglomerate, and Sandstone	Footslope, Gully, Hillcrest, Hillslope	Tall open forest dominated by Narrow-leaved Ironbark with Grey Box or Eucalyptus albens <-> moluccana intermediate and Rough-barked Apple. The understorey shrub layer is dominated by Mock Olive. The ground cover is mid-dense with grass species.	*Eucalyptus crebra, Eucalyptus moluccana, Angophora floribunda* and *Callitris endlicheri* are all present however canopy not dominated by *Eucalyptus crebra* and understorey shrub layer not dominated by *Notelaea microcarpa* (not present in any plots).	Low
956	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Western Grey Box, Black Cypress Pine, Mugga Ironbark, Red Ironbark and Red Box	N/A	Hills and low hills	Shrubby woodland dominated by Western Grey Box with a grass-dominated understorey.	Landscape position is consistent with VZ16. Total number of characteristic species is 5. This includes: 1 tree, 3 grasses and 1 graminoid. PCT 956 is highly unlikely to occur on VZ15 due to the absence of Western Grey Box which dominates this PCT.	Nil
1655	Refer to Appendix B Table 21 (ELA 2023)	Refer to Appendix B Table 10 (ELA 2023)		Refer to Appendix B Table 21 (ELA 2023)				Soil and landscape position of VZ16 is consistent with PCT 1655. Total number of character species is 8. This includes: 2 tree, 2 grasses, 1 graminoid and 3 forbs. All variables assessed are consistent with PCT 1655, except the presence of *Eucalyptus dawsonii* (Slaty Gum) which was not recorded in VZ16, but was observed in the vicinity .	High

Table 51. PCT 1656 Justification

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Identified on the BioNet Vegetation Classification Using Filters									
479	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Narrow-leaved Ironbark, Black Cypress Pine, Grey Gum, Narrow-leaved Stringybark, Narrow-leaved Wattle, Dwyer's Red Gum, Blue-leaved Ironbark, Red Stringybark, Red Ironbark and White Bloodwood	Soil: red-brown loamy clay to sandy loam soils Parent rock: sandstone, siltstone and shale	Hills and low hill	Tall open forest dominated by Narrow-leaved Ironbark and Black Cypress Pine with numerous other canopy species. The sparse shrub layer contains high species richness, while the sparse groundcover is dominated by grasses and graminoids with the occasional forb.	VZ17/VZ18 occur on sandy loam soils on slight sandstone rises (consistent with PCT 479 soil and landscape position). Total number of characteristic species is 18. This includes: 2 trees, 3 shrubs, 5 grasses, 3 graminoids, 4 forbs and 1 fern. Although two dominant tree species of PCT 479 occur across VZ17/VZ18, no other characteristic canopy species occur in the area. VZ17/VZ18 are also dominated by Rough-barked Apple which is not associated with PCT 479.	Nil
617	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Narrow-leaved Ironbark, Grey Box, Rough-barked Apple, Kurrajong, Black Cypress Pine and the White Box/Grey Box intermediate	Soils: loam Parent Rock: basalt or sandstone	Foothills and low hills	Tall open forest dominated by Narrow-leaved Ironbark and the White Box/Grey Box intermediate. The mid-storey is dominated by Mock Olive, while the mid-dense groundcover is dominated by grasses and graminoids with high forb diversity.	The soils and landscape positions of PCT 617 are consistent with VZ17/VZ18. Total number of characteristic species is 17. This includes: 4 trees, 1 shrub, 5 grasses and 7 forbs. PCT 617 could be considered for VZ17/VZ18 as some of dominated overstorey species are present, however, Grey Box and the White Box/Grey Box intermediate are absent, and PCT 617 predominantly occurs in the Scone district of the upper Hunter Valley and on the southern slopes of the Liverpool Ranges.	Moderate
1654	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Narrow-leaved Ironbark, Grey Gum and Rough-barked Apple	Parent rock: sandstone	Ridges Elevation: 250-700 m ASL	Open forest dominated by Narrow-leaved Ironbark with a two-layered mid-stratum containing sparse small trees and	PCT 1654 occurs in Towarri National Park, Wingen Maid Nature Reserve, and Manobalai Nature Reserve, which are north-east of the Development Footprint. Total number of	Nil

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
							a shorter dense shrub layer. The groundcover is dominated by graminoids, sub-shrubs and ferns.	characteristic species is 8. This includes: 2 trees, 1 shrub, 1 grass, 2 graminoids, 1 forb and 1 fern. PCT 1654 is highly unlikely to occur across VZ15 due to its restricted geographic distribution. Black Cypress Pine is also not associated with this PCT but is dominant across VZ17 and VZ18.	
1656	Refer to Appendix B Table 22 (ELA 2023)	Refer to Appendix B Table 10 (ELA 2023)		Refer to Appendix B Table 22 (ELA 2023)				PCT 1656 is found in the northern parts of the Goulburn River National Park, which is east of the Development Footprint. Total number of characteristic species is 7. This includes: 3 trees, 1 shrub, 2 forbs and 1 fern. The shrub layer of VZ17/VZ18 was dominated by Sifton Bush, which is not listed in association with PCT 1656 but is typical of a regenerating landscape. PCT 1656 is considered the most suitable PCT for VZ17/VZ18 due to the landscape position and species composition.	High
1660	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Narrow-leaved Ironbark and Inland Scribbly Gum	Parent rock: sandstone	Mid-slopes and lower slopes Elevation: 300-500 m ASL	Woodland dominated by Narrow-leaved Ironbark with a moderate to dense mid-storey dominated by sclerophyllous shrubs. The grassy groundcover contains a mix of forbs and sub-shrubs.	PCT 1660 is restricted to the Cassilis area within Goulburn National Park and Durridgere State Conservation Area which are north of the Development Footprint. Total number of characteristic species is 6. This includes: 1 tree, 2 grasses, 1 graminoid, 1 forb and 1 fern. PCT 1660 is highly unlikely to occur across VZ17/VZ18 due to its restricted distribution and the absence of Inland Scribbly Gum.	Nil

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
1661	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Narrow-leaved Ironbark and Black Cypress Pine	Parent rock: sandstone	Hills Elevation: 250-500 m	Open forests dominated by Narrow-leaved Ironbark with a sparse to mid-dense mid-storey and groundcover.	PCT 1661 is restricted to the Cassilis, Merriwa and Scone area which is north-east of the Development Footprint. Total number of characteristic species is 9. This includes: 2 trees, 2 grasses, 2 graminoids, 2 forbs and 1 fern. PCT 1661 was excluded from consideration due to the presence of Rough-barked Apple, which is not associated with this PCT.	Low
1770	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Narrow-leaved Ironbark, Red Stringybark and Black Cypress Pine	Parent rock: sandstone and basalt	Hillslopes and flats Elevation: 500-660 m ASL	Tall open forest dominated by Narrow-leaved Ironbark with a sparse shrubby mid-storey and grass and graminoid dominated groundcover.	PCT 1770 occurs near Gulgong and Coolah. Soil and landform pattern are consistent with VZ17/VZ18. Total number of characteristic species is 9. This includes: 2 trees, 2 grasses, 2 graminoids and 3 forbs. PCT 1770 was excluded from consideration due to the absence of Red Stringybark and presence of Rough-barked Apple in VZ17/VZ18.	Low

Table 52. PCT 1661 Justification

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Identified on the BioNet Vegetation Classification Using Filters									
479	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Narrow-leaved Ironbark, Black Cypress Pine, Grey Gum, Narrow-leaved Stringybark, Narrow-leaved Wattle, Dwyer's Red Gum, *Eucalyptus*	Soil: red-brown loamy clay to sandy loam soils Parent rock: sandstone,	Hills and low hill	Tall open forest dominated by Narrow-leaved Ironbark and Black Cypress Pine. The sparse shrub layer contains high species richness,	VZ15 contains clay loam soils and occurs on low sandstone/shale rises which is consistent with PCT 479. Total number of characteristic species is 14. This includes: 2 trees, 3 shrubs, 3 grasses, 2 graminoids, 3 forbs and 1 fern. Although two dominant tree species of PCT 479 occur across VZ15, no other	Low

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
				nubile (Blue-leaved Ironbark), Red Stringybark, Red Ironbark and White Bloodwood	siltstone and shale		while the sparse groundcover is dominated by grasses and graminoids.	characteristic canopy species occur in the area. Most mid-storey species are also absent from VZ15.	
617	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Narrow-leaved Ironbark, Grey Box, Rough-barked Apple, Kurrajong, Black Cypress Pine and the White Box/Grey Box intermediate	Soils: loam Parent Rock: basalt or sandstone	Foothills and low hills	Tall open forest dominated by Narrow-leaved Ironbark and the White Box/Grey Box intermediate. The mid-storey is dominated by *Notelaea microcarpa* (Mock Olive), while the mid-dense groundcover is dominated by grasses and graminoids.	The soils and landscape positions of PCT 617 are consistent with VZ15. Total number of characteristic species is 10. This includes: 3 trees, 2 grasses and 5 forbs. PCT 617 is unlikely to occur across VZ15 as the area is dominated by Black Cypress Pine which is a lesser-dominant species for this PCT. PCT 617 is also dominated by Grey Gum and Kurrajong which are absent from VZ15.	Low
1654	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Narrow-leaved Ironbark, Grey Gum and Rough-barked Apple	Parent rock: sandstone	Ridges Elevation: 250-700 m ASL	Open forest dominated by Narrow-leaved Ironbark with a two-layered mid-stratum containing sparse small trees and a shorter dense shrub layer. The groundcover is dominated by graminoids, sub-shrubs and ferns.	PCT 1654 occurs in Towarri National Park, Wingen Maid Nature Reserve and Manobalai Nature Reserve which are north-east of the Development Footprint. Total number of characteristic species is 5. This includes: 2 trees, 1 grass, 1 graminoid and 1 fern. PCT 1654 is highly unlikely to occur across VZ15 due to its highly restricted geographic distribution. Black Cypress Pine is also not associated with this PCT.	Nil
1656	Sydney Basin	Dry Sclerophyll Forests	Western Slopes Dry	Narrow-leaved Ironbark, Black Cypress Pine,	N/A	Flats and gentle slopes	Open forest co-dominated by Narrow-leaved	No soil characteristics for PCT 1656 were available, however this PCT is restricted to the northern edge of the Goulburn River	Nil

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
	(Kerrabee subregion)	(Shrubby sub-formation)	Sclerophyll Forests	Rough-barked Apple and Red Ironbark		Elevation: 300-400 m ASL	Ironbark and Black Cypress Pine. The sparse to mid-dense shrub layer is dominated by sclerophyllous species, whereas the sparse groundcover contains a mix of sub-shrubs and ferns.	National Park which is east of Mudgee. Total number of characteristic species is 6. This includes: 3 trees, 1 shrub, 1 forb and 1 fern. PCT 1656 is highly unlikely to occur across VZ15 due to its restricted distribution and the low number of characteristic species present in VZ15.	
1660	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Narrow-leaved Ironbark and Inland Scribbly Gum	Parent rock: sandstone	Mid-slopes and lower slopes Elevation: 300-500 m ASL	Woodland dominated by Narrow-leaved Ironbark with a moderate to dense mid-storey dominated by sclerophyllous shrubs. The grassy groundcover contains a mix of forbs and sub-shrubs.	PCT 1660 is restricted to the Cassilis area within Goulburn National Park and Durridgere State Conservation Area which are north of the Development Footprint. Total number of characteristic species is 6. This includes: 1 tree, 2 grasses, 1 graminoid, 1 forb and 1 fern. PCT 1660 is highly unlikely to occur across VZ15 due to its restricted distribution and the dominance of Inland Scribbly Gum which is absent from VZ15.	Nil
1661	Refer to Appendix B Table 20 (ELA 2023)	Refer to Appendix B Table 10 (ELA 2023)		Refer to Appendix B Table 20 (ELA 2023)				PCT 1661 is restricted to the Cassilis, Merriwa and Scone area, north-east of the Development Footprint. Total number of characteristic species is 8. This includes: 2 trees, 1 grass, 2 graminoids, 2 forbs and 1 fern. Despite its restricted distribution, PCT 1661 is likely to occur across VZ15 as its canopy species align with that of VZ15. Black Cypress Pine dominates VZ15 and is a diagnostic species for PCT 1661. The presence of other canopy species such as Rough-barked Apple and Blakely's Red Gum is likely due to the	High

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
								merging of PCT 1661 with PCT 1656, PCT 1655 and PCT 281, creating ecotones between PCTs within the same woodland area.	
1770	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Narrow-leaved Ironbark, Red Stringybark and Black Cypress Pine	Parent rock: sandstone and basalt	Hillslopes and flats Elevation: 500-660 m ASL	Tall open forest dominated by Narrow-leaved Ironbark with a sparse shrubby mid-storey and grass and graminoid dominated groundcover.	PCT 1770 occurs near Gulgong and Coolah. Soil and landform pattern are consistent with VZ15. Total number of characteristic species is 6. This includes: 2 trees, 1 grass, 1 graminoid, 1 forb and 1 fern. Although Narrow-leaved Ironbark and Black Cypress Pine dominate both PCT 1770 and VZ15, Red Stringybark is absent from VZ15. Most species found in VZ15 are not associated with PCT 1770.	Low

Table 53. PCT 1711 Justification

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Mapped on the State Vegetation Map (Central NSW)									
796	Sydney Basin (Kerrabee subregion)	Grasslands	Western Slopes Grasslands	N/A	All lithologies	Footslopes, midslopes, upper slopes and crests	Grassland derived from the clearing of grassy woodland and open forest communities. The mid-storey may be present depending on disturbance and is dominated by Acacias, while the groundcover contains a high diversity of grasses and forbs.	VZ19 is a remnant shrubland found on clay loams on ephemeral to semi-permanent drainage lines. PCT 796 is a grassland occurring on upper slopes and crests. Total number of characteristic species is 5. This includes: 3 grasses and 2 forbs. VZ19 is dominated by Pine-leaved Bottlebrush, Spidery Tea-tree and Thyme Honey-myrtle, all absent from PCT796. Highly unlikely to occur on VZ19 due to incorrect vegetation formation and the absence of most characteristic species.	Nil

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
PCTs Identified on the BioNet Vegetation Classification Using Filters									
281	NSW South Western Slopes; Brigalow Belt South; Darling Riverine Plains; Nandewar	Grassy Woodlands	Western Slopes Grassy Woodlands	Rough-barked Apple, Blakely's Red Gum, Yellow Box, White Cypress Pine, River Red Gum, River Oak, and White Box	Soils: Colluvial sediments, Alluvial loams and clays Parent Rock: Basalt	Bank (streambank) , Footslope , Gully , Valley flat	Tall open forest or woodland with trees up to 30 m high dominated by Rough-barked Apple usually with Blakely's Red Gum or Yellow Box. Shrub species may include wattles such as Acacia implexa, Acacia decora, Acacia penninervis var. penninervis and Acacia deanei. The ground cover is usually dense to mid-dense.	*Arundinella nepalensis, Eucalyptus blakelyi, Angophora floribunda* and *Acacia implexa* present within but excluded by ELA based on scrubbiness and lack of structural similarity to other areas of PCT in the Study Area.	Low
403	Sydney Basin (Kerrabee subregion)	Dry Sclerophyll Forests (Shrubby sub-formation)	Western Slopes Dry Sclerophyll Forests	Mugga Ironbark, Red Stringybark, Western Grey Box, Blakely's Red Gum, Black Cypress Pine and Inland Scribbly Gum	Soils: Brown sandy loam or gravelly sandy loam Parent Rock: sandstone	Hillcrests and hillslopes	Mid-high to tall open woodland or forest dominated by Mugga Ironbark with sparse shrub and groundcover layers. Groundcover is dominated by grasses, graminoids and forbs.	Landscape position and vegetation structure are inconsistent with PCT 403. PCT 403 occurs on hillcrests and hillslopes, as opposed to VZ19 which is found on semi-permanent drainage lines mid to lower slope. Total number of characteristic species is 13. This includes: 1 tree, 2 shrubs, 6 grasses, 3 forbs and 1 fern. VZ19 is unlikely to be PCT 403 due to landscape position and lack of similarities in the upper and middle stratum characteristic species. PCT 403 is also not associated with Rough-barked Apple which occurs across VZ19.	Low
481	Brigalow Belt South; NSW South Western Slopes	Dry Sclerophyll Forests (Shrubby sub-formation)	North Coast Dry Sclerophyll Forests	Rough-barked Apple, Blakely's Red Gum, Grey Gum, Narrow-leaved Ironbark, Narrow-leaved Stringybark, Narrow-	Soils: alluvial sands or loam soil Parent Rock: Sandstone	Terrace flat, Valley flat	Tall open forest to woodland dominated by Rough-barked Apple, Blakely's red Gum with Grey Gum grading upslope into Narrow-leaved Ironbark, Narrow-leaved	This PCT is a sub shrub formation; there is *Eucalyptus blakelyi* in the canopy, most ground stratum consistent with plot data, however other canopy species such as *Eucalyptus punctata, Eucalyptus sparsifolia* and *Eucalyptus crebra* weren't present	Low

PCT	IBRA Region	Vegetation Formation	Vegetation Class	Dominant Tree Species	Geomorphology	Landscape Position	Vegetation Structure	Assessment	Likelihood of Occurrence
				leaved Wattle, and Black Cypress Pine			Stringybark, Acacia linearifolia and Black Cypress Pine. Shrubs are sparse. The ground cover is very sparse and bare in creek beds.		
1607	Brigalow Belt South; Nandewar; NSW South Western Slopes	Dry Sclerophyll Forests (Shrub/grass sub-formation)	North-west Slopes Dry Sclerophyll Woodlands	Blakely's red Gum, Narrow-leaved Ironbark, and Rough-barked Apple	Soils: N/A Parent Rock: Sandstone	Vally flats; Lower slopes	Open forests to woodlands characterised by Blakely's red Gum. The mid- storey consists of an open shrub layer with sparse climbers. The ground layer is typically grassy with numerous forbs.	Numerous diagnostic species across the plots (*Microlaena stipoides, Echinopogon ovatus, Plectranthus parviflorus, Cyperus gracilis*), *E. blakelyi in* upper stratum. Ruled out because middle stratum doesn't align with plot data (presence of *Notelaea microcarpa, Bursaria spinosa, Clematis glycinoides* and *Pandorea pandorana*)	Low
1711	Refer to Appendix B Table 23 (ELA 2023)	Refer to Appendix B Table 10 (ELA 2023)		Refer to Appendix B Table 23 (ELA 2023)				VZ19 is found on clay loams derived from sandstone which is consistent with PCT 1711. Total number of characteristic species is 4. This includes: 2 trees and 2 shrubs. The groundlayer was dominated by graminoids such as Reedgrass and Forest Hedgehog Grass, with Slender Flat-sedge, Common Bog-rush, and Hyssop Loosestrife occurring in wetter areas. PCT 1711 is considered a very likely best fit for VZ19. Variation in groundcover species is likely due to the moisture content of the soil.	High

Appendix F. Consideration of serious and irreversible impacts

Introduction and summary

Section 6 of the BDAR identifies six entities at risk of a serious and irreversible impact (SAII):

- White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland Critically Endangered Ecological Community
- Regent Honeyeater (*Anthochaera phrygia*)
- Swift Parrot (*Lathamus discolor*)
- Broad-headed Snake (*Hoplocephalus bungaroides*)
- Large-eared Pied Bat (*Chalinolobus dwyeri*)
- Eastern Cave Bat (*Vespadelus troughtoni*)

Information about serious and irreversible impacts must prepared by an accredited assessor using the Biodiversity Assessment Method (BAM) (DPIE 2020a) and address the matters listed in Section 9.1.1 and 9.1.2 of the BAM (DPIE 2020a) and Appendix B of the *Guidance to assist a decision-maker to determine a serious and irreversible impact* (DPIE 2019a).

A detailed response to each of these criteria is outlined below for each SAII entity.

White Box-Yellow Box-Blakely's Red Gum Grassy Box Woodland and Derived Native Grassland (Box-Gum Woodland CEEC)

1. Actions to avoid and minimise direct and indirect impacts

Actions to avoid and minimise direct and indirect impacts are detailed in Section 4.1, Section 4.2, Section 5.1, Section 5.2 and Section 8.6.

Impacts from clearing Box-Gum Woodland CEEC have been avoided or minimised through the Project design by:

- Preferentially locating disturbance in areas lacking Box-Gum Woodland CEEC (e.g. Category 1 – exempt land) or where the vegetation/habitat is in the poorest condition (e.g. low quality DNG)
- Avoiding open cut mining within 200 m of Moolarben Creek and Murdering Creek (which have a riparian zone comprising Box-Gum Woodland CEEC)
- Minimising infrastructure within the riparian zone of Moolarben Creek and Murdering Creek and locating creek crossings (three haul road creek crossings are proposed) within previously cleared areas, where practicable and feasible
- Condensing the Development Footprint by locating infrastructure areas immediately adjacent to open cut mining areas and
- Progressively back-filling open cut pits to minimise the required disturbance extent (i.e. reducing the need for large out of-pit overburden emplacements) as far as practically possible, as well as removing pit voids from the final landform

The Development Footprint has also been revised to further avoid impacts to Box-Gum Woodland CEEC, particularly the relatively high-quality woodland areas. The amended Project Development Footprint will result in a 59.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha) and a 6.8% reduction in the area of DNG to be impacted (from 393.53 ha to 366.9 ha). (The total area of Box-Gum Woodland to be impacted has been reduced by 76.63 ha (16%).

As a result of the above, areas of Box-Gum Woodland CEEC in the north, south-west and south-east of the Study Area would be avoided by the Project (Figure 18b).

2. Current status of the CEEC (excluding impacts of the Project)

Box-Gum Woodland CEEC has been listed as a possible SAII due to the following Principles:

- **Principle 1**: species or ecological community currently in a rapid rate of decline.
- **Principle 2**: species or ecological communities with a very small population size.

An assessment of Principles 1 and 2 according to BAM (DPIE 2020a) Section 9.1.1. (2a-b) is provided in Table 54.

Principle 3 (species or area of ecological community with very limited geographic distribution) is not applicable to Box-Gum Woodland as, although the extent of occurrence (EOO), area of occupancy (AOO) and number of threat-defined locations are unknown in the TBDC (DPIE 2020a); the NSW Scientific Committee Determination for the community (TSSC 2020) states 'The geographic distribution of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland is not restricted.' Box-Gum Woodland CEEC is distributed between the southern Queensland and central Victoria on the western slopes and tablelands of the Great Dividing Range, occurring in NSW in the 'Brigalow Belt South, Nandewar, New England Tableland, South Eastern Queensland, Sydney Basin, NSW North Coast, South Eastern Highlands, South East Corner, NSW South Western Slopes, Victorian Midlands and Riverina Bioregions' (TSSC 2020b).

Principle 4 (The ecological community is unlikely to respond to measures to improve its habitat and vegetation integrity) is not applicable as the ecological community is likely to respond to measures to improve its habitat and vegetation integrity through planting and active restoration; as evidenced by the 23,730 credits[13] issued for the CEEC generated on approved offset sites that will be/are being managed to improve biodiversity values.

[13] As listed on the NSW DPE credit supply register as at 10 January 2024

Table 54. Addressing SAII principles – Box-Gum Woodland CEEC current status.

Criteria	Data/ information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information (e.g. TBDC indicates data is unknown or deficient)
2a. Evidence of reduction in geographic distribution (Principle 1)			
Evidence of reduction in geographic distribution as the current total geographic extent of the TEC in NSW AND the estimated reduction in geographic extent of the TEC since 1970 (not including impact of the proposal)	According to the TSSC (2020b), Box-Gum Woodland 'has undergone a very large historical reduction in geographic distribution (since approximately 1750)' and less than 5% of the original distribution remains. This is supported by Gellie (2005), who estimates 65,070 ha of Box-Gum Woodland CEEC remains in south-eastern NSW from the pre-1750 extent of 917,500 ha (93% cleared). Recently, Dr Colin Driscoll (Hunter Eco 2024) reviewed the EOO and AOO of Box-Gum Woodland in NSW and calculated the current Box-Gum Woodland EOO as 327,174 km^2 and the AOO as 160,900 km^2. TBDC displays 'Population reduction of ≥80% in 10 years or three generations'. The estimated reduction in geographic extent of Box-Gum Woodland since 1970 is unknown.	Conservation Assessment of White Box – Yellow Box – Blakeley's Red Gum Grassy Woodland and Derived Native Grassland (TSSC 2020b). Forest ecosystem classification and mapping for the Southern CRA region, Volume II Appendices (Thomas *et al*. 2000). Determination of the Area of Occupancy and Extent of Occurrence in NSW of White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Hunter Eco 2024).	There is uncertainty surrounding the pre-1750 extent of Box –Gum Grassy Woodland and Derived Native Grassland.
2b. Extent of reduction in ecological function for the TEC (Principle 2)			
Evidence that describes the degree of environmental degradation or disruption to biotic processes	*i. Change in community structure* Unmodified woodland remnants contain 15-30 m tall widely -spaced trees with <30% canopy cover, (Keith 2004; Prober *et al*. 2017). The understorey shrub layer is often sparse or absent, while the groundcover is dominated by perennial	Conservation Assessment of White Box – Yellow Box – Blakeley's Red Gum Grassy Woodland and Derived Native Grassland (TSSC 2020b).	

Criteria	Data/ information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information (e.g. TBDC indicates data is unknown or deficient)
	tussock grasses and contains high forb diversity (Prober *et al*. 2017). *ii. Change in species composition* "In general, the diversity of understorey flora species has decreased across the range of the ecological community, primarily as a result of grazing and pasture improvement (TSSC 2006). Clearing the understorey for cropping and cultivated pasture eliminates the native species, including any soil-stored seed, preventing the re-establishment of a native understorey without assistance (TSSC 2006). As a result of this, very few patches with a predominantly native understorey remain, particularly in the central and southern part of the range, where cultivation for crops and pasture improvement has been more prevalent" (TSSC 2006). *iii. Disruption of ecological processes* Prolonged absence of fire may result in declines in species diversity as less competitive species are excluded. Successive fires separated by intermediate to long intervals can result in shrub encroachment whereas short to intermediate intervals maintain open grassy understoreys (Prober et al. 2017). *iv. Invasion and establishment of exotic species* The primary cause of the establishment of exotic species is through introduction of exotic grasses as pasture improvement for grazing, or from addition of fertilisers (TSSC 2006).	Ocean Shores to Desert Dunes: the native vegetation of New South Wales and the ACT (Keith 2004), Temperate Eucalypt Woodlands (Prober *et al.* 2017). Notice of and reason for the Final Determination: White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (TSSC 2020a).	

Criteria	Data/ information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information (e.g. TBDC indicates data is unknown or deficient)
	v. Degradation of habitat "Grazing can have indirect effects upon ground layer species through soil disturbance and physical changes to the soil such as compaction, nutrient enrichment, reduced water infiltration and erosion" (TSSC 2020b). These changes to the soil can facilitate and maintain weed invasion and make soil conditions unsuitable for native species regeneration (Prober et al. 2002a & 2002b; Yates & Hobbs 1997). Extensive areas of the habitat of the community are subject to dryland salinity arising as a consequence of rising water tables (Yates and Hobbs 1997). Extensive areas are subject to elevated soil nitrogen as a result of the application of chemical fertilizers (Benson 2008). Elevated nitrogen has been associated with the invasion of weeds and eventual conversion from native to exotic pasture (Prober et al. 2004a, b). Elevated soil nutrients are thought to transfer to the foliage of Eucalyptus species making them more attractive to insects and thus promoting tree dieback associated with insect attack (Keith 2004). *vi. Fragmentation of habitat* Box-Gum Woodland remnants typically occur as small, isolated and highly fragmented patches (TSSC 2006). Understorey species diversity has been lost, and continues to be lost, through the effects of the severe fragmentation. Small areas are also more susceptible to weed invasion. In addition, many of the remaining areas in best condition occur on linear reserves such as travelling stock routes and road reserves (TSSC 2006). While these linear remnants are important for conservation, they are particularly		

Criteria	Data/ information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information (e.g. TBDC indicates data is unknown or deficient)
	prone to invasion by weeds, such as Coolatai Grass (*Hyparrhenia hirta*) (McArdle et al. 2004).		
2c. Evidence of restricted geographic distribution (Principle 3)			
Not relevant – see Section 2 above			
2d. Evidence that the TEC is unlikely to respond to management (Principle 4)			
Not relevant – see Section 2 above			

Deficient or unknown data in the TBDC

Not applicable.

Impact assessment

See Table 55.

Table 55. SAII Impact assessment – Box-Gum Woodland.

Criteria	Data/ information	Data sources
4a. Impact on the geographic extent of the TEC (Principles 1 and 3) presented by:		
i. Area of TEC to be impacted by the Project (ha)	401.12 ha (comprised of 34.22 ha of woodland and 366.9 ha of DNG).	Niche GIS analysis
ii. Area of TEC to be impacted by the Project as a percent (%) of the current geographic extent in NSW (*Data and information should include direct impacts (i.e. from clearing) and indirect impacts where partial loss of the TEC is likely as a result of the proposal. The assessor should consider for example, changes to fire regime (frequency,*	According to TSSC (2020a) the EOO of the Box-Gum Woodland CEEC is estimated to be 702,800 km^2 and the AOO as 151,100 km^2. Hunter Eco (2024) reviewed the EOO and AOO of Box-Gum Woodland in NSW and calculated the current Box-Gum Woodland EOO as 327,174 km^2 and the AOO as 160,900 km^2.	Notice of and reason for the Final Determination: White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (TSSC 2020a). Determination of the Area of Occupancy and Extent of Occurrence in NSW of White Box

Criteria	Data/ information	Data sources
severity), hydrology, pollutants, species interactions (increased competition, changes to pollinators or dispersal), fragmentation, increased edge effects and disease, pathogens and parasites, which are likely to contribute to the loss of flora and/or fauna species characteristic of the TEC)	The loss of 401.12 ha of TEC within the Development Footprint accounts for 0.0027% of the AOO of the Box-Gum Woodland CEEC in NSW estimated in TSSC (2020a) or 0.0025% of the AOO of the Box-Gum Woodland CEEC in NSW estimated by Hunter Eco (2024). Indirect impacts are discussed in Section 5.2 and also Section 8. *Changes to fire regimes (frequency, severity)* Section 5.7 *Hydrology (groundwater and surface water)* Section 5.3.5 *Pollutants* Sections 5.2.11; 5.2.12; 5.7 *Species interactions (increased competition and effects on dispersal)* Section 5.2.1 *Fragmentation* Section 5.3.2 *Increased edge effects* Section 5.2.2 *Likelihood of disturbance* Section 5.2.2 *Disease, pathogens and parasites* Sections 5.2.6 and 5.2.15	– Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Hunter Eco 2024).
4b.Extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC presented by:		

Criteria	Data/ information	Data sources
i. Estimated size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500 m of the Development Footprint or equivalent area for other types of proposals	Areas of Box-Gum Woodland CEEC within 500 m of the Development Footprint has been calculated by including CEEC mapped by ELA (2023) in the Study area surrounding the Project, CEEC mapped by Niche (unpublished data) in the company-owned land to the west of the Project and applying PCT filters to the SVTM (DPE 2023) and BioNet Vegetation Classification (DPE 2023b). The SVTM (DPE 2023) only includes woodland and does not include the grassland component of the Box-Gum Woodland CEEC, so the area of Box-Gum Woodland CEEC is likely to be conservatively underestimated. There is approximately 339.1 ha of Box-Gum Woodland CEEC within 500 m of the Development Footprint. These TEC areas are not isolated from surrounding native vegetation outside the Study Area, with patches retained in the north, south-west and south-east of the Study Area and a strip along Moolarben and Murdering Creeks.	State Vegetation Type Map layer (DPE 2023) ELA (2023) Niche (unpublished data)
ii. Impacts on connectivity and fragmentation of the remaining areas of TEC measured by: • distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and • estimated maximum dispersal distance for native flora species characteristic of the TEC, and • other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development	*Distance between isolated areas of the TEC* No Box-Gum Woodland CEEC would become isolated as a result of the Project. *Estimated maximum dispersal distance for native flora species characteristic of the TEC*: As no Box-Gum Woodland CEEC would become isolated, the maximum dispersal distance for native flora species characteristic of the TEC is not relevant.	

Criteria	Data/ information	Data sources
	Area to perimeter ratio of remaining remnants as a result of the development (ratio): There are 68 remaining Box-Gum Woodland CEEC patches adjoining the Development Footprint. The average area to perimeter ratio of the remaining remnants as a result of the Development is 19.7.	
iii. Condition of the TEC according to the vegetation integrity score for the relevant vegetation zones. The assessor must also include the relevant condition, structure and function condition scores for each vegetation zone.	VI scores for each vegetation zone associated with this TEC are provided above and in Appendix D: Box-Gum Woodland CEEC. As all VI scores are >15, ecosystem credit obligations apply for all vegetation zones.	

Table 56. Additional impact assessment provisions as per Appendix B of Guidance to assist a decisionmaker to determine a serious and irreversible impact (DPIE 2019a) 57– Box-Gum Woodland.

Criteria	Data/ information
a. the action and measures taken to avoid the direct and indirect impact on the potential entity for a SAII	Addressed in Section 1 of this assessment above.
b. the area (ha) and condition of the threatened ecological community (TEC) to be impacted directly and indirectly by the proposed development. The condition of the *TEC is to be represented by the vegetation integrity score for each vegetation zone*	Addressed in 4a and 4b above. VI scores for relevant vegetation zones within the Development Footprint are provided in Table 30. VI, Structure and Function scores for each vegetation zone associated with this TEC are provided Table 9. As all VI scores are >15, ecosystem credit obligations apply for all vegetation zones.

Criteria	Data/ information
c. a description of the extent to which the impact exceeds the threshold for the potential entity	No threshold has been set for Box-Gum Woodland CEEC.
d. the extent and overall condition of the potential TEC within an area of 1000 ha, and then 10,000 ha, surrounding the proposed development footprint	Areas of Box-Gum Woodland CEEC surrounding the Development Footprint has been calculated by including CEEC mapped by ELA (2023) in the Study Area surrounding the Project, CEEC mapped by Niche (unpublished data) in the company-owned land to the west of the Project and applying PCT filters to the SVTM (DPE 2023) and BioNet Vegetation Classification (DPE 2023b). The SVTM (DPE 2023) only includes woodland and does not include the grassland component of the Box-Gum Woodland CEEC, so the area of Box-Gum Woodland CEEC is likely to be conservatively underestimated. Within the 1,000 ha buffer, approximately 302.9 ha is considered to align with the Box-Gum Woodland CEEC. Within the 10,000 ha buffer, approximately 1,090.3 ha is considered to align with the Box-Gum Woodland CEEC. The condition varies from woodland to derived native grassland.
e. an estimate of the extant area and overall condition of the potential TEC remaining in the IBRA subregion before and after the impact of the proposed development has been taken into consideration	Areas of Box-Gum Woodland CEEC surrounding the Development Footprint has been calculated as described above. Within the Kerrabee IBRA subregion approximately 24,117.4 ha is mapped as containing PCT's which align with the Box-Gum Woodland CEEC. After the Development impact, the remaining Box-Gum Woodland CEEC would be approximately 23,716.28 ha. Using the SVTM, all of the mapped areas include canopy trees. The area of DNG is unknown.
f. an estimate of the area of the candidate TEC that is in the reserve system within the IBRA region and the IBRA subregion	Based on the SVTM (DPE 2023), the total area of Box-Gum Woodland CEEC within National Parks Estate in the Sydney Basin IBRA Region is 7,991.4 ha and in the Kerrabee subregion is 6,894.2 ha.
g.i. the development, clearing or biodiversity certification proposal's impact on: *i. abiotic factors critical to the long-term survival of the potential TEC; for example,*	The Project would involve clearance of Box-Gum Woodland CEEC within the Development Footprint. The Project would not impact on the abiotic factors critical to the long-term survival of the Box-Gum Woodland CEEC outside of the Development Footprint. Potential impacts to groundwater and surface water are described in Section 5.3.5.

Criteria	Data/ information
how much the impact will lead to a reduction of groundwater levels or the substantial alteration of surface water patterns	
g.ii. characteristic and functionally important species through impacts such as, but not limited to, inappropriate fire/flooding regimes, removal of understorey species or harvesting of plants	The Project would involve clearance of Box-Gum Woodland CEEC within the Development Footprint. The Project would not directly impact on the characteristic and functionally important species outside of the Development Footprint.
g.iii. the quality and integrity of an occurrence of the potential TEC through threats and indirect impacts including, but not limited to, assisting invasive flora and fauna species to become established or causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species in the potential TEC	Addressed above and in Section 5.2 and **5.2**. The Project would not involve any spraying of fertilizers, herbicides or other chemicals or pollutants that would kill or inhibit the growth of flora species within the Box-Gum Woodland CEEC. Herbicides and fertilizers may be required for weed management and revegetation purposes, but these would only be used in a manner that would not adversely impact on nearby Box-Gum Woodland CEEC. The Project does not involve regular mobilisation of fertilisers, herbicides or other chemicals or pollutants which may harm or inhibit growth of species.
h. direct or indirect fragmentation and isolation of an important area of the potential TEC	The Project may lead to the fragmentation of Box-Gum Woodland CEEC in the local area by increasing the distance between adjoining patches; however, retained patches around the periphery of the Development Footprint are connected to native vegetation surrounding the Study Area in at least one direction. All areas would be rehabilitated to woodland progressively as the Project stages are completed.

Criteria	Data/ information
i. the measures proposed to contribute to the recovery of the potential TEC in the IBRA subregion	The Habitat Enhancement Area would improve the condition of retained Box-Gum Woodland CEEC, with approximately 75.5 ha to be rehabilitated through revegetation, fencing and pest and weed management. The conceptual final landform for the Project (Figure 19b) includes rehabilitation of 535 ha of the Development Footprint to native woodland, including 140 ha of native grassland with scattered tree species characteristic of Box-Gum Woodland CEEC. The long-term outcome will be a gain in the extent of the community within the Study Area.

Regent Honeyeater (*Anthochaera phrygia*)

1. Actions to avoid and minimise direct and indirect impacts

Impacts on Regent Honeyeater have been avoided or minimised through the Project design by:

- Avoidance of impact to Important Habitat Mapping located around the periphery of the Development Footprint and some larger patches of remnant vegetation in the south-west of the Study Area. The amended Project Development Footprint will result in a 56.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha). The majority of this is located in the south-east of the Development Footprint adjacent to Munghorn Gap Nature Reserve
- Important Habitat (DPE, 2023g) mapped along Moolarben and Murdering Creeks will also be retained and enhanced through revegetation.

2. Current status (excluding impacts of the Project)

The Regent Honeyeater has been listed as a possible SAII due to the following Principles:

- **Principle 1**: species or ecological community currently in a rapid rate of decline
- **Principle 2:** species or ecological communities with a very small population size.

An assessment of Principles 1 and 2 according to BAM (DPIE 2020a) Section 9.1.2 (2a-b) are provided in Table 57.

Principle 3 (species or area of ecological community with very limited geographic distribution) does not apply to the Regent Honeyeater as the species' EOO and AOO are not geographically limited and do not experience fluctuations (Table 56. 57 Section 4b[i]) (DOE 2015c; Garnett et al. 2011). Principle 3 also does not apply to the Regent Honeyeater as the threat-defined locations have not been identified and no extreme fluctuations in the population have been recorded (Table 56. 57 Section 4b[ii-iii]) (Garnett et al. 2011).

Principle 4 (species or ecological community that is unlikely to respond to management and is therefore irreplaceable) is also not applicable to the Regent Honeyeater as: known reproductive characteristics do not severely limit the ability to increase the existing population on a biodiversity stewardship site; the species is not reliant on abiotic habitat which cannot be restored or replaced on a biodiversity stewardship site; and life history traits and/or ecology is known and threatened processes can be controlled on a biodiversity stewardship site (DPE 2010; DOE 2015c).

According to the Saving Our Species program, there are six Priority Management Sites for the Regent Honeyeater: Bundarra-Barraba, Taronga Western Plains Zoo, Mudgee/Wollar, Lower Hunter Valley, Capertee Valley and Taronga Zoo (SOS n.d.).

Table 57. Current status – Regent Honeyeater.

Criteria	Data/ information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information (e.g. TBDC indicates data is unknown or deficient)
2a. Evidence of rapid decline (Principle 1) presented by:			
i. Decline in population of the species in NSW in the past 10 years or three generations (whichever is longer), or	The species has declined by more than 80% in three generations (DPE 2023a). This population reduction is likely due to decline in geographic distribution and habitat quality (DOE 2015c).	NSW BioNet Threatened Biodiversity Database Collection (DPE 2023a) Conservation Advice for the Regent Honeyeater (DOE 2015c).	
ii. Decline in population of the species in NSW in the past 10 years or three generations. Different measures may be used to assess reduction in population size, including: direct observation; an index of abundance appropriate to the species; decline in geographic distribution and/or habitat quality; exploitation; effects of introduced species, hybridisation, pathogens, pollutants, competitors or parasites	Not applicable		
2b. Evidence of small population size (Principle 2) presented by:			
i. An estimate of the species' current population size in NSW	In 2010 at its time of listing by the NSW TSSC it was estimated that the population was fewer than 250 mature individuals (DPE 2010). According to the BioNet Atlas, '<50 individuals or	NSW TSSC final determination – critically endangered species	The NSW total population is not listed in the BioNet Atlas (NSW DCCEEW 2024b) due to data deficiency

Criteria	Data/ information	Data sources	Details of data deficiency, assumptions, reasons for low confidence in information (e.g. TBDC indicates data is unknown or deficient)
	>250 individuals (occur) where threats are known' (DPE 2022d[4]).	listing of Regent Honeyeater (DPE 2010)	
ii. An estimate of the decline in the species' population size in NSW in three years or one generation (whichever is longer)	According to the TSSC, 'the population in NSW was estimated at maximum of 1,000 birds in 1997, but there have been fewer seen subsequently, with a maximum count of just 40 in 2009' (DOE 2015c).	Threatened Species Scientific Committee Conservation Advice for the Regent Honeyeater (DOE 2015c)	An estimate of the decline in the species' population size in NSW in three years or one generation is unknown due to data deficiency.
iii. Where such data is available, an estimate of the number of mature individuals in each subpopulation, or the percentage of mature individuals in each subpopulation, or whether the species is likely to undergo extreme fluctuations	The Regent Honeyeater occurs as one population (Garnett *et al*. 2011). This population has undergone a significant reduction in the last 15-20 years as during the late 1980s the estimated number of mature individuals was 1,500 individuals, however by 2010 the estimated number of mature individuals was 350-400 individuals (Garnett *et al*. 2011; Webster & Menkhorst 1992). The Regent Honeyeater population is thought to currently comprise 250 individuals (Crates *et al*. 2019).		.
2c. Evidence of limited geographic range for the threatened species (Principle 3)			
Not applicable – see Section 2 above			
2d. Evidence that the species is unlikely to respond to management			
Not applicable – see Section 2 above			

Deficient or unknown data in the TBDC

Not applicable.

Impact Assessment

See Table 58.

Table 58. SAII Impact assessment – Regent Honeyeater.

Impact	Data / information	Data sources
4a. The impact on the species' population (Principles 1 and 2) presented by:		
i. An estimate of the number of individuals (mature and immature) present in the subpopulation on the Development Footprint (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population	As 80.5 ha of the Development Footprint is included on the Important Habitat Map for this species, targeted fauna surveys were not required due to assumed presence (DPE 2022d[4]). Despite this, AMBS conducted 23.5 hours of specific diurnal bird surveys over nine days (AMBS 2023). No Regent Honeyeaters were recorded. The Regent Honeyeater population is thought to currently comprise 250 individuals (Crates *et al*. 2019). It is regarded as a single genetic unit largely restricted to two breeding regions (Greater Blue Mountains and Northern Tablelands) separated by > 350 km (Crates *et al*. 2021; Crates *et al*. 2019). It is estimated that the Greater Blue Mountains population is 150 individuals (Heinsohn *et al*. 2022).	Baseline Fauna Survey Report (AMBS 2023) National Recovery Plan for the Regent Honeyeater (DOE 2016)
ii. An estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or	No Regent Honeyeaters were recorded during targeted threatened species surveys (AMBS 2023). The presence of this species is assumed because the Important Habitat Map (DPE 2023g) intersects the Development Footprint. A total area of 80.5 ha of woodland would be impacted by the Project.	Baseline Fauna Survey Report (AMBS 2023)
iii. If the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that would be impacted, along with the area of habitat to be impacted by the proposal	No threshold has been set for the Regent Honeyeater.	NSW BioNet Threatened Biodiversity Database Collection (NSW DCCEEW 2024b)
4b. Impact on geographic range (Principles 1 and 3) presented by:		
i. The area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW	According to the TSSC (DPE 2010), the species' EOO in NSW was estimated at less than 210 000 km2, and AOO less than 200 km^2 in 2000. The current EOO and AOO are estimated at 340,000 km^2 and 300 km^2 (Crates *et al*. 2021). The Project would not impact the species EOO. The area of species' geographic range to be impacted by the Project is 80.5 ha. This accounts for 0.26% of the overall AOO (Crates *et al*. 2021) assuming the Project is within the AOO as calculated by Crates *et al*. (2021).	NSW TSSC final determination – critically endangered species listing of Regent Honeyeater (DPE 2010) Threatened Species Scientific Committee Conservation Advice for the Regent Honeyeater (DOE 2015c)

Impact	Data / information	Data sources
ii. *The impact on the subpopulation as either: all individuals would be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species would be directly impacted*	Impact will affect some habitat, however, individuals of the species are unlikely to be directly impacted as there are no records within the Development Footprint, most records within 30 km of the Study Area are greater than 15-20 years old (NSW DCCEEW 2024), and the Development Footprint is not within currently known key breeding areas (DOE 2016). No Regent Honeyeater individuals were recorded within the Development Footprint during targeted threatened species searches, however species presence is assumed as the site lies within the Important Habitat Map (DPE 2023g). The Important Habitat Map to be affected by the Project is 80.5 ha of remnant woodland.	Baseline Fauna Survey Report (AMBS 2023)
iii. *To determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species*	No Regent Honeyeater subpopulation would be fragmented by the Project. Dispersal and genetic exchange may occur throughout the species range. The Development Footprint would be rehabilitated post mining.	
iv. *To determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects,*	*Changes to fire regimes (frequency, severity):* see Section 5.7 *Hydrology:* see Section 5.3.5 *Pollutants*: see Section 5.2.12; Section 5.7 *Species interactions (increased competition and effects on dispersal):* see Section 5.2.1 *Fragmentation*: see Section 3.7.2, Section 5.2.1, Section 5.3.2 and Section 5.3.3 The Project would not increase habitat fragmentation for the Regent Honeyeater as habitat to be cleared occurs at the edges of large remnant woodland patches adjoining	

Impact	Data / information	Data sources
likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.	grassland areas. No areas of remnant woodland would be isolated due to the Project. Woodland along the riparian zone would be retained. The Regent Honeyeater is a highly mobile species that moves across the landscape to follow flowering resources and their abundance is such that that they occur only irregularly at most sites (DOE 2016). Given the above, it is unlikely that the removal of vegetation within the site would result in the fragmentation of the population. *Increased edge effects:* see Section 5.2.2 *Likelihood of disturbance:* see Section 5.2.1 *Disease, pathogens and parasites:* Section 5.2.6; 5.2.15	

Table 59. Additional impact assessment provisions as per Appendix B of Guidance to assist a decisionmaker to determine a serious and irreversible impact (DPIE 2019a)– Regent Honeyeater.

Criteria	Data/ information
a. Action and measures taken to avoid the direct and indirect impact on the potential entity	Summary in Section 1 above.
b. Size of the local population directly and indirectly impacted by the development	See 4.a.ii. above
c. Extent to which the impact exceeds any threshold for the potential entity	No threshold has been set for Regent Honeyeater.
d. Likely impact (including direct and indirect impacts) that the development will have on the habitat of the local population, including but not limited to:	*i. An estimate of the change in habitat available to the local population as a result of the proposed development* No Regent Honeyeater individuals were recorded within the Development Footprint during targeted threatened species searches. The Project would result in the loss of 80.5 ha of potential habitat. Woodland in the best condition is generally retained outside the Development Footprint to the south-east and south-west of the Development Footprint. The amount of potential habitat to be cleared is 0.04 % of the Important Habitat mapped in the Kerrabee subregion (DPE 2023g). The amount of potential habitat to be cleared is 0.01 % of the Important Habitat Mapped in NSW (DPE 2023g).

Criteria	Data/ information
i. An estimate of the change in habitat available to the local population as a result of the proposed development *ii. The proposed loss, modification, destruction or isolation of the available habitat used by the local population* *iii. Modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development* *(BioNet Atlas records or other documented, quantifiable means must be used by the assessor to estimate what percentage of the species' population and habitat is likely to be lost in the long term within the IBRA subregion due to the direct and indirect impacts of the development)*	*ii. The proposed loss, modification, destruction or isolation of the available habitat used by the local population* The Project would result in the loss of 80.5 ha of potential habitat. In the long-term, an increase in the quantity and quality of available habitat will result from revegetation. No habitat would become isolated. All retained habitat will allow for maintenance of connectivity to surrounding habitat. *iii. Modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development* The potential habitat within the subject area is unlikely to provide critical foraging and/or breeding resources on which the species depend to maintain their lifecycle due to the lack of recent records of the species within the vicinity of the site (see Appendix D for details). The Project is unlikely to modify habitat required for the maintenance of processes important to the species' life cycle.
e. *Likely impact on the ecology of the local population (fauna)* *At a minimum, address the following:* *i. for fauna:* *– breeding* *– foraging*	All individuals occurring throughout the natural distribution of this species are considered a single population (DOE 2016). *Breeding* The Project is within the Regent Honeyeater Mudgee-Wollar breeding area (DPE 2023g; DOE 2016). It is unknown if the species utilises the habitat within the Development Footprint for breeding. The presence of Noisy Miners within the Development Footprint may preclude use of the area by Regent Honeyeater for breeding (due to competitive exclusion by the Noisy Miners), but rather they may breed within the more treed/less fragmented woodland/forest areas around the periphery of the cleared areas and also within adjacent Munghorn Gap Nature Reserve. The Project would result in the removal of 80.5 ha of potential Regent Honeyeater breeding habitat. Even if the species is not breeding within the Development Footprint, they may use the

Criteria	Data/ information
– *roosting, and* – *dispersal or movement pathways*	more dense, intact areas of habitat around the periphery of the Study Area. Some of these areas will not be directly impacted by the Project. However, a possible indirect impact resulting from the Project is increased access of the Noisy Miner to habitat adjacent to the Development Footprint during operation and while the mine landform is being revegetated. A Noisy Miner monitoring and management program would be implemented to minimise the potential impacts from Noisy Miners as described in Section 5.2.2. *Foraging and roosting habitat* Potential exists for displacement of individuals through loss of potential foraging habitat and breeding resources, but given their highly mobile nature, the species are unlikely to be dependent on the habitat within the Development Footprint provides for survival (See Appendix D for details). *Dispersal or movement pathways* The species was not recorded within the Study Area during targeted surveys (AMBS 2023). This species has previously been recorded on several occasions immediately adjacent to the Development Footprint within Munghorn Gap Nature Reserve, with a total of 153 records within 30 km of the Study Area (DPE 2022d[4]), although the majority of records are greater than 15-20 years old (DPE 2022d). The potential habitat within the subject area is unlikely to provide critical foraging and/or breeding resources on which the species depend to maintain their lifecycle due to the lack of recent records of the species within the vicinity of the site (see Appendix D for details).
f. Extent to which the local population will become fragmented or isolated as a result of the development	See 4b.iv above and Section 5.3.3.
g. Relationship of the local population to other population/populations of the species for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range	All individuals occurring throughout the natural distribution of this species are considered a single population (DOE 2016). The species would not be at the limit of its range, if it were to occur in the Development Footprint.
h. Extent to which the proposed development will lead to an increase in threats and indirect impacts,	Threats and indirect impacts to the species as a result of the Project are discussed in this table under 4b.iv. above.

Criteria	Data/ information
including impacts from invasive flora and fauna	
i. Estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion	The species is regarded as one population with approximately 250 individuals (Crates *et al.* 2019). Locally, BioNet records (NSW DCCEEW 2024a) indicate the species has been recorded in Munghorn Gap Nature Reserve, Wollemi National Park and Goulburn River National Park. There is approximately 174,815.8 ha of the Important Habitat mapped in reserve system in NSW, approximately 147,885.4 ha of the Important Habitat mapped in reserve system in the IBRA region and approximately 111,647.7 ha of the Important Habitat mapped in reserve system in the IBRA subregion (DPE 2023g).
j. Measure/s proposed to contribute to the recovery of the species in the IBRA subregion	Measures proposed that may contribute to the recovery of the species are addressed in Section 5.7 and summarised below: **Active restoration**. The Habitat Enhancement Area includes approximately 53 ha of existing woodland and approximately 135 ha of DNG and cleared land that is proposed to be revegetated. The Habitat Enhancement Area includes the riparian zone along Moolarben and Murdering Creeks, (outside of the Development Footprint), providing foraging/nesting resources over 160 ha of land (as shown on Figure 19b). Management measures would include revegetation and stabilisation, fencing, weed management, animal pest management and fire management. **Mine rehabilitation**. Areas disturbed by the Project would be progressively rehabilitated and revegetated (providing foraging habitat). Approximately 535 ha of native woodland, including 140 ha of native grassland with scattered trees is proposed to be established as part of the conceptual post-mining land use for the Project. **Competitor monitoring and management**. Implementation of a Noisy Miner monitoring and management program would be undertaken prior to and during Regent Honeyeater breeding season (June to January).

Swift Parrot (*Lathamus discolor*)

1. Actions to avoid and minimise direct and indirect impacts

Impacts on Swift Parrot have been avoided or minimised through the Project design by:

- Avoidance of impact to foraging habitat including Box-Gum Woodland located around the periphery of the Development Footprint and some larger patches of remnant vegetation in the south-west of the Study Area. The amended Project Development Footprint will result in a 56.4% reduction to the area of woodland habitat impacted (from 84.22 ha to 34.22 ha). The majority of this is located in the south-east of the Development Footprint adjacent to Munghorn Gap Nature Reserve
- Potential foraging habitat along Moolarben and Murdering Creeks will also be retained and enhanced through revegetation.

2. Current status (excluding impacts of the Project)

The Swift Parrot has been listed as a possible SAII due **Principle 1**: Rapid Rate of Decline.

Principle 1 applies to the Swift Parrot. As per Section 9.1.2 (2.a) of the BAM (DPIE 2020a), the Swift Parrot has experienced a population decline of ≥80% in 10 years or three generations (DPE 2022d[4]).

The threatened species listing for the Swift Parrot (TSSC 2000) states that the breeding population in Tasmania declined from in excess of 10,000 pairs to less than 1,000 pairs prior to the year 2000. Numbers in New South Wales are considerably less than this.

The Development Footprint is not mapped on the Important Habitat Map (DPE 2023g) and is not within a SOS priority management area for the Swift Parrot. However, 105.5 ha of the Development Footprint is considered potential foraging habitat as it contains White Box (*Eucalyptus albens*), Yellow Box (*E. melliodora*) and Mugga Ironbark (*E. sideroxylon*) listed as key tree species for Swift Parrot habitat on the Western Slopes of NSW.

Principle 2 (species with a very small population size) does not apply to the Swift Parrot as the total NSW population, estimated rate of decline in three years or one generation, and the number and percentage of mature individuals in each subpopulation or whether the species is likely to undergo extreme fluctuations is unknown for this species (Table 57. 58 Section 4a[i]) (TSSC 2016).

Principle 3 (species with very limited geographic distribution) is not applicable to the Swift Parrot as the species' EOO and AOO are not geographically limited (Table 57. 58 Section 4b[i] of TSSC 2016), the threat-defined locations have not been identified and the likelihood of the species' population undergoing extreme fluctuations is unknown (Table 57. 58 Section 4b[ii-iii]) (TSSC 2016).

Principle 4 (species that is unlikely to respond to management and is therefore irreplaceable) is also not applicable to the Swift Parrot as: known reproductive characteristics do not severely limit the ability to increase the existing population on a biodiversity stewardship site; the species is not reliant on abiotic habitat which cannot be restored or replaced on a biodiversity stewardship site; and life history traits and/or ecology is known and threatened processes can be controlled on a biodiversity stewardship site (TSSC 2016).

Deficient or unknown data in the TBDC

The AOO and EOO for this species is not provided in the TBDC (NSW DCCEEW 2024b).

Impact assessment

See Table 60.

Table 60. SAII Impact assessment – Swift Parrot.

Impact	Data / information	Data sources
4a. The impact on the species' population (Principles 1 and 2) presented by:		
▪ *An estimate of the number of individuals (mature and immature) present in the subpopulation on the Development Footprint (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population*	No Swift Parrot individuals were recorded on the Development Footprint during AMBS threatened species targeted surveys and the species has not been recorded on the Development Footprint in the past (AMBS 2023). The number of individuals in NSW is not accurately known. Garnett *et al.* (2011) estimated approximately 2,000 mature individuals occur in the wild, based on the Bird Action Plan 2010 assessment process. However, the current total population is likely considerably less than 2,000 birds (TSSC 2016).	Baseline Fauna Survey Report (AMBS 2023) TSSC Conservation Advice *Lathamus discolor*: Swift Parrot (TSSC 2016) The Action Plan for Australia Birds 2010 (Garnett *et al.* 2011)
▪ *An estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or*	Not applicable. Species unit of measure is area. See iii below.	
▪ *If the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that would be impacted, along with the area of habitat to be impacted by the proposal*	No individuals were recorded during targeted threatened species surveys (AMBS 2023). This species is considered an ecosystem credit species and 105.52 ha of potential foraging habitat including remnant woodland, forest and shrubland, DNG, regenerating and scattered trees would be impacted by the Project.	Baseline Fauna Survey Report (AMBS 2023)
4b. Impact on geographic range (Principles 1 and 3) presented by:		

Impact	Data / information	Data sources
▪ *The area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW*	According to the TSSC, the current estimated EOO for this species is 57,000 km^2 (Garnett *et al*. 2011). In contrast, the estimated AOO for this species is largely unknown due to the temporal and spatial variability of long-distance movements (TSSC 2016). Over a six-year period (2009-2014), Webb estimated the Swift Parrot AOO ranged from 18.5 km^2 to 355 km^2 (TSSC 2016). The area of potential habitat to be impacted within the species' geographic range is 105.52 ha. This accounts for 0.002% of the overall EOO and between 0.3% to 5.7% of the overall AOO.	TSSC Conservation Advice *Lathamus discolor:* Swift Parrot (TSSC 2016) The Action Plan for Australia Birds 2010 (Garnett *et al.* 2011)
▪ *The impact on the subpopulation as either: all individuals would be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species would be directly impacted*	The Project will impact potential foraging habitat only. No individuals of the species will likely be directly impacted and no areas identified on the Important Habitat Map (DPE 2023g) will be directly impacted. No Swift Parrot individuals were recorded on the Development Footprint during targeted threatened species searches. However, species presence is considered likely on an occasional or irregular basis due to habitat suitability and proximity of previous records (AMBS 2023). The area of suitable potential foraging habitat to be affected by the Project is 105.52 ha of remnant woodland, forest and shrubland, DNG, regenerating and scattered trees. Pre-clearing surveys would be conducted to ensure impacts to any foraging individuals would be avoided.	Baseline Fauna Survey Report (AMBS 2023)
▪ *To determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species*	The Swift Parrot occurs as a single, migratory population. No Swift Parrot subpopulation would be fragmented by the Project. The Development Footprint would be rehabilitated post construction. The restoration of key habitat features (foraging resources) may encourage individuals to utilise foraging resources after mining.	National Recovery Plan for the Swift Parrot *Lathamus discolor*. (Saunders and Tzaros 2011)

Impact	Data / information	Data sources
▪ *To determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.*	*Changes to fire regimes (frequency, severity):* See Section 5.7 *Hydrology:* See Section 5.3.5 *Pollutants*: See Section 5.2.6; 5.7 *Species interactions (increased competition and effects on dispersal):* See Section 5.2.1 *Fragmentation*: See Section 3.7.2 Section 5.2.1, Section 5.3.2 and Section 5.3.3The Project would not increase habitat fragmentation for the Swift Parrot as habitat to be cleared occurs at the edges of large remnant woodland patches and in adjoining grassland areas. No areas of remnant woodland, forest and shrubland, DNG, regenerating or scattered trees would be isolated due to the Project. *Increased edge effects:* See Section 5.2.2 *Likelihood of disturbance:* Targeted pre-clearance surveys would also be conducted within areas of suitable habitat to allow for management (re-location of resident individuals to adjacent habitat) prior to clearance. Habitat clearance is described above. *Disease, pathogens and parasites:* See Section 5.2.6; 5.2.15	

Table 61. Additional impact assessment provisions as per Appendix B of Guidance to assist a decisionmaker to determine a serious and irreversible impact (DPIE 2019a)– Swift Parrot.

Criteria	Data/ information
a. Action and measures taken to avoid the direct and indirect impact on the potential entity	Detailed in Section 1 above.
b. Size of the local population directly and indirectly impacted by the development	See 4a ii. above
c. The extent to which the impact exceeds any threshold for the potential entity	No threshold has been set for Swift Parrot
d. Likely impact (including direct and indirect impacts that the development will have) on the habitat of the local population, including but not limited to: *i. An estimate of the change in habitat available to the local population as a result of the proposed development* *ii. The proposed loss, modification, destruction or isolation of the available habitat used by the local population* *iii. Modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development*	*i) An estimate of the change in habitat available to the local population as a result of the proposed development* The area of potential habitat within the species' geographic range is 105.52 ha. Given Swift Parrots are regarded as being part of one population, this accounts for between 0.3% to 5.7% of the overall AOO. No areas identified on the Important Habitat Map (DPE 2023g) will be directly impacted. *ii) The proposed loss, modification, destruction or isolation of the available habitat used by the local population* Loss of 105.5 ha of potential habitat outside the Important Habitat Map (DPE 2023g) and outside priority management areas is unlikely to have a significant impact on the species. The Project will result in a net gain in habitat/foraging resources in the longer term. Modification of habitat required for the maintenance of processes important to the species' life cycle, genetic diversity and long-term evolutionary development is unlikely due to absence of mapped habitat considered critical for the survival of the Swift Parrot. *iii) Modification of habitat required for the maintenance of processes important to the species' life cycle* The potential habitat within the subject area is unlikely to provide critical foraging resources on which the species depend to maintain their lifecycle due to the lack of recent records of the species within the vicinity of the site. The Project is unlikely to modify habitat required for the maintenance of processes important to the species' life cycle.

Criteria	Data/ information
(BioNet Atlas records or other documented, quantifiable means must be used by the assessor to estimate what percentage of the species' population and habitat is likely to be lost in the long term within the IBRA subregion due to the direct and indirect impacts of the development)	
e. Likely impact on the ecology of the local population (fauna) *At a minimum, address the following:* *i. for fauna:* *– breeding* *– foraging* *– roosting, and* *– dispersal or movement pathways*	*Breeding* The Swift Parrot breeds in Tasmania but migrates to the mainland to forage over the winter months. The Project will not affect breeding habitat. *Foraging and roosting habitat* The Swift Parrot is considered to have the potential to utilise foraging resources within the Development Footprint (AMBS 2023). The removal of potential foraging resources within the Development Footprint is considered unlikely to impact on foraging resources that are important for the lifecycle of the Swift Parrot due to the fact that no habitat as identified on the Important Habitat Map for the species will be impacted. *Dispersal or movement pathways* Development of the Habitat Enhancement Area and re-vegetation of the Development Footprint will provide potential resources in the short and longer term. As such, likely impact on foraging behaviour and/or movement patterns of migrating individuals is likely minor.
Extent to which the local population will become fragmented or isolated as a result of the development	The Project would not fragment or isolate a local population.
f. Relationship of the local population to other population/populations of the species for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range	The Swift Parrot occurs as a single, migratory population. The Development Footprint does not include any areas that have been mapped on the important habitat map (as detailed in Section 2.1.4), therefore the Project is considered unlikely to impact on resources that might be important for lifecycle of the species. The species is not at the limit of its geographic range in the Study Area.

Criteria	Data/ information
g. Extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn to a decrease in the viability of the local population	Threats to the Swift Parrot include loss of key foraging habitat and Psittacine Circoviral Disease (PCD), otherwise known as Beak and Feather Disease, carried in wild populations with no effective treatment (DCCEEW 2022b). Access to the mining tenements would be restricted and weeds and pathogens are very unlikely to be transported from the site to adjacent vegetation via vehicles or human activity.
Estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion	The Swift Parrot population is estimated to include less than 2000 individuals (TSSC 2016). Swift Parrots depend on seasonal flowering of preferred tree species for food and thus forage over large areas of NSW, throughout the coastal and western slopes regions, including National Parks Estate and private land (TSSC 2016). The species has not been recorded within the Development Footprint but has records in close proximity (AMBS 2023) and is known to utilise resources within more suitable intact habitat within the wider local area, including within the adjacent and protected Munghorn Gap Nature Reserve. Within the Kerrabee IBRA subregion there are only nine Swift Parrot BioNet records, compared to 416 in the Hunter region and 186 in the Inland Slopes (DPE 2022d[4]). This, along with absence of Important Habitat Mapping within the Development Footprint suggests lower visitation of the Kerrabee IBRA subregion for foraging.
j. Measure/s proposed to contribute to the recovery of the species in the IBRA subregion	**Active restoration**. The Habitat Enhancement Area includes approximately 53 ha of existing woodland and approximately 135 ha of DNG and cleared land that is proposed to be revegetated. The Habitat Enhancement Area includes the riparian zone along Moolarben and Murdering Creeks, (outside of the Development Footprint), providing foraging/nesting resources over 160 ha of land (as shown on Figure 19b). Management measures would include revegetation and stabilisation, fencing, weed management, animal pest management and fire management. **Mine rehabilitation**. The Development Footprint would be progressively rehabilitated and revegetated (providing foraging habitat). Approximately 535 ha of native woodland, including 140 ha of native grassland with scattered trees is proposed to be established as part of the conceptual post-mining land use for the Project.

Broad-headed Snake (*Hoplocephalus bungaroides*)

1. Actions to avoid and minimise direct and indirect impacts

Impacts on Broad-headed Snake have been avoided or minimised through the Project design by:

- Avoidance of direct impacts on mapped rocky habitat (i.e. caves, crevices, cliffs, rocks)
- Mitigation and minimisation of indirect vibration impacts to nearby rocky habitat through: pre-blast desktop assessments; site-specific vibration modelling per blast to calculate MIC required to meet PPV limit for nearest mapped rocky habitat; continuation of existing vibration monitoring as described in the Blast Management Plan (MCO, 2020d); additional vibration monitoring at one or more new representative sites of mapped rocky habitat adjacent to the Project; ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary
- Visual inspections of key representative mapped rocky habitat on a 6-monthly basis

2. Current status (excluding impacts of the Project)

The Broad-headed Snake has been listed in the TBDC as a possible SAII due to **Principle 4**: species or ecological community that is unlikely to respond to management and is therefore irreplaceable.

Principle 1 (species or ecological community currently in a rapid rate of decline) does not apply to the Broad-headed Snake as the total NSW population and evidence of rapid decline in the last 10 years or three generation is unknown (Table 62, Table 63 Section 4a[i]). Draft Conservation Advice (DEECCW 2023) states that the species has undergone a severe population reduction of > 50 % over three generations (30 years) from 1989–2020 due to human disturbance (rock shelter removal and disturbance, illegal collecting), vegetation overgrowth and severe fire.

Principle 2 (species or ecological communities with a very small population size) also does not apply as the total NSW population, estimated rate of decline in three years or one generation, and the number and percentage of mature individuals in each subpopulation or whether the species is likely to undergo extreme fluctuations is unknown for this species.

Principle 3 (species or area of ecological community with very limited geographic distribution) is also not applicable to the Broad-headed Snake as the species' EOO and AOO are not geographically limited (Table 62, Table 63 Section 4b[i]). However, the species is only known from an area within 250 km of Sydney. Principle 3 also does not apply to the Broad-headed Snake as the threat-defined locations have not been identified and the likelihood of the species' population undergoing extreme fluctuations is unknown (Table Section 4b[ii-iii]) (DCCEEW 2023f).

Principle 4 applies to the Broad-headed Snake as per Section 9.1.2 (2.d) of the BAM (DPIE 2020a) as this species is "unlikely to respond to management because:

i. Known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site

ii. The species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or

iii. Life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus)".

According to the Saving Our Species (SOS) program, there are three Priority Management Sites for the Broad-headed Snake: Royal National Park, Woronora Plateau and Morton National Park (SOS n.d.). The historical range is 'along rocky sections of the Sydney coastline from the entrance of Port Jackson south to Botany Bay, and around Middle Harbour, Lane Cove and Parramatta' (DOE2014), however populations are currently restricted to the southern Sydney, Blue Mountains, Nowra hinterland and an area north-west of the Cumberland Plain on Triassic and Permian sandstones (DPE 2023e; NPWS 1999). This species utilises west to north-west aspect rocky outcrops and adjacent sclerophyll woodland and is often associated with *Eucalyptus gummifera* (Red Bloodwood), *Eucalyptus punctata* (Grey Gum), *Eucalyptus piperita* (Sydney Peppermint) and *Eucalyptus agglomerata* (Blue Leaf Stringybark) (Cogger *et al*. 1993; NPWS 1999).

Item ii. Above (*the species is reliant on abiotic habitat which cannot be restored or replaced on a biodiversity stewardship site*) is applicable to the Broad-headed Snake which relies on rocky outcrops, a finite and restricted resource, for shelter and breeding.

However, Goldingay and Newell (2016) found that outcrop restoration can restore habitat quality: 'lizard prey of the Broad-headed Snake was more abundant in constructed compared to natural outcrops; Broad-headed Snakes were detected equally in constructed and natural outcrops'. Therefore, is it likely that the species habitat can be restored or replaced on a biodiversity stewardship site.

Deficient or unknown data in the TBDC

The AOO and EOO for this species is not provided in the TBDC (NSW DCCEEW 2024b).

Impact assessment

See Table 62.

Table 62. SAII Impact assessment – Broad-headed Snake.

Impact	Data / information	Data sources
4a. The impact on the species' population (Principles 1 and 2) presented by:		
An estimate of the number of individuals (mature and immature) present in the subpopulation on the Development Footprint (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population, and	The total NSW population of the Broad-headed Snake is unknown. In the 1950s and 1970s this species was collected from the wild to supply the domestic pet market. According to SPRAT (DCCEEW 2023b), studies conducted in Morton National Park indicate the population of Broad-headed Snakes was stable between 1992-1996, however declined in 1997 as 85% of adult females disappeared from the population due to illegal collection. No Broad-headed Snakes were recorded within the Development Footprint. One Broad-headed Snake was recorded during a targeted survey by AMBS (2023) approximately 100 m outside of the Development Footprint. A population estimate could not be carried out as the Development Footprint is a small portion of a much larger area of potential habitat likely extending into Munghorn Gap Nature Reserve.	Species profile and threats database (Cth DCCEEW 2023b) Baseline Fauna Survey Report (AMBS 2023)
An estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or	Not applicable. Species unit of measure is area. See 4a.iii below.	
If the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that would be impacted, along with the area of habitat to be impacted by the proposal	No individuals were recorded within the Development Footprint. One individual was recorded in adjacent habitat about 100 m from the Development Footprint. The Broad-headed Snake shelters under rocks and within crevices during the late summer to early spring but tends to move to tree hollows within 500 m of escarpments in summer as conditions warm up (DPE 2023a). All mapped rocky habitat for the Broad-headed Snake would be avoided by the Project, including woodland/forest within 100 m of the mapped rocky habitat. Breeding habitat (the area included in a species polygon) is considered by DPE (2021b) to include woodland/forest with tree hollows within 100 m of mapped rocky habitat. Potential refuge/foraging habitat for the Broad-headed Snake includes any suitable woodland/forest with tree hollows within 500 m of suitable rocky habitat. As such, the Project would remove 166 ha of potential refuge/foraging habitat woodland/forest with tree hollows within 500 m of mapped rocky habitat.	Baseline Fauna Survey Report (AMBS 2023)

Impact	Data / information	Data sources
	Targeted pre-clearance surveys would also be conducted within areas of suitable habitat to allow for management (re-location of resident individuals to adjacent habitat) prior to clearance.	
4b. Impact on geographic range (Principles 1 and 3) presented by:		
i. The area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW	The International Union for Conservation of Nature (IUCN) Red List Assessment (Webb *et al.* 2018) states that the EOO for the Broad-headed Snake is 30,756 square kilometres (km^2) and the AOO is 688 km^2. No area of the species' geographic range is to be impacted by the Project.	Search the Atlas of Living Australia (ALA 2022)
ii. The impact on the subpopulation as either: all individuals would be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species would be directly impacted	See Section 3.7.2 where preferred habitat is discussed. All mapped rocky habitat for the Broad-headed Snake would be avoided by the Project, including woodland/forest within 100 m of the mapped rocky habitat. As such, the Project would not directly impact individuals and habitat, including the location where the species was recorded.	
iii. To determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species	The Project would not increase habitat fragmentation for the Broad-headed Snake as potential habitat to be cleared occurs at the edges of large remnant woodland patches adjoining grassland areas. No areas of remnant woodland habitat for the species would be fragmented due to the Project. It is likely that the subpopulation will remain viable given all mapped rocky habitat for the Broad-headed Snake would be avoided by the Project and areas disturbed by mining would be progressively rehabilitated and revegetated following completion of active mining operations. Targeted pre-clearance surveys would also be conducted within areas of suitable habitat to allow for management (re-location of resident individuals to adjacent habitat) prior to clearance.	
iv. To determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes	*Changes to fire regimes (frequency, severity):* See Section 5.2.16 *Hydrology:* See Section 5.3.5 *Pollutants*: See Section 5.2.10; 5.7	Species profile and threats database (Cth DCCEEW 2023b)

Impact	Data / information	Data sources
in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.	*Species interactions (increased competition and effects on dispersal):* The Broad-headed Snake is threatened by feral goats damaging habitat and by foxes and cats, which are considered potential predators (DCCEW 2022c). No goats were recorded by AMBS (2023). The Project is considered unlikely to increase competition between feral fauna and the Broad-headed Snake as foxes or cats are already likely to frequent the area and their presence is unlikely to increase due to the Project given the proposed animal pest management program to be implemented. *Fragmentation*: See Section 3.7.2, Section 5.2.1, Section 5.3.2 and Section 5.3.3 The Project would not increase habitat fragmentation for the Broad-headed Snake as habitat to be cleared occurs at the edges of large remnant woodland patches adjoining grassland areas. No areas of remnant woodland habitat for the species would be fragmented due to the Project. *Increased edge effects:* See Section 5.2.2 *Likelihood of disturbance:* Targeted pre-clearance surveys would also be conducted within areas of suitable habitat to allow for management (re-location of resident individuals to adjacent habitat) prior to clearance. Habitat clearance is described above. *Disease, pathogens and parasites: See* Section 5.2.6; 5.2.15	NSW BioNet Threatened Biodiversity Database Collection (NSW DCCEEW 2024b)

Table 63. Additional impact assessment provisions as per Appendix B of Guidance to assist a decisionmaker to determine a serious and irreversible impact (DPIE 2019a)– Broad-headed Snake.

Criteria	Data/ information
a. Action and measures taken to avoid the direct and indirect impact on the potential entity	As detailed in Section 1 above
b. Size of the local population directly and indirectly impacted by the development	See 4.a.ii above.
c. The extent to which the impact exceeds any threshold for the potential entity	No thresholds have been set for Broad-headed Snake.

Criteria	Data/ information
d. *Likely impact (including direct and indirect impacts that the development will have on the habitat of the local population, including but not limited to:* i. *An estimate of the change in habitat available to the local population as a result of the proposed development* ii. *The proposed loss, modification, destruction or isolation of the available habitat used by the local population* iii. *Modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development* *(BioNet Atlas records or other documented, quantifiable means must be used by the assessor to estimate what percentage of the species' population and habitat is likely to be lost in the long term within the IBRA subregion due to the direct and indirect impacts of the development)*	*An estimate of the change in habitat available to the local population as a result of the proposed development* All mapped rocky habitat for the Broad-headed Snake would be avoided by the Project, including woodland/forest within 100 m of the mapped rocky habitat. Breeding habitat (the area included in a species polygon) is considered by DPE (2021b) to include woodland/forest with tree hollows within 100 m of mapped rocky habitat. Potential refuge/foraging habitat for the Broad-headed Snake includes any suitable woodland/forest with tree hollows within 500 m of suitable rocky habitat. As such, the Project would remove 166 ha of potential refuge/foraging habitat woodland/forest with tree hollows within 500 m of mapped rocky habitat. *The proposed loss, modification, destruction or isolation of the available habitat used by the local population* As above. *modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development.* Broad-headed Snake uses dry forest within a distance of up to 500 m within sandstone shelters for foraging in summer months (DPE 2023e). The habitat within the Development Footprint that meets these criteria is relatively limited since woodland in the valley has been historically cleared for agriculture. Connected habitat outside the Development Footprint is to be retained.
e. *Likely impact on the ecology of the local population (fauna) – breeding, foraging, roosting, dispersal or movement pathways*	*Breeding* Rocky breeding habitat and vegetation within 100 m of this habitat would be avoided and access controlled. *Foraging and roosting habitat*

Criteria	Data/ information
	Potential refuge/foraging habitat for the Broad-headed Snake includes any suitable woodland/forest with tree hollows within 500m of suitable rocky habitat. As such, the Project would remove 166 ha of potential refuge/foraging habitat woodland/forest with tree hollows within 500 m of mapped rocky habitat. *Dispersal or movement pathways* Dispersal or movement pathways are unlikely to be affected.
f. Extent to which the local population will become fragmented or isolated as a result of the development	The Project would not fragment or isolate a local population.
g. Relationship of the local population to other population/populations of the species for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range	Two subpopulations, to the north and south of Kiama, have been shown to be evolutionarily significant units within this species and no longer share gene flow (Cth DCCEEW 2023f). The Study Area occurs within the distribution of the northern subpopulation and is close to the north-western extent of the species range (in Munghorn Gap Nature Reserve) according to BioNet records (NSW DCCEEW 2024a). The average home range size of snakes that occupy woodlands and forests in the warm months is 4.4 ± 1.5 ha in the north. There is little overlap in male home ranges during spring and summer, and all adults in woodlands and forests appear to avoid each other (during the warm months). The average home range size in rocky areas (in the cool season) is 0.5 ± 0.22 ha (Webb & Shine 1997a; Croak et al. 2013). The individual recorded within the Study Area has habitat connectivity to Munghorn Gap Nature Reserve where another individual record occurs. The relationship with other populations is unknown, however, breeding and dispersal (usually along ridgelines) are unlikely to be impacted by the Project.
h. Extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population	The project would not clear land within 100 m of all mapped rocky habitat suitable for the species. Access to these areas would be strictly controlled. Vibration associated with blasts has the potential to impact rocky habitat. Mitigation and minimisation of indirect vibration impacts to nearby rocky habitat would be undertaken as per detailed in Section 5.7 and 5.2.15 would include: pre-blast desktop assessments; site-specific vibration modelling per blast to calculate MIC required to meet PPV limit for nearest mapped rocky habitat; continuation of existing vibration monitoring as described in the Blast Management Plan (MCO, 2020d); additional vibration monitoring at one or more new representative sites of mapped rocky habitat adjacent to the Project; ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary. Visual inspections of key representative mapped rocky habitat would occur on a six-monthly basis.
i. Estimate of the area, or number of populations and size of populations that is in the reserve system in NSW,	Most of the current Broad-headed Snake distribution occurs on public land, including in Wollemi, Yengo, Blue Mountains, Royal, Heathcote and Morton National Parks; Parr and Upper Nepean State Conservation Areas; Newnes and Yalwal State Forests; and the Holsworthy Military Training Area and Woronora Dam Catchment Area. This species also occurs on Crown

Criteria	Data/ information
the IBRA region and the IBRA subregion	Land managed by the Nowra Local Aboriginal Land Council. Locally, the species is recorded within Munghorn Gap Nature Reserve and Wollemi National Park (Cth DCCEEW 2023f).The Sydney Basin IBRA region contains almost all records of the species, within an estimated area of 250km^2 (NSW DCCEEW 2024a).
j. Measure/s proposed to contribute to the recovery of the species in the IBRA subregion	**Active restoration**. During the operations, MCO would implement a Habitat Enhancement Area surrounding the Project, involving revegetation, fencing to exclude livestock (as required), weed management, animal pest management, and fire management. Since the BDAR (Niche 2022) was submitted, MCO is committing to increase the Habitat Enhancement Area, resulting in an overall total of 4.9 ha of Broad-headed Snake habitat in the Habitat Enhancement Area. **Mine rehabilitation**. Progressive rehabilitation and revegetation of disturbed areas following completion of active mining operations, including the reuse of salvaged large hollow-bearing trees/stags, will be conducted. Since the BDAR (Niche 2022) was submitted, MCO is committing to increase the rehabilitation of mined areas to woodland from 325 ha to 535 ha.

Large-eared Pied Bat (*Chalinolobus dwyeri*)

1. Actions to avoid and minimise direct and indirect impacts

Impacts on Large-eared Pied Bat have been avoided or minimised through the Project design by:

- Avoidance of direct impacts on mapped rocky habitat (i.e. caves, crevices, cliffs, rocks)
- Mitigation and minimisation of indirect vibration impacts to nearby rocky habitat through: pre-blast desktop assessments; site-specific vibration modelling per blast to calculate MIC required to meet PPV limit for nearest mapped rocky habitat; continuation of existing vibration monitoring as described in the Blast Management Plan (MCO, 2020d); additional vibration monitoring at one or more new representative sites of mapped rocky habitat adjacent to the Project; ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary
- Visual inspections of key representative mapped rocky habitat on a 6-monthly basis.

2. Current status (excluding impacts of the Project)

The Large-eared Pied Bat has been listed in the TBDC as a possible SAII due to **Principle 4**: species or ecological community that is unlikely to respond to management and is therefore irreplaceable.

Principle 1 (species or ecological community currently in a rapid rate of decline) does not apply to the Large-eared Pied Bat due to insufficient data surrounding the total NSW population and evidence of rapid decline in the last 10 years or three generation (Table 64, Table 65 Section 4a[i]) (TSSC 2012).

Principle 2 (species or ecological communities with a very small population size) also does not apply as there is insufficient data to determine the total NSW population, estimate the rate of decline in three years or one generation, and the number and percentage of mature individuals in each subpopulation or whether the species is likely to undergo extreme fluctuations is unknown for this species (TSSC 2012). Similarly, **Principle 3** (species or area of ecological community with very limited geographic distribution) is also not applicable to the Large-eared Pied Bat as the species' EOO and AOO are not geographically limited (Table Section 4b[i]). Principle 3 also does not apply to the Large-eared Pied Bat as the threat-defined locations have not been identified and the likelihood of the species' population undergoing extreme fluctuations is unknown (Table Section 4b[ii-iii]) (TSSC 2012).

Principle 4 applies to the Large-eared Pied Bat as per Section 9.1.2 (2.d) of the BAM (DPIE 2020a) as this species is "unlikely to respond to management because:

i. Known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site

ii. The species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or

iii. Life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus)".

This species is listed as a data deficient species under the Save Our Species (SOS) program and no priority Management Sites exist (SOS n.d.). The current distribution of the Large-eared Pied Bat is poorly known, however, recorded sightings occur from north of Rockhampton in Queensland through to Ulladulla in

south-east NSW (Hoye 2005). This bat relies on caves, cliff crevices, old mines and disused Fairy Martin nests for roosting, while foraging occurs below the forest canopy in gullies (DPIE 2022e; Schultz 1998).

Item ii listed above (*the species is reliant on abiotic habitat which cannot be restored or replaced on a biodiversity stewardship site*) is applicable to the Large-eared Pied Bat which relies on rocky outcrops for breeding. This species often revisits the same cave each year (DPE 2022d[4]).

All mapped rocky habitat for the Large-eared Pied Bat would be avoided by the Project, including woodland/forest within 100 m of the mapped rocky habitat. Foraging habitat for the Large-eared Pied Bat includes any suitable woodland/forest within two kilometres of suitable rocky habitat (DPE 2023a). The Project would remove a total of 113.02 ha of foraging habitat for the Large-eared Pied Bat.

Deficient or unknown data in the TBDC

The AOO and EOO for this species is not provided in the TBDC (NSW DCCEEW 2024b).

Impact assessment

See Table 64.

Table 64. SAII Impact assessment – Large-eared Pied Bat. As per previous comment

Impact	Data / information	Data sources
4a. The impact on the species' population (Principles 1 and 2) presented by:		
i. An estimate of the number of individuals (mature and immature) present in the subpopulation on the Development Footprint (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population	AMBS (2023) targeted threatened species searches recorded at least 19 individuals including two adult females, one lactating. The number of individuals in NSW is not accurately known, however the species' total population size is estimated to be <20,000 individuals (Woinarski *et al*. 2014).	Baseline Fauna Survey Report (AMBS 2023) Species profile and threats database (Cth DCCEW 2023b)
ii. An estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or	Not applicable. Species unit of measure is area. See iii below.	
iii. If the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that would be impacted, along with the area of habitat to be impacted by the proposal	The total number of individuals on the site is unknown, however 19 individuals were recorded by AMBS (2023) and the presence of three roosting sites was identified in the Study Area. All mapped rocky habitat for the Large-eared Pied Bat would be avoided by the Project, including woodland/forest within 100 m of the mapped rocky habitat. The Project would remove a total 453of 113.02 ha of foraging habitat for the Large-eared Pied Bat.	Baseline Fauna Survey Report (AMBS 2023)
4b. Impact on geographic range (Principles 1 and 3) presented by:		
i. The area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW	According to Woinarski *et al*. (2014), the species' EOO is 280,000 km^2, while the AOO is 1,500 km^2, defined by the area supporting maternity roost sites. The area of foraging habitat within the species' geographic range to be impacted by the Project is 113.02 ha. This accounts for 0.075% of the overall AOO. The Project would not impact the EOO of the species, as the Project is not at a limit of the species extent.	Species profile and threats database (Cth DCCEEW 2023b)
ii. The impact on the subpopulation as either: all individuals would be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species would be directly impacted	*Impact will affect some individuals and habitat:* Nineteen (19) individuals were recorded within the Study Area during targeted searches (AMBS 2023). The Project would lead to the loss of 113.02 ha of foraging habitat within 2 km of mapped rocky habitat. Large-eared Pied Bat roosting individuals will not be directly impacted by the Project as all identified roosting habitat is to be retained.	

Impact	Data / information	Data sources
	grassland areas. No areas of remnant woodland would be fragmented due to the Project. *Increased edge effects:* see Section 5.2.2 *Likelihood of disturbance:* see Section 5.2.3 Potential vibration impacts from blasting would be minimised through implementation of blast criterion of 50 millimetres per second (mm/s) at nearest rocky habitat. Risk of subsidence is negated through open cut rather than longwall mining. Targeted pre-clearance surveys would be conducted within areas of suitable habitat to allow for management (re-location of resident individuals to adjacent habitat) prior to clearance. Habitat clearance is described above. *Disease, pathogens and parasites: see* Section 5.2.6; 5.2.15.	

Table 6566. Additional impact assessment provisions as per Appendix B of Guidance to assist a decisionmaker to determine a serious and irreversible impact (DPIE 2019a)– Large-eared Pied Bat.

Criteria	Data/ information
a. Action and measures taken to avoid the direct and indirect impact on the potential entity	Detailed in Section 5.1 (direct impacts) and Section 5.2 (indirect impacts). Direct impacts on rocky habitat will be avoided and buffered by 100 m. Potential indirect impacts (such as noise, dust, blasting and vibration) will be avoided, mitigated and managed as detailed in Section 5.7. Loss of foraging habitat will occur within the Development Footprint, however all areas where the species was recorded will be avoided and the resulting percentage of native vegetation cover within a 1500 m buffer (23%) around (and including) the site is greater than the minimum necessary to support occasional or continual use (11-30%) (NSW DCCEEW 2024b), given the rocky habitat adjoins Munghorn Gap Nature Reserve.
b. Size of the local population directly and indirectly impacted by the development	See Section 4(ii). above

Impact	Data / information	Data sources
iii. To determine if the persisting subpopulation that is fragmented will remain viable, estimate the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species	The Project would not increase habitat fragmentation for the Large-eared Pied Bat. It is likely that the subpopulation will remain viable, given that all mapped rocky habitat for the Large-eared Pied Bat would be avoided by the Project and areas disturbed by mining would be progressively rehabilitated and revegetated following completion of active mining operations. Approximately 535 ha of native woodland/open woodland is proposed to be established as part of the conceptual final landform for the Project, which is likely to provide potential foraging habitat for this species.	
iv. To determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.	*Changes to fire regimes (frequency, severity):* see Section No evidence of recent fire was present in the Study Area. The Project is unlikely to increase fire risk. Bushfire risk would be managed in accordance with the MCC Bushfire Management Plan. Mitigation measures that would be implemented by MCO to reduce bushfire risk would focus on education and training, minimising and controlling ignition sources (e.g. by appropriate engineering design, where relevant) and developing appropriate responses and evacuation strategies. Any fuel reduction planned burns would be undertaken only in conjunction with NSW Rural Fire Service at an appropriate time and when weather conditions were still to avoid any potential for smoke hazard at rocky habitat. *Hydrology:* see Section . The water sources of Moolarben and Murdering Creeks would be avoided and managed within the Habitat Enhancement Area. *Pollutants*: see Section ; 5.7. Pollutants would be avoided. *Species interactions (increased competition and effects on dispersal):* see Section 5.2.15 Foxes are considered potential predators for the Large-eared Pied Bat (DCCEW 2022c). The Project is considered unlikely to increase competition between foxes and the Large-eared Pied Bat, as any foxes occurring on the Development Footprint are likely to already frequent the surrounding area and their presence is unlikely to increase due to the Project. Feral animal control would be undertaken within the Habitat Enhancement Area. *Fragmentation*: see Section 3.7.2, Section 5.2.1, Section 5.3.2 and Section 5.3.3 The Project would not increase habitat fragmentation for the Large-eared Pied Bat as habitat to be cleared occurs at the edges of large remnant woodland patches adjoining	

Criteria	Data/ information
c. *The extent to which the impact exceeds any threshold for the potential entity*	No thresholds have been set for Large-eared Pied Bat
d. *Likely impact (including direct and indirect impacts that the development will have on the habitat of the local population, including but not limited to:* *i. An estimate of the change in habitat available to the local population as a result of the proposed development* *ii. The proposed loss, modification, destruction or isolation of the available habitat used by the local population* *iii. Modification of habitat required for the maintenance of processes important to the species' life cycle (such as in the case of a plant – pollination, seed set, seed dispersal, germination), genetic diversity and long-term evolutionary development* *(BioNet Atlas records or other documented, quantifiable means must be used by the assessor to estimate what percentage of the species' population and habitat is likely to be lost in the long term within the IBRA subregion due to the direct and indirect impacts of the development)*	*i) An estimate of the change in habitat available to the local population as a result of the proposed development* No rocky habitat will be impacted, however 113.02 ha of foraging habitat within 2 km of mapped rocky habitat would be lost. The Project design incorporates a 100 m setback of all disturbance (including open cut pit extents) from mapped rocky habitat associated with sandstone specialist threatened species as well as a 100 m setback from habitat within adjacent Munghorn Gap Nature Reserve *ii) The proposed loss, modification, destruction or isolation of the available habitat used by the local population* Breeding and roosting habitat would be avoided and habitat isolation would not result from the Project (see Section 5.2.1). Bats were recorded from the Moolarben Creek riparian zone, which will also be enhanced as part of the Habitat Enhancement Area. *iii) Modification of habitat required for the maintenance of processes important to the species' life cycle, genetic diversity and long-term evolutionary development* Loss of 113.02 ha of foraging habitat (woodland) greater than 100 m from suitable rocky habitat is unlikely to be important to the species' life cycle, genetic diversity or long-term evolutionary development (as discussed in Section 5.3.1).

Criteria	Data/ information
e. Likely impact on the ecology of the local population (fauna) – breeding, foraging, roosting, dispersal or movement pathways	Likely impact on breeding/foraging/roosting and dispersal and movement are detailed in Section and . Potential breeding habitat for the Large-eared Pied Bat was mapped as suitable PCTs within 100 m buffer of rocky habitat. Three confirmed roosts were located in the Study Area, outside the Development Footprint. These areas will be avoided and breeding and roosting habitat will not be directly impacted. Indirect A species polygon was generated for this species to include all suitable foraging habitat within 2 km of rocky habitat, with the result that 113.02 ha of foraging habitat will be cleared. This will be progressively replaced following mining. Movement pathways (foraging bats) within the Development Footprint may be affected in the short term as vegetation is cleared. Potential indirect impacts (such as blasting, noise and vibration) to foraging, roosting, and breeding is detailed in Section 5.2.3 and will be mitigated and managed accordingly (see Section 5.7).
f. Extent to which the local population will become fragmented or isolated as a result of the development	The Project would not fragment or isolate a local population.
g. Relationship of the local population to other population/populations of the species for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range	The species population structure and number of locations are poorly known. The species' total population size is estimated to be less than 20 000 individuals (Woinarski et al. 2014). There are some accounts of subpopulation size for a number of individual locations, with the largest known maternity colonies containing 20-40 females. Up to 100 individuals may be present at such roosts, possibly representing a substantial proportion of a local population (DERM 2011). Pennay et al. (2011) note that in the area with its highest recording, the species comprised only 6% of all bat observations. The species range extends from Rockhampton in Queensland to the Southern Highlands in NSW and west to Narromine. It is not at the edge of its range in the Study Area.
h. Extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population	Although the Project has been designed to avoid clearance of mapped rocky habitat, the Project has the potential to impact the Large-eared Pied Bat through disruption of breeding (such as indirect impacts from noise [blasting and operational noise], lighting and vegetation clearance in proximity to roosts) and clearance of foraging habitat (direct impacts). Indirect impacts of light spill, noise and blasting would be mitigated, managed and monitored as part of the Project.
i. Estimate of the area, or number of populations and size of populations that is in the reserve system in NSW,	Details of the number of populations and size of populations in the reserve system in NSW are unknown (NSW DCCEEW 2024b).

Criteria	Data/ information
the IBRA region and the IBRA subregion	Within the Kerrabee IBRA sub-region, Large-eared Pied Bat has BioNet records (NSW DCCEEW 2024a) within Munghorn Gap and Manobalai Nature Reserves and Wollemi and Goulburn River National Parks. Collectively, these protected areas cover almost half of the sub-region. Within the Sydney Basin bioregion there are 2,086 validated BioNet records (DPE 2022d[4]), out of a total of 3,096 throughout NSW.
j. Measure/s proposed to contribute to the recovery of the species in the IBRA subregion	**Active restoration within the Study Area**. The Habitat Enhancement Area includes approximately 53 ha of existing woodland and approximately 135 ha of DNG and cleared land that is proposed to be revegetated. The Habitat Enhancement Area includes the riparian zone along Moolarben Creek comprising over 160 ha of land. Management measures would include revegetation and stabilisation, fencing, weed management and fire management, as well as pest animal management (feral goats, pigs, fox and cat) which should reduce threats posed to roost sites. **Mine rehabilitation**. Areas disturbed by the Project would be progressively rehabilitated and revegetated (providing foraging habitat). Approximately 535 ha of native woodland, is proposed to be established as part of the conceptual post-mining land use for the Project.

Eastern Cave Bat (*Vespadelus troughtoni*)

1. Actions to avoid and minimise direct and indirect impacts

Impacts on Eastern Cave Bat have been avoided or minimised through the Project design by:

- Avoidance of direct impacts on mapped rocky habitat (i.e. caves, crevices, cliffs, rocks)
- Mitigation and minimisation of indirect vibration impacts to nearby rocky habitat through: pre-blast desktop assessments; site-specific vibration modelling per blast to calculate MIC required to meet PPV limit for nearest mapped rocky habitat; continuation of existing vibration monitoring as described in the Blast Management Plan (MCO, 2020d); additional vibration monitoring at one or more new representative sites of mapped rocky habitat adjacent to the Project; ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary
- Visual inspections of key representative mapped rocky habitat on a 6-monthly basis

2. Current status (excluding impacts of the Project)

The Eastern Cave Bat has been listed as a possible SAII due to **Principle 4**: species or ecological community that is unlikely to respond to management and is therefore irreplaceable.

Principle 1 (species or ecological community currently in a rapid rate of decline) does not apply to the Eastern Cave Bat due to insufficient data surrounding the total NSW population and evidence of rapid decline in the last 10 years or three generation (Table 66 Section 4a[i]).

Principle 2 (species or ecological communities with a very small population size) also does not apply as the total NSW population, estimated rate of decline in three years or one generation, and the number and percentage of mature individuals in each subpopulation or whether the species is likely to undergo extreme fluctuations is unknown for this species (Table 66. Section 4a[i]).

Principle 3 (species or area of ecological community with very limited geographic distribution) is not applicable to the Eastern Cave Bat as the species' EOO and AOO are not geographically limited (Section 4b[i]). Principle 3 also does not apply to the Eastern Cave Bat as the threat-defined locations have not been identified and the likelihood of the species' population undergoing extreme fluctuations is unknown (Table 66. Section 4b[ii-iii]).

Principle 4 applies to the Eastern Cave Bat as per Section 9.1.2 (2.d) of the BAM (DPIE 2020a) as this species is "*unlikely to respond to management*" because:

i. Known reproductive characteristics severely limit the ability to increase the existing population on, or occupy new habitat (e.g. species is clonal) on, a biodiversity stewardship site

ii. The species is reliant on abiotic habitats which cannot be restored or replaced (e.g. karst systems) on a biodiversity stewardship site, or

iii. Life history traits and/or ecology is known but the ability to control key threatening processes at a biodiversity stewardship site is currently negligible (e.g. frogs severely impacted by chytrid fungus)".

The Eastern Cave Bat has been assigned to the Landscape species management stream of the Saving Our Species (SOS) Program. This species has three main Priority Management Areas: a southern area which

covers the Pilliga State Forest and follows a band from Mudgee to Newcastle, and two smaller northern areas from Coffs Harbour to Tenterfield and around Yetman (SOS n.d.).

Item ii. above (*the species is reliant on abiotic habitat which cannot be restored or replaced on a biodiversity stewardship site*) is applicable to the Eastern Cave Bat which relies on rocky areas, overhangs, caves, crevices, cliffs, escarpments, or man-made structures for breeding. Caves, crevices, cliffs and rocks suitable for breeding in the surrounding area would be avoided by the Project (DPE 2022d[4]). Therefore, only foraging habitat within two kilometres of rocky areas is considered at risk of an SAII.

Deficient or unknown data in the TBDC

The AOO and EOO for this species is not provided in the TBDC (NSW DCCEEW 2024b).

Impact assessment

See Table 66.

Table 66. SAII Impact assessment – Eastern Cave Bat.

Impact	Data / information	Data sources
4a. The Impact on the species' population (Principles 1 and 2) presented by:		
i. An estimate of the number of individuals (mature and immature) present in the subpopulation on the Development Footprint (the site may intersect or encompass the subpopulation) and as a percentage of the total NSW population	Six (6) individuals and one active roost were recorded during AMBS (2023) targeted threatened species searches. Individuals found included one adult female that was post-lactating, and two immature males. The roost was recorded in the Study Area, outside the Development Footprint. The total NSW population of Eastern Cave Bats is unknown, however, based on ALA records, 567 individuals have been recorded in NSW since 2002 (20 years). Based on this, it is estimated that 1% of the NSW population Eastern Cave Bats occurs within the Study Area.	Search the Atlas of Living Australia (ALA 2022) Baseline Fauna Survey Report (AMBS 2023)
ii. An estimate of the number of individuals (mature and immature) to be impacted by the proposal and as a percentage of the total NSW population, or	Not applicable. Species unit of measure is area. See iii below.	
iii. If the species' unit of measure is area, provide data on the number of individuals on the site, and the estimated number that would be impacted, along with the area of habitat to be impacted by the proposal	The total number of individuals on the site is unknown, however six individuals were recorded during targeted fauna surveys (AMBS 2023). The Project would avoid all suitable rocky breeding habitat. A total of 113.02 ha of foraging habitat within the two-kilometre buffer occurs within the Development Footprint. This is the area of habitat to be impacted by the Project. The estimated number of individuals that would be impacted by the Project is unknown due to data deficiency.	Baseline Fauna Survey Report (AMBS 2023)
4b. Impact on geographic range (Principles 1 and 3) presented by:		
1. The area of the species' geographic range to be impacted by the proposal in hectares, and a percentage of the total AOO, or EOO within NSW	113.02 ha of foraging habitat within the Eastern Cave Bat's geographic range would be impacted by the Project. According to the Atlas of Living Australia calculations, the AOO is 41,946 km^2 and the EOO is 285,609 km^2. The area of species' geographic range to be impacted by the Project is 113.02 ha. This accounts for 0.003% of the overall AOO. The Project would not impact the EOO of the species, as the Project is not at a limit of the species extent.	

Impact	Data / information	Data sources
2. *The impact on the subpopulation as either: all individuals would be impacted (subpopulation eliminated); OR impact will affect some individuals and habitat; OR impact will affect some habitat, but no individuals of the species would be directly impacted*	*Impact will affect some individuals and habitat*: Six individuals and one active roost were identified during targeted threatened species surveys (AMBS 2023). The Project would lead to the loss of 113.02 ha of foraging habitat within 2 km of sandstone cliffs, escarpments and overhangs. Eastern Cave Bat roosting individuals will not be directly impacted by the Project as all identified roosting habitat will be avoided by the Project. Indirect impacts (such as noise, blasts and vibration) are detailed in Section 5.2.3.	Baseline Fauna Survey Report (AMBS 2023)
3. *To determine if the persisting subpopulation that is fragmented will remain viable, estimate (based on published and unpublished sources such as scientific publications, technical reports, databases or documented field observations) the habitat area required to support the remaining population, and habitat available within dispersal distance, and distance over which genetic exchange can occur (e.g. seed dispersal) and pollination distance for the species*	The existing population of Eastern Cave Bat is unlikely to be fragmented by the Project (see Section 3.7.2 and Section 5.2.1). Pre-clearance surveys will ensure any Eastern Cave Bat individuals found on the Development Footprint would be relocated into suitable surrounding habitat. No subpopulations will persist within the Development Footprint. The Development Footprint would be rehabilitated post construction. The restoration of key habitat features may encourage the subpopulation in the surrounding area to re-colonise the site.	
4. *To determine changes in threats affecting remaining subpopulations and habitat if the proposed impact proceeds, estimate changes in environmental factors including changes to fire regimes (frequency, severity); hydrology, pollutants; species interactions (increased competition and effects on pollinators or dispersal); fragmentation, increased edge effects, likelihood of disturbance; and disease, pathogens and parasites. Where*	Potential changes to environmental factors as a result of the Project that have the potential to impact the Eastern Cave Bat are discussed as below: *Changes to fire regimes (frequency, severity):* See Section 5.7 *Hydrology:* See Section 5.3.5 *Pollutants*: See Section 5.2.11; 5.2.12;	

Impact	Data / information	Data sources
these factors have been considered elsewhere in relation to the target species, the assessor may refer to the relevant sections of the BDAR or BCAR.	*Species interactions (increased competition and effects on dispersal):* Species interactions and associated threats are unknown. *Fragmentation*: see Section 3.7.2, Section 5.2.1, Section 5.3.2 and Section 5.3.3. The Project would not increase habitat fragmentation for the Eastern Cave Bat as habitat to be cleared occurs at the edges of large remnant woodland patches adjoining grassland areas. No areas of remnant woodland would be divided due to the Project. *Increased edge effects:* See Section 5.2.2 *Likelihood of disturbance:* See Section 5.2.3 Targeted pre-clearance surveys would also be conducted within areas of suitable habitat to allow for management (re-location of resident individuals to adjacent habitat) prior to clearance. Habitat clearance is described above. *Disease, pathogens and parasites:* See Section 5.2.6;	

Table 67. Additional impact assessment provisions as per Appendix B of Guidance to assist a decisionmaker to determine a serious and irreversible impact (DPIE 2019a)– Eastern Cave Bat.

Criteria	Data/ information
a. *Action and measures taken to avoid the direct and indirect impact on the potential entity*	Summary in Section 1 above.
b. *Size of the local population directly and indirectly impacted by the development*	See 4a ii. above
c. *The extent to which the impact exceeds any threshold for the potential entity*	No threshold has been set for Eastern Cave Bat.
d. *Likely impact (including direct and indirect impacts that the development will have on the habitat of the local population, including but not limited to: (BioNet Atlas records or other documented, quantifiable means must be used by the assessor to estimate what percentage of the species' population and habitat is likely to be lost in the long term within the IBRA subregion due to the direct and indirect impacts of the development)*	*An estimate of the change in habitat available to the local population as a result of the proposed development* No rocky habitat will be impacted, however 113.02 ha of foraging habitat within 2 km of mapped rocky habitat would be lost. The Project design incorporates a 100 m setback of all disturbance (including open cut pit extents) from mapped rocky habitat associated with sandstone specialist threatened species as well as a 100 m setback from habitat within adjacent Munghorn Gap Nature Reserve. *The proposed loss, modification, destruction or isolation of the available habitat used by the local population* Breeding and roosting habitat would be avoided and habitat isolation would not result from the Project. *Modification of habitat required for the maintenance of processes important to the species' life cycle, genetic diversity and long-term evolutionary development* Loss of 113.02 ha of foraging habitat (woodland) greater than 100 m from suitable rocky habitat is unlikely to be important to the species' life cycle, genetic diversity or long-term evolutionary development.
e. *Likely impact on the ecology of the local population (fauna) – breeding, foraging, roosting, dispersal or movement pathways*	Breeding, roosting and dispersal will be unaffected by the Project. Minor loss of potential foraging habitat will result, however riparian habitat will be retained.

Criteria	Data/ information
f. Extent to which the local population will become fragmented or isolated as a result of the development	The Project would not fragment or isolate a local population.
g. Relationship of the local population to other population/populations of the species for factors such as breeding, dispersal and genetic viability/diversity, and whether the local population is at the limit of the species' range	The population structure and relationships between sub-populations are poorly known, however, the project would avoid all known roosting habitat. The species is not at or near the limit of its range in the Study Area.
h. Extent to which the proposed development will lead to an increase in threats and indirect impacts, including impacts from invasive flora and fauna, that may in turn lead to a decrease in the viability of the local population	Although the Project has been designed to avoid clearance of mapped rocky habitat, the Project has the potential to impact the Eastern Cave Bat through disruption of breeding (such as indirect impacts from noise [blasting and operational noise], lighting and vegetation clearance in proximity to roosts) and clearance of foraging habitat (direct impacts). Indirect impacts of light spill, noise and blasting would be mitigated, managed and monitored as part of the Project.
i. Estimate of the area, or number of populations and size of populations that is in the reserve system in NSW, the IBRA region and the IBRA subregion	BioNet (DPE 2022d[4]) indicates 812 records of the species in NSW. The area of habitat within the reserve system is unknown. There are 442 records on BioNet (DPE 2022d[4]) within the Sydney Basin bioregion. There are 442 records on BioNet (DPE 2022d[4]) within the Sydney Basin bioregion
j. Measure/s proposed to contribute to the recovery of the species in the IBRA subregion	**Active restoration within the Study Area**. The Habitat Enhancement Area includes approximately 53 ha of existing woodland and approximately 135 ha of DNG and cleared land that is proposed to be revegetated. The Habitat Enhancement Area includes the riparian zone along Moolarben Creek comprising over 160 ha of land. Management measures would include revegetation and stabilisation, fencing, weed management and fire management, as well as pest animal management (feral goats, pigs, fox and cat) which should reduce threats posed to roost sites. **Mine rehabilitation**. Areas disturbed by the Project would be progressively rehabilitated and revegetated (providing foraging habitat). Approximately 535 ha of native woodland, is proposed to be established as part of the conceptual post-mining land use for the Project.

Criteria	Data/ information

Appendix G. Digital files created for the BDAR

Subject Land

Project general arrangement

Footprint staging

Threatened Flora Study Area

Cliffs

Steep slopes

Rocky areas

Caves

Vegetation 1500 m buffer

BAM plots

BAM line

PCT mapping

Threatened Ecological Communities

Access track from veg mapping dataset

Threatened flora records

Threatened fauna records

Flora survey tracks

Fauna survey sites

Scat collection

AMBS Anabat trap locations

Harp trap location

Fauna survey tracks

AMBS bat records

AMBS threatened fauna records

Pomaderris cotoneaster species polygon

Pink-tailed Legless Lizard species polygon

Broad-headed Snake species polygon

Regent Honeyeater species polygon

Koala species polygon

Squirrel Glider species polygon

Large-eared Pied Bat species polygon

Eastern Cave Bat species polygon

Appendix H. BAM-C Credit reports – Stage 1

Credit summary

Variation

Like for like

BAM Credit Summary Report

Proposal Details

Assessment Id
00031449/BAAS19016/22/00031450

Proposal Name
Moolarben Coal Complex OC3 Extension Project - Stage 1

BAM data last updated *
22/06/2023

Assessor Name
Amanda Griffith

Report Created
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Assessor Number
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BAM Case Status
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Assessment Revision
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Assessment Type
Major Projects

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

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

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin												
9	1655_High	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	52.3	52.3	12	PCT Cleared - 36%	High Sensitivity to Gain	Vulnerable Ecological Community	Critically Endangered	1.75		275
											Subtotal	**275**
Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley												
6	483_High	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	83.4	83.4	0.04	PCT Cleared - 90%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	2
											Subtotal	**2**

Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin												
10	1656_Regenerating	Not a TEC	56	56.0	6	PCT Cleared - 8%	High Sensitivity to Gain			1.50		126
11	1656_High	Not a TEC	47.5	47.5	11.8	PCT Cleared - 8%	High Sensitivity to Gain			1.50		210
											Subtotal	**336**
Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin												
12	1661_High	Not a TEC	51.9	51.9	3.7	PCT Cleared - 50%	High Sensitivity to Gain			1.75		84
											Subtotal	**84**
Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin												
8	1629_High	Not a TEC	56.3	56.3	0.8	PCT Cleared - 1%	High Sensitivity to Gain			1.50		17
											Subtotal	**17**

Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion												
3	281_DNG_Low	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	32.7	32.7	115.6	PCT Cleared - 67%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	2363

4	281_DNG	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	33.3	33.3	40	PCT Cleared - 67%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	833

5	281_High	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	90.4	90.4	6.6	PCT Cleared - 67%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	373

13	281_Scattered	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	84.4	84.4	0.3	PCT Cleared - 67%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	16
											Subtotal	**3585**
White Box - Black Cypress Pine shrubby woodland of the Western Slopes												
7	1610_Regenerating	Not a TEC	41.2	41.2	2.7	PCT Cleared - 67%	High Sensitivity to Gain			1.75		49
											Subtotal	**49**

White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion												
1	266_DNG	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	39.8	39.8	4.5	PCT Cleared - 94%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	112

2	266_High	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	88.1	88.1	0.6	PCT Cleared - 94%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	33

14	266_Scattered	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	67.2	67.2	0.5	PCT Cleared - 94%	High Sensitivity to Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	True	21
											Subtotal	**166**
											Total	**4514**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits
Anthochaera phrygia / Regent Honeyeater (Fauna)									
266_DNG	39.8	39.8	0.07			Critically Endangered	Critically Endangered	True	2

266_High	88.1	88.1	0.2			Critically Endangered	Critically Endangered	True	13
281_DNG_Low	32.7	32.7	1.3			Critically Endangered	Critically Endangered	True	32
281_DNG	33.3	33.3	2			Critically Endangered	Critically Endangered	True	50
281_High	90.4	90.4	4.5			Critically Endangered	Critically Endangered	True	305
1629_High	56.3	56.3	0.7			Critically Endangered	Critically Endangered	True	30
1655_High	52.3	52.3	9.7			Critically Endangered	Critically Endangered	True	381
1656_Regenerating	56.0	56.0	3.6			Critically Endangered	Critically Endangered	True	151
1656_High	47.5	47.5	11.3			Critically Endangered	Critically Endangered	True	402
1661_High	51.9	51.9	3.7			Critically Endangered	Critically Endangered	True	144
281_Scattered	84.4	84.4	0.09			Critically Endangered	Critically Endangered	True	6
266_Scattered	67.2	67.2	0.07			Critically Endangered	Critically Endangered	True	4
								Subtotal	**1520**
Aprasia parapulchella / Pink-tailed Legless Lizard (Fauna)									
266_DNG	39.8	39.8	4.5			Vulnerable	Vulnerable	False	90
266_High	88.1	88.1	0.3			Vulnerable	Vulnerable	False	13
281_DNG	33.3	33.3	18.1			Vulnerable	Vulnerable	False	301

281_High	90.4	90.4	2.2			Vulnerable	Vulnerable	False	99
1610_Regenerating	41.2	41.2	2.7			Vulnerable	Vulnerable	False	56
1629_High	56.3	56.3	0.8			Vulnerable	Vulnerable	False	23
1655_High	52.3	52.3	10.9			Vulnerable	Vulnerable	False	285
1656_High	47.5	47.5	2.2			Vulnerable	Vulnerable	False	52
1656_Regenerating	56.0	56.0	6			Vulnerable	Vulnerable	False	168
1661_High	51.9	51.9	0.3			Vulnerable	Vulnerable	False	8
281_DNG_Low	32.7	32.7	17.6			Vulnerable	Vulnerable	False	288
483_High	83.4	83.4	0.04			Vulnerable	Vulnerable	False	2
266_Scattered	67.2	67.2	0.02			Vulnerable	Vulnerable	False	1
								Subtotal	**1386**
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)									
266_High	88.1	88.1	0.6			Vulnerable	Vulnerable	True	40
281_High	90.4	90.4	6.6			Vulnerable	Vulnerable	True	447
483_High	83.4	83.4	0.04			Vulnerable	Vulnerable	True	3
1610_Regenerating	41.2	41.2	2.7			Vulnerable	Vulnerable	True	84
1629_High	56.3	56.3	0.8			Vulnerable	Vulnerable	True	34
1655_High	52.3	52.3	11.9			Vulnerable	Vulnerable	True	467
1656_Regenerating	56.0	56.0	6			Vulnerable	Vulnerable	True	252
1656_High	47.5	47.5	11.8			Vulnerable	Vulnerable	True	420
1661_High	51.9	51.9	3.7			Vulnerable	Vulnerable	True	144

281_Scattered	84.4	84.4	0.3			Vulnerable	Vulnerable	True	19
266_Scattered	67.2	67.2	0.5			Vulnerable	Vulnerable	True	25
								Subtotal	**1935**
Petaurus norfolcensis / Squirrel Glider (Fauna)									
266_High	88.1	88.1	0.6			Vulnerable	Not Listed	False	26
281_High	90.4	90.4	6.6			Vulnerable	Not Listed	False	298
1610_Regenerating	41.2	41.2	2.7			Vulnerable	Not Listed	False	56
1629_High	56.3	56.3	0.8			Vulnerable	Not Listed	False	23
1655_High	52.3	52.3	11.9			Vulnerable	Not Listed	False	311
1656_High	47.5	47.5	11.8			Vulnerable	Not Listed	False	280
1656_Regenerating	56.0	56.0	6			Vulnerable	Not Listed	False	168
1661_High	51.9	51.9	3.7			Vulnerable	Not Listed	False	96
483_High	83.4	83.4	0.04			Vulnerable	Not Listed	False	2
281_Scattered	84.4	84.4	0.3			Vulnerable	Not Listed	False	13
266_Scattered	67.2	67.2	0.5			Vulnerable	Not Listed	False	17
								Subtotal	**1290**
Phascolarctos cinereus / Koala (Fauna)									
266_High	88.1	88.1	0.6			Endangered	Endangered	False	26
281_High	90.4	90.4	6.6			Endangered	Endangered	False	298
1610_Regenerating	41.2	41.2	2.7			Endangered	Endangered	False	56
1629_High	56.3	56.3	0.8			Endangered	Endangered	False	23
1655_High	52.3	52.3	11.9			Endangered	Endangered	False	311

1656_High	47.5	47.5	11.8			Endangered	Endangered	False	280
1656_Regenerating	56.0	56.0	6			Endangered	Endangered	False	168
1661_High	51.9	51.9	3.7			Endangered	Endangered	False	96
483_High	83.4	83.4	0.04			Endangered	Endangered	False	2
281_Scattered	84.4	84.4	0.3			Endangered	Endangered	False	13
266_Scattered	67.2	67.2	0.5			Endangered	Endangered	False	17
								Subtotal	**1290**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)									
266_High	88.1	88.1	0.6			Vulnerable	Not Listed	True	40
281_High	90.4	90.4	6.6			Vulnerable	Not Listed	True	447
1610_Regenerating	41.2	41.2	2.7			Vulnerable	Not Listed	True	84
1629_High	56.3	56.3	0.8			Vulnerable	Not Listed	True	34
1655_High	52.3	52.3	11.9			Vulnerable	Not Listed	True	467
1656_High	47.5	47.5	11.8			Vulnerable	Not Listed	True	420
1656_Regenerating	56.0	56.0	6			Vulnerable	Not Listed	True	252
1661_High	51.9	51.9	3.7			Vulnerable	Not Listed	True	144
483_High	83.4	83.4	0.04			Vulnerable	Not Listed	True	3
281_Scattered	84.4	84.4	0.3			Vulnerable	Not Listed	True	19
266_Scattered	67.2	67.2	0.5			Vulnerable	Not Listed	True	25
								Subtotal	**1935**

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00031449/BAAS19016/22/00031450

Proposal Name
Moolarben Coal Complex OC3 Extension Project - Stage 1

BAM data last updated *
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Assessor Name
Amanda Griffith

Assessor Number
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Proponent Name(s)

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Major Projects

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07/03/2024

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	483-Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat
Anthochaera phrygia / Regent Honeyeater

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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

BAM Biodiversity Credit Report (Variations)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	5.6	54	112	166.00
281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	162.5	389	3196	3585.00
483-Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	0.0	0	2	2.00
1610-White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Not a TEC	2.7	49	0	49.00
1629-Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	Not a TEC	0.8	17	0	17.00
1655-Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	12.0	275	0	275.00
1656-Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin	Not a TEC	17.8	336	0	336.00

1661-Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	Not a TEC	3.7	84	0	84.00

266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840,	-	266_DNG	No	112	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511,	-	266_High	Yes	33	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347,	-	266_Scattered	Yes	21	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt	-	281_DNG_Low	No	2363	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy	-	281_DNG	No	833	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo.

	Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394,					or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332,	-	281_High	Yes	373	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654,	-	281_Scattered	Yes	16	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
483-Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347,	-	483_High	No	2	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
1610-White Box - Black Cypress Pine shrubby woodland of the Western Slopes	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 217, 255, 273, 287, 330, 333, 341, 343, 346, 348, 358, 403, 455, 456, 472, 577, 581, 592, 617, 673, 676, 713, 940, 956, 1277, 1279, 1313, 1316, 1381, 1610, 1661, 1668, 1709, 3753, 3754, 3756, 3768, 3769, 4153	Western Slopes Dry Sclerophyll Forests >=50% and <70%	1610_Regenerating	Yes	49	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	1610_Regenerating	Yes (including artificial)	49	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1629-Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354,	Western Slopes Dry Sclerophyll Forests <50%	1629_High	Yes	17	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 4153					
	Variation options					

	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1629_High	Yes (including artificial)	17	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1655-Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion This includes PCT's: 1176, 1655, 3490	-	1655_High	Yes	275	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 5 or higher threat status	1655_High	Yes (including artificial)	275	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1656-Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291,	Western Slopes Dry Sclerophyll Forests <50%	1656_Regenerating	Yes	126	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the

	309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781,					impacted site.

	3782, 3783, 3784, 3785, 3786, 4153					
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709,	Western Slopes Dry Sclerophyll Forests <50%	1656_High	Yes	210	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 4153					
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1656_Regenerating	Yes (including artificial)	126	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1656_High	Yes (including artificial)	210	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1661-Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 217, 255, 273, 287, 330, 333, 341, 343, 346, 348, 358, 403, 455, 456, 472, 577, 581, 592, 617, 673, 676, 713, 940, 956, 1277, 1279, 1313, 1316, 1381, 1610, 1661, 1668, 1709, 3753, 3754, 3756, 3768, 3769, 4153	Western Slopes Dry Sclerophyll Forests >=50% and <70%	1661_High	Yes	84	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region
Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	1661_High	Yes (including artificial)	84	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Anthochaera phrygia / Regent Honeyeater	**266_DNG, 266_High, 281_DNG_Low, 281_DNG, 281_High, 1629_High, 1655_High, 1656_Regenerating, 1656_High, 1661_High, 281_Scattered, 266_Scattered**	37.2	1520.00

Aprasia parapulchella / Pink-tailed Legless Lizard	**266_DNG, 266_High, 281_DNG, 281_High, 1610_Regenerating, 1629_High, 1655_High, 1656_High, 1656_Regenerating, 1661_High, 281_DNG_Low, 483_High, 266_Scattered**	65.7	1386.00
Chalinolobus dwyeri / Large-eared Pied Bat	**266_High, 281_High, 483_High, 1610_Regenerating, 1629_High, 1655_High, 1656_Regenerating, 1656_High, 1661_High, 281_Scattered, 266_Scattered**	44.9	1935.00
Petaurus norfolcensis / Squirrel Glider	**266_High, 281_High, 1610_Regenerating, 1629_High, 1655_High, 1656_High, 1656_Regenerating, 1661_High, 483_High, 281_Scattered, 266_Scattered**	44.9	1290.00
Phascolarctos cinereus / Koala	**266_High, 281_High, 1610_Regenerating, 1629_High, 1655_High, 1656_High, 1656_Regenerating, 1661_High, 483_High, 281_Scattered, 266_Scattered**	44.9	1290.00
Vespadelus troughtoni / Eastern Cave Bat	**266_High, 281_High, 1610_Regenerating, 1629_High, 1655_High, 1656_High, 1656_Regenerating, 1661_High, 483_High, 281_Scattered, 266_Scattered**	44.9	1935.00

Credit Retirement Options

Like-for-like options

Anthochaera phrygia/ Regent Honeyeater	Spp		IBRA region
	Anthochaera phrygia/Regent Honeyeater *Note: Variation rules do not apply for Critically Endangered species and impacts on Commonwealth listed entities that are a controlled action.*		Any in NSW
Aprasia parapulchella/ Pink-tailed Legless Lizard	Spp		IBRA region
	Aprasia parapulchella/Pink-tailed Legless Lizard		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Chalinolobus dwyeri/ Large-eared Pied Bat	Spp		IBRA region
	Chalinolobus dwyeri/Large-eared Pied Bat		Any in NSW
	Variation options		
	Kingdom	Any species with same or	IBRA region

		higher category of listing under Part 4 of the BC Act shown below	
	Fauna	Vulnerable	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Petaurus norfolcensis/ Squirrel Glider	Spp		IBRA region
	Petaurus norfolcensis/Squirrel Glider		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Phascolarctos cinereus/ Koala	Spp		IBRA region
	Phascolarctos cinereus/Koala		Any in NSW

Phascolarctos cinereus/ Koala	**Variation options**		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Endangered	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Vespadelus troughtoni/ Eastern Cave Bat	Spp	IBRA region	
	Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00031449/BAAS19016/22/00031450

Proposal Name
Moolarben Coal Complex OC3 Extension Project - Stage 1

BAM data last updated *
22/06/2023

Assessor Name
Amanda Griffith

Assessor Number
BAAS19016

BAM Data version *
61

Proponent Names

Report Created
07/03/2024

BAM Case Status
Finalised

Assessment Revision
6

Assessment Type
Major Projects

Date Finalised
07/03/2024

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	483-Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat
Anthochaera phrygia / Regent Honeyeater

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	5.6	54	112	166
281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	162.5	389	3196	3585
483-Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	0.0	0	2	2
1610-White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Not a TEC	2.7	49	0	49

1629-Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	Not a TEC	0.8	17	0	17
1655-Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	12.0	275	0	275
1656-Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin	Not a TEC	17.8	336	0	336
1661-Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin	Not a TEC	3.7	84	0	84

266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267,	-	266_DNG	No	112	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum	-	266_High	Yes	33	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and

	Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331,					Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437,	-	266_Scattered	Yes	21	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW	-	281_DNG_Low	No	2363	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100

	North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695,					kilometers of the outer edge of the impacted site.

	1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567,	-	281_DNG	No	833	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267,	-	281_High	Yes	373	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum	-	281_Scattered	Yes	16	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and

	Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331,					Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
483-Grey Box x White Box grassy open woodland on basalt hills in the Merriwa region, upper Hunter Valley	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298,	-	483_High	No	2	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
1610-White Box - Black Cypress Pine shrubby woodland of the Western Slopes	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 217, 255, 273, 287, 330, 333, 341, 343, 346, 348, 358, 403, 455, 456, 472, 577, 581, 592, 617, 673, 676, 713, 940, 956, 1277, 1279, 1313, 1316, 1381, 1610, 1661, 1668, 1709, 3753, 3754, 3756, 3768, 3769, 4153	Western Slopes Dry Sclerophyll Forests >=50% and <70%	1610_Regenerating	Yes	49	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1629-Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398,	Western Slopes Dry Sclerophyll Forests <50%	1629_High	Yes	17	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781,					

	3782, 3783, 3784, 3785, 3786, 4153					
1655-Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion This includes PCT's: 1176, 1655, 3490	-	1655_High	Yes	275	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1656-Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest on sandstone slopes of the upper Hunter and Sydney Basin	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243,	Western Slopes Dry Sclerophyll Forests <50%	1656_Regenerating	Yes	126	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or

	255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758,					Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 4153					
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713,	Western Slopes Dry Sclerophyll Forests <50%	1656_High	Yes	210	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 4153					

BAM Biodiversity Credit Report (Like for like)

1661-Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest on sandstone ranges of the upper Hunter and Sydney Basin

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 217, 255, 273, 287, 330, 333, 341, 343, 346, 348, 358, 403, 455, 456, 472, 577, 581, 592, 617, 673, 676, 713, 940, 956, 1277, 1279, 1313, 1316, 1381, 1610, 1661, 1668, 1709, 3753, 3754, 3756, 3768, 3769, 4153	Western Slopes Dry Sclerophyll Forests >=50% and <70%	1661_High	Yes	84	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Anthochaera phrygia / Regent Honeyeater	**266_DNG, 266_High, 281_DNG_Low, 281_DNG, 281_High, 1629_High, 1655_High, 1656_Regenerating, 1656_High, 1661_High, 281_Scattered, 266_Scattered**	37.2	1520.00
Aprasia parapulchella / Pink-tailed Legless Lizard	**266_DNG, 266_High, 281_DNG, 281_High, 1610_Regenerating, 1629_High, 1655_High, 1656_High, 1656_Regenerating, 1661_High, 281_DNG_Low, 483_High, 266_Scattered**	65.7	1386.00
Chalinolobus dwyeri / Large-eared Pied Bat	**266_High, 281_High, 483_High, 1610_Regenerating, 1629_High, 1655_High, 1656_Regenerating, 1656_High, 1661_High, 281_Scattered, 266_Scattered**	44.9	1935.00

Petaurus norfolcensis / Squirrel Glider	**266_High, 281_High, 1610_Regenerating, 1629_High, 1655_High, 1656_High, 1656_Regenerating, 1661_High, 483_High, 281_Scattered, 266_Scattered**	44.9	1290.00
Phascolarctos cinereus / Koala	**266_High, 281_High, 1610_Regenerating, 1629_High, 1655_High, 1656_High, 1656_Regenerating, 1661_High, 483_High, 281_Scattered, 266_Scattered**	44.9	1290.00
Vespadelus troughtoni / Eastern Cave Bat	**266_High, 281_High, 1610_Regenerating, 1629_High, 1655_High, 1656_High, 1656_Regenerating, 1661_High, 483_High, 281_Scattered, 266_Scattered**	44.9	1935.00

Credit Retirement Options

Like-for-like credit retirement options

Anthochaera phrygia / Regent Honeyeater	Spp	IBRA subregion

	Anthochaera phrygia / Regent Honeyeater	Any in NSW
Aprasia parapulchella / Pink-tailed Legless Lizard	Spp	IBRA subregion
	Aprasia parapulchella / Pink-tailed Legless Lizard	Any in NSW
Chalinolobus dwyeri / Large-eared Pied Bat	Spp	IBRA subregion
	Chalinolobus dwyeri / Large-eared Pied Bat	Any in NSW
Petaurus norfolcensis / Squirrel Glider	Spp	IBRA subregion
	Petaurus norfolcensis / Squirrel Glider	Any in NSW
Phascolarctos cinereus / Koala	Spp	IBRA subregion
	Phascolarctos cinereus / Koala	Any in NSW
Vespadelus troughtoni / Eastern Cave Bat	Spp	IBRA subregion
	Vespadelus troughtoni / Eastern Cave Bat	Any in NSW

Appendix I. BAM-C Credit Reports – Stage 2

Credit summary

Variation

Like for like

BAM Credit Summary Report

Proposal Details

Assessment Id
00031449/BAAS19016/22/00033408

Proposal Name
Moolarben Coal Complex OC3 Extension Project - Stage 2

BAM data last updated *
22/06/2023

Assessor Name
Amanda Griffith

Report Created
07/03/2024

BAM Data version *
61

Assessor Number
BAAS19016

BAM Case Status
Finalised

Date Finalised
07/03/2024

Assessment Revision
5

Assessment Type
Major Projects

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

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

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin												
6	1655_High	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	52.3	52.3	1.9	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Vulnerable Ecological Community	Not Listed	1.75		44
											Subtotal	**44**
Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin												
5	1629_High	Not a TEC	56.3	56.3	4.7	PCT Cleared - 1%	High Sensitivity to Gain			1.50		99
											Subtotal	**99**

Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion												
1	281_DNG_Low	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	32.7	32.7	2	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	41

2	281_DNG	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	33.3	33.3	110.2	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	2294

3	281_High	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	90.4	90.4	3.5	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	198

8	281_Scattered	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	84.4	84.4	1.2	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	63
											Subtotal	**2596**
Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin												
7	1711_High	Not a TEC	47.2	47.2	1.6	PCT Cleared - 0%	High Sensitivity to Gain			1.50		28
											Subtotal	**28**
White Box - Black Cypress Pine shrubby woodland of the Western Slopes												
4	1610_High	Not a TEC	43.5	43.5	12	PCT Cleared - 67%	High Sensitivity to Gain			1.75		228

9	1610_Regenerating	Not a TEC	41.2	41.2	4.2	PCT Cleared - 67%	High Sensitivity to Gain			1.75		76
											Subtotal	**304**
White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion												
10	266_DNG	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	39.8	39.8	18	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	448

11	266_High	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	88.1	88.1	0.3	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	17

12	266_Scattered	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	67.2	67.2	0.1	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	4
											Subtotal	**469**
											Total	**3540**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits

Anthochaera phrygia / Regent Honeyeater (Fauna)									
281_DNG_Low	32.7	32.7	0.3	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	7
281_DNG	33.3	33.3	1.7	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	42
281_High	90.4	90.4	1.6	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	108
1610_High	43.5	43.5	8.7	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	284
1629_High	56.3	56.3	4.4	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	186

1655_High	52.3	52.3	1.8	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	71
1711_High	47.2	47.2	1.2	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	43
281_Scattered	84.4	84.4	0.8	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	51
1610_Regenerating	41.2	41.2	1.7	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	53
266_DNG	39.8	39.8	0.4	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	12
266_High	88.1	88.1	0.06	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	4

266_Scattered	67.2	67.2	0.07	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	4
								Subtotal	**865**
Aprasia parapulchella / Pink-tailed Legless Lizard (Fauna)									
281_DNG_Low	32.7	32.7	0.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	5
281_DNG	33.3	33.3	45	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	749
281_High	90.4	90.4	1.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	59
1610_High	43.5	43.5	11.7	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	254
1629_High	56.3	56.3	4.4	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	124

1610_Regenerating	41.2	41.2	4.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	87
266_DNG	39.8	39.8	16.7	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	333
266_High	88.1	88.1	0.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	13
								Subtotal	**1624**
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)									
281_High	90.4	90.4	3.5	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	237
1610_High	43.5	43.5	12	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	391
1629_High	56.3	56.3	4.7	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	198

1655_High	52.3	52.3	1.9	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	75
1711_High	47.2	47.2	1.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	57
281_Scattered	84.4	84.4	1.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	76
1610_Regenerating	41.2	41.2	4.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	130
266_High	88.1	88.1	0.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	20
266_Scattered	67.2	67.2	0.1	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	5
								Subtotal	**1189**

Petaurus norfolcensis / Squirrel Glider (Fauna)									
281_High	90.4	90.4	3.5	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	158
1610_High	43.5	43.5	12	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	261
1629_High	56.3	56.3	4.7	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	132
1655_High	52.3	52.3	1.9	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	50
1711_High	47.2	47.2	1.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	38
281_Scattered	84.4	84.4	1.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	51
1610_Regenerating	41.2	41.2	4.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	87

266_High	88.1	88.1	0.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	13
266_Scattered	67.2	67.2	0.1	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	3
								Subtotal	**793**
Phascolarctos cinereus / Koala (Fauna)									
281_High	90.4	90.4	3.5	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	158
1610_High	43.5	43.5	12	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	261
1629_High	56.3	56.3	4.7	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	132

1655_High	52.3	52.3	1.9	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	50
1711_High	47.2	47.2	1.6	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	38
281_Scattered	84.4	84.4	1.2	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	51
1610_Regenerating	41.2	41.2	4.2	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	87
266_High	88.1	88.1	0.3	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	13
266_Scattered	67.2	67.2	0.1	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	3

								Subtotal	**793**
Pomaderris cotoneaster / Cotoneaster Pomaderris (Flora)									
1629_High	56.3	56.3	0.07	Biodiversity Conservation Act listing status	Ability to colonise improved habitat	Endangered	Endangered	False	2
								Subtotal	**2**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)									
281_High	90.4	90.4	3.5	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	237
1610_High	43.5	43.5	12	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	391
1629_High	56.3	56.3	4.7	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	198
1655_High	52.3	52.3	1.9	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	75
1711_High	47.2	47.2	1.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	57

281_Scattered	84.4	84.4	1.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	76
1610_Regenerating	41.2	41.2	4.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	130
266_High	88.1	88.1	0.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	20
266_Scattered	67.2	67.2	0.1	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	5
								Subtotal	**1189**

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00031449/BAAS19016/22/00033408

Proposal Name
Moolarben Coal Complex OC3 Extension Project - Stage 2

BAM data last updated *
22/06/2023

Assessor Name
Amanda Griffith

Assessor Number
BAAS19016

BAM Data version *
61

Proponent Name(s)

Report Created
07/03/2024

BAM Case Status
Finalised

Assessment Revision
5

Assessment Type
Major Projects

Date Finalised
07/03/2024

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat
Anthochaera phrygia / Regent Honeyeater

Additional Information for Approval

PCT Outside Ibra Added

PCT
471-Dwyer's Red Gum - Black Cypress Pine - ironbark low woodland on sandstone hillcrests in the Dubbo - Gilgandra region, south-western Brigalow Belt South Bioregion

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	116.9	261	2335	2596.00

1610-White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Not a TEC	16.2	304	0	304.00
1629-Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	Not a TEC	4.7	99	0	99.00
1655-Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	1.9	44	0	44.00
1711-Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin	Not a TEC	1.6	28	0	28.00
266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	18.4	21	448	469.00

266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298,	-	266_DNG	No	448	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	-	266_High	Yes	17	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the	-	266_Scattered	Yes	4	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100

	NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533,					kilometers of the outer edge of the impacted site.

	4147, 4149, 4150					
281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324,	-	281_DNG_Low	No	41	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599,	-	281_DNG	No	2294	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421,	-	281_High	Yes	198	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276,	-	281_Scattered	Yes	63	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
1610-White Box - Black Cypress Pine shrubby woodland of the Western Slopes	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 217, 255, 273, 287, 330, 333, 341, 343, 346, 348, 358, 403, 455, 456, 472, 577, 581, 592, 617, 673, 676, 713, 940, 956, 1277, 1279, 1313, 1316, 1381, 1610, 1661, 1668, 1709, 3753, 3754, 3756, 3768, 3769, 4153	Western Slopes Dry Sclerophyll Forests >=50% and <70%	1610_High	Yes	228	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 217, 255, 273, 287, 330, 333, 341, 343, 346, 348, 358, 403, 455, 456, 472, 577, 581, 592, 617, 673, 676, 713, 940, 956, 1277, 1279, 1313, 1316, 1381, 1610, 1661, 1668, 1709, 3753, 3754, 3756, 3768, 3769, 4153	Western Slopes Dry Sclerophyll Forests >=50% and <70%	1610_Regenerating	Yes	76	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region

	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	1610_High	Yes (including artificial)	228	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	1610_Regenerating	Yes (including artificial)	76	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1629-Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576,	Western Slopes Dry Sclerophyll Forests <50%	1629_High	Yes	99	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 4153					
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1629_High	Yes (including artificial)	99	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1655-Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion This includes PCT's: 1176, 1655, 3490	-	1655_High	Yes	44	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 5 or higher threat status	1655_High	Yes (including artificial)	44	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1711-Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409,	Western Slopes Dry Sclerophyll Forests <50%	1711_High	Yes	28	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 4153					
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region

	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1711_High	Yes (including artificial)	28	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Anthochaera phrygia / Regent Honeyeater	**281_DNG_Low, 281_DNG, 281_High, 1610_High, 1629_High, 1655_High, 1711_High, 281_Scattered, 1610_Regenerating, 266_DNG, 266_High, 266_Scattered**	22.7	865.00
Aprasia parapulchella / Pink-tailed Legless Lizard	**281_DNG_Low, 281_DNG, 281_High, 1610_High, 1629_High, 1610_Regenerating, 266_DNG, 266_High**	83.9	1624.00
Chalinolobus dwyeri / Large-eared Pied Bat	**281_High, 1610_High, 1629_High, 1655_High, 1711_High, 281_Scattered, 1610_Regenerating, 266_High, 266_Scattered**	29.5	1189.00
Petaurus norfolcensis / Squirrel Glider	**281_High, 1610_High, 1629_High, 1655_High, 1711_High, 281_Scattered, 1610_Regenerating, 266_High, 266_Scattered**	29.5	793.00

Phascolarctos cinereus / Koala	**281_High, 1610_High, 1629_High, 1655_High, 1711_High, 281_Scattered, 1610_Regenerating, 266_High, 266_Scattered**	29.5	793.00
Pomaderris cotoneaster / Cotoneaster Pomaderris	**1629_High**	0.1	2.00
Vespadelus troughtoni / Eastern Cave Bat	**281_High, 1610_High, 1629_High, 1655_High, 1711_High, 281_Scattered, 1610_Regenerating, 266_High, 266_Scattered**	29.5	1189.00

Credit Retirement Options

Like-for-like options

Anthochaera phrygia/ Regent Honeyeater	Spp	IBRA region	
	Anthochaera phrygia/Regent Honeyeater *Note: Variation rules do not apply for Critically Endangered species and impacts on Commonwealth listed entities that are a controlled action.*	Any in NSW	
Aprasia parapulchella/ Pink-tailed Legless Lizard	Spp	IBRA region	
	Aprasia parapulchella/Pink-tailed Legless Lizard	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

	Fauna	Vulnerable	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Chalinolobus dwyeri/ Large-eared Pied Bat	Spp	IBRA region	
	Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Petaurus norfolcensis/ Squirrel Glider	Spp	IBRA region	
	Petaurus norfolcensis/Squirrel Glider	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing	IBRA region

		under Part 4 of the BC Act shown below	
	Fauna	Vulnerable	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Phascolarctos cinereus/ Koala	Spp	IBRA region	
	Phascolarctos cinereus/Koala	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Endangered	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Pomaderris cotoneaster/ Cotoneaster Pomaderris	Spp	IBRA region	
	Pomaderris cotoneaster/Cotoneaster Pomaderris	Any in NSW	
	Variation options		

	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Flora	Endangered	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Vespadelus troughtoni/ Eastern Cave Bat	Spp	IBRA region	
	Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00031449/BAAS19016/22/00033408

Proposal Name
Moolarben Coal Complex OC3 Extension Project - Stage 2

BAM data last updated *
22/06/2023

Assessor Name
Amanda Griffith

Assessor Number
BAAS19016

BAM Data version *
61

Proponent Names

Report Created
07/03/2024

BAM Case Status
Finalised

Assessment Revision
5

Assessment Type
Major Projects

Date Finalised
07/03/2024

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat
Anthochaera phrygia / Regent Honeyeater

Additional Information for Approval

PCT Outside Ibra Added

PCT
471-Dwyer's Red Gum - Black Cypress Pine - ironbark low woodland on sandstone hillcrests in the Dubbo - Gilgandra region, south-western Brigalow Belt South Bioregion

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

BAM Biodiversity Credit Report (Like for like)

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	116.9	261	2335	2596
1610-White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Not a TEC	16.2	304	0	304
1629-Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	Not a TEC	4.7	99	0	99
1655-Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	1.9	44	0	44
1711-Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin	Not a TEC	1.6	28	0	28
266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	18.4	21	448	469

266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654,	-	266_DNG	No	448	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281,	-	266_High	Yes	17	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native	-	266_Scattered	Yes	4	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or

	Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608,					Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381,	-	281_DNG_Low	No	41	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland,	-	281_DNG	No	2294	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388,					

	3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654,	-	281_High	Yes	198	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281,	-	281_Scattered	Yes	63	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
1610-White Box - Black Cypress Pine shrubby woodland of the Western Slopes	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 217, 255, 273, 287, 330, 333, 341, 343, 346, 348, 358, 403, 455, 456, 472, 577, 581, 592, 617, 673, 676, 713, 940, 956, 1277, 1279, 1313, 1316, 1381, 1610, 1661, 1668, 1709, 3753, 3754, 3756, 3768, 3769, 4153	Western Slopes Dry Sclerophyll Forests >=50% and <70%	1610_High	Yes	228	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 217, 255, 273, 287, 330, 333, 341, 343, 346, 348, 358, 403, 455, 456, 472, 577, 581, 592, 617, 673, 676, 713, 940, 956, 1277, 1279, 1313, 1316, 1381, 1610, 1661, 1668, 1709, 3753, 3754, 3756, 3768, 3769, 4153	Western Slopes Dry Sclerophyll Forests >=50% and <70%	1610_Regenerating	Yes	76	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1629-Narrow-leaved Stringybark - Grey Gum shrubby open forest on sandstone ranges of the Sydney Basin	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398,	Western Slopes Dry Sclerophyll Forests <50%	1629_High	Yes	99	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 4153					
1655-Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion This includes PCT's: 1176, 1655, 3490	-	1655_High	Yes	44	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1711-Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457,	Western Slopes Dry Sclerophyll Forests <50%	1711_High	Yes	28	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 4153					

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Anthochaera phrygia / Regent Honeyeater	**281_DNG_Low, 281_DNG, 281_High, 1610_High, 1629_High, 1655_High, 1711_High, 281_Scattered, 1610_Regenerating, 266_DNG, 266_High, 266_Scattered**	22.7	865.00
Aprasia parapulchella / Pink-tailed Legless Lizard	**281_DNG_Low, 281_DNG, 281_High, 1610_High, 1629_High, 1610_Regenerating, 266_DNG, 266_High**	83.9	1624.00
Chalinolobus dwyeri / Large-eared Pied Bat	**281_High, 1610_High, 1629_High, 1655_High, 1711_High, 281_Scattered, 1610_Regenerating, 266_High, 266_Scattered**	29.5	1189.00
Petaurus norfolcensis / Squirrel Glider	**281_High, 1610_High, 1629_High, 1655_High, 1711_High, 281_Scattered, 1610_Regenerating, 266_High, 266_Scattered**	29.5	793.00

Phascolarctos cinereus / Koala	**281_High, 1610_High, 1629_High, 1655_High, 1711_High, 281_Scattered, 1610_Regenerating, 266_High, 266_Scattered**	29.5	793.00
Pomaderris cotoneaster / Cotoneaster Pomaderris	**1629_High**	0.1	2.00
Vespadelus troughtoni / Eastern Cave Bat	**281_High, 1610_High, 1629_High, 1655_High, 1711_High, 281_Scattered, 1610_Regenerating, 266_High, 266_Scattered**	29.5	1189.00

Credit Retirement Options

Like-for-like credit retirement options

Anthochaera phrygia / Regent Honeyeater	Spp	IBRA subregion
	Anthochaera phrygia / Regent Honeyeater	Any in NSW
Aprasia parapulchella / Pink-tailed Legless Lizard	Spp	IBRA subregion
	Aprasia parapulchella / Pink-tailed Legless Lizard	Any in NSW
Chalinolobus dwyeri / Large-eared Pied Bat	Spp	IBRA subregion
	Chalinolobus dwyeri / Large-eared Pied Bat	Any in NSW

Petaurus norfolcensis / Squirrel Glider	Spp	IBRA subregion
	Petaurus norfolcensis / Squirrel Glider	Any in NSW
Phascolarctos cinereus / Koala	Spp	IBRA subregion
	Phascolarctos cinereus / Koala	Any in NSW
Pomaderris cotoneaster / Cotoneaster Pomaderris	Spp	IBRA subregion
	Pomaderris cotoneaster / Cotoneaster Pomaderris	Any in NSW
Vespadelus troughtoni / Eastern Cave Bat	Spp	IBRA subregion
	Vespadelus troughtoni / Eastern Cave Bat	Any in NSW

Appendix J. BAM-C Credit Reports – Stage 3

Credit summary

Variation

Like for like

BAM Credit Summary Report

Proposal Details

Assessment Id
00031449/BAAS19016/22/00033409

Proposal Name
Moolarben Coal Complex OC3 Extension Project - Stage 3

BAM data last updated *
22/06/2023

Assessor Name
Amanda Griffith

Report Created
07/03/2024

BAM Data version *
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Assessor Number
BAAS19016

BAM Case Status
Finalised

Date Finalised
07/03/2024

Assessment Revision
4

Assessment Type
Major Projects

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

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

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin												
8	1655_High	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	52.3	52.3	2.3	Biodiversity Conservation Act listing status	High Sensitivity to Gain	Vulnerable Ecological Community	Not Listed	1.75		53
											Subtotal	**53**
Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion												
3	281_DNG_Low	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	32.7	32.7	18	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	368

4	281_DNG	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	33.3	33.3	53.1	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	1105

5	281_High	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	90.4	90.4	15.2	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	859

10	281_Scattered	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	84.4	84.4	0.08	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	4
											Subtotal	**2336**
Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin												
9	1711_High	Not a TEC	47.2	47.2	5.9	PCT Cleared - 0%	High Sensitivity to Gain			1.50		105
											Subtotal	**105**
White Box - Black Cypress Pine shrubby woodland of the Western Slopes												
6	1610_Regenerating	Not a TEC	41.2	41.2	4.3	PCT Cleared - 67%	High Sensitivity to Gain			1.75		78

7	1610_High	Not a TEC	43.5	43.5	5	PCT Cleared - 67%	High Sensitivity to Gain			1.75		95
											Subtotal	**173**
White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion												
1	266_DNG	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	39.8	39.8	5.5	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	137

2	266_High	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	88.1	88.1	5.8	Population size	High Sensitivity to Gain	Critically Endangered Ecological Community	Not Listed	2.50	True	319
											Subtotal	**456**
											Total	**3123**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits

Anthochaera phrygia / Regent Honeyeater (Fauna)									
266_DNG	39.8	39.8	0.2	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	6
266_High	88.1	88.1	2.8	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	185
281_DNG_Low	32.7	32.7	1	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	25
281_DNG	33.3	33.3	3	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	75
281_High	90.4	90.4	7.6	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	515

1610_High	43.5	43.5	0.5	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	16
1655_High	52.3	52.3	2.3	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	90
1711_High	47.2	47.2	3.1	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	110
281_Scattered	84.4	84.4	0.04	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Critically Endangered	Critically Endangered	True	3
								Subtotal	**1025**
Aprasia parapulchella / Pink-tailed Legless Lizard (Fauna)									
266_DNG	39.8	39.8	2.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	46

266_High	88.1	88.1	0.04	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	2
281_DNG_Low	32.7	32.7	0.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	13
281_DNG	33.3	33.3	17.5	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	291
281_High	90.4	90.4	5.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	253
1610_Regenerating	41.2	41.2	2.9	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	60
1610_High	43.5	43.5	2.6	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	56
1655_High	52.3	52.3	0.08	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	2

1711_High	47.2	47.2	0.4	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	False	9
								Subtotal	**732**
Chalinolobus dwyeri / Large-eared Pied Bat (Fauna)									
266_High	88.1	88.1	5.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	383
281_High	90.4	90.4	15.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	1030
1610_Regenerating	41.2	41.2	4.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	133
1610_High	43.5	43.5	5	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	163
1655_High	52.3	52.3	2.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	90

1711_High	47.2	47.2	5.9	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	209
281_Scattered	84.4	84.4	0.08	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Vulnerable	True	5
								Subtotal	**2013**
Petaurus norfolcensis / Squirrel Glider (Fauna)									
266_High	88.1	88.1	5.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	255
281_High	90.4	90.4	15.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	687
1610_Regenerating	41.2	41.2	4.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	89
1610_High	43.5	43.5	5	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	109

1655_High	52.3	52.3	2.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	60
1711_High	47.2	47.2	5.9	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	139
281_Scattered	84.4	84.4	0.08	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	False	3
								Subtotal	**1342**
Phascolarctos cinereus / Koala (Fauna)									
266_High	88.1	88.1	5.8	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	255
281_High	90.4	90.4	15.2	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	687
1610_Regenerating	41.2	41.2	4.3	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	89

1610_High	43.5	43.5	5	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	109
1655_High	52.3	52.3	2.3	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	60
1711_High	47.2	47.2	5.9	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	139
281_Scattered	84.4	84.4	0.08	Biodiversity Conservation Act listing status	Effectiveness of management in controlling threats	Endangered	Endangered	False	3
								Subtotal	**1342**
Vespadelus troughtoni / Eastern Cave Bat (Fauna)									
266_High	88.1	88.1	5.8	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	383

281_High	90.4	90.4	15.2	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	1030
1610_Regenerating	41.2	41.2	4.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	133
1610_High	43.5	43.5	5	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	163
1655_High	52.3	52.3	2.3	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	90
1711_High	47.2	47.2	5.9	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	209
281_Scattered	84.4	84.4	0.08	Biodiversity Conservation Act listing status	Species dependent on habitat attributes	Vulnerable	Not Listed	True	5
								Subtotal	**2013**

BAM Biodiversity Credit Report (Variations)

Proposal Details

Assessment Id
00031449/BAAS19016/22/00033409

Proposal Name
Moolarben Coal Complex OC3 Extension Project - Stage 3

BAM data last updated *
22/06/2023

Assessor Name
Amanda Griffith

Assessor Number
BAAS19016

BAM Data version *
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Proponent Name(s)

Report Created
07/03/2024

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Finalised

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4

Assessment Type
Major Projects

Date Finalised
07/03/2024

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat
Anthochaera phrygia / Regent Honeyeater

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	11.3	319	137	456.00

281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	86.4	863	1473	2336.00
1610-White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Not a TEC	9.3	173	0	173.00
1655-Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	2.3	53	0	53.00
1711-Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin	Not a TEC	5.9	105	0	105.00

266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

Like-for-like credit retirement options

Class	Trading group	Zone	HBT	Credits	IBRA region
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381,	-	266_DNG	No	137	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267,	-	266_High	Yes	319	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					

281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332,	-	281_DNG_Low	No	368	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654,	-	281_DNG	No	1105	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437,	-	281_High	Yes	859	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281,	-	281_Scattered	Yes	4	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
1610-White Box - Black Cypress Pine shrubby woodland of the Western Slopes	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region

Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 217, 255, 273, 287, 330, 333, 341, 343, 346, 348, 358, 403, 455, 456, 472, 577, 581, 592, 617, 673, 676, 713, 940, 956, 1277, 1279, 1313, 1316, 1381, 1610, 1661, 1668, 1709, 3753, 3754, 3756, 3768, 3769, 4153	Western Slopes Dry Sclerophyll Forests >=50% and <70%	1610_Regenerating	Yes	78	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 217, 255, 273, 287, 330, 333, 341, 343, 346, 348, 358, 403, 455, 456, 472, 577, 581, 592, 617, 673, 676, 713, 940, 956, 1277, 1279, 1313, 1316, 1381, 1610, 1661, 1668, 1709, 3753, 3754, 3756, 3768, 3769, 4153	Western Slopes Dry Sclerophyll Forests >=50% and <70%	1610_High	Yes	95	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Variation options

Formation	Trading group	Zone	HBT	Credits	IBRA region

	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	1610_Regenerating	Yes (including artificial)	78	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 3 or higher threat status	1610_High	Yes (including artificial)	95	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1655-Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion This includes PCT's: 1176, 1655, 3490	-	1655_High	Yes	53	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 5 or higher threat status	1655_High	Yes (including artificial)	53	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1711-Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin	Like-for-like credit retirement options					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713, 714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677,	Western Slopes Dry Sclerophyll Forests <50%	1711_High	Yes	105	Kerrabee,Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	1678, 1679, 1680, 1709, 1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 4153					
	Variation options					
	Formation	Trading group	Zone	HBT	Credits	IBRA region
	Dry Sclerophyll Forests (Shrubby sub-formation)	Tier 4 or higher threat status	1711_High	Yes (including artificial)	105	IBRA Region: Sydney Basin, or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Anthochaera phrygia / Regent Honeyeater	**266_DNG, 266_High, 281_DNG_Low, 281_DNG, 281_High, 1610_High, 1655_High, 1711_High, 281_Scattered**	20.5	1025.00
Aprasia parapulchella / Pink-tailed Legless Lizard	**266_DNG, 266_High, 281_DNG_Low, 281_DNG, 281_High, 1610_Regenerating, 1610_High, 1655_High, 1711_High**	32.2	732.00

Chalinolobus dwyeri / Large-eared Pied Bat	**266_High, 281_High, 1610_Regenerating, 1610_High, 1655_High, 1711_High, 281_Scattered**	38.6	2013.00
Petaurus norfolcensis / Squirrel Glider	**266_High, 281_High, 1610_Regenerating, 1610_High, 1655_High, 1711_High, 281_Scattered**	38.6	1342.00
Phascolarctos cinereus / Koala	**266_High, 281_High, 1610_Regenerating, 1610_High, 1655_High, 1711_High, 281_Scattered**	38.6	1342.00
Vespadelus troughtoni / Eastern Cave Bat	**266_High, 281_High, 1610_Regenerating, 1610_High, 1655_High, 1711_High, 281_Scattered**	38.6	2013.00

Credit Retirement Options

Like-for-like options

Anthochaera phrygia/ Regent Honeyeater	Spp	IBRA region
	Anthochaera phrygia/Regent Honeyeater *Note: Variation rules do not apply for Critically Endangered species and impacts on Commonwealth listed entities that are a controlled action.*	Any in NSW
Aprasia parapulchella/ Pink-tailed Legless Lizard	Spp	IBRA region
	Aprasia parapulchella/Pink-tailed Legless Lizard	Any in NSW

Aprasia parapulchella/ Pink-tailed Legless Lizard	**Variation options**		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Chalinolobus dwyeri/ Large-eared Pied Bat	Spp	IBRA region	
	Chalinolobus dwyeri/Large-eared Pied Bat	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Petaurus norfolcensis/ Squirrel Glider	Spp		IBRA region
	Petaurus norfolcensis/Squirrel Glider		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Phascolarctos cinereus/ Koala	Spp		IBRA region
	Phascolarctos cinereus/Koala		Any in NSW
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region

	Fauna	Endangered	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
Vespadelus troughtoni/ Eastern Cave Bat	Spp	IBRA region	
	Vespadelus troughtoni/Eastern Cave Bat	Any in NSW	
	Variation options		
	Kingdom	Any species with same or higher category of listing under Part 4 of the BC Act shown below	IBRA region
	Fauna	Vulnerable	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id
00031449/BAAS19016/22/00033409

Proposal Name
Moolarben Coal Complex OC3 Extension Project - Stage 3

BAM data last updated *
22/06/2023

Assessor Name
Amanda Griffith

Assessor Number
BAAS19016

BAM Data version *
61

Proponent Names

Report Created
07/03/2024

BAM Case Status
Finalised

Assessment Revision
4

Assessment Type
Major Projects

Date Finalised
07/03/2024

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

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	Critically Endangered Ecological Community	281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion

Species
Chalinolobus dwyeri / Large-eared Pied Bat
Vespadelus troughtoni / Eastern Cave Bat
Anthochaera phrygia / Regent Honeyeater

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
No Changes

BAM Biodiversity Credit Report (Like for like)

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

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	11.3	319	137	456
281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla	86.4	863	1473	2336
1610-White Box - Black Cypress Pine shrubby woodland of the Western Slopes	Not a TEC	9.3	173	0	173
1655-Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion	2.3	53	0	53
1711-Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin	Not a TEC	5.9	105	0	105

266-White Box grassy woodland in the upper slopes sub-region of the NSW South Western Slopes Bioregion

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
White Box - Yellow Box - Blakely's Red Gum	-	266_DNG	No	137	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and

	Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331,					Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437,	-	266_High	Yes	319	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
281-Rough-Barked Apple - red gum - Yellow Box woodland on alluvial clay to loam soils on valley flats in the northern NSW South Western Slopes Bioregion and Brigalow Belt South Bioregion	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW	-	281_DNG_Low	No	368	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100

	North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695,					kilometers of the outer edge of the impacted site.

	1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567,	-	281_DNG	No	1105	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267,	-	281_High	Yes	859	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331, 1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
	White Box - Yellow Box - Blakely's Red Gum	-	281_Scattered	Yes	4	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and

	Grassy Woodland and Derived Native Grassland in the NSW North Coast, New England Tableland, Nandewar, Brigalow Belt South, Sydney Basin, South Eastern Highla This includes PCT's: 74, 75, 83, 250, 266, 267, 268, 270, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 286, 298, 302, 312, 341, 342, 347, 350, 352, 356, 367, 381, 382, 395, 401, 403, 421, 433, 434, 435, 436, 437, 451, 483, 484, 488, 492, 496, 508, 509, 510, 511, 528, 538, 544, 563, 567, 571, 589, 590, 597, 599, 618, 619, 622, 633, 654, 702, 703, 704, 705, 710, 711, 796, 797, 799, 840, 847, 851, 921, 1099, 1103, 1303, 1304, 1307, 1324, 1329, 1330, 1331,					Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	1332, 1333, 1334, 1383, 1401, 1512, 1606, 1608, 1611, 1691, 1693, 1695, 1698, 3314, 3359, 3363, 3373, 3376, 3387, 3388, 3394, 3395, 3396, 3397, 3398, 3399, 3406, 3415, 3533, 4147, 4149, 4150					
1610-White Box - Black Cypress Pine shrubby woodland of the Western Slopes	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 217, 255, 273, 287, 330, 333, 341, 343, 346, 348, 358, 403, 455, 456, 472, 577, 581, 592, 617, 673, 676, 713, 940, 956, 1277, 1279, 1313, 1316, 1381, 1610, 1661, 1668, 1709, 3753, 3754, 3756, 3768, 3769, 4153	Western Slopes Dry Sclerophyll Forests >=50% and <70%	1610_Regenerating	Yes	78	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 217, 255, 273, 287, 330, 333, 341, 343, 346, 348, 358, 403, 455, 456, 472, 577, 581, 592, 617, 673, 676, 713, 940, 956, 1277, 1279, 1313, 1316, 1381, 1610, 1661, 1668, 1709, 3753, 3754, 3756, 3768, 3769, 4153	Western Slopes Dry Sclerophyll Forests >=50% and <70%	1610_High	Yes	95	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1655-Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Hunter Valley Footslopes Slaty Gum Woodland in the Sydney Basin Bioregion This includes PCT's: 1176, 1655, 3490	-	1655_High	Yes	53	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1655-Grey Box - Slaty Box shrub - grass woodland on sandstone slopes of the upper Hunter and Sydney Basin	
1711-Tantoon - Lepyrodia leptocaulis shrubland on sandstone drainage lines of the Sydney Basin	**Like-for-like credit retirement options**

Class	Trading group	Zone	HBT	Credits	IBRA region
Western Slopes Dry Sclerophyll Forests This includes PCT's: 54, 110, 179, 217, 243, 255, 270, 273, 287, 291, 309, 321, 322, 323, 324, 325, 327, 330, 331, 333, 341, 343, 346, 348, 354, 358, 379, 387, 396, 398, 399, 401, 402, 403, 404, 405, 406, 407, 408, 409, 414, 415, 417, 419, 420, 423, 425, 430, 431, 440, 443, 449, 455, 456, 457, 459, 462, 463, 467, 468, 469, 470, 471, 472, 473, 476, 477, 478, 479, 480, 482, 515, 531, 532, 576, 577, 581, 592, 610, 617, 671, 673, 676, 712, 713,	Western Slopes Dry Sclerophyll Forests <50%	1711_High	Yes	105	Kerrabee, Hunter, Inland Slopes, Liverpool Range, Pilliga, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	714, 746, 863, 889, 940, 956, 1133, 1176, 1277, 1278, 1279, 1307, 1313, 1314, 1316, 1381, 1398, 1610, 1629, 1654, 1655, 1656, 1657, 1660, 1661, 1663, 1668, 1669, 1671, 1672, 1674, 1676, 1677, 1678, 1679, 1680, 1709, 1711, 1770, 1771, 3753, 3754, 3756, 3757, 3758, 3759, 3760, 3761, 3762, 3763, 3766, 3767, 3768, 3769, 3770, 3771, 3772, 3773, 3774, 3775, 3776, 3777, 3778, 3780, 3781, 3782, 3783, 3784, 3785, 3786, 4153					

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Anthochaera phrygia / Regent Honeyeater	**266_DNG, 266_High, 281_DNG_Low, 281_DNG, 281_High, 1610_High, 1655_High, 1711_High, 281_Scattered**	20.5	1025.00
Aprasia parapulchella / Pink-tailed Legless Lizard	**266_DNG, 266_High, 281_DNG_Low, 281_DNG, 281_High, 1610_Regenerating, 1610_High, 1655_High, 1711_High**	32.2	732.00
Chalinolobus dwyeri / Large-eared Pied Bat	**266_High, 281_High, 1610_Regenerating, 1610_High, 1655_High, 1711_High, 281_Scattered**	38.6	2013.00
Petaurus norfolcensis / Squirrel Glider	**266_High, 281_High, 1610_Regenerating, 1610_High, 1655_High, 1711_High, 281_Scattered**	38.6	1342.00
Phascolarctos cinereus / Koala	**266_High, 281_High, 1610_Regenerating, 1610_High, 1655_High, 1711_High, 281_Scattered**	38.6	1342.00

Vespadelus troughtoni / Eastern Cave Bat	**266_High, 281_High, 1610_Regenerating, 1610_High, 1655_High, 1711_High, 281_Scattered**	38.6	2013.00

Credit Retirement Options

Like-for-like credit retirement options

Anthochaera phrygia / Regent Honeyeater	Spp	IBRA subregion
	Anthochaera phrygia / Regent Honeyeater	Any in NSW
Aprasia parapulchella / Pink-tailed Legless Lizard	Spp	IBRA subregion
	Aprasia parapulchella / Pink-tailed Legless Lizard	Any in NSW
Chalinolobus dwyeri / Large-eared Pied Bat	Spp	IBRA subregion
	Chalinolobus dwyeri / Large-eared Pied Bat	Any in NSW
Petaurus norfolcensis / Squirrel Glider	Spp	IBRA subregion
	Petaurus norfolcensis / Squirrel Glider	Any in NSW
Phascolarctos cinereus / Koala	Spp	IBRA subregion
	Phascolarctos cinereus / Koala	Any in NSW

Vespadelus troughtoni / Eastern Cave Bat	Spp	IBRA subregion
	Vespadelus troughtoni / Eastern Cave Bat	Any in NSW

Appendix K. Niche IGGAM and BAM plot data

Plot	Transect metre	*Species*	Category
01	1	*Conyza bonariensis*	Perennial Exotic
01	2	*Microlaena stipoides*	Perennial Native
01	3	*Plantago lanceolata*	Perennial Exotic
01	4	*Microlaena stipoides*	Perennial Native
01	5	*Plantago lanceolata*	Perennial Exotic
01	6	*Plantago lanceolata*	Perennial Exotic
01	7	*Microlaena stipoides*	Perennial Native
01	8	*Plantago lanceolata*	Perennial Exotic
01	9	*Microlaena stipoides*	Perennial Native
01	10	*Plantago lanceolata*	Perennial Exotic
01	11	*Microlaena stipoides*	Perennial Native
01	12	*Conyza bonariensis*	Perennial Exotic
01	13	*Latuca saligna*	Perennial Exotic
01	14	*Microlaena stipoides*	Perennial Native
01	15	*Plantago lanceolata*	Perennial Exotic
01	16	*Microlaena stipoides*	Perennial Native
01	17	*Plantago lanceolata*	Perennial Exotic
01	18	*Plantago lanceolata*	Perennial Exotic
01	19	*Microlaena stipoides*	Perennial Native
01	20	*Eleusine tristachya*	Perennial Exotic
01	21	*Rumex acetosella*	Perennial Exotic
01	22	*Microlaena stipoides*	Perennial Native
01	23	*Plantago lanceolata*	Perennial Exotic
01	24	*lomandra multiflora subsp. multiflora*	Perennial Native
01	25	*Hypericum perforatum*	Perennial Exotic
01	26	*Rubus fruticosus sp. agg.*	Perennial Exotic
01	27	*Panicum effusum*	Perennial Native
01	28	*Rubus fruticosus sp. agg.*	Perennial Exotic
01	29	*Sporobolus creber*	Perennial Native
01	30	*Microlaena stipoides*	Perennial Native
01	31	*Rubus fruticosus sp. agg.*	Perennial Exotic
01	32	*Rubus fruticosus sp. agg.*	Perennial Exotic
01	33	*Rubus fruticosus sp. agg.*	Perennial Exotic
01	34	*Rubus fruticosus sp. agg.*	Perennial Exotic
01	35	*Rubus fruticosus sp. agg.*	Perennial Exotic
01	36	*Cirsium vulgare*	Perennial Exotic
01	37	*Rubus fruticosus sp. agg.*	Perennial Exotic
01	38	*Panicum effusum*	Perennial Native
01	39	*lomandra multiflora subsp. multiflora*	Perennial Native
01	40	*Plantago lanceolata*	Perennial Exotic
01	41	*Cotula bipinnata*	Perennial Exotic
01	42	*Setaria parviflora*	Perennial Exotic
01	43	*Hypericum perforatum*	Perennial Exotic
01	44	*Juncus usitatus*	Perennial Native
01	45	*Cynodon dactylon*	Perennial Native
01	46	*Cotula bipinnata*	Perennial Exotic
01	47	*Trifolium repens*	Perennial Exotic
01	48	*Austrostipa scabra*	Perennial Native
01	49	*Plantago lanceolata*	Perennial Exotic
01	50	*Setaria parviflora*	Perennial Exotic
01	51	*Juncus sp. 2*	Perennial Native
01	52	*Verbena bonariensis*	Perennial Exotic
01	53	*Plantago lanceolata*	Perennial Exotic
01	54	*Sporobolus creber*	Perennial Native
01	55	*Juncus sp. 2*	Perennial Native
01	56	*Sporobolus creber*	Perennial Native
01	57	*Plantago lanceolata*	Perennial Exotic
01	58	*Juncus sp. 2*	Perennial Native
01	59	*Juncus sp. 2*	Perennial Native
01	60	*Juncus sp. 2*	Perennial Native
01	61	*Juncus sp. 2*	Perennial Native
01	62	*Setaria parviflora*	Perennial Exotic
01	63	*Juncus sp. 2*	Perennial Native
01	64	*Plantago lanceolata*	Perennial Exotic
01	65	*Gahnia aspera*	Perennial Native
01	66	*Conyza bonariensis*	Perennial Exotic
01	67	*Juncus sp. 2*	Perennial Native
01	68	*Cotula bipinnata*	Perennial Exotic
01	69	*Sporobolus creber*	Perennial Native
01	70	*Sporobolus creber*	Perennial Native
01	71	*lomandra multiflora subsp. multiflora*	Perennial Native
01	72	*Juncus usitatus*	Perennial Native
01	73	*Hypericum perforatum*	Perennial Exotic
01	74	*Microlaena stipoides*	Perennial Native
01	75	*lomandra multiflora subsp. multiflora*	Perennial Native
01	76	*Plantago lanceolata*	Perennial Exotic
01	77	*Verbena bonariensis*	Perennial Exotic
01	78	*lomandra multiflora subsp. multiflora*	Perennial Native
01	79	*Verbena bonariensis*	Perennial Exotic
01	80	*lomandra multiflora subsp. multiflora*	Perennial Native
01	81	*Plantago lanceolata*	Perennial Exotic
01	82	*Sporobolus creber*	Perennial Native
01	83	*Rubus fruticosus sp. agg.*	Perennial Exotic
01	84	*Austrostipa scabra*	Perennial Native
01	85	*Verbena bonariensis*	Perennial Exotic
01	86	*Austrostipa scabra*	Perennial Native
01	87	*Austrostipa scabra*	Perennial Native
01	88	*Microlaena stipoides*	Perennial Native
01	89	*Plantago lanceolata*	Perennial Exotic
01	90	*Juncus sp. 2*	Perennial Native

01	91	*Rubus fruticosus sp. agg.*	Perennial Exotic
01	92	*Sporobolus creber*	Perennial Native
01	93	*Sporobolus creber*	Perennial Native
01	94	*Sporobolus creber*	Perennial Native
01	95	*Microlaena stipoides*	Perennial Native
01	96	*Verbena bonariensis*	Perennial Exotic
01	97	*Juncus sp. 2*	Perennial Native
01	98	*Juncus sp. 2*	Perennial Native
01	99	*Sporobolus creber*	Perennial Native
01	100	*Juncus sp. 2*	Perennial Native
02	1	*Cynodon dactylon*	Perennial Native
02	2	*Cynodon dactylon*	Perennial Native
02	3	*Cynodon dactylon*	Perennial Native
02	4	*Cynodon dactylon*	Perennial Native
02	5	*Microlaena stipoides*	Perennial Native
02	6	*Cynodon dactylon*	Perennial Native
02	7	*Microlaena stipoides*	Perennial Native
02	8	*Cynodon dactylon*	Perennial Native
02	9	*Microlaena stipoides*	Perennial Native
02	10	*Cynodon dactylon*	Perennial Native
02	11	*Juncus usitatus*	Perennial Native
02	12	*Microlaena stipoides*	Perennial Native
02	13	*Sporobolus creber*	Perennial Native
02	14	*Microlaena stipoides*	Perennial Native
02	15	*Cynodon dactylon*	Perennial Native
02	16	*Cynodon dactylon*	Perennial Native
02	17	*Microlaena stipoides*	Perennial Native
02	18	*Microlaena stipoides*	Perennial Native
02	19	*Cynodon dactylon*	Perennial Native
02	20	*Cynodon dactylon*	Perennial Native
02	21	*Cynodon dactylon*	Perennial Native
02	22	*Cynodon dactylon*	Perennial Native
02	23	*Microlaena stipoides*	Perennial Native
02	24	*Microlaena stipoides*	Perennial Native
02	25	*Microlaena stipoides*	Perennial Native
02	26	*Microlaena stipoides*	Perennial Native
02	27	*Cynodon dactylon*	Perennial Native
02	28	*Microlaena stipoides*	Perennial Native
02	29	*Microlaena stipoides*	Perennial Native
02	30	*Rytidosperma sp.*	Perennial Native
02	31	*Sporobolus creber*	Perennial Native
02	32	*Hypochaeris radicata*	Perennial Exotic
02	33	*Microlaena stipoides*	Perennial Native
02	34	*Microlaena stipoides*	Perennial Native
02	35	*Microlaena stipoides*	Perennial Native
02	36	*Microlaena stipoides*	Perennial Native
02	37	*Microlaena stipoides*	Perennial Native
02	38	*Microlaena stipoides*	Perennial Native
02	39	*Verbena bonariensis*	Perennial Exotic
02	40	*Juncus usitatus*	Perennial Native
02	41	*Microlaena stipoides*	Perennial Native
02	42	*Microlaena stipoides*	Perennial Native
02	43	*Microlaena stipoides*	Perennial Native
02	44	*Microlaena stipoides*	Perennial Native
02	45	*Aristida racemosa*	Perennial Native
02	46	*Microlaena stipoides*	Perennial Native
02	47	*Microlaena stipoides*	Perennial Native
02	48	*Aristida racemosa*	Perennial Native
02	49	*Microlaena stipoides*	Perennial Native
02	50	*Microlaena stipoides*	Perennial Native
02	51	*Microlaena stipoides*	Perennial Native
02	52	*Microlaena stipoides*	Perennial Native
02	53	*Microlaena stipoides*	Perennial Native
02	54	*Sporobolus creber*	Perennial Native
02	55	*Microlaena stipoides*	Perennial Native
02	56	*Microlaena stipoides*	Perennial Native
02	57	*Microlaena stipoides*	Perennial Native
02	58	*Eragrostis brownii*	Perennial Native
02	59	*Microlaena stipoides*	Perennial Native
02	60	*Aristida racemosa*	Perennial Native
02	61	*Microlaena stipoides*	Perennial Native
02	62	*Microlaena stipoides*	Perennial Native
02	63	*Aristida racemosa*	Perennial Native
02	64	*Microlaena stipoides*	Perennial Native
02	65	*Microlaena stipoides*	Perennial Native
02	66	*Microlaena stipoides*	Perennial Native
02	67	*Microlaena stipoides*	Perennial Native
02	68	*Cynodon dactylon*	Perennial Native
02	69	*Cynodon dactylon*	Perennial Native
02	70	*Paspalum dilatatum*	Perennial Exotic
02	71	*Microlaena stipoides*	Perennial Native
02	72	*Microlaena stipoides*	Perennial Native
02	73	*Microlaena stipoides*	Perennial Native
02	74	*Microlaena stipoides*	Perennial Native
02	75	*Microlaena stipoides*	Perennial Native
02	76	*Microlaena stipoides*	Perennial Native
02	77	*Microlaena stipoides*	Perennial Native
02	78	*Microlaena stipoides*	Perennial Native
02	79	*Aristida racemosa*	Perennial Native
02	80	*Microlaena stipoides*	Perennial Native
02	81	*Cynodon dactylon*	Perennial Native
02	82	*Microlaena stipoides*	Perennial Native
02	83	*Sporobolus creber*	Perennial Native
02	84	*Cynodon dactylon*	Perennial Native
02	85	*Microlaena stipoides*	Perennial Native
02	86	*Microlaena stipoides*	Perennial Native
02	87	*Aristida racemosa*	Perennial Native
02	88	*Cynodon dactylon*	Perennial Native
02	89	*Panicum effusum*	Perennial Native
02	90	*Microlaena stipoides*	Perennial Native
02	91	*Sporobolus creber*	Perennial Native
02	92	*Cynodon dactylon*	Perennial Native
02	93	*Cynodon dactylon*	Perennial Native
02	94	*Cynodon dactylon*	Perennial Native

02	95	*Cynodon dactylon*	Perennial Native
02	96	*Cynodon dactylon*	Perennial Native
02	97	*Aristida racemosa*	Perennial Native
02	98	*Rytidosperma sp.*	Perennial Native
02	99	*Rytidosperma sp.*	Perennial Native
02	100	*Aristida racemosa*	Perennial Native
03	1	*Setaria parviflora*	Perennial Exotic
03	2	*Phalaris aquatica*	Perennial Exotic
03	3	*Microlaena stipoides*	Perennial Native
03	4	*Plantago lanceolata*	Perennial Exotic
03	5	*Juncus usitatus*	Perennial Native
03	6	*Plantago lanceolata*	Perennial Exotic
03	7	*Microlaena stipoides*	Perennial Native
03	8	*Cotula bipinnata*	Perennial Exotic
03	9	*Microlaena stipoides*	Perennial Native
03	10	*Phalaris aquatica*	Perennial Exotic
03	11	*Panicum effusum*	Perennial Native
03	12	*Setaria parviflora*	Perennial Exotic
03	13	*Verbena bonariensis*	Perennial Exotic
03	14	*juncus sp. 2*	Perennial Native
03	15	*juncus sp. 2*	Perennial Native
03	16	*Microlaena stipoides*	Perennial Native
03	17	*Juncus usitatus*	Perennial Native
03	18	*Haloragis aspera*	Perennial Native
03	19	*juncus sp. 2*	Perennial Native
03	20	*Plantago lanceolata*	Perennial Exotic
03	21	*juncus sp. 2*	Perennial Native
03	22	*Microlaena stipoides*	Perennial Native
03	23	*Juncus sp. 2*	Perennial Native
03	24	*Juncus sp. 2*	Perennial Native
03	25	*Juncus usitatus*	Perennial Native
03	26	*Microlaena stipoides*	Perennial Native
03	27	*Juncus sp. 2*	Perennial Native
03	28	*Microlaena stipoides*	Perennial Native
03	29	*Juncus sp. 2*	Perennial Native
03	30	*Setaria parviflora*	Perennial Exotic
03	31	*Setaria parviflora*	Perennial Exotic
03	32	*Setaria parviflora*	Perennial Exotic
03	33	*Microlaena stipoides*	Perennial Native
03	34	*Setaria parviflora*	Perennial Exotic
03	35	*Cynodon dactylon*	Perennial Native
03	36	*Microlaena stipoides*	Perennial Native
03	37	*Setaria parviflora*	Perennial Exotic
03	38	*Juncus usitatus*	Perennial Native
03	39	*Microlaena stipoides*	Perennial Native
03	40	*Microlaena stipoides*	Perennial Native
03	41	*Setaria parviflora*	Perennial Exotic
03	42	*Setaria parviflora*	Perennial Exotic
03	43	*Microlaena stipoides*	Perennial Native
03	44	*Hypericum perforatum*	Perennial Exotic
03	45	*Setaria parviflora*	Perennial Exotic
03	46	*Microlaena stipoides*	Perennial Native
03	47	*Setaria parviflora*	Perennial Exotic
03	48	*Microlaena stipoides*	Perennial Native
03	49	*Microlaena stipoides*	Perennial Native
03	50	*Juncus sp. 2*	Perennial Native
03	51	*Juncus sp. 2*	Perennial Native
03	52	*Juncus sp. 2*	Perennial Native
03	53	*Setaria parviflora*	Perennial Exotic
03	54	*Microlaena stipoides*	Perennial Native
03	55	*Microlaena stipoides*	Perennial Native
03	56	*Setaria parviflora*	Perennial Exotic
03	57	*Haloragis aspera*	Perennial Native
03	58	*Juncus sp. 2*	Perennial Native
03	59	*Setaria parviflora*	Perennial Exotic
03	60	*Setaria parviflora*	Perennial Exotic
03	61	*Microlaena stipoides*	Perennial Native
03	62	*Microlaena stipoides*	Perennial Native
03	63	*Setaria parviflora*	Perennial Exotic
03	64	*Setaria parviflora*	Perennial Exotic
03	65	*Juncus usitatus*	Perennial Native
03	66	*Juncus sp. 2*	Perennial Native
03	67	*Juncus usitatus*	Perennial Native
03	68	*Cynodon dactylon*	Perennial Native
03	69	*Sporobolus creber*	Perennial Native
03	70	*juncus sp. 2*	Perennial Native
03	71	*juncus sp. 2*	Perennial Native
03	72	*juncus sp. 2*	Perennial Native
03	73	*juncus sp. 2*	Perennial Native
03	74	*Plantago lanceolata*	Perennial Exotic
03	75	*juncus sp. 2*	Perennial Native
03	76	*juncus sp. 2*	Perennial Native
03	77	*juncus sp. 2*	Perennial Native
03	78	*Sporobolus creber*	Perennial Native
03	79	*Microlaena stipoides*	Perennial Native
03	80	*Juncus usitatus*	Perennial Native
03	81	*Setaria parviflora*	Perennial Exotic
03	82	*Setaria parviflora*	Perennial Exotic
03	83	*Setaria parviflora*	Perennial Exotic
03	84	*Plantago lanceolata*	Perennial Exotic
03	85	*Verbascum thapsus*	Perennial Exotic
03	86	*Juncus sp. 2*	Perennial Native
03	87	*Juncus sp. 2*	Perennial Native
03	88	*Juncus sp. 2*	Perennial Native
03	89	*Conyza bonariensis*	Perennial Exotic
03	90	*Juncus sp. 2*	Perennial Native
03	91	*Verbascum thapsus*	Perennial Exotic
03	92	*juncus sp. 2*	Perennial Native
03	93	*juncus sp. 2*	Perennial Native
03	94	*juncus sp. 2*	Perennial Native
03	95	*Microlaena stipoides*	Perennial Native
03	96	*Sporobolus creber*	Perennial Native
03	97	*Setaria parviflora*	Perennial Exotic
03	98	*Juncus usitatus*	Perennial Native
03	99	*Conyza bonariensis*	Perennial Exotic

03	100	*Sporobolus creber*	Perennial Native
04	1	*Microlaena stipoides*	Perennial Native
04	2	*Microlaena stipoides*	Perennial Native
04	3	*Modiola caroliniana*	Perennial Exotic
04	4	*Microlaena stipoides*	Perennial Native
04	5	*Conyza bonariensis*	Perennial Exotic
04	6	*Microlaena stipoides*	Perennial Native
04	7	*Microlaena stipoides*	Perennial Native
04	8	*Conyza bonariensis*	Perennial Exotic
04	9	*Microlaena stipoides*	Perennial Native
04	10	*Microlaena stipoides*	Perennial Native
04	11	*Microlaena stipoides*	Perennial Native
04	12	*Microlaena stipoides*	Perennial Native
04	13	*Microlaena stipoides*	Perennial Native
04	14	*Geranium solanderi*	Perennial Native
04	15	*Verbena bonariensis*	Perennial Exotic
04	16	*Plantago lanceolata*	Perennial Exotic
04	17	*Microlaena stipoides*	Perennial Native
04	18	*Microlaena stipoides*	Perennial Native
04	19	*Microlaena stipoides*	Perennial Native
04	20	*Cirsium vulgare*	Perennial Exotic
04	21	*Microlaena stipoides*	Perennial Native
04	22	*Microlaena stipoides*	Perennial Native
04	23	*Microlaena stipoides*	Perennial Native
04	24	*Microlaena stipoides*	Perennial Native
04	25	*Microlaena stipoides*	Perennial Native
04	26	*Veronica persica*	Perennial Exotic
04	27	*Microlaena stipoides*	Perennial Native
04	28	*Microlaena stipoides*	Perennial Native
04	29	*Oxalis perennans*	Perennial Exotic
04	30	*Microlaena stipoides*	Perennial Native
04	31	*Microlaena stipoides*	Perennial Native
04	32	*Geranium solanderi*	Perennial Native
04	33	*Microlaena stipoides*	Perennial Native
04	34	*Trifolium repens*	Perennial Exotic
04	35	*Trifolium repens*	Perennial Exotic
04	36	*Microlaena stipoides*	Perennial Native
04	37	*Microlaena stipoides*	Perennial Native
04	38	*Microlaena stipoides*	Perennial Native
04	39	*Trifolium repens*	Perennial Exotic
04	40	*Oxalis perennans*	Perennial Exotic
04	41	*Microlaena stipoides*	Perennial Native
04	42	*Cirsium vulgare*	Perennial Exotic
04	43	*Microlaena stipoides*	Perennial Native
04	44	*Microlaena stipoides*	Perennial Native
04	45	*Arctotheca calendula*	Perennial Exotic
04	46	*Microlaena stipoides*	Perennial Native
04	47	*Microlaena stipoides*	Perennial Native
04	48	*Microlaena stipoides*	Perennial Native
04	49	*Trifolium repens*	Perennial Exotic
04	50	*Microlaena stipoides*	Perennial Native
04	51	*Microlaena stipoides*	Perennial Native
04	52	*Microlaena stipoides*	Perennial Native
04	53	*Cirsium vulgare*	Perennial Exotic
04	54	*Verbena bonariensis*	Perennial Exotic
04	55	*Microlaena stipoides*	Perennial Native
04	56	*Rumex acetosella*	Perennial Exotic
04	57	*Rumex acetosella*	Perennial Exotic
04	58	*Oxalis perennans*	Perennial Exotic
04	59	*Cirsium vulgare*	Perennial Exotic
04	60	*Cirsium vulgare*	Perennial Exotic
04	61	*Cirsium vulgare*	Perennial Exotic
04	62	*Geranium solanderi*	Perennial Native
04	63	*Microlaena stipoides*	Perennial Native
04	64	*Microlaena stipoides*	Perennial Native
04	65	*Oxalis perennans*	Perennial Exotic
04	66	*Microlaena stipoides*	Perennial Native
04	67	*Oxalis perennans*	Perennial Exotic
04	68	*Oxalis perennans*	Perennial Exotic
04	69	*Bare Earth*	N/A
04	70	*Microlaena stipoides*	Perennial Native
04	71	*Microlaena stipoides*	Perennial Native
04	72	*Microlaena stipoides*	Perennial Native
04	73	*Phalaris aquatica*	Perennial Exotic
04	74	*Oxalis perennans*	Perennial Exotic
04	75	*Phalaris aquatica*	Perennial Exotic
04	76	*Microlaena stipoides*	Perennial Native
04	77	*Phalaris aquatica*	Perennial Exotic
04	78	*Oxalis perennans*	Perennial Exotic
04	79	*Microlaena stipoides*	Perennial Native
04	80	*Microlaena stipoides*	Perennial Native
04	81	*Microlaena stipoides*	Perennial Native
04	82	*Microlaena stipoides*	Perennial Native
04	83	*Microlaena stipoides*	Perennial Native
04	84	*Microlaena stipoides*	Perennial Native
04	85	*Veronica persica*	Perennial Exotic
04	86	*Trifolium repens*	Perennial Exotic
04	87	*Veronica persica*	Perennial Exotic
04	88	*Trifolium repens*	Perennial Exotic
04	89	*Veronica persica*	Perennial Exotic
04	90	*Microlaena stipoides*	Perennial Native
04	91	*Microlaena stipoides*	Perennial Native
04	92	*Microlaena stipoides*	Perennial Native
04	93	*Microlaena stipoides*	Perennial Native
04	94	*Microlaena stipoides*	Perennial Native
04	95	*Microlaena stipoides*	Perennial Native
04	96	*Trifolium repens*	Perennial Exotic
04	97	*Microlaena stipoides*	Perennial Native
04	98	*Microlaena stipoides*	Perennial Native
04	99	*Microlaena stipoides*	Perennial Native
04	100	*Microlaena stipoides*	Perennial Native
05	1	*Cynodon dactylon*	Perennial Native
05	2	*Cynodon dactylon*	Perennial Native
05	3	*Cynodon dactylon*	Perennial Native
05	4	*Cynodon dactylon*	Perennial Native

05	5	*Cynodon dactylon*	Perennial Native
05	6	*Microlaena stipoides*	Perennial Native
05	7	*Microlaena stipoides*	Perennial Native
05	8	*Microlaena stipoides*	Perennial Native
05	9	*Phalaris aquatica*	Perennial Exotic
05	10	*Cynodon dactylon*	Perennial Native
05	11	*Cynodon dactylon*	Perennial Native
05	12	*Cynodon dactylon*	Perennial Native
05	13	*Cynodon dactylon*	Perennial Native
05	14	*Cynodon dactylon*	Perennial Native
05	15	*Geranium solanderi*	Perennial Native
05	16	*Cynodon dactylon*	Perennial Native
05	17	*Phalaris aquatica*	Perennial Exotic
05	18	*Phalaris aquatica*	Perennial Exotic
05	19	*Microlaena stipoides*	Perennial Native
05	20	*Bromus catharticus*	Perennial Exotic
05	21	*Cynodon dactylon*	Perennial Native
05	22	*Cynodon dactylon*	Perennial Native
05	23	*Phalaris aquatica*	Perennial Exotic
05	24	*Cynodon dactylon*	Perennial Native
05	25	*Phalaris aquatica*	Perennial Exotic
05	26	*Bromus catharticus*	Perennial Exotic
05	27	*Cynodon dactylon*	Perennial Native
05	28	*Phalaris aquatica*	Perennial Exotic
05	29	*Cynodon dactylon*	Perennial Native
05	30	*Cynodon dactylon*	Perennial Native
05	31	*Bromus catharticus*	Perennial Exotic
05	32	*Microlaena stipoides*	Perennial Native
05	33	*Cynodon dactylon*	Perennial Native
05	34	*Phalaris aquatica*	Perennial Exotic
05	35	*Bromus catharticus*	Perennial Exotic
05	36	*Microlaena stipoides*	Perennial Native
05	37	*Microlaena stipoides*	Perennial Native
05	38	*Phalaris aquatica*	Perennial Exotic
05	39	*Phalaris aquatica*	Perennial Exotic
05	40	*Phalaris aquatica*	Perennial Exotic
05	41	*Phalaris aquatica*	Perennial Exotic
05	42	*Bromus catharticus*	Perennial Exotic
05	43	*Phalaris aquatica*	Perennial Exotic
05	44	*Phalaris aquatica*	Perennial Exotic
05	45	*Phalaris aquatica*	Perennial Exotic
05	46	*Phalaris aquatica*	Perennial Exotic
05	47	*Phalaris aquatica*	Perennial Exotic
05	48	*Microlaena stipoides*	Perennial Native
05	49	*Microlaena stipoides*	Perennial Native
05	50	*Eragrostis parviflora*	Perennial Exotic
05	51	*Phalaris aquatica*	Perennial Exotic
05	52	*Cynodon dactylon*	Perennial Native
05	53	*Phalaris aquatica*	Perennial Exotic
05	54	*Cynodon dactylon*	Perennial Native
05	55	*Cynodon dactylon*	Perennial Native
05	56	*Microlaena stipoides*	Perennial Native
05	57	*Phalaris aquatica*	Perennial Exotic
05	58	*Cynodon dactylon*	Perennial Native
05	59	*Phalaris aquatica*	Perennial Exotic
05	60	*Microlaena stipoides*	Perennial Native
05	61	*Bromus catharticus*	Perennial Exotic
05	62	*Microlaena stipoides*	Perennial Native
05	63	*Phalaris aquatica*	Perennial Exotic
05	64	*Phalaris aquatica*	Perennial Exotic
05	65	*Phalaris aquatica*	Perennial Exotic
05	66	*Microlaena stipoides*	Perennial Native
05	67	*Microlaena stipoides*	Perennial Native
05	68	*Cynodon dactylon*	Perennial Native
05	69	*Phalaris aquatica*	Perennial Exotic
05	70	*Bromus catharticus*	Perennial Exotic
05	71	*Microlaena stipoides*	Perennial Native
05	72	*Phalaris aquatica*	Perennial Exotic
05	73	*Phalaris aquatica*	Perennial Exotic
05	74	*Microlaena stipoides*	Perennial Native
05	75	*Microlaena stipoides*	Perennial Native
05	76	*Phalaris aquatica*	Perennial Exotic
05	77	*Phalaris aquatica*	Perennial Exotic
05	78	*Microlaena stipoides*	Perennial Native
05	79	*Phalaris aquatica*	Perennial Exotic
05	80	*Cynodon dactylon*	Perennial Native
05	81	*Phalaris aquatica*	Perennial Exotic
05	82	*Bare Earth*	N/A
05	83	*Microlaena stipoides*	Perennial Native
05	84	*Cynodon dactylon*	Perennial Native
05	85	*Bare Earth*	N/A
05	86	*Phalaris aquatica*	Perennial Exotic
05	87	*Bromus catharticus*	Perennial Exotic
05	88	*Cynodon dactylon*	Perennial Native
05	89	*Phalaris aquatica*	Perennial Exotic
05	90	*Microlaena stipoides*	Perennial Native
05	91	*Cynodon dactylon*	Perennial Native
05	92	*Phalaris aquatica*	Perennial Exotic
05	93	*Microlaena stipoides*	Perennial Native
05	94	*Phalaris aquatica*	Perennial Exotic
05	95	*Phalaris aquatica*	Perennial Exotic
05	96	*Bromus catharticus*	Perennial Exotic
05	97	*Microlaena stipoides*	Perennial Native
05	98	*Phalaris aquatica*	Perennial Exotic
05	99	*Microlaena stipoides*	Perennial Native
05	100	*Cynodon dactylon*	Perennial Native
06	1	*Juncus sp. 2*	Perennial Native
06	2	*Juncus sp. 2*	Perennial Native
06	3	*Cynodon dactylon*	Perennial Native
06	4	*Plantago lanceolata*	Perennial Exotic
06	5	*Haloragis aspera*	Perennial Native
06	6	*Phalaris aquatica*	Perennial Exotic
06	7	*Juncus sp. 2*	Perennial Native
06	8	*Trifolium repens*	Perennial Exotic
06	9	*Microlaena stipoides*	Perennial Native

06	10	*Microlaena stipoides*	Perennial Native
06	11	*Microlaena stipoides*	Perennial Native
06	12	*Trifolium repens*	Perennial Exotic
06	13	*Juncus sp. 2*	Perennial Native
06	14	*Juncus sp. 2*	Perennial Native
06	15	*Juncus sp. 2*	Perennial Native
06	16	*Juncus usitatus*	Perennial Native
06	17	*Trifolium repens*	Perennial Exotic
06	18	*Microlaena stipoides*	Perennial Native
06	19	*Juncus sp. 2*	Perennial Native
06	20	*Juncus sp. 2*	Perennial Native
06	21	*Phalaris aquatica*	Perennial Exotic
06	22	*Trifolium repens*	Perennial Exotic
06	23	*Phalaris aquatica*	Perennial Exotic
06	24	*Cynodon dactylon*	Perennial Native
06	25	*Juncus sp. 2*	Perennial Native
06	26	*Juncus sp. 2*	Perennial Native
06	27	*Cynodon dactylon*	Perennial Native
06	28	*Cynodon dactylon*	Perennial Native
06	29	*Juncus sp.2*	Perennial Native
06	30	*Trifolium repens*	Perennial Exotic
06	31	*Juncus sp. 2*	Perennial Native
06	32	*Juncus sp. 2*	Perennial Native
06	33	*Juncus sp. 2*	Perennial Native
06	34	*Juncus sp. 2*	Perennial Native
06	35	*Juncus sp. 2*	Perennial Native
06	36	*Chloris gayana*	Perennial Exotic
06	37	*Chloris gayana*	Perennial Exotic
06	38	*Chloris gayana*	Perennial Exotic
06	39	*Chloris gayana*	Perennial Exotic
06	40	*Chloris gayana*	Perennial Exotic
06	41	*Paspalum dilatatum*	Perennial Exotic
06	42	*Chloris gayana*	Perennial Exotic
06	43	*Juncus sp. 2*	Perennial Native
06	44	*Geranium solanderi*	Perennial Native
06	45	*Chloris gayana*	Perennial Exotic
06	46	*Chloris gayana*	Perennial Exotic
06	47	*Sporobolus creber*	Perennial Native
06	48	*Chloris gayana*	Perennial Exotic
06	49	*Juncus sp. 2*	Perennial Native
06	50	*Sporobolus creber*	Perennial Native
06	51	*Chloris gayana*	Perennial Exotic
06	52	*Chloris gayana*	Perennial Exotic
06	53	*Chloris gayana*	Perennial Exotic
06	54	*Juncus usitatus*	Perennial Native
06	55	*Cynodon dactylon*	Perennial Native
06	56	*Cynodon dactylon*	Perennial Native
06	57	*Cynodon dactylon*	Perennial Native
06	58	*Cynodon dactylon*	Perennial Native
06	59	*Chloris gayana*	Perennial Exotic
06	60	*Chloris gayana*	Perennial Exotic
06	61	*Paspalum dilatatum*	Perennial Exotic
06	62	*Cynodon dactylon*	Perennial Native
06	63	*Cynodon dactylon*	Perennial Native
06	64	*Microlaena stipoides*	Perennial Native
06	65	*Microlaena stipoides*	Perennial Native
06	66	*Cynodon dactylon*	Perennial Native
06	67	*Cynodon dactylon*	Perennial Native
06	68	*Plantago lanceolata*	Perennial Exotic
06	69	*Chloris gayana*	Perennial Exotic
06	70	*Microlaena stipoides*	Perennial Native
06	71	*Microlaena stipoides*	Perennial Native
06	72	*Hypochaeris radicata*	Perennial Exotic
06	73	*Chloris gayana*	Perennial Exotic
06	74	*Microlaena stipoides*	Perennial Native
06	75	*Microlaena stipoides*	Perennial Native
06	76	*Microlaena stipoides*	Perennial Native
06	77	*Microlaena stipoides*	Perennial Native
06	78	*Conyza bonariensis*	Perennial Exotic
06	79	*Microlaena stipoides*	Perennial Native
06	80	*Microlaena stipoides*	Perennial Native
06	81	*Microlaena stipoides*	Perennial Native
06	82	*Microlaena stipoides*	Perennial Native
06	83	*Cynodon dactylon*	Perennial Native
06	84	*Microlaena stipoides*	Perennial Native
06	85	*Microlaena stipoides*	Perennial Native
06	86	*Sporobolus creber*	Perennial Native
06	87	*Cynodon dactylon*	Perennial Native
06	88	*Plantago lanceolata*	Perennial Exotic
06	89	*Microlaena stipoides*	Perennial Native
06	90	*Microlaena stipoides*	Perennial Native
06	91	*Sporobolus creber*	Perennial Native
06	92	*Sporobolus creber*	Perennial Native
06	93	*Sporobolus creber*	Perennial Native
06	94	*Sporobolus creber*	Perennial Native
06	95	*Microlaena stipoides*	Perennial Native
06	96	*Sporobolus creber*	Perennial Native
06	97	*Sporobolus creber*	Perennial Native
06	98	*Sporobolus creber*	Perennial Native
06	99	*Cynodon dactylon*	Perennial Native
06	100	*Cynodon dactylon*	Perennial Native
07	1	*Rytidosperma sp.*	Perennial Native
07	2	*Microlaena stipoides*	Perennial Native
07	3	*Microlaena stipoides*	Perennial Native
07	4	*Microlaena stipoides*	Perennial Native
07	5	*Cynodon dactylon*	Perennial Native
07	6	*Microlaena stipoides*	Perennial Native
07	7	*Microlaena stipoides*	Perennial Native
07	8	*Microlaena stipoides*	Perennial Native
07	9	*Microlaena stipoides*	Perennial Native
07	10	*Microlaena stipoides*	Perennial Native
07	11	*Modiola caroliniana*	Perennial Exotic
07	12	*Microlaena stipoides*	Perennial Native
07	13	*Chloris gayana*	Perennial Exotic
07	14	*Cynodon dactylon*	Perennial Native

07	15	*Cynodon dactylon*	Perennial Native
07	16	*Microlaena stipoides*	Perennial Native
07	17	*Cynodon dactylon*	Perennial Native
07	18	*Microlaena stipoides*	Perennial Native
07	19	*Microlaena stipoides*	Perennial Native
07	20	*Microlaena stipoides*	Perennial Native
07	21	*Microlaena stipoides*	Perennial Native
07	22	*Microlaena stipoides*	Perennial Native
07	23	*Microlaena stipoides*	Perennial Native
07	24	*Microlaena stipoides*	Perennial Native
07	25	*Chloris gayana*	Perennial Exotic
07	26	*Microlaena stipoides*	Perennial Native
07	27	*Microlaena stipoides*	Perennial Native
07	28	*Modiola caroliniana*	Perennial Exotic
07	29	*Microlaena stipoides*	Perennial Native
07	30	*Chloris gayana*	Perennial Exotic
07	31	*Modiola caroliniana*	Perennial Exotic
07	32	*Microlaena stipoides*	Perennial Native
07	33	*Microlaena stipoides*	Perennial Native
07	34	*Chloris gayana*	Perennial Exotic
07	35	*Microlaena stipoides*	Perennial Native
07	36	*Microlaena stipoides*	Perennial Native
07	37	*Microlaena stipoides*	Perennial Native
07	38	*Hypochaeris radicata*	Perennial Exotic
07	39	*Trifolium repens*	Perennial Exotic
07	40	*Microlaena stipoides*	Perennial Native
07	41	*Microlaena stipoides*	Perennial Native
07	42	*Microlaena stipoides*	Perennial Native
07	43	*Microlaena stipoides*	Perennial Native
07	44	*Microlaena stipoides*	Perennial Native
07	45	*Microlaena stipoides*	Perennial Native
07	46	*Microlaena stipoides*	Perennial Native
07	47	*Microlaena stipoides*	Perennial Native
07	48	*Microlaena stipoides*	Perennial Native
07	49	*Cynodon dactylon*	Perennial Native
07	50	*Cynodon dactylon*	Perennial Native
07	51	*Microlaena stipoides*	Perennial Native
07	52	*Microlaena stipoides*	Perennial Native
07	53	*Bare Earth*	N/A
07	54	*Microlaena stipoides*	Perennial Native
07	55	*Geranium solanderi*	Perennial Native
07	56	*Microlaena stipoides*	Perennial Native
07	57	*Microlaena stipoides*	Perennial Native
07	58	*Microlaena stipoides*	Perennial Native
07	59	*Microlaena stipoides*	Perennial Native
07	60	*Microlaena stipoides*	Perennial Native
07	61	*Microlaena stipoides*	Perennial Native
07	62	*Conyza bonariensis*	Perennial Exotic
07	63	*Plantago lanceolata*	Perennial Exotic
07	64	*Microlaena stipoides*	Perennial Native
07	65	*Microlaena stipoides*	Perennial Native
07	66	*Microlaena stipoides*	Perennial Native
07	67	*Microlaena stipoides*	Perennial Native
07	68	*Rumex acetosella*	Perennial Exotic
07	69	*Microlaena stipoides*	Perennial Native
07	70	*Conyza bonariensis*	Perennial Exotic
07	71	*Microlaena stipoides*	Perennial Native
07	72	*Microlaena stipoides*	Perennial Native
07	73	*Hypochaeris radicata*	Perennial Exotic
07	74	*Microlaena stipoides*	Perennial Native
07	75	*Microlaena stipoides*	Perennial Native
07	76	*Microlaena stipoides*	Perennial Native
07	77	*Microlaena stipoides*	Perennial Native
07	78	*Microlaena stipoides*	Perennial Native
07	79	*Arctotheca calendula*	Perennial Exotic
07	80	*Microlaena stipoides*	Perennial Native
07	81	*Modiola caroliniana*	Perennial Exotic
07	82	*Microlaena stipoides*	Perennial Native
07	83	*Microlaena stipoides*	Perennial Native
07	84	*Microlaena stipoides*	Perennial Native
07	85	*Microlaena stipoides*	Perennial Native
07	86	*Microlaena stipoides*	Perennial Native
07	87	*Trifolium repens*	Perennial Exotic
07	88	*Microlaena stipoides*	Perennial Native
07	89	*Trifolium repens*	Perennial Exotic
07	90	*Microlaena stipoides*	Perennial Native
07	91	*Microlaena stipoides*	Perennial Native
07	92	*Microlaena stipoides*	Perennial Native
07	93	*Microlaena stipoides*	Perennial Native
07	94	*Microlaena stipoides*	Perennial Native
07	95	*Microlaena stipoides*	Perennial Native
07	96	*Microlaena stipoides*	Perennial Native
07	97	*Geranium solanderi*	Perennial Native
07	98	*Microlaena stipoides*	Perennial Native
07	99	*Microlaena stipoides*	Perennial Native
07	100	*Microlaena stipoides*	Perennial Native
08	1	*Cynodon dactylon*	Perennial Native
08	2	*Bromus catharticus*	Perennial Exotic
08	3	*Bromus catharticus*	Perennial Exotic
08	4	*Bromus catharticus*	Perennial Exotic
08	5	*Bromus catharticus*	Perennial Exotic
08	6	*Oxalis perennans*	Perennial Exotic
08	7	*Bromus catharticus*	Perennial Exotic
08	8	*Bromus catharticus*	Perennial Exotic
08	9	*Cynodon dactylon*	Perennial Native
08	10	*Cynodon dactylon*	Perennial Native
08	11	*Microlaena stipoides*	Perennial Native
08	12	*Microlaena stipoides*	Perennial Native
08	13	*Microlaena stipoides*	Perennial Native
08	14	*Microlaena stipoides*	Perennial Native
08	15	*Microlaena stipoides*	Perennial Native
08	16	*Microlaena stipoides*	Perennial Native
08	17	*Microlaena stipoides*	Perennial Native
08	18	*Phalaris aquatica*	Perennial Exotic
08	19	*Microlaena stipoides*	Perennial Native

08	20	*Microlaena stipoides*	Perennial Native
08	21	*Microlaena stipoides*	Perennial Native
08	22	*Cynodon dactylon*	Perennial Native
08	23	*Cynodon dactylon*	Perennial Native
08	24	*Bare Earth*	N/A
08	25	*Cynodon dactylon*	Perennial Native
08	26	*Cynodon dactylon*	Perennial Native
08	27	*Cynodon dactylon*	Perennial Native
08	28	*Cynodon dactylon*	Perennial Native
08	29	*Cynodon dactylon*	Perennial Native
08	30	*Cynodon dactylon*	Perennial Native
08	31	*Oxalis perennans*	Perennial Exotic
08	32	*Cynodon dactylon*	Perennial Native
08	33	*Cynodon dactylon*	Perennial Native
08	34	*Arctotheca calendula*	Perennial Exotic
08	35	*Trifolium repens*	Perennial Exotic
08	36	*Bromus catharticus*	Perennial Exotic
08	37	*Phalaris aquatica*	Perennial Exotic
08	38	*Arctotheca calendula*	Perennial Exotic
08	39	*Verbena bonariensis*	Perennial Exotic
08	40	*Arctotheca calendula*	Perennial Exotic
08	41	*Verbena bonariensis*	Perennial Exotic
08	42	*Microlaena stipoides*	Perennial Native
08	43	*Oxalis perennans*	Perennial Exotic
08	44	*Microlaena stipoides*	Perennial Native
08	45	*Microlaena stipoides*	Perennial Native
08	46	*Plantago lanceolata*	Perennial Exotic
08	47	*Microlaena stipoides*	Perennial Native
08	48	*Microlaena stipoides*	Perennial Native
08	49	*Microlaena stipoides*	Perennial Native
08	50	*Arctotheca calendula*	Perennial Exotic
08	51	*Cirsium vulgare*	Perennial Exotic
08	52	*Microlaena stipoides*	Perennial Native
08	53	*Cirsium vulgare*	Perennial Exotic
08	54	*Rumex crispus*	Perennial Exotic
08	55	*Microlaena stipoides*	Perennial Native
08	56	*Microlaena stipoides*	Perennial Native
08	57	*Microlaena stipoides*	Perennial Native
08	58	*Microlaena stipoides*	Perennial Native
08	59	*Microlaena stipoides*	Perennial Native
08	60	*Microlaena stipoides*	Perennial Native
08	61	*Cirsium vulgare*	Perennial Exotic
08	62	*Microlaena stipoides*	Perennial Native
08	63	*Modiola caroliniana*	Perennial Exotic
08	64	*Microlaena stipoides*	Perennial Native
08	65	*Phalaris aquatica*	Perennial Exotic
08	66	*Bromus catharticus*	Perennial Exotic
08	67	*Bromus catharticus*	Perennial Exotic
08	68	*Bromus catharticus*	Perennial Exotic
08	69	*Microlaena stipoides*	Perennial Native
08	70	*Microlaena stipoides*	Perennial Native
08	71	*Microlaena stipoides*	Perennial Native
08	72	*Microlaena stipoides*	Perennial Native
08	73	*Microlaena stipoides*	Perennial Native
08	74	*Microlaena stipoides*	Perennial Native
08	75	*Microlaena stipoides*	Perennial Native
08	76	*Microlaena stipoides*	Perennial Native
08	77	*Microlaena stipoides*	Perennial Native
08	78	*Microlaena stipoides*	Perennial Native
08	79	*Microlaena stipoides*	Perennial Native
08	80	*Modiola caroliniana*	Perennial Exotic
08	81	*Trifolium repens*	Perennial Exotic
08	82	*Microlaena stipoides*	Perennial Native
08	83	*Microlaena stipoides*	Perennial Native
08	84	*Phalaris aquatica*	Perennial Exotic
08	85	*Microlaena stipoides*	Perennial Native
08	86	*Bromus catharticus*	Perennial Exotic
08	87	*Bromus catharticus*	Perennial Exotic
08	88	*Microlaena stipoides*	Perennial Native
08	89	*Microlaena stipoides*	Perennial Native
08	90	*Microlaena stipoides*	Perennial Native
08	91	*Bromus catharticus*	Perennial Exotic
08	92	*Bromus catharticus*	Perennial Exotic
08	93	*Bromus catharticus*	Perennial Exotic
08	94	*Bromus catharticus*	Perennial Exotic
08	95	*Bromus catharticus*	Perennial Exotic
08	96	*Microlaena stipoides*	Perennial Native
08	97	*Microlaena stipoides*	Perennial Native
08	98	*Bromus catharticus*	Perennial Exotic
08	99	*Microlaena stipoides*	Perennial Native
08	100	*Microlaena stipoides*	Perennial Native
09	1	*Bare Earth*	N/A
09	2	*Paspalum dilatatum*	Perennial Exotic
09	3	*Verbena bonariensis*	Perennial Exotic
09	4	*Microlaena stipoides*	Perennial Native
09	5	*Cynodon dactylon*	Perennial Native
09	6	*Microlaena stipoides*	Perennial Native
09	7	*Microlaena stipoides*	Perennial Native
09	8	*Microlaena stipoides*	Perennial Native
09	9	*Microlaena stipoides*	Perennial Native
09	10	*Microlaena stipoides*	Perennial Native
09	11	*Microlaena stipoides*	Perennial Native
09	12	*Microlaena stipoides*	Perennial Native
09	13	*Microlaena stipoides*	Perennial Native
09	14	*Microlaena stipoides*	Perennial Native
09	15	*Sporobolus creber*	Perennial Native
09	16	*Microlaena stipoides*	Perennial Native
09	17	*Microlaena stipoides*	Perennial Native
09	18	*Microlaena stipoides*	Perennial Native
09	19	*Microlaena stipoides*	Perennial Native
09	20	*Microlaena stipoides*	Perennial Native
09	21	*Thinopyrum ponticum*	Perennial Exotic
09	22	*Microlaena stipoides*	Perennial Native
09	23	*Microlaena stipoides*	Perennial Native
09	24	*Verbena bonariensis*	Perennial Exotic

09	25	*Microlaena stipoides*	Perennial Native
09	26	*Microlaena stipoides*	Perennial Native
09	27	*Paspalum dilatatum*	Perennial Exotic
09	28	*Cirsium vulgare*	Perennial Exotic
09	29	*Geranium solanderi*	Perennial Native
09	30	*Rytidosperma sp.*	Perennial Native
09	31	*Microlaena stipoides*	Perennial Native
09	32	*Microlaena stipoides*	Perennial Native
09	33	*Microlaena stipoides*	Perennial Native
09	34	*Hypericum perforatum*	Perennial Exotic
09	35	*Microlaena stipoides*	Perennial Native
09	36	*Microlaena stipoides*	Perennial Native
09	37	*Paspalum dilatatum*	Perennial Exotic
09	38	*Microlaena stipoides*	Perennial Native
09	39	*Rytidosperma sp.*	Perennial Native
09	40	*Rytidosperma sp.*	Perennial Native
09	41	*Rytidosperma sp.*	Perennial Native
09	42	*Microlaena stipoides*	Perennial Native
09	43	*Rytidosperma sp.*	Perennial Native
09	44	*Rytidosperma sp.*	Perennial Native
09	45	*Trifolium repens*	Perennial Exotic
09	46	*Microlaena stipoides*	Perennial Native
09	47	*Paspalum dilatatum*	Perennial Exotic
09	48	*Rytidosperma sp.*	Perennial Native
09	49	*Paspalum dilatatum*	Perennial Exotic
09	50	*Microlaena stipoides*	Perennial Native
09	51	*Microlaena stipoides*	Perennial Native
09	52	*Paspalum dilatatum*	Perennial Exotic
09	53	*Microlaena stipoides*	Perennial Native
09	54	*Microlaena stipoides*	Perennial Native
09	55	*Thinopyrum ponticum*	Perennial Exotic
09	56	*Geranium solanderi*	Perennial Native
09	57	*Rytidosperma sp.*	Perennial Native
09	58	*Paspalum dilatatum*	Perennial Exotic
09	59	*Microlaena stipoides*	Perennial Native
09	60	*Microlaena stipoides*	Perennial Native
09	61	*Microlaena stipoides*	Perennial Native
09	62	*Microlaena stipoides*	Perennial Native
09	63	*Microlaena stipoides*	Perennial Native
09	64	*Paspalum dilatatum*	Perennial Exotic
09	65	*Paspalum dilatatum*	Perennial Exotic
09	66	*Paspalum dilatatum*	Perennial Exotic
09	67	*Paspalum dilatatum*	Perennial Exotic
09	68	*Microlaena stipoides*	Perennial Native
09	69	*Microlaena stipoides*	Perennial Native
09	70	*Microlaena stipoides*	Perennial Native
09	71	*Microlaena stipoides*	Perennial Native
09	72	*Microlaena stipoides*	Perennial Native
09	73	*Modiola caroliniana*	Perennial Exotic
09	74	Arctotheca calendula	Perennial Exotic
09	75	*Microlaena stipoides*	Perennial Native
09	76	*Microlaena stipoides*	Perennial Native
09	77	*Microlaena stipoides*	Perennial Native
09	78	*Sporobolus creber*	Perennial Native
09	79	*Sporobolus creber*	Perennial Native
09	80	*Microlaena stipoides*	Perennial Native
09	81	*Microlaena stipoides*	Perennial Native
09	82	*Verbena bonariensis*	Perennial Exotic
09	83	*Verbena bonariensis*	Perennial Exotic
09	84	*Sporobolus creber*	Perennial Native
09	85	*Sporobolus creber*	Perennial Native
09	86	*Hypericum perforatum*	Perennial Exotic
09	87	*Microlaena stipoides*	Perennial Native
09	88	*Chloris gayana*	Perennial Exotic
09	89	*Chloris gayana*	Perennial Exotic
09	90	*Sporobolus creber*	Perennial Native
09	91	*Microlaena stipoides*	Perennial Native
09	92	*Microlaena stipoides*	Perennial Native
09	93	*Microlaena stipoides*	Perennial Native
09	94	*Chloris gayana*	Perennial Exotic
09	95	*Juncus usitatus*	Perennial Native
09	96	*Hypericum perforatum*	Perennial Exotic
09	97	*Paspalum dilatatum*	Perennial Exotic
09	98	*Microlaena stipoides*	Perennial Native
09	99	*Paspalum dilatatum*	Perennial Exotic
09	100	*Hypericum perforatum*	Perennial Exotic
10	1	*Bare Earth*	N/A
10	2	*Microlaena stipoides*	Perennial Native
10	3	*Microlaena stipoides*	Perennial Native
10	4	*Microlaena stipoides*	Perennial Native
10	5	*Microlaena stipoides*	Perennial Native
10	6	*Microlaena stipoides*	Perennial Native
10	7	*Microlaena stipoides*	Perennial Native
10	8	*Juncus usitatus*	Perennial Native
10	9	*Hypericum perforatum*	Perennial Exotic
10	10	*Cynodon dactylon*	Perennial Native
10	11	*Thinopyrum ponticum*	Perennial Exotic
10	12	*Cynodon dactylon*	Perennial Native
10	13	*Verbascum thapsus*	Perennial Exotic
10	14	*Verbascum thapsus*	Perennial Exotic
10	15	*Microlaena stipoides*	Perennial Native
10	16	*Modiola caroliniana*	Perennial Exotic
10	17	*Microlaena stipoides*	Perennial Native
10	18	*Microlaena stipoides*	Perennial Native
10	19	*Microlaena stipoides*	Perennial Native
10	20	*Hypericum perforatum*	Perennial Exotic
10	21	*Microlaena stipoides*	Perennial Native
10	22	*Modiola caroliniana*	Perennial Exotic
10	23	*Microlaena stipoides*	Perennial Native
10	24	*Microlaena stipoides*	Perennial Native
10	25	*Microlaena stipoides*	Perennial Native
10	26	*Bare Earth*	N/A
10	27	*Sporobolus creber*	Perennial Native
10	28	*Hypericum perforatum*	Perennial Exotic
10	29	*Microlaena stipoides*	Perennial Native

10	30	*Modiola caroliniana*	Perennial Exotic
10	31	*Microlaena stipoides*	Perennial Native
10	32	*Microlaena stipoides*	Perennial Native
10	33	*Hypericum perforatum*	Perennial Exotic
10	34	*Cynodon dactylon*	Perennial Native
10	35	*Cynodon dactylon*	Perennial Native
10	36	*Cynodon dactylon*	Perennial Native
10	37	*Cynodon dactylon*	Perennial Native
10	38	*Cynodon dactylon*	Perennial Native
10	39	*Hypericum perforatum*	Perennial Exotic
10	40	*Cynodon dactylon*	Perennial Native
10	41	*Cynodon dactylon*	Perennial Native
10	42	*Cynodon dactylon*	Perennial Native
10	43	*Cynodon dactylon*	Perennial Native
10	44	*Cynodon dactylon*	Perennial Native
10	45	*Hypericum perforatum*	Perennial Exotic
10	46	*Modiola caroliniana*	Perennial Exotic
10	47	*Microlaena stipoides*	Perennial Native
10	48	*Microlaena stipoides*	Perennial Native
10	49	*Microlaena stipoides*	Perennial Native
10	50	*Hypericum perforatum*	Perennial Exotic
10	51	*Hypericum perforatum*	Perennial Exotic
10	52	*Verbena bonariensis*	Perennial Exotic
10	53	*Microlaena stipoides*	Perennial Native
10	54	*Paspalum dilatatum*	Perennial Exotic
10	55	*Microlaena stipoides*	Perennial Native
10	56	*Bare Earth*	N/A
10	57	*Hypericum perforatum*	Perennial Exotic
10	58	*Microlaena stipoides*	Perennial Native
10	59	*Modiola caroliniana*	Perennial Exotic
10	60	*Microlaena stipoides*	Perennial Native
10	61	*Microlaena stipoides*	Perennial Native
10	62	*Paspalum dilatatum*	Perennial Exotic
10	63	*Microlaena stipoides*	Perennial Native
10	64	*Microlaena stipoides*	Perennial Native
10	65	*Microlaena stipoides*	Perennial Native
10	66	*Microlaena stipoides*	Perennial Native
10	67	*Microlaena stipoides*	Perennial Native
10	68	*Microlaena stipoides*	Perennial Native
10	69	*Microlaena stipoides*	Perennial Native
10	70	*Plantago lanceolata*	Perennial Exotic
10	71	*Microlaena stipoides*	Perennial Native
10	72	*Microlaena stipoides*	Perennial Native
10	73	*Modiola caroliniana*	Perennial Exotic
10	74	*Microlaena stipoides*	Perennial Native
10	75	*Microlaena stipoides*	Perennial Native
10	76	*Microlaena stipoides*	Perennial Native
10	77	*Microlaena stipoides*	Perennial Native
10	78	*Verbena bonariensis*	Perennial Exotic
10	79	*Microlaena stipoides*	Perennial Native
10	80	*Paspalum dilatatum*	Perennial Exotic
10	81	*Microlaena stipoides*	Perennial Native
10	82	*Microlaena stipoides*	Perennial Native
10	83	*Thinopyrum ponticum*	Perennial Exotic
10	84	*Hypericum perforatum*	Perennial Exotic
10	85	*Hypericum perforatum*	Perennial Exotic
10	86	*Thinopyrum ponticum*	Perennial Exotic
10	87	*Verbena bonariensis*	Perennial Exotic
10	88	*Thinopyrum ponticum*	Perennial Exotic
10	89	*Microlaena stipoides*	Perennial Native
10	90	*Microlaena stipoides*	Perennial Native
10	91	*Microlaena stipoides*	Perennial Native
10	92	*Microlaena stipoides*	Perennial Native
10	93	*Microlaena stipoides*	Perennial Native
10	94	*Microlaena stipoides*	Perennial Native
10	95	*Microlaena stipoides*	Perennial Native
10	96	*Hypericum perforatum*	Perennial Exotic
10	97	*Paspalum dilatatum*	Perennial Exotic
10	98	*Microlaena stipoides*	Perennial Native
10	99	*Microlaena stipoides*	Perennial Native
10	100	*Microlaena stipoides*	Perennial Native
11	1	*Phalaris aquatica*	Perennial Exotic
11	2	*Phalaris aquatica*	Perennial Exotic
11	3	*Phalaris aquatica*	Perennial Exotic
11	4	*Phalaris aquatica*	Perennial Exotic
11	5	*Verbena bonariensis*	Perennial Exotic
11	6	*Phalaris aquatica*	Perennial Exotic
11	7	*Phalaris aquatica*	Perennial Exotic
11	8	*Phalaris aquatica*	Perennial Exotic
11	9	*Cynodon dactylon*	Perennial Native
11	10	*Phalaris aquatica*	Perennial Exotic
11	11	*Phalaris aquatica*	Perennial Exotic
11	12	*Phalaris aquatica*	Perennial Exotic
11	13	*Phalaris aquatica*	Perennial Exotic
11	14	*Phalaris aquatica*	Perennial Exotic
11	15	*Phalaris aquatica*	Perennial Exotic
11	16	*Verbena bonariensis*	Perennial Exotic
11	17	*Hypericum perforatum*	Perennial Exotic
11	18	*Phalaris aquatica*	Perennial Exotic
11	19	*Phalaris aquatica*	Perennial Exotic
11	20	*Phalaris aquatica*	Perennial Exotic
11	21	*Phalaris aquatica*	Perennial Exotic
11	22	*Microlaena stipoides*	Perennial Native
11	23	*Phalaris aquatica*	Perennial Exotic
11	24	*Microlaena stipoides*	Perennial Native
11	25	*Verbena bonariensis*	Perennial Exotic
11	26	*Phalaris aquatica*	Perennial Exotic
11	27	*Microlaena stipoides*	Perennial Native
11	28	*Microlaena stipoides*	Perennial Native
11	29	*Microlaena stipoides*	Perennial Native
11	30	*Phalaris aquatica*	Perennial Exotic
11	31	*Phalaris aquatica*	Perennial Exotic
11	32	*Phalaris aquatica*	Perennial Exotic
11	33	*Microlaena stipoides*	Perennial Native
11	34	*Microlaena stipoides*	Perennial Native

11	35	*Phalaris aquatica*	Perennial Exotic
11	36	*Phalaris aquatica*	Perennial Exotic
11	37	*Phalaris aquatica*	Perennial Exotic
11	38	*Phalaris aquatica*	Perennial Exotic
11	39	*Microlaena stipoides*	Perennial Native
11	40	*Phalaris aquatica*	Perennial Exotic
11	41	*Phalaris aquatica*	Perennial Exotic
11	42	*Phalaris aquatica*	Perennial Exotic
11	43	*Phalaris aquatica*	Perennial Exotic
11	44	*Phalaris aquatica*	Perennial Exotic
11	45	*Microlaena stipoides*	Perennial Native
11	46	*Cynodon dactylon*	Perennial Native
11	47	*Microlaena stipoides*	Perennial Native
11	48	*Microlaena stipoides*	Perennial Native
11	49	*Phalaris aquatica*	Perennial Exotic
11	50	*Phalaris aquatica*	Perennial Exotic
11	51	*Phalaris aquatica*	Perennial Exotic
11	52	*Microlaena stipoides*	Perennial Native
11	53	*Microlaena stipoides*	Perennial Native
11	54	*Microlaena stipoides*	Perennial Native
11	55	*Microlaena stipoides*	Perennial Native
11	56	*Microlaena stipoides*	Perennial Native
11	57	*Phalaris aquatica*	Perennial Exotic
11	58	*Microlaena stipoides*	Perennial Native
11	59	*Microlaena stipoides*	Perennial Native
11	60	*Microlaena stipoides*	Perennial Native
11	61	*Phalaris aquatica*	Perennial Exotic
11	62	*Microlaena stipoides*	Perennial Native
11	63	*Phalaris aquatica*	Perennial Exotic
11	64	*Microlaena stipoides*	Perennial Native
11	65	*Microlaena stipoides*	Perennial Native
11	66	*Microlaena stipoides*	Perennial Native
11	67	*Phalaris aquatica*	Perennial Exotic
11	68	*Phalaris aquatica*	Perennial Exotic
11	69	*Phalaris aquatica*	Perennial Exotic
11	70	*Phalaris aquatica*	Perennial Exotic
11	71	*Microlaena stipoides*	Perennial Native
11	72	*Microlaena stipoides*	Perennial Native
11	73	*Juncus usitatus*	Perennial Native
11	74	*Juncus usitatus*	Perennial Native
11	75	*Phalaris aquatica*	Perennial Exotic
11	76	*Microlaena stipoides*	Perennial Native
11	77	*Cynodon dactylon*	Perennial Native
11	78	*Cynodon dactylon*	Perennial Native
11	79	*Cynodon dactylon*	Perennial Native
11	80	*Phalaris aquatica*	Perennial Exotic
11	81	*Phalaris aquatica*	Perennial Exotic
11	82	*Phalaris aquatica*	Perennial Exotic
11	83	*Phalaris aquatica*	Perennial Exotic
11	84	*Microlaena stipoides*	Perennial Native
11	85	*Microlaena stipoides*	Perennial Native
11	86	*Juncus usitatus*	Perennial Native
11	87	*Paspalum dilatatum*	Perennial Exotic
11	88	*Cynodon dactylon*	Perennial Native
11	89	*Paspalum dilatatum*	Perennial Exotic
11	90	*Paspalum dilatatum*	Perennial Exotic
11	91	*Juncus usitatus*	Perennial Native
11	92	*Juncus usitatus*	Perennial Native
11	93	*Paspalum dilatatum*	Perennial Exotic
11	94	*Juncus usitatus*	Perennial Native
11	95	*Phalaris aquatica*	Perennial Exotic
11	96	*Microlaena stipoides*	Perennial Native
11	97	*Cynodon dactylon*	Perennial Native
11	98	*Paspalum dilatatum*	Perennial Exotic
11	99	*Verbena bonariensis*	Perennial Exotic
11	100	*Paspalum dilatatum*	Perennial Exotic
12	1	*Rumex acetosella*	Perennial Exotic
12	2	*Microlaena stipoides*	Perennial Native
12	3	*Microlaena stipoides*	Perennial Native
12	4	*Rumex acetosella*	Perennial Exotic
12	5	*Rumex acetosella*	Perennial Exotic
12	6	*Rumex acetosella*	Perennial Exotic
12	7	*Cynodon dactylon*	Perennial Native
12	8	*Bare Earth*	N/A
12	9	*Microlaena stipoides*	Perennial Native
12	10	*Rumex acetosella*	Perennial Exotic
12	11	*Rumex acetosella*	Perennial Exotic
12	12	*Microlaena stipoides*	Perennial Native
12	13	*Microlaena stipoides*	Perennial Native
12	14	Arctotheca calendula	Perennial Exotic
12	15	*Cynodon dactylon*	Perennial Native
12	16	*Microlaena stipoides*	Perennial Native
12	17	*Rumex acetosella*	Perennial Exotic
12	18	*Bare Earth*	N/A
12	19	*Bare Earth*	N/A
12	20	*Bare Earth*	N/A
12	21	Arctotheca calendula	Perennial Exotic
12	22	*Verbascum thapsus*	Perennial Exotic
12	23	*Bare Earth*	N/A
12	24	*Rumex acetosella*	Perennial Exotic
12	25	*Rumex acetosella*	Perennial Exotic
12	26	*Rumex acetosella*	Perennial Exotic
12	27	*Microlaena stipoides*	Perennial Native
12	28	*Rumex acetosella*	Perennial Exotic
12	29	*Verbascum thapsus*	Perennial Exotic
12	30	*Rumex acetosella*	Perennial Exotic
12	31	*Rumex acetosella*	Perennial Exotic
12	32	*Rumex acetosella*	Perennial Exotic
12	33	*Rumex acetosella*	Perennial Exotic
12	34	*Microlaena stipoides*	Perennial Native
12	35	*Rumex acetosella*	Perennial Exotic
12	36	*Microlaena stipoides*	Perennial Native
12	37	*Microlaena stipoides*	Perennial Native
12	38	*Rumex acetosella*	Perennial Exotic
12	39	*Rumex acetosella*	Perennial Exotic

12	40	*Rumex acetosella*	Perennial Exotic
12	41	*Rumex acetosella*	Perennial Exotic
12	42	*Rumex acetosella*	Perennial Exotic
12	43	*Rumex acetosella*	Perennial Exotic
12	44	Arctotheca calendula	Perennial Exotic
12	45	*Rumex acetosella*	Perennial Exotic
12	46	*Verbascum thapsus*	Perennial Exotic
12	47	*Rumex acetosella*	Perennial Exotic
12	48	*Rumex acetosella*	Perennial Exotic
12	49	*Rumex acetosella*	Perennial Exotic
12	50	*Cynodon dactylon*	Perennial Native
12	51	*Rumex acetosella*	Perennial Exotic
12	52	*Rumex acetosella*	Perennial Exotic
12	53	*Bare Earth*	N/A
12	54	*Rumex acetosella*	Perennial Exotic
12	55	*Rumex acetosella*	Perennial Exotic
12	56	*Rumex acetosella*	Perennial Exotic
12	57	*Rumex acetosella*	Perennial Exotic
12	58	*Rumex acetosella*	Perennial Exotic
12	59	*Rumex acetosella*	Perennial Exotic
12	60	*Microlaena stipoides*	Perennial Native
12	61	*Rumex acetosella*	Perennial Exotic
12	62	*Plantago lanceolata*	Perennial Exotic
12	63	*Microlaena stipoides*	Perennial Native
12	64	*Rumex acetosella*	Perennial Exotic
12	65	*Microlaena stipoides*	Perennial Native
12	66	*Microlaena stipoides*	Perennial Native
12	67	*Sporobolus creber*	Perennial Native
12	68	*Rumex acetosella*	Perennial Exotic
12	69	*Rumex acetosella*	Perennial Exotic
12	70	*Microlaena stipoides*	Perennial Native
12	71	*Microlaena stipoides*	Perennial Native
12	72	Arctotheca calendula	Perennial Exotic
12	73	*Microlaena stipoides*	Perennial Native
12	74	*Microlaena stipoides*	Perennial Native
12	75	*Microlaena stipoides*	Perennial Native
12	76	*Rumex acetosella*	Perennial Exotic
12	77	*Microlaena stipoides*	Perennial Native
12	78	*Rumex acetosella*	Perennial Exotic
12	79	*Rumex acetosella*	Perennial Exotic
12	80	*Bare Earth*	N/A
12	81	*Rumex acetosella*	Perennial Exotic
12	82	*Rumex acetosella*	Perennial Exotic
12	83	*Rumex acetosella*	Perennial Exotic
12	84	*Rumex acetosella*	Perennial Exotic
12	85	*Microlaena stipoides*	Perennial Native
12	86	*Bare Earth*	N/A
12	87	*Microlaena stipoides*	Perennial Native
12	88	*Microlaena stipoides*	Perennial Native
12	89	*Rumex acetosella*	Perennial Exotic
12	90	*Bare Earth*	N/A
12	91	*Bare Earth*	N/A
12	92	Arctotheca calendula	Perennial Exotic
12	93	*Rumex acetosella*	Perennial Exotic
12	94	Arctotheca calendula	Perennial Exotic
12	95	Arctotheca calendula	Perennial Exotic
12	96	*Bare Earth*	N/A
12	97	*Rumex acetosella*	Perennial Exotic
12	98	*Bare Earth*	N/A
12	99	*Bare Earth*	N/A
12	100	*Rumex acetosella*	Perennial Exotic
13	1	*Plantago lanceolata*	Perennial Exotic
13	2	*Setaria parviflora*	Perennial Exotic
13	3	*Setaria parviflora*	Perennial Exotic
13	4	*Microlaena stipoides*	Perennial Native
13	5	*Setaria parviflora*	Perennial Exotic
13	6	*Microlaena stipoides*	Perennial Native
13	7	*Arctotheca calendula*	Perennial Exotic
13	8	*Cotula bipinnata*	Perennial Exotic
13	9	*Hypochaeris radicata*	Perennial Exotic
13	10	*Hypochaeris radicata*	Perennial Exotic
13	11	*Hypochaeris radicata*	Perennial Exotic
13	12	*Setaria parviflora*	Perennial Exotic
13	13	*Setaria parviflora*	Perennial Exotic
13	14	*Microlaena stipoides*	Perennial Native
13	15	*Hypochaeris radicata*	Perennial Exotic
13	16	*Hypochaeris radicata*	Perennial Exotic
13	17	*Plantago lanceolata*	Perennial Exotic
13	18	*Microlaena stipoides*	Perennial Native
13	19	*Microlaena stipoides*	Perennial Native
13	20	*Microlaena stipoides*	Perennial Native
13	21	*Hypochaeris radicata*	Perennial Exotic
13	22	*Setaria parviflora*	Perennial Exotic
13	23	*Phalaris aquatica*	Perennial Exotic
13	24	*Microlaena stipoides*	Perennial Native
13	25	*Hypochaeris radicata*	Perennial Exotic
13	26	*Microlaena stipoides*	Perennial Native
13	27	*Microlaena stipoides*	Perennial Native
13	28	*Setaria parviflora*	Perennial Exotic
13	29	*Hypochaeris radicata*	Perennial Exotic
13	30	*Trifolium repens*	Perennial Exotic
13	31	*Microlaena stipoides*	Perennial Native
13	32	*Microlaena stipoides*	Perennial Native
13	33	*Arctotheca calendula*	Perennial Exotic
13	34	*Cynodon dactylon*	Perennial Native
13	35	*Verbascum thapsus*	Perennial Exotic
13	36	*Setaria parviflora*	Perennial Exotic
13	37	*Setaria parviflora*	Perennial Exotic
13	38	*Setaria parviflora*	Perennial Exotic
13	39	*Sporobolus creber*	Perennial Native
13	40	*Setaria parviflora*	Perennial Exotic
13	41	*Hypochaeris radicata*	Perennial Exotic
13	42	*Setaria parviflora*	Perennial Exotic
13	43	*Microlaena stipoides*	Perennial Native
13	44	*Setaria parviflora*	Perennial Exotic

13	45	*Phalaris aquatica*	Perennial Exotic
13	46	*Microlaena stipoides*	Perennial Native
13	47	*Microlaena stipoides*	Perennial Native
13	48	*Setaria parviflora*	Perennial Exotic
13	49	*Hypochaeris radicata*	Perennial Exotic
13	50	*Microlaena stipoides*	Perennial Native
13	51	*Setaria parviflora*	Perennial Exotic
13	52	*Hypochaeris radicata*	Perennial Exotic
13	53	*Setaria parviflora*	Perennial Exotic
13	54	*Setaria parviflora*	Perennial Exotic
13	55	*Setaria parviflora*	Perennial Exotic
13	56	*Hypochaeris radicata*	Perennial Exotic
13	57	*Hypochaeris radicata*	Perennial Exotic
13	58	*Verbascum thapsus*	Perennial Exotic
13	59	*Plantago lanceolata*	Perennial Exotic
13	60	*Microlaena stipoides*	Perennial Native
13	61	*Setaria parviflora*	Perennial Exotic
13	62	*Plantago lanceolata*	Perennial Exotic
13	63	*Sporobolus creber*	Perennial Native
13	64	*Setaria parviflora*	Perennial Exotic
13	65	*Eleusine tristachya*	Perennial Exotic
13	66	*Setaria parviflora*	Perennial Exotic
13	67	*Geranium solanderi*	Perennial Native
13	68	*Sporobolus creber*	Perennial Native
13	69	*Microlaena stipoides*	Perennial Native
13	70	*Eragrostis parviflora*	Perennial Exotic
13	71	*Trifolium repens*	Perennial Exotic
13	72	*Microlaena stipoides*	Perennial Native
13	73	*Microlaena stipoides*	Perennial Native
13	74	*Trifolium repens*	Perennial Exotic
13	75	*Trifolium repens*	Perennial Exotic
13	76	*Microlaena stipoides*	Perennial Native
13	77	*Trifolium repens*	Perennial Exotic
13	78	*Microlaena stipoides*	Perennial Native
13	79	*Microlaena stipoides*	Perennial Native
13	80	*Verbena bonariensis*	Perennial Exotic
13	81	*Microlaena stipoides*	Perennial Native
13	82	*Setaria parviflora*	Perennial Exotic
13	83	*Microlaena stipoides*	Perennial Native
13	84	*Microlaena stipoides*	Perennial Native
13	85	*Microlaena stipoides*	Perennial Native
13	86	*Plantago lanceolata*	Perennial Exotic
13	87	*Trifolium repens*	Perennial Exotic
13	88	*Lythrum hyssopifolia*	Annual Native
13	89	*Hypochaeris radicata*	Perennial Exotic
13	90	*Setaria parviflora*	Perennial Exotic
13	91	*Lythrum hyssopifolia*	Annual Native
13	92	*Lythrum hyssopifolia*	Annual Native
13	93	*Lythrum hyssopifolia*	Annual Native
13	94	*Setaria parviflora*	Perennial Exotic
13	95	*Microlaena stipoides*	Perennial Native
13	96	*Microlaena stipoides*	Perennial Native
13	97	*Lythrum hyssopifolia*	Annual Native
13	98	*Setaria parviflora*	Perennial Exotic
13	99	*Setaria parviflora*	Perennial Exotic
13	100	*Setaria parviflora*	Perennial Exotic
14	1	*Tagetes minuta*	Perennial Exotic
14	2	*Modiola caroliniana*	Perennial Exotic
14	3	*Microlaena stipoides*	Perennial Native
14	4	*Chloris gayana*	Perennial Exotic
14	5	*Microlaena stipoides*	Perennial Native
14	6	*Chloris gayana*	Perennial Exotic
14	7	*Sporobolus creber*	Perennial Native
14	8	*Sporobolus creber*	Perennial Native
14	9	*Hypericum perforatum*	Perennial Exotic
14	10	*Microlaena stipoides*	Perennial Native
14	11	*Chloris gayana*	Perennial Exotic
14	12	*Sporobolus creber*	Perennial Native
14	13	*Sporobolus creber*	Perennial Native
14	14	*Trifolium repens*	Perennial Exotic
14	15	*Hypericum perforatum*	Perennial Exotic
14	16	*lomandra multiflora subsp. multiflora*	Perennial Native
14	17	*Chloris gayana*	Perennial Exotic
14	18	*Hypericum perforatum*	Perennial Exotic
14	19	*Trifolium repens*	Perennial Exotic
14	20	*Microlaena stipoides*	Perennial Native
14	21	*Setaria parviflora*	Perennial Exotic
14	22	*Trifolium repens*	Perennial Exotic
14	23	*Microlaena stipoides*	Perennial Native
14	24	*Microlaena stipoides*	Perennial Native
14	25	*Hypericum perforatum*	Perennial Exotic
14	26	*Microlaena stipoides*	Perennial Native
14	27	*Sporobolus creber*	Perennial Native
14	28	*Chloris gayana*	Perennial Exotic
14	29	*Microlaena stipoides*	Perennial Native
14	30	*lomandra multiflora subsp. multiflora*	Perennial Native
14	31	*Trifolium repens*	Perennial Exotic
14	32	*Sporobolus creber*	Perennial Native
14	33	*Trifolium repens*	Perennial Exotic
14	34	*Sporobolus creber*	Perennial Native
14	35	*Microlaena stipoides*	Perennial Native
14	36	*Microlaena stipoides*	Perennial Native
14	37	*Cynodon dactylon*	Perennial Native
14	38	*Microlaena stipoides*	Perennial Native
14	39	*Hypericum perforatum*	Perennial Exotic
14	40	*Microlaena stipoides*	Perennial Native
14	41	*Microlaena stipoides*	Perennial Native
14	42	*lomandra multiflora subsp. multiflora*	Perennial Native
14	43	*lomandra multiflora subsp. multiflora*	Perennial Native
14	44	*Hypericum perforatum*	Perennial Exotic
14	45	*Chloris gayana*	Perennial Exotic

14	46	*Trifolium repens*	Perennial Exotic
14	47	*Trifolium repens*	Perennial Exotic
14	48	*Trifolium repens*	Perennial Exotic
14	49	*Sporobolus creber*	Perennial Native
14	50	*Microlaena stipoides*	Perennial Native
14	51	*Sporobolus creber*	Perennial Native
14	52	*Hypericum perforatum*	Perennial Exotic
14	53	*Sporobolus creber*	Perennial Native
14	54	*Sporobolus creber*	Perennial Native
14	55	*Austrostipa scabra*	Perennial Native
14	56	*Microlaena stipoides*	Perennial Native
14	57	*Microlaena stipoides*	Perennial Native
14	58	*Sporobolus creber*	Perennial Native
14	59	*lomandra multiflora subsp. multiflora*	Perennial Native
14	60	*Microlaena stipoides*	Perennial Native
14	61	*Panicum effusum*	Perennial Native
14	62	*Melichrus urceolatus*	Perennial Native
14	63	*Microlaena stipoides*	Perennial Native
14	64	*Microlaena stipoides*	Perennial Native
14	65	*Microlaena stipoides*	Perennial Native
14	66	*Cynodon dactylon*	Perennial Native
14	67	*Bare Earth*	N/A
14	68	*Bare Earth*	N/A
14	69	*Bare Earth*	N/A
14	70	*Bare Earth*	N/A
14	71	*Bare Earth*	N/A
14	72	*Bare Earth*	N/A
14	73	*Bare Earth*	N/A
14	74	*Bare Earth*	N/A
14	75	*Bare Earth*	N/A
14	76	*Plantago lanceolata*	Perennial Exotic
14	77	*Echium plantagineum*	Perennial Exotic
14	78	*Bare Earth*	N/A
14	79	*Echium plantagineum*	Perennial Exotic
14	80	*Conyza bonariensis*	Perennial Exotic
14	81	*Conyza bonariensis*	Perennial Exotic
14	82	*Conyza bonariensis*	Perennial Exotic
14	83	*Echium plantagineum*	Perennial Exotic
14	84	*Sporobolus creber*	Perennial Native
14	85	*Chloris gayana*	Perennial Exotic
14	86	*Microlaena stipoides*	Perennial Native
14	87	*Sporobolus creber*	Perennial Native
14	88	*Sporobolus creber*	Perennial Native
14	89	*Hypericum perforatum*	Perennial Exotic
14	90	*Microlaena stipoides*	Perennial Native
14	91	*Sporobolus creber*	Perennial Native
14	92	*Microlaena stipoides*	Perennial Native
14	93	*Microlaena stipoides*	Perennial Native
14	94	*Sporobolus creber*	Perennial Native
14	95	*Microlaena stipoides*	Perennial Native
14	96	*Rumex acetosella*	Perennial Exotic
14	97	*Microlaena stipoides*	Perennial Native
14	98	*Microlaena stipoides*	Perennial Native
14	99	*Sporobolus creber*	Perennial Native
14	100	*Aristida racemosa*	Perennial Native
15	1	*Microlaena stipoides*	Perennial Native
15	2	*Microlaena stipoides*	Perennial Native
15	3	*Chloris gayana*	Perennial Exotic
15	4	*Microlaena stipoides*	Perennial Native
15	5	*Microlaena stipoides*	Perennial Native
15	6	*Microlaena stipoides*	Perennial Native
15	7	*Microlaena stipoides*	Perennial Native
15	8	*Microlaena stipoides*	Perennial Native
15	9	*Microlaena stipoides*	Perennial Native
15	10	*Paspalum dilatatum*	Perennial Exotic
15	11	*Microlaena stipoides*	Perennial Native
15	12	*Thinopyrum ponticum*	Perennial Exotic
15	13	*Microlaena stipoides*	Perennial Native
15	14	*Microlaena stipoides*	Perennial Native
15	15	*Microlaena stipoides*	Perennial Native
15	16	*Paspalum dilatatum*	Perennial Exotic
15	17	*Paspalum dilatatum*	Perennial Exotic
15	18	*Rytidosperma sp.*	Perennial Native
15	19	*Thinopyrum ponticum*	Perennial Exotic
15	20	*Chloris gayana*	Perennial Exotic
15	21	*Paspalum dilatatum*	Perennial Exotic
15	22	*Paspalum dilatatum*	Perennial Exotic
15	23	*Paspalum dilatatum*	Perennial Exotic
15	24	*Paspalum dilatatum*	Perennial Exotic
15	25	*Verbena bonariensis*	Perennial Exotic
15	26	*Paspalum dilatatum*	Perennial Exotic
15	27	*Microlaena stipoides*	Perennial Native
15	28	*Rytidosperma sp.*	Perennial Native
15	29	*Microlaena stipoides*	Perennial Native
15	30	*Rytidosperma sp.*	Perennial Native
15	31	*Microlaena stipoides*	Perennial Native
15	32	*Microlaena stipoides*	Perennial Native
15	33	*Microlaena stipoides*	Perennial Native
15	34	*Microlaena stipoides*	Perennial Native
15	35	*Microlaena stipoides*	Perennial Native
15	36	*Rytidosperma sp.*	Perennial Native
15	37	*Microlaena stipoides*	Perennial Native
15	38	*Microlaena stipoides*	Perennial Native
15	39	*Paspalum dilatatum*	Perennial Exotic
15	40	*Paspalum dilatatum*	Perennial Exotic
15	41	*Cirsium vulgare*	Perennial Exotic
15	42	*Hypericum perforatum*	Perennial Exotic
15	43	*Microlaena stipoides*	Perennial Native
15	44	*Hypericum perforatum*	Perennial Exotic
15	45	*Microlaena stipoides*	Perennial Native
15	46	*Microlaena stipoides*	Perennial Native
15	47	*Hypericum perforatum*	Perennial Exotic
15	48	*Microlaena stipoides*	Perennial Native
15	49	*Microlaena stipoides*	Perennial Native

15	50	*Paspalum dilatatum*	Perennial Exotic
15	51	*Microlaena stipoides*	Perennial Native
15	52	*Paspalum dilatatum*	Perennial Exotic
15	53	*Microlaena stipoides*	Perennial Native
15	54	*Microlaena stipoides*	Perennial Native
15	55	*Microlaena stipoides*	Perennial Native
15	56	*Microlaena stipoides*	Perennial Native
15	57	*Chloris gayana*	Perennial Exotic
15	58	*Microlaena stipoides*	Perennial Native
15	59	*Microlaena stipoides*	Perennial Native
15	60	*Microlaena stipoides*	Perennial Native
15	61	*Paspalum dilatatum*	Perennial Exotic
15	62	*Microlaena stipoides*	Perennial Native
15	63	*Microlaena stipoides*	Perennial Native
15	64	*Chloris gayana*	Perennial Exotic
15	65	*Chloris gayana*	Perennial Exotic
15	66	*Hypericum perforatum*	Perennial Exotic
15	67	*Hypericum perforatum*	Perennial Exotic
15	68	*Chloris gayana*	Perennial Exotic
15	69	*Chloris gayana*	Perennial Exotic
15	70	*Microlaena stipoides*	Perennial Native
15	71	*Microlaena stipoides*	Perennial Native
15	72	*Microlaena stipoides*	Perennial Native
15	73	*Microlaena stipoides*	Perennial Native
15	74	*Microlaena stipoides*	Perennial Native
15	75	*Microlaena stipoides*	Perennial Native
15	76	*Microlaena stipoides*	Perennial Native
15	77	*Hypericum perforatum*	Perennial Exotic
15	78	*Chloris gayana*	Perennial Exotic
15	79	*Cynodon dactylon*	Perennial Native
15	80	*Microlaena stipoides*	Perennial Native
15	81	*Microlaena stipoides*	Perennial Native
15	82	*Paspalum dilatatum*	Perennial Exotic
15	83	*Rytidosperma sp.*	Perennial Native
15	84	*Paspalum dilatatum*	Perennial Exotic
15	85	*Rytidosperma sp.*	Perennial Native
15	86	*Paspalum dilatatum*	Perennial Exotic
15	87	*Rytidosperma sp.*	Perennial Native
15	88	*Cirsium vulgare*	Perennial Exotic
15	89	*Microlaena stipoides*	Perennial Native
15	90	*Rytidosperma sp.*	Perennial Native
15	91	*Paspalum dilatatum*	Perennial Exotic
15	92	*Microlaena stipoides*	Perennial Native
15	93	*Rytidosperma sp.*	Perennial Native
15	94	*Paspalum dilatatum*	Perennial Exotic
15	95	*Rytidosperma sp.*	Perennial Native
15	96	*Chloris gayana*	Perennial Exotic
15	97	*Microlaena stipoides*	Perennial Native
15	98	*Plantago lanceolata*	Perennial Exotic
15	99	*Paspalum dilatatum*	Perennial Exotic
15	100	*Geranium solanderi*	Perennial Native

Appendix L. Stephen Bell (2024) – Moolarben Coal OC3 threatened flora assessment

EASTCOAST FLORA SURVEY
VEGETATION ASSESSMENT & MAPPING

PO Box 216 KOTARA NSW 2289
Ph. 02 4953 6523

29 February 2024

Amanda Griffith
Niche Environment and Heritage
L3/93 George Street
Parramatta NSW 2150

RE: Moolarben Coal Complex OC3 Extension Project – Review of *Commersonia procumbens, Monotaxis macrophylla, Commersonia rosea* and *Kennedia retrorsa*

Dear Amanda,

This letter report provides my opinion on the likely presence or otherwise of four threatened flora species (*Commersonia procumbens, Monotaxis macrophylla, Commersonia rosea* and *Kennedia retrorsa*) within the area subject to the Moolarben Coal Complex OC3 Extension Project (the Project).

It serves as an Expert Report for *Commersonia rosea* and *Kennedia retrorsa*, prepared in accordance with Section 5.2.4 of the Biodiversity Assessment Method (BAM) (New South Wales [NSW] Department of Planning, Industry and Environment [DPIE] 2020a).

I am not an accredited Expert for *Commersonia procumbens* or *Monotaxis macrophylla*; however, I have experience with both species so I can provide a review of whether the known habitats required by these two species are present or absent in accordance with Section 5.2.3 of the BAM (DPIE 2020a).

1. Background

The Moolarben Coal Complex OC3 Extension Project Biodiversity Assessment Report (Niche Environment and Heritage [Niche] 2022) (the BDAR) provides a summary of the proposed Project and the need for my assessment of the target threatened plant species. Key details are:

1.1 The Project

The Moolarben Coal Complex is located approximately 40 kilometres (km) north of Mudgee, NSW, and is operated by Moolarben Coal Operations Pty Ltd (MCO), a wholly owned subsidiary of Yancoal Australia Limited (Yancoal). The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities).

MCO is proposing an extension to the approved OC3 mining operations to allow for extraction of additional coal within existing mining and exploration tenements adjacent to approved operations at the Moolarben Coal Complex. Approval for the Project is being sought under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

Niche, in collaboration with Premise, was commissioned by MCO to prepare the BDAR for the Project. The BDAR was prepared in accordance with the BAM (DPIE 2020a) to describe and assess direct, indirect and prescribed impacts to ecological values, including threatened biodiversity listed under the NSW *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Since the initial BDAR (Niche 2022) was submitted, MCO undertook a detailed review of the Project Development Footprint as presented in the Moolarben Coal Complex OC3 Extension Project Environmental Impact Statement, which resulted in a reduced Development Footprint.

1.2 Native Vegetation

The reduced Development Footprint is 675.21 hectares (ha) in size, comprising 480.01 ha of native vegetation, 186.6 ha of non-native vegetation and 8.6 ha of access roads, dams and buildings. Native vegetation in the Project area was surveyed in March 2019, March 2020, March to April and September to December 2021 and January 2022 in accordance with the BAM (DPIE 2020a) and the BAM 2020 Operational Manual – Stage 1 (DPIE 2020b).

Most of the native woodland/forest within the Project area (particularly the lower slopes and flat land) has been previously cleared for agriculture and habitats are fragmented. The majority of the native woodland/forest remaining in the Development Footprint (particularly on the upper slopes) is directly connected to extensive areas of native vegetation to the south within the Munghorn Gap Nature Reserve, and along the ranges running to the east. A total of nine Plant Community Types (PCTs) in various conditions were mapped within the Development Footprint by Niche (2022).

1.3 Threatened Species

Targeted surveys for threatened flora species were undertaken between September and October 2021 and January 2022 via a grid and parallel transect method in accordance with the NSW *Surveying Threatened Plants and Their Habitats: NSW Survey Guide for The Biodiversity Assessment Method* (DPIE 2020c). One threatened flora species, *Pomaderris cotoneaster*, listed as Endangered under both the BC Act and EPBC Act, was recorded in the Project area.

The presence of two other species (*Monotaxis macrophylla,* listed as Endangered under the BC Act; and *Commersonia procumbens,* listed as Vulnerable under the BC Act and EPBC Act) were assumed despite not being recorded during targeted survey. It was noted by Niche (2022) that there was a lack of conditions that make both species detectable (i.e. fire and/or ground disturbance).

Two further threatened disturbance-species (*Commersonia rosea* and *Kennedia retrorsa*) were also searched for during field surveys but were not detected. Table 1 provides a summary of the PCTs within the reduced Development Footprint relevant to each of the four target species, as per the Threatened Biodiversity Profile Database Collection (TBPDC) in BioNet.

After the BDAR was submitted, a Charge Quote was obtained for the Project. In correspondence with the Charge Quote, the Biodiversity Conservation Trust (BCF) state:

> *The BCF Charge System has altered the way that the amount required to pay to the BCF for Species Credits is calculated. It now takes into account the likely cost of generating credits at an offset site, considering survey costs, difficulty to find offset sites and how many credits are typically generated under the Biodiversity Assessment Method. This has resulted in significant increases in the Charge for some species. We note that this Charge Quote has a high value for Species Credits, but that the development application has yet to be approved. As identified in Biodiversity Offsets Scheme Update No. 10 (attached) we recommend that you discuss with your Accredited Assessor the options in relation to*

species credits, particularly if you have assumed presence, rather than undertaking survey or obtained an Expert Report.

Table 1 PCTs comprising species polygons, MCO OC3 Amended Project (Source: Niche 2024).

PCT	PCT (abbreviated name)	*Commersonia procumbens*	*Monotaxis macrophylla*	*Commersonia rosea*	*Kennedia retrorsa*
483	Grey Box x White Box grassy open woodland on basalt hills	-	X	-	-
1610	White Box - Black Cypress Pine shrubby woodland	X	X	-	-
1655	Grey Box - Slaty Box shrub - grass woodland on sandstone slopes	X	-	X	X
1656	Narrow-leaved Ironbark - Black Pine - Narrow-leaved Wattle shrub - grass open forest	X	X	-	-
1661	Narrow-leaved Ironbark - Black Pine - Sifton Bush heathy open forest	X	X	-	-
Total		**4**	**4**	**1**	**1**

1.4 Purpose of this Letter

This letter is an Expert Report for *Commersonia rosea* and *Kennedia retrorsa* prepared in accordance with Section 5.2.4 of the Biodiversity Assessment Method (BAM) (NSW Department of Planning, Industry and Environment [DPIE] 2020a).

I am not an accredited Expert for *Commersonia procumbens* or *Monotaxis macrophylla*; however, I have experience with both species so I can provide a review of whether the microhabitats required by these two species are present or absent in accordance with Section 5.2.3 of the BAM (DPIE 2020a).

2. Knowledge of Target Species

I have field knowledge of all four threatened flora species that are the subject of this assessment. I am an accredited biodiversity expert for 13 plant species including *Commersonia rosea* and *Kennedia retrorsa* (see https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity-offsets-scheme/accredited-assessors/experts), and I have field experience and knowledge on *Commersonia procumbens* and *Monotaxis macrophylla*. I have published peer-reviewed and other papers dealing with all four species (Bell 2000, 2001, 2008, 2019; Bell & Copeland 2009; Bell & Holzinger 2015; Bell & Nicolle 2020; Gallagher et al 2023) and have 30 years field experience working in the habitats within the Greater Hunter region in which these species occur. I have run my own botanical consultancy for 28 years and have been an adjunct researcher at the University of Newcastle since 2014. Evidence of my experience in the plant ecology field is at https://www.newcastle.edu.au/profile/stephen-bell.

3. Literature Review of Target Species

To capture relevant habitat information for each of the target species, I have reviewed the available literature and databases (see Appendix 1 and 2 for the latter) to better understand the requirements

of each species. Wherever possible, I have attempted to identify the most relevant PCT that each existing record is linked to, so that my assessment of the likelihood of presence within the Project area is evidence-based. Ideally, this is best achieved through formal allocation of floristic plots to specific PCTs as shown in BioNet, particularly the recent Eastern New South Wales (ENSW) classification (DPE 2022). Where such data is not available, I have reviewed PCT mapping (DCCEEW 2022) and associated documentation (DPE 2022) which describes each PCT.

Note that only brief assessment has been made of *Commersonia rosea* and *Kennedia retrorsa*, as both were discounted from the Project area by Niche (2022) through an absence of detections during targeted surveys. Nevertheless, I have provided my opinion on these species given my thorough knowledge of them both.

3.1 Commersonia procumbens

Commersonia procumbens is listed as Vulnerable under the EPBC Act and BC Act. Maiden and Betche (1898) described *Commersonia procumbens* (as *Rulingia procumbens*) from the Dubbo area of NSW, which has since been found to be a stronghold for the species. Ayers et al. (1996) documented habitat for *Commersonia procumbens* as sandy sites (often on roadsides, quarries, gravel stockpiles and along power line easements) where the associated vegetation was *Eucalyptus dealbata-Eucalyptus sideroxylon* woodland, *Melaleuca uncinata* shrubland, and mallee eucalypt with *Calytrix tetragona*. Other associated species include *Acacia triptera, Callitris endlicheri, Eucalyptus melliodora, Allocasuarina diminuta, Philotheca salsolifolia, Xanthorrhoea* spp*., Exocarpos cupressiformis, Leptospermum parvifolium,* and *Kunzea parvifolia* (Gross & Mackay 1998). Shelly and Lewer (2002) found that all their study populations in the Goonoo Forests occurred in disturbed sites and bare open ground, and searches of nearby intact forest and woodland sites failed to find plants. At a broader scale, favoured habitat was said to be sandy soils in dry sclerophyll forest or woodland with a heathy understorey (e.g. Plantnet).

Hunter (2008) makes a brief note of a historical record of *Commersonia procumbens* for Mt Kaputar National Park, although no details are provided on the habitat in that work (but see later). Additionally, a 1996 observation near Sandy Hollow, initially thought to represent *Commersonia procumbens*, has since been described as *Commersonia rosea* (Bell & Copeland 2004). Shelly and Lewer (2002) alluded to this likely change, yet the record remains erroneously in the BioNet database. This location can be consequently safely disregarded for *Commersonia procumbens*; however, a recent collection made from central eastern Goulburn River National Park in 2021, 30 km west of Sandy Hollow, now represents the eastern limit of distribution for the species (Bell 2021).

A review of the Australasian Virtual Herbarium (AVH) specimen and BioNet observation databases (accessed February 2024) revealed 46 collections and 443 observations of *Commersonia procumbens* within NSW respectively, at seven broad locations (Nymagee, Dubbo-Gilgandra, Pilliga Forests, Mt Kaputar National Park [NP], Trinky State of Conservation Area [SCA], Ulan, and Goulburn River NP). Removing exact and essentially exact duplicates (e.g. replicate voucher collections dispersed to different herbaria, but with slightly different co-ordinates) reduced this number to 330 records (Appendix 1), five of which have no publicly accessible locational details which could not be traced through other means (voucher specimens NSW793955, NSW824379, NSW891471, NSW993709, NSW998728).

To aid this discussion, I have examined the habitat separately for all seven locations (termed 'meta-populations'), as each reflect widely varied environmental landscapes.

1. Nymagee

A single collection (1000 metres [m] accuracy) from the Shuttleton district just west of Nymagee in central NSW (South Western Plains) was made in 1903 and is represented by several replicates. There are no habitat notes associated with this collection, and through Geographic Information System (GIS) analysis it appears to fall on Quaternary colluvium, but this may be an artefact of positional accuracy. More likely habitat, based on knowledge from other populations in NSW, is the nearby Early Devonian Shume Formation, which is dominated by sandstone lithology. Potential PCTs in this area include PCT 173 Sandplain Mallee of Central NSW, PCT 176 Green Mallee – White Cypress Pine Very Tall Mallee Woodland on Gravel Rises, or PCT 180 Green Mallee – White Cypress Pine Woodland on Rocky Hills. However, there is no way to determine with confidence which of these might be the best fit for this 1903 record.

2. Dubbo-Gilgandra

There are 229 unique location records (4 to 25,000 m accuracy) for *Commersonia procumbens* in the Dubbo and Gilgandra districts (Central Western Slopes) between 1887 and 2021 (Appendix 1), which includes Goonoo SCA, Mogriguy NP and Coolbaggie Nature Reserve (NR). Nine of these records are voucher specimens and the remaining 220 are observational records; none emanate from full floristic plot sampling hence detailed associated species are not available. Nevertheless, many of the observations do contain anecdotal comments on associated species, suggesting important habitat in this area to be forests of *Eucalyptus dealbata* and *Eucalyptus sideroxylon* with *Melaleuca uncinata* on sandy rises; or *Callitris endlicheri* +/- *Eucalyptus crebra* woodland; or *Eucalyptus crebra* with *Acacia neriifolia, A. caesiella,* and *Melaleuca thymifolia*; or low heathland of *Acacia triptera*; or mallee heath and shrubby regrowth with *Calytrix tetragona* and *Daviesia, Acacia, Olax, Ozothamnus, Allocasuarina, Dillwynia,* or *Gompholobium.* Several observations are from bare open areas along road edges, table drains or other disturbed locations, and many mention post-fire germination. Equating these brief descriptions to PCTs cannot be done with certainty, however the following are likely important: PCT 256 Green Mallee Tall Mallee Woodland on Rises, PCT 425 Spur-wing Wattle Heath on Sandstone Substrates, PCT 467 Blue-leaved Ironbark – Black Cypress Pine Shrubby Sandstone Open Forest, PCT 468 Narrow-leaved Ironbark – Black Cypress Pine +/- Blakely's Red Gum Shrubby Open Forest, PCT 469 White Cypress Pine – Narrow-leaved Ironbark – Buloke Grassy Open Forest, PCT 470 Mugga Ironbark – Narrow-leaved Ironbark – Buloke – Black Cypress Pine Shrub Grass Open Forest. Geologically, 95 percent (%) of records (n=229) fell within the Jurassic Pilliga Sandstone formation, 4% in Cainozoic Quaternary sediments, and <1% each in Triassic and Cretaceous sediments.

3. Pilliga Forests

A total of 83 unique records (5 to 100,000 m accuracy) of *Commersonia procumbens* occur in the Pilliga area (North Western Slopes), between 1954 and 2022. Eleven of these records originate from floristic plot survey data, but none of these data have been formally allocated to PCTs. However, all 11 do support full floristic data associated with them, which can be used in combination with summary habitat data linked to two herbarium collections (Appendix 1) to infer likely PCTs. Collectively, these data indicate that *Commersonia procumbens* in the Pilliga area occurs in shrubby forests dominated by various combinations of *Eucalyptus crebra, Eucalyptus chloroclada, Corymbia trachyphloia, Eucalyptus dwyeri, Eucalyptus fibrosa, Eucalyptus sideroxylon, Eucalyptus blakelyi, Eucalyptus macrorhyncha* and *Callitris endlicheri*. It is not possible to confidently identify the relevant PCTs that capture these habitats; however, those likely include one or more of the following: PCT 141 Broombush – Wattle Very Tall Shrubland, PCT 398 Narrow-leaved Ironbark – White Cypress Pine –

Buloke Tall Open Forest, PCT 401 Rough-barked Apple – Blakely's Red Gum – Black Cypress Pine Woodland on Sandy Flats, PCT 404 Red Ironbark – White Bloodwood +/- Burrows Heathy Woodland on Sandy Soil, or PCT 405 White Bloodwood – Red Ironbark – Black Cypress Pine Shrubby Sandstone Woodland. Of the 83 records, 46% fall within the Cainozoic Quaternary sediments, 36% within the Cretaceous Keelindi beds, and 18% within the Jurassic Pilliga Sandstone formation.

4. Mt Kaputar NP

There are four observational records (100 m accuracy) for the Mt Kaputar area (North Western Slopes), all made during floristic plot surveys in 2000, but no voucher collections are included in the AVH. Only one of the four floristic plots has been allocated directly to a PCT via the ENSW classification: **PCT 3342 Kaputar White Box-Apple Sheltered Forest**. The three remaining plots captured vegetation in similar habitat, at sites dominated by *Eucalyptus albens, Eucalyptus dealbata* or *Eucalyptus crebra*, and all might be considered representative of PCT 3342. Notes with these records suggest fires had occurred at <5 years prior to detection for two of them, but >20 years is mentioned for the other two. The geology at these locations (n=4) is dominated by Tertiary aged rhyolite (50%) and basalt (25%), and Triassic sandstone (25%).

5. Trinky SCA

A single observation record (100 m accuracy) made during floristic plots surveys in 1999 occurs in Trinkey SCA, near Premer (North Western Slopes). Data from this plot is not directly affiliated with a PCT, however it was dominated by *Eucalyptus fibrosa, Callitris endlicheri, Allocasuarina gymnanthera* and *Calytrix tetragona*. PCT mapping at this location suggests the relevant vegetation type to be PCT 457 White Bloodwood – Red Ironbark – Black Cypress Pine Woodland on Sandstone Hills, which accords with the floristic description. There had been no evidence of recent fire at the time of survey. The geology at this location is sandstone of the Jurassic Pilliga Sandstone formation.

6. Ulan

There are two observation records (10 m accuracy) of *Commersonia procumbens* in the Ulan area (Central Western Slopes), from 2021 and 2022 (one with a repeat survey in 2023). No other habitat information is available for these records; however, PCT mapping suggests them to be one of seven possible PCTs: PCT 3528 Western Hunter Flats Apple-Gum Shrub Forest, PCT 3763 Northwest Wollemi Colluvial Apple Forest, PCT 3532 Western Hunter Ironbark-Box Forest, PCT 3781 Ulan Sandstone Ironbark-Pine Woodland, PCT 3780 Goulburn River Ironbark-Bloodwood Heathy Forest, PCT 3760 Munghorn Sandstone Grey Gum – Stringybark Forest, or PCT 3786 Western Hunter Scribbly Gum – Pine Woodland. The dominant lithology at these sites is sandstone from the Triassic Narrabeen series.

7. Goulburn River NP

Four observation records (10 m accuracy) made by me in Goulburn River NP (Central Western Slopes) in May 2021 (Appendix 1) are yet to appear on the BioNet database. These were made approximately eight months after the 2019-2020 fires, on severely burnt ridgetops towards the middle of the NP. No floristic data was collected at the time, however the likely PCTs present include PCT 3771 Western Hunter Broombush Mallee Shrubland and PCT 3780 Goulburn River Ironbark – Bloodwood Heathy Forest. These ridges are comprised of Triassic Narrabeen sandstone and conglomerate.

Summary of PCTs Relevant to *Commersonia procumbens*

Based on reported habitat features from the seven meta-populations of *Commersonia procumbens* known in NSW, 24 PCTs can be considered the likely key vegetation types for this species (Table 2). One of these, PCT 3342 Kaputar White Box-Apple Sheltered Forest, has a direct link to known *Commersonia procumbens* habitat through component floristic plots in the ENSW PCT classification, but all others have been determined based on available habitat data linked to point records.

The closest and most relevant populations to the Project area are at Ulan (15-25 km to the north) and at Goulburn River NP (40 km to the east). These populations occur on Triassic Narrabeen geology on ridges supporting either woodland or heath communities. The next closest population is at Dubbo-Gilgandra, c. 90 km to the north-west and on the older Jurassic Pilliga Sandstone.

None of the PCTs shown to support or potentially support *Commersonia procumbens* in NSW match the six shown in Table 1 for the Project area.

3.2 Monotaxis macrophylla

Monotaxis macrophylla (Euphorbiaceae) is listed as Endangered under the BC Act. It occurs sporadically within selected parts of NSW and Queensland, and almost all detections have occurred following the passage of fire or other ground disturbance mechanisms (e.g. fire trail construction, within cultivation). Hunter (1998a) noted that all NSW populations of this species were found after fire events, while in Queensland fire did not appear to be a prerequisite. However, this observation may be related to limited ground disturbance options outside of fire in rocky habitat. There are also some anecdotal comments (e.g. NSW1098864, NSW716868) that germination has followed on from extended dry periods without fire or other physical ground disturbance, suggesting breaking of dormancy through non-direct means.

Documented habitat in the western districts of NSW includes isolated plants on rocky hillsides in vegetation characterised by *Acacia doratoxylon* (Ayers et al. 1996; Cunningham et al. 2011), and further east on granite heaths of the Northern Tablelands (Hunter 1998a; Hunter & Copeland 2007), and scrubby heath on sandstone on the Central Western Slopes (Bell & Holzinger 2005). In Queensland, Stanley and Ross (1995) considered stony or sandy soils east of the ranges as favoured habitat. Newer recent finds on the South Coast and Far North Coast of NSW have also occurred primarily in heathland. In their review of the genus, Halford and Henderson (2002) summarise known habitat as coastal heathland and open eucalypt forests on deep white coastal sands, and heath, woodland and open forest on rocky mountain slopes and sandstone plateaux, although it is unclear how comprehensive or representative these are in NSW.

A review of all known records held within the BioNet Atlas database (observations: BioNet) and Australasia's Virtual Herbarium (voucher specimens: AVH) in February 2024 found a total of 115 unique records (Appendix 1). Based on these records, 11 meta-populations of *Monotaxis macrophylla* can be delineated for NSW, and up to 20 further meta-populations for Queensland. I will outline only the NSW populations individually here.

1. Bald Knob SF

Up to five records (3 to 1000 m accuracy) exist for Bald Knob State Forest (SF) near Woodenbong (far North Coast) between 1998 and 2020, although it is difficult to determine if these are all unique and separate locations. They may represent just three locations. Notes associated with all of them indicate that plants were growing in rocky heath on a volcanic outcrop ('Bald Knob') and viewing of aerial

imagery shows that this landscape feature is unique in the otherwise well-forested area. Two floristic vegetation plots (VOLCBK2, VOLCBK3) sampled at this location have been classified as **PCT 3856 Woodenbong Plugs Rocky Scrub** in the ENSW classification, and other records in this vicinity appear also to represent this type. Characteristic species in this PCT include *Leptospermum variabile, Acacia brunioides, Leptospermum microcarpum, Leucopogon neoanglicus* and *Pimelea linifolia*. This location supports rhyolite from the Carboniferous age.

Table 2 Plant Community Types known or likely to support *Commersonia procumbens*.

PCT ID	PCT Name	Source Populations
PCT 173	Sandplain Mallee of Central NSW	Nymagee
PCT 176	Green Mallee – White Cypress Pine Very Tall Mallee Woodland on Gravel Rises	Nymagee
PCT 180	Green Mallee – White Cypress Pine Woodland on Rocky Hills	Nymagee
PCT 256	Green Mallee Tall Mallee Woodland on Rises	Dubbo-Gilgandra
PCT 425	Spur-wing Wattle Heath on Sandstone Substrates	Dubbo-Gilgandra
PCT 467	Blue-leaved Ironbark – Black Cypress Pine Shrubby Sandstone Open Forest	Dubbo-Gilgandra
PCT 468	Narrow-leaved Ironbark – Black Cypress Pine +/- Blakely's Red Gum Shrubby Open Forest	Dubbo-Gilgandra
PCT 469	White Cypress Pine – Narrow-leaved Ironbark – Buloke Grassy Open Forest	Dubbo-Gilgandra
PCT 470	Mugga Ironbark – Narrow-leaved Ironbark – Buloke – Black Cypress Pine Shrub Grass Open Forest	Dubbo-Gilgandra
PCT 141	Broombush – Wattle Very Tall Shrubland	Pilliga
PCT 398	Narrow-leaved Ironbark – White Cypress Pine – Buloke Tall Open Forest	Pilliga
PCT 401	Rough-barked Apple – Blakely's Red Gum – Black Cypress Pine Woodland on Sandy Flats	Pilliga
PCT 404	Red Ironbark – White Bloodwood +/- Burrows Heathy Woodland on Sandy Soil	Pilliga
PCT 405	White Bloodwood – Red Ironbark – Black Cypress Pine Shrubby Sandstone Woodland	Pilliga
PCT 457	White Bloodwood – Red Ironbark – Black Cypress Pine Woodland on Sandstone Hills	Trinky SCA
* PCT 3342	Kaputar White Box-Apple Sheltered Forest	Mt Kaputar NP
PCT 3528	Western Hunter Flats Apple-Gum Shrub Forest	Ulan
PCT 3532	Western Hunter Ironbark-Box Forest	Ulan
PCT 3760	Munghorn Sandstone Grey Gum – Stringybark Forest	Ulan
PCT 3763	Northwest Wollemi Colluvial Apple Forest	Ulan
PCT 3780	Goulburn River Ironbark-Bloodwood Heathy Forest	Ulan
PCT 3781	Ulan Sandstone Ironbark-Pine Woodland	Ulan
PCT 3786	Western Hunter Scribbly Gum – Pine Woodland	Ulan
PCT 3771	Western Hunter Broombush Mallee Shrubland	Goulburn River NP
PCT 3780	Goulburn River Ironbark-Bloodwood Heathy Forest	Goulburn River NP

NB: * = PCTs with component floristic plots supporting *Commersonia procumbens* formalised within the ENSW PCT classification; all others are likely PCTs based on review of habitat data associated with *Commersonia procumbens* records and PCT mapping.

2. Torrington SCA

A single collection (unknown accuracy) of *Monotaxis macrophylla* was made from Torrington SCA (North Western Slopes) in 1998 (NE 68038), and notes associated with it mention heath vegetation on granitic rock. Viewing of aerial imagery shows an extensive granite landscape in this district, and consequently the most likely PCT associated with this area is PCT 4128 Northern New England Rock Outcrop Shrubland, which was defined from data at Torrington. This PCT is characterised by species such as *Calytrix tetragona, Leptospermum novae-angliae, Callitris endlicheri, Eucalyptus prava* and *Allocasuarina brachystachya*. Geologically, this area supports Triassic leucogranite lithology across large areas.

3. Howell

Five unique records (10 to 10,000 m accuracy) exist for the Howell locality between 1905 and 2003 (North Western Slopes), and all note occurrence on rocky outcrops in heath vegetation. One floristic vegetation plot (MCT246) sampled at this location has been classified as **PCT 4132 Western New England Rocky Granite Shrubland** in the ENSW classification, and it is reasonable to assume that other records of *Monotaxis macrophylla* here were made in similar vegetation. This PCT is described as supporting a widely scattered low canopy of *Eucalyptus dealbata* or *Eucalyptus prava*, with occasional *Callitris endlicheri*, and *Leucopogon muticus, Leptospermum brevipes, Leucopogon melaleucoides, Leucopogon neoanglicus, Homoranthus prolixus* and *Acacia viscidula*. Floristic changes brought about by an absence of fire in the Howell area have been documented by Hunter (1998b), where *Monotaxis macrophylla* was apparently not seen for over 90 years. The geology of the Howell area is primarily Triassic granite from the Gilgai Granite Formation.

4. Warra NP

Fifteen unique records (100 m accuracy) have been made at Warra NP (Northern Tablelands), all as part of vegetation surveys of the large areas of granite outcropping that occur in this park around 1995. Thirteen of these records comprised floristic plots (8OBCE, 8OBCC, 8OBCB, 9OBCB, 9OBCA, 10OBCA, 10OBCB, 12OBCB, 12OBCD, 12OBCC, 12OBCF, 12OBCE, 12OBCA) which were included in the ENSW PCT classification. These plots subsequently contributed to the delineation of **PCT 3827 Eastern New England Leucogranite Mallee Scrub**. PCT 3827 is characterised by the occasional mallee *Eucalyptus codonocarpa* and low growing *Eucalyptus calignosa* or *Eucalyptus radiata,* with *Leptospermum novae-angliae, Mirbelia confertifolia, Leucopogon neoanglicus* and *Acacia falciformis*. Geology here has been mapped as Permian-aged granite from the Oban River Leucoadamellite Formation.

5. Mt Kaputar NP

Two collections (3 m accuracy) of *Monotaxis macrophylla* from 2020 in the Waa Gorge area of Mt Kaputar NP (North Western Slopes) were made in shrubland on rocky scree slopes with *Eucalyptus nandemarica, Alstonia constricta, Notelaea microcarpa, Kunzea ambigua, Kunzea ericoides, Prostanthera cruciflora,* and *Homoranthus flavescens*. PCT mapping and descriptions of this area suggests PCT 521 Mount Kaputar Kunzea – Five Star Heath – Spur-wing Wattle Shrubland to be appropriate for this location, and aerial imagery shows an expansive area of rocky outcrop here. Descriptions for this PCT provide characteristic species as *Kunzea sp*. Mt Kaputar, *Ozothamnus obcordatus, Calytris tetragona, Acacia triptera, Melichrus urceolatus, Micromyrtus sessilis, Leionema viridiflorum* and *Prostanthera cruciflora*. This area occurs on Tertiary rhyolite from the Nandewar Volcanic Group.

6. Pilliga AA

Two records (100 m accuracy) of *Monotaxis macrophylla* from 1995 and 2010 occur within Pilliga Aboriginal Area (AA) on the eastern edge of the Pilliga forests (North Western Slopes). Both of these instances occurred within full floristic plots (WB001314, WL14), and review of those data show the first to be within grassy woodland of *Eucalyptus chloroclada, Corymbia trachyphloia* and *Angophora floribunda*, while the second was in scrubby heath of *Corymbia trachyphloia, Philotheca salsolifolia, Dampiera adpressa*, and *Digitaria breviglumis*. Assessing likely PCTs for both locations' points to PCT 405 White Bloodwood - Red Ironbark - Black Cypress Pine Shrubby Sandstone Woodland as the likely type, although there is some uncertainty with the 1995 recording. The 2010 record occurs on a small rocky sandstone hill ('Willala Knob'), supporting scrubby vegetation consistent with the floristics reported and notes in Hunter (2011), in an otherwise flat woodland/forest landscape (where the 1995 record was made). Both records in Pilliga, where shrubs appear to have been scarce, are unusual for this species (scoring only a one in each plot) and suggest perhaps atypical habitat or an under-recognised habitat (although admittedly the Pilliga has been very well sampled over many decades, including post-fire). Hunter (2011) noted that his unit 16 (equivalent to PCT 405) occupied only 86 ha (0.1%) of his 235,000 ha Pilliga study area, indicating a rare habitat in that region. The geology of the region supporting these two records is Jurassic Pilliga Sandstone.

7. Cobar

A 1903 collection (10,000 m accuracy) from Hermitage Plains near Cobar represents the only record of *Monotaxis macrophylla* from the North Western Plains, and is the most westerly occurrence known. No habitat data is linked to that collection, and its low geospatial resolution compromises assessment of the likely PCT for that location. The plotted location for this record lies on the plains where PCT 103 Poplar Box – Gum Coolabah – White Cypress Pine Shrubby Woodland is expected and has been mapped, but this seems unlikely. The western parts of Hermitage Plains support longitudinal barren hills (near and including Barrow SF), and it is possible that the original collection location was in such habitat. If so, perhaps a more logical vegetation type might be PCT 180 Grey Mallee – White Cypress Pine Woodland on Rocky Hills, or PCT 184 Dwyer's Red Gum – White Cypress Pine – Currawang Low Shrub-grass Woodland. PCT 180 is characterised by species such as *Eucalyptus morrisii, Callitris glaucophylla, Acacia doratoxylon, Eucalyptus viridis, Eucalyptus dwyeri,* and various *Eremophila* and *Dodonaea* species, while for PCT 184 it is *Eucalyptus dwyeri, Eucalyptus vicina, Acacia doratoxylon, Callitris glaucophylla,* and *Callitris endlicheri*. Both of these occur within 10 km of the plotted location for *Monotaxis macrophylla*. The geology of this area shows Quaternary gravels on the plains with Devonian conglomerate of the Barrow Range Member for the hills.

8. Boona Mount

The single 1977 collection (1,000 m accuracy) from Boona Mount north of Condolobin is the only record for *Monotaxis macrophylla* on the South Western Plains. Notes inform that this collection was made near the trig station on a sandstone hill with skeletal sandy soils supporting *Eucalyptus dwyeri* and *Acacia doratoxylon*. This would equate well with either PCT 184 Dwyer's Red Gum – White Cypress Pine – Currawang Low Shrub-grass Woodland or PCT 186 Dwyer's Red Gum – Black Cypress Pine – Currawang Shrubby Low Woodland which are both mapped for the location. Both support *Eucalyptus dwyeri* and *Acacia doratoxylon* with either *Callitris glaucophylla* or *Callitris endlicheri*, and *Allocasuarina verticillata* and a range of shrubs. Lewer et al. (2003) describe the close relationship between the vegetation types on these sandstone ridges, but *Eucalyptus dwyeri* and *Acacia*

doratoxylon are key components. Geology here is Devonian sandstone from the Yarra Yarra Creek Group.

9. Wollemi NP

Eight unique records (10 to 100 m accuracy) exist for the northern Wollemi NP area (Central Western Slopes) from 1999 (1 record) and 2014 (7 records). The 1999 record reported habitat as skeletal soil over sandstone rock platforms forming localised heath patches, with *Eucalyptus dwyeri, Allocasuarina littoralis, Isopogon dawsonii*, and *Leptospermum parvifolium*. Records from 2014 contain little habitat data, although first-hand knowledge at these sites indicates a scrubby heath of *Eucalyptus dwyeri, Eucalyptus dealbata* subsp*. aperticola, Calytrix tetragona, Leptospermum parvifolium, Acacia triptera, Leucopogon muticus, Boronia anethifolia, Isopogon dawsonii, Harmogia densifolia*, and *Grevillea montana* (Bell 2019; Bell & Nicolle 2020). Review of this knowledge against PCT mapping suggests the likely vegetation types to be PCT 3784 Western Hunter Rocky Scrub (eastern records) and the very similar PCT 3866 Wollemi Rockplate Scrub (more westerly occurrence). These ridges all lie on Triassic Narrabeen series sandstone and conglomerate.

10. Deua NP

Two unique records (50 to 1,000 m accuracy) exist for *Monotaxis macrophylla* from 1991 and 1993 in the eastern section of Deua NP (South Coast). Habitat data associated with the 1991 record refers to plants growing in a cleared fire break through dry rainforest, with co-occurring species including *Backhousia myrtifolia, Phebalium squameum, Philotheca trachyphylla, Acacia silvestris,* and *Parsonsia straminea*. The nearest rainforest vegetation shown for that area is PCT 3045 South Coast Temperate Gully Rainforest, although *Monotaxis* has evidently appeared following fire mitigation clearing, and given occupied habitats elsewhere it is questionable how representative rainforest is for this species. Given the mention of *Acacia silvestris* and *Philotheca trachyphylla*, it is possible that vegetation more similar to PCT 3669 Brogo Wattle Scrub, which is characterised by both of these species, once occurred here prior to rainforest development. The 1993 record was localised and rare around a rockslip. in shrubland on an exposed rhyolite slope near a creek. Associated species include *Melaleuca hypericifolia, Lepidosperma urophorum, Prostanthera porcata, Kunzea ambigua,* and *Dodonaea rhombifolia*. Inference from these habitat traits suggests that PCT 3870 Far Southeast Mountain Rock Scrub may be representative of this site. Both of these records occur on Devonian sediments of the Ben Boyd Formation, primarily sandstone with some volcanic rhyolite extrusives.

11. South East Forests NP

Six records (5 to 100 m accuracy) for *Monotaxis macrophylla* between 2003 and 2020 exist for the South East Forests NP, inland from Bega on the South Coast. Three of these formed part of full floristic plot surveys (BEMFIRE8, BEMFIRE6, Acgeo08), of which two were classified as part of the ENSW PCT classification. Plots BEMFIRE8 and Acgeo08 both formed part of **PCT 3642 Brogo Scarp Mallee Scrub**, and plot BEMFIRE6, located close to BEMFIRE8 in the same landscape, likely supports the same vegetation. PCT 3642 is characterised by a sparse canopy of *Eucalyptus agglomerata* and *Allocasuarina littoralis*, with *Eucalyptus spectatrix, Eucalyptus wilcoxii, Acacia georgensis, Acacia subtilnervis, Micromyrtus ciliata* and *Persoonia linearis*. Other records include additional habitat data such as occurrence on skeletal sandy soil over broken conglomerate on a cliff top, behaving as a post-disturbance coloniser after extreme drought in 2002-3 (NSW716868, SDMPI0072073, CANB 912055.1). The dominant lithology at these sites is sandstone from the Devonian Merrimbula Group, perhaps with some intrusive granodiorite from the Bemboka Suite.

Summary of PCTs Relevant to *Monotaxis macrophylla*

Using habitat data for *Monotaxis macrophylla* records in NSW, the 11 defined meta-populations can be linked to 15 PCTs (Table 3). Four of these emanate directly from the ENSW PCT classification, and the remainder have been attributed with high confidence. Most PCTs comprise scrub or heath communities on rock plates or rocky outcrops, but key exceptions include western locations (Cobar, Boona Mount, Pilliga AA) where scrubby woodlands on sandstone ridges appear to be key habitat. There is some uncertainty about PCT 3045 South Coast Temperate Gully Rainforest from the South Coast, which contrasts strongly with all other habitats defined.

The closest known population of *Monotaxis macrophylla* to the Project area lies c. 70 km to the southeast, in Wollemi NP. At this population, the species occurs in PCT 3784 Western Hunter Rocky Scrub and PCT 3866 Wollemi Rockplate Scrub. The next closest population is at Pilliga, 170 km to the north. Note that a May 2005 observational record of *Monotaxis macrophylla*, comprising a single individual from the upper Hunter Valley near Scone, was excluded from analysis as notes associated with it mention that insufficient fertile material was available at the time to confirm identification.

None of the PCTs shown to support or potentially support *Monotaxis macrophylla* in NSW match the seven shown in Table 1 for the Project area.

Table 3 Plant Community Types known or likely to support *Monotaxis macrophylla*.

PCT ID	PCT Name	Source Populations
*PCT 3856	Woodenbong Plugs Rocky Scrub	Bald Knob SF
PCT 4128	Northern New England Rock Outcrop Shrubland	Torrington SCA
*PCT 4132	Western New England Rocky Granite Shrubland	Howell
*PCT 3827	Eastern New England Leucogranite Mallee Scrub	Warra NP
PCT 521	Mount Kaputar Kunzea – Five Star Heath – Spur-wing Wattle Shrubland	Mt Kaputar NP
PCT 405	White Bloodwood - Red Ironbark - Black Cypress Pine Shrubby Sandstone Woodland	Pilliga AA
PCT 180	Grey Mallee – White Cypress Pine Woodland on Rocky Hills	Cobar
PCT 184	Dwyer's Red Gum – White Cypress Pine – Currawang Low Shrub-grass Woodland	Cobar
PCT 184	Dwyer's Red Gum – White Cypress Pine – Currawang Low Shrub-grass Woodland	Boona Mount
PCT 186	Dwyer's Red Gum – Black Cypress Pine – Currawang Shrubby Low Woodland	Boona Mount
PCT 3784	Western Hunter Rocky Scrub	Wollemi NP
PCT 3866	Wollemi Rockplate Scrub	Wollemi NP
PCT 3045	South Coast Temperate Gully Rainforest (?)	Deua NP
PCT 3669	Brogo Wattle Scrub	Deua NP
PCT 3870	Far Southeast Mountain Rock Scrub	Deua NP
*PCT 3642	Brogo Scarp Mallee Scrub	SE Forests NP

NB: * = PCTs with component floristic plots supporting *Monotaxis macrophylla* formalised within the ENSW PCT classification; all others are likely PCTs based on review of habitat data associated with *Monotaxis macrophylla* records and PCT mapping.

3.3 Commersonia rosea

Bell and Copeland (2004) described *Commersonia rosea* as a species inhabiting skeletal sandy soils of the Triassic Narrabeen series, in scrub or heath vegetation with occasional emergents of *Eucalyptus crebra, Callitris endlicheri* or *Eucalyptus caleyi* subsp*. caleyi.* Since that time, additional populations have been discovered across a broader area than the original restricted range, all on this same geological type. Bell and Woolley (2021) summarised the finds up to 2020, where a revised Extent of Occurrence of 1760 km^2 was reported. Further additional populations have been discovered by me in central Goulburn River NP in 2021, co-occurring with *Commersonia procumbens*, and in Corrabare North SCA near Millfield in 2023 (Bell & Sims in prog.).

The TBPDC includes 20 PCTs that might be expected to support populations of *Commersonia rosea*, but only one of these (1655 Grey Box - Slaty Box Shrub - Grass Woodland) has been mapped within the Project area. Based on my knowledge of this species, for which I am an accredited expert, there is no evidence that supports such vegetation, characterised by *Eucalyptus moluccana* and *Eucalyptus dawsonii,* as important habitat for *Commersonia rosea*.

3.4 Kennedia retrorsa

Kennedia retrorsa was described by Hemsley (1907) from material collected near Mt Dangar in the Hunter Valley, and relatively few populations are currently known. The stronghold is in the Goulburn River valley, along Dingo Creek and in sheltered locations below Mt Dangar (Bell 2016). These locations comprise colluvial soils derived from the Triassic Narrabeen series, perhaps with some Tertiary basalt influence. A more disjunct population at Devils Hole in Parr SCA requires confirmation, although almost certainly this location represents a misidentification of the common *Kennedia rubicunda* (see discussion in Gibson [2002]). Most Goulburn River valley occurrences are in riparian zones or near to them, where *Eucalyptus crebra, Angophora floribunda* and *Eucalyptus punctata* are typical over dense stands of *Bursaria spinosa, Notaleae microcarpa* and *Lasiopetalum longistamineum*. One small population lies on a rocky ridge of *Corymbia trachyphloia, Eucalyptus dwyeri* and *Eucalyptus fibrosa*, but is considered atypical.

The TBPDC includes 11 PCTs that might be expected to support populations of *Kennedia retrorsa*, but only one of these (1655 Grey Box - Slaty Box Shrub - Grass Woodland) has been mapped within the Project area. Based on my knowledge of this species, for which I am an accredited expert, there is no evidence that supports such vegetation, characterised by *Eucalyptus moluccana* and *Eucalyptus dawsonii,* as important habitat for *Kennedia retrorsa*.

4. Field Inspection at OC3

On the 21 December 2023, I undertook a field inspection of the proposed extension area at Moolarben. Prior to my visit, I had analysed the supplied GIS files showing the mapped species polygons for *Commersonia procumbens* and *Monotaxis macrophylla*, as well as vegetation mapping files for the entire Project Area. According to Niche (2022), species polygons were constructed for each species on the basis of mapped PCT distribution (see Table 1), which for *Commersonia procumbens* entailed 6 PCTs and for *Monotaxis macrophylla* 7. I understand that PCT affiliations for each of the target species were sourced, as is required under BAM, from the TBPDC.

During my field inspection, I recorded my position, tracks and points of interest in *LocusGIS* (https://www.locusgis.com/), later downloaded to my office GIS system for review and analysis. During my preparation for the field inspection, I had pre-selected around 30 locations which I planned to visit and review the suitability of habitat for all four target species. These locations were based on

species polygon mapping prepared by Niche (2022), which I had imported into *LocusGIS* for use in the field.

At each inspection point, I noted dominant plant species in canopy, shrub and ground layers, as well as other habitat attributes such as the extent of rocky substrates, representativeness of the inspection point characteristics of the surrounding landscape, and evidence of feral or stock grazing activities. Photographs were taken at most inspection points to inform preparation of this report.

Inspection was also undertaken of a recently burnt location outside of the Project area (c. 5 km to the north west) but within similar landscapes, to survey for any of the target species. All four species are fire ephemerals to a certain degree, and if seeds were present in these landscapes, then it may be expected that the fire in 2023 might have stimulated some germination. As in previous searches, walked tracks were recorded in *LocusGIS*.

5. Findings

5.1 Inspection points

Figure 1 and Figure 2 show the locations of my inspection points across the OC3 area, relative to the *Commersonia procumbens* and *Monotaxis macrophylla* species polygons. Photographs for most of these inspection points are shown in Appendix 2; note that some points were not photographed, while others had multiple photos.

In my opinion, none of the species are likely to be present on site for the following reasons:

- *Commersonia procumbens* – the seven meta-populations of this species known from throughout NSW occur in a range of habitats (see Table 2), in either shrublands or low woodlands on rocky or sandy substrates, which are absent from the Project area. Records for Ulan and in Goulburn River NP, the nearest populations, occur in scrubby heath or heathy forest on the Triassic Narrabeen series, a geological type absent from the Development Footprint (but immediately surrounding it). None of the PCTs I have identified as supporting populations of this species in NSW, based on review of database records, have been mapped for the Project area. Additionally, none of the known populations of *Commersonia procumbens* occur on Permian-aged sediments from the Illawarra coal measures (dominant within the Project area), and only 3% of records occur on Triassic-aged sediments (upper fringes of the Project area).
- *Monotaxis macrophylla* - the 11 meta-populations of this species known from throughout NSW occur in a range of landscapes (see Table 3), but nearly all are in rocky heath or shrublands, which are absent from the Project area. Central western NSW populations occur in low shrubby woodland on rocky hills, and one location on the far South Coast is in or near to rainforest vegetation, but all others are unequivocally associated with scrubby heath on rock outcrops. Records for Wollemi NP, the nearest population, occur in scrubby heath on the Triassic Narrabeen series, a geological type absent from the Development Footprint (but present immediately surrounding it). None of the PCTs I have identified as supporting populations of this species in NSW, based on review of database records, have been mapped for the Project area. Geologically, none of the known populations of *Monotaxis macrophylla* occur on Permian-aged sediments from the Illawarra coal measures (only the Warrah NP population is of Permian age, but that is granite from the Oban River Leucoadamellite Formation), and only one population (Wollemi NP) occurs on Triassic Narrabeen sediments (which fringes the Project area).
- *Commersonia rosea* – similar to *Commersonia procumbens*, this species is known exclusively from the scrubby heaths and adjacent heathy woodlands on Triassic Narrabeen series geology, primarily in Goulburn River and Wollemi NPs. None of the PCTs associated with these landscapes occur within the Project area due to the absence of Narrabeen series outcropping supporting

scrubby heath. There is no evidence in support for PCT 1655 Grey Box - Slaty Box Shrub - Grass Woodland, the only affiliated PCT present within the Project area, to form important habitat for this species.

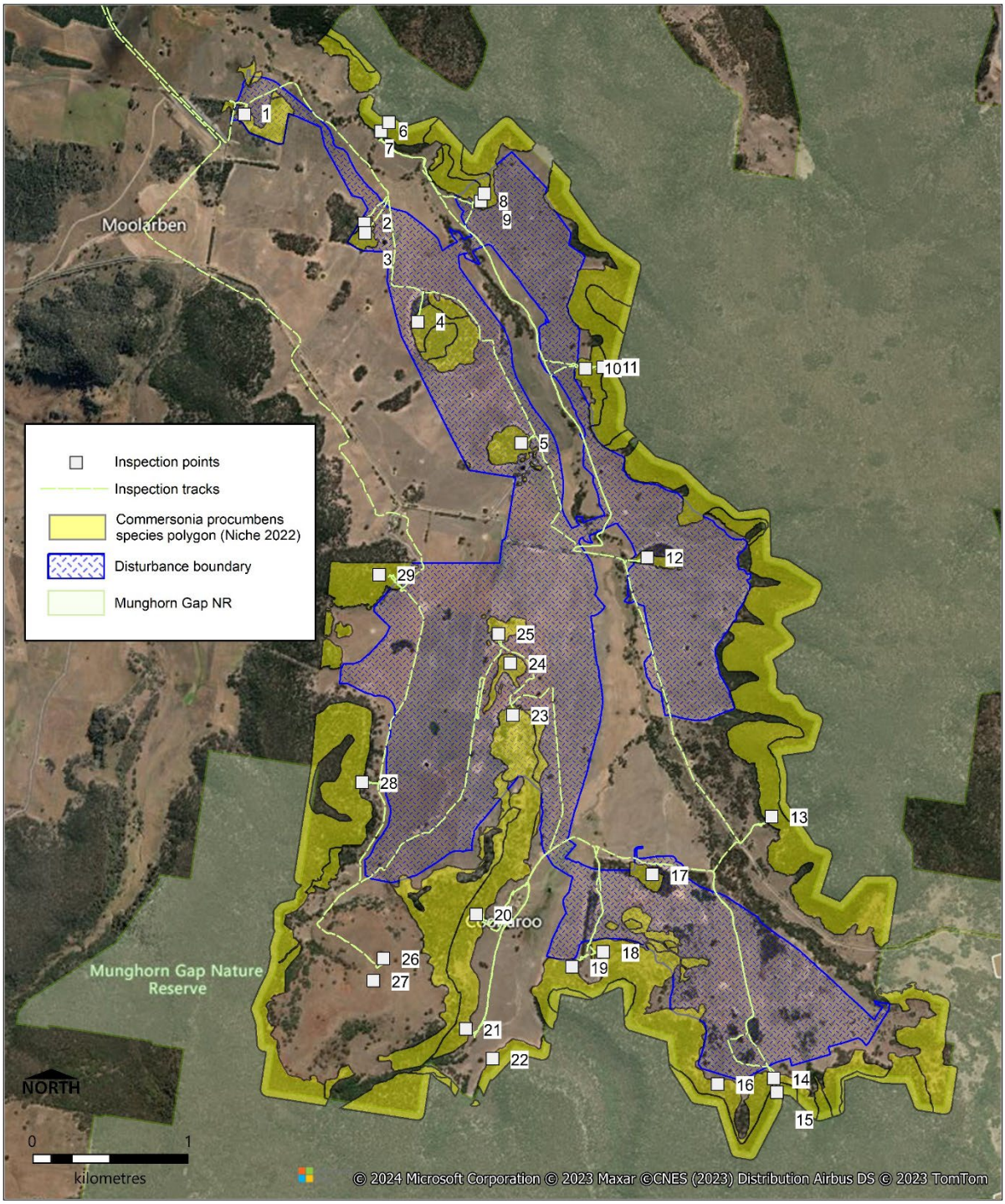

Figure 1 Inspection points within the Project area, shown with species polygon for *Commersonia procumbens* (Niche 2022).

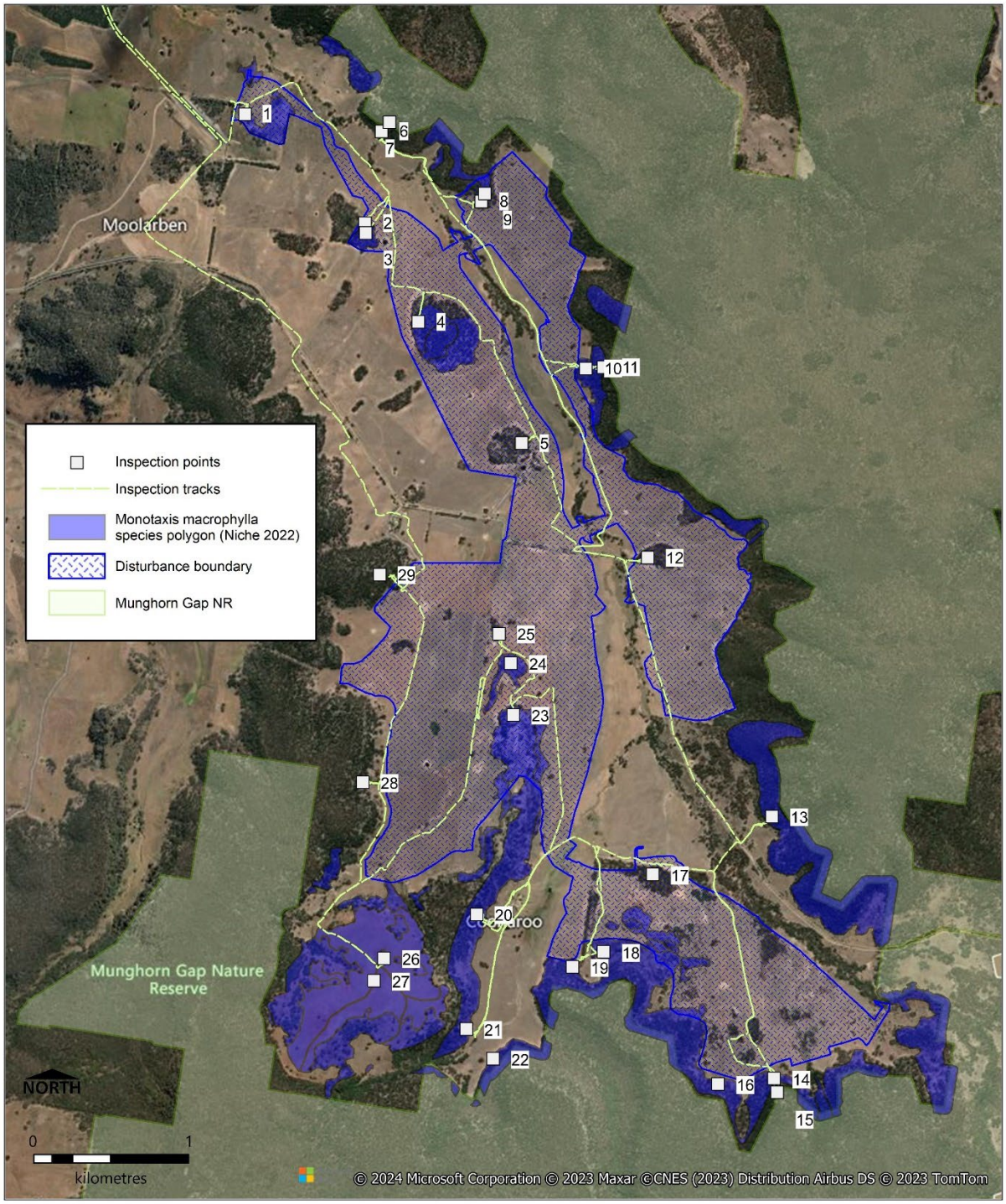

Figure 2 Inspection points within the Project area, shown with species polygon for *Monotaxis macrophylla* (Niche 2022).

- *Kennedia retrorsa* – key populations for this species occur in the Goulburn River valley in the vicinity of Dingo Creek and Mt Dangar. At those locations, this species inhabits sheltered riverine forests within Triassic Narrabeen series geology and typified by *Eucalyptus crebra, Eucalyptus punctata* and *Angophora floribunda*. There is no evidence in support for PCT 1655 Grey Box - Slaty Box Shrub - Grass Woodland, the only affiliated PCT present within the Project area, to form important habitat for this species.

5.2 Recently burnt area

My brief inspection of recently burnt habitat near Ulan Road and Moolarben Creek did not locate any of the target species, despite focusing on areas where bedrock material was evident (Figure 3). Almost all the burnt area was of Carboniferous and Permian age, with a small area of Triassic towards the south. Appendix 4 shows representative photographs of these areas.

Figure 3 Green tracks show the area inspected for target species in recently burnt lands north of the Project Areas.

6. Conclusion

Following a detailed review of existing database records for both *Commersonia procumbens* and *Monotaxis macrophylla*, I have identified 24 actual or potential PCTs for the former and 15 PCTs for the latter, based on available evidence from the literature, voucher collections, observational records and full floristic plot surveys. None of these PCTs (Table 2 and Table 3) have been mapped by Niche (2022) for the Project area (cf. Table 1 with Table 2 and 3), hence neither of these species are likely to occur because the habitats required by the species are absent.

In addition, I have visited the Project area to gain firsthand knowledge of the landscapes and vegetation communities present, and inspection at 30 separate locations within mapped species polygons supports the conclusions drawn from my database analysis. Both of these species almost always occur in scrubby heath vegetation on rocky ridgelines or outcrops, a feature completely lacking from the Project area. Neither species has known populations within the Permian-aged Illawarra coal measures, and while both do have known populations on Triassic Narrabeen geology, which fringes the Project area, the relevant PCTs and structural vegetation types are absent.

For *Commersonia rosea* and *Kennedia retrorsa*, these too are species restricted to Triassic Narrabeen landscapes, the first from scrubby heath on ridgelines and the second on sheltered slopes and gullies. While the Project area does support Triassic Narrabeen geology on the higher ridges, they sit atop older Permian sediments which elsewhere in areas supporting these species are considerably deeper and do not outcrop on the lower slopes. Hence, these species are unlikely to be present on the Project area.

Regards,

Dr Stephen Bell

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Appendices

1 *Commersonia procumbens* records
2 *Monotaxis macrophylla* records
3 Inspection point photos
4 Burnt area photos

Appendix 1: *Commersonia procumbens* records

Commersonia procumbens			
Date	Source	Location	Habitat Notes
1. Nymagee			
Nov 1903 (or 1905)	Baeurerlen, W. MEL 2212776A AD 98439235 CANB 348546.1 BRI AQ0387758 NSW154615 NSW154616 NSW48691	Nymagee	No data
2. Dubbo-Gilgandra			
1 Apr 1770 (error)	RBG Herbarium Specimen Register	Bearbong Road, near Gilgandra.	No data
Nov 1887	Betche, E. MEL 2212783A MEL 2212784A MEL 2212785A HO22700 NSW424114 NSW48689	Dubbo	No data
1 Aug 1948	Althofer, G.W. NSW48690	Balladoran - Mendooran Road.	No data – 2 different locations
1 Oct 1950	Rupp, H.M.R. NSW424117	Dubbo	No data
1 Oct 1952	Biddiscombe, E.F. CANB 635638.1 NSW48692	12 m N Dubbo.	{Eucalyptus dealbata - E. sideroxylon} sandy rise. Understorey is {Melaleuca uncinata} scrub. – 3 different locations
1960	Readdie, W.M. NSW424112	Bearbong Road, near Gilgandra. dubbo	No data
9 Oct 1969	Willis, J.H. MEL 0698291A	Goonoo Forest, c. 5 miles E of HQ, along Mendooran Road (NNE of Dubbo).	No data
17 Nov 1969	Briggs, B.G., Johnson, L.A.S. NSW424121	3 km SE of Dubbo-Mendooran Road, on road to Boomley.	Colonising disturbed road edge, on sand soil. – 3 different locations
13 Dec 1973	Streimann, H. CBG 52946.1	13 km NE of Gilgandra	No data – 2 different locations

Appendix 1: *Commersonia procumbens* records

Commersonia procumbens			
Date	Source	Location	Habitat Notes
	NSW424116		
11 Jan 1993	Jobson, P.C. | Albrecht, D.E. MEL 2023153A	W side of Mendooran-Dubbo road, 27 km SE of Mendooran	Uncommon in open Eucalyptus spp. (ironbark-white gum)-Callitris endlicheri woodland. Pink clay loam on undulating hills
1 Nov 1993	Grant, H. NSW281617	Close to Dubbo.	No data
5 Nov 1997	Wilson, P.G. NE 82155 NSW416180	2.5km NE of Frost Road on the Dubbo to Mendooran road	Growing on almost bare ground at the roadside. Brownish clay loam – 2 different locations
5 Nov 1997	DPIE Default Sightings	2.7km NE of Samuels Rd on Dubbo to Mendooran Rd	in sandy roadside drainage ditch, both sides of road
9 Nov 1997	White, M.D. NSW419876	Mendooran road, Goonoo State Forest, approx. 41 km NE of Dubbo. At roadside along 60 m stretch.	At roadside. Soils gravelly/ sandy and free draining.
24 Nov 1997	DPIE Default Sightings	3.8km NE of Muronbong silo on side of road and along track to gravel pit near power line	No data
1 Jan 1998	DPIE Default Sightings	approx 5 km west of Elong Elong on the Dubbo - Dunedoo rd	Located on roadside verge (southern side of road), near entrance to small quarry.
30 Jan 1998	DPIE Default Sightings	Baumans Road, Goonoo State Forest	Scattered plants on both sides of road
30 Jan 1998	DPIE Default Sightings	Cashells Dam Road, Goonoo State Forest	Plants occur on Western side of road, scattered through regenerating vegetation which had been burned (management burn by State Forests), in 1992 or 1993.
1 Feb 1998	DPIE Data from Scientific Licences dataset	Goonoo State Forest - Site 1 - Northern end of Samuels Road (Goonoo State Forest): along the northern end of Samuels Road, approx 2 km N of the Dubbo - Mendooran Road and approx 750 metres north of Samuels Dam; in Compartment 44 (Goonoo SF).	Soil: red-brown sandy loam; Topography: flat to very slightly undulating, 50m from a minor drainage depression; Vegetation: regenerating Narrow-leaved Ironbark (Eucalyptus crebra). Plants first started to appear after 1998 fire.
1 Feb 1998	DPIE Data from Scientific Licences dataset	Goonoo State Forest - Site 4 - Dubbo - Mendooran Road: - along the Dubbo - Mendooran Road, approx 2-3 km E of the junction of Frosts Road & Samuels Road with the Dubbo-Mendooran Road, in the NE corner of Compartment 52 (Goonoo SF).	on the barren roadside verge; on the eastern side of the road. soil: skeletal loam, hard-setted or surface- sealed; topography: gentle slope, along the roadside verge; and vegetation: not associated with an intact vegetation community
1 Feb 1998	DPIE Data from Scientific Licences dataset	Site 5 - Dubbo - Dunedoo Road: - approximately 5 km west of Elong Elong, on the Dubbo-Dunedoo road and 45 km north-east of Dubbo.	soil: red-brown sandy loam, podzol, overlying Pilliga Sandstone; topography: gentle slope (low rolling hills), along the roadside verge; and vegetation: low Acacia heath dominated by Acacia triptera (Spur Wing Wattle)
1 Mar 1998	DPIE Default Sightings	Goonoo State Forest, Cpt 50, .5 klm north of Paddys Dam	Plants occur in thick patches in area which was burned by wildfire in early January 1998

Appendix 1: *Commersonia procumbens* records

Commersonia procumbens			
Date	Source	Location	Habitat Notes
4 Nov 1998	Wilson, P.G.; Robertson, G. NE 70814 BRI AQ0538982 NSW424000 NSW424001	Paddys Dam Road, 750 m from Garlings Road, Goonoo State Forest	Reddish loamy sand on plain in recently burnt Ironbark and Callitris woodland. Ground covered with numerous herbs. – 3 different locations Recently burnt area. Mallee eucalypts with Calytrix understorey; red loamy sand – 3 different locations
6 Nov 1998	DPIE Default Sightings	Mendooran Road, 200m North of Ranters Creek crossing, 2.6k s of Garlings Road	No data
9 Nov 1999	DPIE Default Sightings	Mendooran Rd near track alongside Gramby Ck	No data
10 Feb 2002	DPIE Default Sightings	56 Km from Dubbo along Danedo Rd,at Turnoff to Wellington	Cypress Pine / grassland, slight slope
24 May 2003	DPIE Data from Scientific Licences dataset	Goonoo State Forest, Dubbo Specified Reserve: Goonoo SF	No data
2 Nov 2004	Wilkins, C.; Whitlock, B. PERTH 7995644 NSW923129	About 5 km E of Paddy's Dam road, 600 m S from intersection at Paddy's dam road and Garlings Road, Goonoo State Forest	Post burn. Pale red brown sandy clay. Callitris woodland with myrtaceous shrubs, Acacia spp
5 Jun 2007	DPIE Default Sightings	Beside Starkeys Rd approx 1.5km east of the Western Boundary Rd, Goonoo SCA	Area had been burnt in the January 2007 fire.
18 Dec 2007	Johnstone, R. CANB 712406.1 NSW759549	1.2 km S of Garling's Road on Mount Carl Road. Goonoo State Conservation Area.	Low lying broad gully in gently undulating country, burnt previous summer. Open forest with Eucalyptus crebra, Acacia neriifolia, A. caesiella, Actinotus gibbonsii, Rulingia procumbens, Melaleuca thymifolia, Goodenia sp., Wahlenbergia sp. Pale red sandy soil, over sandstone – 3 different locations
20 Dec 2007	DPIE Default Sightings	In mitre drain on western side of Brennans Rd, approx. 400m south of Frost Rd intersection, Goonoo SCA	No data – 2 different locations
20 Dec 2007	DPIE Default Sightings	In table dains both sides of Frost Rd approx. 6km east of Mendooran Rd, extending for approx. 300m east towards Mt Carl Rd, Goonoo SCA	No data
6 Nov 2009	DPIE Default Sightings	Western Boundary Road Goonoo CCA	No data
1 Sep 2011	DPIE Default Sightings	West Side of Road	No data – 4 different locations
1 Sep 2011	DPIE Default Sightings	East Side of Road	No data
10 Jan 2012	DPIE Default Sightings	Goonoo State Conservation Area - south of junction Starkeys/Frazers Rd	No data
14 Feb 2012	DPIE Default Sightings	Frost Rd and Cashells Rd junction.	No data

Appendix 1: *Commersonia procumbens* records

Commersonia procumbens			
Date	Source	Location	Habitat Notes
14 Feb 2012	DPIE Default Sightings	Cashells Rd, north of Withers Rd.	No data – 2 different locations
15 Feb 2012	DPIE Default Sightings	Starkeys Trail Goonoo SCA	No data
1 Sep 2012	DPIE Default Sightings	West Side of Road	No data – 22 different locations
1 Sep 2012	DPIE Default Sightings	East Side of Road	No data – 15 different locations
1 Dec 2013	DPIE Default Sightings	Goonoo reserves	No data – 20 different locations
16 Dec 2020	DPIE Data from Scientific Licences dataset	Goonoo SCA	No data – 3 different locations
17 Dec 2020	DPIE Data from Scientific Licences dataset	Goonoo SCA	No data – 77 different locations
19 Dec 2020	DPIE Data from Scientific Licences dataset	Goonoo SCA	No data – 23 different locations
20 Dec 2020	DPIE Data from Scientific Licences dataset	Goonoo SCA	No data – 14 different locations
23 Oct 2021	DPIE Data from Scientific Licences dataset	Mendooran Rd, c. 1 km SW of Goonoo forests. In graded roadside with many native shrubs and forbs.	In sandy soil with roadbase. Graded and lacking trees, but with a diverse assortment of native shrubs and forbs - Daviesia, Acacia, Dampiera, Xerochrysum, Olax, Ozothamnus, Allocasuarina, Dillwynia, Gompholobium. Flowering over roughly three months.
3. Pilliga Forests			
5 Oct 1954	DPIE Default Sightings	Pilliga SF, Coghill Ck-Molleroi Ck, c50km NE of Kenebri Specified Map No: 8736 Specified Reserve: Pilliga East SF	Frequent on distrubed areas in sandy heath. Prostrate undershrub, woody stolons, flowers creamy.
5 Nov 1954	Johnson, L.A.S., Constable, E.F NSW30371	Coghill Creek to Molleroi Creek, 31 miles [49.6 km] NE of Kenelvi,	On disturbed areas in sandy heath.
18 Nov 1999	DPIE Default Sightings	Approx 900m NNE of Galloway Rd 2.2km SW of JCT with Baileys Rd Specified Map No: 8836-S Specified Reserve: Pilliga NR	No data
19 Nov 1999	DPIE Default Sightings	On Galloway Rd approx 4.5km NE from jct with Kerringle Rd Specified Map No: 8836 Specified Reserve: Pilliga NR	No data

Appendix 1: *Commersonia procumbens* records

Commersonia procumbens			
Date	Source	Location	Habitat Notes
2 Dec 1999	DPIE Default Sightings	4.9km east of jct of Newell Hwy and No. 1 break Rd on SW aspect Specified Map No: 8736 Specified Reserve: Pilliga NR	No data – 2 different locations
3 Dec 1999	Alexander, J.D.	Ridge NE of Danbyrock PIL99_17	No PCT allocation Eucalyptus crebra, Eucalyptus chloroclada, Aotus subglauca
5 Dec 1999	Alexander, J.D.	Pilliga PN356	No PCT allocation Eucalyptus chloroclada, Brachyloma daphnoides, Grevillea floribunda, Cassinia laevis
6 Dec 1999	Alexander, J.D.	Pilliga PN363	No PCT allocation Eucalyptus crebra, Eucalyptus chloroclada, Dodonaea viscosa, Harmogia densifolia
9 Dec 1999	Alexander, J.D.	South of Keringle Rd east of Galloway Rd turnoff PIL99_12	No PCT allocation Corymbia trachyphloia, Eucalyptus dwyeri, Eucalyptus macrorhyncha, Cassinia laevis
11 Dec 1999	Alexander, J.D.	Pilliga PN358	No PCT allocation Corymbia trachyphloia, Cassinia laevis, Calytrix tetragona
11 Dec 1999	Alexander, J.D.	Sandstone ridge east of Borah Creek Road PIL99_10	No PCT allocation Eucalyptus sideroxylon, Eucalyptus blakelyi, Leptospermum polygalifolium, Brachyloma daphnoides
16 Dec 1999	DPIE Default Sightings	km on Kerringle Rd from jct of Kerringle and Galloway, Specified Map No: 8836-S Specified Reserve: Pilliga NR	in mallee E. dwyeri, sandy soils
18 Dec 1999	White, M.D.	On gentle slopes below low sandstone ridgeline. Long unburnt callitris endlicheri PILMW212	No PCT allocation Callistris endlicheri, Eucalyptus fibrosa, Corymbia trachyphloia, Allocasuarina diminuta, Leptospermum parviflium, Calytrix tetragona
1 Jan 2009	DPIE Data from Scientific Licences dataset	Pilliga	No data
17 Sep 2009	Armstrong, R., Mazzer, T.	Coolah Common 3524-1	No PCT allocation Corymbia trachyphloia, Leptospermum polygalifolium, Kunzea parvifolia
15 Sep 2010	Hunter, J.T.	Pilliga	No PCT allocation

Appendix 1: *Commersonia procumbens* records

Commersonia procumbens			
Date	Source	Location	Habitat Notes
		PE52	Eucalyptus fibrosa, Harmogia densifolia, Calytrix tetragona, Philotheca ciliata, Leptospermum parvifolium
9 Jan 2011	Hunter, J.T.	Pilliga PN122	No PCT allocation Eucalyptus crebra, Eucalyptus dwyeri, Leptospermum parvifolium, Bossiaea concolor
20 Jan 2011	Hunter, J.T.	Pilliga PN174	No PCT allocation Eucalyptus dwyeri, Corymbia trachyphloia, Allocasuarina diminuta, Calytrix tetragona, Homoranthus flavescens, Harmogia densifolia, Bossiaea concolor
29 Oct 2011	Copeland, L.M. NE 99040 NSW929227 CANB 830399.1	Pilliga East State Forest, N side of Beehive Rd, 2 km WNW of Hardys Spring	Eucalyptus crebra, Callitris endlicheri, Corymbia trachyphloia woodland. Shallow sandy loam over sandstone
23 Jan 2012	State Forests Biodata	intersection of Ironbarks Crossing and L Roads, extending north along Ironbarks Crossing Road and east along L Road	No data
24 Sep 2012	DPIE Data from Scientific Licences dataset	Pilliga East State Forest	No data - 32 different locations
23 Apr 2020	DPIE Data from Scientific Licences dataset	Pilliga East SCA, Beehive Road, c. 22 km E of Newell Highway.	Corymbia trachyphloia and Callitris endlicheri shrubby woodland.
10 Jan 2022	DPIE Data from Scientific Licences dataset	Newell Highway between Coonabarabran and Narrabri, c. 200 m north of Sir William Bridges Rest Area.	In margin of sandy trail c. 50 m from road. Solitary plant. Parent population not located. Flowering.
18 Mar 2022	Turner, B. NSW1119325	Pilliga Forest, Lanes Mill Flora Reserve.	Found in red sand in the recently graded / mechanically disturbed road edge of Pilliga Forest Way in the Pilliga Forest. Found on edge of an area mapped as PCT141, a shrubland vegetation community containing Broombush (Melaleuca uncinata), Acacia triptera, Acacia burrowii, Westringia cheelii, Allocasuarina diminuta, and various other shrub and forbs. Some Mugga Ironbark (Eucalyptus sideroxylon) in the general surrounding area, however a few hundred metres from where the plants were found.
18 Mar 2022	DPIE Data from Scientific Licences dataset	Pilliga Forest Way, The Pilliga NSW	No data – 27 different locations

Appendix 1: *Commersonia procumbens* records

Commersonia procumbens			
Date	Source	Location	Habitat Notes
4. Mt Kaputar			
3 Feb 2000	Hunter & Kingsford	Mt Kaputar NP KAPJH030	No PCT allocation Eucalyptus albens, Eucalyptus dealbata, Cassinia quinquefaria, Acacia buxifolia, Cymbopogon refractus
8 Feb 2000	Hunter, J.	Mt Kaputar NP KAPJH037	No PCT allocation Eucalyptus crebra, Dodonaea viscosa, Poa sieberiana
9 Apr 2000	Hunter & Alexander	Mt Kaputar NP KAPJH060	**3513 Kaputar White Box-Apple Sheltered Forest** Eucalyptus albens, Notelaea microcarpa, Dodonaeae viscosa
10 Apr 2000	Hunter & Alexander	Mt Kaputar NP KAPJH065	No PCT allocation Eucalyptus albens, Callitris endlicheri, Beyeria viscosa,
5. Trinkey SCA			
21 Oct 1999	Binns, D.L.	Trinkey SCA WTDLB012	No PCT allocation Eucalyptus fibrosa, Callitris endlicheri, Allocasuarina gymnanthera, Calytrix tetragona
6. Ulan			
20 Sep 2022 & 21 Apr 2023	DPIE Data from Scientific Licences dataset	2.8km South of Saddlers Creek Road, Ulan 2850	No data – 2 different dates
15 Oct 2021	DPIE Data from Scientific Licences dataset	km NE of Firetail Lane, Bungaba, NSW	No data
7. Goulburn River NP			
5 May 2021	Bell, S	central Goulburn River NP	No PCT allocation – 4 different locations
8. Unknown			
Oct 1977	Godfrey, M. NSW424113	Location withheld [CWS]	No data
8 Mar 1978	Coveny, R.G. Ingram, C.K. NSW824379	Location withheld [CWS]	Rare in sandy soil on low ridge in scrub with Zieria aspalathoides, Acacia uncinata, A. triptera, A. buxifolia, Eucalyptus crebra, Casuarina, etc.

Appendix 1: *Commersonia procumbens* records

Commersonia procumbens			
Date	Source	Location	Habitat Notes
21 Mar 2009	Benson, J.S., Waller, S. NSW793955	Location withheld [NWS] NSW Vegetation Classification and Assessment project (NSW VCA), field trip 14, site 62; ID424.	Ridge. Gravelly quartz sandstone. Eucalyptus dwyeri - E. crebra 8 m high low woodland.
11 Jan 2011	Sullivan, M. NSW891471	Location withheld [NWP]	Open woodland of Corymbia trachyphloia and Callitris endlicheri on red sandy soil downslope of sandstone outcropping. Large number of plants growing on graded road edge, but also extending into adjoining bushland.
29 Nov 2016	Jensen, R., Kemp, J.E. NSW993709	Location withheld [NWP]	In woodland of Acacia burrowii, Eucalyptus sideroxylon and the occasional Callitris glaucophylla over Actinotus gibbonsii, Gonocarpus sp., Gnephosis tenuissima, Aristida ramosa, Microlaena stipoides, Cyperus spp., Goodenia rotundifolia and Hypochaeris glabra on sandy loam. This plant seems to favour recently burnt areas/ashbeds
29 May 2017	McKenzie, D. NSW998728	Location withheld [CWS]	W facing, rocky sandstone hill that had been burnt the previous year. Surrounding vegetation: Acacia doratoxylon, Callitris endlicheri, Eucalyptus dwyeri, E. fibrosa & Persoonia linearis. Moderately dense ground cover with Hemigenia cuneifolia, Ozothamnus sp., Gonocarpus elatus, regenerating Acacia doratoxylon

Appendix 2: *Monotaxis macrophylla* records

Monotaxis macrophylla					
NSW	**Date**	**Location**	**Habitat / Notes**	**PCT**	**Source**
1. Bald Knob SF (North Coast)					
1	22 Sep 1998	Bald Knob area	-	ENSW classification **3856: Woodenbong Plugs Rocky Scrub**	BioNet VOLC Vegetation Survey Plot: VOLCBK3 Andrew Benwell
2	1 Oct 1998	Woodenbong near Qld (1km accuracy)	Growing in rocky Leptospermum species heathland on acid volcanics.	Voucher only [**3856: Woodenbong Plugs Rocky Scrub**] – by inference from habitat description	BioNet Royal Botanic Gardens Herbarium Specimen Register NSW425348 Benwell, A.
3	22 Sep 1998	Bald Knob State Forest, Little Plain, 8 km NW of Woodenbong	Rock outcrop; moderate slope, N aspect. Very shallow loam on acid volcanics. Shrubland with Leptospermum variable, L. microcarpum, Jacksonia sp. nov.	Voucher only [**3856: Woodenbong Plugs Rocky Scrub**] – by inference from habitat description	AVH NE 82702 Benwell, A.S.
4	30 Sep 2001	13.1 km along Mt Lindsay Highway, ENE of Boonal turnoff at Old Koreelah, c. 10 km WNW of Woodenbong, 300 m S of highway.	Skeletal sandy-loam amongst crevices in a volcanic outcrop. Heath with Acacia brunioides	Voucher only [**3856: Woodenbong Plugs Rocky Scrub**] – by inference from habitat description	AVH NE 76438 BRI AQ0643878 MEL 2291254A CANB 550233.1 NSW622129 Copeland, L.M
5	22 Aug 2020	Bald Knob State Forest.	Locally occasional herb to c. 0.4m. Several large plants scattered around, in early fruit/flower. Heath on rock outcrop. On mid to lower slopes of large N facing outcrop in shaded understorey of tea tree thicket. With Leptospermum polygalifolium, Leucopogon sp, Jacksonia scoparia, Plectranthus alloplectus, P. parviflora, Trachymene incisa. Soils mossy deposits on rhyolite.	ENSW classification **3856: Woodenbong Plugs Rocky Scrub**	AVH NSW1101079 Phillips, G.P. | Watts, L. VOLC Vegetation SurveyPlot: VOLCBK2 Andrew Benwell
2. Torrington SCA (North Western Slopes)					

Appendix 2: *Monotaxis macrophylla* records

Monotaxis macrophylla					
NSW	**Date**	**Location**	**Habitat / Notes**	**PCT**	**Source**
6	6 Nov 1998	Torrington SCA	Heath	Voucher only [**4128: Northern New England Rock Outcrop Shrubland**] – by inference from PCT map	AVH NE 68038 L.F. Fulloon
3. Howell (North Western Slopes)					
7	Aug 1905	Howell (10km accuracy)	Growing in alluvial deposits in crevices near the summit of the hills in clumps under similar conditions as Phebalium rotundifolium.	Voucher only [**4132: Western New England Rocky Granite Shrubland**] – by inference from habitat description	BioNet Royal Botanic Gardens Herbarium Specimen Register NSW465730 Maiden, J.H.
8	27 Aug 2003	Howell	Top of rock outcrop. Sandy soil in cracks in granite. Heath with Babingtonia densifolia, Rulingia sp. nov.	Voucher only [**4132: Western New England Rocky Granite Shrubland**] – by inference from habitat description	BioNet Royal Botanic Gardens Herbarium Specimen Register NSW538186 Clarke, P.J. | Knox, K.J.
9	16 Oct 2003	Howell	Large rock outcrop; E aspect. Skeletal sandy loam in crevices in granite. Heath dominated by Babingtonia densifolia & Acacia triptera. Abundant, localised, c. 500 plants seen. Fire-ephemeral growing in abundance approx. 10 months after the outcrop was burnt.	Voucher only [**4132: Western New England Rocky Granite Shrubland**] – by inference from habitat description	BioNet Royal Botanic Gardens Herbarium Specimen Register NSW623193 Copeland, L.M.
10	23 Oct 2003	Howell, Lake Copeton	Eucalyptus delbata / Cllitris endlicheri scattered low forest with: E. caleyi and E. andrewsii. Homoranthus prolixus forming occasional low heath thickets	ENSW classification **4132: Western New England Rocky Granite Shrubland**	BioNet MACINTYRE Vegetation Survey Plot MCT246 Alan Ede, Greg Steenbeeke AVH NSW889585 Steenbeeke, G.L.
4. Warra NP (Northern Tablelands)					
11	9 Feb 1995	Warra NP	-	ENSW classification **3827: Eastern New England Leucogranite Mallee Scrub**	BioNet GRAN Vegetation Survey Plot: 8OBCE John T Hunter

Appendix 2: *Monotaxis macrophylla* records

Monotaxis macrophylla					
NSW	**Date**	**Location**	**Habitat / Notes**	**PCT**	**Source**
12	9 Feb 1995	Warra NP	-	ENSW classification **3827: Eastern New England Leucogranite Mallee Scrub**	BioNet GRAN Vegetation Survey Plot: 8OBCC John T Hunter
13	9 Feb 1995	Warra NP	-	ENSW classification **3827: Eastern New England Leucogranite Mallee Scrub**	BioNet GRAN Vegetation Survey Plot: 8OBCB John T Hunter
14	21 Feb 1995	Warra NP	-	ENSW classification **3827: Eastern New England Leucogranite Mallee Scrub**	BioNet GRAN Vegetation Survey Plot: 9OBCB John T Hunter
15	21 Feb 1995	Warra NP	-	ENSW classification **3827: Eastern New England Leucogranite Mallee Scrub**	BioNet GRAN Vegetation Survey Plot: 9OBCA John T Hunter
16	22 Feb 1995	Warra NP	-	ENSW classification **3827: Eastern New England Leucogranite Mallee Scrub**	BioNet GRAN Vegetation Survey Plot: 10OBCA John T Hunter
17	22 Feb 1995	Warra NP	-	ENSW classification **3827: Eastern New England Leucogranite Mallee Scrub**	BioNet GRAN Vegetation Survey Plot: 10OBCB John T Hunter
18	23 Feb 1995	Warra NP	-	ENSW classification **3827: Eastern New England Leucogranite Mallee Scrub**	BioNet GRAN Vegetation Survey Plot: 12OBCB John T Hunter

Appendix 2: *Monotaxis macrophylla* records

Monotaxis macrophylla					
NSW	**Date**	**Location**	**Habitat / Notes**	**PCT**	**Source**
19	23 Feb 1995	Warra NP	-	ENSW classification **3827: Eastern New England Leucogranite Mallee Scrub**	BioNet GRAN Vegetation Survey Plot: 12OBCD John T Hunter
20	23 Feb 1995	Warra NP	-	ENSW classification **3827: Eastern New England Leucogranite Mallee Scrub**	BioNet GRAN Vegetation Survey Plot: 12OBCC John T Hunter
21	23 Feb 1995	Warra NP	-	ENSW classification **3827: Eastern New England Leucogranite Mallee Scrub**	BioNet GRAN Vegetation Survey Plot: 12OBCF John T Hunter
22	23 Feb 1995	Warra NP	-	ENSW classification **3827: Eastern New England Leucogranite Mallee Scrub**	BioNet GRAN Vegetation Survey Plot: 12OBCE John T Hunter
23	23 Feb 1995	Warra NP	-	ENSW classification **3827: Eastern New England Leucogranite Mallee Scrub**	BioNet GRAN Vegetation Survey Plot: 12OBCA John T Hunter
5. Mt Kaputar NP (North Western Slopes)					
24	22 Apr 2020	Waa Gorge, Mt Kaputar NP	Shrubland/dry rainforest thicket on scree slopes below cliffs. In soils with vegetative cover on lower cliff and scree in semi-shade to full shade on various aspects. With Eucalyptus nanderwarica, Alstonia constricta, Notelaea microcarpa, Kunzea ambigua. Soils shallow loams on trachyte.	Voucher only [**PCT 521: Mount Kaputar Kunzea – Five Star Heath – Spur-wing Wattle Shrubland**] – by inference from PCT map and habitat description	AVH NSW1098864 Copeland, L.M. | Phillips, G.P.
25	12 Nov 2020	Waa Gorge, Mt Kaputar NP	Shrubland on rocky gorge slope. On steep, NW facing slope in shrubby pockets of vegetation among vast rock slab. With	Voucher only	AVH NSW1101261 Phillips, G.P. | Watts, L.

Appendix 2: *Monotaxis macrophylla* records

Monotaxis macrophylla					
NSW	**Date**	**Location**	**Habitat / Notes**	**PCT**	**Source**
			Eucalyptus nandewarica, Kunzea ericoides, Prostanthera cruciflora, Homoranthus flavescens, Austrostipa sp. Soils loamy deposits on trachyte.	[**PCT 521: Mount Kaputar Kunzea – Five Star Heath – Spur-wing Wattle Shrubland**] – by inference from PCT map and habitat description	
6. Pilliga AA (North Western Slopes)					
26	Sep 1995	Pilliga	Red Gum – Pilliga Box From plot: Euc chloroclada, Cory trachyphloia, Ango floribunda grassy woodland type	Not classified [could be **405: White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions**] – inference from PCT mapping and habitat	BioNet PIL_SF_95 Vegetation Survey Plot: WB001314 Doug Binns
27	Nov 2010	Pilliga	Soil dark brown loamy sand From plot: Cory trachyphloia, Philo sals, Damp adpressa, Digi brevi scrubby heath	Not classified [could be **405: White Bloodwood - Red Ironbark - Black Cypress Pine shrubby sandstone woodland of the Pilliga Scrub and surrounding regions**] – inference from PCT mapping and habitat	BioNet JTH_WL Vegetation Survey Plot: WL14 John T Hunter
7. Cobar (North Western Plains)					
28	July 1903	Hermitage Plains (10km accuracy)	-	Voucher only [**103: Poplar Box – Gum Coolabah – White Cypress Pine Shrubby Woodland**] – by inference from rough location and PCT map	BioNet DPIE Data from Scientific Licences dataset AVH NSW252069 NSW252064 Baeuerlen, W.
8. Boona Mount (South Western Plains)					
29	7 Aug 1977	Boona Mount (10km accuracy)	Sandstone hill, skeletal, sandy. Skeletal, sandy. Sandstone hill, Ukdy [Eucalyptus dwyeri] / Akdx [Acacia doratoxylon	Voucher only [**184: Dwyer's Red Gum – White Cypress Pine – Currawang Low Shrub-Grass Woodland**] – by inference from habitat description and PCT map	BioNet Royal Botanic Gardens Herbarium Specimen Register NSW465741 Cunningham, G.M. | Milthorpe, P.L.

Appendix 2: *Monotaxis macrophylla* records

Monotaxis macrophylla					
NSW	**Date**	**Location**	**Habitat / Notes**	**PCT**	**Source**
9. Wollemi NP (Central Western Slopes)					
30	26 Apr 1999	Wollemi NP, Crescent Hill Ridge	regenerating heath/scrub. Soil landscape: Lees Pinch, texture fine to coarse (weathered conglomerate). Mostly well-drained. localised heath community	Observation only [**3866: Wollemi Rockplate Scrub**] – by inference from PCT map	BioNet DPIE Default Sightings
31	29 Apr 1999	Crypt Hill, upper Baerami Valley, W of Denman	Ridge burnt about two summers ago. Eucalyptus dwyeri, Allocasuarine littoralis, Isopogon dawsonii, Leptospermum parvifolium.	Observation only [appears to be same as above but slightly different date] [**3866: Wollemi Rockplate Scrub**] – by inference from PCT map	AVH NSW490336 Gibson, C.P. | Miller, R.T.
32	22 Sep 2014	Wollemi NP, Gungalwa Cr area 1	Shrub to 1 m growing on bare ground after severe October 2013 fire. Hundreds of plants observed	Observation only [**3784: Western Hunter Rocky Scrub**] – by inference from PCT map	BioNet DPIE Data from Scientific Licences dataset
33	11 Oct 2014	Wollemi NP, Gungalwa Cr area 2	Small herb present ca. 12 months after wildfire. Scattered in many small groups along several km of burnt ridgeline.	Observation only [**3784: Western Hunter Rocky Scrub**] – by inference from PCT map	BioNet DPIE Data from Scientific Licences dataset AVH NSW973929 Bell, S.A.J.
34	11 Oct 2014	Wollemi NP, Martindale area	Ridge above Pat and Brians property	Observation only [**3784: Western Hunter Rocky Scrub**] – by inference from PCT map	BioNet DPIE Data from Scientific Licences dataset
35	2 Nov 2014	Wollemi NP, Glen Gallic Tr	Ridge top, northerly aspect, sparse open forest, burnt severely 12 months previously. With Eucalyptus sp., Muehlenbeckia adpressa, Commersonia rosea, Monotaxis macrophylla, Acacia longifolia, Dampiera stricta, Gonocarpus sp., etc. Reddish brown rocky loam over conglomerate sandstone.	Observation only [**3784: Western Hunter Rocky Scrub**] – by inference from PCT map	BioNet DPIE Data from Scientific Licences dataset AVH NSW878524 Holzinger, W. | Johnstone, R.L.
36	2 Nov 2014	Wollemi NP, New Found Out Cr area	Shrub to 1 m growing on bare ground after severe October 2013 fire.	Observation only	BioNet

Appendix 2: *Monotaxis macrophylla* records

Monotaxis macrophylla					
NSW	**Date**	**Location**	**Habitat / Notes**	**PCT**	**Source**
				[**3784: Western Hunter Rocky Scrub**] – by inference from PCT map	DPIE Data from Scientific Licences dataset
37	23 Nov 2014	Wollemi NP, Glen Gallic Trail	Shrub to 1 m growing on bare ground after severe October 2013 fire	Observation only [**3784: Western Hunter Rocky Scrub**] – by inference from PCT map	BioNet DPIE Data from Scientific Licences dataset
10.Deua NP (South Coast)					
38	4 Jan 1991	Deua NP	Growing in cleared fire break through dry rainforest. Ass. spp. include Backhousia myrtifolia, Phebalium squameum, Eriostemon trachyphyllus, Acacia silvestris, Parsonsia straminea . Annual herb c. 30-50 cm high (germinated and attained this height in 2-3 months). c. 24 plants.	Voucher only [**?3045: South Coast Temperate Gully Rainforest**] – by inference from PCT map More likely something like **3669: Brogo Wattle Scrub**	AVH MEL 2012602A NSW237751 D.E. Albrecht & J Westaway
39	1 Jan 1993	Deua NP, Burra Creek	Growing in shrubland on exposed rhyolite slope near creek. Ass. spp. include Melaleuca hypericifolia, Lepidosperma urophorum, Prostanthera porcata, Kunzea ambigua, Dodonaea rhombifolia	Voucher only [**3870: Far Southeast Mountain Rock Scrub**] – by inference from PCT map and habitat description	AVH MEL 2016780A D.E. Albrecht
11. South East Forests NP (South Coast)					
40	14 Dec 2003	Southern end of long promontory on S side of Desert Creek, 60 m S of first ford on Mistake Creek Fire Trail, from Tin Hut Fire Trail end. Bemboka Section	Skeletal sandy soil over broken conglomerate, 3-4 deg. slope. Dry sclerophyll forest - Eucalyptus agglomerata, Acacia georgensis, Euc. wilcoxii, Allocasuarine littoralis, Prostanthera ovalifolia, Zieria cytisoides, Ozothamnus obcordatus, Platysace lanceolata, Stypandra glauca, Pomax umbellata, Lomandra conf. rubiginosa, Lepidosperma urophorum.	Voucher only [**PCT 3642 Brogo Scarp Mallee Scrub** – by inference from habitat and similar classified plots nearby]	AVH NSW716868 Miles, J.
41	27 Dec 2014	Near crest of more northerly of two peaks/cliff-lines south of Desert Creek.	Recently burnt (7 months) rock scrub: Eucalyptus spectatrix, Allocasuarina littoralis (dead), Acacia subtilinervis, Philotheca salsolifolia, P. myoporoides, Micromyrtus ciliata (dead), Haloragodendron baeuerlenii,	ENSW classification **3642: Brogo Scarp Mallee Scrub**	AVH NSW989541 Miles, J. NP_HEATH

Appendix 2: *Monotaxis macrophylla* records

Monotaxis macrophylla					
NSW	**Date**	**Location**	**Habitat / Notes**	**PCT**	**Source**
			Muehlenbeckia rhyticarya, Actinotus gibbonsii, Phyllanthus hirtellus, Entolasia stricta & Stypandra glauca. Skeletal sandy loam soil derived from Devonian conglomerate. Aspect: W. Slope: 10Â°.		BEMFIRE8
42	27 Dec 2014	west-facing slope about 100m W from top of more northerly of the two cliffs (NE from Bemfire3)	-	Not classified [**3642: Brogo Scarp Mallee Scrub** – by inference from nearby plots]	NP_HEATH BEMFIRE6
43	10 Apr 2019	SEFNP Bemboka Section c. 300m from Mistake FT	Growing in rock scrub on edge of conglomerate cliff. Growing in shallow soil on rocky pavement. Associated species: {Acacia georgensis, Allocasuarina littoralis, Micromyrtus ciliata, Stypandra glauca, Phyllanthus hirtellus, Entolasia stricta}.	ENSW classification **3642: Brogo Scarp Mallee Scrub**	AVH CANB 912055.1 G.T. Wright J. Miles SE_EATS_ThrFlo Acgeo08
12. Wingen Maid (not considered)					
44	May 2005	Wingen Maid	Shrubby OF	Not classified Likely misidentification	BioNet HCR_BANGAL Vegetation Survey Plot: SC104

Appendix 3: Inspection point photos

Project Area – Sites 1 to 5 December 2023

Site 1 *A. floribunda*

Site 2 *E. crebra/C. endlicheri/ A. floribunda*

Site 3 *E. crebra/ A. floribunda*

Site 4 *A. floribunda/ C. endlicheri*

Site 5a *E. crebra*

Site 5b Dense grassy layer

Appendix 3: Inspection point photos

Project Area – Sites 6 to 10 December 2023

Site 6 *A. floribunda/ C. endlicheri*

Site 7 *C. endlicheri/ E. dealbata*

Site 8 *C. endlicheri/ E. bridgesiana/ E. melliodora*

Site 9a *E. crebra/ E. macrorhyncha/ E. punctata*

Site 9b Conglomerate bench

Site 10 *E. punctata/ E/ sideroxylon/ E. macrorhyncha*

Appendix 3: Inspection point photos

Project Area – Sites 11 to 14 December 2023

Site 11a *C. endlicheri/ E/ punctata/ E. sideroxylon*

Site 11b Rocky cliff higher up

Site 12 *E. moluccana* regrowth

Site 13a *E. punctata/ C. endlicheri/ E. albens*

Site 13b *E. punctata/ C. endlicheri/ E. albens*

Site 14 *E. albens/ E. blakelyi/ C. endlicheri*

Appendix 3: Inspection point photos

Project Area – Sites 15 to 21 (16 not photographed) December 2023

Site 15 *E. punctata/ A. floribunda/ A. doratoxylon*

Site 17 *E. moluccana*

Site 18 *E. albens/ B. spinosa*

Site 19 *E. albens*

Site 20 *A. floribunda/ E. albens*

Site 21 *E. albens/ A. floribunda/ C. endlicheri*

Appendix 3: Inspection point photos

Project Area – Sites 23 to 29 (24 not photographed) December 2023

Site 23 *E. albens* on flat rocky bench

Site 25 *E. moluccana/ E. microcarpa*

Site 26 *E. albens*

Site 27 Derived native grassland

Site 28 *E. punctata/ E. sparsifolia*

Site 29 *E. punctata/ E. sparsifolia/ E. macrorhyncha*

Appendix 4: Burnt area photos

Non Project Area (Burnt in 2023) December 2023






niche-eh.com

Excellence in your environment

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Offset strategy and assessment (NSW, QLD, Commonwealth)
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