

LEADING THE WAY
IN ENVIRONMENTAL
MANAGEMENT



**ECOLOGICAL
ASSESSMENT FOR
NGAMBAA REWILDING
PROJECT**

NATIONAL PARKS AND WILDLIFE
SERVICES C/O GHD PTY LTD

September 2021

Contents

Document Control Page	6
1. Executive Summary	7
Legislative Compliance	7
2. Abbreviations	8
3. Background Information	9
3.1 Location of the Study Site and Key Definitions	9
3.2 Development Proposal	9
3.3 Soils, Topography and Geology.....	10
3.4 Land Use	11
4. Methods.....	16
4.1 Desktop Study and Literature Review	16
4.2 Flora Survey	17
4.3 Fauna Survey.....	18
4.4 Survey Timing and Limitations.....	24
4.5 Weather Conditions	25
5. Results	28
5.1 Desktop Search Results.....	28
5.2 Flora Survey Results	36
5.3 Fauna Survey Results	49
6. Impact Assessment	66
6.1 Direct Impacts	66
6.2 Indirect Impacts.....	67
7. Biodiversity Conservation Act 2016 Assessment	72
7.1 Assessment Pathway	72
7.2 Five-part Test of Significance	72
8. Fisheries Management Act Assessment.....	76
8.1 Waterways Definition and Description	76
8.2 Aquatic Vegetation	76
8.3 Key Fish Habitat	78
8.4 Threatened Fauna and Populations	79
8.5 Impacts of the Proposal	79
8.6 Permit Requirement.....	80
9. Recommendations.....	81



9.1	General Clearing Measures	81
9.2	Pre-clearing Survey and Clearing Supervision.....	81
9.3	Threatened Flora Protection	82
9.4	Hollow-bearing Tree Removal.....	82
9.5	Hollow log and Bush Rock Salvage.....	82
9.6	Koala Food Tree Offsets.....	83
9.7	Aquatic Habitats, Hydrology and Water Quality Controls	83
9.8	Sedimentation and Erosion Control	83
9.9	Weed Control.....	84
9.10	Introduction of Pests and Pathogens.....	84
9.11	Lighting, Noise, Vibration and Air Quality.....	85
9.12	Excavations	85
9.13	Movement Barriers and Connectivity	85
9.14	Fencing	86
9.15	Waste	86
9.16	Vertebrate pest control programs	86
9.17	Monitoring	86
9.18	Management of Excess Reintroduced Species	87
10.	Conclusion	88
10.1	Further legislative requirements.....	88
11.	References.....	89
12.	Appendices	92



List of Tables

Table 1: List of abbreviations used within the report	8
Table 2: Threatened flora species for target survey	17
Table 3: Locally recorded threatened species.....	28
Table 4: <i>Lantana camara</i> biosecurity duty	48
Table 5: Summary of site habitat values.....	49
Table 6: Threatened fauna recorded during surveys.....	60
Table 7: Potentially occurring species subject to a Test of Significance.....	72
Table 8: Contribution to Key Threatening Processes	73
Table 9: Comprehensive list of flora recorded during the survey period.....	93
Table 10: Comprehensive list of fauna recorded during the survey period	98
Table 11: Potential occurrence assessment - TECs	102
Table 12: Potential occurrence assessment - flora	103
Table 13: Potential occurrence assessment - fauna	107
Table 14: BC Act Test of Significance - <i>Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion</i>	123
Table 15: BC Act Test of Significance - <i>Rhodamnia rubescens, Parsonsia dorrigoensis and Marsdenia longiloba</i>	126
Table 16: BC Act Test of Significance – Green-thighed Frog and Giant Barred Frog	130
Table 17: BC Act Test of Significance - Microchiropteran Bats.....	133
Table 18: BC Act Test of Significance – Threatened Forest Owls.....	136
Table 19: BC Act Test of Significance – Threatened Woodland Birds	138
Table 20: BC Act Test of Significance – Stephen’s Banded Snake.....	141
Table 21: BC Act Test of Significance - Koala	145
Table 22: BC Act Test of Significance - Spotted-tailed Quoll	148
Table 23: BC Act Test of Significance – Red-legged Pademelon	150
Table 24: BC Act Test of Significance – Arboreal mammals	154
Table 25: Significant impact assessment – Glossy Black-cockatoo and Little Lorikeet.....	157

List of Figures

Figure 1: Location of the subject site	12
Figure 2: Development layout plan	13
Figure 3: NSW (Mitchell) Landscapes	14
Figure 4: Quaternary geology	15
Figure 5: Location of fauna surveys (part 1)	26
Figure 6: Location of fauna surveys (part 2)	27
Figure 7: Bionet Atlas flora records in the study area.....	32
Figure 8: Bionet Atlas fauna records in the study area	33



Figure 9: Bionet Atlas flora records in the subject site 34

Figure 10: Bionet Atlas fauna records in the subject site 35

Figure 11: DPI NSW Forest Types 38

Figure 12: Site vegetation communities (a) 39

Figure 13: Site vegetation communities (b) 40

Figure 14: Site vegetation communities (c) 41

Figure 15: Site vegetation communities (d) 42

Figure 16: Site vegetation communities (e) 43

Figure 17: Site vegetation communities (f) 44

Figure 18: Site vegetation communities (g) 45

Figure 19: Location of threatened flora species 47

Figure 20: Location of hollow-bearing trees 55

Figure 21: Location of Koala food trees 56

Figure 22: Location of Aquatic habitat surveys 57

Figure 23: Location of threatened fauna 63

Figure 24: Key fish habitat mapping (DPI 2021b) 78

List of Photos

Photo 1: HBT 19 marked within the subject site 51

Photo 2: Representative aquatic habitats within the subject site (Site 4). 53

Photo 3: Representative aquatic habitats within the subject site (Site 6). 54

Photo 4: Feather-tailed Glider 58

Photo 5: Swamp Wallaby 59

Photo 6: Short-beaked Echidna 59

Photo 7: Long-nosed Bandicoot 60

Photo 8: Brush-tailed Phascogale 61

Photo 9: Koala 61

Photo 10: Possible Red-legged Pademelon 62

Photo 11: Cat (*Felis catus*) 64

Photo 12: Domestic Cattle (*Bos taurus*) 65

Photo 13: Stream bank riparian vegetation present within Ngambaa Nature Reserve (Site 4).
..... 77

Photo 14: Stream bank riparian vegetation present within Ngambaa Nature Reserve (Site 5).
..... 77



Document Control Page

Version Control

Version	Purpose	Author	Reviewed / approved by	Date
Rev 1.0	Draft Report	Natasha Reid	Leonie Stevenson/Anne-Marie Smit	20/08/2021
Rev 2.0	Draft Report	Natasha Reid	Leonie Stevenson/Anne-Marie Smit	06/09/2021
Rev 3.0	Draft Report	Natasha Reid	Anne-Marie Smit	15/09/2021
Rev 5.0	Draft Report	Lachlan Webster	Karl Robertson	14/06/2022

Distribution Control

Copy	Purpose	Method	Issued to:	Name	Date
1	File Copy	Electronic/Email	Biodiversity Australia	Chantal Sargeant	20/08/2021
2	Client Review	Electronic/Email	GHD Pty Ltd	Ben Luffman	20/08/2021
3	File Copy	Electronic/Email	Biodiversity Australia	Chantal Sargeant	06/09/2021
4	Client Review	Electronic/Email	GHD Pty Ltd	Ben Luffman	06/09/2021
5	File Copy	Electronic/Email	Biodiversity Australia	Chantal Sargeant	15/09/2021
6	Client Review	Electronic/Email	GHD Pty Ltd	Ben Luffman	15/09/2021
7	File Copy	Electronic/Email	Biodiversity Australia	Chantal Sargeant	14/06/2022
8	Client Review	Electronic/Email	NSW NPWS	Scott Filmer	14/06/2022

Project Number: EC4702

Our Document Reference: EC4702-BEC-REP-NgambaaRewildingEA-rev5.0

This document has been prepared to the requirements of the client identified on the cover page and no representation is made to any third party. It may be cited for the purposes of scientific research or other fair use, but it may not be reproduced or distributed to any third party by any physical or electronic means without the express permission of the client for whom it was prepared or Biodiversity Australia Pty Ltd.



1. Executive Summary

The subject site is located at Ngambaa Nature Reserve on the Mid-North Coast of NSW. The construction of a feral-proof fence and the associated works is proposed at the site and was assessed in accordance with the requirements of the NSW *Biodiversity Conservation Act 2016* (BC Act), *Biodiversity Conservation Regulation 2017*, and the *Fisheries Management Act 1994*. The assessment was undertaken to determine the potential impacts that the proposed works would have on the ecological values of the subject site.

The NSW Rewilding Program is a ten-year project that aims to reintroduce native fauna and restore ecosystems in NSW. The program involves the establishment of a large feral predator (cats and foxes) free area at Ngambaa Nature Reserve. This predator free area will enable the reintroduction of locally extinct species, provide conservation benefits to other threatened species and restore essential ecosystem functioning processes. The development proposal includes the construction of a 31.36 kilometre feral-proof fencing and all associated works. The proposed development site covers an area of approximately 69.75 ha within moderate to remnant forested areas. Vegetation removal, earthworks and instream works will be required to establish the proposed predator proof fence.

Potential impacts of the proposal include loss of vegetation and habitats, loss of Hollow-Bearing Trees and Koala Food Trees and impacts to aquatic habitats. Potential indirect impacts include fragmentation, weed invasion and barriers to fauna movement and connectivity.

Surveys were carried out in June-July 2021. One (1) threatened ecological community, *Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion* listed as endangered under the BC Act, was recorded within the subject site. Two (2) threatened flora and eight (8) threatened fauna species listed under the BC Act. A total of 13 additional threatened fauna species were found to have at least a fair potential to occur within the subject site.

The significance assessments carried out for the proposed predator-proof fence construction and associated works determined that the proposal is not expected to significantly impact upon the potentially occurring threatened community nor threatened species known, or those potentially occurring within the subject site due to the extent of vegetation to be retained, that potential local populations of the subject species would extend well beyond the subject site and considering the application of the proposed ameliorative measures detailed in this report.

Legislative Compliance

Fisheries Management Act 1994: The proposal involves works within the Allgoamera, Stockyard and Eungai Creeks, this includes in-stream works and the potential removal and/or impact on aquatic vegetation and habitats. As such, a permit under Section 219 of the FM Act 1994 is required to obstruct the free passage of fish.

Biodiversity Conservation Act and Regulation: Tests of Significance have determined that the proposal is unlikely to result in a significant impact on listed species or ecological communities, or their habitats. The proposal is not considered to require a Biodiversity Development Assessment Report (BDAR) under the BC Act 2016.



2. Abbreviations

Table 1: List of abbreviations used within the report

AEC	Animal Ethics Committee
ASL	Above Sea Level
ASS	Acid Sulphate Soils
BAM	Biodiversity Assessment Method
BC Act	<i>Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
DAWE	Department of Agriculture, Water and the Environment
DEC	Department of Environment and Conservation
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
EEC	Endangered Ecological Community
EPA	Environmental Protection Authority
FE	Forest Ecosystem
FM Act	<i>Fisheries Management Act 1994</i>
FT	Forest Type
GIS	Geographic Information System
GPS	Global Positioning System
HBT	Hollow-bearing Tree
KFT	Koala Food Tree
KMA	Koala Management Area
KTP	Key Threatening Process
Microbat	Microchiropteran bat
NPWS	National Parks and Wildlife Services
NSW	New South Wales
OEH	Office of Environment and Heritage
OGT	Old Growth Trees
PCT	Plant Community Type
PIR	Passive Infrared Camera
REF	Review of Environmental Factors
RFQ	Request for Quote
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community
the reserve	Ngambaa Nature Reserve
WHS	Workplace Health and Safety



3. Background Information

3.1 Location of the Study Site and Key Definitions

Ngambaa Nature Reserve (the reserve) is situated in the Mid-north Coast of New South Wales. It is located approximately ten kilometres south-west of Macksville and 16 kilometres north-west of Kempsey and covers a total area of approximately 10,560 hectares (Figure 1).

Ngambaa Nature Reserve is one of four selected locations in NSW for the establishment of a feral predator-free area to enable the reintroduction of locally extinct species. The establishment of this area will involve the construction of exclusion fencing and the establishment of a temporary basecamp worksite compound. This report assesses the environmental impact of the establishment of this feral predator-free area.

3.1.1 Key definitions

- The Calculated construction activity footprint (CCAF) is defined as the area of land directly affected by the proposed development, and refers to the area which is calculated from the activity footprint plus the applied construction buffers. The CCAF is based on worst case scenario with the intent to allow for micro-siting of the final activity footprint while constructing. This encompasses the area within a ten-metre buffer of the fence line (62.61 ha) and the basecamp worksite compound (7.14 ha), totalling 69.75 hectares.
- The subject site refers to the site as defined by the 'Calculated Construction Activity Footprint' plus 10 m either side of the defined outer limit of the linear CCAF.
- The study area/locality is land within a ten-kilometre buffer of the CCAF. The development proposal is shown in Figure 2.

3.2 Development Proposal

The NSW Rewilding Program is a ten-year project that aims to reintroduce native fauna and restore ecosystems in NSW. It involves the establishment of four large feral predator (cats and foxes) free areas which will enable the reintroduction of locally extinct species, provide conservation benefits to other threatened species and restore the function of essential ecosystem processes. Ngambaa Nature Reserve is one of these four selected locations.

The project will deliver conservation benefits for threatened animal species in NSW by:

- Re-establishing species currently listed as extinct in NSW;
- Establishing new populations of animals currently locally extinct; and
- Reducing the extinction risk of many species including those impacted by bushfire.

Key elements of the project involve:

- Detailed planning and identification of suitable sites
- Consultation with key stakeholders
- Planning and approvals including amendment to the reserve Plan of Management and environmental and cultural assessments.
- Construction of feral proof fencing (31.36 kilometres) and additional internal release fence. The conservation fence will be a 1.8 metre high, wire mesh fence with floppy top, mesh size/gauge designed to exclude foxes, feral cats and rabbits. It will consist of two mid height electric wires and



a skirt to lay flat on the ground to prevent burrowing. Specially, designed gates will be placed strategically for management emergency and public access. An example fence design (Newscape 2020), including indicative full clearing areas and management zones is provided in Appendix A-1.

- Other associated infrastructure; which will involve vegetation management for both sides of the proposed fence, roading to improve access for construction and maintenance, associated drainage (six culvert and/or crossing infrastructure), erosion and sediment control and establishment of site base camp compound, office, hard-roofed shed, storage shelter and composting toilet and shower.
- Eradication of feral predators, and feral herbivores (where practical).
- Reintroduction of locally extinct animal species. Species considered for reintroduction include the Eastern Bettong (*Bettongia gaimardi gaimardi*), Rufous Bettong (*Aepyprymnus rufescens*), Eastern Quoll (*Dasyurus viverrinus*), Common Planigale (*Planigale maculata*), Long-nosed Potoroo (*Potorous tridactylus*), New Holland Mouse (*Pseudomys novaehollandiae*), Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*) and Parma Wallaby (*Macropus parma*).
- Monitoring, evaluation and reporting on species, threats and ecosystem health.
- Development opportunities for visitors, researchers and educational groups.
- Ongoing maintenance and park management activities.

Biodiversity Australia has prepared this ecological assessment (EA) with the aim of providing a robust survey to determine the development proposals impact on listed fauna, flora and vegetation communities within and adjacent to the subject site.

This EA will form an appendix to the Review of Environmental Factors (REF), prepared by GHD.

3.3 Soils, Topography and Geology

Ngambaa Nature Reserve protects a large area of the coastal range and incorporates a number of significant ridgelines and mountains. Mungay Mountain forms part of a steep ridgeline which runs north east along most of the western boundary of the reserve and also includes Good Friday and Scotsman Mountains. This ridgeline is the watershed for streams flowing north and west to Taylors Arm and east to Eungai and Allgomera Creeks. A steep ridge also runs east west along the southern boundary of the reserve. The reserve contains a mix of gentle and very steep slopes that exceed up 30 degrees in some areas (NPWS 2004). Elevation varies across the reserve between approximately 80 metres asl (asl) in the valleys to 450 meters asl at Mungay Mountain. Allgomera Creek to the north, Stockyard Creek in the centre and Eungai Creek to the south all consist of catchment areas from within the reserve (NPWS 2004).

NSW landscapes (formally Mitchell) mapping has mapped two soil types across the subject site. This mapping is shown in Figure 3 and described as follows:

Macleay Escarpment Foothills, NNC Manning – Macleay. Ridges, hills and drainage basins leading up to the Great Escarpment on complex and poorly known geology of Silurian-Devonian, Permian and Carboniferous schist, phyllite, slate, quartzite, schistose sandstone, conglomerate, sandstone, mudstone, limited limestone and interbedded volcanics. General elevation 200 to 500m, local relief 250m. Shallow brown earths, grading to brown texture-contrast soils on lower slopes. Thin stony profiles on steep slopes, yellow texture-contrast soils on high river terraces in wider valleys. The valleys and near coastal sectors contain forest and open forest of spotted gum (*Corymbia maculata*), narrow-leaved ironbark (*Eucalyptus crebra*), white mahogany (*Eucalyptus acmenoides*), large-fruited grey gum (*Eucalyptus canaliculata*), cabbage gum (*Eucalyptus amplifolia*), grey box (*Eucalyptus moluccana*), rough-barked apple (*Angophora floribunda*) and forest oak (*Allocasuarina torulosa*) with river oak (*Casuarina cunninghamiana*) along the streams. In the west and extending into the gorges lowland



subtropical closed forest is found with; brush box (*Lophostemon confertus*), Sydney blue gum (*Eucalyptus saligna*), yellow carabeen (*Sloanea woollsi*), jackwood (*Cryptocarya glaucescens*), pigeonberry ash (*Cryptocarya erythroxylon*), pepperberry tree (*Cryptocarya obovata*), bolly gum (*Litsea reticulata*), sassafras (*Doryphora sassafras*), crabapple (*Schizomeria ovata*), white quandong (*Elaeocarpus kirtonii*), and churnwood (*Citronella moorei*) with cabbage-tree palm (*Livistona australis*) and bangalow palm (*Archontophoenix cunninghamiana*). Dry closed forest on steep sites protected from fire, small areas with cool temperate closed forest components on southern aspects at higher altitudes. Limestone areas have not been mapped but include both the Kunderang Brook and Willi Willi karst (DoECC 2002).

Ingalba Coastal Hills, NNC Manning – Macleay. Coastal hills and slopes on lower Permian slate, phyllite, schistose sandstone and schistose conglomerate. General elevation 0 to 830 m, local relief 350 m. Thin, stony gradational loam and sandy loam on the slopes grading to yellow-brown texture-contrast soils on lower slopes and in valleys. Dry coastal hardwood forest of; blackbutt (*Eucalyptus pilularis*), spotted gum (*Corymbia maculata*), large-fruited blackbutt (*Eucalyptus pyrocarpa*), tallow wood (*Eucalyptus microcorys*), Sydney blue gum (*Eucalyptus saligna*), northern grey gum (*Eucalyptus propinqua*), white mahogany (*Eucalyptus acmenoides*) and grey ironbark (*Eucalyptus paniculata*) (DoECC 2002).

Quaternary geology mapping (see Figure 4) shows that two areas within the eastern portion of the proposed fence alignment lies on Quaternary undifferentiated (Qap) alluvial floodplain. This unit consists of Silt, clay, fluvial sand and gravel and is a plain bounding active stream channel generally incorporating areas of other alluvial plain unit types (Troedson and Hashimoto 2008).

No areas are mapped as Acid Sulfate Soils (ASS) within close proximity to the subject site. Mapped low probability of ASS risk occurs approximately 6 km south-east of the subject site and high probability of ASS risk occurs approximately 7 km south-east of the subject site (SEED 2021).

3.4 Land Use

Climate, landform, geology and plant and animal communities have determined how humans have used Ngambaa Nature Reserve. A long history of logging is evident throughout the reserve by the existing road systems and vegetation structure. The reserve comprised land that was previously part of Ingalba, Collombatti and Tamban State Forests. These State Forests now adjoin the reserve. Other land uses that adjoin the reserve are rural land holdings primarily used for grazing livestock. Aboriginal resource use has also influenced the landscape through activities such as clearing, grazing and recreational uses (NPWS 2004).

The Reserve contains some areas of old growth forest. Currently the reserve is open to public access for bushwalking, birdwatching, picnics and car touring along the many established dirt tracks.



Figure 2: Development layout plan

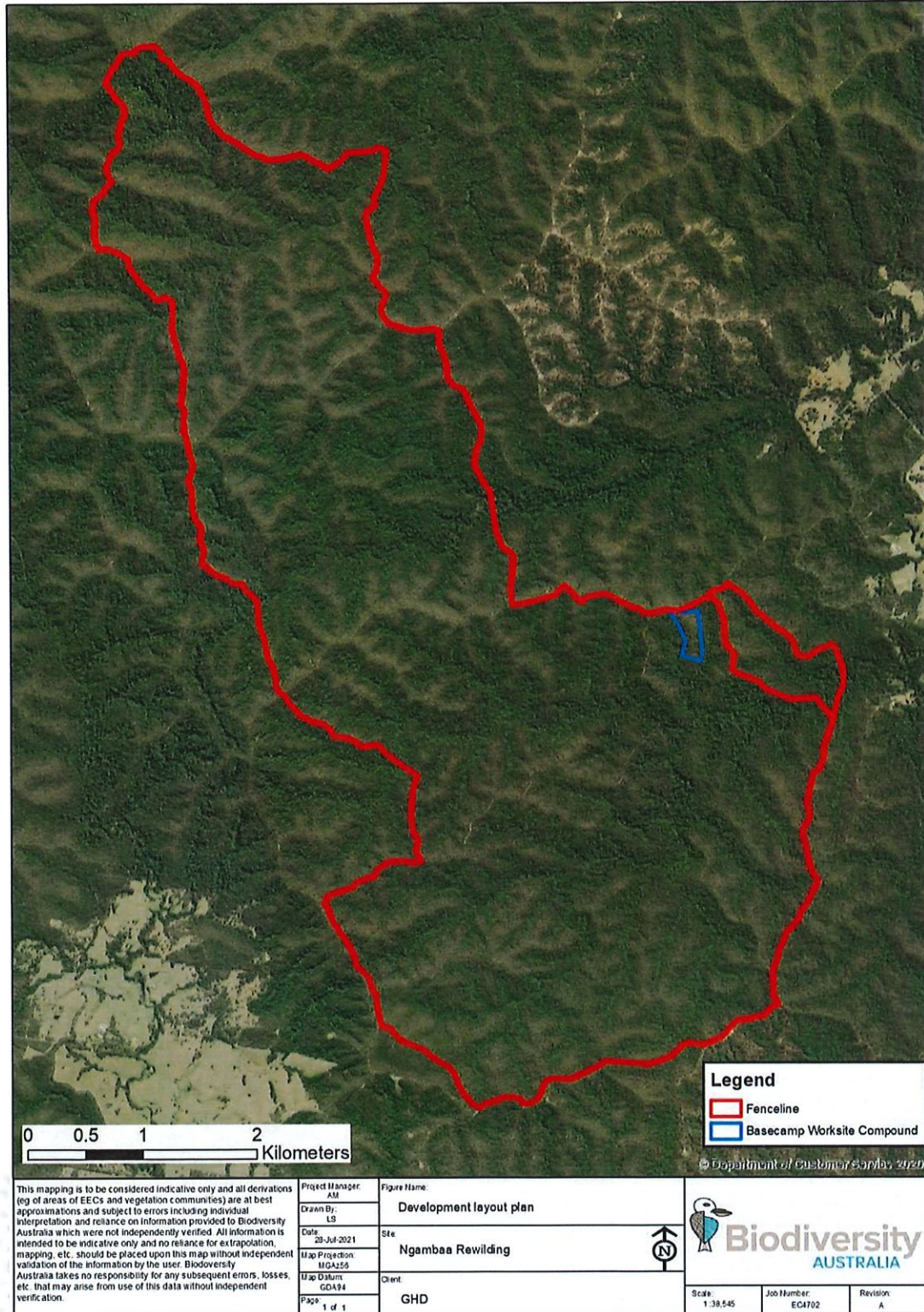


Figure 3: NSW (Mitchell) Landscapes

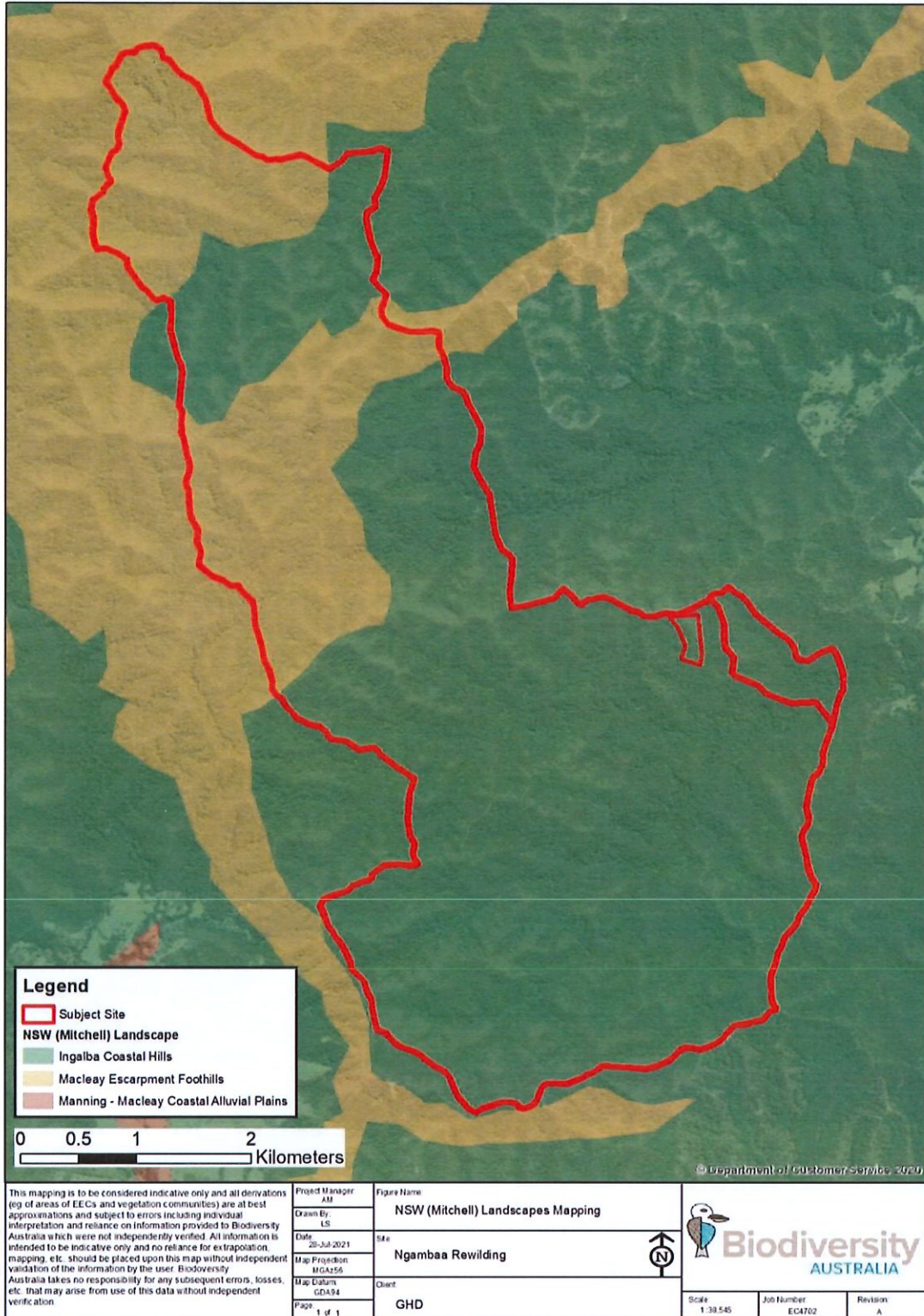
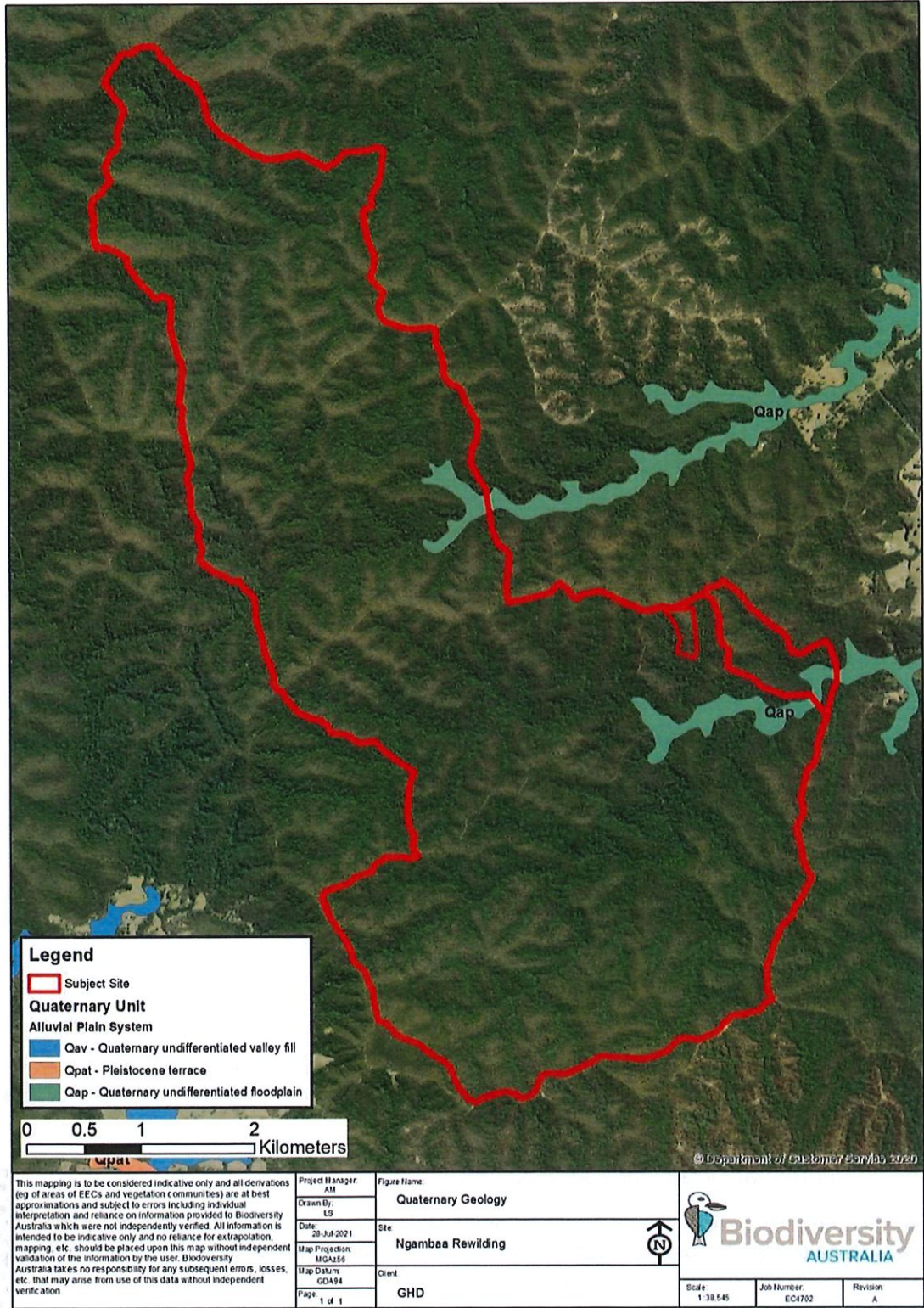


Figure 4: Quaternary geology



4. Methods

4.1 Desktop Study and Literature Review

A desktop study and literature review was carried out to gather relevant information and data. The following databases, literature and Geographic Information System (GIS) layers were searched/obtained prior to the preparation of survey methodology and field surveys:

- Department of Agriculture, Water and the Environment - Protected Matters Search Tool (DAWE 2021a).
- Department of Agriculture, Water and the Environment - Species Profile and Threats Database (SPRAT) (DAWE 2021b).
- Department of Agriculture, Water and the Environment - National Flying-fox monitoring Viewer (DAWE 2021c).
- Department of Planning, Industry and the Environment - NSW BioNet/Atlas of Wildlife (DPIE 2021a).
- Department of Planning, Industry and the Environment - Threatened Biodiversity Data Collection (DPIE 2021b).
- Department of Planning, Industry and the Environment - NSW Vegetation Information System (DPIE 2021c).
- Department of Planning, Industry and the Environment - Biodiversity Values Map and Threshold Tool and digital data layer (DPIE 2021d).
- Department of Primary Industries - NSW Fisheries Spatial Data Portal (DPI 2021a).
- Department of Primary Industries - Key Fish Habitat mapping (DPI 2021b).
- Department of Primary Industries - Threatened Species Lists (DPI 2021c).
- Forestry Corporation of NSW Open Data Site – NSW Forest Types (FCNSW 2021).
- Coastal Quaternary Geology – North and South Coast of NSW digital data layer (Troedson & Hashimoto 2008).

A literature review of the following documents was undertaken to gain an understanding of the history of the subject site and the environmental attributes previously documented. The following literature was reviewed:

- Ngambaa Nature Reserve Plan of Management (2004).
- Ngambaa Nature Reserve Threatened and Rare Plant Species Booklet (Graham, undated).
- Australian Wildlife Conservancy (2017). Review of Environmental Factors. Proposed construction and operation of conservation fencing and associated infrastructure and reintroduction of locally extinct mammals in the Pilliga State Conservation Area.

4.1.1 Potential Occurrence Assessment

Potential occurrence assessments of locally recorded and predicted to occur threatened communities, flora and fauna species are provided in Appendix A-4. This section assesses threatened species for their potential to occur within the subject site based on the habitats which occur.



4.2 Flora Survey

The flora survey was undertaken by a botanist with more than 20 years' experience in botany, Greg Elks, on the 6th and 7th of July 2021. This survey consisted of three main components:

- Identification, description and mapping of the vegetation communities on the subject site.
- Identification and condition assessment of any Threatened Ecological Communities listed under the BC Act.
- Searches for threatened species listed under the *Biodiversity Conservation Act 2016 (BC Act)* undertaken in accordance with the NSW Guide to Surveying Threatened Plants (OEH 2016).

4.2.1 Vegetation Identification, Classification and Mapping

Subject site floristics and vegetation communities were sampled via random meander transects along the length of the subject site.

Plant species were identified to species or subspecies level and nomenclature conforms to that currently recognised by the Royal Botanic Gardens and follows Harden (1990, 2007) and PlantNET (Royal Botanic Gardens 2021) for changes since Harden.

Vegetation communities were assessed against the Department of Primary Industries (DPI) NSW Forest Types (FT) and Forest Ecosystems (FE) mapping and classifications were based on the NSW Plant Community Type (PCT) Classification. Identification of possible Threatened Ecological Communities (TECs) was based on the data collected in the survey and review of the relevant listings on the Department of Planning, Industry and the Environment - Threatened Biodiversity Data Collection (DPIE 2021b).

4.2.2 Threatened Flora Species

A target list of threatened flora species was assembled from the Ngambaa Nature Reserve Threatened and Rare Plants Species booklet (Graham, undated), the Ngambaa Rewilding Project Request for Quote (RFQ) (DPIE 2021e) and a Bionet search of the study area (DPIE 2021a). The following table lists the species selected for target survey based on their likelihood to occur in the area.

Table 2: Threatened flora species for target survey

Common Name	Scientific Name	BC Act Status
Slender Marsdenia	<i>Marsdenia longiloba</i>	E
Rusty Plum	<i>Niemeyera whitei</i>	V
Milky Silkpod	<i>Parsonsia dorrigoensis</i>	V
Scant pomaderris	<i>Pomaderris queenslandica</i>	E
Scrub Turpentine	<i>Rhodamnia rubescens</i>	E
Native Guava	<i>Rhodomyrtus psidioides</i>	E
Rainforest Cassia	<i>Senna acclinis</i>	E
Key: Endangered (E), Vulnerable (V) and not listed (-).		

Targeted searches for threatened plant species were undertaken in conjunction with vegetation classifications and mapping surveys. Threatened flora searches involved the use of foot and vehicle



traverses along the length of the subject site. These traverses focused on areas of potentially suitable habitat for threatened flora species within the subject site. Focus was made on selected target flora species however all threatened flora species listed under the *Biodiversity Conservation Act 2016* (BC Act) were targeted.

A total of 15 kilometres of foot traverses were undertaken along the subject site during the survey period. The remainder of the subject site was surveyed for threatened flora via slow-moving vehicle traverses with spot searches at regular intervals targeting threatened flora likely to occur in the area.

In the event that a threatened flora species was identified, follow-up foot traverses within 100 metres of a threatened flora detection site were conducted.

Opportunistic searches for threatened flora species were also undertaken during other activities on the subject site.

4.3 Fauna Survey

The fauna survey was undertaken by a Senior Ecologist and Ecologist under Biodiversity Australia's scientific license and animal research authority. These were undertaken between the 7th of June and 8th July 2021. The methods per survey measure are detailed below.

4.3.1 Terrestrial Habitat Evaluation

This was the main survey method employed to assess the suitability of site habitats for threatened species recorded in the study area, or in broadly similar habitats in the region.

Habitats on and adjacent to the subject site were defined and assessed according to parameters such as:

- Structural and floristic characteristics of the vegetation;
- Degree and extent of disturbance;
- Presence of water in any form;
- Presence of nests, roosts and burrows;
- Presence of hollow-bearing trees;
- Presence of food resources (Allocasuarinas, Koala food trees, winter-flowering eucalypts);
- Presence of caves, cliffs, overhangs, culverts, bridges;
- Size and abundance of hollows and fallen timber;
- Availability of shelter e.g. rocks, logs, hollows, undergrowth;
- Wildlife corridors, refuges and proximate habitat types; and
- Presence of mistletoe, nectar, gum, seed and sap sources.

This information is considered for evaluation of the potential occurrence of threatened species on or adjacent to the site based on cited ecology and personal experience/knowledge of the species.

4.3.2 Aquatic Habitat Evaluation

The aquatic habitats present within the subject site were assessed for their potential to support aquatic fauna and threatened aquatic species.



An aquatic habitat assessment was undertaken at each of the six creek crossing sites. These assessments document the geomorphic characteristics of the waterway, the flow regime, the description of the visual water quality, surrounding land use and vegetation in the riparian zone, presence and condition of aquatic vegetation and the substrate type as a minimum in accordance with the *Policy and Guidelines for Fish Habitat Conservation and Management* (DPI 2013).

Where habitats were considered suitable for the Purple-spotted Gudgeon (*Mogurnda adspersa*), a 20-minute targeted dip net dip netting was undertaken. Additional optional bait trapping was also undertaken where habitats allowed a suitable depth for sampling.

4.3.3 Dip Netting and Bait Trapping

Where aquatic habitat assessments identified potential suitable habitat for the Southern Purple Spotted Gudgeon (*Mogurnda adspersa*) and a suitable water depth, a dip net survey and bait trapping were undertaken in line with the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) *Survey guidelines for Australia's threatened fish* (DSEWPC 2011).

The dip netting surveys involved a 20-minute targeted survey whereby a hand-held net was scooped/dipped along edge and riffle habitats within the creek. Species captured were temporarily placed in a bucket of creek water for identification, before being returned to the water. A total of three water crossings within the subject site were sampled via this methodology.

Bait trapping surveys involved the deployment of a single 3mm mesh bait trap, baited with seafood flavoured, dry cat food. Traps were set over a period of two days/nights and checked periodically. Only a single water crossing within the subject site was determined to be suitable for bait trapping and was surveyed via this method. The location of this survey is provided in Figure 5.

4.3.4 Habitat Tree Inventory

A habitat tree inventory was compiled during the survey period. This included hollow-bearing trees, old growth trees and Koala food trees within the subject site.

All hollow-bearing trees (HBTs) and old growth trees (OGTs) within the subject site were located and recorded via a GPS enabled tablet. These were marked with blue or green flagging tape and given a unique identifying number. HBTs were categorised as containing small (<5cm), medium (5-15cm) and/or large (>15cm) hollows and hollow characteristics such as signs of usage e.g., droppings, chewed or worn edges, were recorded. This assessed for potential habitat value and aided in the determination of suitability of the habitats for hollow-obligate fauna species. This may include species such as, the Squirrel Glider, Brush-tailed Phascogale, Yellow-bellied Glider, threatened microbats and threatened forest bird and owl species.

Tree species listed under the DPIE NSW Koala Strategy (DPIE 2021f) as, *High Preferred Use* trees for the Koala in the North Coast Koala Management Area (KMA), were identified and recorded via GPS enabled tablet. Tree species listed include:

- *Eucalyptus biturbinata* (Grey Gum);
- *Eucalyptus canaliculate* (Large-fruited Grey Gum);
- *Eucalyptus microcorys* (Tallowwood);
- *Eucalyptus moluccana* (Grey Box);
- *Eucalyptus propinqua* (Small-fruited Grey Gum);
- *Eucalyptus punctata* (Grey Gum);



- *Eucalyptus robusta* (Swamp Mahogany); and
- *Eucalyptus tereticornis* (Forest Red Gum).

4.3.5 Direct Observation

This involved passive and active observation of any fauna on or directly adjacent to the subject site during survey activities. Birds and mammals were the main focus of the surveys with searches for Koalas, birds' nests and dreys in the crowns of trees undertaken.

Bird surveys involved passive (e.g. listening for bird calls) and active observation/binocular searches while walking around the entire subject site; and opportunistically during other activities.

Torch searches for roosting microchiropteran bats were also undertaken during daylight hours in decorticated bark, accessible tree hollows and in any artificial structures found within the subject site.

A total of 180 person-hours was spent on this activity over the survey period, in conjunction with other survey activities.

4.3.6 Secondary Evidence Searches

Secondary evidence searches were undertaken opportunistically throughout the subject site in conjunction with other fauna surveys. These searches involved:

- the inspection of trees for fauna claw markings, nests and dreys;
- searches for scats, diggings, owl regurgitation pellets, tracks, scratches and bones;
- searches under *Allocasuarina* species for cones chewed by Glossy Black Cockatoos;
- the inspection of potential microbat roosts for usage (i.e., urine stains, droppings, remains and bat fly casings); and
- targeted Koala scat searches under trees listed under the DPIE NSW Koala Strategy (DPIE 2021f) as *High Preferred Use* trees for the Koala in the KMA.

Secondary evidence recorded was attributed to fauna species as per Triggs (1996).

A total of 180 person-hours was spent on this activity over the survey period, in conjunction with other survey activities.

4.3.7 Diurnal Bird Surveys

Diurnal bird surveys consisted of fixed-point searches including passive (e.g., listening for bird calls) and active observation/binocular searches. These surveys were undertaken with consideration of the survey recommendations of the *Survey Guidelines for Australia's threatened birds* (DEWHA 2017).

A total of ten diurnal bird surveys were undertaken during the survey period with each survey conducted by two personnel, for a period of 30 minutes each. All bird species observed or heard calling were recorded.

Opportunistic identifications during other activities were also be recorded.

A total of ten-person hours was spent on this activity during the survey period. The location of bird surveys is displayed in Figure 5.



4.3.8 Herpetofauna Surveys

A total of 11 herpetofauna searches were conducted within the subject site. These involved two-person, 20-minute active searches for reptiles and amphibians whilst physically lifting and disturbing debris, decorticating bark, timber, logs and leaf litter.

Herpetofauna searches were conducted both diurnally and nocturnally and were taken in consideration of the *Survey Guidelines for Australia's threatened reptiles* (DSEWPC 2011). All herpetofauna were found were recorded with particular focus on locating the threatened species, Stephen's Banded Snake (*Hoplocephalus stephensi*), Giant Barred Frog (*Mixophyes iterates*) and Green-thighed Frog (*Litoria brevipalmata*).

A total of 7.5 person-hours was spent on this survey method during the survey period. The location of herpetofauna surveys is displayed in Figure 5.

4.3.9 Spotlighting and Torch Searches

Spotlighting was conducted throughout the subject site during the subject period. The procedure involved two-people actively searching for fauna at night with a hand-held 1100 lumen LED spotlight. Spotlighting targeted the trunks and branches of canopy trees and understorey vegetation, whilst periodically scanned the ground. This survey method targeted all nocturnal mammals, birds, amphibians and reptiles.

Spotlighting surveys were conducted via walking and vehicle transects. A total of ten walking transects, each encompassing a one-kilometre stretch of the subject site were undertaken during the survey period. Walking transects were conducted at a slow pace (one hour per kilometre) that maximised the likelihood of fauna detection.

An additional ten vehicle transects were undertaken across the subject site. These were conducted from a slow-moving vehicle (<5km/hr) at a distance of one to 3.3 kilometres per transect.

The location of the spotlighting transects are displayed in Figure 6.

4.3.10 Call Playback and Detection

Active call playback for fauna including mammals, owls and amphibians was undertaken across suitable habitats on the site. One call playback survey was undertaken in conjunction with each spotlighting survey which targeted threatened species which may occur within the study area including:

- Koala (*Phascolarctos cinereus*);
- Threatened Owls: Powerful Owl (*Ninox strenua*), Masked Owl (*Tyto novaehollandiae*), Sooty Owl (*Tyto tenebricosa*) and Barking Owl (*Ninox connivens*);
- Bush-stone Curlew (*Burhinus grallarius*)
- Yellow-bellied Glider (*Petaurus australis*);
- Squirrel Glider (*Petaurus norfolcensis*); and
- Giant Barred Frog (*Mixophyes iteratus*) (in aquatic locations only).

A total of ten call playback surveys were conducted over the survey period. The location of call playback surveys is shown in Figure 5.



4.3.11 Microbat Call Recording and Analysis

Microchiropteran bat (microbat) call detection was undertaken with the consideration of the *Survey guidelines for Australia's threatened bats* (DEWHA 2010).

Microbats use high frequency echolocation to navigate and detect prey. Ultrasonic echolocation detectors detect and record these high frequency calls which can be used for species identification. Microbat bat surveys included the deployment of ten Anabat Express unit (Titley Scientific) set along the edge of potential microbat corridors within the subject site for a period of 11 consecutive nights each. As high winds and rainfall can affect the detectability of microbats, data from eight nights of optimum weather conditions were forwarded Dr Anna McConville of Echo Ecology, a bat call identification consultant, for identification of the bat species.

A total survey effort of 80 nights was achieved via fix-ultrasonic echolocation detectors. The survey locations of these Anabat units are shown in Figure 5.

Additional walking transect surveys with a handheld Anabat Swift unit (Titley Scientific) were undertaken in conjunction with spotlighting surveys. This survey methodology aimed to capture ultrasonic echolocation of microbats that were observed in flight over a larger area rather than fix-point detectors.

4.3.12 Passive Infra-red (PIR) Cameras

A total of 26 Stealthcam STC-G34 infra-red cameras were deployed across the subject site, for a period of 22 days/nights each.

Eleven (11) were mounted on trees at a height of approximately four metres facing a baited tube to target arboreal species. These cameras aimed to target all arboreal species with particular focus on targeted threatened species Brush-tailed Phascogale (*Phascogale tapoatafa*), Squirrel Glider (*Petaurus norfolcensis*) Yellow-bellied Glider (*Petaurus australis*), and the Greater Glider (*Petauroides volans*).

The remaining 15 were placed on trees at approximately 0.5 metres facing a baited tube placed on the ground. Ground-set cameras were targeted all ground-dwelling species with particular focus on threatened species such as Long-nosed Potoroo (*Potorous tridactylus tridactylus*), Spotted-tailed Quoll (*Dasyurus maculatus*) and Red-legged Pademelon (*Thylogale stigmatica*) as well as other ground-dwelling threatened fauna.

The hair tubes were baited with a mixture of oats, peanut butter, honey and vanilla essence, with the exception of five ground-set cameras which were baited with raw chicken to specifically target the Spotted-tailed Quoll.

A total survey effort of 572 survey days/nights was spent on this activity during the survey period.

In addition to PIR cameras set within the survey period, the National Parks and Wildlife Service (NPWS) set six cameras within the vicinity of the subject site between November 2020 and February 2021.

The location of the PIR cameras is shown in Figure 5.

4.3.13 Hair Tube Surveys

Four (4) hair tube line surveys were conducted within the site. Each survey site comprised of a transect of ten hair tubes containing three (3) arboreally mounted hair tubes at a height of approximately four (4) meters to target arboreal species and seven (7) ground deployed hair tubes to target ground-dwelling species. Therefore, a total of 40 hair tubes were set within the subject site. The hair tubes were baited with a standard bait mix of peanut butter, oats, honey and vanilla essence and set for a minimum of four nights per line.



Hair samples collected during the survey were forwarded to Trace Ecology for analysis. The location of hair tube lines is displayed in Figure 5.



4.4 Survey Timing and Limitations

4.4.1 Seasonal Limitations

Fauna and flora detectability is limited by seasonal, behavioural or lifecycle characteristics of each species and even by habitat variations (e.g. flowering periods), which can occur within a year, between years, decades, etc. (DEC 2004).

The fauna surveys were conducted over a short period of time at the beginning of winter which is a period of low activity for arboreal mammals, Microchiropteran bats, frogs and birds (DEC 2004). Temperatures during the survey period were abnormally low for the region which is likely to have limited faunal activity and hence detectability.

Longitudinal and latitudinal migrants such as the Swift Parrot would potentially be present at this time of year.

The survey timing is not considered to be a limitation for the detection of threatened flora species.

4.4.2 Subject Site Finalisation

Field survey locations were based on a preliminary subject site provided to Biodiversity Australia. During the course of the field component, the extent of this subject site was altered. This resulted in some field assessments being conducted in areas no longer within the finalised subject site area.

This alteration is not anticipated to be a limitation for the detectability of fauna within the subject site, as fauna within the area would traverse areas greater than the difference in site boundaries.

4.4.3 Flora Inventory

The field surveys aimed to record a comprehensive list of flora species within in each vegetation community occurring within the subject site. Due to a combination of survey timing limitations, access issues and subject site alterations after the completion of the floral survey, this could not be completed for all vegetation communities within the finalised subject site. Comprehensive flora species lists were however recorded for the three dominant vegetation communities within the subject site.

4.4.4 Targeted Survey Methodology

Due to timing constraints imposed by NPWS, surveys conducted for the development of this EA were required to be completed in a short turn-around. This provided a limitation for species detectability for some targeted species which require survey in set time-periods or seasons.

4.4.5 Summary

Given the timing and duration of surveys, it is highly likely that some species that occur in the subject site either permanently, seasonally or transiently, were not detected during the survey. These species may include annual, ephemeral or cryptic flora species; nocturnal fauna; birds, reptiles and frogs that call at other times of year as well as mobile or transient fauna in general. The habitat assessment conducted allows for identification of habitat resources for such species, in order to assess their likelihood of occurring within the subject site. As such, the survey was not designed to detect all species, rather to provide an overall assessment of the ecological values and constraints within the subject site. This information was used to predict potential impacts of the proposal on biodiversity values and to assist with the development of a design and approach to fence construction that specifically avoids and/or reduces impacts on threatened ecological communities and known and potential habitat for



threatened species as much as possible. This approach is considered best practice to address the Principle of Uncertainty.

4.5 Weather Conditions

The weather over the survey period was generally fine and sunny with only three moderate rainfall events occurring, 9th June (7 mm), 30th June (7 mm) and 2nd July (11 mm). Rainfall data was taken from data collected at Taylors Arm weather station, station number [059032].

Winter conditions were evident throughout the survey period with the surveys conducted in a period of abnormally low temperatures. The minimum temperature during the survey period was as low as 0°C with the daily minimum ranging from 0-13°C. Maximum daily temperatures ranged from 15-22°C. Temperature data was obtained from data at Kempsey Airport AWS NSW weather station, station number [059007] (BOM 2021).



Figure 5: Location of fauna surveys (part 1)

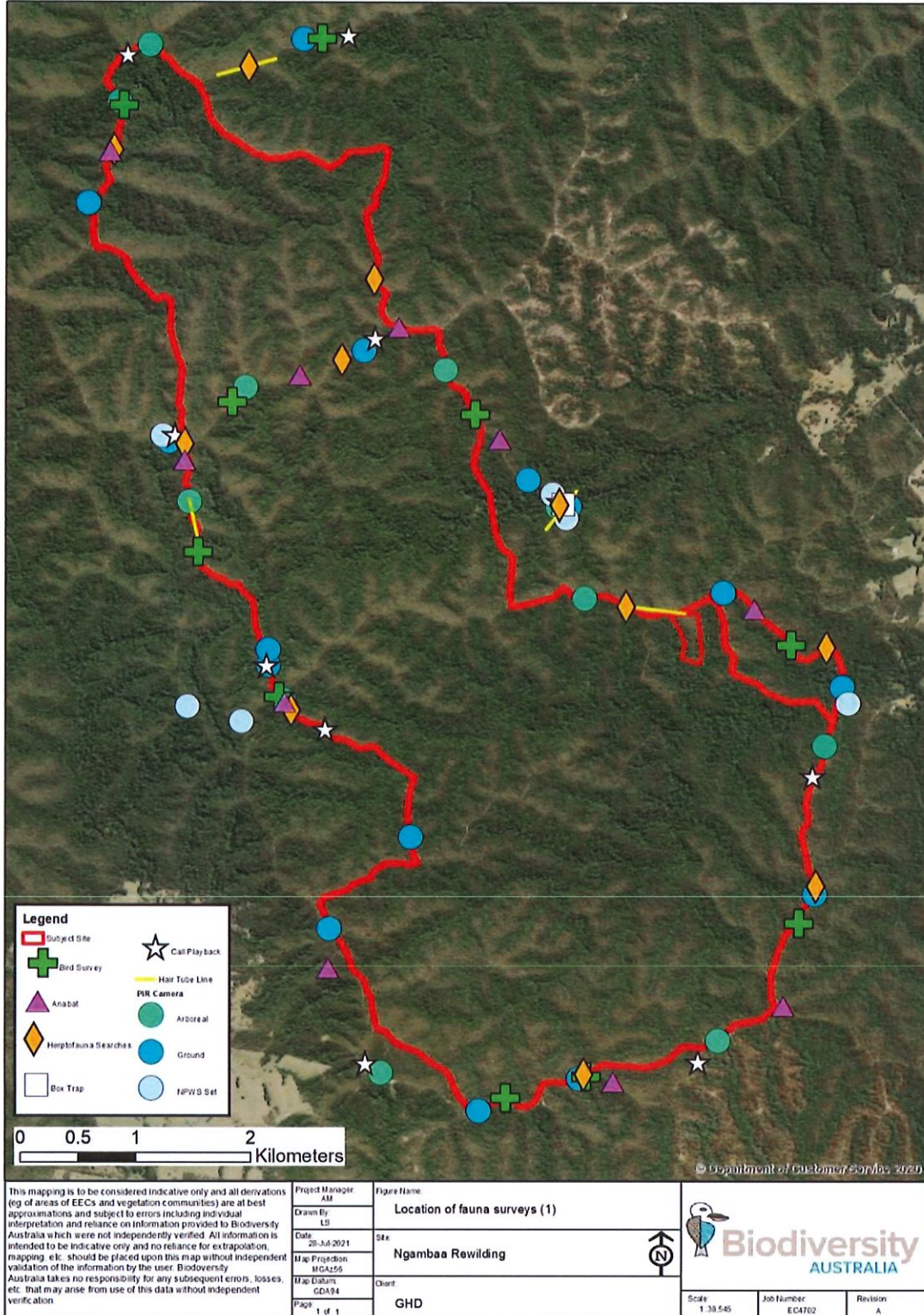
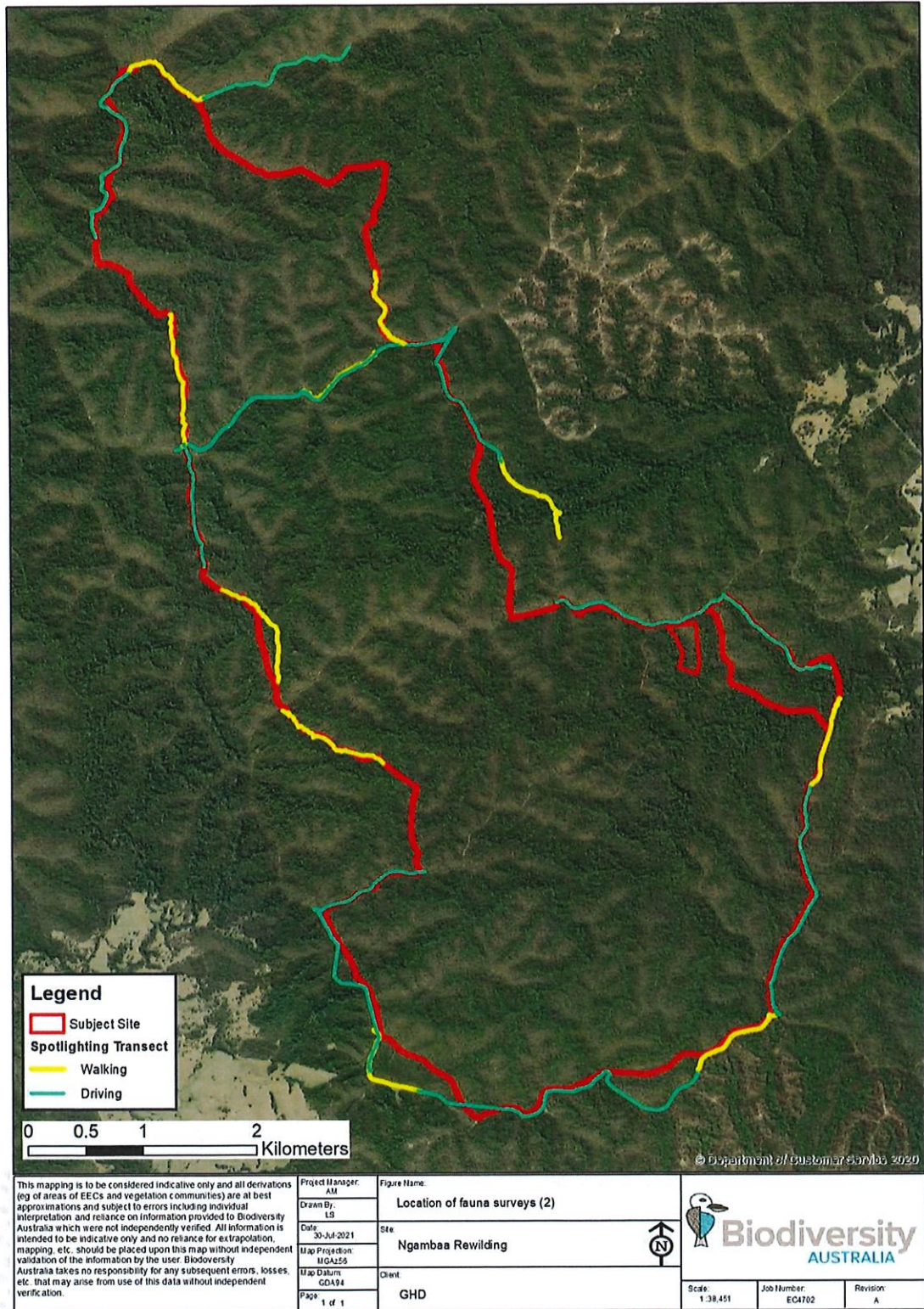


Figure 6: Location of fauna surveys (part 2)



5. Results

5.1 Desktop Search Results

5.1.1 Locally Recorded Threatened Species

The following table lists the threatened flora and fauna species identified in database and literature searches of the study area. Figure 7 and Figure 8 show the location of locally recorded species which are listed as threatened under the BC Act (as obtained from the NSW Bionet Atlas). These are replicated in Figure 9 and Figure 10 within the context of the subject site.

Table 3: Locally recorded threatened species

Common Name	Scientific Name	BC Act	Number of records	Source
Flora				
Floyd's Grass	<i>Alexfloydia repens</i>	E	2	Bionet Atlas
White-flowered Wax Plant	<i>Cynanchum elegans</i>	E	1	Bionet Atlas
Spider Orchid	<i>Dendrobium melaleucaphilum</i>	E	27	Bionet Atlas
Willawarrin Doubletail	<i>Diuris disposita</i>	E	59	Bionet Atlas
Slender Marsdenia	<i>Marsdenia longiloba</i>	E	101	Bionet Atlas, Graham (undated)
-	<i>Maundia triglochinosoides</i>	V	94	Bionet Atlas
Rusty Plum, Plum Boxwood	<i>Niemeyera whitei</i>	V	30	Bionet Atlas
Milky Silkpod	<i>Parsonsia dorrigoensis</i>	V	653	Bionet Atlas, Graham (undated)
Scant Pomaderris	<i>Pomaderris queenslandica</i>	E	1	Bionet Atlas, Graham (undated)
Scrub Turpentine	<i>Rhodamnia rubescens</i>	E	68	Bionet Atlas
Native Guava	<i>Rhodomyrtus psidioides</i>	E	7	Bionet Atlas
Rainforest Cassia	<i>Senna acclinis</i>	E	10	Bionet Atlas
Aves				



Common Name	Scientific Name	BC Act	Number of records	Source
Regent Honeyeater	<i>Anthochaera phrygia</i>	E	3	Bionet Atlas
Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>	V	3	Bionet Atlas
Bush Stone-curlew	<i>Burhinus grallarius</i>	E	4	Bionet Atlas
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	V	556	Bionet Atlas, NPWS 2004
Spotted Harrier	<i>Circus assimilis</i>	V	1	Bionet Atlas
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	V	1	Bionet Atlas
Barred Cuckoo-shrike	<i>Coracina lineata</i>	V	1	Bionet Atlas
Varied Sittella	<i>Daphoenositta chrysoptera</i>	V	21	Bionet Atlas
Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>	E	26	Bionet Atlas
Little Lorikeet	<i>Glossopsitta pusilla</i>	V	29	Bionet Atlas
Little Eagle	<i>Hieraetus morphnoides</i>	V	1	Bionet Atlas
White-throated Needletail	<i>Hirundapus caudacutus</i>	-	22	Bionet Atlas
Comb-crested Jacana	<i>Irediparra gallinacea</i>	V	4	Bionet Atlas
Black Bittern	<i>Ixobrychus flavicollis</i>	V	1	Bionet Atlas, NPWS 2004
Square-tailed Kite	<i>Lophoictinia isura</i>	V	12	Bionet Atlas
Barking Owl	<i>Ninox connivens</i>	V	6	Bionet Atlas
Powerful Owl	<i>Ninox strenua</i>	V	59	Bionet Atlas,
Wompoo Fruit-Dove	<i>Ptilinopus magnificus</i>	V	27	NPWS 2004
Rose-crowned Fruit Dove	<i>Ptilinopus regina</i>	V	unknown	NPWS 2004
Diamond Firetail	<i>Stagonopleura guttata</i>	V	1	Bionet Atlas
Eastern Grass Owl	<i>Tyto longimembris</i>	V	2	Bionet Atlas



Common Name	Scientific Name	BC Act	Number of records	Source
Masked Owl	<i>Tyto novaehollandiae</i>	V	27	Bionet Atlas,
Sooty Owl	<i>Tyto tenebricosa</i>	V	39	NPWS 2004
Mammalia				
Rufous Bettong	<i>Aepyprymnus rufescens</i>	V	2	Bionet Atlas
Hoary Wattled Bat	<i>Chalinolobus nigrogriseus</i>	V	3	Bionet Atlas
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	V	32	Bionet Atlas, NPWS 2004
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	V	2	Bionet Atlas
Parma Wallaby	<i>Macropus parma</i>	V	1	OEH Bionet
Eastern Coastal Free-tailed Bat	<i>Micronomus norfolkensis</i>	V	12	Bionet Atlas
Little Bent-winged Bat	<i>Miniopterus australis</i>	V	78	Bionet Atlas, NPWS 2004
Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	V	24	Bionet Atlas
Southern Myotis	<i>Myotis macropus</i>	V	6	Bionet Atlas
Greater Glider	<i>Petauroides volans</i>	-	60	Bionet Atlas
Yellow-bellied Glider	<i>Petaurus australis</i>	V	115	Bionet Atlas, NPWS 2004
Squirrel Glider	<i>Petaurus norfolcensis</i>	V	27	Bionet Atlas
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	V	26	Bionet Atlas,
Koala	<i>Phascolarctos cinereus</i>	E	334	NPWS 2004
Golden-tipped Bat	<i>Phoniscus papuensis</i>	V	18	Bionet Atlas
Common Planigale	<i>Planigale maculata</i>	V	1	Bionet Atlas
Long-nosed Potoroo	<i>Potorous tridactylus</i>	V	1	Bionet Atlas



Common Name	Scientific Name	BC Act	Number of records	Source
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	153	Bionet Atlas,
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	V	12	NPWS 2004
Eastern Cave Bat	<i>Vespadelus troughtoni</i>	V	1	Bionet Atlas
Amphibia				
Green and Golden Bell Frog	<i>Litoria aurea</i>	E	3	Bionet Atlas
Green-thighed Frog	<i>Litoria brevipalmata</i>	V	10	Bionet Atlas
Stuttering Frog	<i>Mixophyes balbus</i>	E	3	Bionet Atlas
Giant Barred Frog	<i>Mixophyes iteratus</i>	E	55	Bionet Atlas, NPWS 2004
Reptilia				
Stephens' Banded Snake	<i>Hoplocephalus stephensii</i>	V	3	Bionet Atlas, NPWS 2004
Key: Critically Endangered (CE), Endangered (E), Vulnerable (V), Migratory (M), Not Listed (-).				



Figure 7: Bionet Atlas flora records in the study area

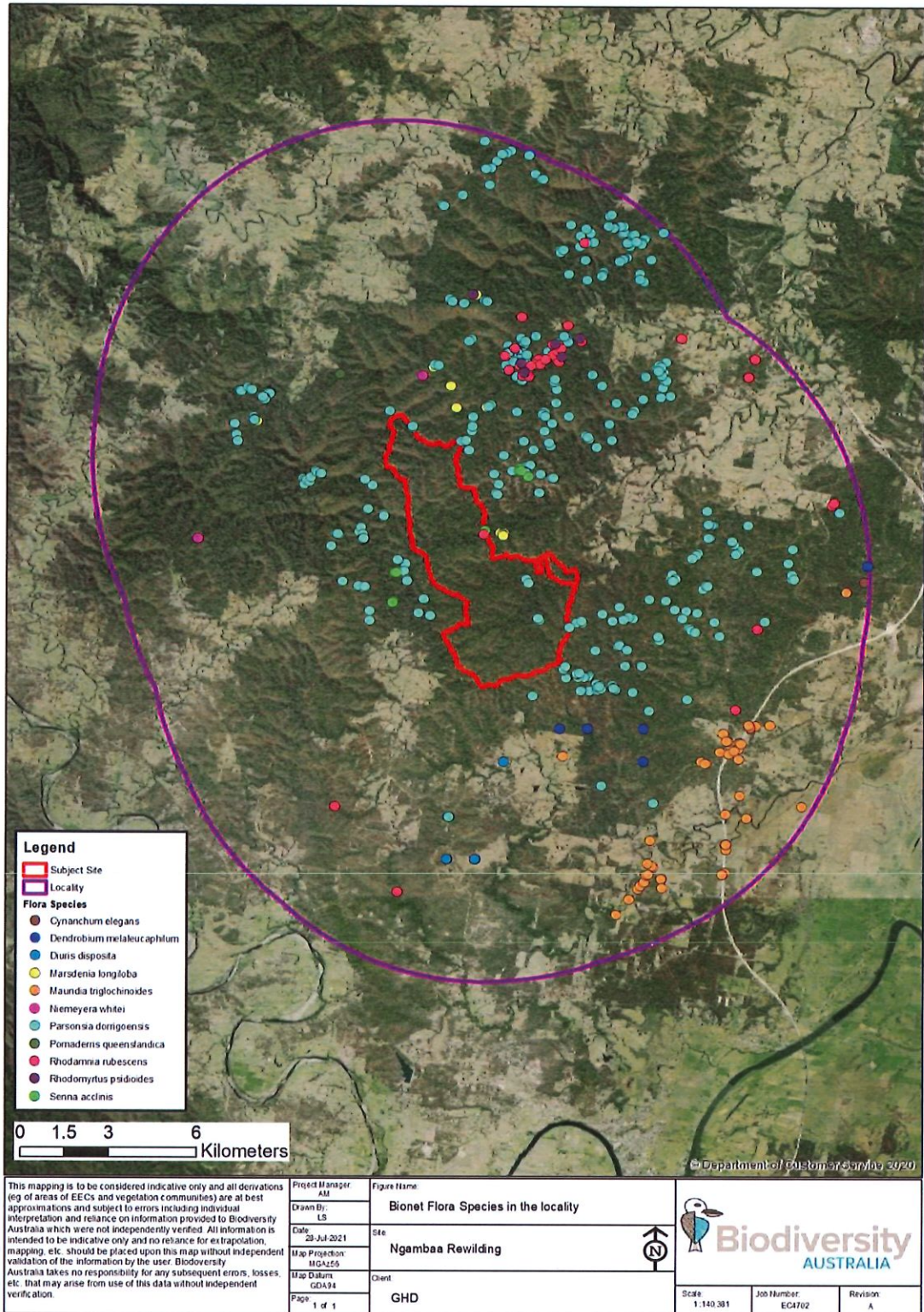


Figure 8: Bionet Atlas fauna records in the study area

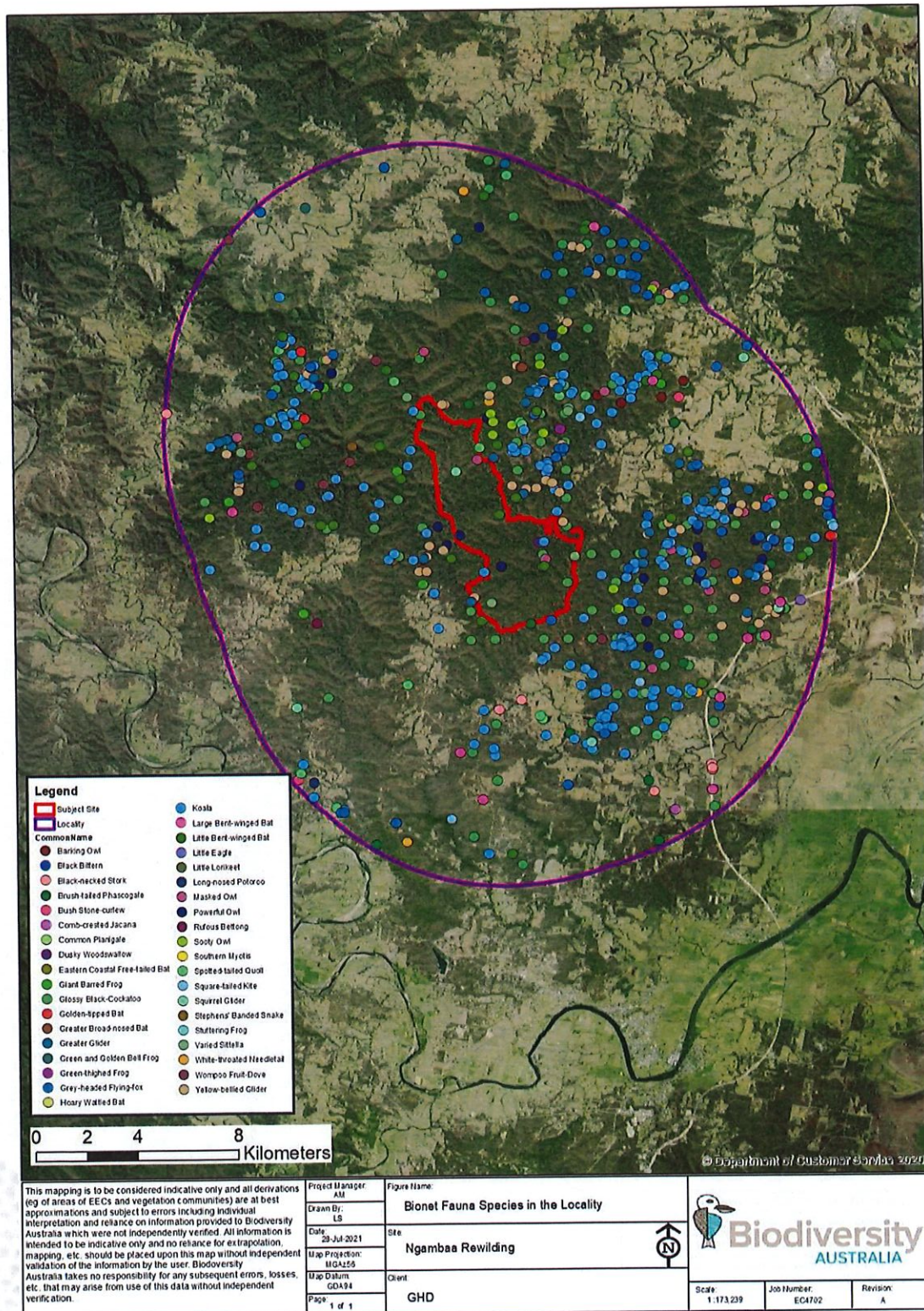


Figure 9: Bionet Atlas flora records in the subject site

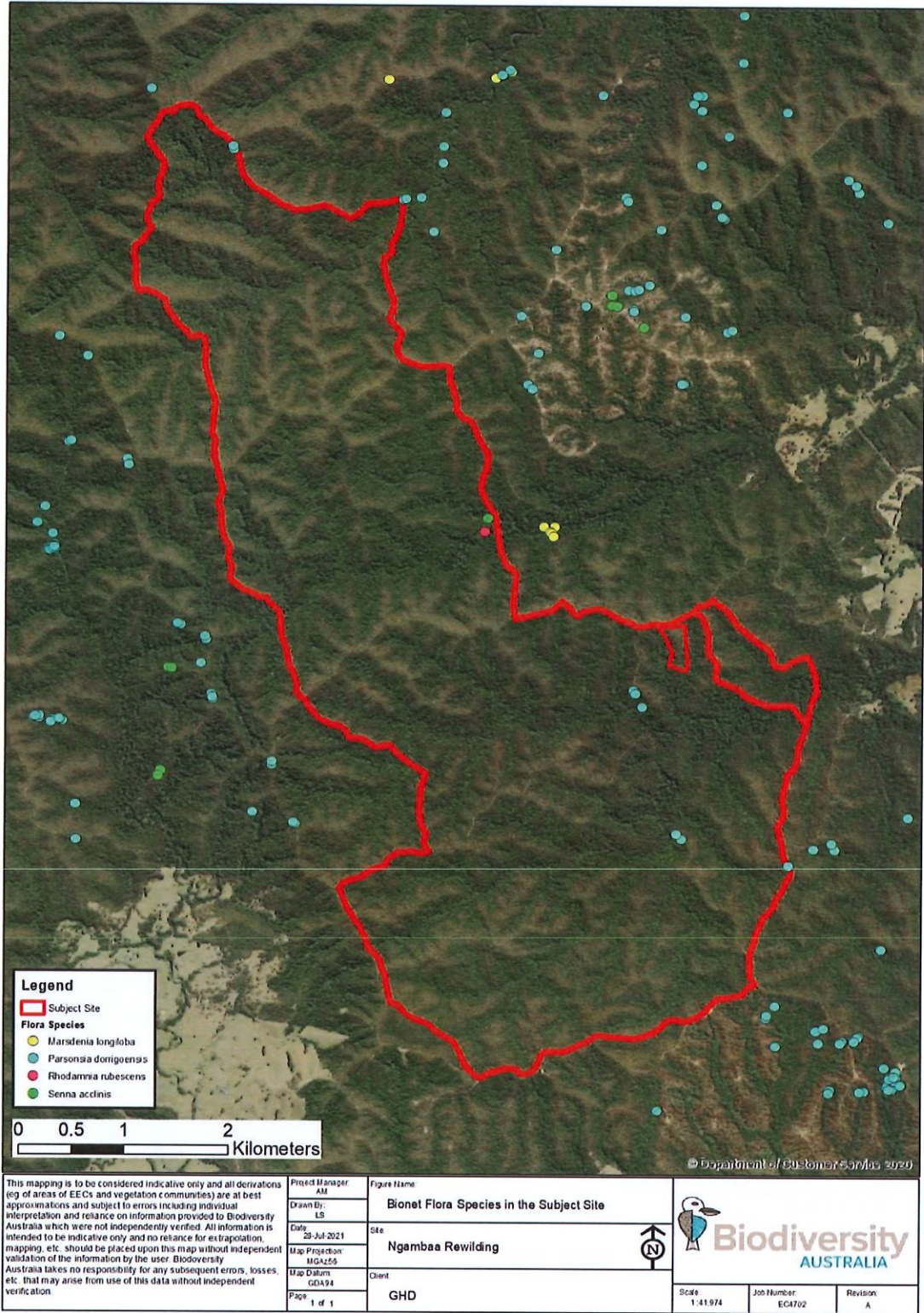
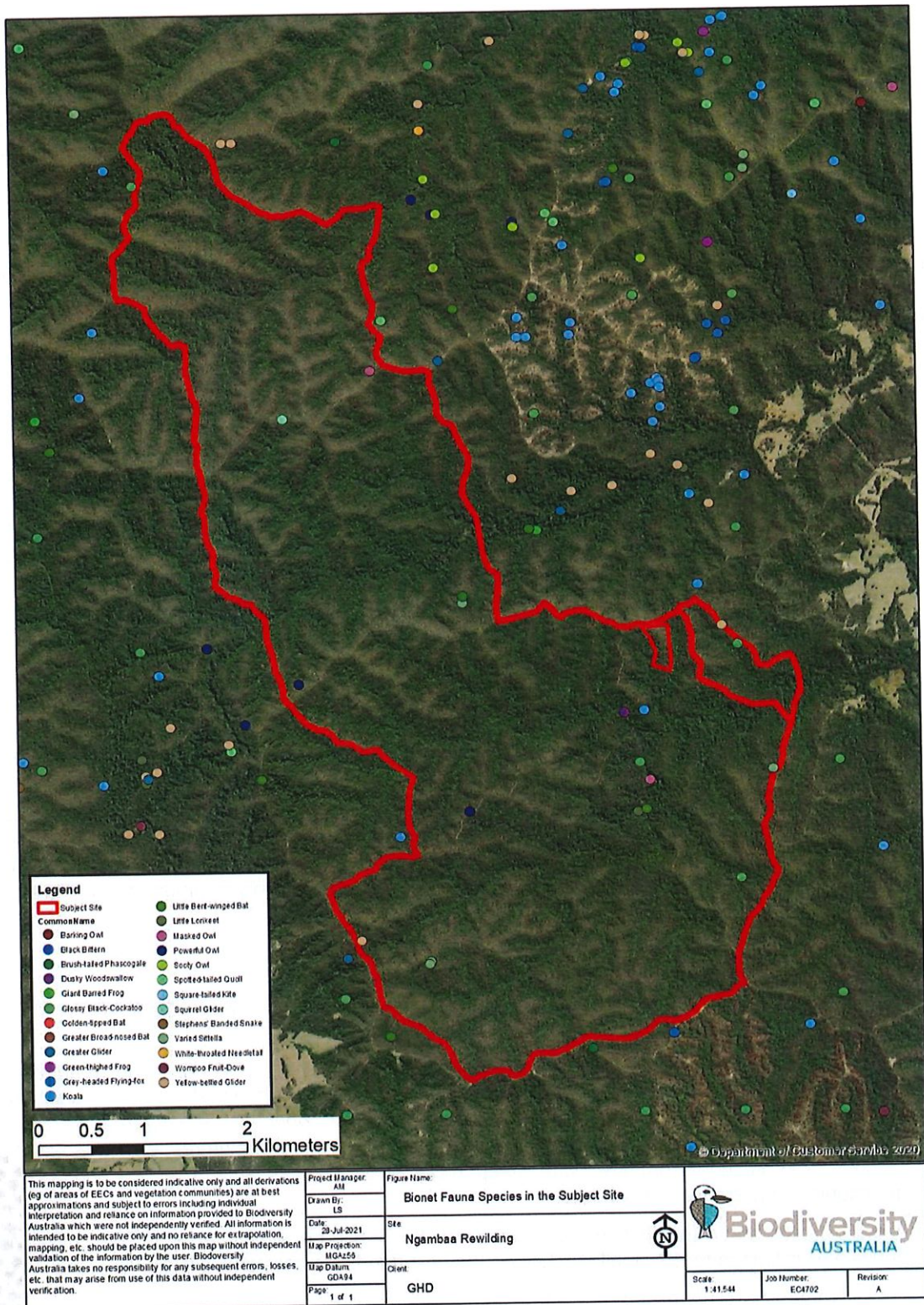


Figure 10: Bionet Atlas fauna records in the subject site



5.2 Flora Survey Results

5.2.1 Vegetation Communities

Flora surveys were undertaken using an integrated assessment method of desktop and field data to undertake vegetation community mapping and identification. A comparison of flora data with species occurrences listed in the PCT vegetation classifications for the north coast bioregion (DPIE 2021c) was used to identify PCTs within the CCAF. Floyd (1990) and DPI NSW Forestry Types (FCNSW 2021) has aided in the identification of PCTs within the CCAF. FCNSW (2021) mapping is shown in Figure 11.

A total of six Plant Community Types (PCTs) were identified within the subject site. These consist of dry sclerophyll forest, wet sclerophyll forest, and dry and subtropical rainforest communities; all occurring in moderate to remnant conditions. The structure and condition of the vegetation communities within the subject site is further described in the below.

- **Spotted Gum/Grey Gum Wet/Dry Sclerophyll Forest**

PCT 1215: Spotted Gum - Grey Ironbark open forest of the Macleay Valley lowlands of the NSW North Coast Bioregion

PCT 1215 occurs as a dry sclerophyll forest on ridgelines and exposed northerly and westerly aspects where *Corymbia maculata* (Spotted Gum) is less common than *Eucalyptus propinqua* (Small-fruited Grey Gum). It also occurs as a shrubby wet sclerophyll forest on lower slopes adjoining PCT 1142. It is the drier phase of this forest that has been most heavily logged, although there are still occasional large old trees. PCT 1215 is the most floristically diverse with 108 species recorded, as it covers a large area, a wide range of conditions and ranges from a dry sclerophyll forest with an understorey of grasses and heath shrubs through grassy to shrubby wet sclerophyll forest.

This community occurs over 42.83 hectares of the subject site.

- **Blackbutt/Tallowwood Dry Sclerophyll Forest**

PCT 690: Blackbutt – Tallowwood Dry Grassy Open Forest of the Central Parts of the NSW North Coast Bioregion

PCT 690 is confined to low hills and ridgelines in the eastern part of Ngambaa Nature Reserve. It has a grassy understorey with heathy and sclerophyllous shrubs and very few rainforest elements. The community has been heavily logged and most trees are in the mature growth stage, meaning that there are very few large old trees or hollow trees. Diversity within this community is moderate.

This community occurs over 24.81 hectares of the subject site.

- **Dry Rainforest**

PCT 1142: Shatterwood - Giant Stinging Tree - Yellow Tulipwood dry rainforest of the NSW North Coast Bioregion and northern Sydney Basin Bioregion

PCT 1142 was also very diverse with 69 floral species recorded. PCT 1142 occurs upstream on smaller floodplains and terraces and adjoining lower slopes associated with the major streams, such as at the western part of proposed fence crossing Stockyard Creek. *Lophostemon confertus* (Brush Box) is present as an emergent or a sparse canopy and most are very old. Rainforest elements create some degree of protection from fire, with steep rocky stream banks and protected southerly slopes functioning to minimise fire damage.

Small patches within this PCT includes elements of PCT 670 on alluvial terraces. The extent of these influences is limited to the small patches on the best floodplain sites and is likely very small in extent.

This community occurs over 1.21 hectares of the subject site.



- **North Coast Wet Sclerophyll Forest**

PCT 826: Flooded Gum - Brush Box moist forest of the coastal ranges of the North Coast

PCT 826 is mapped as FT53 and only occurs in the eastern part of the subject site on broad low-lying alluvial areas and is dominated by Flooded gum. This community appears to have been heavily logged and some of the trees may have been planted. Logging disturbance and probable changes to the fire regime have resulted in a very dense midstratum of *Cissus*.

This community occurs over 0.52 hectares of the subject site.

- **Subtropical Rainforest**

PCT 670: Black Booyong - Rosewood - Yellow Carabeen subtropical rainforest of the NSW North Coast Bioregion

PCT 670 occurs in one small patch within the subject site which consists of well-developed rainforest and, *Lophostemon confertus* (Brush Box) emergents are rare or absent. Elements of this PCT are also evident within PCT 1142 as very small patches on the most fertile river floodplain terraces.

This community occurs over 0.22 hectares of the subject site.

- **Moist Sclerophyll Forest**

PCT 747: Brush Box - Tallowwood - Sydney Blue Gum tall moist forest of the ranges of the central NSW North Coast Bioregion

PCT 747 occurs where the western fence boundary crosses the headwaters of Allomera Creek and likely in other headwaters where the NSW Forest Type FT53 is mapped as narrow and there is little protection from fires.

This community occurs over 0.18 hectares of the subject site.

PCTs 670, 747 and 826 were very restricted in occurrence in the subject site, therefore separation of these communities in the field and compiling representative flora species lists per PCT was difficult. Figures 12-18 map the location of the vegetation communities identified within the subject site. A flora list per community or community group, is provided in Appendix A-2.



Figure 11: DPI NSW Forest Types

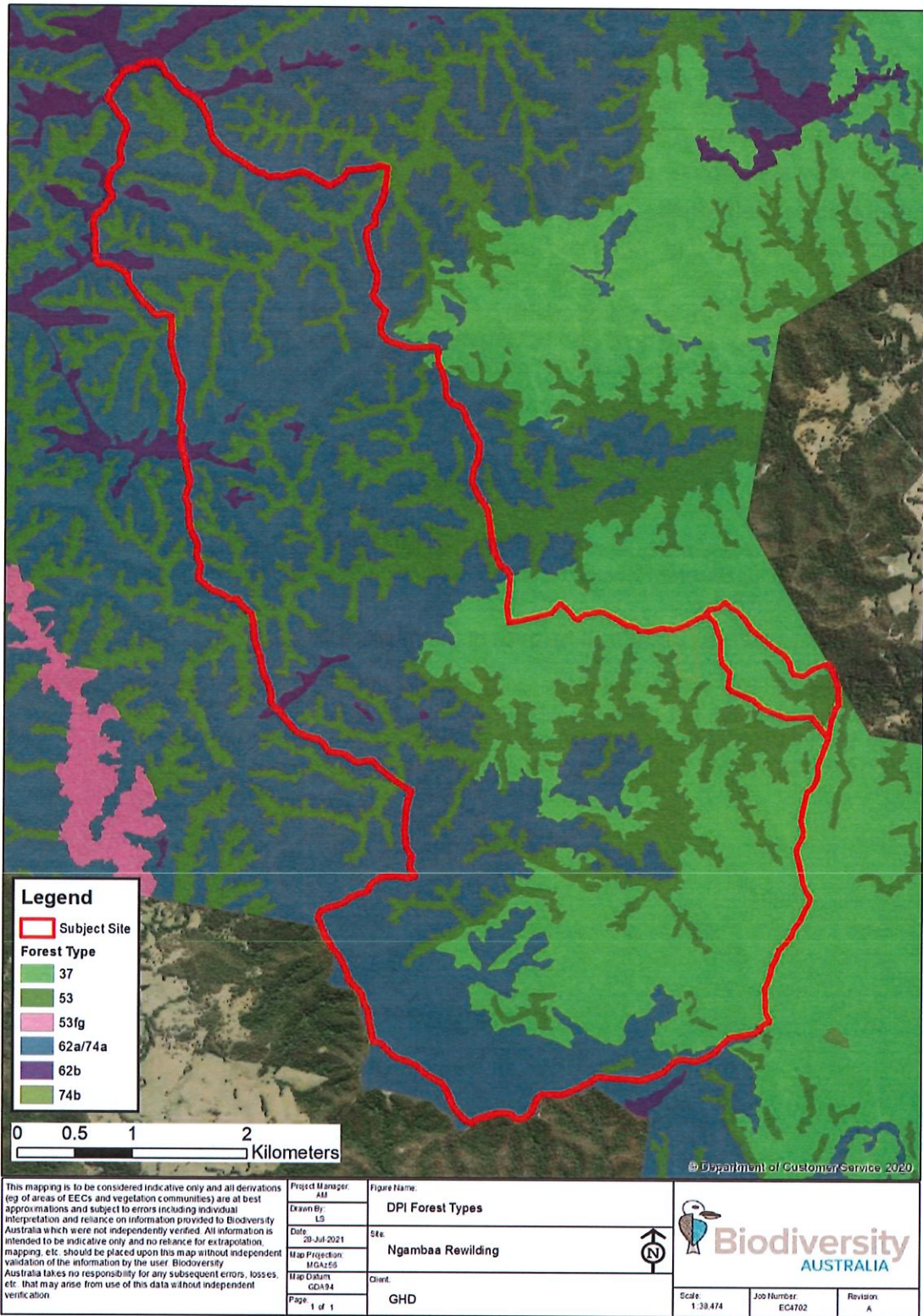


Figure 12: Site vegetation communities (a)

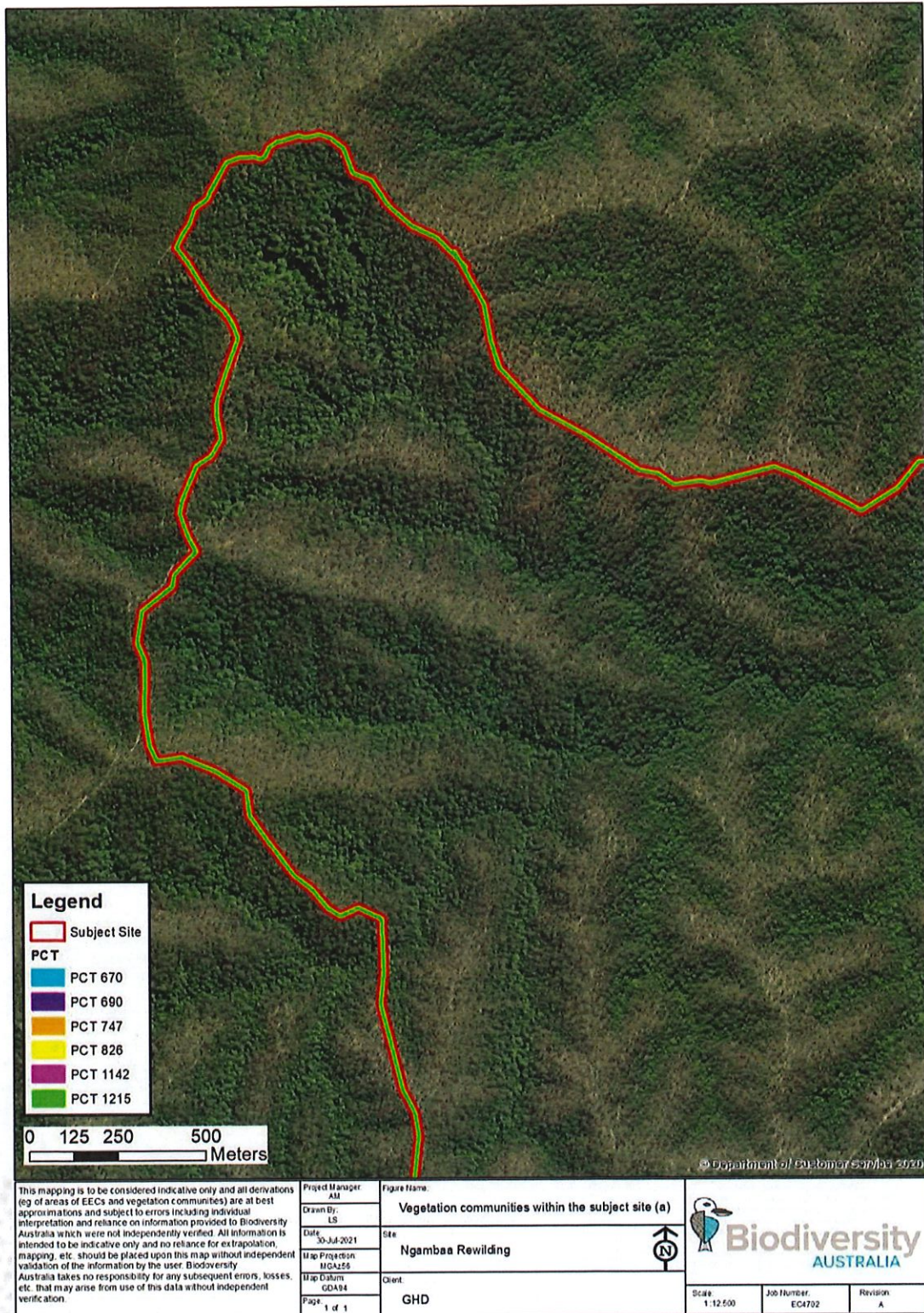


Figure 13: Site vegetation communities (b)

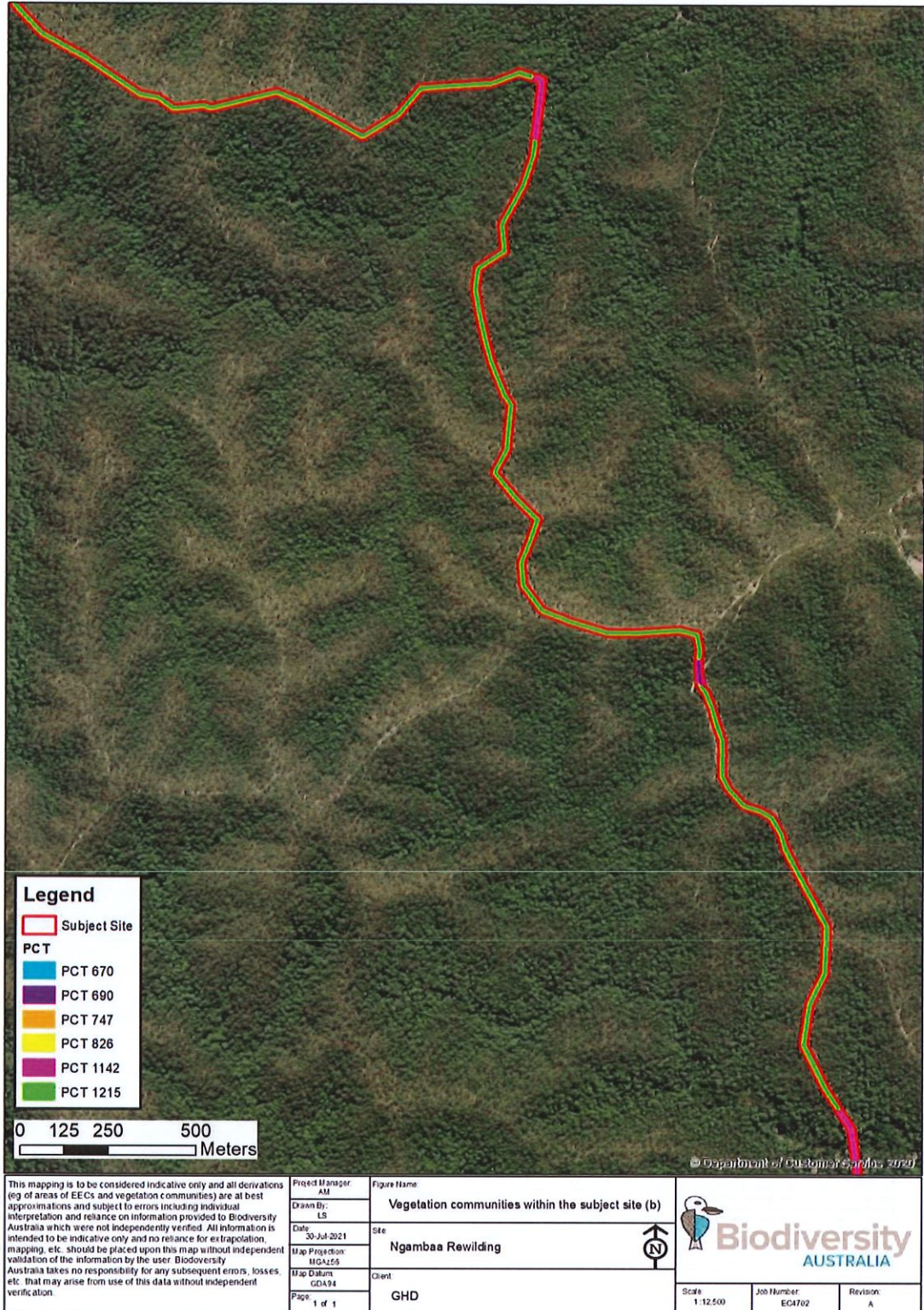


Figure 14: Site vegetation communities (c)

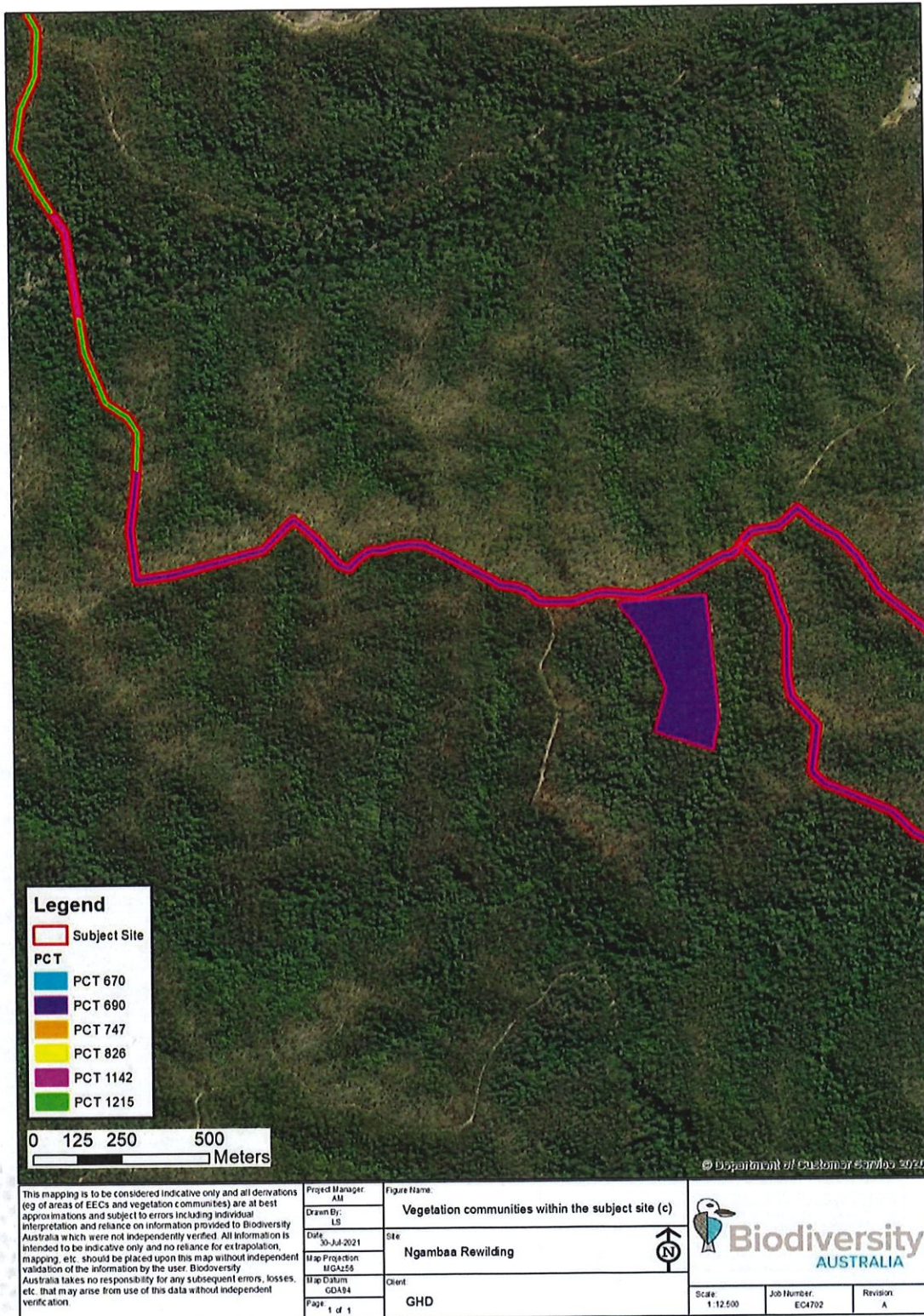


Figure 15: Site vegetation communities (d)

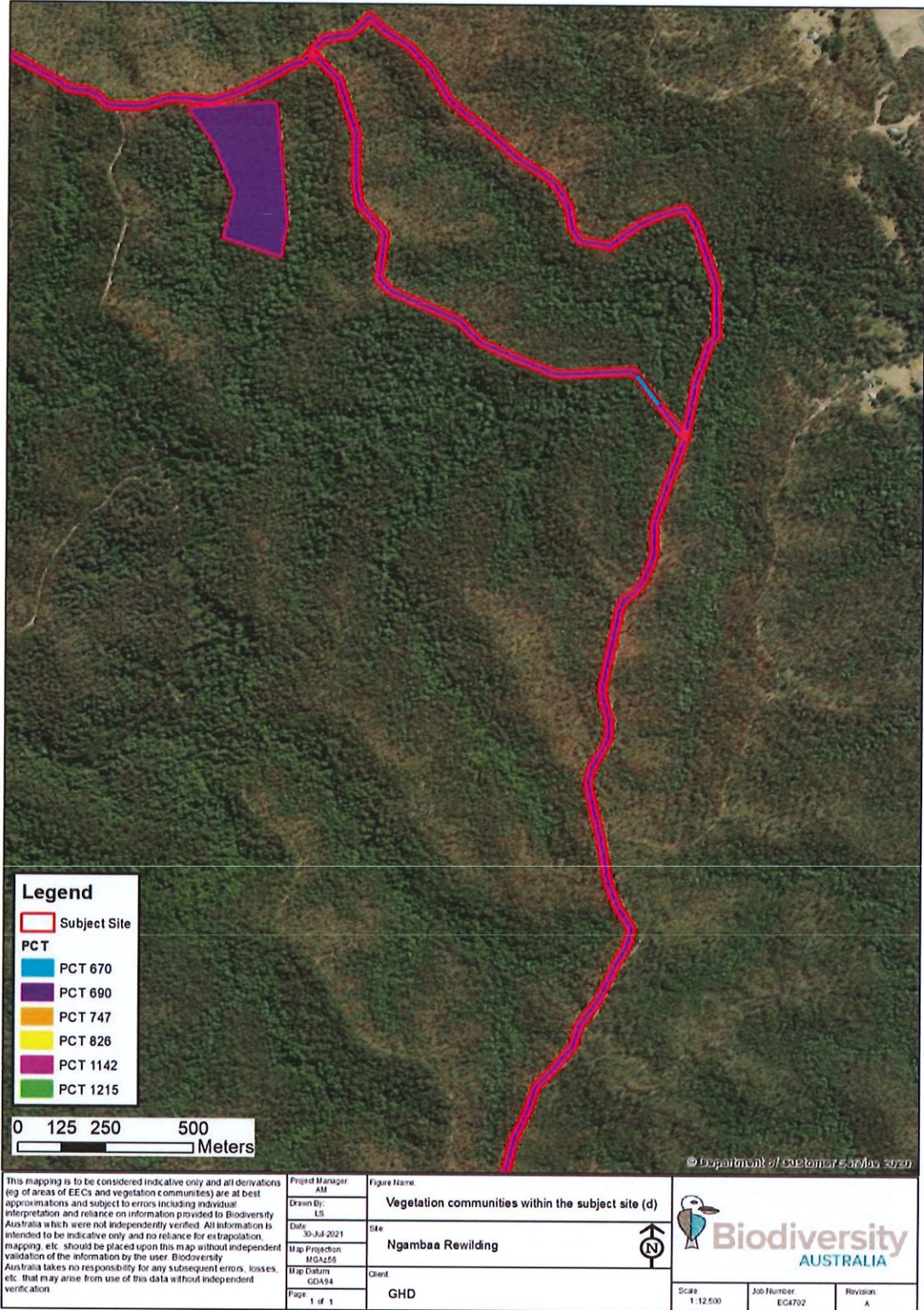


Figure 16: Site vegetation communities (e)

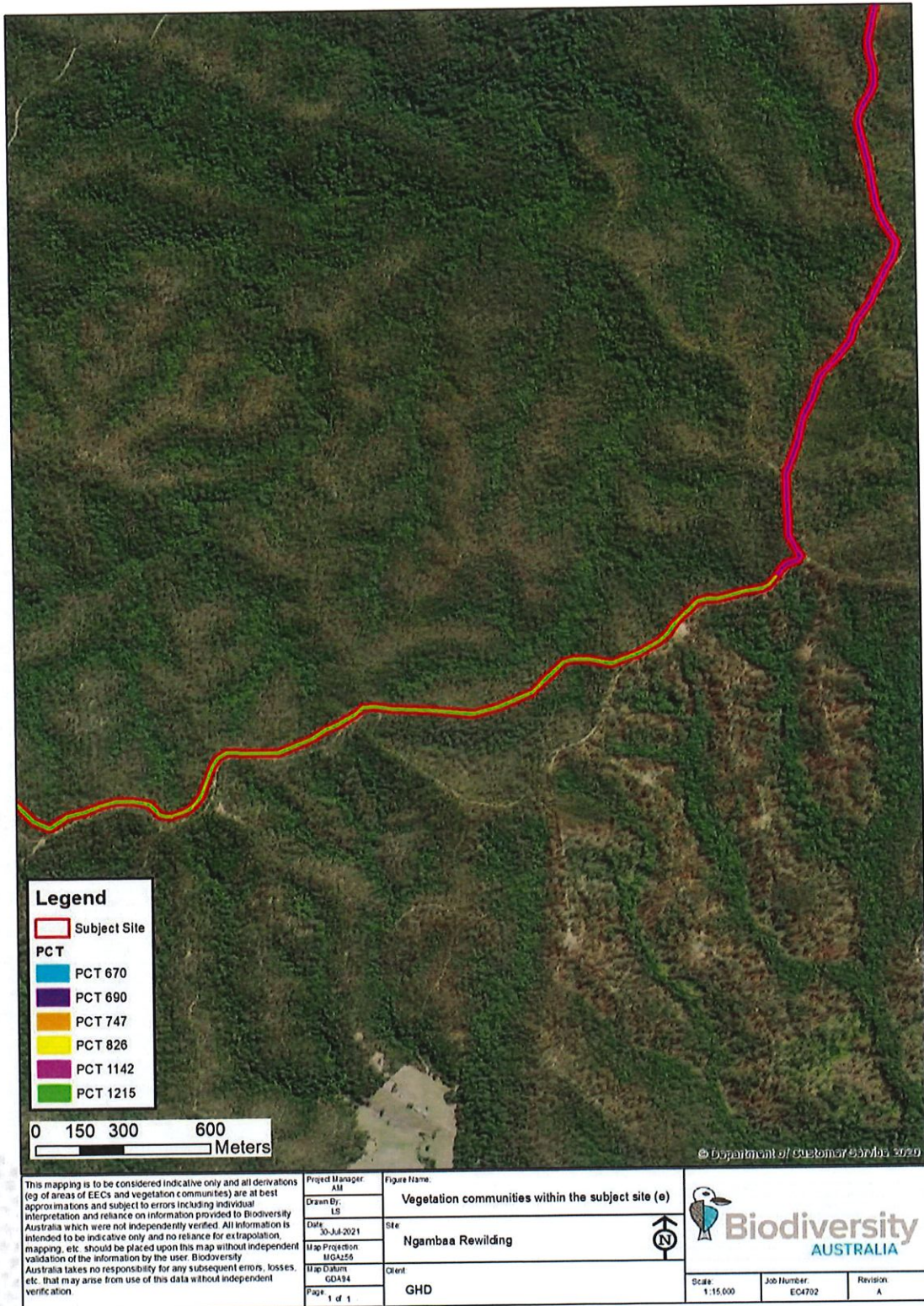


Figure 17: Site vegetation communities (f)

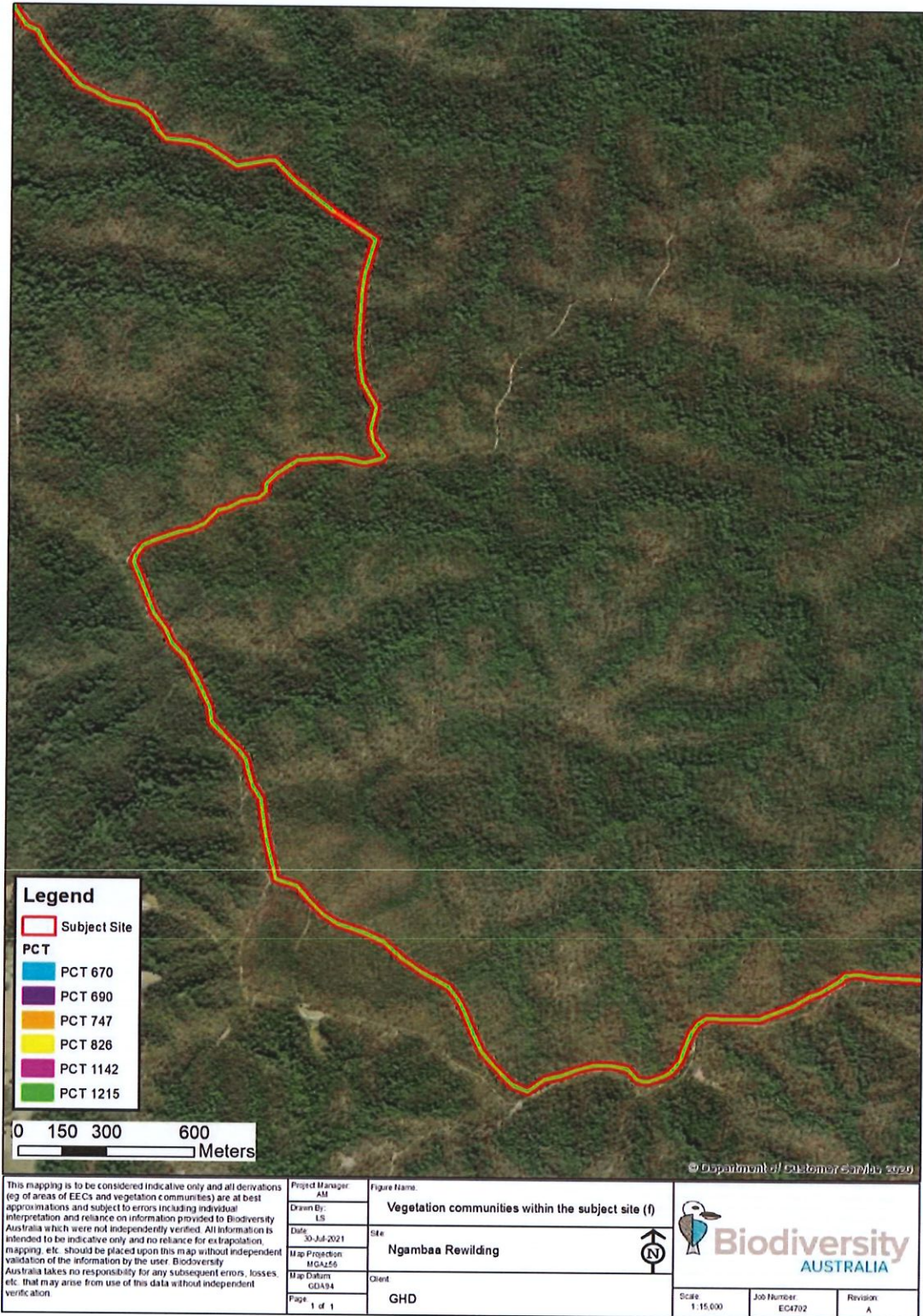
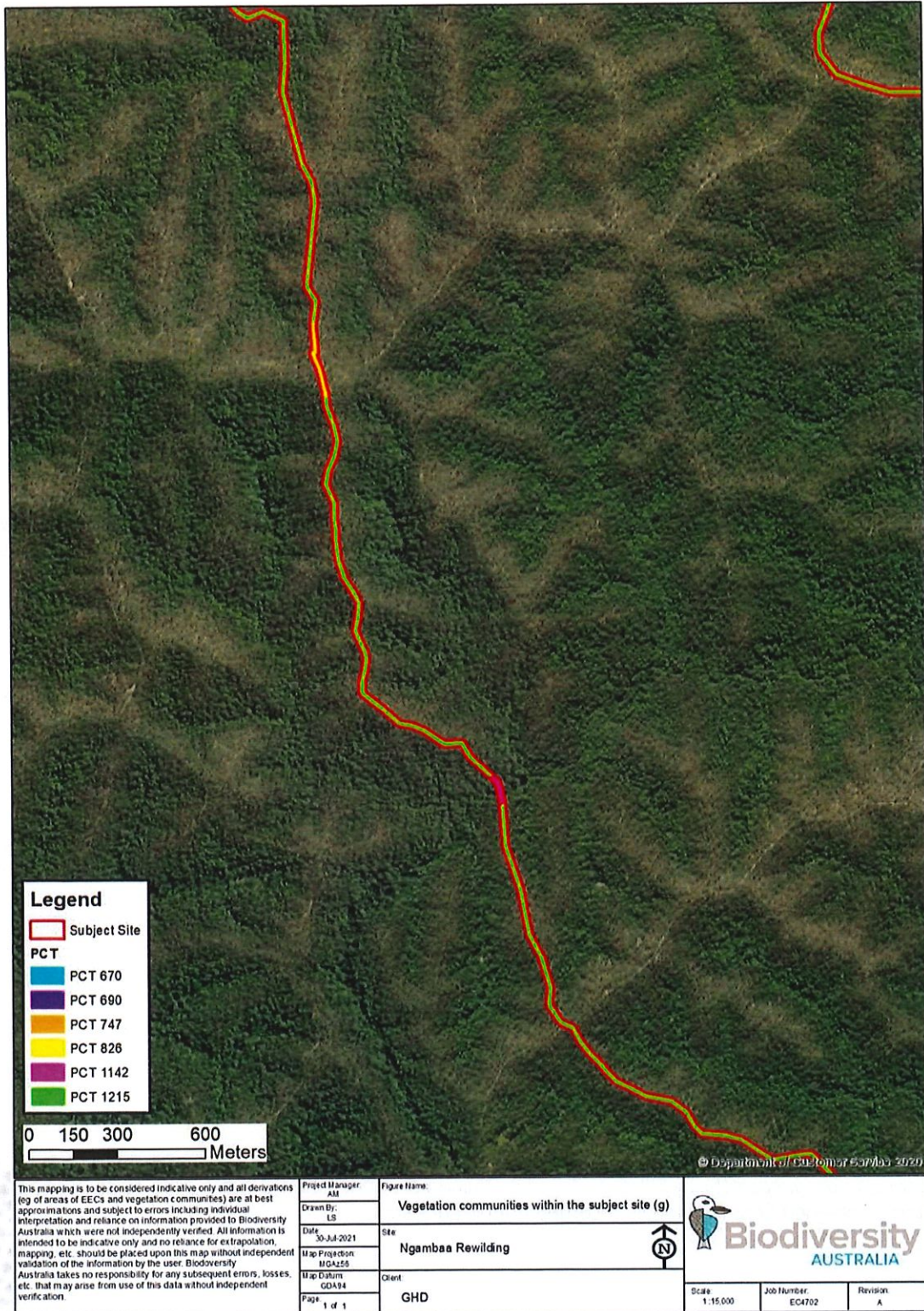


Figure 18: Site vegetation communities (g)



5.2.2 Threatened Ecological Communities

As described in Section 3.3, parts of the subject site fall on alluvial floodplain formations. These areas satisfy the geomorphological criteria for floodplain Threatened Ecological Communities (TECs).

The Lowland Rainforest of Subtropical Australia listing advice indicates that the vegetation community PCT 670 falls within Condition Classes 2 and/or 3.

Two vegetation communities recorded within this alluvial formation within the subject site are associated with the BC Act listed TEC, *Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion*.

The Threatened Species Scientific Committee (1999), *Final Determination for Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion*, identifies that the best fit for rainforests of PCT 1142 in the subject site is Suballiance 29 *Backhousia myrtifolia – Lophostemon confertus – Tristaniopsis laurina*, which is not listed as part of the TEC Lowland Rainforest on Floodplain. PCT 670 is also referable to Suballiance 10, *Argyrodendron actinophyllum - Dendrocnide excelsa - Ficus*. PCT 670 is also referable to Suballiance 33: *Ceratopetalum/Schizomeria-Heritiera/Sloanea*, which is listed as part of the EEC. However, this classification has its limitations, as outlined in Paragraph 11 of the determination:

"11. In any individual stand more than one Suballiance may be represented, and separation of Suballiances may, in some instances, be difficult as complex intergradations occur."

As such, the small patch of *PCT 670: Black Booyong - Rosewood - Yellow Carabeen subtropical rainforest of the NSW North Coast Bioregion* within the subject site is likely to conform to the TEC, *Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion* under the BC Act.

PCT 1142: Shatterwood - Giant Stinging Tree - Yellow Tulipwood dry rainforest of the NSW North Coast Bioregion and northern Sydney Basin Bioregion does not conform floristically to this TEC however the small patches throughout this PCT which include elements of PCT 670 on alluvial terraces are likely to also conform to the Lowland Rainforest TEC. The extent of these is limited to small patches on the best floodplain sites and are likely very small in extent.

This *Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion* TEC, likely to occur within the subject site is listed as Endangered under the BC Act.

The full extent of these likely very small patches of *Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion* TEC has not been mapped as it requires extensive on-ground works outside of the scope of standard vegetation community identification. As a guide to identifying any occurrences of Lowland Rainforest on Floodplain in the subject site, any structurally complex area of rainforest on the floodplain or an associated terrace where Brush Box and eucalypt emergents are rare or absent, such as those in parts of Cedar Park, should be regarded as that TEC, especially given application of the precautionary principle.

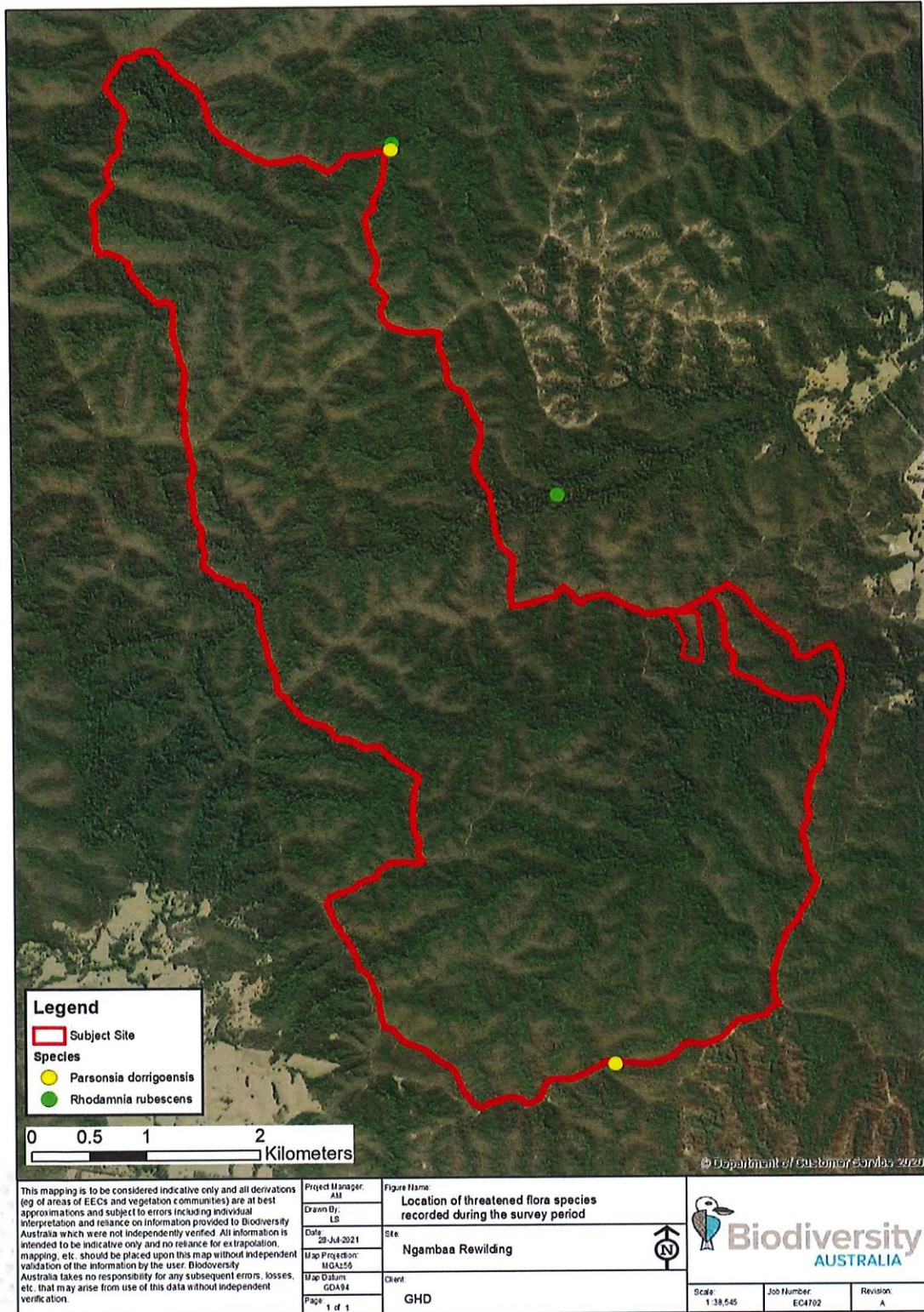
5.2.3 Threatened Flora

5.2.3.1 Results of Threatened Flora Survey

Two threatened flora species were detected within, and nearby the subject site during flora surveys. *Parsonsia dorrigoensis* (Milky Silkpod), listed as Vulnerable under the BC Act. Figure 19 shows the location of the threatened flora individuals recorded during flora surveys.



Figure 19: Location of threatened flora species



5.2.3.2 Potential Occurrence Assessment

As tabulated in Section 5.1 of this report, searches of relevant literature and databases (DPIE 2021a) found records of 12 threatened flora species within the study area and the Protected Matters Search Tool also produced a list of additional potential occurrences in the study area (Appendix **Error! Reference source not found.**). These are assessed for their potential to occur on site in Appendix A-4.

A total of three flora species were identified as known or likely to occur within the subject site. Of these, two were recorded during survey with an additional species, *Marsdenia longiloba* (Slender Marsdenia), also considered to potentially occur due to the suitable quality habitats occurring within the subject site and the proximity of local records. This species, in addition to the threatened flora recorded during surveys is subject to further statutory assessments being a five-part test of significance under the BC Act.

5.2.4 Priority Weeds

Several weed species occur within the subject site and are listed within the site flora list in Appendix A-2. One declared priority weed species *Lantana camara* (Lantana), listed on the priority weeds list for the North Coast (DPI 2021d), was identified within the subject site. This species is listed as a Weed of National Significance. The Biosecurity details for *Lantana camara* are outlined in Table 4.

Table 4: *Lantana camara* biosecurity duty

Area	Duty
All of NSW	<p>General Biosecurity Duty</p> <p>All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.</p>
All of NSW	<p>Prohibition on dealings</p> <p>Must not be imported into the State or sold.</p>



5.3 Fauna Survey Results

5.3.1 Habitat Evaluation, Corridors and Linkages

The following table summarises the habitat evaluation results and comments on regional/local corridors and habitat linkages. It should be noted that the alignment of the proposed fence line was altered following undertaking the fauna surveys. Fauna surveys were undertaken along the subject site or within habitat in close proximity to and representative of the habitats within the final alignment. Table 5 summarises the habitat values within the subject site.

Table 5: Summary of site habitat values

Habitat/Attribute Type	Subject Site	Potential Values to Threatened Species Occurrence
Groundcover	Groundcover varies throughout the subject site from no groundcover in areas of existing tracks to groundcover that comprises both exotic and native grasses and herbs at varying degrees of cover.	Habitats with significant native groundcover present suitable value habitats for threatened species such as the Red-legged Pademelon and Spotted-tailed Quoll. Groundcover also provides habitats and shelter for prey species for threatened forest Owls.
Logs and debris	Abundant hollow and non-hollow logs and woody debris occur throughout the subject site.	Fallen timber, hollow logs and woody debris provide habitat value to threatened species such as the Spotted-tailed Quoll and the Stephen's Banded Snake.
Hollows	Extensive hollow-bearing trees occur throughout the subject site, the subject site and within the habitats beyond the subject site in the broader study area. These hollow-bearing Trees contain all hollow sizes ranging between <5cm to >50cm. The extent of HBTs is further discussed in Section 5.3.2.	The hollow-bearing Trees within the subject site contains extensive amounts of nesting/denning habitat for hollow-obligate species that could be used by microbats, birds and small arboreal mammals.
Nectar Sources	Canopy trees on site mostly provide spring/summer/autumn nectar sources however Tallowwoods within the subject site may provide some late winter flowering nectar resources.	Eucalypts in subject site could potentially be used when flowering by arboreal mammals as well as the Little Lorikeet.
High preferred use Koala Food Trees	Two high preferred use Koala Food Trees listed for the North Coast Koala Management Area (KMA) (DPIE 2021e) were found within the subject site in abundant numbers including <i>Eucalyptus microcorys</i> (Tallowwood) and <i>Eucalyptus propinqua</i> (Small-fruited Grey Gum). The extent of KFTs is further discussed in Section 5.3.3.	Subject site contains potential foraging resources for the Koala. Koala scats were recorded during the survey in the south of the subject site.
Allocasuarinas	Allocasuarinas were recorded patchily throughout the subject site. In some areas Allocasuarinas were the dominant understorey species	Site contains a potential foraging resource for the Glossy-black Cockatoo. No evidence of this species was recorded during the survey.
Aquatic/wetland habitats	Six aquatic habitats intersect the subject site as creek lines. These include Allomera Creek to the north, Stockyard Creek in the centre and Eungai Creek to the south. The extent of aquatic habitats is further discussed in Section 5.3.4.	These areas may provide habitat to threatened amphibian species such as the Giant Barred Frog and the Green-thighed Frog, where leaf litter is dense in the riparian zone.
Fruiting species	Fruiting species are occasional on site, therefore provide low fruiting resources at present.	Low fruiting resources to attract threatened frugivores such as Wompoo Fruit-dove, Rose-crowned Fruit-dove, Barred Cuckoo Shrike and the Grey Headed Flying Fox.



Habitat/Attribute Type	Subject Site	Potential Values to Threatened Species Occurrence
Caves, cliffs, overhangs, culverts, bridges	Absent on within the subject site. However, bridges do occur over some creek crossings within a 1 km radius of the subject site, including at Cedar Park.	Absence of these roost types within the subject site for obligate Microchiropteran bats.
Small terrestrial prey	Varied groundcover and shrub layers occur throughout the subject site however the majority of the subject site is mapped as dry sclerophyll forest which offers poor habitat for small terrestrial species which were detected in limited numbers during surveys.	Despite limitations, site may form a small part of the foraging range of the Powerful Owl, Masked Owl and Sooty Owl.
Corridors	Areas of the subject site falls within an OEH mapped regional for the Koala.	The subject site has been determined to provide a regional corridor for the Koala. This species was detected within the subject site by scat identification.
Habitat Linkages	The forest community extends to the north, east and west of Ngambaa Nature reserve. Private property and Forestry lands occur to the south of the subject site where there is varied and temporary habitat linkages.	Linkages of existing groundcover and shrub layer would remain in-tact to the north, east and west for small terrestrials' dependant on continuous cover. Given the nature of the proposal is to contain small terrestrial mammals, linkages for existing populations may be affected. Highly mobile species (e.g., birds and bats) would be able to move freely through the site.

5.3.2 Hollow-Bearing Trees

An abundance of hollow-bearing trees (HBTs) were recorded within the subject site during the survey. A total of 621 HBTs were recorded within the subject site during surveys, these HBT's contained hollows ranging between <5cm to >50cm providing potential roosting and nesting habitats for all hollow obligate fauna including microbats, bird and mammal species. An example of a hollow-bearing tree marked on site is shown in Photo 1. Figure 20 below shows a broad view of the locations of these HBTs across the subject site. The density of HBTs is evidently increased in the western portion of the subject site. Given the extensive data gathered by the HBT survey, these data have been provided as a shapefile as opposed to an appended HBT register.



Photo 1: HBT 19 marked within the subject site



5.3.3 Koala Food Trees

An abundance of high preferred use Koala Food Trees (KFTs) were recorded within the subject site during the survey. A total of 2,500 KFT's were recorded within the subject site during surveys, these KFTs included species such as *Eucalyptus microcorys* (Tallowwood) and *Eucalyptus propinqua* (Small-fruited Grey Gum) in significantly abundant numbers. Figure 21 below show a broad indication of the locations of these KFT's across the subject site. The density of KFTs is evidently high with the exception of an approximate two-kilometre stretch of the subject site along Stockyard Creek Road in the eastern portion of the subject site. Given the extensive data gathered by the KFT survey, these data have been provided as a shapefile as opposed to an appended KFT register.

5.3.4 Aquatic Habitats

The aquatic habitats present within the subject site were assessed for their potential to support aquatic fauna and threatened aquatic species. A total of six creek crossings occur within the subject site.

Aquatic assessments were undertaken at each of the water crossings within the subject site. The locations of the aquatic habitat assessments are shown in Figure 22. Results for the aquatic habitat assessment were generally consistent across the subject site. Each creek crossing occurred within a broad valley with low water levels ranging between zero to one metre in depth. Each bank provided moderate shading and



riparian vegetation consisting of trees >10m height. Stream width varied between one and eight metres and each site consistently exhibited very clear, clean water on a generally pebble (20-60mm) / cobble (60-200mm) substrate with minimal submerged aquatic vegetation present.

Of the six creek crossings, one site (Site 4) was considered to contain potentially suitable habitat for the Purple-spotted Gudgeon (*Mogurnda adspersa*) due to the extent of the aquatic habitat and water depth. A targeted dip net survey and bait trapping survey was hence undertaken at this location. These surveys failed to detect aquatic fauna other than aquatic macroinvertebrates in low numbers. Following the targeted survey and aquatic habitat assessment, it was determined that due to the lack of aquatic vegetation and aquatic prey resources, Site 4 was also unlikely to present habitats suitable for the Purple-spotted Gudgeon.

No habitats were considered suitable for the Platypus due to the upper reach stream habitat, low water levels and marginal suitable quality bank habitat.



Photo 2: Representative aquatic habitats within the subject site (Site 4).



Photo 3: Representative aquatic habitats within the subject site (Site 6).



Figure 20: Location of hollow-bearing trees

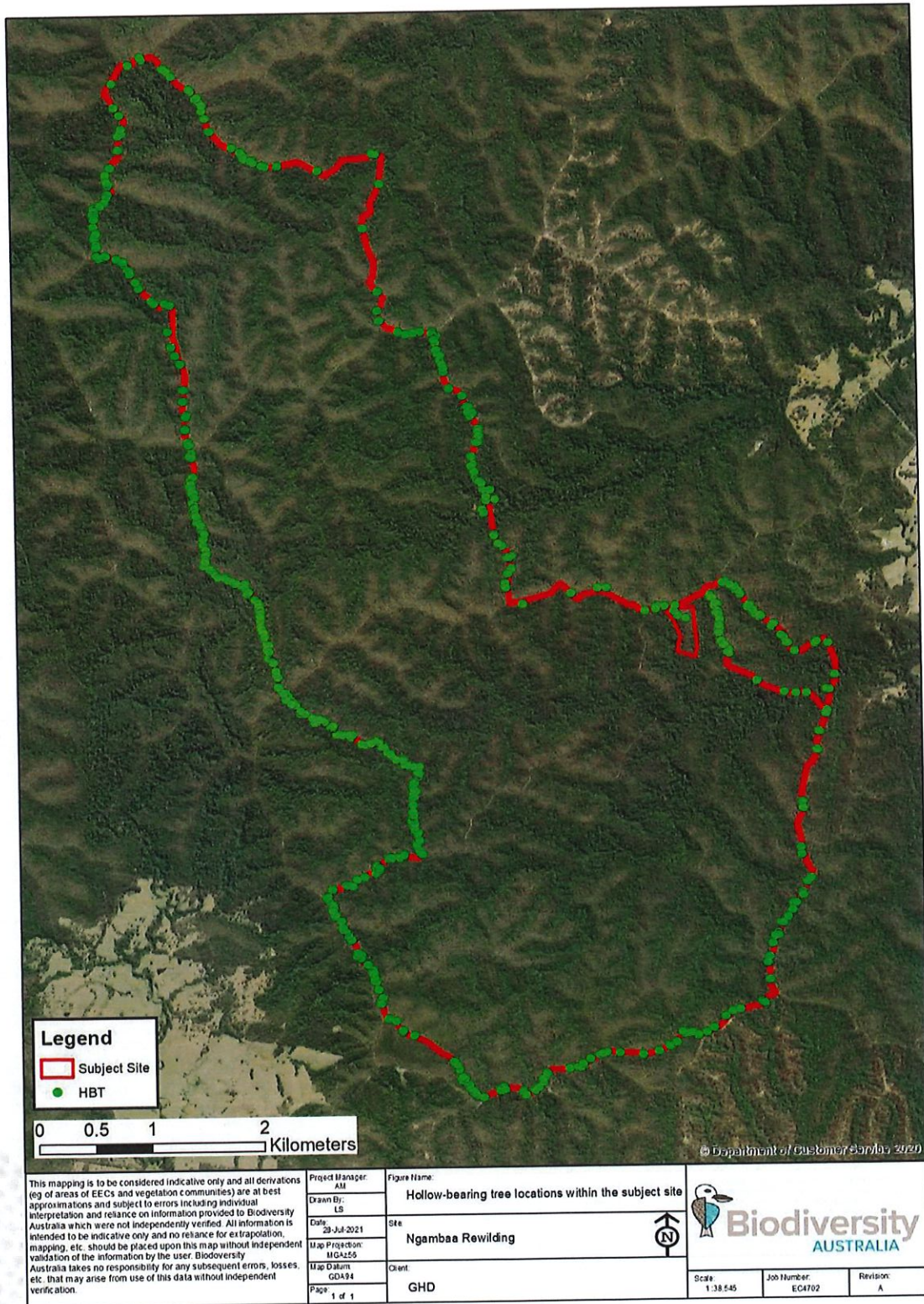


Figure 21: Location of Koala food trees

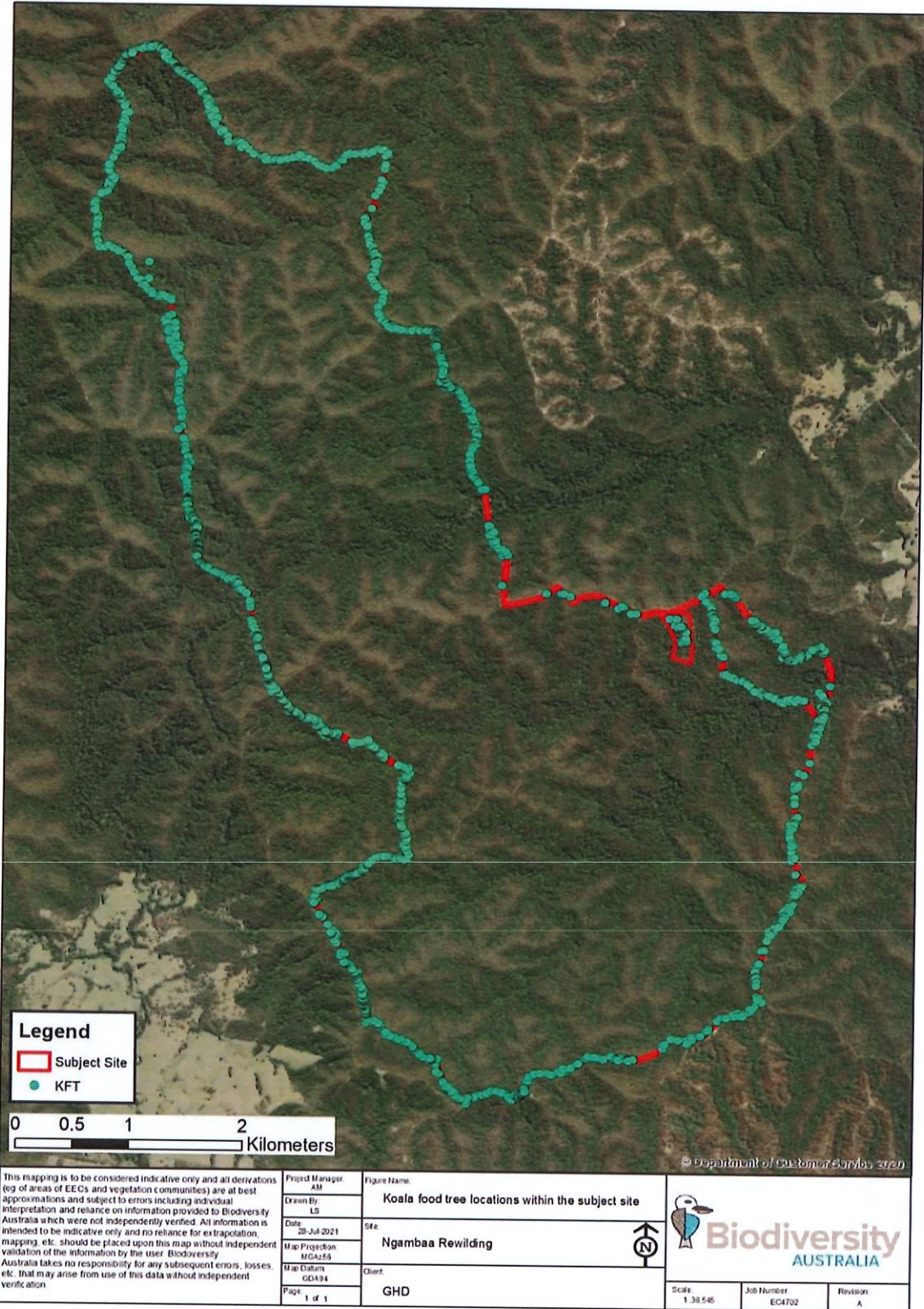
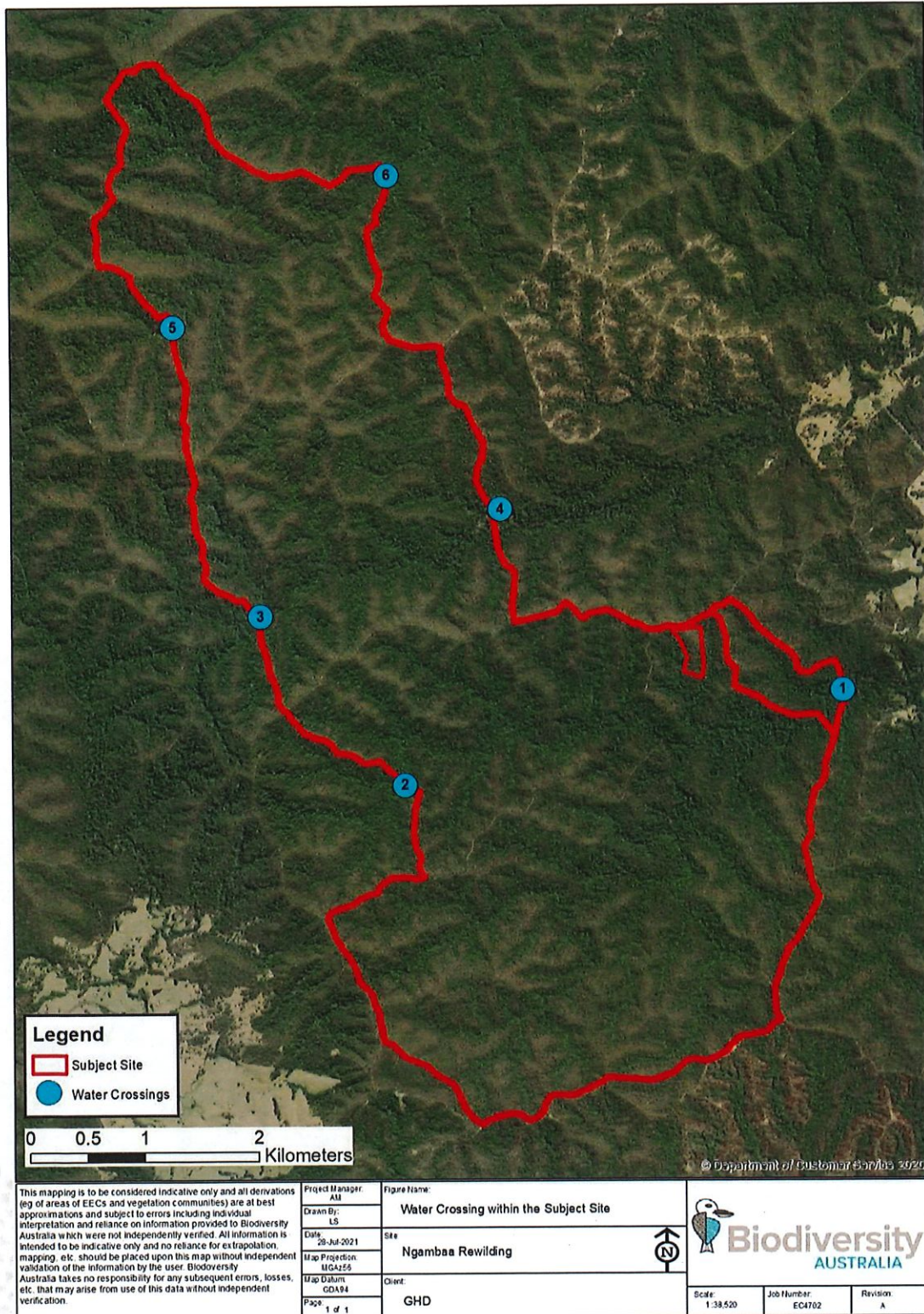


Figure 22: Location of Aquatic habitat surveys



5.3.5 Observed/Detected Fauna

A total of 90 fauna species were detected throughout the survey period within the subject site via direct and indirect survey methods. Despite a significant number of fauna recorded during surveys, the surveys detected a limited range of fauna species likely due to the timing of the survey period and sub-optimal weather conditions. Species recorded consisted of 57 bird species including several common birds such as the Rainbow Lorikeet (*Trichoglossus moluccanus*), Eastern Rosella (*Platycercus eximius*) and Pied Currawong (*Strepera graculina*). Some were observed on the subject site while others were seen flying overhead or heard calling from adjacent habitats. Of these, three (3) threatened birds were detected. See Section 5.3.6.

Twenty-six (26) mammal species and one reptile species were detected throughout the survey period. No amphibians were recorded in or adjacent to the subject site during the field surveys. Photos 4-7 display some of the fauna detected within the subject site via PIR cameras. Appendix 0 provides the total fauna list for the subject site and details the method of detection for each species. Five (5) threatened fauna species were detected on site during field surveys. These species are further discussed in Section 5.3.6 below.

No amphibians and notably few reptile species were recorded within the subject site during the survey period. This is likely due to the low temperatures at the time of survey which would coincide with low activity levels for reptile and amphibious species.

Three introduced mammal species were recorded within the subject site during fauna surveys, these include; Domestic Cattle (*Bos taurus*), Feral Cat (*Felis catus*) and the House Mouse (*Mus musculus*).

Photo 4: Feather-tailed Glider

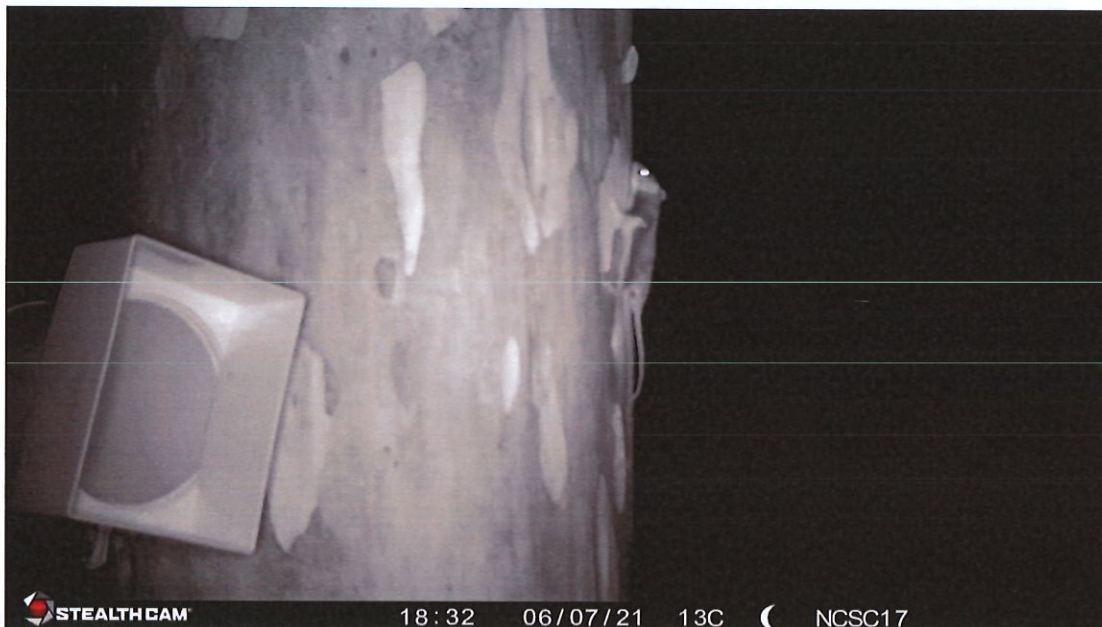


Photo 5: Swamp Wallaby



Photo 6: Short-beaked Echidna



Photo 7: Long-nosed Bandicoot



5.3.6 Threatened Fauna

A total of seven threatened fauna species were confirmed to occur within the subject site during the survey period. Table 6 details the threatened fauna species recorded during the fauna surveys, their detection method and their listing status under the BC Act and are further described below. The locations of the threatened species recorded during surveys is shown in Figure 23.

Table 6: Threatened fauna recorded during surveys

Common Name	Scientific Name	Detection Method	BC Act Status
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	HC, Vis	V
Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>	Vis	V
Powerful Owl	<i>Ninox strenua</i>	HC	V
Little Bent-wing Bat	<i>Miniopterus australis</i>	Ana	V
Squirrel Glider	<i>Petaurus norfolcensis</i>	HC	V
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	Cam	V
Koala	<i>Phascolarctos cinereus</i>	Scat, Cam	E
Red-legged Pademelon ¹	<i>Thylogale stigmatica</i>	Cam	V

Key: Endangered (E), Vulnerable (V) and not listed (-).
 Detection Method key: Anabat detection device (Ana), PIR Camera (Cam), Heard call (HC), Nest (NE), Scats found (Scat), Visually observed (Vis).
¹Species identification not confirmed.

The following photos display the threatened species recorded during fauna surveys by PIR camera.



Photo 8: Brush-tailed Phascogale



Photo 9: Koala



In addition to these species, a Pademelon was recorded via PIR camera which cannot be positively identified to species level due to lack of photo colour and limited photo captures (Photo 10). Limited photos of this species were recorded with it occurring only on a single camera (PIR Camera 16) on a single evening. Species identification has been narrowed down to either the non-threatened, Red-necked Pademelon (*Thylogale thetis*) or the BC Act listed (vulnerable) threatened species the Red-legged Pademelon (*Thylogale stigmatica*).

As a precautionary measure, both species have been assumed to be present within the subject site.

Photo 10: Possible Red-legged Pademelon



Although not positively identified, an additional seven microbats were recorded as possible identifications in the analysis of bat calls. These were unable to be confirmed due to difficulty distinguishing between species calls. These species are discussed in the Bat Call Analysis Report in Appendix A-7 and have been considered in the potential occurrence assessment.

The location of threatened fauna species recorded during the survey period is provided in Figure 23.

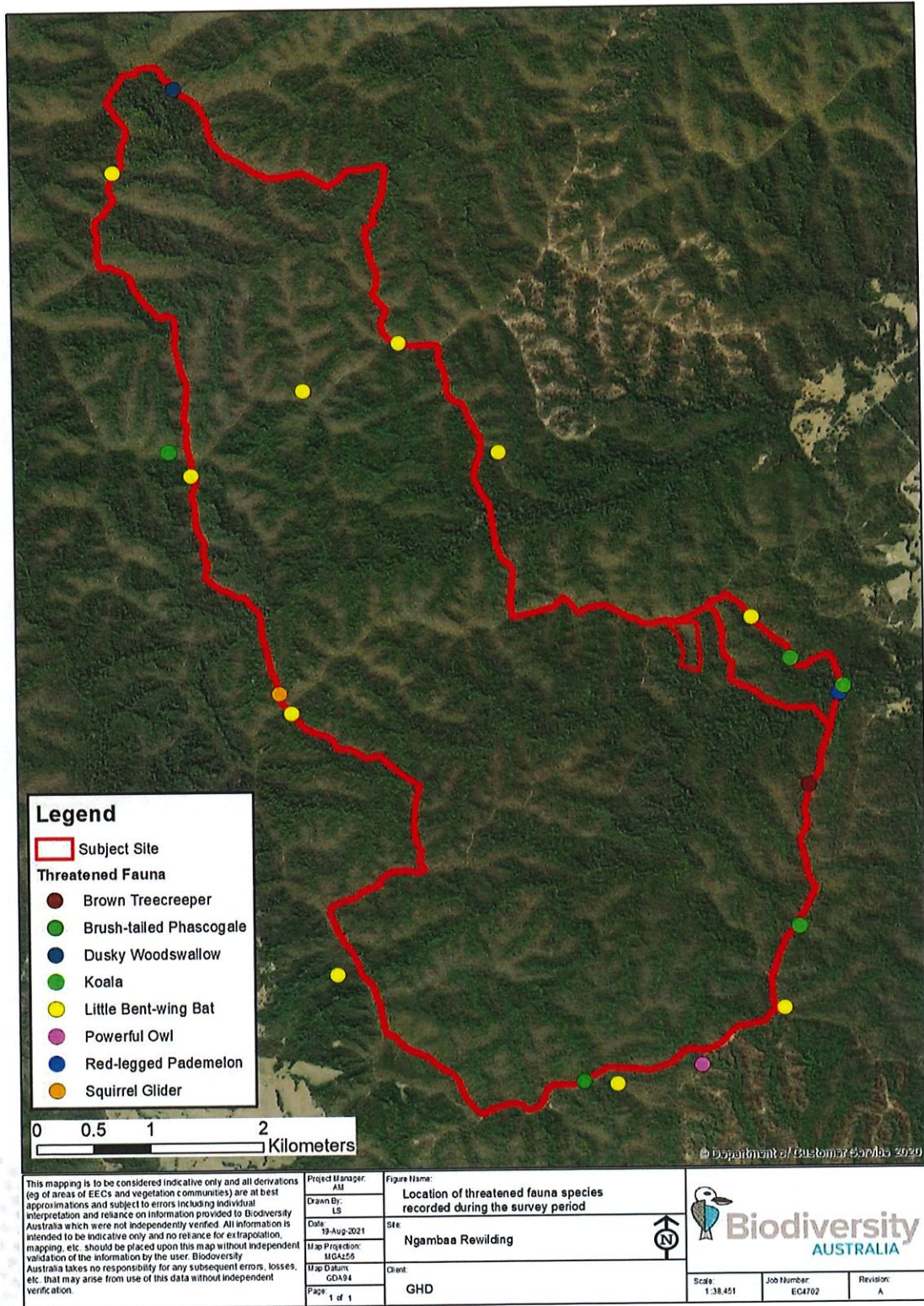
5.3.6.1 Potential Occurrence Assessment

A number of threatened fauna species have been recorded in the study area in the Bionet Atlas of Wildlife (DPIE 2021a, NPWS 2004). In Appendix 0, these species are evaluated for their potential to occur on the subject site and their eligibility/requirement for further assessment.

Locally recorded marine species have not been addressed as there is no habitat for these species on the subject site.



Figure 23: Location of threatened fauna



5.3.7 Feral Predators and Herbivores

Feral predators are considered the primary threat to extant native mammal species. Wild dogs, foxes and cats kill a range of native species including birds, mammals, reptiles, amphibians and invertebrates. Of the three exotic mammal species detected during field surveys, one feral predator, the feral cat (*Felis catus*) was recorded once on PIR camera. See Photo 11. No evidence of the European Red Fox (*Vulpes vulpes crucigera*) or Wild dogs (*Canis lupus dingo*) were detected during field surveys, however these species are likely present within the subject site in low numbers due to low prey resources.

Photo 11: Cat (*Felis catus*)



The House Mouse (*Mus musculus*) was also regularly detected within the subject site at a total of nine PIR camera locations, indicating that this species is a common occurrence within the subject site. Central NSW experienced a mouse plague in 2020 into early 2021 due to optimal weather conditions for breeding and timing of the end of the 2017 to 2019 drought. High numbers of the House Mouse within the subject site is expected to be a result of this mouse plague.

Non predatory, introduced herbivores detected within the subject site during field surveys include only Domestic Cattle (*Bos taurus*), see Photo 12. Numerous individuals were recorded by opportunistic sightings, PIR camera and by secondary evidence throughout the southern extent of the subject site where the CCAF borders NSW Forestry and privately owned land. No evidence of other domestic livestock or feral horses, goats, deer, pigs, hares or rabbits was detected.



Photo 12: Domestic Cattle (*Bos taurus*)



The presence of the Eastern Grey Kangaroo (*Macropus giganteus*) was not detected during field survey. This is important to note given the ability of this species to overpopulate, reduce groundcover and compete for resources with the existing native and threatened species of the study area.



6. Impact Assessment

6.1 Direct Impacts

6.1.1 Removal and Modification of Habitats

As mentioned previously, the proposal is for the construction of a 31.36 km predator proof fence within Ngambaa Nature Reserve. It is estimated that up to 69.75 hectares of native vegetation consisting of dry sclerophyll forest, wet sclerophyll forest, and dry and subtropical rainforest communities as well as up to 0.22 ha of known TEC rainforest vegetation within the linear 20 m wide corridor will require removal or modification to establish the proposed predator proof fence. This will involve the following removal and/or modification of habitat as follows:

- Tallowwood and Small-fruited Grey Gum which are the only known high preferred use Koala food trees requiring removal. A total of 2,500 trees of these species have been recorded within the subject site to potentially be impacted by the proposal.
- A total of 621 hollow-bearing trees were recorded within the subject site which may potentially be impacted by the proposal. Recommendations have been made to retain hollow-bearing trees within the subject site where possible to minimise the potential impacts of the proposal to hollow-bearing trees.
- A total of six creek crossings will be temporarily subjected to direct impacts during the construction of the proposed fence. This may include the removal/impact of riparian vegetation, temporary obstruction of fish passage, temporary impacts to water quality, pollution and sedimentation and erosion impacts. These activities and impacts may additionally further affect downstream water quality beyond the subject site.
- Removal of habitat features such as hollow logs and log piles.
- Topographical modification: Cutting and filling may be required to establish the proposed fence line, particularly where concrete footings are required and around aquatic habitats and drainage lines. which may impact soils and topography within the subject site and furthermore potentially change the current hydrological flows and run off.

6.1.2 Feral Predator and Herbivore Removal

Feral cats, foxes and feral dogs are opportunistic, generalist predators. Feral cats can be expected to kill and eat in the order of 7 prey items per cat per night (McGregor et al. 2015).

Feral herbivores have the potential to impose a range of adverse impacts on native species and the ecosystem as a whole by reducing the cover of palatable plants to native mammals, reducing groundcover and shelter sites and increasing the exposure of native ground-dwelling mammals, reptiles and birds to predation. Feral herbivores such as cattle degrade riparian vegetation, decrease water quality and increase the spread of weeds and soil erosion rates.

Removal of feral predators and the implementation of vertebrate pest control programs within the study area has the potential to create both negative and positive impacts. Small, introduced herbivores such as hares and rabbits will also see a reduction in predation, therefore programs for the control of non-predatory introduced herbivores should also be implemented. Positive impacts of the implementation of vertebrate pest control programs both within, and beyond the proposed predator proof fence, will deliver substantial benefits to extant native fauna species by significantly reducing the rates of predation.



By removal of feral herbivores such as stray cattle from the proposed rewilding area, permanent exclusion of cats, dogs and foxes from the rewilding area and the implementation of vertebrate pest control programs, the impacts of these species are likely to be significantly reduced and will therefore improve habitats for extant native species within the study area.

6.1.3 Rewilding Reintroductions

Species considered for reintroduction of locally extinct animal species include the Eastern Bettong (*Bettongia gaimardi gaimardi*), Rufous Bettong (*Aepyprymnus rufescens*), Eastern Quoll (*Dasyurus viverrinus*), Common Planigale (*Planigale maculata*), Long-nosed Potoroo (*Potorous tridactylus*), New Holland Mouse (*Pseudomys novaehollandiae*), Eastern Chestnut Mouse (*Pseudomys gracilicaudatus*) and Parma Wallaby (*Macropus parma*).

The direct benefit associated with these reintroductions is the substantial increase in the global population sizes of up to eight threatened Australian mammals. By establishing new populations of these threatened and locally extinct species within the proposed rewilding area, this emphasises the huge environmental benefit and positive impact of this proposal.

The reintroduction of these small to medium sized ground dwelling mammals can also deliver ecological benefits to ecological processes such as soil turnover and nutrient and water retention, as well as the return of omnivores such as the Eastern Quoll. These benefits are likely to help restore the structure of faunal assemblages. In summary, the changes to plant and animal assemblages and ecosystem processes that are associated with reintroductions can be assumed to be the historical condition (AWC 2017).

6.2 Indirect Impacts

The following potential indirect impacts may be associated with the proposal:

6.2.1 Fragmentation and Landscape Change

Fragmentation of faunal habitat has the potential to impact the dispersal of fauna, modify gene flow and alter the microclimate in the area by directly reducing accessibility to habitat and increasing the area of vegetation subject to edge effects (see Section 6.2.4) (Battisti 2003; Offerman et al 1995; Saunders et al 2012). Fragmentation and the associated landscape changes at all scales is major factor in the decline of biodiversity, the modification of ecosystems, and alteration of ecosystem processes. Its effects vary with factors such as distance of fragments from similar habitat, their position in the landscape, the forms of habitat modification of isolates that occurs (e.g. due to edge effects), and types of surrounding land uses in the matrix, the ecology of the species affected, and how these factors influence the movement of organisms between the isolates and larger areas of habitat (Lindenmayer and Fisher 2006, DPIE 2021b).

The removal of vegetation for the proposed predator proof fence will contribute to local habitat loss. Given the narrow, linear nature of the proposal, that being a 20 metre corridor that utilises existing roads and tracks where possible as well as the extensive areas of vegetation adjacent to the subject site boundary and within the management zones of this 20 metre corridor to be retained where design permits, the proposed vegetation removal will marginally increase the distance between these patches of vegetation however impacts from this are anticipated to be minimal with the application of recommendations detailed in Section 9.

Anthropogenic fragmentation and barriers to movement and connectivity that may be caused as a result of constructing the predator proof fence are discussed below in Section 6.2.2.



6.2.2 Barriers to Movement and Connectivity

Some threatened fauna can be injured by collision with wire fences, particularly barbed wire e.g. the Yellow-bellied Glider, owls and Squirrel Glider have been recorded being injured by barbed wire fences (Lindenmayer 2002, Woodford 1999). Any temporary fences required for construction works have the potential to restrict fauna movements (e.g. colorbond) or are capable of inflicting injury (e.g. barbed wire fence).

There may be negative impacts to native mammal species with the introduction of exclusion fencing within the Ngambaa Nature Reserve. Several threatened species have been recorded during the 2021 surveys which may be impacted by the introduction of predator proof fencing. The potential impacts of the fencing includes disrupting natural dispersal patterns of terrestrial fauna, restricting gene flow of naturally occurring populations within the broader landscape, and creating imbalances within populations of certain animals (through fragmentation, and/or creating an imbalance of numbers of different sexes).

To address these concerns, it is important to understand the current conditions of existing populations including:

- a) population dynamics,
- b) home range size,
- c) typical viable population size, and
- d) current dispersal patterns.

Having this understanding can help mitigate the impacts exclusion fencing may have on species in the long term.

Threatened species that may be impacted by barriers formed by exclusion fencing include the Spotted-tailed Quoll, Common Planigale, Red-legged Pademelon, Rufous Bettong, Koala, and Long-nosed Potoroo. Some of these threatened species, among others, will be considered for reintroduction to the area for the purposes of the Rewilding project. Consideration of movement barriers and connectivity impacts to selected threatened species known or predicted to occur within the Reserve are discussed below.

Spotted-tailed quoll

In the case of the Spotted-tailed Quoll, studies into quoll re-introductions, and introduced predator-free fenced reserves have identified a number of constraints, based on the population dynamics of quolls. The first issue raised is that fenced reserves are inevitably containing predators that are naturally wide roaming (West et al. 2018). Spotted-tailed Quolls have large home ranges (200-500 ha for females, 500 ha to over 4000 ha for males (DPIE 2021b), and their breeding type is polygynous, meaning males will wander widely during breeding seasons to mate with multiple females (Soderquist and Serena 1990; West et al. 2018). Previous re-introduction programs have found that males frequently escape reserves by climbing fences whilst searching for females (West et al. 2018). It may therefore be important that for quolls, fences are designed so individuals can climb to leave the reserve. However, as the fencing will need to exclude introduced predators, quolls will not be able to re-enter with this design. The implications of this may be problematic for genetic diversity within the reserve, as the genetic pool may decrease over time.

Another consideration when containing native predators, is the potential impact on the threatened prey species. Some studies on islands and fully contained reserves where quolls are unable to disperse over fences, has resulted in an over-abundance of predators, resulting in excessive predation pressure on prey species (Griffiths et al. 2017; Hayward et al. 2007).



Koala

For the Koala, it is similarly important to consider home range size, dispersal habitats, and Koala densities within the proposed fenced area. With respect to ensuring connectivity between the fenced area and the forest beyond, there are fence designs that can allow one-way movement. Timber poles situated along fence lines can allow koalas to climb over fences and drop to the ground on the other side. The design of these timber poles, to either allow koalas to move into the reserve, or out of the reserve will likely depend on the current population within the fenced area, and the carrying capacity this area has for supporting a viable Koala population. The same issue exists for the Koala as it does for quolls, semi-permeable structures have the potential to cause:

- a) decline of numbers within the reserve, if animals are able to escape; or
- b) and over-abundance of animals within the reserve if animals are retained.

These structures also have the potential to compromise the purposes of the Rewilding project. Understanding the densities and movement patterns of koalas within the broader area by monitoring populations will help to address these concerns.

Red-legged Pademelon

Should a viable population occur within the area, considerations as to the impact fencing may have on populations should include home range size, population densities and life histories, with the goal of addressing whether the fenced reserve would separate an existing viable population into two populations or if the fenced reserve is large enough to support a genetically diverse population. Red-legged Pademelons have relatively small home ranges, on average 2.3 hectares in size (Vernes et al, 1995).

Recommendations have been made to reduce and minimise the potential impacts of movement barriers and connectivity impacts to selected threatened species, these are discussed in Section 9.

6.2.3 Injury/mortality During Clearing

Animals within hollows and fallen logs, as well as dense vegetation and leaf litter have the potential to be injured or killed during clearing operations. This risk increases during breeding seasons (generally spring to late autumn) and in cooler seasons when mammals and reptiles enter torpor.

The subject site contains areas of dense groundcover, habitat logs, hollow-bearing trees and koala food trees which are required to be removed as a result of the proposal, therefore providing a risk of fauna mortality during clearing. The presence of an ecologist during all clearing activities will mitigate the risk of injury to fauna. Koalas are also at risk of injury if they are present on site at the time of clearing. An ecologist must be present prior to and during clearing activities to search for Koalas and ensure they do not enter the subject site. Further detail of the mitigation measures proposed to reduce injury or mortality during clearing is provided in Section 9.

6.2.4 Edge Effects

Changes to the edges of vegetation communities has been attributed to a range of detrimental effects on different ecosystems. These changes have been linked to effects such as the alteration of environmental conditions, changes in species abundance and distributions and changes in species interactions (Murcia 1995).

Clearing for the proposal will slightly extend on existing gaps within the forest where the proposal utilises existing road and track routes. In other sections the proposal will create a narrow linear gap through the existing in-tact forested vegetation. To a small degree, this can allow for edge effects such as weed



invasion, light penetration and wind damage to penetrate the adjoining forest. Impacts from edge effects are anticipated to be minimal with the application of recommendations detailed in Section 9.

6.2.5 Erosion and Sedimentation

Sedimentation and erosion impacts can occur at both the construction and establishment phases. Erosion/sedimentation may occur via erosion of fill material and disturbed soils, scouring of exposed soil, earthen banks and via directed flow (e.g. stormwater), or where runoff is concentrated. If unmitigated, these can lead to the reduction in water quality of downstream waterways and cause siltation, having flow-on effect to flora and fauna (Queensland Government 2019).

Standard mechanisms and controls will be required to ensure the prevention of erosion and sedimentation during construction and post-construction and such impacts do not extend beyond the subject site. These mitigation measures are discussed in Section 9.

6.2.6 Weed Invasion

An increase in vehicle and foot traffic within the subject site vegetation during the construction phase has potential to increase the spread of weeds along the roadside and fence line. The introduction of weeds can have a significant impact on native flora and fauna by altering the balance of natural ecosystems and outcompeting native flora when it comes to necessary sunlight, shade, nutrients and space (DPE 2019). This can result in long-term effects unless appropriate mitigation and management measures are implemented.

The proposal is unlikely to introduce any new weed species as the subject site currently contains a density of weed species. This however does provide the potential for further spreading. Mitigation measures to limit the potential for spread and minimise impacts from weeds are further discussed in Section 9.

6.2.7 Noise, Vibration and Anthropogenic Disturbances

A significant/frequent increase in noise levels have been documented to impact on behavioural changes, population densities, community structure and breeding success of fauna (Barber *et al* 2009). These responses can result from the frequent disturbance to daily activities via evoking anti-predatory responses as well as by blocking call signals between individuals (Barber *et al* 2009).

Currently, for the majority of the subject site, minimal noise is derived only from traffic nearby rural roads and access tracks within the Reserve and nearby rural properties. Within the south and south-east of the subject site, the adjacent land outside of the Reserve are owned by private forestry operations. Forestry clearing works are currently being undertaken creating significant amounts of temporary and intermittent noise and vibration in these areas of the subject site.

The clearing and construction phase of the proposed predator proof fence will result in increased levels of noise and vibration within and immediately surrounding the subject site. This increase in noise and vibration is however only expected to have a minimal effect on local fauna due to the following:

- works will to be diurnal only;
- the clearing/construction phase is temporary; and
- fauna would be able to avoid affected habitat by utilising adjoining vegetation if needed.

Once established, noise and vibration levels are expected to return to levels of which occurred prior to construction. As fauna occurring in and adjacent to the subject site in areas that adjoin forestry are



expected to have a substantial tolerance to the current level of noise in the area, long-term impacts are not anticipated.

6.2.1 Downstream Water Quality

As discussed previously, the proposal is likely to lead to direct impacts on the aquatic habitats present within the subject site during construction. These activities may also lead to indirect impacts on water quality downstream and beyond the subject site if left unmitigated. Impacts on aquatic habitats post-construction are not expected as a result of the proposal. Details of the recommendations proposed to reduce impacts on aquatic habitats are provided in Section 9.

6.2.2 Trampling of Threatened Flora Species

Two threatened flora species, *Rhodamnia rubescens* (Scrub Turpentine) and *Parsonsia dorrigoensis* (Milky Silkpod) were both recorded during the survey period. As such, there is potential for juvenile plants to be trampled during the construction phase. Trampling of juveniles could have detrimental effects on this species recruitment ability.

The clearing footprint is to be clearly marked and all staff to be made aware that no clearing or inadvertent damage to the root zones of flora is to occur outside of these marked areas. Following construction, these threatened flora species within and surrounding the subject site are anticipated to maintain the ability to recruit within the subject site. Further recommendations are provided in Section 9. If mitigation measures are effectively implemented, impacts to threatened flora individuals and populations are anticipated to be minimal.

6.2.3 Cumulative Impacts

The potential for both positive and negative cumulative impacts are likely as a result of the proposal. Positive impacts will be achieved through continued activities such as feral predator control and herbivore/livestock removal as well as the removal of priority weeds from the subject site, which would be undertaken in conjunction with other weed and vertebrate pest management programs within the study area and broader region.

Habitat and vegetation removal as a result of the proposal have been considered to have negative cumulative impact as large areas of habitat and vegetation are removed within the study area in the course of forestry operations and, to a lesser extent, within privately owned rural properties.



7. Biodiversity Conservation Act 2016 Assessment

7.1 Assessment Pathway

Under the NSW *Biodiversity Conservation Act 2016* and *Biodiversity Conservation Regulation 2017*, Part 5 developments under the *Environmental Planning & Assessment Act 1979* are not required to enter into the Biodiversity Offset Scheme (BOS) as this is an optional assessment pathway.

Given that assessment under the BOS is not required for Part 5 proposals, a Test of Significance has been carried out to assess the potential impacts of the proposal on threatened species and ecological communities.

7.2 Five-part Test of Significance

The Test of Significance is prescribed in Part 7, Division 1, Section 7.3 of the *Biodiversity Conservation Act 2016*. The purpose of the Test of Significance is to determine whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. The Test of Significance applies if:

- a) it is likely to significantly affect threatened species or ecological communities, or their habitats, according to the test in section 7.3, or
- b) the development exceeds the biodiversity offsets scheme threshold if the biodiversity offsets scheme applies to the impacts of the development on biodiversity values, or
- c) it is carried out in a declared area of outstanding biodiversity value.

For an activity under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), an assessment of an activity that is likely to significantly affect a threatened species must be accompanied by a species impact statement (SIS) or, if the proponent elects to participate in the Biodiversity Offset Scheme, a Biodiversity Development Assessment Report will be required.

The Test of Significance has been prepared in consideration of the *Threatened Species Test of Significance Guidelines* (OEH 2018).

7.2.1 Entities Assessed

Field surveys and the potential occurrence assessments in Appendix A-4 have determined that one BC Act listed TEC and 23 BC Act threatened species are known to occur or considered to potentially occur in the subject site. These entities are described in the table below and are subject to a Test of Significance under the BC Act.

Each of these entities are assessed in the Test of Significance in Appendix A-5. Tests of Significance for these entities have determined that the proposed development will not significantly impact these threatened species or ecological communities listed under the BC Act.

Table 7: Potentially occurring species subject to a Test of Significance

Species/Community	BC Act Status	Likelihood of occurrence
Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion	E	Known



Species/Community	BC Act Status	Likelihood of occurrence
<i>Rhodamnia rubescens</i> (Scrub Turpentine)	CE	Known
<i>Parsonsia dorrigoensis</i> (Milky Silkpod)	V	Known
<i>Marsdenia longiloba</i> (Slender Marsdenia)	E	Moderate
Green-thighed Frog (<i>Litoria brevipalmata</i>)	V	Fair
Giant Barred Frog (<i>Mixophyes iterates</i>)	E	Fair
Glossy Black Cockatoo (<i>Calyptorhynchus lathamii</i>)	V	Moderate
Little Lorikeet (<i>Glossopsitta pusilla</i>)	V	Moderate
Masked Owl (<i>Tyto novaehollandiae</i>)	V	Moderate
Sooty Owl (<i>Tyto tenebricosa</i>)	V	Fair
Powerful Owl (<i>Ninox strenua</i>)	V	Known
Brown Treecreeper (<i>Climacteris picumnus victoriae</i>)	V	Known
Dusky Woodswallow (<i>Artamus cyanopterus cyanopterus</i>)	V	Known
Brush-tailed Phascogale (<i>Phascogale tapoatafa</i>)	V	Known
Koala (<i>Phascolarctos cinereus</i>)	V	Known
Greater Glider (<i>Petauroides Volans</i>)	E	Fair
Spotted-Tailed Quoll (<i>Dasyurus maculatus</i>)	V	Fair
Squirrel Glider (<i>Petaurus norfolkensis</i>)	V	Known
Red-legged Pademelon (<i>Thylogale stigmatica</i>)	V	Likely/Known
Yellow-bellied Glider (<i>Petaurus australis</i>)	V	Likely
Little Bent-wing Bat (<i>Miniopterus australis</i>)	V	Known
Eastern Coastal Free-tail Bat (<i>Micronomus norfolkensis</i>)	V	Fair
Greater Broad-nosed Bat (<i>Scoteanax rueppellii</i>)	V	Low/Fair
Stephens' Banded Snake (<i>Hoplocephalus stephensii</i>)	V	Fair

7.2.2 Key Threatening Processes

A Key Threatening Process (KTP) is defined as a process that threatens, or may have the capability to threaten, the survival or evolutionary development of species, populations or ecological communities. An assessment of KTPs in relation to the development is provided in the table below.

Table 8: Contribution to Key Threatening Processes

Key Threatening Processes	Will Proposal Affect KTP?
Aggressive exclusion of birds from woodland and forest habitat by abundant Noisy Miners <i>Manorina melanocephala</i>	No
Alteration of habitat following subsidence due to longwall mining	No
Alteration to the natural flow regimes of rivers and streams and their floodplains and wetlands	No
Anthropogenic Climate Change	Yes – vegetation removal and greenhouse gasses generated by machinery used during construction



Key Threatening Processes	Will Proposal Affect KTP?
Bushrock removal	Yes – however bushrock would be relocated to nearby habitats
Clearing of native vegetation	Yes – up to 69.75ha of native vegetation to be removed/modified.
Competition and grazing by the feral European Rabbit, <i>Oryctolagus cuniculus</i>	No
Competition and habitat degradation by Feral Goats, <i>Capra hircus</i>	No
Competition from feral honeybees, <i>Apis mellifera</i>	No
Death or injury to marine species following capture in shark control programs on ocean beaches	No
Entanglement in or ingestion of anthropogenic debris in marine and estuarine environments	No
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners	No
Herbivory and environmental degradation caused by feral deer	No
High frequency fire resulting in the disruption of life cycle processes in plants and animals and loss of vegetation structure and composition	No
Importation of Red Imported Fire Ants <i>Solenopsis invicta</i>	No
Infection by <i>Psittacine Circoviral</i> (beak and feather) Disease affecting endangered psittacine species and populations	No
Infection of frogs by amphibian <i>chytrid</i> causing the disease chytridiomycosis	No – provided recommendations for construction hygiene are followed
Infection of native plants by <i>Phytophthora cinnamomi</i>	No – provided recommendations for construction hygiene are followed
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae	No – provided recommendations for construction hygiene are followed
Introduction of the Large Earth Bumblebee <i>Bombus terrestris</i>	No
Invasion and establishment of exotic vines and scramblers	No – provided recommendations for construction hygiene are followed
Invasion and establishment of Scotch Broom (<i>Cytisus scoparius</i>)	No
Invasion and establishment of the Cane Toad (<i>Bufo marinus</i>)	No
Invasion of native plant communities by African Olive <i>Olea europaea subsp. cuspidata</i> .	No
Invasion of native plant communities by <i>Chrysanthemoides monilifera</i>	No
Invasion of native plant communities by exotic perennial grasses	No – provided recommendations for construction hygiene are followed
Invasion of the Yellow Crazy Ant, <i>Anoplolepis gracilipes</i> into NSW	No
Invasion, establishment and spread of Lantana (<i>Lantana camara</i>)	No - Lantana already occurs on the subject site. Recommendations for construction hygiene are to be followed
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	No
Loss of Hollow-bearing Trees	Yes – 621 hollow-bearing trees occurs within the subject site.
Loss or degradation (or both) of sites used for hill-topping by butterflies	No
Predation and hybridisation by Feral Dogs, <i>Canis lupus familiaris</i>	No



Key Threatening Processes	Will Proposal Affect KTP?
Predation by <i>Gambusia holbrooki</i> (Plague Minnow or Mosquito Fish)	No
Predation by the European Red Fox <i>Vulpes vulpes</i>	No
Predation by the Feral Cat <i>Felis catus</i>	No
Predation by the Ship Rat <i>Rattus rattus</i> on Lord Howe Island	No
Predation, habitat degradation, competition and disease transmission by Feral Pigs, <i>Sus scrofa</i>	No



8. Fisheries Management Act Assessment

This section specifically focuses on habitat and organisms associated with the *Fisheries Management Act 1994* (FM Act) and *Fisheries Management (Amendments) Act 1997*. The subject site encompasses six water crossings, two at Allgomera Creek to the north, two at Stockyard Creek in the centre and two at Eungai Creek to the south of Ngambaa Nature Reserve. All these waterways consist of catchment areas from within the reserve (NPWS 2004) and are proposed to be traversed by the construction of the predator proof fence.

8.1 Waterways Definition and Description

Allgomera, Stockyard and Eungai Creeks that traverse the reserve, all flow into Warrell Creek. Warrell Creek forms part of the Nambucca catchment and is identified to have 'potential high conservation value' due to the extent of undisturbed waterways within the catchment (NPWS 2004). The aquatic sites are located between approximately 10-18 kilometres from the mouth of Warrell Creek which flows into the Nambucca River at Nambucca Heads, NSW.

As per the *Policy and Guidelines and Fish Habitat Conservation and Management* (NSW DPI 2013), the classification of the waterways or fish passage and the stream order as per the Strahler system, in relation to the habitats located within the Reserve are described below:

- Allgomera Creek – a Class 3 waterway or fish passage, classified as a 2nd order stream.
- Stockyard Creek – a Class 3 waterway or fish passage, classified as a 3rd order stream.
- Eungai Creek - a Class 3 waterway or fish passage, classified as a 3rd order stream.

Class 3 Minimal Key Fish Habitat is defined as: "*Named or unnamed waterway with intermittent flow and sporadic refuge, breeding or feeding areas for aquatic fauna (e.g. fish, yabbies). Semi-permanent pools form within the waterway or adjacent wetlands after a rain event. Otherwise, any minor waterway that interconnects with wetlands or other CLASS 1-3 fish habitats.*" (NSW DPI 2013).

Aquatic assessments were undertaken at each of the aquatic habitats within the subject site. The locations of the aquatic habitat assessments are shown in Figure 22. Results for the aquatic habitat assessment were generally consistent across the subject site. Each creek crossing occurred within a broad valley with low water levels ranging between zero and one metre in depth. Each crossing contained moderate shading and riparian vegetation consisting of trees >10 metres height. Stream width varied between one and eight metres and each site consistently exhibited very clear, clean water on a generally pebble (20-60mm)/cobble (60-200mm) substrate with minimal submerged aquatic vegetation present.

8.2 Aquatic Vegetation

The six aquatic sites subject to aquatic survey exhibited minimal to no aquatic vegetation at the time of survey (June-July 2021).

To date, no aquatic vegetation has been listed as Vulnerable or Endangered under the *Fisheries Management Act 1994*. One Endangered marine vegetation population has been listed comprising *Posidonia australis* seagrass in the Port Hacking, Botany Bay, Sydney Harbour, Pittwater, Brisbane Waters and Lake Macquarie regions and four Endangered Ecological Communities have been listed; however this does not occur within the proximity of the subject site.



Photo 13: Stream bank riparian vegetation present within Ngambaa Nature Reserve (Site 4).



Photo 14: Stream bank riparian vegetation present within Ngambaa Nature Reserve (Site 5).



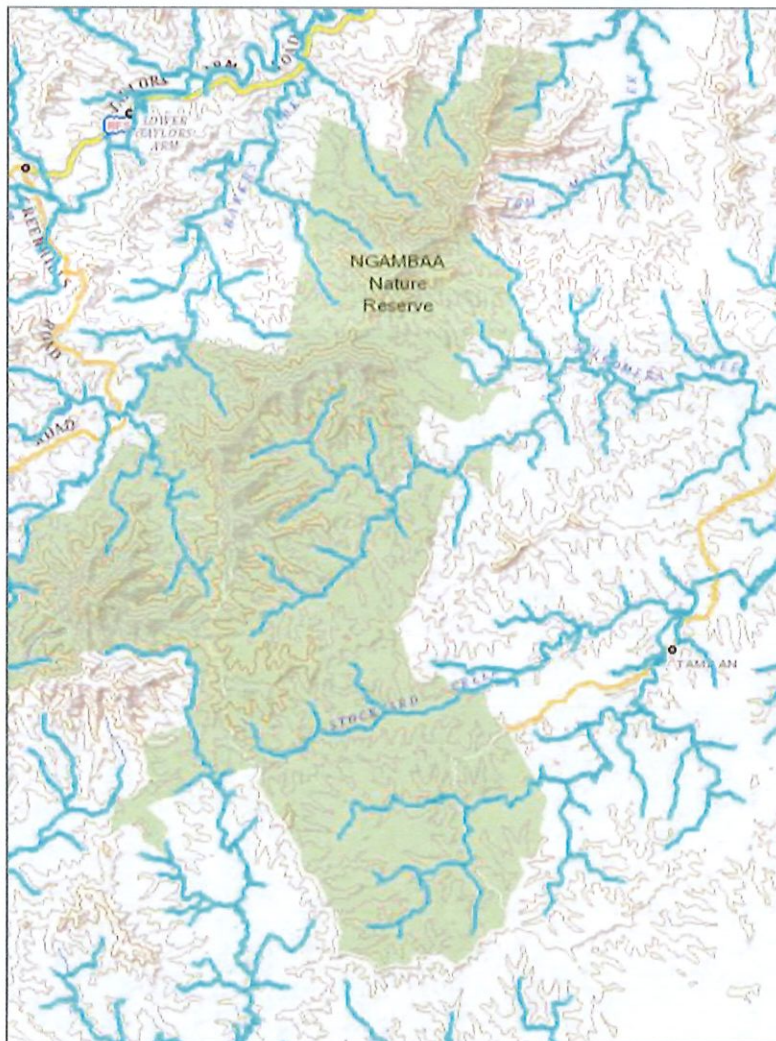
8.3 Key Fish Habitat

Allgamera, Stockyard and Eungai Creeks all qualify and are mapped as 'Key Fish Habitat' under the *FM Act* (Figure 24). Based on the definitions provided in *Policy and Guidelines and Fish Habitat Conservation and Management* (NSW DPI 2013), all aquatic habitats within the subject site would be most closely defined as Type 1 Habitat (Highly sensitive Key Fish Habitat). This is due to the requirement; "Freshwater habitats that contain in-stream gravel beds, rocks greater than 500 mm in two dimensions, snags greater than 300 mm in diameter or 3 metres in length, or native aquatic plants". (NSW DPI 2013).

The proposed development will have a direct impact on in-stream gravel beds and native riparian plants. There is potential for indirect impacts such as sedimentation, and specific mitigation measures have been recommended to minimise these impacts.

It is noted that the works are likely to temporarily obstruct potential fish passage within each of the six creek crossings.

Figure 24: Key fish habitat mapping (DPI 2021b)



8.4 Threatened Fauna and Populations

8.4.1 Local Records

There are no records of threatened aquatic species listed under the *BC Act 2016* in the Bionet Atlas search. No threatened species or Endangered Populations are known to occur in the study area listed under the FM Act however habitat mapping for the Purple Spotted Gudgeon (*Mogurnda adspersa*), listed as Endangered under the FM Act (DPI 2021c).

8.4.2 Key Threatening Processes

Key threatening processes (KTPs) are threatening processes that, in the opinion of the Fisheries Scientific Committee, adversely affect threatened species populations or ecological communities, or could cause species, populations or ecological communities that are not threatened to become threatened. The proposal has the potential to contribute to the following KTPs listed under the FM Act:

- Degradation of native riparian vegetation along New South Wales water courses
- Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams
- Removal of large woody debris from New South Wales rivers and streams

With the implementation of recommendations outlined in Section 9, impacts of these KTPs are not expected on threatened entities listed under the FM Act, nor are impacts expected to cause a species, population or community to become threatened.

8.4.3 Potential Occurrence Assessment

The Purple Spotted Gudgeon is listed as Endangered under the FM Act. The potential occurrence assessment has determined this species to have a low potential to occur due to the lack of habitat requirements and shallow upper reach habitat. As such, this species is not considered in subsequent statutory assessments.

Therefore, it is considered that Tests of Significance for any threatened species listed under the FM Act are not required as a result of the proposal.

8.5 Impacts of the Proposal

The construction of the proposed predator proof fence and the associated works within the Allgomera, Stockyard and Eungai Creeks includes in-stream works and the direct impacts of potential removal and/or impact on aquatic vegetation and habitats and the temporary obstruction to fish passage.

The aquatic habitats downstream of each creek crossing within the subject site are placed at risk of indirect impacts as a result of carrying out construction works in close proximity to the waterway as well as erosion caused by construction within the aquatic system. These indirect impacts include temporary impacts to water quality, pollution and sedimentation and erosion impacts. These activities and impacts may affect downstream water quality beyond the subject site. Mitigation measures proposed to reduce impacts on aquatic habitats is provided in Section 9.



8.6 Permit Requirement

The proposal involves works within the Allgoamera, Stockyard and Eungai Creeks, this includes in-stream works and the potential removal and/or impact on aquatic vegetation and habitats. As such, a permit under Section 219 of the FM Act is required to obstruct the free passage of fish.



9. Recommendations

The following mitigation measures are recommended to minimise any potential direct or indirect impacts of the proposal. The conclusions of this assessment assume the measures are implemented and effective in mitigating impacts.

9.1 General Clearing Measures

The following measures are recommended to manage clearing:

- No clearing should be undertaken to establish stockpile and compound areas.
- The extent of the construction footprint to be clearly marked (e.g. via pegging/fencing/flagging) before clearing in order to prevent any inadvertent clearance beyond what is required and has been assessed and to avoid damage or encroachment into the root zone of retained trees. This fencing/markings is to remain until all clearing and construction is completed.
- Site induction is to specify that no clearing is to occur beyond the marked area. All vehicles are only to be parked in designated areas.
- Clearing should begin in the most distant and disturbed vegetation and work progressively towards areas of secure habitat and/or retained vegetation to encourage any fauna within the clearing footprint to disperse into these areas.
- Clearing and earthworks is to avoid damage to root zones of the retained trees.

9.2 Pre-clearing Survey and Clearing Supervision

The following is recommended to be implemented to minimise risk of direct mortality of fauna during clearing works:

- The clearing extent is to be inspected for fauna by a suitably qualified fauna spotter / catcher immediately prior to commencement of any vegetation removal involving machinery and/or tree-felling. This is to occur each morning if clearing spans over multiple days/weeks. The ecologist is to flag any habitat features which may contain fauna and trees which contain nests or dreys.
- If a Koala is present in an area subject to vegetation removal/modification, works must be suspended until the Koala moves along on its own volition. If the Koala is located in a position that a 50 - metre buffer may be established, works may proceed outside this buffer. In this event, the ecologist is to remain on site to monitor the Koala for signs of distress.
- A wildlife rescue organisation (e.g. WIRES) should be made aware of operations in case any injured fauna are found. If an animal is trapped or injured an animal handling expert / wildlife carer / or appropriately qualified ecologist would be contacted to assist with the capture and relocation. The following wildlife rescue organisations are in the area:
 - FAWNA Wildlife Rescue Port Macquarie (preferred) 02 6581 4141.
 - WIRES, Ph. 13 000 WIRES - 13 00 094 737
- All animals encountered will be treated humanely, ethically, and in accordance with relevant codes under the *NSW Prevention of Cruelty to Animals Act 1979*.
- The ecologist is to remain on site to supervise removal of any flagged habitat features and manage any fauna interactions. Other than Koalas, any detected fauna is to be relocated off-site. Any bird



nest considered active is to be removed in a manner that allows retrieval of eggs/young, and these are to be taken into care by FAWNA.

9.3 Threatened Flora Protection

- The *Rhodamnia rubescens* (Scrub Turpentine) and *Parsonsia dorrigoensis* (Milky Silkpod) individuals within the subject site would be clearly marked out with flagging tape or fencing prior to works commencing to prevent accidental removal or damage.
- The threatened flora on site are to be retained in situ and protected via permanent post and rail fencing at a two metre radius around the plants.
- Site induction is to ensure that all personnel on site are aware of their location and to specify that no clearing is to occur within the fenced area.
- Ideally, the proposal alignment should be designed to avoid these threatened flora species.

9.4 Hollow-bearing Tree Removal

It is recommended that hollow-bearing trees are to be retained where the proposal design permits. Where hollow-bearing trees, cannot be retained, they are to be felled in a manner that will minimise the risk of injury/mortality of denning/roosting fauna within the limitation of Work Health and Safety (WHS) Guidelines. This is suggested to be achieved by the following general procedure:

- Non-hollow-bearing trees are to be removed first. Hollow-bearing trees should be left to stand for 24 hours after all other vegetation has been removed.
- If removed with an excavator, the hollow-bearing trees are to be gently bumped several times prior to removal to encourage any fauna present to vacate.
- If the hollow is determined to be occupied and fauna do not require assistance (e.g. roosting bats), the entrance is to be blocked and the log placed in a shaded and protected area on the edge of the site. The obstacle is to be removed just prior to dusk to allow passive escape of the fauna within. The log may then be removed if required.
- A suitably qualified fauna spotter / catcher is to be present during felling and sectioning of the hollow-bearing trees in case of animal injury. Hollows are to be inspected for fauna once the tree is deposited. All uninjured animals are to be released in the retained habitat in the subject site.
- Any hollows deemed suitable for salvage at the time of clearing are recommended to be relocated on the ground within nearby vegetation. Where feasible, hollows may be sectioned and relocated onto a nearby retained tree within the nearby vegetation proposed to be retained. After cutting, the hollow should be capped with timber or sheet metal and loosely fastened to a lower branch of a nearby tree. The hollow is to be secured to the retained tree using wire with garden hose to protect the tree.
- Nest boxes may be erected to compensate for hollows that cannot be salvaged and relocated. Nest box numbers may be decided at NPWS discretion. Nest boxes are to be mounted within the retained habitat nearby. Nest boxes are to be constructed of ACQ treated timber and mounted by an ecologist prior to clearing of the site's hollow-bearing tree.

9.5 Hollow log and Bush Rock Salvage

Existing hollow logs and bush rock requiring removal for the proposal should be relocated into the management zones of the subject site or within adjoining habitats in close proximity to the subject site.



9.6 Koala Food Tree Offsets

It is recommended that Koala Food Trees *Eucalyptus microcorys* (Tallowwood) and *Eucalyptus propinqua* (Small-fruited Grey Gum) are to be retained where the proposal design permits.

9.7 Aquatic Habitats, Hydrology and Water Quality Controls

The following is recommended to be implemented to minimise the risk of impacts to aquatic habitat, hydrology and water quality alterations:

- Preferred waterway crossing types in relation to Class 3 key fish habitat is a culvert or ford crossing. Box culverts are preferred to fords and pipe culverts (in that order) (NSW DPI 2013).
- A frog hygiene protocol should be implemented for areas within 40 metres of waterways to reduce the risk of spread of chytrid fungus. This would involve the removal of soil from plant/equipment via washing down or brushing with a wire brush and disinfection with cleaning products containing benzalkonium chloride, in accordance with the Hygiene protocol for the Control of Disease in Frogs (DECC, 2008).
- The storage and handling of fuels and chemicals would comply with Australian Standard (AS1940).
- All chemicals must be kept in clearly marked bunded areas.
- Vehicle wash downs and/or concrete truck washouts would be undertaken within a designated bunded area on an impervious surface or off-site.
- Regularly inspect vehicles and mechanical plant for leakage of fuel or oil.
- Do not re-fuel, wash, or maintain vehicles or plant within 20 metres of a waterway. Refuelling, fuel decanting and vehicle maintenance work if required would take place in a designated sealed and bunded area within the construction compounds.
- At least one 'spill kit' would be kept on site at all times for potential chemical or fuel spills, one at each end of the proposal site. Construction contractors would be trained in the correct use of a spill kit.
- A toilet would be provided for site workers, which would be appropriately managed by a licenced contractor.
- No works would be undertaken in periods of heavy rain or flooding. Weather forecasts would be monitored daily.
- A facility for collecting, treating and disposing of any concrete or bitumen wastes generated during construction would be installed on site.
- Stockpiles would be established at least 50 metres from waterways where possible.
- Materials/equipment laydown and compound areas would be located in cleared or degraded areas to prevent any damage to the surrounding plants or habitat.

9.8 Sedimentation and Erosion Control

Standard soil and sedimentation control measures will be required throughout the earthworks phase to ensure that habitats in the subject site, as well as subsequent habitats nearby are not substantially affected.

- Install erosion and sediment control measures prior to works commencing.
- Controls would be established prior to works commencing and would remain in place until all work sites are reinstated.



- Erosion and sediment controls would be implemented in accordance with the 'Blue Book' (Landcom 2004). Other publications include:
- Regularly inspect erosion and sediment control measures, particularly following rainfall events to ensure their functionality.
- Manage stockpiles appropriately to minimise potential erosion and surface water runoff. This may include implementing silt fences to capture and isolate surface runoff.
- Apply dust suppressants or covers to soil stockpiles.
- Proposed drainage systems need to be adequately designed and effectively established to prevent the risk of substantial impacts including erosion and sedimentation from stormwater runoff as per statutory obligations.
- Excavated materials should be moved off site immediately.
- Following completion of construction works, cleared areas within the proposal footprint would be rehabilitated progressively in an ecologically appropriate manner using rapid soil stabilisation measures.

9.9 Weed Control

Disturbance of the subject site's soils and vegetation removal has potential to encourage weed invasion. It is recommended that:

- During the site induction, photos of declared priority weeds such as *Lantana camara* (Lantana) should be provided to contractors.
- Declared priority weed species must be managed in accordance with the requirements of the *Biosecurity Act 2015*.
- Disturbance of vegetation and soils on the site should be limited to the areas of the proposed work and should not extend into adjacent vegetation.
- Construction vehicles, plant and equipment will be washed down prior to entering the site. Inspection of exteriors should be undertaken and ensure all plant propagules (such as seeds) have been removed from vehicle tyres, undercarriages, grills, floors and trays. Any weed material or propagules identified within the vehicle is to be removed and disposed of in accordance with the Weed Management and Disposal Guide (TfNSW 2015).
- Separate weed species from remaining vegetation and do not mulch or re-use weed material on-site.
- Declared priority weed species must be disposed of in accordance with Department of Primary Industries' guidelines for the classification of weed using NSW Weedwise web browser (DPI 2021d).
- Dispose of weed contaminated soils at an appropriate waste management facility.
- Rehabilitate disturbed vegetation where appropriate immediately or as soon as possible to limit the potential for colonisation by weeds.

9.10 Introduction of Pests and Pathogens

The following is recommended to be implemented to reduce the potential introduction and spread of pests and pathogens:

- Implement hygiene measures to prevent the introduction or spread of the pathogens. Measures include decontamination of personnel and plant equipment prior to entering the proposal site and when traversing between areas of vegetation within the proposal site.



- Ensure that vehicles and construction plant and equipment are washed down prior to entering the site. Inspect vehicle exteriors and ensure all foreign materials are removed from vehicle tyres, undercarriages, grills, floors and trays.

9.11 Lighting, Noise, Vibration and Air Quality

The following is recommended to be implemented:

- Restrict construction vehicle movements to daylight hours only when fauna movements are low. Works should be limited to standard working hours for construction activities.
- Implement and enforce appropriate speed limits within the proposal boundary for all construction contractors' vehicles to minimise dust generation.
- Use a water cart or similar to spray unpaved access tracks during the construction phase where required.
- Apply dust suppressants or covers to soil stockpiles.
- Plant and machinery would be turned off when not in use as much as possible and would be fitted with emission control devices complying with Australian Standards

9.12 Excavations

Excavations may be required for the construction of the proposed predator proof fence and compound/basecamp site. Risk of harm/injury to fauna by excavations would be minimised by:

- Continuously backfilling excavations to minimise the amount of open trench that is exposed, reducing the risk of fauna falling into trenches.
- Implementing a fauna ramp or low-grade entrance to the trench at days end to allow potentially captured fauna to escape.
- For pipe works, a temporary pipe sleeve/plastic board to be installed at days end to prevent fauna potentially entering the pipe under construction within the trench.
- Prior to commencing works each day - site inspection of trench by site staff to be undertaken to identify any potentially trapped fauna. If an animal is trapped within a trench an animal handling expert / wildlife carer (eg. FAWNA) or an appropriately qualified ecologist would be contacted to assist with the capture and relocation.

9.13 Movement Barriers and Connectivity

- It is recommended that where favoured habitats for the Giant Barred Frog occurs, such as freshwater streams, rainforest and wet sclerophyll riparian vegetation, that the design of the predator proof fence considers sections of mesh that are no smaller than 30mm mesh size to allow a semipermeable access for this species and other small fauna.
- It is recommended that introduced predator control additionally occurs around the outside of the reserve, especially if any semi-permeable fencing structures are used to allow movement of animals in or out of the reserve.
- Post approval, monitoring should be implemented to gauge existing population sizes of species on both sides of the proposed fence. Where this monitoring suggests that population sizes are small and potentially subject to potential loss in genetic diversity as a result of the proposed predator proof fence, post-construction, manual dispersal (capture and release) both ways, across the fence should be undertaken to maintain connectivity between populations. In order to maintain genetic diversity



either side of the proposed fence, the required rate of dispersal is likely to be low (ie. one to two individuals per generation).

9.14 Fencing

- Temporary fencing may be required during construction, particularly at the site compound and basecamp area. Fences have potential to obstruct the movement of fauna across the site or are capable of inflicting injury (e.g., barbed wire fence). Any fencing required should be Koala friendly, permeable and not pose a barrier or risk of entanglement to fauna (e.g., post and plain wire).
- Bunting or caution tape may be used as an alternative to temporary construction fencing.
- Where temporary construction fencing is required, the use of barbed wire should not be permitted. Temporary construction fencing would ideally have a minimum 50cm gap between ground level and the first rail or strand where practical. Spacings above this can be determined at NPWS discretion.

9.15 Waste

Rubbish and food scraps would be removed from the subject site so as not to encourage fauna into the work area during construction.

9.16 Vertebrate pest control programs

- Cattle and/or other livestock would be removed from the Reserve prior to the construction of the predator proof fence construction. If necessary, ongoing livestock removal from within the predator free area following the construction of the fence should be conducted.
- In conjunction with the fence design allowing for connectivity structures to allow the movement of some threatened species known or predicted to occur within the Reserve, ongoing vertebrate pest control programs should be undertaken to minimise the potential for feral species such as cats to utilise these structures and gain entry into the predator free area.
- Vertebrate pest control programs should aim to eradicate all cats, dogs, foxes from within the predator free area.
- Vertebrate pest control programs should aim to eradicate or minimise populations of cats, dogs, foxes in areas surrounding the predator free area, particularly in for feral cats that have the potential to use recommended connectivity structures.
- Vertebrate pest control programs should aim to eradicate or minimise populations of feral herbivores including deer, goats, pigs and rabbits from within the predator free area.
- Vertebrate pest control programs will be conducted in line with feral animal control plans using techniques such as trapping, shooting and baiting following the relevant codes of practice including animal welfare requirements recommended by the EPA and Australian Pesticides and Veterinary Medicines Authority permits.
- Vertebrate pest control programs should include the control of non-predatory introduced species such as rabbits and hares.

9.17 Monitoring

- Before-After-Control-Impact (BACI) monitoring design is recommended to be undertaken to evaluate the ecological impacts and changes of the proposed predator proof fence.
- The ongoing monitoring of fauna by the use of PIR cameras is recommended to evaluate the species populations both within and outside of the predator proof fence, to ensure existing populations of



species are not separated into two or more populations and to monitor the population sizes, threats and responses of the mammal species to be reintroduced for the Rewilding Project.

- Trapping and release programs (both ways) should be considered where populations of species may have been split into two populations, or where individuals of species are undesirable within the proposed predator proof fence.
- Regular maintenance checks of the predator proof fence should be undertaken so damaged areas can be repaired quickly.
- Following the construction of the predator proof fence, ongoing research, monitoring and studies are recommended to better understand the population dynamics including the densities, dispersal patterns, and habitat requirements for species including the Spotted-tailed Quoll and Koala that are known to occur or potentially occur within the Reserve. This will aid in achieving a better understanding of the impact of the exclusion fencing on these species and ensure dispersal and gene flow within populations are maintained effectively without compromising the aims of the rewilding project.

9.18 Management of Excess Reintroduced Species

During research and/or monitoring activities, it may become evident that population sizes of particular species exceed their thresholds or 'carrying capacity' within the Rewilding area. If this circumstance should arise, the following options may be considered to reduce the population size of a given reintroduced mammal (AWC 2017):

- Release of a proportion of individuals outside the fence
- Translocation of individuals to another reintroduction site; or
- Introduce terrestrial native predators such as the Eastern Quoll (if not initially introduced).



10. Conclusion

The NSW Rewilding Program is a ten-year project that aims to reintroduce native fauna and restore ecosystems in NSW. It involves the establishment of a feral predator (cats and foxes) free area at Ngambaa Nature Reserve on the NSW Mid North Coast, which will enable the reintroduction of locally extinct species, provide conservation benefits to other threatened species and restore the functioning of essential ecosystem processes. The proposal was assessed in accordance with the requirements of the NSW *Biodiversity Conservation Act 2016*, Biodiversity Conservation Regulation 2017, *Fisheries Management Act 1991* and the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* - Matters of National Environmental Significance.

Up to 69.75 hectares of native vegetation will potentially be removed and up to six aquatic habitat sites will be directly impacted by this proposal during construction of the predator proof fence. 621 hollow-bearing trees and 2,500 koala food trees were located within the subject site. These habitat features provide foraging resources for the Koala and roosting and nesting habitats for birds, arboreal mammals and microbat species. Potential indirect impacts include, habitat removal, edge effects, construction impacts, fauna movement barriers, weed invasion and water quality impacts. Recommendations have been provided to reduce potential direct and indirect impacts of the proposal.

One (1) threatened ecological community, *Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion* listed as endangered under the BC Act was recorded within the subject site. Two threatened flora and eight threatened fauna species listed under the BC were recorded during the site surveys. A total of 13 additional threatened fauna species were found to have at least a fair potential to occur within the subject site.

The significance assessments carried out for the proposed predator proof fence construction and associated works determined that the proposal is not expected to significantly impact upon the potentially occurring threatened community or threatened species known or potentially occurring within the subject site due to the extent of vegetation to be retained; the fact that potential local populations of the subject species would extend well beyond the subject site and the proposed ameliorative measures detailed in this report.

10.1 Further legislative requirements

The proposal is not considered to require a Biodiversity Development Assessment Report (BDAR) under the *BC Act 2016*.



11. References

- Australian Standard, AS1940 The storage and handling of flammable and combustible liquids (AS1940)
- Australian Wildlife Conservancy (2017). Review of Environmental Factors. Proposed construction and operation of conservation fencing and associated infrastructure and reintroduction of locally extinct mammals in the Pilliga State Conservation Area.
- Barber, J.R., Fristrup, K.M., Brown, C.L., Hardy, A.R., Angeloni, L.M. and Crooks, K.R. (2009). Conserving the wild life therein-protecting park fauna from anthropogenic noise. *ParkScience*, Vol. 26:3.
- Battisti, C. (2003). Habitat fragmentation, fauna and ecological network planning: Toward a theoretical conceptual framework. *Italian Journal of Zoology*, Vol. 70:3, pp 241-247.
- Biodiversity Conservation Act* (2016). Website
<<https://www.legislation.nsw.gov.au/~view/act/2016/63>>.
- Biosecurity Act 2015*.
- Bureau of Meteorology (2021). Taylors Arm [059032], New South Wales & Kempsey Airport AWS NSW [059007] Daily Weather Observations. Australian Government. Website
<<http://www.bom.gov.au/climate/dwo/IDCJDW2129.latest.shtml>>.
- Department of Environment and Conservation (DEC 2004). Field survey methods for environmental consultants and surveyors when assessing proposed developments or other activities on sites containing threatened species.
- Department of Environment and Conservation (DEC 2004a). Threatened Biodiversity Survey and Assessment: Guidelines for Development and Activities. Working Draft. NSW DEC, Hurstville.
- Department of Environment and Climate Change (DECC 2007). Threatened Species Assessment Guidelines: The Assessment of Significance. NSW DECC, Hurstville.
- Department of Environment and Science (DES 2020). Koala-sensitive Design Guideline. A guide to koala-sensitive design measures for planning and development activities.
- Department of the Environment, Water, Heritage and the Arts (DEWHA 2010). Survey Guidelines for Australia's Threatened Bats.
- Department of the Environment, Water, Heritage and the Arts (DEWHA 2017). Survey Guidelines for Australia's Threatened Birds.
- Department of Primary Industries (DPI 2013). Policy and Guidelines for Fish Habitat Conservation and Management, update.
- Department of Primary Industries (DPI 2021a). Fisheries Spatial Data Portal. Website
<https://www.dpi.nsw.gov.au/about-us/research-development/spatial-data-portal>
- Department of Primary Industries (DPI 2021b). Key Fish Habitat. Website
<https://www.dpi.nsw.gov.au/fishing/habitat/publications/pubs/key-fish-habitat-maps>



- Department of Primary Industries (DPI 2021c). Threatened species lists. Website: <https://www.dpi.nsw.gov.au/fishing/threatened-species/what-current>
- Department of Primary Industries (DPI 2021d). NSW Weedwise. Department of Primary Industries. Accessed at: <https://weeds.dpi.nsw.gov.au/>
- Department of Planning, Industry and the Environment (DPIE 2021a). Bionet/Atlas of Wildlife. Website <<http://www.bionet.nsw.gov.au/>>.
- Department of Planning, Industry and the Environment (DPIE 2021b). Threatened Biodiversity Data Collection. Website <<https://www.environment.nsw.gov.au/threatenedSpeciesApp/>>.
- Department of Planning, Industry and the Environment (DPIE 2021c) Bionet Vegetation Classification. Website <https://www.environment.nsw.gov.au/NSWVCA20PRapp/default.aspx>
- Department of Planning, Industry and the Environment (DPIE 2021d). Biodiversity Values Map and Threshold Tool. Website <<https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap>>
- Department of Planning, Industry and the Environment (DPIE 2021e). Request for Quotation - Ngambaa Rewilding Project - Review of Environmental Factors RFQ: SR2910796395
- Department of Planning, Industry and the Environment (DPIE 2021f). Revegetating Koala Habitat - North Coast Koala Management Area. Website <https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/programs-legislation-and-framework/nsw-koala-strategy/local-government-resources-for-koala-conservation/north-coast-koala-management-area#:~:text=Koalas%20usually%20feed%20within%20trees,Acacia%20%E2%80%93%20wattle>
- Department of Sustainability, Environment, Water, Population and Communities (DSEWPC 2011). Survey guidelines of Australia's threatened reptiles.
- Department of the Environment and Climate Change (DoECC 2002). Descriptions for NSW (Mitchell) Landscapes. Version 2.
- Environment Protection and Biodiversity Conservation Act (1999)*
<https://www.legislation.gov.au/Series/C2004A00485>.
- Forestry Corporation of New South Wales (FCNSW 2021). NSW Open Data Site – NSW Forest Types
- Griffiths, A. D., Rankmore, B., Brennan, K., and Woinarski, J. C. Z. (2017). Demographic evaluation of translocating the threatened northern quoll to two Australian islands. *Wildlife Research*, 44, 238–247.
- Harden, G.J. (Editor) (1990) *Flora of NSW*. Vols 1-4. NSW Press, Sydney.
- Harden, G.J, McDonald, B. and Williams, J.B. (2007). *Rainforest Climbing Plants – A field guide to their identification*. Gwen Harden Publishing, Nambucca Heads.
- Hayward, M. W., Kerley, G. I., Adendorff, J., Moolman, L. C., O'brien, J., Sholto-Douglas, A., Bissett, C., Bean, P., Fogarty, A., and Howarth, D. (2007). The reintroduction of large carnivores to the Eastern Cape, South Africa: an assessment. *Oryx*, 41, 205–214.
- Landcom, 2004, *Managing Urban Stormwater: Soils and Construction*



- Lindenmayer, D.B. and Fischer, J. (2006). Habitat fragmentation and landscape change. An ecological and conservation synthesis. CSIRO Publishing. Melbourne, Australia. McGregor, H., Legge, S., Jones, M.E., Johnson, C.N. (2015). Feral cats are better killers in open habitats, revealed by animal-borne video. PLoS ONE 10: e0133915.
- National Parks and Wildlife Service (NPWS 2004). Ngambaa Reserve Plan of Management
- National Parks and Wildlife Service (Graham, undated). Ngambaa Nature Reserve threatened and Rare Plant Species Booklet.
- Newscape (2020). Castlereagh Nature Reserve Sanctuary Predator Proof Fence – Design report
- Offerman, H.L., Dale, V.H., Pearson, S.M., Bierregaard, R.O. and O'Neill, R.V. (1995). Environmental Reviews, Vol. 3.
- Office of Environment and Heritage (OEH 2016). NSW Guide to Surveying Threatened Plants.
- Royal Botanical Gardens (2019). Plantnet. Website <www.plantnet.rbgsyd.nsw.gov.au/search>.
- Saunders, D.A., Hobbs, R.J. and Margules, C.R. (2012). Biological Consequences of Ecosystem Fragmentation: A Review. *Society for Conservation Biology*, Vol. 5, No 1, pp. 18-32.
- SEED The Central Resource for Sharing and Enabling Environmental Data. (SEED 2021). Accessed on 1/09/2021 at https://geo.seed.nsw.gov.au/Public_Viewer/index.html?viewer=Public_Viewer&locale=en-AU
- Soderquist, T., and Serena, M. (1990). Occurrence and outcome of polyoestry in wild western quolls, *Dasyurus geoffroii* (Marsupialia: Dasyuridae). *Australian Mammalogy*, 13, 205–208.
- TfNSW (2015). Weed Management and Disposal Guide. Transport for NSW. Planning and Environmental Services-Environmental Management.
- Triggs, B. (1996). Scat, track and other traces. New Holland, Sydney.
- Troedson, A.L. and Hashimoto, T.R. (2008). Coastal Quaternary Geology – north and south coast of NSW. Geological Survey of New South Wales, Bulletin 34.
- Threatened Species Scientific Committee (1999). Lowland rainforest on floodplain in the NSW North Coast Bioregion - endangered ecological community listing.
- Threatened Species Scientific Committee (2016). Consultation on Species Listing Eligibility and Conservation Actions *Petauroides volans* (Greater Glider (southern))
- Vernes, K., Marsh, H., and Winter, J. (1995). Home-range characteristics and movement patterns of the red-legged pademelon (*Thylogale stigmatica*) in a fragmented tropical rainforest. *Wildlife Research*, 22, 699-708.
- West, R.S., Tilley, L. and Moseby, K.E. (2020). A trial reintroduction of the western quoll to a fenced conservation reserve: implications of returning native predators. *Australian Mammalogy*, 42, 257-265.



12. Appendices

A-1 Example Fence Design



A-2 Site Vegetation List

Table 9: Comprehensive list of flora recorded during the survey period

NSW Forest Type		FT 37	FT 53	FT 53	FT 62 & 74	-
Common Name	Scientific Name	PCT 690	PCT 1142 & 670	PCT 747 & 826	PCT 1215	Opp.
Hickory Wattle	<i>Acacia falcata</i>	X			X	
White Sally Wattle	<i>Acacia floribunda</i>				X	
Prickly Moses	<i>Acacia ulicifolia</i>				X	
Soft Corkwood	<i>Ackama paniculata</i>		X			
Maidenhair Fern	<i>Adiantum aethiopicum</i>					X
Giant Maidens Hair	<i>Adiantum formosum</i>		X			
Rough Maidenhair Fern	<i>Adiantum hispidulum</i>		X			
Native Quince	<i>Alectryon subcinereus</i>				X	
Forest Oak	<i>Allocasuarina torulosa</i>	X			X	
Red Ash	<i>Alphitonia excelsa</i>				X	
Native Ginger	<i>Alpinia arundelliana</i>		X			
Native Ginger	<i>Alpinia caerulea</i>		X			
Prickly Shield Fern	<i>Arachniodes aristata</i>		X			
Rose Myrtle	<i>Archirhodomyrtus beckleri</i>			X	X	
Black Booyong	<i>Argyrodendron actinophyllum</i>		X			
Bird's Nest Fern	<i>Asplenium australasicum</i>					X
-	<i>Astrotricha latifolia</i>				X	
Blood Vine	<i>Austrosteenisia blackii</i>				X	
Grey Myrtle	<i>Backhousia myrtifolia</i>		X	X		
Brush Bloodwood	<i>Baloghia inophylla</i>		X			
Cobbler's Pegs*	<i>Bidens pilosa*</i>					X
Hairy Apple Berry	<i>Billardiera scandens</i>	X			X	
Gristle Fern	<i>Blechnum cartilagineum</i>		X			
Coffee Bush	<i>Breynia oblongifolia</i>	X			X	
Blackthorn	<i>Bursaria spinosa</i>	X				
Christmas Orchid	<i>Calanthe triplicata</i>		X			
Rainbow Fern	<i>Calochlaena dubia</i>				X	
Brush Caper Berry	<i>Capparis arborea</i>		X			
Rock Fern	<i>Cheilanthes austrotenuifolia</i>				X	
Kangaroo Vine	<i>Cissus antarctica</i>		X	X	X	
Water Vine	<i>Cissus hypoglauca</i>		X		X	
Brittlewood	<i>Claoxylon australe</i>				X	



NSW Forest Type		FT 37	FT 53	FT 53	FT 62 & 74	-
Common Name	Scientific Name	PCT 690	PCT 1142 & 670	PCT 747 & 826	PCT 1215	Opp.
Headache Vine	<i>Clematis glycinoides</i>				X	
Lolly Bush	<i>Clerodendrum floribundum</i>			X	X	
Narrow-leaved Palm Lily	<i>Cordyline stricta</i>		X		X	
Red Bloodwood	<i>Corymbia gummifera</i>					X
Pink Bloodwood	<i>Corymbia intermedia</i>	X				
Spotted Gum	<i>Corymbia maculata</i>	X			X	
Green Native Cascarilla	<i>Croton verreauxii</i>				X	
Murrogun	<i>Cryptocarya microneura</i>		X	X		
Forest Maple	<i>Cryptocarya rigida</i>		X		X	
Elderberry	<i>Cuttsia viburnea</i>		X			
Coast Canthium	<i>Cyclophyllum coprosmoides</i>		X			
Barbed Wire Grass	<i>Cymbopogon refractus</i>	X			X	
-	<i>Cyperus filipes</i>				X	
-	<i>Daphnandra micrantha</i>		X			
-	<i>Daviesia squarrosa</i>				X	
Ironbark Orchid	<i>Dendrobium aemulum</i>					X
Giant Stinging Tree	<i>Dendrocnide excelsa</i>		X			
Shiny-leaved Stinging Tree	<i>Dendrocnide photinophylla</i>		X			
Narrow-leaved Orangebark	<i>Denhamia silvestris</i>				X	
Slender tick trefoil	<i>Desmodium gunnii</i>				X	
-	<i>Desmodium rhytidophyllum</i>	X			X	
Blue Flax Lily	<i>Dianella caerulea</i>				X	
Blueberry Lily	<i>Dianella longifolia</i>	X			X	
Shorthair Plumegrass	<i>Dichelachne micrantha</i>	X			X	
Kidney Weed	<i>Dichondra repens</i>				X	
-	<i>Digitaria spp</i>	X				
Black Plum	<i>Diospyros australis</i>			X	X	
Myrtle Ebony	<i>Diospyros pentamera</i>		X			
Native Tamarind	<i>Diploglottis australis</i>		X			
Large-leaf Hop-bush	<i>Dodonaea triquetra</i>				X	
Rasp Fern	<i>Doodia aspera</i>		X		X	
-	<i>Drypetes australisica</i>		X			
Rosewood	<i>Dysoxylum fraserianum</i>		X			
-	<i>Embelia australiana</i>		X			
Green-leaved Rose Walnut	<i>Endiandra muelleri subsp muelleri</i>		X			



NSW Forest Type		FT 37	FT 53	FT 53	FT 62 & 74	-
Common Name	Scientific Name	PCT 690	PCT 1142 & 670	PCT 747 & 826	PCT 1215	Opp.
Hard Corkwood	<i>Endiandra sieberi</i>		X			
Wiry Panic	<i>Entolasia stricta</i>	X			X	
-	<i>Eragrostis spp</i>				X	
White Mahogany	<i>Eucalyptus acmenoides</i>				X	
Diehard Stringybark	<i>Eucalyptus cameronii</i>				X	
Thick-leaved Mahogany	<i>Eucalyptus carnea</i>	X			X	
Flooded Gum	<i>Eucalyptus grandis</i>			X		
Tallowwood	<i>Eucalyptus microcorys</i>	X			X	
Blackbutt	<i>Eucalyptus pilularis</i>	X				
Small-fruited Grey Gum	<i>Eucalyptus propinqua</i>	X				
Sydney Blue Gum	<i>Eucalyptus saligna</i>			X		
Grey Ironbark	<i>Eucalyptus siderophloia</i>	X			X	
Small Bolwarra	<i>Eupomatia bennettii</i>				X	
Bolwarra	<i>Eupomatia laurina</i>			X	X	
-	<i>Euroschinus falcata</i>				X	
Wombat Berry	<i>Eustrephus latifolius</i>				X	
Native Cherry	<i>Exocarpos cupressiformis</i>	X				
Sandpaper Fig	<i>Ficus coronata</i>		X			
Cudgerie	<i>Flindersia schottiana</i>		X			
Cheese Tree	<i>Glochidion ferdinandi</i>		X		X	
-	<i>Glycine clandestina</i>	X				
White Beech	<i>Gmelina leichhardtii</i>		X			
-	<i>Goodenia rotundifolia</i>	X	X			
Guioa	<i>Guioa semiglauca</i>		X		X	
Settler's Twine	<i>Gymnostachys anceps</i>		X		X	
Sweet Morinda	<i>Gynochthodes jasminoides</i>		X	X	X	
Purple Coral Pea	<i>Hardenbergia violacea</i>	X				
Climbing Guinea Flower	<i>Hibbertia scandens</i>				X	
Swamp Hibiscus	<i>Hibiscus diversifolius</i>		X	X		
-	<i>Homalanthus stillingiifolius</i>				X	
-	<i>Hybanthus stellarioides</i>				X	
Native Frangipani	<i>Hymenosporum flavum</i>		X			
Blady Grass	<i>Imperata cylindrica</i>	X				
Australian Indigo	<i>Indigofera australis</i>				X	
Winged Broom-pea	<i>Jacksonia scoparia</i>				X	



NSW Forest Type		FT 37	FT 53	FT 53	FT 62 & 74	-
Common Name	Scientific Name	PCT 690	PCT 1142 & 670	PCT 747 & 826	PCT 1215	Opp.
Lantana*	<i>Lantana camara*</i>			X	X	
Shield Fern	<i>Lastreopsis spp.</i>				X	
Slender Wire Lily	<i>Laxmannia gracilis</i>				X	
-	<i>Lepidosperma laterale</i>	X			X	
Prickly Beard-heath	<i>Leucopogon juniperinus</i>	X			X	
Walking Stick Palm	<i>Linospadix monostachyos</i>		X			
Tall Lobelia	<i>Lobelia gibbosa</i>				X	
Whiteroot	<i>Lobelia purpurascens</i>					X
Wattle Mat-rush	<i>Lomandra filiformis</i>	X			X	
-	<i>Lomandra hystrix</i>		X			
Spiny-headed Mat-rush	<i>Lomandra longifolia</i>	X			X	
Many-flowered Mat-rush	<i>Lomandra multiflora</i>				X	
-	<i>Lomandra spicata</i>		X			
Brush Box	<i>Lophostemon confertus</i>		X	X	X	
Cockspur Thorn	<i>Maclura cochinchinensis</i>			X	X	
Red Kamala	<i>Mallotus philippensis</i>				X	
Milk Vine	<i>Marsdenia rostrata</i>				X	
Yellow Pear-fruit	<i>Mischocarpus pyriformis</i>		X			
Unknown	<i>Myrsine variabilis</i>				X	
Hairy-leaved Bolly Gum	<i>Neolitsea dealbata</i>		X			
Large Mock-olive	<i>Notelaea longifolia</i>		X		X	
-	<i>Notelaea ovata</i>				X	
-	<i>Olearia nernstii</i>				X	
Australian Basket Grass	<i>Oplismenus aemulus</i>				X	
Large Tick-trefoil	<i>Oxytes brachypoda</i>		X			
Rice Flower	<i>Ozothamnus diosmifolius</i>	X			X	
Wonga Wonga Vine	<i>Pandorea pandorana</i>	X			X	
Two-colour Panic	<i>Panicum simile</i>				X	
Milky Silkpod	<i>Parsonia dorrigoensis</i>				X	
Native Passionfruit	<i>Passiflora herbertiana</i>				X	
-	<i>Pellaea paradoxa</i>				X	
-	<i>Persoonia sericea</i>				X	
-	<i>Persoonia stradbrokeensis/conjuncta</i>	X			X	
Plum Myrtle	<i>Ptilidostigma glabrum</i>		X			



NSW Forest Type		FT 37	FT 53	FT 53	FT 62 & 74	-
Common Name	Scientific Name	PCT 690	PCT 1142 & 670	PCT 747 & 826	PCT 1215	Opp.
Orange Thorn	<i>Pittosporum multiflorum</i>				X	
Wild Yellow Jasmine	<i>Pittosporum revolutum</i>		X		X	
Black Apple	<i>Planchonella australis</i>		X			
Staghorn	<i>Platycerium superbum</i>					X
Elkhorn Fern	<i>Platycerium bifurcatum</i>					X
Cockspur Flower	<i>Plectranthus parviflorus</i>				X	
Poa Tussock	<i>Poa labillardierei</i>				X	
Prickly Shaggy Pea	<i>Podolobium ilicifolium</i>	X				
Featherwood	<i>Polyosma cunninghamii</i>		X			
Celery Wood	<i>Polyscias elegans</i>		X		X	
Pencil Cedar	<i>Polyscias murrayi</i>		X			
Elderberry Panax	<i>Polyscias sambucifolia</i>	X				
-	<i>Pomax umbellata</i>	X			X	
Whiteroot	<i>Pratia purpurascens</i>				X	
Pastel Flower	<i>Pseuderanthemum variabile</i>				X	
Hairy Psychotria	<i>Psychotria loniceroides</i>				X	
Nodding Greenhood	<i>Pterostylis nutans</i>				X	
Spiny Bush-pea	<i>Pultenaea spinosa</i>				X	
Hairy Bush-pea	<i>Pultenaea villosa</i>	X				
Scrub Turpentine	<i>Rhodamnia rubescens</i>		X			
Prickly Supplejack	<i>Ripogonum discolor</i>		X			
Small Supplejack	<i>Ripogonum fawcettianum</i>		X			
-	<i>Sannantha angusta</i>				X	
Crabapple	<i>Schizomeria ovata</i>		X			
Flintwood	<i>Scolopia braunii</i>			X	X	
Indian Weed	<i>Sigesbeckia orientalis</i>				X	
Maiden's Blush	<i>Sloanea australis</i>		X			
Lawyer Vine	<i>Smilax australis</i>				X	
Sweet Sarsaparilla	<i>Smilax glycyphylla</i>	X				
-	<i>Solanum hapalum</i>				X	
Wild Tobacco Bush*	<i>Solanum mauritianum*</i>					X
Devil's Needles	<i>Solanum stelligerum</i>				X	
White Hazelwood	<i>Symplocos stawellii</i>		X			
Turpentine	<i>Syncarpia glomulifera</i>		X		X	
Scentless Rosewood	<i>Synoum glandulosum</i>		X	X	X	



NSW Forest Type		FT 37	FT 53	FT 53	FT 62 & 74	-
Common Name	Scientific Name	PCT 690	PCT 1142 & 670	PCT 747 & 826	PCT 1215	Opp.
Brush Cherry	<i>Syzygium australe</i>		X			
-	<i>Tetrastigma nitens</i>				X	
Kangaroo Grass	<i>Themeda triandra</i>	X			X	
Red Cedar	<i>Toona ciliata</i>		X			
Ground Lily	<i>Tripladenia cunninghamii</i>				X	
Water Gum	<i>Tristaniopsis laurina</i>		X			
Tree Heath	<i>Trochocarpa laurina</i>		X		X	
-	<i>Uvaria leichhardtii</i>		X			
-	<i>Vernonia cinerea</i>				X	
Native Violet	<i>Viola betonicifolia</i>	X				
Veiny Wilkiea	<i>Wilkiea huegeliana</i>		X	X		
Johnson's Grass Tree	<i>Xanthorrhoea johnsonii</i>					X
-	<i>Xanthorrhoea macronema</i>				X	
-	<i>Xanthorrhoea malacophylla</i>				X	

A-3 Site Fauna list

Table 10: Comprehensive list of fauna recorded during the survey period

Common Name	Scientific Name	Detection Method
Aves		
Yellow Thornbill	<i>Acanthiza nana</i>	HC, Vis
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>	HC, Vis
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>	Vis
Australian Brush-turkey	<i>Alectura lathamii</i>	Vis, NE, NPCam
Australian King-Parrot	<i>Alisterus scapularis</i>	HC, Vis
Southern Whiteface	<i>Aphelocephala leucopsis</i>	HC, Vis
Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>	Vis
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>	HC
Yellow-tailed Black-Cockatoo	<i>Calyptorhynchus funereus</i>	HC, Vis
Red-browed Treecreeper	<i>Climacteris erythroptis</i>	HC, Vis
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	HC, Vis
Treecreeper	<i>Climacteris/Cormobates sp.</i>	Cam
Grey Shrike-thrush	<i>Colluricincla harmonica</i>	Cam, HC, Vis, NPCam
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	HC
White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>	Vis



Common Name	Scientific Name	Detection Method
White-throated Treecreeper	<i>Cormobates leucophaea</i>	Cam, HC, Vis
Torresian Crow	<i>Corvus orru</i>	Cam, HC, Vis
Brown Quail	<i>Coturnix ypsilophora</i>	Vis
Grey Butcherbird	<i>Cracticus torquatus</i>	HC
Laughing Kookaburra	<i>Dacelo novaeguineae</i>	HC, Vis
Galah	<i>Eolophus roseicapilla</i>	HC
Eastern Yellow-robin	<i>Eopsaltria australis</i>	Cam, HC, Vis, NPCam
Wonga Pigeon	<i>Leucosarcia melanoleuca</i>	Cam, HC, NPCam
Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	HC, Vis
Topknot Pigeon	<i>Lopholaimus antarcticus</i>	Vis
Brown Cuckoo-Dove	<i>Macropygia phasianella</i>	Vis
Noisy Miner	<i>Manorina melanocephala</i>	HC
Bell Miner	<i>Manorina melanophrys</i>	HC
Tawny Grassbird	<i>Megalurus timoriensis</i>	HC
Lewin's Honeyeater	<i>Meliphaga lewinii</i>	HC, Vis
White-naped Honeyeater	<i>Melithreptus lunatus</i>	HC, Vis
Superb Lyrebird	<i>Menura novaehollandiae</i>	HC, NPCam
Scarlet Honeyeater	<i>Myzomela sanguinolenta</i>	HC
Red-browed Finch	<i>Neochmia temporalis</i>	Vis
Southern Boobook	<i>Ninox novaeselandiae</i>	HC
Powerful Owl	<i>Ninox strenua</i>	HC
Olive-backed Oriole	<i>Oriolus sagittatus</i>	HC
Australian Logrunner	<i>Orthonyx temminckii</i>	Vis, NE, NPCam
Golden Whistler	<i>Pachycephala pectoralis</i>	HC, Vis
Spotted Pardalote	<i>Pardalotus punctatus</i>	HC
Noisy Pitta	<i>Pitta versicolor</i>	Cam, NPCam
Crimson Rosella	<i>Platycercus elegans</i>	Vis
Eastern Rosella	<i>Platycercus eximius</i>	HC, Vis
Tawny Frogmouth	<i>Podargus strigoides</i>	Vis
Eastern Whipbird	<i>Psophodes olivaceus</i>	HC, NPCam
Button-quail	<i>Quail sp.</i>	Vis
Grey Fantail	<i>Rhipidura albiscapa</i>	HC, Vis
Willie Wagtail	<i>Rhipidura leucophrys</i>	Vis
White-browed Scrubwren	<i>Sericornis frontalis</i>	HC, NPCam
Regent Bowerbird	<i>Sericulus chrysocephalus</i>	Vis
Weebill	<i>Smicronis brevirostris</i>	HC
Australasian Figbird	<i>Sphecotheres vieilloti</i>	HC, Vis



Common Name	Scientific Name	Detection Method
Pied Currawong	<i>Strepera graculina</i>	Cam, HC
Sacred Kingfisher	<i>Todiramphus sanctus</i>	HC
Scaly-breasted Lorikeet	<i>Trichoglossus chlorolepidotus</i>	HC
Rainbow Lorikeet	<i>Trichoglossus moluccanus</i>	HC
Bassian Thrush	<i>Zoothera lunulata</i>	Cam, NPCam
Mammalia		
Feathertail Glider	<i>Acrobates sp.</i>	Cam
Brown Antechinus	<i>Antechinus stuartii</i>	HT, NPCam
White-striped Free-tailed Bat	<i>Austronomus australis</i>	Ana, HC
Bandicoot	<i>Bandicoot sp.</i>	Cam, Vis
Domestic Cattle*	<i>Bos taurus*</i>	Cam, Scat
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>	Ana
Chocolate Wattled Bat	<i>Chalinolobus morio</i>	Ana
Feral/Domestic Cat*	<i>Felis catus*</i>	Cam, NPCam
Red-necked Wallaby	<i>Macropus rufogriseus</i>	Cam, NPCam
Little Bent-wing Bat	<i>Miniopterus australis</i>	Ana
House Mouse*	<i>Mus musculus*</i>	Cam, Vis
Long-nosed Bandicoot	<i>Perameles nasuta</i>	Cam, HT, NPCam
Squirrel Glider	<i>Petaurus norfolcensis</i>	HC
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	Cam
Koala	<i>Phascolarctos cinereus</i>	Cam, Scat, NPCam
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>	HT, NPCam
Bush Rat	<i>Rattus fuscipes</i>	Cam, HT, NPCam
Eastern Horseshoe Bat	<i>Rhinolophus megaphyllus</i>	Ana
Common Dunnart	<i>Sminthopsis murina</i>	Cam, NPCam
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>	Cam, NPCam
Red-legged Pademelon	<i>Thylogale stigmatica</i>	Cam¹
Red-necked Pademelon	<i>Thylogale thetis</i>	Cam ¹ , NPCam
Common Brushtail Possum	<i>Trichosurus vulpecula</i>	Cam, NPCam
Large Forest Bat	<i>Vespadelus darlingtoni</i>	Ana
Eastern Forest Bat	<i>Vespadelus pumilus</i>	Ana
Swamp Wallaby	<i>Wallabia bicolor</i>	Cam
Reptilia		
Moritz's Leaf-tailed Gecko	<i>Saltuarius moritzi</i>	Vis
Key: bold denotes a species listed as threatened under the BC Act, * denotes an introduced species., ¹ species identification not confirmed. Detection Method key: Anabat detection device (Ana), PIR Camera (Cam), Heard call (HC), Hair Tube (HT), Nest (NE), NPWS set PIR Camera (NPCam), Scats found (Scat), Visually observed (Vis).		



A-4 Potential Occurrence Assessment

The following tables are used as a summary to address threatened species in terms of potential occurrence and requirement for formal assessment. A threatened species has been assessed if it is:

- a) Recorded on-site; or
- b) Not recorded on site, but recorded within a 10 km radius (the study area), and may occur at a fair to high degree on-site due to potential habitat, key habitat component, etc.

Likelihood of occurrence is based on the probability of occurrence in terms of:

- Habitat extent (e.g. sufficient to support an individual or the local population; comprises all of home range; forms part of larger territory, etc.); quality (i.e. condition, including an assessment of threats, historical land uses on and off-site, and future pressures); interconnectivity to other habitat; and ability to provide all the species life-cycle requirements (either the site alone, or other habitat within its range);
- Occurrence frequency (i.e. on-site resident; portion of larger territory or seasonal migrant); and
- Usage i.e. breeding or non-breeding; opportunistic foraging (e.g. seasonal, migratory or opportunistic); marginal fringe of core range; refuge; roosts; etc.

An indicative scale used by the author to indicate the likelihood of the species to potentially occur in the habitat on the study sites (if they have not been recorded in the study area) is as follows:

- *Unlikely* (<1% probability) - no potentially suitable habitat; too disturbed; or habitat is very poor. No or few records in region or records/site very isolated e.g. by pastoral land, urbanisation, etc.
- *Low* (1-25%) - few minor areas of potential habitat; highly modified site/habitat; or few habitat parameters present, but others absent or relatively insignificant (sub-optimum habitat). Usually very few records in study area.
- *Fair* (25-50%) - some significant areas of potential habitat, but some habitat parameters limited. Potential for occasional foraging e.g. from nearby more optimal areas or known habitat. Records within 10-15 km radius of site.
- *Moderate* (50-75%) - quite good potentially suitable habitat on and adjacent to the site, and/or good quality and abundance of some vital habitat parameters. Records within <10km, or adjacent to site, or adjacent to high quality habitat where species likely to occur.
- *High* (>75%) - very good to optimum habitat occurring on or adjacent to the site (support breeding pair or population). Recorded within 5-10 km of site in same or similar habitat.

Marine species have been excluded from this list due to lack of available habitats within and in close proximity to the subject site.



A-4-1 Threatened Ecological Communities Potential Occurrence Assessment

Table 11: Potential occurrence assessment - TECs

TEC Name	Listing	Link to Profile	Present within the subject site?
BC Act Listed TEC			
<i>Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions</i>	E	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10866	No
<i>Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions</i>	E	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10929	No
<i>Littoral Rainforest in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions</i>	E	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10867	No
<i>Lowland Rainforest in the NSW North Coast and Sydney Basin Bioregions</i>	E	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20073	No
<i>Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion</i>	E	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10497	Yes
<i>Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions</i>	E	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10936	No
<i>Subtropical Coastal Floodplain Forest of the New South Wales North Coast Bioregion</i>	E	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10944	No
<i>Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions</i>	E	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10945	No
<i>Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions</i>	E	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10786	No
<i>Themeda grassland on seacliffs and coastal headlands in the NSW North Coast, Sydney Basin and South East Corner Bioregions</i>	E	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20042	No
<i>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</i>	CE	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10837	No
<i>White Gum Moist Forest in the NSW North Coast Bioregion</i>	E	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20100	No



A-4-2 Flora Species Potential Occurrence Assessment

Table 12: Potential occurrence assessment - flora

Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Milky Silkpod <i>Parsonsia dorrigoensis</i>	V	653	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10587	Found in subtropical and warm-temperature rainforest, on rainforest margins, and in moist eucalypt forest up to 800 m, on brown clay soils. Limited suitable habitats for this species occurs within the subject site. 653 records within the study area. Recorded within the subject site. Known to occur.	Yes
Slender Marsdenia <i>Marsdenia longiloba</i>	E	101	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10507	Subtropical and warm temperate rainforest, lowland moist or open eucalypt forest adjoining rainforest. Associated species include <i>Eucalyptus crebra</i> , <i>E. microcorys</i> , <i>E. acmenoides</i> , <i>E. saligna</i> , <i>E. propinqua</i> , <i>Corymbia intermedia</i> and <i>Lophostemon confertus</i> . Suitable habitats for this species occurs within the subject site. 101 records within the study area. Not recorded within the subject site however some associated species do occur. Moderate chance of occurrence.	Yes
Rainforest Cassia <i>Senna acclinis</i>	E	10	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10753	Grows on the margins of subtropical, littoral and dry rainforests. Often found as a gap phase shrub. Some suitable habitat occurs within the subject site. Few local records. Not recorded within subject site during site surveys. Low likelihood of occurrence.	No
- <i>Maundia triglochinooides</i>	V	94	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10511	Grows in swamps, lagoons, dams, channels, creeks or shallow freshwater 30 - 60 cm deep on heavy clay, low nutrients. Several local records however habitats of this type are very limited within the subject site. Low chance of occurrence.	No
Scrub Turpentine <i>Rhodamnia rubescens</i>	CE	7	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20341	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. Recorded during site surveys. Known to occur.	Yes



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
White-flowered Wax Plant <i>Cynanchum elegans</i>	E	1	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10196	This species predominately occurs in dry rainforest and littoral rainforest communities. Very limited habitat of this type occurs on the subject site. One record within the study area. Not recorded during site surveys. Unlikely to occur.	No
Native Guava <i>Rhodomyrtus psidioides</i>	E	7	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20342	Pioneer species found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest often near creeks and drainage lines. Limited suitable habitats for this species occurs within the subject site. Seven records within the study area however these records are a located approximately 4km east of the subject site. Not recorded during site surveys. Low chance of occurrence within PCT 748.	No
Spider Orchid <i>Dendrobium melaleucaphilum</i>	E	27	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10213	Grows frequently on <i>Melaleuca styphelioides</i> , less commonly on rainforest trees or on rocks in coastal districts. <i>Melaleuca styphelioides</i> was not recorded within the subject site during surveys. Local records of the spider orchid occurs approximately 3 km south of the subject site. Low chance of occurrence.	No
Willawarrin Doubletail <i>Diuris disposita</i>	E	59	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10237	Known only from Willawarrin near Kempsey, where it is rare. Local records of the spider orchid occurs approximately 4 km south of the subject site. Not recorded during site surveys. Low chance of occurrence.	No
Floyd's Grass <i>Alexfloydia repens</i>	E	2	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10036	Floyd's Grass occurs predominantly in swamp sclerophyll forest where Swamp Oak <i>Casuarina glauca</i> and/or Broad-leaved Paperbark <i>Melaleuca quinquenervia</i> are usually the dominant canopy species. The plant favours the moderate to high sunlight levels in this habitat. These habitats do not occur within the subject site for this species. 2 local records. Not recorded during site surveys. Unlikely to occur.	No
Scant Pomaderris <i>Pomaderris queenslandica</i>	E	1	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10656	Found in moist eucalypt forest or sheltered woodlands with a shrubby understorey, and occasionally along creeks. Limited suitable quality	No



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Rusty Plum <i>Niemeyera whitei</i>	V	30	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10044	habitat for this species occurs within the subject site. One local record. Not recorded during site surveys. Unlikely to occur. Found in gullies, warm temperate or littoral rainforests and the adjacent understorey of moist eucalypt forest. It occurs on poorer soils in areas below 600 metres above sea level. Nearest local record occurs approximately 1.5 km north of the subject site. Limited suitable quality habitats occur within the subject site. Not recorded during site surveys. Low chance of occurrence.	No
Leafless Tongue-orchid <i>Cryptostylis hunteriana</i>	V	0	https://www.environment.nsw.gov.au/threatenedspeciesApp/profile.aspx?id=10187	This species is often found in association with the Large Tongue Orchid (<i>C. subulata</i>) and the Tartan Tongue Orchid (<i>C. erecta</i>). These species were not detected during surveys. Site habitat marginally suitable due to lack of understorey in some areas and leaf litter extent for nutrient requirements. Not recorded within the study area. Unlikely to occur.	No
- <i>Euphrasia arguta</i>	CE	0	https://www.environment.nsw.gov.au/threatenedspeciesApp/profile.aspx?id=20165	Species typically occurs in habitats with a grass and shrub understorey. Regeneration of the species favours disturbance. Limited suitable habitats occur within the subject site. Species not recorded during site surveys and no local records. Unlikely to occur.	No
Tail Velvet Sea-berry <i>Haloragis exalata subsp. velutina</i>	V	0	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10393	Grows in damp places near watercourses. This subspecies also occurs in woodland on the steep rocky slopes of gorges. Limited suitable habitats occur within the subject site. Species not recorded during site surveys and no local records. Unlikely to occur.	No
Macadamia Nut <i>Macadamia integrifolia</i>	-	0	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=7326	This species is generally found in Queensland with the subject site occurring in the southern extent of this species' known distribution. It grows in remnant rainforest preferring partially open areas such as rainforest edges. Limited suitable quality habitats occur within the subject site. Not recorded during site surveys and no local records. Low chance of occurrence.	No



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Tall Knotweed <i>Persicaria elatior</i>	V	0	https://www.environment.nsw.gov.au/threatenedspeciesApp/profile.aspx?id=10590	This species prefers damp habitats beside waterbodies or streams. Limited suitable quality habitats occur within the subject site. Not recorded during site surveys and no local records. Low chance of occurrence.	No
Lesser Swamp-orchid <i>Phaius australis</i>	E	0	https://www.environment.nsw.gov.au/threatenedspeciesApp/profile.aspx?id=10610	This species is limited to areas of swampy grassland and swampy forest. No suitable habitat occurs on the subject site. Not recorded during site surveys and no local records. Unlikely to occur.	No
Ravine Orchid <i>Sarcochilus fitzgeraldii</i>	V	0	https://www.environment.nsw.gov.au/threatenedspeciesApp/profile.aspx?id=10744	The Ravine Orchid grows mainly on rocks, amongst organic matter, in cool, moist, shady ravines, gorges and on cliff faces in dense subtropical rainforest at altitudes between 500 and 700 m. Occasional clumps are found on the bases of fibrous-barked trees. Optimal habitat for this species does not occur within the subject site with the highest elevation approximately 450m asl. Not recorded during site surveys. No local records. Unlikely to occur.	No
Austral Toadflax <i>Thesium australe</i>	V	0	https://www.environment.nsw.gov.au/threatenedspeciesApp/profile.aspx?id=10802	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (<i>Themeda australis</i>). Habitats of this type do not occur within the subject site. Not recorded during site survey and no local records. Unlikely to occur.	No
Cryptic Forest Twiner <i>Tylophora woollsi</i>	E	0	https://www.environment.nsw.gov.au/threatenedspeciesApp/profile.aspx?id=10816	This species grows in moist eucalypt forest, moist sites in dry eucalypt forest and rainforest margins. Suitable habitat occurs within the subject site at rainforest and dry eucalypt margins. Species not recorded during site surveys and no local records. Low chance of occurrence.	No

Key: Critically Endangered (CE), Endangered (E), Vulnerable (V).



A-4-3 Fauna Species Potential Occurrence Assessment

Table 13: Potential occurrence assessment - fauna

Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Amphibia					
Giant Barred Frog <i>Mixophyes iterates</i>	E	3	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10538	This species is found in moist forests and rainforests within deep leaf litter. The vegetation communities on site are potentially suitable for this species. Records for this species occurs within 1km of the subject site. Not recorded during surveys however surveys were conducted during a period of decreased activity for amphibians. Fair chance of occurrence.	Yes
Green & Golden Bell Frog <i>Litoria aurea</i>	E	3	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10483	This species inhabits permanent waterbodies with a preference for those which are still. No still waterbodies are present on site. Local records are not located near to the subject site and are greater than 20 years old. Not recorded during surveys however surveys were conducted during a period of decreased activity for amphibians. Unlikely to occur.	No
Green-thighed Frog <i>Litoria brevipalmata</i>	V	10	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10485	Green-thighed Frogs occur in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. It prefers wetter forests in the south of its range, but extends into drier forests in northern NSW and southern Queensland (DPIE 2021b). Suitable habitats for this species occurs within the subject site. 10 local records. Not detected during site surveys however surveys were undertaken during a period of decreased activity for amphibians. Fair chance of occurrence.	Yes
Stuttering Frog <i>Mixophyes balbus</i>	E	3	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10536	Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the summer breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor. Limited suitable habitat present on site local records are located beyond 1 km of the subject site and are	No



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Reptilia					
Three-toed Snake-tooth Skink <i>Coeranoscincus reticulatus</i>	-	0	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10172	greater than 20 years old. Not recorded during surveys however surveys were conducted during a period of decreased activity for amphibians. Unlikely to occur.	No
Stephens' Banded Snake <i>Hoplocephalus stephensii</i>	V	34	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10414	This species inhabits eucalypt forests, rainforests and rocky areas up to 950m in altitude (DPIE 2021b). This species requires loose bark, vines or hollow trunk limbs for shelter. The subject site provides potential shelter resources for this species. Local records occur within 2km from the subject site however this species was not recorded during site surveys. Fair chance of occurrence.	Yes
Aves					
Australasian Bittern <i>Botaurus poiciloptilus</i>	E	0	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10105	An estuarine or freshwater species found in areas of dense sedges, reeds and rushes. Suitable habitat for this species does not occur on site. Unlikely to occur.	No
Black Bittern <i>Ixobrychus flavicollis</i>	V	1	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10441	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. No suitable habitat occurs on the subject site. Unlikely to occur.	No
Black Necked Stork <i>Ephippiorhynchus asiaticus</i>	E	26	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10275	This species is found in close proximity to a water source. Generally inhabits lakes, swamps, mudflats and mangroves. Habitat of this type does not occur on the development site. Unlikely to occur.	No
Spotted Harrier <i>Circus assimilis</i>	V	1	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20134	Occurs in grassy open woodland, Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It also occurs in agricultural land, foraging over open habitats including edges of inland wetlands (DPIE 2021b). Limited habitats suitable for	No



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Bush Stone-curlew <i>Burhinus grallarius</i>	E	4	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10113	this species occurs within the subject site. Only one local record occurs and this species was not recorded during site surveys. Given the linear nature of the subject site, this species is more likely to be seen flying over between more suitable foraging and nesting habitats. Unlikely to occur.	No
Comb-crested Jacana <i>Irediparra gallinacea</i>	V	4	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10435	This species is found in areas with a permanent water source and a good cover of surface vegetation. It is most commonly recorded in freshwater swamps, billabongs and ponds. Habitat for this species does not occur on site. Unlikely to occur.	No
Glossy Black Cockatoo <i>Calyptorhynchus lathami</i>	V	556	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10140	This species requires <i>Allocasuarina</i> and/or casuarina species to forage and large tree hollows to breed. Both foraging and breeding habitat for this species occurs within the subject site. Although this species or evidence of this species was not recorded within the subject site there are 556 local records, several occurring within close proximity to the subject site. Moderate to high chance of occurring.	Yes
Little Eagle <i>Hieraaetus morphnoides</i>	V	1	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20131	This species forages in forest and woodland communities that contain an abundance of prey resources. The subject site is unlikely to support sufficient prey sources for this species however there is a very marginal potential for it to forage over the site as part of a larger range. Only one local record. Not recorded during site surveys. Unlikely to occur.	No
Little Lorikeet <i>Glossopsitta pusilla</i>	V	29	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20111	This species forages primarily in the canopy of open <i>Eucalyptus</i> forest and woodland, yet also finds food in <i>Angophora</i> , <i>Melaleuca</i> and other tree species. Riparian habitats are particularly used. The Little Lorikeet has been recorded occurring in isolated roadside and paddock trees. Potential foraging	Yes



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
				resources occur throughout the subject site and adjoining habitats. Nesting habitat in the form of small hollows also occurs within the subject site. Records of this species occur within 2 km of the subject site. Moderate chance of occurrence.	
Sooty Owl <i>Tyto tenebricosa</i>	V	39	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10821	A rainforest species which requires very large tree-hollows to roost/nest. The limited desirable vegetation within the subject site is a large constraint for this species however several large hollows occur throughout the subject site. Local records for this species occur within 2 km of the subject site. Not recorded during site surveys. Fair potential to occur.	Yes
Masked Owl <i>Tyto novaehollandiae</i>	V	27	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10820	This species occurs in forests and woodlands with a sparse understorey. It requires tree hollows for nesting and an abundance and diversity of prey species. Large tree hollows were recorded on site however prey species are may be scarce across the subject site. This species may potentially forage over the subject site as part of a larger range. 27 local records including two within 1km of the subject site. Moderate chance of occurrence.	Yes
Barking Owl <i>Ninox connivers</i>	V	6	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10561	This species hunts over large territories where it prefers open country. Tree hollows in well-forested hills, flats or riverine woodland are required for nesting. Although nesting habitat occur on site for this species, the subject site does not provide this species preferred foraging habitat of open country and is likely only to utilise the subject site as a small part of a larger hunting range. Few local records. Low chance of occurrence.	No
Eastern Grass Owl <i>Tyto longimembris</i>	V	2	https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10819	Eastern Grass Owls are found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains. No suitable habitat occurs on the subject site. Unlikely to occur.	No



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Painted Honeyeater <i>Grantiella picta</i>	V	0	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=470	This species inhabits mistletoe-infested forest and woodland communities. This habitat is rare within the subject site and this species has not been recorded in the study area. Unlikely to occur.	No
Powerful Owl <i>Ninox strenua</i>	V	59	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10562	This species occurs in sclerophyll forests and requires an abundance and diversity of prey species. Tree hollows are also required for nesting. Prey species are likely to be scarce however the site may form part of a larger foraging territory. Several large hollows occur throughout the subject site for nesting habitat for this species. 59 local records, several within close proximity to the subject site. Recorded by call playback during site surveys. Known to occur.	Yes
Brown Treecreeper <i>Climacteris picumnus victoriana</i>	V	1	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10171	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey (DPIE 2021b). Suitable foraging and nesting habitats occur within the subject site. Only one record of this species within the study area however the Brown Treecreeper was recorded within the subject site during site surveys.	Yes
Regent Honeyeater <i>Anthochaera phrygia</i>	CE	3	http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10841	Although winter flowering nectar sources for this species occur on site, favoured species Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany are not present. The subject site is not located near a known breeding area for this species. Three records occur in the study area. Not recorded during site surveys. Low chance of occurring.	No
Square-tailed Kite <i>Lophoictinia isura</i>	V	1	http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10495	This species is commonly found in open forests and woodlands. Large stick nests are constructed in forks of living trees. No nests found on or adjacent to the site and it was not detected by the survey. One record in study area, hence unlikely to low chance of occurrence as part of a larger foraging range.	No



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Swift Parrot <i>Lathamus discolor</i>	E	0	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=744	This species favours winter flowering eucalypts however no records of the Swift parrot occur in the study area. This species does not breed on mainland Australia and was not detected during site surveys. Unlikely to occur.	No
Wompoo Fruit-dove <i>Ptilinopus magnificus</i>	V	27	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10707	Occurs in, or near rainforest, low elevation moist eucalypt forest and brush box forests. Limited habitats of this type occurs within and in close proximity to the subject site. 27 local records, nearest local record approximately 2km from the subject site. Low likelihood of occurrence as a small part of a larger home and foraging range.	No
White-throated Needletail <i>Hirundapus caudacutus</i>	-	22	https://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=682	White-throated Needletail is almost exclusively aerial, the species forages aerially and roosts in trees in forests and woodlands in dense foliage or hollows. Marginal to nil roosting habitat for this species occurs on the subject site. Unlikely to occur however may be seen flying over the site from time to time.	No
Varied Sittella <i>Daphoenositta chrysoptera</i>	V	21	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20135	This species forages in trees with rough bark or on dead trees. It is known to occur in a range of vegetation types excluding deserts and grassland. Habitat within the subject site may provide potential foraging habitats for this species as a small part of a larger foraging range. Few records occur within 2km of the subject site. Low chance of occurrence.	No
Barred Cuckoo-shrike <i>Coracina lineata</i>	V	1	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10176	This species occurs in rainforest, eucalypt forests and woodlands, clearings in secondary growth, swamp woodlands and timber along watercourses. Limited suitable habitat occurs on the subject site for foraging and sheltering habitat. Given the extent of the of the rainforest vegetation within the subject site, the number of local records and that this species was not recorded during site surveys, the likelihood of occurrence for this species is low.	No
Dusky Woodswallow <i>Artamus cyanopterus cyanopterus</i>	V	3	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20303	Primarily inhabits dry, open eucalypt forests and woodlands with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and	Yes



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Diamond Firetail <i>Stagonopleura guttata</i>	V	1	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10768	groundcover of grasses or sedges and fallen woody debris. Areas of the subject site exhibit understory, shrub species and woody debris. Only three records in the study area, with the nearest record approximately 1km from the subject site. This species was recorded within the subject site during site surveys. Known to occur.	No
Curllew Sandpiper <i>Calidris ferruginea</i>	-	0	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20166	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum <i>Eucalyptus pauciflora</i> Woodlands. This species is also often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Roosting and nesting occurs in dense shrubby understory (DPIE 2021b). The subject site provides very limited suitable habitat for this species where understory is dense. Only one record for this species occurs within the study area. Not recorded during site surveys. Unlikely to occur.	No
Red Goshawk <i>Erythrotriorchis radiatus</i>	CE	0	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10279	A migratory shorebird. No suitable habitat for this species occurs within the subject site. Unlikely to occur.	No
Grey Falcon <i>Falco hypoleucos</i>	E	0	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10330	This species is not known or predicted to occur as far south as Port Macquarie with most NSW records occurring in the Clarence River Catchment (DPIE 2021b). In NSW, they are recorded in riparian habitats and are known to prefer mixed subtropical rainforest, riparian Eucalyptus forests of coastal rivers and Melaleuca swamp forests. The subject site may provide potential habitats for this species however the subject site is located just outside of the known distribution for the Red Goshawk. No local records occur. Low chance of occurrence.	No



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Eastern Curlew <i>Numenius madagascariensis</i>	-	0	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20284	A coastal species, not generally recorded as far inland as the subject site. It requires large areas of coastal lakes, bays and estuaries. Habitat of this type does not occur on the subject site. Unlikely to occur.	No
Insecta					
Black Grass-dart Butterfly <i>Ocybadistes knightorum</i>	E	1	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10573	The Black Grass-dart Butterfly occurs only on the NSW mid north coast from Coffs Harbour to Scotts Head. Habitat is predominantly located in swamp sclerophyll forest where Swamp Oak <i>Casuarina glauca</i> and/or Broad-leaved Paperbark <i>Melaleuca quinquerivra</i> are usually the dominant canopy species. Floyd's Grass <i>Alexfloydia repens</i> being the only larval food plant known. Habitats for this species is not located within the subject site, no the larval food plant Floyd's Grass. One local record and not detected during site surveys. Unlikely to occur.	No
Australian Fritillary <i>Argynnis hyperbius inconstans</i>	E	0	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10064	The Australian Fritillary is found in open swampy coastal habitat. No suitable habitat on the subject site. Unlikely to occur.	No
Pink Underwing Moth <i>Phyllodes imperialis smithersi</i>	E	0	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=86084	The Pink Underwing Moth is found below the altitude of 600 m in undisturbed, subtropical rainforest on rich volcanic soils and fertile alluvium. It occurs in association with the vine <i>Carronia multisepealea</i> , a collapsed shrub that provides the food and habitat the moth requires in order to breed (DAWE 2021b). The Pink Underwing Moth and <i>Carronia multisepealea</i> were not recorded within the subject site during site surveys. No local records. Unlikely to occur.	No
Mammalia					
Brush-tailed Phascogale <i>Phascogale tapoatafa</i>	V	26	https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10613	This species is generally found in areas of dry sclerophyll open forest containing sparse groundcover (DPIE 2021b). The subject site contains suitable foraging habitat and denning habitat for this species. Several records occur within 2km of the subject site and this species was recorded by PIR camera during site surveys. Known to occur.	Yes



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Koala <i>Phascolarctos cinereus</i>	E	334	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10616	Koalas inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. The subject site does contain preferred koala food trees. Species was observed by scat identification within the subject site during surveys, there are 334 local records for the Koala. Known to occur.	Yes
Brush-tailed Rock-wallaby <i>Petrogale penicillata</i>	V	0	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10605	This species requires areas of rocky escarpments, outcrops and cliffs as it seeks shelter in caves and rock crevices by day. By night, this species is forages on vegetation adjacent to these areas. No habitat of this type occurs within close proximity to the subject site. No local records. Unlikely to occur.	No
Common Planigale <i>Planigale maculata</i>	V	1	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10635	This species is found in areas where there is dense groundcover and in close proximity to water. Hollow logs, rocks and crevices are required for shelter diurnally. The vegetation types within the subject site and lack of permanent water sources at the subject site is unlikely to support this species. One local record. Unlikely to occur.	No
Eastern Coastal Free-tail Bat <i>Micronomus norfolkensis</i>	V	12	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10544	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures. Subject site contains suitable roosting and foraging habitats for this species. Twelve local records however not recorded during site surveys. Fair chance of occurrence.	Yes
Hoary Wattled Bat <i>Chalinolobus nigrogriseus</i>	V	3	https://www.environment.nsw.gov.au/ThreatenedSpeciesApp/profile.aspx?id=10158	Hoary Wattled Bat occurs in dry open eucalypt forests, favouring forests dominated by Spotted Gum, boxes and ironbarks, and heathy coastal forests where Red Bloodwood and Scribbly Gum are common. Roosts in hollows and rock crevices. Preferred tree species and roosting sites occur on the site, species may use the site as part of a larger foraging territory. Three local records however this	No



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Greater Glider <i>Petauroides volans</i>	E	60	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=20306	species was not recorded during site surveys. Low likelihood of occurrence. This species requires a high density of tree hollows for shelter. Numerous local records occur nearby the subject site in areas of dense vegetation. Proximity records indicate their presence nearby and the subject site and surrounding areas contain extensive hollow-bearing trees to support this species. It is likely that this species will utilise the subject site to move between habitats offsite. Not recorded during site surveys. Fair chance of occurring in the subject site.	Yes
Grey-headed Flying Fox <i>Pteropus poliocephalus</i>	V	153	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10697	A nomadic species which is dependent on winter flowering eucalypts. Suitable foraging resources occur on site for this species however no breeding or roosting camps were located within the subject site or the broader study area (DAWE 2021c). Not recorded during site surveys. Low chance of occurrence on a transient basis for foraging as part of larger range.	No
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i>	V	12	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10748	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. This species usually roosts in tree hollows, it has also been found in buildings (DPIE 2021b). Roosting and foraging habitats occur within the subject site as part of a larger home range. Twelve records of this species in the study area. Not confidently recorded during site surveys, however this species may be a 'possible' detection by anabat. Low to fair chance of occurrence.	Yes
Large-eared Pied Bat <i>Chalinolobus dwyeri</i>	V	0	http://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10157	This species is found in well-timbered areas containing gullies. The subject site lacks preferred roosts such as caves, mines and Fairy Martin nests. This species may occur within the subject site for foraging habitat on a transient basis and as part of a larger home range. No local records and not definitely	No



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Little Bent-wing Bat <i>Miniopterus australis</i>	V	78	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10533	or possibly recorded by anabat during site surveys. Low chance of occurrence. This species prefers moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges (DPIE 2021b). Suitable roosting habitats occur within the subject site and foraging habitats occur which may be utilised by this species on a transient basis as part of a larger home range. Several local records. Recorded by anabat during site surveys. Known to occur.	Yes
Eastern Cave Bat <i>Vespadelus troughtoni</i>	V	1	https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10829	A cave-roosting species that is usually found in dry open forest and woodland, near cliffs or rocky overhangs. Occasionally found along cliff-lines in wet eucalypt forest and rainforest (DPIE 2021b). The subject site and the adjacent areas lack cliffs or rocky overhangings. One record within the study area. Not recorded during site surveys. Unlikely to occur.	No
Golden-tipped Bat <i>Phoniscus papuensis</i>	V	18	https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10444	This species is found in rainforest, eucalypt forests and Casuarina-dominated riparian forests and roosts in rainforest gullies, usually roosts in abandoned hanging Yellow-throated Scrubwren and Brown Gerygone nests and occasionally hollows (DPIE 2021b). Limited suitable foraging habitats occur, extensive hollows for roosting occurs within the subject site. Few local records occur within 3 km of the subject site. Low chance of occurring.	No
Eastern False Pipistrelle <i>Falsistrellus tasmaniensis</i>	V	2	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10331	A winter-hibernating species with a preference for moist habitats containing trees taller than 20m in height (DPIE 2021b). Roosts in eucalypt hollows however has been found roosting in buildings or under loose bark. Roosting habitat in the form of hollows occurs on site however the subject site may contain some potential habitat which may be used for foraging on a transient basis as part of a larger area. Not detected during site surveys however survey	No



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
				timing has restricted potential detection of this species. Two records within 10 km study area. Unlikely to low potential to occur.	
Southern Myotis <i>Myotis macropus</i>	V	6	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10549	This species requires tree hollows, caves, tunnels or dense foliage for roosting. Forages along creek lines and other waterbodies and has a preference for riparian habitat. The subject site contains limited suitable foraging and roosting habitat for this species. Few local records occur; however not within 2km of the subject site. Not recorded during site surveys. Unlikely to low potential to occur.	No
Long-nosed Potoroo (SE mainland) <i>Potorous tridactylus</i>	V	1	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10662	This species inhabits coastal heaths and dry and wet sclerophyll forests. Dense understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature. requires a dense understorey and groundcover for refuge whilst feeding. Marginal areas of dense understorey habitats occur within the subject site. Only one local record, this record is from 2015 and not recorded within 2 km of the subject site. Not recorded during site surveys. Small portions of site habitats are suitable however due to low records in the study area, this species is considered to have a low chance of occurring in suitable habitats only.	No
New Holland Mouse <i>Pseudomys novaehollandiae</i>	-	0	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=96	This species requires heathlands with a dense understorey. Suitable habitat for this species does not occur within the subject site. No local records. Not recorded during site surveys. Unlikely to occur.	No
Spotted-Tailed Quoll <i>Dasyurus maculatus</i>	V	32	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10207	This species prefers forest habitats with dense vegetation. For nesting, caves, large hollow logs or tree hollows are required. Limited areas of suitable quality forest habitats and hollow logs occur within the subject site for this species. Local records occur for this species within 1km of the subject site. Not recorded during site surveys. Fair potential to occur.	Yes



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Squirrel Glider <i>Petaurus norfolcensis</i>	V	27	http://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10604	This species is commonly found in dry, open forests with an abundance of winter-flowering trees and required abundant trees for nesting (DPIE 2021b). The subject site does contain potential foraging and nesting habitats in the form of abundant hollows. Local records for this species occur within close proximity to the subject site. This species was detected during site surveys. Known to occur.	Yes
Red-legged Pademelon <i>Thylogale stigmatica</i>	V	0	https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10805	This species is found in forests containing a dense understorey and ground layer. Marginal areas of dense understorey habitats occur within the subject site however the majority of vegetation within the subject site is open and is unlikely to provide sufficient shelter for this species. No records occur within the study area however this species may have been detected during site surveys by PIR camera but cannot confidently be identified. On a precautionary basis, this species will be considered as likely to occur and assessed accordingly.	Yes
Yellow-bellied Glider <i>Petaurus australis</i>	V	115	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10601	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Den, often in family groups, in hollows of large trees. The subject site contains suitable foraging and denning habitats for this species. Several local records within close proximity so the subject site. Not recorded during field surveys. Likely to occur.	Yes
Rufous Bettong <i>Aepyprymnus rufescens</i>	V	2	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10033	This species occurs in open woodland/forest areas with a dense grass layer (DPIE 2021b). Limited areas of suitable habitat for this species occurs within the subject site however the majority is likely too exposed to support this species. There are limited local records which do not occur within close proximity to the subject site. Not recorded during site surveys. Unlikely to occur.	No



Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Parma Wallaby <i>Macropus parma</i>	V	1	https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10501	This species prefers moist eucalypt forest with a thick scrubby understorey. Dense groundcover is required for shelter during the day (DPIE 2021b). Site habitats are not suitable for this species with vegetation likely to be too exposed. The single record of this species from 2012 does not occur within close proximity to the subject site. Not recorded during site surveys. Low chance of occurrence.	No
Listed Migratory Terrestrial Species					
Oriental Cuckoo <i>Cuculus optatus</i>	-	0	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=86651	Species forages solitary in upper and middle levels of boreal forest and mixed woodlands. No suitable habitat occurs on the subject site. No local records. Unlikely to occur.	No
Black-faced Monarch <i>Monarcha melanopsis</i>	-	0	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=609	The Black-faced Monarch mainly occurs in rainforest ecosystems. The site contains limited potential habitats for this species however there are no local records. Habitats may be utilised on a transient basis. Fair likelihood of occurrence.	Yes
Spectacled Monarch <i>Monarcha trivirgatus</i>	-	0	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=83946	Usually occurs in dense rainforests and moist eucalypt forests of eastern and north-eastern Australia, the Spectacled Monarch sometimes also inhabits mangroves and other densely vegetated habitats. The site contains potential habitat for this species however there are no local records. Low likelihood of occurrence.	No
Satin Flycatcher <i>Myiagra cyanoleuca</i>	-	0	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=612	Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. The site contains potential habitat for this species however there are no local records. Low likelihood of occurrence.	No
Rufous Fantail <i>Rhipidura rufifrons</i>	-	0	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=612	In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts usually with a dense shrubby understorey often including ferns. The site contains potential habitat for this species however	Yes



ECOLOGICAL ASSESSMENT FOR NGAMBAA REWILDING PROJECT | SEPTEMBER 2021

Species	BC Act	No. of Records	Link to Profile	Likelihood of Occurrence	Significance Assessment Required?
Yellow Wagtail <i>Motacilla flava</i>	-	0	http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=644	there are no local records. Fair likelihood of occurrence for this species to utilise habitats on a transient basis. Widespread wagtail, favouring wet meadows, marshland, grassy and muddy lakeshores. Occurs in fields and often near livestock during migration. No suitable habitat occurs within the subject site. No local records. Unlikely to occur.	No

Key: Critically Endangered (CE), Endangered (E), Vulnerable (V), Migratory (M).



Biodiversity Australia Pty Ltd
ABN 81 127 154 787

A-5 Significance Assessments

The following provides significance assessments in order to determine whether the development is likely to have a significant effect on known or potentially occurring entities. Assessments have been provided under the BC Act

Five-part Test of Significance (BC Act 2016)

The Test of Significance has been prepared in consideration of the *Threatened Species Test of Significance Guidelines* (OEH 2018). For an activity under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act), an assessment of an activity that is likely to significantly affect a threatened species under the five-part test of significance must be accompanied by a species impact statement (SIS) or, if the proponent elects to participate in the Biodiversity Offset Scheme, a Biodiversity Development Assessment Report will be required.



A-5-1 Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion

BC Act Status: Endangered

Lowland Rainforest on Floodplain generally occupies riverine corridors and alluvial flats with rich, moist silts often in sub-catchments dominated by basic volcanic substrates. This community which now occurs only as small remnants in scattered localities on the NSW north coast, with less than 1000ha in total thought to remain (DPIE 2021b). Larger stands of the community typically have a dense canopy, which blocks most light from reaching the ground, creating cool, moist conditions. Lowland Rainforest on Floodplain supports a diversity of plants and animals. Typical tree species in the community include figs (*Ficus macrophylla*, *F. obliqua* and *F. watkinsiana*), palms (*Archontophoenix cunninghamiana* and *Livistona australis*), Silky Oak (*Grevillea robusta*), Black Bean (*Castanospermum australe*) and Brush Cherry (*Syzygium australe*) (DPIE 2021b). The extent of this community within the subject site is 0.22 ha and is considered to be in relatively good condition.

The most relevant threats to this TEC in relation to the proposed predator proof fence construction includes; Invasion and establishment of transformer weed species, Clearing from rural, agricultural and urban development leading to edge effects, degradation and further fragmentation. Myrtle rust infection of characteristic species, grazing and trampling by livestock causing loss of or damage to plants, compaction of soil, erosion, influx of nutrients and dispersal of weeds and browsing by deer leading to removal of understorey species and suppression of regeneration (DPIE 2021b).

BC Act Test of Significance

Table 14: BC Act Test of Significance - *Lowland Rainforest on Floodplain in the New South Wales North Coast Bioregion*

Significant Impact Criteria	Details
a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	Not Applicable to this Endangered Ecological Community.
b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: (i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or (ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.	Lowland Rainforest on Floodplain EEC occurs within the subject site. The extent of this EEC within the subject site occurs as 0.22 ha linear strip where the proposal crosses the creek line at Eungai Creek for the internal release fencing. This EEC extends beyond the site to the east and west along the creek bank. The local occurrence of this EEC has not been fully surveyed however it is likely to be present in small areas within PCT 1142 Dry Rainforest beyond the subject site. Due to the lack of historical disturbances the EEC is in relatively good condition. The proposal will require the removal/modification of a narrow linear 20 m corridor strip of this vegetation totalling 0.22 ha in area, of which, approximately half of this will be retained within the subject site as a management zone. This vegetation removal will impact and reduce the extent of the community. However, the works are unlikely to place the local occurrence at risk of extinction given the area to be removed is a relatively small proportion of this patch of EEC which extends into the Reserve in patches along Eungai Creek. Under the assumption that 1000 ha of this EEC is thought to remain and the proposal indicates the removal/modification of up to 0.22 ha at most, this is a very minor (0.02%) loss of in area of this EEC in proportion to the known extent.



Significant Impact Criteria	Details
	<p>While this is a contribution to a cumulative loss of this EEC, it is unlikely to adversely affect the extent of the ecological community such that its local occurrence will be placed at risk of extinction. Additionally, the proposal is unlikely to introduce new threats or impacts further than what currently exists. Recommendations are provided to assist in minimising potential indirect impacts on this EEC.</p>
<p>c) In relation to the habitat of a threatened species or ecological community:</p> <p>(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p> <p>(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p> <p>(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the study area.</p>	<p>The proposal will require the removal/modification of a narrow linear strip of this vegetation totalling 0.22 ha in area, of which, approximately half of this will be retained within the subject site as a management zone.</p> <p>The habitat to be removed and modified is unlikely to fragment or isolate any areas of the existing vegetation, only to create a narrow (20 m maximum) linear gap through the existing intact vegetation to construct the predator proof fence. Connectivity will remain to the east and west of this gap where the subject site adjoins the Reserve where the remaining extent of the Lowland Rainforest EEC will be retained for conservation.</p> <p>The proposal indicates the removal/modification of up to 0.22 ha at most, this is a very minor (0.02%) loss of in area of this EEC in proportion to the total known extent. While this is a contribution to a cumulative loss of this EEC that is important to the proposal is unlikely to impact the long-term survival of this EEC within the study area.</p>
<p>d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).</p>	<p>The proposed development will not directly or indirectly affect an area of outstanding biodiversity value for the Gould’s Petrel, Little Penguin population, Mitchell’s Rainforest Snail or the Wollemi Pine.</p>
<p>e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.</p>	<p>As per assessed in Section 7.2.2, the proposed development contributes to the following KTP:</p> <ul style="list-style-type: none"> • Clearing of native vegetation <p>The proposed development may increase the potential impact of the following KTP’s listed under the BC Act.</p> <p>Invasion, establishment and spread of Lantana (<i>Lantana camara</i>)</p> <ul style="list-style-type: none"> • Invasion of native plant communities by exotic perennial grasses • Invasion and establishment of exotic vines and scramblers • Invasion, establishment and spread of Lantana (<i>Lantana camara</i>) • Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae <p>Recommendations are provided to assist in minimising potential indirect impacts on this EEC. Given these measures are followed impacts from these KTPs are unlikely.</p>
<p>Conclusion</p>	<p>The proposal will directly impact this TEC by the direct removal of a maximum of 0.22 ha of known EEC vegetation. The proposal is not considered to significantly impact this EEC due to the following factors:</p> <ul style="list-style-type: none"> • A significant area of this vegetation within the subject site will be retained as a management zone. • The extent of vegetation to be removed is a minute proportion of the extent of this EEC which exists within the study area. • The local occurrence and composition of this EEC will not be impacted to place the community at risk of extinction. • The proposal will not fragment or isolate any areas of this EEC • Connectivity will remain unaffected to the east and west of the subject site with vegetation to be retained for conservation within Ngambaa Nature Reserve.



Significant Impact Criteria	Details
	<ul style="list-style-type: none"> Recommendations have been made to minimise the likelihood of potential impacts of KTPs within the subject site.

A-5-2 Threatened Flora: *Rhodamnia rubescens* (Scrub Turpentine) *Parsonsia dorrigoensis* (Milky Silkpod) and *Marsdenia longiloba* (Slender Marsdenia)

BC Act Status: Critically Endangered (Scrub Turpentine), Endangered (Slender Marsdenia), Vulnerable (Milky Silkpod).

Distribution and ecology

Scrub Turpentine occur in coastal districts within NSW and extend inland into escarpments up to 600m asl and areas with rainfall of 1,000-1,600mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils (DPIE 2021b).

Milky Silkpod is found in scattered populations in NSW in the north coast region between Kendall and Woolgoolga. This species occurs in warm-temperate rainforest on rainforest margins and moist eucalypt forest up to elevations of 800m asl on brown clay soils (DPIE 2021b).

In NSW Slender Marsdenia is found on the north coast in scattered sites from Barrington Tops to the Queensland border. This species typically occurs in subtropical and warm temperate rainforest and lowland moist or open eucalypt forest adjoining rainforest. Slender Marsdenia is associated with species including *Eucalyptus crebra*, *E. microcorys*, *E. acmenoides*, *E. saligna*, *E. propinqua*, *Corymbia intermedia* and *Lophostemon confertus*.

Threats

Threats to these species includes:

- Decline in health/loss of mature plants and a lack of seed based recruitment due to infection by *Austropuccinia psidii* (Myrtle Rust) in Scrub Turpentine.
- Degradation of habitat and competition from transformer weed species.
- Clearing from rural, agricultural or urban development leading to edge effects, degradation and further fragmentation.
- Habitat degradation and clearing due to forestry operations.
- Too frequent/intense fire destroying habitat and individual plants.
- Damage caused by inappropriate use of four-wheel drive vehicles.
- Road and track development and maintenance.
- Herbicide spraying along roads within areas of habitat or herbicide impacts during other weed control works.
- Grazing and trampling by cattle.



Survey Results

Both Scrub Turpentine and Milky Silkpod were detected within the subject site during site surveys. Suitable habitats for Slender Marsdenia occurs within the subject site, and records of this species occurs approximately 500m from the subject site. Additionally, species associated with Slender Marsdenia *E. microcorys* and *E. propinqua* and *Corymbia intermedia* occur within the subject site. Several records of Milky Silkpod occur within the subject site and within a 1km radius of the subject site. One record of Scrub Turpentine occurs approximately 100m from the subject site near Cedar Park picnic area.

BC Act Test of Significance

Table 15: BC Act Test of Significance - *Rhodamnia rubescens*, *Parsonsia dorrigoensis* and *Marsdenia longiloba*.

Significant Impact Criteria	Details
<p>a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.</p>	<p>Habitat requirements for <i>Rhodamnia rubescens</i>, <i>Parsonsia dorrigoensis</i> and <i>Marsdenia longiloba</i> are generally similar in distribution, vegetation and soils context. <i>Rhodamnia rubescens</i> and <i>Parsonsia dorrigoensis</i> were recorded within the eastern areas of the subject site during surveys.</p> <p>Further records of all three of these species have been recorded within a 2km radius of the subject site, therefore viable local populations of these species have been identified within the study area.</p> <p>It is estimated that approximately 69.75 ha of native vegetation including up to 0.22 ha of EEC rainforest vegetation will be removed/modified as a result of the proposal. The proposal should be designed to protect and avoid removal of <i>Rhodamnia rubescens</i> and <i>Parsonsia dorrigoensis</i> as well as potential <i>Marsdenia longiloba</i>. Indirect threats to this species include weed invasion, pollution and increased nutrients from runoff.</p> <p>Following construction, the subject site would continue to provide available habitats for recruitment of these threatened flora species. Provided that the recommendations for the protection of threatened flora and protocols for construction hygiene, weed control and pollution and waste are followed, the proposed construction of the proposed predator proof fence would not be capable of placing the long-term survival of known and potential local population at risk of extinction.</p>
<p>b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p> <p>(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.</p>	<p>Not Applicable to this threatened species.</p>
<p>c) In relation to the habitat of a threatened species or ecological community:</p> <p>(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p>	<p>It is estimated that up to 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation will be removed/modified as a result of the proposal. The proposal site is narrow and linear in nature, it is a 20m corridor to be partially cleared and in several locations, utilises existing roads and tracks.</p> <p>Both <i>Rhodamnia rubescens</i> and <i>Parsonsia dorrigoensis</i> were detected within dry rainforest PCT 1142 within the subject site. A further record of</p>



Significant Impact Criteria	Details
<p>(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p> <p>(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.</p>	<p><i>Parsonsia dorrigoensis</i> was also recorded within dry sclerophyll PCT 1215 in the south of the subject site.</p> <p>The habitat to be removed only represents a fraction of the extent of suitable habitat for known and potential viable local populations of these threatened flora species. No barrier to pollination or recruitment for these species will result from the proposal. The proposal site is narrow and linear in nature, it is a 20m corridor to be partially cleared and in several locations, utilises existing roads and tracks. The proposal will result in a very minor area of potential habitat for these species to be removed/modified in proportion to the extensive undisturbed habitats available to these species adjacent to the subject site and broader study area. However, any individuals of these species that currently occur within close proximity to the subject site will maintain the opportunity to recruit within the subject site post construction.</p> <p>Relative to the ecology of these species and the extent of interconnected habitat and the numbers of Bionet records of these species within the study area the habitats within the subject site to be removed/modified are likely to constitute important habitat for these species. However, as recommended, the threatened flora species recorded within the subject site should be retained and protected, therefore individual specimens are not impacted by the proposal and ensuring the long-term survival of the known and potential populations.</p>
<p>d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).</p>	<p>The proposal will not directly or indirectly affect an area of outstanding biodiversity value for the Gould's Petrel, Little Penguin population, Mitchell's Rainforest Snail or the Wollemi Pine.</p>
<p>e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.</p>	<p>As assessed and detailed in Section 7.2.2, the proposal contributes to the following KTP:</p> <ul style="list-style-type: none"> • Clearing of native vegetation <p>The proposed development may increase the potential impact of the following KPTs on this threatened species, listed under the BC Act:</p> <ul style="list-style-type: none"> • Invasion and establishment of exotic vines and scramblers • Invasion of native plant communities by exotic perennial grasses • Invasion, establishment and spread of Lantana (<i>Lantana camara</i>) <p>These KTPs have the potential to impact this species by reducing the area of potential habitats and recruitment habitats available for these threatened flora species. Recommendations are provided to assist in minimising these potential indirect impacts through retention and protection of threatened flora individuals within the subject site. Given these measures are followed, impacts from these KTPs are unlikely.</p>
<p>Conclusion</p>	<p>It is estimated that up to 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation will be removed/modified as a result of the proposal. This native vegetation provides potential habitat and recruitment habitat for these species. The proposal is not considered to significantly impact this species due to the following factors:</p> <ul style="list-style-type: none"> • <i>Rhodamnia rubescens</i> and <i>Parsonsia dorrigoensis</i> detected within the subject site will be retained and protected. • The identification of these species will be communicated to construction personnel prior to beginning construction works. • The extent of native vegetation to be removed is linear in nature and a minute proportion of the extent of potential habitat for these species existing within the study area. • The proposal will not fragment or isolate any areas of this habitat for these species.



Significant Impact Criteria	Details
	<ul style="list-style-type: none">• Recommendations have been made to avoid and minimise the likelihood of potential impacts of KTPs on this species within the subject site.



Green-thighed Frog (*Litoria brevipalmata*) and Giant Barred Frog (*Mixophyes iterates*)

BC Act Status: Endangered (*Mixophyes iterates*), Vulnerable (*Litoria brevipalmata*)

Distribution and ecology

The Green-thighed Frog occurs in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. This species is thought to forage in leaf litter. Breeding occurs from spring to autumn following heavy rainfall, green-thighed Frogs prefer flooded areas and larger temporary pools for breeding (DPIE 2021b).

The Giant Barred Frog is distributed along the coast and ranges from Eumundi in south-east Queensland to Warrimoo in the Blue Mountains. Giant Barred Frogs are found along freshwater streams with permanent or semi-permanent water, generally at lower elevation. Moist riparian habitats such as rainforest or wet sclerophyll forest are favoured for the deep leaf litter that they provide for shelter and foraging, as well as open perching sites on the forest floor. However, this species will occur in other riparian habitats, such as drier forest or degraded riparian remnants (DPIE 2021b).

Threats

Threats to these species includes habitat loss and modification, damage to riparian vegetation, disease (Chytrid fungus), changes to natural water flows and quality and damage to habitat (vegetation removal, disturbance and turbidity) by domestic stock and other agricultural activities. Other threats include dense weed infestations and predation of individuals and destruction of eggs by feral pigs.

Survey Results

The Green-thighed Frog and the Giant Barred Frog were not detected in the subject site during site survey. Site survey was however diurnal and undertaken during the winter months therefore, was at a period of low activity for these species. 55 records of the Giant Barred Frog occur within a 10km radius from the subject site, the nearest record being approximately 600m from the subject site. The Green-thighed Frog has only three records of this species within a 10km study area, however the nearest record is located approximately 2km to the east of the subject site. The subject site contains potential habitat for these threatened species.



BC Act Test of Significance

Table 16: BC Act Test of Significance – Green-thighed Frog and Giant Barred Frog

Significant Impact Criteria	Details
<p>a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.</p>	<p>The subject site includes aquatic habitat, aquatic vegetation and riparian habitats of rainforest and wet sclerophyll forest suitable for these threatened frogs and also exhibits areas of areas of deep leaf litter. Adult Giant Barred Frogs reside in deep leaf litter and thick understory vegetation on the forest floor outside of breeding season. During breeding season, Green-thighed Frogs eggs are laid in large temporary pools and flooded areas however this species may use other aquatic habitats for breeding. Giant Barred Frogs eggs are fertilised in the water, then kicked onto a suitable bank (e.g. overhanging or steeply sloped). Only limited suitable breeding habitat for the Giant Barred Frog occurs within the subject site. Adult individuals may have potential to occur within the subject site from time to time.</p> <p>Any local populations of these species are likely to fulfil the majority of their lifecycle requirements beyond the subject site.</p> <p>A small amount of potential habitat for these species will be impacted as part of this proposal however better-quality potential habitat occurs beyond the subject site where deep leaf litter and more suitable breeding habitat attributes occur. Given this, and the extent of local habitat that may currently support these species, the loss of vegetation and disturbance to aquatic habitats required for the proposal, while an incremental and cumulative loss of habitat, is not likely to be capable of disrupting the lifecycle of a local population of either of these threatened amphibians such that it will place either species at risk of extinction.</p>
<p>b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p> <p>(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.</p>	<p>Not Applicable to this threatened species.</p>
<p>c) In relation to the habitat of a threatened species or ecological community:</p> <p>(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p> <p>(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p> <p>(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.</p>	<p>It is estimated that approximately 69.75 ha of native vegetation including up to 0.22 ha of EEC rainforest vegetation will be removed/modified as a result of the proposal. In addition, the proposed predator proof fence will intersect a total of six separate ephemeral riparian/aquatic habitats across the subject site which may provide potential habitat for these threatened amphibian species. The habitats available to these species is not expected to be fragmented or isolated as a result of the proposal and connectivity will be maintained via the use of appropriately sized mesh.</p> <p>Habitat to be removed represents a minute proportion of the habitat available to the subject species in the subject site and study area, the subject site also includes an aquatic habitat which may provide potential breeding habitat for these species, however this would form a minute area of potential breeding habitat within the study area for this species. Aquatic habitats within the subject site are expected to only be temporarily disturbed during construction and return to an undisturbed habitat post-construction.</p> <p>The habitat to be removed/modified is unlikely to fragment or isolate any areas of the existing vegetation or habitats. Connectivity with adjacent habitats for these species will not be impacted. Given this, the proposal is</p>



Significant Impact Criteria	Details
	unlikely to impact the long-term survival of these species within the study area.
d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).	The proposal will not directly or indirectly affect an area of outstanding biodiversity value for the Gould's Petrel, Little Penguin population, Mitchell's Rainforest Snail or the Wollemi Pine.
e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	<p>As per assessed in Section 7.2.2, the proposed development contributes to the following KTP:</p> <ul style="list-style-type: none"> • Clearing of native vegetation <p>The proposed development may increase the potential impact of the following KTP's on this threatened species, listed under the BC Act:</p> <ul style="list-style-type: none"> • Infection of frogs by amphibian <i>chytrid</i> causing the disease chytridiomycosis • Invasion, establishment and spread of Lantana (<i>Lantana camara</i>) <p>These KTPs have the potential to impact this species by reducing the area of habitats available and potentially cause disease to these species. Recommendations are provided to assist in minimising potential indirect impacts on this threatened species. Given these measures are followed impacts from these KTPs are unlikely.</p>
Conclusion	<p>It is estimated that approximately 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation will be removed/modified as a result of the proposal. In addition, the proposed predator proof fence will intersect a total of six separate ephemeral riparian/aquatic habitats across the subject site which may provide potential habitat for these threatened amphibian species. The proposal is not considered to significantly impact this species due to the following factors:</p> <ul style="list-style-type: none"> • The extent of native vegetation to be removed/modifies and the aquatic habitats to be disturbed is a minute proportion of the extent of foraging and breeding habitat available for this species which exists within the study area. • The proposal will not fragment or isolate any areas of this foraging habitat. • Connectivity will remain unaffected throughout the subject site via the use of appropriately sized mesh used for the fence design in areas of suitable habitats for these species. • The Green-thighed Frog and Giant Barred Frog were not detected during diurnal searches. • Recommendations have been made to minimise the likelihood of potential impacts of KTPs within the subject site.



A-5-3 Microchiropteran Bats: *Miniopterus australis* (Little Bent-winged Bat), *Micronomus norfolkensis* (Eastern-Coastal Free-tailed Bat) and *Scoteanax rueppellii* (Greater Broad-nosed Bat)

BC Act Status: Vulnerable

Distribution

The Little Bent-wing Bat is found on the East coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW, preferring moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. They are generally found in well-timbered areas and roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day. At night they forage for small insects beneath the canopy of densely vegetated habitats (DPIE 2021b).

The Eastern Coastal Free-tailed Bat is found along the east coast from south Queensland to southern NSW, occurring in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. This species mainly roosts in tree hollows but will also roost under bark or in man-made structures (DPIE 2021b).

The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland, being widespread on the New England Tablelands in NSW, although it does not occur at altitudes above 500m. This species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, most commonly occurring in tall wet forest. The species usually roosts in tree hollows but has also been found in buildings (DPIE 2021b).

Threats

Threats to these species include: disturbance of colonies, especially in nursery or hibernating caves, bio accumulation of pesticides on insects and in water consumed by bats or adjacent to foraging areas, resulting in poisoning of individuals; predation from feral cats, particularly found in the vicinity of maternity caves, winter roosts and roosts within culverts, tunnels and under bridges, loss of hollow-bearing trees or foraging and/or roosting habitat (DPIE 2021b).

Survey Results

The Little Bent-wing Bat was confidently detected in the subject site during nocturnal site survey with the Eastern Coastal Free-tailed Bat and Greater Broad-nosed Bat identified as possibly occurring within the site but could not be confirmed to be present. Notably, there are 78 records of the Little Bent-wing Bat, 12 records of the Eastern Coastal Free-tailed Bat and 12 records of the Greater Broad-nosed Bat species that occur within a ten kilometre radius of the subject site (DPIE 2021a). The subject site has the potential to provide limited foraging habitats but extensive roosting habitat in the form of hollow-bearing trees for these bat species.



BC Act Test of Significance

Table 17: BC Act Test of Significance - Microchiropteran Bats

Significant Impact Criteria	Details
<p>a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.</p>	<p>The subject site is considered to provide potential foraging and extensive roosting habitat for these species. All these microbat species require home ranges that by far exceed the subject site at least seasonally depending on lifecycle stage or due to their ecology (Churchill 2009). Therefore, ecologically, while an individual/s may use the subject site for foraging, the local populations of these species would extend well beyond the subject site to meet all their full lifecycle requirements.</p> <p>The minor vegetation loss relative to the broader extensive undisturbed site area, and the temporary disruption of foraging habitat associated with the proposal, are unlikely to impact on the foraging and roosting habitats for these species due to the planned retention, where possible, of an extensive number of hollow-bearing trees (HBTs) on the site. Given this planned retention of the HBTs where possible for this proposal, the breeding success and lifecycle of the Little Bent-winged Bat individuals and any possible individuals of the Eastern Coastal Free-tailed Bat and Greater Broad-nosed Bat within the subject site, would not be impacted by this proposal and therefore, would not place a local population of the subject bats at risk of extinction.</p>
<p>b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p> <p>(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.</p>	<p>Not applicable to these threatened species.</p>
<p>c) In relation to the habitat of a threatened species or ecological community:</p> <p>(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p> <p>(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p> <p>(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.</p>	<p>The proposal will result in the removal/modification of up to 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation to establish the proposed predator proof fence.</p> <p>The roosting habitat includes hollow-bearing trees, which are planned to be retained where possible with the habitat to be removed, representing a small proportion of the total habitat available to the subject species in the subject site and study area as well as within the home range of the subject species.</p> <p>The habitat to be removed and modified is unlikely to fragment or isolate any areas of the existing vegetation for these species. Connectivity will remain surrounding the subject site where native vegetation continues to the east and west.</p> <p>Given this, the planned retention of roosting HBTs and the fact that microbats are highly mobile species that will readily traverse gaps in vegetation for foraging and roosting habitats, the proposal is unlikely to impact the long-term survival of the subject microbats within the study area.</p>
<p>d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).</p>	<p>The proposed development will not directly or indirectly affect an area of outstanding biodiversity value for the Gould's Petrel, Little Penguin population, Mitchell's Rainforest Snail or the Wollemi Pine.</p>



Significant Impact Criteria	Details
<p>e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.</p>	<p>As assessed and detailed in Section 7.2.2, the proposal contributes to the following KTP:</p> <ul style="list-style-type: none"> • Clearing of native vegetation <p>The proposal may increase the potential impact of the following KTPs on these threatened species, listed under the BC Act:</p> <ul style="list-style-type: none"> • Invasion and establishment of exotic vines and scramblers • Loss of hollow-bearing trees (HBTs) • Removal of dead wood and dead trees <p>These KTPs have the potential to impact this species by reducing the area of potential foraging and roosting habitats available for these microbat species. Recommendations are provided to assist in minimising these potential indirect impacts through retention of as many hollow-bearing trees as is possible on the site. Given these measures are followed, impacts from these KTPs are unlikely.</p>
<p>Conclusion</p>	<p>The proposal will remove up to 69.75 ha of native vegetation which provides both potential (limited) foraging and extensive roosting habitat for these threatened microbats. The proposal is not considered to significantly impact these species due to the following factors:</p> <ul style="list-style-type: none"> • The extent of native vegetation to be removed is a relatively marginal proportion of the extent of foraging vegetation for this species which exists within the study area. • The disturbance to potential foraging habitats within the subject site would be temporary and restricted to daylight hours. • These highly mobile species will readily traverse gaps in existing vegetation to access foraging habitats in the study area and within the extent of their home range. • The proposal will not fragment or isolate any areas of this foraging or roosting habitat. • Connectivity for these species will remain unaffected throughout the subject site and study area. • No evidence of roosting or foraging microbats were detected opportunistically during diurnal surveys. • Potential roosting habitats will be retained where it is possible to do so with respect to retained HBTs for the Little Bent-winged Bat, the Eastern Coastal Free-tailed Bat and the Greater Broad-nosed Bat. • Recommendations have been made to minimise the likelihood of potential impacts of KTPs within the subject site.



A-5-4 Threatened Forest Owls: *Ninox strenua* (Powerful Owl), *Tyto novaehollandiae* (Masked Owl) and *Tyto tenebricosa* (Sooty Owl)

BC Act Status: Vulnerable

Distribution and ecology

The Powerful Owl is endemic to eastern and south-eastern Australia, occurring mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria, widely distributed throughout the eastern forests in NSW from the coast inland to the tablelands. Typically, this species is found in wet and hilly sclerophyll forest with dense gullies adjacent to more open forest. This species also occur in smaller, drier forest, provided that there are some large tree hollows and an adequate supply of prey. The species is considered to occur at low densities across most of its eastern range with rare occurrence along the Murray River (DPIE 2021b).

The Masked Owl occurs along a broad coastal band, within about 300km from the coast around most of the Australian mainland. Overall records for this species falls within approximately 90% of NSW, also occurring throughout Tasmania. There is no seasonal variation in their distribution. The species is found in forest and open woodland with adjacent clearings from sea level to 1100m. They roost by day in dense foliage of tall trees (such as moist eucalypt forested gullies) using large tree hollows or sometimes caves for nesting and also occupy holes between rocks (DPIE 2021b).

The Sooty Owl occupies the eastern-most one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. The species occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest as well as moist eucalypt forests. They roost by day in the hollow of a tall forest tree or in heavy vegetation and hunt at night for small ground or tree-dwelling mammals. They nest in very large tree hollows (DPIE 2021b).

Threats

Threats to these owl species include: clearing of habitat with loss of mature hollow-bearing trees and changes to forest and woodland structure to make way for agriculture, forestry and other developments where this leads to fewer such trees in the future and affects the quality of ground cover for mammal prey; secondary poisoning from rodenticides; threat of being hit by vehicles (Masked Owl).

Survey Results

The Powerful Owl is known to occur in the area of the subject site with 59 local records documented, several within close proximity to the subject site (DPIE 2021a). Identification was confirmed through call playback recorded during site surveys supported by the presence of several large hollows found to occur throughout the subject site which are suitable nesting habitat for this species.

The Masked Owl was considered to potentially occur due to suitable nesting habitat present on site although due to the lack of an abundance of diverse prey required by this species, the site was considered to have at best the potential for foraging by this species as part of a larger range. Local records (27) documented for the Masked Owl included two within 10 km of the subject site (DPIE 2021a). These records considered together with results of the survey assessment, support the consideration of a moderate chance of occurrence on/in the vicinity of the subject site for this species.

The Sooty Owl was not recorded during site surveys although 39 local records for this species are documented within a 10km radius from the subject site (DPIE 2021a). Local records confirm their



occurrence to be within 2 km of the subject site. Considering the limited desirable vegetation existing within the subject site that is a large constraint for this species, despite several large hollows that occur throughout the subject site, this owl species was assessed to have a fair potential to occur on/within the vicinity of the subject site.

BC Act Test of Significance

Table 18: BC Act Test of Significance – Threatened Forest Owls

Significant Impact Criteria	Details
<p>a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.</p>	<p>The subject site is considered to provide potential foraging and extensive roosting habitat for these threatened forest owl species. All three of these owl species have known home ranges that by far exceed the footprint of subject site at least seasonally (except for the Masked Owl which has no seasonal variation in its distribution), depending on lifecycle stage or due to their ecology. Notably, Powerful Owl pairs mate for life (30 yrs) and defend their territory all-year round. Considering the large number of HBTs recommended to be retained, the linear nature of the proposal and that the subject site adjoins extensive available high-quality foraging habitat and abundant breeding habitat, the site activity due to the proposal is not expected to have an adverse effect on the life cycle of these threatened owl species. Therefore, ecologically, while an individual/s may use the subject site for foraging and roosting, the local populations of these species would extend well beyond the subject site to meet all their full lifecycle requirements.</p> <p>Overall, the minor vegetation removal/modification relative to the broader extensive areas of forest vegetation to the north, east and west of the subject site, is unlikely to significantly impact on both the foraging and roosting habitats for these owl species such that it would place a local population of the subject threatened owl species at risk of extinction.</p>
<p>b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p> <p>(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.</p>	<p>Not Applicable to these threatened species.</p>
<p>c) In relation to the habitat of a threatened species or ecological community:</p> <p>(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p> <p>(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p> <p>(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the</p>	<p>The proposed activity will result in the removal of up to 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation to establish the proposed predator proof fence. This is a small proportion of the total area of vegetation that extends beyond the footprint of the subject site into the broader study area which would form a minor component of the extent of home range for these owl species.</p> <p>The habitat includes abundant suitable HBTs which are recommended to be retained where possible. The habitat to be removed represents a small proportion of the total habitat available to the subject species within the broader study area and extended home ranges for the subject species.</p> <p>Given the persistence of home range requirements beyond the subject site and the planned retention of abundant HBTs for nesting habitats for these species, and the fact that these owls are highly mobile species that will readily traverse the proposed habitat removal/modification. It is</p>



Significant Impact Criteria	Details
species or ecological community in the locality.	unlikely that the proposal would impact the long-term survival of the subject owls within the study area.
d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).	The proposed activity will not directly or indirectly affect an area of outstanding biodiversity value for the Gould's Petrel, Little Penguin population, Mitchell's Rainforest Snail or the Wollemi Pine.
e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	<p>As assessed and detailed in Section 7.2.2, the proposed development contributes to the following KTP:</p> <ul style="list-style-type: none"> • Clearing of native vegetation <p>The proposed development may increase the potential impact of the following KPTs on this threatened species, listed under the BC Act:</p> <ul style="list-style-type: none"> • Invasion and establishment of exotic vines and scramblers • Loss of HBTs • Removal of dead wood and dead trees <p>These KTPs have the potential to impact this species by reducing the area of potential foraging and roosting habitats available for these owl species. Recommendations are provided to assist in minimising these potential indirect impacts through retention of an abundance of HBTs on the site. Given these measures are followed, impacts from these KTPs are unlikely.</p>
Conclusion	<p>The proposed project will remove/modify up to 69.75 ha of native vegetation within the linear 20m corridor which provides both potential (limited) foraging and extensive roosting habitat for these threatened owls. However, the proposed project activities are not considered to significantly impact these species due to the following factors:</p> <ul style="list-style-type: none"> • The extent of native vegetation to be removed already comprises limited desirable vegetation with the abundance and diversity of prey species required for these owls likely to be scarce within the subject site which is already a large constraint for these owls. Since this vegetation forms a very small component of a much larger foraging territory for these owl species, the native vegetation beyond the subject site will provide extensive foraging opportunities for these owls. • Recommendations have been made to retain HBTs where possible within the subject site. • Recommendations have been made to minimise the likelihood of potential impacts of KTPs within the subject site.



A-5-5 Threatened Woodland Birds: *Climacteris picumnus victoriae* (Brown Treecreeper) and *Artamus cyanopterus cyanopterus* (Dusky Woodswallow)

BC Act Status: Vulnerable

Distribution and ecology

The Brown Treecreeper is endemic to eastern Australia and occurs in eucalypt woodlands (including Box-Gum Woodland) and in dry open forest of the inland slopes and plains inland of the Great Dividing Range, spending much of their time foraging on the ground but also along the bark of trees. The species mainly inhabit woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey and will stay in the same area all year round. The species nest in suitable tree hollows or similar site and use hollows to shelter from predators (DPIE 2021b).

The Dusky Woodswallow has an extended range mostly from Atherton Tableland, QLD, down to Tasmania and west to Eyre Peninsula, SA. The species primarily inhabits dry, open eucalypt forests and woodlands with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, as well as groundcover of grasses or sedges and fallen woody debris. These woodland birds adhere to seasonal migration and movements are spontaneous. They roost communally, building nests in a tree fork, behind bark, in a stump hollow or in a fence post, about 1 m - 10 m above the ground.

Threats

Threats to these species include: loss of habitat as a result of agriculture and residential development; fragmentation of woodland and forest remnants which isolates populations and causes local extinctions; ongoing degradation of habitat particularly the loss of tree hollows and fallen timber; lack of regeneration of eucalypt overstorey in woodland due to overgrazing and too-frequent fires; predation by feral cats and foxes.

Survey Results

Suitable foraging and nesting habitats for the Brown Treecreeper occur within the subject site. Although only one (1) member of this species was recorded within the study area (DPIE 2021a), the Brown Treecreeper was recorded within the subject site during site surveys.

Areas of the subject site exhibit understory, shrub species and woody debris which is suitable habitat for the Dusky Woodswallow. Only three records in the study area with the nearest record approximately 1km from the subject site (DPIE 2021a). Since this species was recorded within the subject site during site surveys, it is known to occur there.

BC Act Test of Significance

Table 19: BC Act Test of Significance – Threatened Woodland Birds

Significant Impact Criteria	Details
a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population	Both woodland bird species were recorded on site and are known to occur there. The subject site is considered to provide potential foraging and extensive roosting habitat for the threatened woodland bird although both species have known home ranges that by far exceed the footprint of the subject site. The Dusky Woodswallow adheres to seasonal and spontaneous migration, whereas the Brown Treecreeper will remain in the



Significant Impact Criteria	Details
of the species is likely to be placed at risk of extinction.	<p>same area all year round. Due to their typical foraging and nesting behaviour as well as their ecology, the minor vegetation loss relative to the broader extensive area of forest vegetation to the east and west of the subject site and the large number of HBTs planned to be retained, the temporary disruption of foraging habitat associated with the proposed project is unlikely to adversely impact on the life cycle of the species and is therefore unlikely to place them at risk of extinction.</p> <p>Since the proximity of equally desirable high-value native vegetation exists east and west of the linear site and an abundance of suitable HBTs are planned to be retained, a viable population of the subject birds is not likely to be placed at risk of extinction.</p>
<p>b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p> <p>(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.</p>	Not Applicable to these threatened species.
<p>c) In relation to the habitat of a threatened species or ecological community:</p> <p>(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p> <p>(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p> <p>(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.</p>	<p>The proposed activity will result in the removal of up to 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation to establish the proposed predator proof fence. This is a small proportion of the total area of vegetation that extends beyond the footprint of the subject site into the broader study area which would form a minor component of the extended home range for these woodland bird species.</p> <p>The habitat includes abundant suitable HBTs planned to be retained where possible, with the habitat to be removed representing a small proportion of the total habitat available to the subject species in the subject site and study area as well as within the extended and continuous home range of native vegetation for the subject species to the east and west of the linear 20m corridor that comprises the subject site.</p> <p>Given the persistence of home range requirements in proximity east and west of the subject site and the planned retention of abundant roosting HBTs, the spontaneous nature of these birds (in the case of the Dusky Woodswallow) suggests that the proposed habitat activities is unlikely to impact the long-term survival of the subject birds within the study area. For the Brown Treecreeper, due to the retention of abundant HBTs on site and the proximity of equally suitable foraging and roosting habitat east and west of the subject site, the proposed project activities of removal will not likely modify/fragment the habitat that the long-term survival of the species would be impacted in the study area.</p>
d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).	The proposed project will not directly or indirectly affect an area of outstanding biodiversity value for the Gould's Petrel, Little Penguin population, Mitchell's Rainforest Snail or the Wollemi Pine.
e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	<p>As assessed and detailed in Section 7.2.2, the proposed development contributes to the following KTP:</p> <ul style="list-style-type: none"> • Clearing of native vegetation



Significant Impact Criteria	Details
	<p>The proposed development may increase the potential impact of the following KTPs on this threatened species, listed under the BC Act:</p> <ul style="list-style-type: none"> • Invasion and establishment of exotic vines and scramblers • Loss of HBTs • Removal of dead wood and dead trees <p>These KTPs have the potential to impact this species by reducing the area of potential foraging and roosting habitats available for these woodland bird species. Recommendations are provided to assist in minimising these potential indirect impacts through retention of an abundance of HBTs on the site. Given these measures are followed, impacts from these KTPs are unlikely.</p>
<p>Conclusion</p>	<p>The proposed project activities will remove up to 69.75 ha of native vegetation within the linear 20m corridor which provides both potential (limited) foraging and extensive roosting habitat for these threatened woodland birds. However, the proposed project activities are not considered to significantly impact these species due to the following factors:</p> <ul style="list-style-type: none"> • The extent of native vegetation to be removed comprises a very small component of a much larger foraging territory for these woodland birds with the native vegetation to the east and west and beyond the subject site that will provide extended foraging opportunities for these birds. • Recommendations have been made to retain an abundance of HBTs in as much as it is possible to do so on the subject site. • Additional woodland bird species that may be present within the site but were not recorded cannot be excluded from the habitat assessment and are considered here in conjunction with the survey results so as not to discount the likelihood of occurrence of other woodland bird species. • Recommendations have been made to minimise the likelihood of potential impacts of KTPs within the subject site.



A-5-6 Threatened Reptiles: *Hoplocephalus stephensii* (Stephens' Banded Snake)

BC Act Status: Vulnerable

Distribution and ecology

Stephens' Banded Snake is found along the Coast and ranges from Southern Queensland to Gosford in NSW, occurring in rainforest and eucalypt forests and rocky areas up to 950 m in altitude (DPIE 2021b). The species is nocturnal and shelters between loose bark and tree trunks, amongst vines or in hollow trunk limbs, rock crevices or under slabs during the day.

Threats

Threats to Stephens' Banded Snake includes: clearing and fragmentation of habitat; forestry practices which result in loss of old or dead trees; too frequent burning for fuel reduction or grazing management which destroys old and dead trees and removes understorey vegetation; illegal collection of snakes from the wild; and poor knowledge of the species' habitat preferences.

Survey Results

Stephens' Banded Snake habitat requirements include loose bark, vines or hollow trunk limbs for shelter. The subject site provides potential shelter resources by way of loose bark, vines and hollow trunk limb. Three local records are documented to occur within 2km from the subject site (DPI 2021a). However, this species was not recorded during site surveys and all information taken together, was assessed for the species to have a fair chance of occurrence on the subject site.

BC Act Test of Significance

Table 20: BC Act Test of Significance – Stephen's Banded Snake

Significant Impact Criteria	Details
<p>a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.</p>	<p>Although Stephens' Banded Snake was not recorded during site surveys and based on local records, three (3) listed occurrences of the species was documented within 2km from the subject site (DPI 2021a), the subject site provides potential shelter resources by way of loose bark, vines and hollow trunk limbs and this information in combination, was assessed to expect the species to have a fair chance of occurrence on the subject site.</p> <p>The proposed construction of a predator proof fence is unlikely to pose any added risk to the threatened snake species within the area. Given the proposed project activities will not remove any significant area of habitat proportionate to the remaining habitats available, and recommendations have been made to ensure the connectivity for this species is maintained, the subject site will continue to provide foraging habitats and movement corridors for this species. Consequently, an adverse effect on the lifecycle of this species is not expected as a result of the proposed site activities. As such, it is considered unlikely to place a local viable population of Stephen's Banded Snake eat risk of extinction.</p>
<p>b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p>	<p>Not Applicable to these threatened species.</p>



Significant Impact Criteria	Details
<p>(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.</p>	
<p>c) In relation to the habitat of a threatened species or ecological community:</p> <p>(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p> <p>(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p> <p>(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.</p>	<p>The proposed activity will result in the removal of up to 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation to establish the proposed predator proof fence. Recommendations for a 3cm diameter for mesh holes in the fence will unlikely deter any resident snake species access through the fencing to adjacent areas beyond the subject site. The subject site fence is likely to act as a key local corridor to high-value vegetation for foraging, potential refuge and breeding. Since the modified site forms a relatively small proportion of the total area of vegetation that extends beyond the footprint of the subject site into the broader study area, the habitat to be removed represents</p> <p>The habitat includes abundant suitable HBTs planned to be retained where possible, with the habitat to be removed is unlikely to fragment or isolate any areas of the existing vegetation provided that connectivity recommendations are followed.</p> <p>The planned retention of abundant roosting HBTs suggests that the proposed habitat activities is unlikely to impact the long-term survival of the subject snakes which rely on hollows in trees within the study area. Given these considerations, the proposed project activities of removal will not likely modify/fragment the habitat such that the long-term survival of the species would be impacted in the study area.</p>
<p>d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).</p>	<p>The proposed project will not directly or indirectly affect an area of outstanding biodiversity value for the Gould's Petrel, Little Penguin population, Mitchell's Rainforest Snail or the Wollemi Pine.</p>
<p>e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.</p>	<p>As assessed and detailed in Section 7.2.2, the proposed development contributes to the following KTP:</p> <ul style="list-style-type: none"> • Clearing of native vegetation <p>The proposed development may increase the potential impact of the following KPTs on this threatened species, listed under the BC Act:</p> <ul style="list-style-type: none"> • Invasion and establishment of exotic vines and scramblers • Loss of HBTs • Removal of dead wood and dead trees <p>These KTPs have the potential to impact this species by reducing the area of potential foraging and breeding habitats available for these woodland bird species. Recommendations are provided to assist in minimising these potential indirect impacts through retention of an abundance of HBTs that can be used for shelter of Stephens' Banded Snake species on the site. Given these measures are followed, impacts from these KTPs are unlikely.</p>
<p>Conclusion</p>	<p>The proposed project activities will remove up to 69.75 ha of native vegetation within the linear 20m corridor which provides both potential (limited) foraging and extensive breeding habitat for these threatened snakes. However, the proposed project activities are not considered to significantly impact these species due to the following factors:</p> <ul style="list-style-type: none"> • The extent of native vegetation to be removed comprises a very small component of a much larger foraging territory for these snakes with the native vegetation to the east and west and beyond



Significant Impact Criteria	Details
	<p>the subject site that will provide extended foraging, shelter and breeding opportunities for these snakes.</p> <ul style="list-style-type: none">• Recommendations have been made to retain an abundance of HBTs in as much as it is possible to do so on the subject site.• Recommendations have been made to minimise the likelihood of potential impacts of KTPs within the subject site.



A-5-7 Koala (*Phascolarctos cinereus*)

BC Act Status: Endangered

Distribution

The listed species range for the Koala is from north-eastern Queensland to the Victorian border, however as a result of translocations, a number of populations can be found outside of this range (DAWE 2020b). In NSW, the distribution of the Koala extends as far west as the Darling River Plains, Cobar Penneplain and Murray-Darling Depression bioregions (DAWE 2021b). Koala distribution is highly dependent on altitude (<800 metres above sea level), temperature and in some instances, leaf moisture (DAWE 2021b). Koala distribution is highly dependent on altitude (<800 metres above sea level), temperature and in some instances, leaf moisture (DAWE 2021b).

The Threatened Species Scientific Committee estimated that the Koala population between 1990 and 2010 in NSW declined at a rate of 33%, with numbers falling from 31,400 to 21,000. These numbers predicted to be much fewer currently (DAWE 2021b).

Koalas are found in a range of Eucalypt forest and woodland communities, including coastal forests, rainforest, riparian areas, swamp sclerophyll forests, heathland and shrubland.

Threats

The key existing threats to the Koala are ongoing habitat loss and fragmentation, vehicle strike and predation by the domestic/feral dog. The Australian Government also recognises the significant threat of extreme environmental conditions (i.e. extreme heat, drought, fire) and disease (in particular Chlamydia infections and Koala Retrovirus) to the Koala (DAWE 2020b).

Survey Results

The Koala was not detected within the subject site by direct observation however, secondary evidence of the Koala was detected by scat within the southern part of the subject site. Numerous records (334) of the Koala occur in the study area with the nearest records occurring approximately 10m from the subject site. Two tree species listed under the DPIE NSW Koala Strategy (DPIE 2021f) as, *High Preferred Use* trees for the Koala in the North Coast Koala Management Area (KMA), these include *Eucalyptus microcorys* (Tallowwood) and *Eucalyptus propinqua* (Small-fruited Grey Gum) were recorded in abundance within the subject site.



BC Act Test of Significance

Table 21: BC Act Test of Significance - Koala

Significant Impact Criteria	Details
<p>a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.</p>	<p>The Koala was recorded by scat within the subject site during the site survey; and several records occur within the study area (DPIE 2021a). The site vegetation in relation to the surrounding vegetation forms part of extensive Dry Sclerophyll Forests that extends beyond the site and maintains connectivity to the north, east and west. This vegetation within the subject site is likely to act potential refuge for transient individuals. Given this and the cited home ranges for the Koala, the local population would extend well beyond the subject site.</p> <p>The proposed construction of a predator proof fence is unlikely to pose any added risk of road strike within the subject site. Given the proposal will not remove any significant area of habitat proportionately to the remaining habitats available and that recommendations have been made to ensure the connectivity for populations of this species is maintained, the subject site will continue to provide foraging habitats and movement corridors for this species, therefore an adverse effect on the lifecycle of this species is not expected as a result of the proposal and is considered unlikely to place a local viable population at risk of extinction.</p>
<p>b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p> <p>(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.</p>	<p>Not Applicable to this threatened species.</p>
<p>c) In relation to the habitat of a threatened species or ecological community:</p> <p>(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p> <p>(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p> <p>(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.</p>	<p>It is estimated that approximately 69.75 ha of native vegetation will be removed/modified as a result of the proposal. Two species of high use Koala Food Trees were recorded extensively throughout the subject site including Tallowwood and Small-fruited Grey Gum. These species occur extensively throughout the subject site and likely extend into the broader study area in similar numbers.</p> <p>The vegetation within the subject site occurs as a linear 20m corridor with extensive in-tact vegetation throughout the reserve. Areas within the reserve are likely to act as a key local corridor, potential refuge and low value foraging habitat for the Koala.</p> <p>Habitat to be removed represents a minute proportion of the habitats available to the subject species in the subject site and the broader study area. The habitat to be removed and/or modified is unlikely to fragment or isolate any areas of the existing vegetation, provided that connectivity recommendations are followed. The proposed fence may create a movement barrier for this species that may isolate some areas of habitat. Connectivity for Koala movements will be maintained throughout the reserve to the north, east and west by ameliorative measures of monitoring and capture and release methods where required. Given this, and that the Koala is a mobile species that will readily traverse gaps in vegetation for foraging, the proposal is unlikely to impact the long-term survival of this species within the study area.</p>



Significant Impact Criteria	Details
<p>d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).</p>	<p>The proposal will not directly or indirectly affect an area of outstanding biodiversity value for the Gould's Petrel, Little Penguin population, Mitchell's Rainforest Snail or the Wollemi Pine.</p>
<p>e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.</p>	<p>As per assessed in Section 7.2.2, the proposed development contributes to the following KTP:</p> <ul style="list-style-type: none"> • Clearing of native vegetation <p>The proposal may increase the potential impact of the following KTP's on this threatened species, listed under the BC Act:</p> <ul style="list-style-type: none"> • Invasion and establishment of exotic vines and scramblers <p>These KTPs have the potential to impact this species by reducing the area of habitats available for Koala movements. Recommendations are provided to assist in minimising potential indirect impacts on this threatened species. Given these measures are followed impacts from these KTPs are unlikely.</p>
<p>Conclusion</p>	<p>The proposal will remove/modify up to 69.75 ha of native vegetation within potential corridor habitat for the Koala. The proposal is not considered to significantly impact this species due to the following factors:</p> <ul style="list-style-type: none"> • Foraging habitat for this species to be removed within the subject site is a minute proportion of the extent of corridor vegetation and available habitats for this species existing within the study area. • Recommendations have been made to retain Koala Food Trees Tallowwood and Small-fruited Grey Gum within the subject site where possible. • The proposal will not fragment or isolate any areas of this corridor habitat. Connectivity and movements will remain unaffected throughout the subject site by the incorporation of ameliorative measures. • Equally high-value habitats will remain available for the Koala in the vegetation adjacent to and beyond the subject site. • Increases of human activity and the presence of domestic dogs are not expected to increase. • Recommendations have been made to minimise the likelihood of potential impacts of KTPs within the subject site.



A-5-8 Spotted-tailed Quoll (*Dasyurus maculatus*)

BC Act Status: Vulnerable

Distribution

The Spotted-tailed Quoll was historically widely distributed across the east of Australia known from as far north as southeast Queensland to as far south as Tasmania (DAWE 2021b). The mainland subspecies however has reduced in population dramatically with this species now generally confined to within 200km of the coast. The Department of Agriculture, Water and the Environment (2021b) list the current known locations as:

- Hunter Valley, Taree, Port Macquarie and Coffs Harbour through to the gorges and escarpments of the New England Tableland;
- Local populations in the south of the state (i.e. Kosciuszko NP and coastal national parks);
- Isolated records near Hay; and
- Disjunct populations between the Border Ranges and the Blue Mountains/Illawarra area.

Female Spotted-tailed Quolls occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares. These species are known to traverse their home ranges along densely vegetated creek lines (DPIE 2021b).

Threats

The DPIE (2021b) list the following key threats to the Spotted-tailed Quoll:

- Habitat loss and degradation - clearing, timber harvesting and forest management practices which also result in prey reduction;
- Predation - by Red Foxes, Dingos and domestic dogs;
- Fire - both short and long-term;
- Direct killing - largely by landholders in response to lost poultry;
- Road mortality;
- Poisoning through Cane Toads; and
- 1080 baiting.

Survey Results

Targeted surveys for this species were undertaken by incorporating PIR cameras set with tubes baited with chicken necks to camera trapping surveys for ground-dwelling mammals. The Spotted-tailed Quoll was not recorded during site survey however the Ngambaa Nature Reserve Plan of Management lists the Spotted-tailed Quoll as known to occur (NPWS 2004). A total of 32 records of the Spotted-tailed Quoll occur within a 10km study area with the nearest record being approximately 1km from the subject site (DPIE 2021b).

A potential occurrence assessment for the Spotted-tailed Quoll identified that the site may provide some areas of suitable quality denning and foraging habitat for this species.



BC Act Test of Significance

Table 22: BC Act Test of Significance - Spotted-tailed Quoll

Significant Impact Criteria	Details
<p>a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.</p>	<p>The Spotted-tailed Quoll requires very large home ranges (measured in at least hundreds of hectares in high quality habitat but more often thousands of hectares encompassing a mosaic of varying quality habitat) that far exceed the subject site (DPIE 2021b, DAWE 2021b). Hence the subject site has only the potential to form a minute part of a local breeding group's range, and consequently, a potential local population needs to fulfil the majority of its lifecycle requirements well beyond the linear area of the subject site.</p> <p>It is estimated that approximately 69.75 ha of native vegetation including 0.22 ha of EEC rainforest vegetation which will require removal/modification to establish the proposed predator proof fence. Potential den trees and hollow logs require removal as a result of the proposal, however due to the narrow, linear nature of the proposal and the extensive habitat to be retained both within and adjacent to the subject site. The proposal will therefore only impact the Quoll by vegetation and habitat removal minutely (in context of their home range size) and available habitats. However, this is still an incremental and cumulative loss of potential foraging and denning habitats within a potential home range. This loss is not considered likely to be sufficient to undermine a local population's ability to forage or raise young.</p> <p>The construction of a predator proof fence however may have an adverse effect on the life cycle of this species as the proposal may cause the separation of a potential population occurring within the study area hindering the connectivity values of the landscape and posing barrier between individuals.</p> <p>The Spotted-tailed Quoll is highly mobile and known to be capable of crossing human-modified habitat Provided that the recommended monitoring and capture and release programs are implemented where required and that vegetation and denning habitats such as hollow logs are retained where possible the proposal is unlikely to place a viable local population of the Quoll at risk of extinction given that no barrier will be created and linkages with adjacent habitat will be retained.</p>
<p>b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p> <p>(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.</p>	<p>Not Applicable to this threatened species.</p>
<p>c) In relation to the habitat of a threatened species or ecological community:</p> <p>(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p>	<p>It is estimated that approximately 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation will be removed/modified as a result of the proposal. Habitat features such as hollow-bearing trees, bush rock and habitat logs occur within the subject site that may be subject to removal as a result of the proposal. These habitat features are to be retained where possible. Habitat to be</p>



Significant Impact Criteria	Details
<p>(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p> <p>(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.</p>	<p>removed/modified represents a minute proportion of the habitat available to the subject species in the subject site and study area.</p> <p>The habitat is not expected to be fragmented however given the nature of the proposal, isolation of habitats is expected to occur and connectivity to adjacent habitats may be compromised.</p> <p>To maintain connectivity between habitats for the Spotted-tailed Quoll, recommendations have been made to incorporate monitoring and capture and release programs to allow for movements of this species and minimise barrier impacts within a potential population of this species. Given these recommendations are followed and that the Spotted-tailed Quoll is a highly mobile species that will readily traverse gaps in vegetation for foraging and denning habitats, the proposal is unlikely to impact the long-term survival of this species within the study area.</p>
<p>d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).</p>	<p>The proposal will not directly or indirectly affect an area of outstanding biodiversity value for the Gould's Petrel, Little Penguin population, Mitchell's Rainforest Snail or the Wollemi Pine.</p>
<p>e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.</p>	<p>As per assessed in Section 7.2.2, the proposal contributes to the following KTP:</p> <ul style="list-style-type: none"> • Clearing of native vegetation <p>The proposal may increase the potential impact of the following KTPs on this threatened species, listed under the BC Act:</p> <ul style="list-style-type: none"> • Removal of hollow-bearing trees • Removal of dead wood and dead trees • Bushrock removal <p>These KTPs have the potential to impact this species by reducing the area of habitats available to these species. Recommendations are provided to assist in minimising potential indirect impacts on this threatened species. Given these measures are followed impacts from these KTPs are unlikely.</p>
<p>Conclusion</p>	<p>The proposal will remove/modify a relatively minute area of native vegetation relative to the habitats available to this species within the subject site and the broader study area. These habitats form potential foraging and denning habitat for the Spotted-tailed Quoll. The proposal is not considered to significantly impact this species due to the following factors:</p> <ul style="list-style-type: none"> • Potential denning resources such as hollows, dead wood and bush rock will be retained/relocated where possible for this species. • Connectivity will be maintained by undertaking monitoring and implementing capture and release programs. • Alternative potential foraging and denning habitat in the study area is extensive. • The Spotted-tailed Quoll is highly mobile and known to be capable of crossing human-modified habitat. • The extent of native vegetation proposed to be removed is likely to only form a minute portion habitat utilised by a potential local population of this species. • The proposal will not fragment any areas of this foraging habitat. • Recommendations have been made to minimise the likelihood of potential impacts of KTPs within the subject site.



A-5-9 Red-legged Pademelon (*Thylogale stigmatica*)

BC Act Status: Vulnerable

Distribution

The distribution of the Red-legged Pademelon is patchy throughout south-eastern Australia. It inhabits rainforests, dense eucalypt forests and wet gullies that often exhibit dense understorey and ground cover to provide shelter from predators (DPIE 2021b).

Threats

The DPIE (2021b) list the following key threats to the Red-legged Pademelon:

- Loss or fragmentation of habitat due to land clearing and under scrubbing.
- Predation - by cats, foxes, dingos and domestic dogs;
- Fire - Inappropriate fire regime reducing or degrading habitat, especially as a result of overly frequent or intense fires and regular burning of forest margins.
- Habitat degradation and grazing competition by feral horses, cattle, pigs, and rabbits; and
- Broad scale lantana removal resulting in habitat loss.

Survey Results

Field surveys for ground-dwelling mammals were undertaken by PIR cameras set with tubes baited with either a mixture of oats, honey, peanut butter and vanilla essence or chicken necks. The Red-legged Pademelon was potentially detected by PIR camera at a densely vegetated gully in the south-east of the subject site. This record is unconfirmed. The photo taken during surveys could be identified as either the Red-legged Pademelon or the Red-necked Pademelon (not threatened). The Ngambaa Nature Reserve Plan of Management has not listed the Red-legged Pademelon as a species that is known to occur (NPWS 2004). No records of the Red-legged Pademelon occur within a 10 km radius of the subject site (DPIE 2021b).

A potential occurrence assessment for the Red-legged Pademelon identified that the site may provide some areas of suitable quality denning and foraging habitat for this species.

BC Act Test of Significance

Table 23: BC Act Test of Significance – Red-legged Pademelon

Significant Impact Criteria	Details
<p>a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.</p>	<p>The densely vegetated rainforest and gully habitats within the subject site may form a minute part of a potential local breeding group's range. Consequently, a potential local population would likely fulfil the majority of its lifecycle requirements well beyond the linear area of the subject site.</p> <p>It is estimated that approximately 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation which will require removal/modification to establish the proposed predator proof fence. Due to the narrow, linear nature of the proposal and the extensive habitat to be retained both within and adjacent to the subject site, the proposal will only minutely impact potential habitats for the Red-legged Pademelon by the removal of vegetation and habitat. This habitat removal/modification is a small proportion of the habitats available to this species within the study area. However, this is still an incremental and cumulative loss of</p>



Significant Impact Criteria	Details
	<p>potential foraging and sheltering habitat within a potential home range. This loss is not considered likely to be sufficient to undermine a local population's ability to forage or raise young.</p> <p>The construction of a predator proof fence however may have an adverse effect on the life cycle of this species as the proposal may cause the separation of a potential population occurring within the study area hindering the connectivity values of the landscape and posing barrier between individuals. It should be noted however, that there is not enough evidence to determine that a viable local population of this species exists within the study area. Given this, and that vegetation within the subject site will be retained where possible and the retention of extensive habitats available in the subject site and broader study area for this species, the proposal is unlikely to place a viable local population of the Red-legged Pademelon at risk of extinction.</p>
<p>b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p> <p>(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.</p>	<p>Not Applicable to this threatened species.</p>
<p>c) In relation to the habitat of a threatened species or ecological community:</p> <p>(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p> <p>(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p> <p>(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.</p>	<p>It is estimated that approximately 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation will be removed/modified as a result of the proposal. Habitat features for this species such as shrubby groundcover and dense understorey occur within the subject site that may be subject to removal as a result of the proposal. These habitat features are to be retained where possible. Habitat to be removed/modified represents a minute proportion of the habitat available to the subject species in the subject site and study area.</p> <p>The habitat is not expected to be fragmented however given the nature of the proposal, potential isolation of habitats is expected to occur and connectivity to adjacent habitats may be compromised as the construction of the proposed fence will create a movement barrier for individuals. However, recommendations have been made to monitor potential populations and to implement a capture and release program where required.</p> <p>Given the extent of vegetation to be removed that would be considered as suitable habitat for the Red-legged Pademelon is only marginal in proportion to the habitats to that will remain available in the subject site and broader study area for this species, that recommendations have been made for monitoring and capture and release programs, the retention of vegetation where possible and that it is not confirmed that a viable population exists within the study area, the proposal is unlikely to impact the long-term survival of this species within the study area.</p>
<p>d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).</p>	<p>The proposal will not directly or indirectly affect an area of outstanding biodiversity value for the Gould's Petrel, Little Penguin population, Mitchell's Rainforest Snail or the Wollemi Pine.</p>
<p>e) Whether the proposed development or activity is or is part of a key</p>	<p>As per assessed in Section 7.2.2, the proposal contributes to the following KTP:</p>



Significant Impact Criteria	Details
<p>threatening process or is likely to increase the impact of a key threatening process.</p>	<ul style="list-style-type: none"> • Clearing of native vegetation <p>The proposal may increase the potential impact of the following KTPs on this threatened species, listed under the BC Act:</p> <ul style="list-style-type: none"> • Invasion of native plant communities by exotic perennial grasses <p>These KTPs have the potential to impact this species by reducing the area of habitats available to these species. Recommendations are provided to assist in minimising potential indirect impacts on this threatened species. Given these measures are followed impacts from these KTPs are unlikely.</p>
<p>Conclusion</p>	<p>The proposal will remove/modify a relatively minute area of native vegetation relative to the habitats available to this species within the subject site and the broader study area. These habitats form potential foraging and sheltering habitat for the Red-legged Pademelon. The proposal is not considered to significantly impact this species due to the following factors:</p> <ul style="list-style-type: none"> • Potential habitats of dense understory will be retained where possible for this species. • Monitoring and capture and release programs will be implemented. • Alternative potential foraging and denning habitat in the study area is extensive. • That it is not confirmed that a viable population exists within the study area. • The extent of native vegetation proposed to be removed is likely to only form a minute portion habitat utilised by a potential local population of this species. • Recommendations have been made to minimise the likelihood of potential impacts of KTPs within the subject site.



A-5-10 Arboreal Mammals: Yellow-bellied Glider (*Petaurus australis*), Squirrel Glider (*Petaurus norfolcensis*), Greater Glider (*Petauroides Volans*) and Brush-tailed Phascogale (*Phascogale tapoatafa*)

Yellow-bellied Glider: BC Act Status: Vulnerable,

Squirrel Glider: BC Act Status: Vulnerable,

Brush-tailed Phascogale: BC Act Status: Vulnerable,

Greater Glider: BC Act Status: Endangered,

Distribution

The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. They occur in tall mature eucalypt forest in areas with nutrient rich soils and high rainfall (DPIE 2021b).

The Squirrel Glider is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature Blackbutt-Bloodwood forest with heath understorey in coastal areas east of the Great Dividing Range and require abundant hollows for nest sites (DPIE 2021b).

The Greater Glider occurs in forests and woodlands across eastern Australia where it forages on eucalypt leaves and occasionally flowers (TSSC 2016). It requires large tracks of remnant forests which contain old growth trees containing hollows which it uses for denning. Individual home ranges of the Greater Glider are small with an average size of around 1-3 hectares. This species is usually solitary within this home range and is known to be very loyal to their territory (TSSC 2016).

The Brush-tailed Phascogale has a patchy distribution, In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of the divide. They prefer Dry Sclerophyll open Forest with a sparse groundcover of herbs, grasses, shrubs or leaf litter and rough barked trees of 25cm DBH or greater (DPIE 2021b).

Threats

Key existing threats to these threatened arboreal mammal species includes:

- Habitat loss and degradation
- Fragmentation of habitat;
- Loss of hollow-bearing trees;
- Injury from barbed wire fences; and
- Predation by exotic predators

Survey Results

The Squirrel Glider and Brush-tailed Phascogale were both recorded within the subject site during site surveys. The Brush-tailed Phascogale was recorded by PIR camera within the southern area of the subject site and the Squirrel Glider was heard calling opportunistically following a spotlighting survey near the centre of the western boundary of the subject site. Records for all of these threatened arboreal mammals occur within a 2km radius of the subject site (DPIE 20212a).



BC Act Test of Significance

Table 24: BC Act Test of Significance – Arboreal mammals

Significant Impact Criteria	Details
<p>a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.</p>	<p>It is estimated that approximately 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation which will require removal/modification to establish the proposed predator proof fence.</p> <p>The vegetation within the subject site has the potential to form a minute part of a local breeding group's range for each of these species. The narrow, linear nature of the proposal means that a potential local population of any of these species would need to fulfil the majority of their lifecycle requirements well beyond the linear area of the subject site.</p> <p>Potential nesting habitats for these species in the form of hollow-bearing trees will require removal as a result of the proposal, however due to the narrow, linear nature of the proposal and the extensive habitat (including hollow-bearing trees) to be retained within and adjacent to the subject site, only a minute area of the vegetation and habitat available to these species will be removed. However, this is still an incremental and cumulative loss of potential foraging and nesting habitats within potential home ranges. This loss is not considered likely to be sufficient to undermine a local population's ability to forage, breed or raise young, given the extensive habitats to remain in the subject site and broader study area.</p> <p>The construction of a predator proof fence is unlikely to have an adverse effect on the life cycle of these species as recommendations have been made to monitor and implement capture and release programs to maintain connectivity and allow movements of these species between habitats post-construction.</p> <p>These threatened arboreal species are highly mobile and known to be capable of crossing human-modified habitat. Provided that the recommended connectivity measures are incorporated into the proposal and that vegetation and nesting habitats such as hollow-bearing trees are retained where possible, the proposal is unlikely to place viable local populations of these species at risk of extinction given that no barrier will be created and linkages with adjacent habitat will be retained.</p>
<p>b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p> <p>(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.</p>	<p>Not Applicable to this threatened species.</p>
<p>c) In relation to the habitat of a threatened species or ecological community:</p> <p>(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p> <p>(ii) Whether an area of habitat is likely to become fragmented or isolated from</p>	<p>It is estimated that approximately 69.75 ha of native vegetation including up to 0.22 ha of EEC rainforest vegetation will be removed/modified as a result of the proposal. Habitat features such as hollow-bearing trees, bush rock and habitat logs occur within the subject site that may be subject to removal as a result of the proposal. These habitat features are to be retained where possible. Habitat to be removed/modified represents a minute proportion of the habitat available to the subject species in the subject site and the broader study area.</p> <p>The habitat is not expected to be fragmented however given the nature of the proposal, isolation of habitats is expected to occur. To avoid</p>



Significant Impact Criteria	Details
<p>other areas of habitat as a result of the proposed development or activity, and (iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.</p>	<p>impacts to connectivity for these species, it has been recommended to incorporate monitoring and capture and release programs to maintain connectivity and to allow these arboreal mammals to move between these habitats. Given these recommendations are followed and that these threatened arboreal mammals are highly mobile species the proposal is unlikely to impact the long-term survival of this species within the study area.</p>
<p>d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).</p>	<p>The proposal will not directly or indirectly affect an area of outstanding biodiversity value for the Gould’s Petrel, Little Penguin population, Mitchell’s Rainforest Snail or the Wollemi Pine.</p>
<p>e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.</p>	<p>As per assessed in Section 7.2.2, the proposal contributes to the following KTP: • Clearing of native vegetation The proposal may increase the potential impact of the following KTPs on this threatened species, listed under the BC Act: • Removal of hollow-bearing trees • Removal of dead wood and dead trees These KTPs have the potential to impact this species by reducing the area of habitats available to these species. Recommendations are provided to assist in minimising potential indirect impacts on this threatened species. Given these measures are followed impacts from these KTPs are unlikely.</p>
<p>Conclusion</p>	<p>The proposal will remove/modify a relatively minute area of native vegetation relative to the habitats available to these species within the subject site and the broader study area. These habitats form potential foraging and nesting habitat for these threatened arboreal mammals. The proposal is not considered to significantly impact this species due to the following factors:</p> <ul style="list-style-type: none"> • Potential denning resources such as hollows, dead wood and bush rock will be retained/relocated where possible for this species. • Connectivity will be maintained by monitoring populations of these species and undertaking capture and release programs where required. • Alternative potential foraging and nesting habitat in the subject site and broader study area is extensive. • These species are highly mobile and known to be capable of crossing human-modified habitat. • The extent of native vegetation proposed to be removed is likely to only form a minute portion habitat utilised by potential local populations of these species. • The proposal will not fragment any areas of this potential habitat. • Recommendations have been made to minimise the likelihood of potential impacts of KTPs within the subject site.



A-5-11 Glossy Black-cockatoo (*Calyptorhynchus lathamii*) and the Little Lorikeet (*Glossopsitta pusilla*)

BC Act Status: Vulnerable

Distribution

The Glossy Black-cockatoo is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. They inhabit open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. Glossy Black-cockatoos feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species), shredding the cones with the massive bill. They depend on large (>15cm) hollow-bearing Eucalypts for nests sites and breeding. Abundant foraging resources occur within the subject site and immediate surroundings, this species was also recorded within the subject site by evidence of signs of feeding. The subject site does not contain any hollow-bearing trees for breeding habitat for the Glossy Black-cockatoo (DPIE 2021b).

The Little Lorikeet is widespread across the coastal regions of Australia with New South Wales providing a significant portion of core habitat. The Little Lorikeet has been recorded across the extent of the NSW coast and is known to extend as far inland as Dubbo (DPIE 2021b). It forages in the canopy of open Eucalypt woodlands and forests with movements heavily influenced by nectar and pollen availability and season. Flocks are usually less than ten individuals and are often recorded amongst other lorikeet species (DPIE 2021b).

Threats

Threats to these species includes activities and processes such as:

- Habitat loss and fragmentation;
- Reduction of food available due to drought conditions;
- Competition for food resources with European Bees and honeyeaters;
- Reduction of habitat regeneration as a result of weed invasion;
- High-frequency fires;

Survey Results

The Glossy Black-cockatoo and the Little Lorikeet were not recorded within or adjacent to the subject site during site surveys, either by direct observation or secondary evidence. I.e. chewed Allocasuarina cones by the Glossy Black-cockatoo. Suitable foraging and nesting habitats were located within the subject site in the form of hollow-bearing trees, nectar producing Eucalypts and *Allocasuarina torulosa* (Forest Oak) which were abundant throughout the subject site and broader study area. Several records of these species occur within a 2km radius of the subject site (DPIE 2021a).



BC Act Test of Significance

Table 25: Significant impact assessment – Glossy Black-cockatoo and Little Lorikeet

Significant Impact Criteria	Details
<p>a) In the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.</p>	<p>It is estimated that approximately 69.75 ha of native vegetation including abundant hollow-bearing trees, Allocasuarinas and nectar producing eucalypts which provide potential foraging and nesting habitat for the Glossy- Black-cockatoo will require removal/modification to establish the proposed predator proof fence.</p> <p>The vegetation within the subject site has the potential to form a minute part of a potential local breeding group’s range for each of these species. The narrow, linear nature of the proposal means that a potential local population of any of these species is likely to fulfil the majority of their lifecycle requirements well beyond the linear area of the subject site.</p> <p>Due to the narrow, linear nature of the proposal and the extensive habitat (including hollow-bearing trees) to be retained within and adjacent to the subject site, only a minute area of the vegetation and habitat available to these species will be removed. However, this is still an incremental and cumulative loss of potential foraging and nesting habitats within these species’ potential home ranges. This loss is not considered likely to be sufficient to undermine a local population’s ability to forage, breed or raise young, given the extensive habitats to remain in the subject site and broader study area.</p> <p>The construction of a predator proof fence is unlikely to have an adverse effect on the life cycle of these species as recommendations have been made to maintain canopy connectivity to allow movements of these species between habitats post-construction. However, these species are highly mobile and known to be capable of easily traversing the proposed fence. Provided that vegetation and nesting habitats such as hollow-bearing trees are retained where possible, the proposal is unlikely to place viable local populations of these species at risk of extinction given that no barrier will be created for these species and extensive foraging and breeding habitats will be retained within the subject site and the broader study area which will be available to these species.</p>
<p>b) In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:</p> <p>(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or</p> <p>(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.</p>	<p>Not Applicable to this threatened species.</p>
<p>c) In relation to the habitat of a threatened species or ecological community:</p> <p>(i) The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and</p> <p>(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and</p>	<p>It is estimated that approximately 69.75 ha of native vegetation including potential foraging and breeding habitats for these species will be removed/modified as a result of the proposal. Habitat features such as hollow-bearing trees occur within the subject site that may be subject to removal as a result of the proposal. These habitat features are recommended to be retained where possible. Habitat to be removed/modified represents a minute proportion of the habitat available to the subject species in the subject site and the broader study area.</p> <p>Fragmentation and isolation of habitats for these species is not expected to occur as a result of the proposal. Given recommendations are followed to retain vegetation and hollow-bearing trees where possible and that these threatened birds are highly mobile species that can easily traverse</p>



Significant Impact Criteria	Details
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality.	man-made structures, the proposal is unlikely to impact the long-term survival of these species within the study area.
d) Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).	The proposal will not directly or indirectly affect an area of outstanding biodiversity value for the Gould's Petrel, Little Penguin population, Mitchell's Rainforest Snail or the Wollemi Pine.
e) Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	<p>As per assessed in Section 7.2.2, the proposal contributes to the following KTP:</p> <ul style="list-style-type: none"> • Clearing of native vegetation <p>The proposal may increase the potential impact of the following KTPs on this threatened species, listed under the BC Act:</p> <ul style="list-style-type: none"> • Removal of hollow-bearing trees • Removal of dead wood and dead trees <p>These KTPs have the potential to impact these species by reducing the area of habitats available to these species. Recommendations are provided to assist in minimising potential indirect impacts on these threatened birds. Given these measures are followed impacts from these KTPs are unlikely.</p>
Conclusion	<p>The proposal will remove/modify a relatively minute area of native vegetation relative to the habitats available to these species within the subject site and the broader study area. These habitats form potential foraging and nesting habitats for these threatened birds. The proposal is not considered to significantly impact the Glossy Black-cockatoo or the Little Lorikeet due to the following factors:</p> <ul style="list-style-type: none"> • Potential nesting resources such as hollow-bearing trees will be retained/relocated where possible for this species. • The extent of Allocasuarina and Casuarina vegetation to be removed is a small proportion of the extent of foraging vegetation for the Glossy Black-cockatoo which will continue to exist within the subject site and the broader study area. • Alternative potential foraging and nesting habitat for these species in the subject site and broader study area is extensive. • These species are highly mobile and known to be capable of crossing human-modified habitat. • The extent of native vegetation proposed to be removed is likely to only form a minute portion habitat utilised by potential local populations of these species. • The proposal will not fragment or isolate any areas of this potential habitat for these species • Recommendations have been made to minimise the likelihood of potential impacts of KTPs within the subject site.



A-5-12 Migratory Species: Black-faced Monarch (*Monarcha melanopsis*) and Rufous Fantail (*Rhipidura rufifrons*)

The Black-faced Mornarch is widespread in eastern Australia, it occurs mainly in rainforest ecosystems and is sometimes found in nearby open eucalyptus forests where there are gullies with dense understorey. As a migratory species, they spend spring, summer and autumn in eastern Australia, and winter in southern and eastern Papua New Guinea from March to August. They breed from October to March in rainforest habitat within the tree canopy. In New South Wales, eggs have been recorded from October to February (DAWE 2021b).

The Rufous Fantail occurs in coastal and near coastal districts of northern and eastern Australia. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallowwood (*Eucalyptus microcorys*), Mountain Grey Gum (*E. cypellocarpa*), Narrow-leaved Peppermint (*E. radiata*), Mountain Ash (*E. regnans*), Alpine Ash (*E. delegatensis*), Blackbutt (*E. pilularis*) or Red Mahogany (*E. resinifera*); with dense shrubby understorey often including ferns. They also occur in subtropical and temperate rainforests. The Rufous Fantail breeds from September to February, with 81% of eggs laid November-December (DAWE 2021b).

The main threat to populations of Rufous Fantail and the Black-faced Monarch is fragmentation and loss of core moist forest breeding habitat through land clearing and urbanisation.



A-6 Hair Analysis Results



TRACE ECOLOGY

Hair, Scat & Bone Analysis

Date: 22nd July 2021

Att: Leonie Stevenson
Ecologist
Biodiversity Australia
3/64 Clarence St, Port Macquarie,
NSW 2444

Job Number: 20210722-1

Hair analysis – EC4702

Dear Leonie,

I analysed 40 hair samples in accordance with the methods outlined in Brunner and Coman, The Identification of Mammalian Hairs, Inkata Press, 1974 and Hair ID: An Interactive Tool for Identifying Australian Mammalian Hair, Ecobyte, 2002.

The results of the analysis are provided below in the following table.

Line	SampleID	Date	Results	Confidence
1	18-G	11/06/2021	<i>Rattus fuscipes</i>	Confident
1	15-G	11/06/2021	<i>Rattus fuscipes</i>	Confident
1	16-A	11/06/2021	Nil	Confident
1	12-G	11/06/2021	<i>Rattus fuscipes</i>	Confident
1	13-A	11/06/2021	<i>Pseudocheirus peregrinus</i>	Confident
1	11-A	11/06/2021	<i>Rattus fuscipes</i>	Confident
1	14	11/06/2021	<i>Rattus fuscipes</i>	Confident
1	20-G	11/06/2021	<i>Pseudocheirus peregrinus</i>	Confident
1	17-G	11/06/2021	Nil	Confident
1	19-G	11/06/2021	<i>Rattus fuscipes</i>	Confident
2	3-G	11/06/2021	Nil	Confident
2	6-A	11/06/2021	Nil	Confident
2	5-G	11/06/2021	Nil	Confident
2	10-A	11/06/2021	Nil	Confident
2	8-G	11/06/2021	<i>Rattus fuscipes</i>	Confident
2	2-G	11/06/2021	Nil	Confident
2	7-A	11/06/2021	Nil	Confident
2	9-G	11/06/2021	<i>Perameles nasuta, Rattus fuscipes</i>	Confident
2	1-G	11/06/2021	<i>Rattus fuscipes</i>	Confident
2	4-G	11/06/2021	<i>Rattus fuscipes</i>	Confident
3	11-A	18/06/2021	Nil	Confident

Trace Ecology
ABN: 39 535 102 265

Line	SampleID	Date	Results	Confidence
3	12-A	18/06/2021	<i>Insect material</i>	Confident
3	13-G	18/06/2021	<i>Rattus fuscipes</i>	Confident
3	14-G	18/06/2021	<i>Rattus fuscipes</i>	Confident
3	15-G	18/06/2021	<i>Rattus fuscipes</i>	Confident
3	16-A	18/06/2021	Nil	Confident
3	17-G	18/06/2021	<i>Rattus fuscipes</i>	Confident
3	18-G	18/06/2021	Nil	Confident
3	19-G	18/06/2021	<i>Rattus fuscipes</i>	Confident
3	20-G	18/06/2021	<i>Rattus fuscipes</i>	Confident
4	1-G	18/06/2021	<i>Rattus fuscipes</i>	Confident
4	2-G	18/06/2021	Nil	Confident
4	3-A	18/06/2021	Nil	Confident
4	4-G	18/06/2021	<i>Rattus fuscipes</i>	Confident
4	5-G	18/06/2021	<i>Rattus fuscipes</i>	Confident
4	6-G	18/06/2021	<i>Antechinus stuartii</i>	Confident
4	7-A	18/06/2021	<i>Rattus fuscipes</i>	Confident
4	8-G	18/06/2021	<i>Pseudocheirus peregrinus, Rattus fuscipes</i>	Confident
4	9-G	18/06/2021	<i>Antechinus stuartii</i>	Confident
4	10-A	18/06/2021	<i>Rattus fuscipes</i>	Confident

If you have any questions about the results, please do not hesitate to contact me.

Kind regards,

Trace Ecology

Mob: 0423 501 384

Email: traceecology@gmail.com

A-7 Anabat Analysis Results





NSW NATIONAL PARKS & WILDLIFE SERVICE

Ngambaa Feral Predator Free Area

**Matters of National Environmental
Significance Assessment Report**

Matters of National Environmental Significance

The search was undertaken using a ten-kilometre search radius from the subject site.

Table 1: Summary of MNES search results

Category	Result	Description
World Heritage Properties	None	-
National Heritage Places	None	-
Wetlands of International Importance	None	-
Great Barrier Reef Marine Park	None	-
Commonwealth Marine Area	None	-
Listed Threatened Ecological Communities	2	Two listed threatened ecological communities are listed as likely/may to occur within the study area. No threatened ecological communities listed under the EPBC Act occur within the- subject site
Listed Threatened Species	41	Species or species habitat is known/likely/may occur within the study area.
Listed Migratory Species	15	Migratory wetland, terrestrial and marine species or species habitat is known/likely/may occur within the study area.
<i>Other matters protected by the EPBC Act</i>		
Commonwealth Land	None	-
Commonwealth Heritage Places	None	-
Listed Marine Species	20	Species or species habitat is known/likely/may occur within the study area.
Whales and other Cetaceans	None	-
Critical Habitats	None	-
Commonwealth Reserves - Terrestrial	None	-
Commonwealth Reserves - Marine	None	-

1.1.1.1 Results of Threatened Flora Survey

Two threatened flora species were detected within, and nearby the subject site during flora surveys. *Parsonia dorrigoensis* (Milky Silkpod), listed as Endangered under the EPBC Act and *Rhodamnia rubescens* (Scrub Turpentine), listed as Critically Endangered under the EPBC Act were both recorded within the eastern portion of the subject site by Biodiversity Australia (2021).

1.1.1.2 Potential Occurrence Assessment

Searches of relevant literature and databases (DPIE 2021a) found records of 12 threatened flora species within the study area and the Protected Matters Search Tool also produced a list of additional potential occurrences in the study area (Appendix **Error! Reference source not found.**). These are assessed for their potential to occur on site in Appendix **Error! Reference source not found.**

A total of three flora species were identified as known or likely to occur within the subject site. Of these, two were recorded during survey with an additional species, *Marsdenia longiloba* (Slender Marsdenia), also considered to potentially occur due to the suitable quality habitats occurring within the subject site and the proximity of local records. This species, in addition to the threatened flora recorded during surveys is subject to a Significance Assessment under the EPBC Act.

Threatened fauna recorded during surveys

Common Name	Scientific Name	Detection Method	BC Act Status	EPBC Act Status
Brown Treecreeper (eastern subspecies)	<i>Climacteris picumnus victoriae</i>	HC, Vis	V	-
Dusky Woodswallow	<i>Artamus cyanopterus</i>	Vis	V	-
Powerful Owl	<i>Ninox strenua</i>	HC	V	-
Little Bent-wing Bat	<i>Miniopterus australis</i>	Ana	V	-
Squirrel Glider	<i>Petaurus norfolcensis</i>	HC	V	-
Brush-tailed Phascogale	<i>Phascogale tapoatafa</i>	Cam	V	-
Koala	<i>Phascolarctos cinereus</i>	Scat, Cam	E	E
Red-legged Pademelon ¹	<i>Thylogale stigmatica</i>	Cam	V	-

Key: Endangered (E), Vulnerable (V) and not listed (-).
Detection Method key: Anabat detection device (Ana), PIR Camera (Cam), Heard call (HC), Nest (NE), Scats found (Scat), Visually observed (Vis).
¹Species identification not confirmed.

1.1.1.1 Potential Occurrence Assessment

A number of threatened fauna species have been recorded in the study area in the Bionet Atlas of Wildlife (DPIE 2021a, NPWS 2004), and a number of others are considered potential occurrences by the EPBC Protected Matters Search Tool (DAWE 2021a). In Appendix **Error! Reference source not found.**, these species are evaluated for their potential to occur on the subject site and their eligibility/requirement for further assessment.

1.1.2 Local Records

There are no threatened aquatic species listed under the *EPBC Act 1999* in the Protected Matters Search Tool and there are no records of threatened aquatic species listed under the *BC Act 2016* in the Bionet Atlas search. No threatened species or Endangered Populations are known to occur in the study area listed under the FM Act however habitat mapping for the Purple Spotted Gudgeon (*Mogurnda adspersa*), listed as Endangered under the FM Act (DPI 2021c).

2. EPBC Act 1999 - MNES Significance Assessment

2.1 General Assessment Overview

The provisions of the *EPBC Act (1999)* require determination of whether the proposal has, will or is likely to have a significant impact on a “matter of national environmental significance” (MNES). The search was undertaken using a ten-kilometre search radius from the subject site. These matters are summarised in Section 0. See Appendix A-6 for the full report.

The Protected Matters Search Tool (DAWE 2021a) identified a range of MNES that could potentially occur in the study area. Threatened species listed as MNES were recorded in the subject site during the field surveys. These are discussed in the following sections.

2.2 Threatened Ecological Communities

No Threatened Ecological Communities listed under the EPBC Act were recorded within the subject site.

Potential Occurrence assessment - TECs

<i>Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community</i>	E	http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=142	No
<i>Littoral Rainforest and Coastal Vine Thickets of Eastern Australia</i>	CE	http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=76	No
<i>Lowland Rainforest of Subtropical Australia</i>	CE	http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=101	No
<i>Subtropical and Temperate Coastal Saltmarsh</i>	V	http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=118	No
<i>Alpine Sphagnum Bogs and Associated Fens ecological community</i>	E	https://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=29	No
Key: Critically Endangered (CE), Endangered (E), Vulnerable (V).			

2.3 Threatened Species Significance Assessments

One federally listed threatened fauna species, the Koala, and two federally listed flora species, *Rhodamnia rubescens* (Scrub Turpentine) and *Parsonsia dorrigoensis* (Milky Silkpod), were recorded within the subject site during site surveys.

Potential occurrence assessments identified an additional four species listed under the EPBC Act that are considered to potentially occur on the subject site. These species are described in the table below. These are assessed in the MNES Significance Assessment for each species in Appendix A-1.

Significance Assessments for these entities have determined that the proposed development will not significantly impact these threatened species listed under the EPBC Act.

Table 2: Potentially occurring threatened fauna and flora species

Group	Species	Predicted Type of Occurrence	Listing Status		Likelihood of Occurrence
			BC Act	EPBC Act	
Amphibia	Giant Barred Frog (<i>Mixophyes iterates</i>)	Species or species habitat likely to occur within area	E	E	Moderate chance of occurring given availability of broadly suitable habitat.
Mammalia	Spotted-Tailed Quoll (<i>Dasyurus maculatus</i>)	Species or species habitat likely to occur within area	V	E	Fair chance of occurrence given local records and broadly suitable habitat.
	Greater Glider (<i>Petauroides Volans</i>)	Species or species habitat known to occur within area	E	V	Fair chance of occurrence given availability of broadly suitable habitat.

Group	Species	Predicted Type of Occurrence	Listing Status		Likelihood of Occurrence
			BC Act	EPBC Act	
	Koala (<i>Phascolarctos cinereus</i>)	Species or species habitat known to occur within area	E	E	Species was indirectly recorded during survey. Large areas of available habitat exist.
Flora	<i>Marsdenia longiloba</i> (Slender Marsdenia)	Species or species habitat known to occur within area	E	V	Moderate chance of occurring given availability of broadly suitable habitat.

Key: Endangered (E), Vulnerable (V).

2.4 Listed Migratory Species

Two migratory species, the Black-faced Monarch (*Monarcha melanopsis*) and the Rufous Fantail (*Rhipidura rufifrons*) are considered potential occurrences in the study area (DAWE 2021a). The following table outlines the species requiring an assessment of significance.

Table 3: Migratory species requiring an assessment of significance

Group	Species	Predicted Type of Occurrence	Likelihood of Occurrence
Aves	Black-faced Monarch (<i>Monarcha melanopsis</i>)	Species known to occur within area	Fair chance of occurrence.
	Rufous Fantail (<i>Rhipidura rufifrons</i>)	Species known to occur within area	Fair chance of occurrence.

These species are assessed in the MNES Significance Assessment for each species in Appendix A-1.

Significance Assessments for the Black-faced Monarch and the Rufous Fantail have determined that the proposed development will not significantly impact these migratory species listed under the EPBC Act.

Conclusion

A matters of national environmental significance (MNES) assessment under the EPBC Act was undertaken to assess the impact of the proposal on MNES. The assessment found:

- no threatened ecological communities listed under the EPBC Act occur within the study area
- 41 listed threatened species or species habitat are known / likely / may occur within the study area
- 15 listed migratory wetland, terrestrial and marine species or species habitat are known / likely / may occur within the study area.

MNES assessments of significance under the EPBC Act determined the proposal was unlikely to have significant impact on MNES.

A-1 Significance Assessments

The following provides significance assessments in order to determine whether the development is likely to have a significant effect on known or potentially occurring entities.

Significant Impact Assessment (EPBC Act 1999)

The MNES, Significant Impact Guidelines 1.1 (DEWHA 2013), define an action as likely to have a significant impact on an Endangered Ecological Community if the action would:

- *Reduce the extent of an ecological community.*
- *Fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines.*
- *Adversely affect habitat critical to the survival of an ecological community.*
- *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.*
- *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.*
- *Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:*
 - *assisting invasive species, that are harmful to the listed ecological community, to become established, or*
 - *causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or*
- *Interfere with the recovery of an ecological community.*

Assessment of Significance (EPBC Act) - The MNES, Significant Impact Guidelines 1.1 (DotE 2013) define an action as likely to have a significant impact on a vulnerable species, if it will:

- *lead to a long-term decrease in the size of an important population of a species.*
- *reduce the area of occupancy of an important population:*
- *fragment an existing important population into two or more populations*
- *adversely affect habitat critical to the survival of a species,*
- *disrupt the breeding cycle of an important population*
- *modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline*
- *result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat*
- *introduce disease that may cause the species to decline:*
- *interfere substantially with the recovery of the species.*

An *important population* is defined under the MNES Significant Impact Guidelines 1.1 (DotE 2013) as one that is necessary for a species' long-term survival and recovery. This includes such populations as:

- key 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.

According to the MNES, Significant Impact Guidelines 1.1 (DotE 2013), *critical habitat* refers to areas critical to the survival of a species or ecological community and may include areas that are necessary for/to:

- activities such as foraging, breeding, roosting or dispersal;
- succession;
- maintain genetic diversity and long-term evolutionary development; or
- reintroduction of populations or recovery of the species/community.

Giant Barred Frog (*Mixophyes iterates*)

EPBC Act Status: Endangered (*Mixophyes iterates*)

Distribution and ecology

The Green-thighed Frog occurs in a range of habitats from rainforest and moist eucalypt forest to dry eucalypt forest and heath, typically in areas where surface water gathers after rain. This species is thought to forage in leaf litter. Breeding occurs from spring to autumn following heavy rainfall, green-thighed Frogs prefer flooded areas and larger temporary pools for breeding (DPIE 2021b).

The Giant Barred Frog is distributed along the coast and ranges from Eumundi in south-east Queensland to Warrimoo in the Blue Mountains. Giant Barred Frogs are found along freshwater streams with permanent or semi-permanent water, generally at lower elevation. Moist riparian habitats such as rainforest or wet sclerophyll forest are favoured for the deep leaf litter that they provide for shelter and foraging, as well as open perching sites on the forest floor. However, this species will occur in other riparian habitats, such as drier forest or degraded riparian remnants (DPIE 2021b).

Threats

Threats to these species includes habitat loss and modification, damage to riparian vegetation, disease (Chytrid fungus), changes to natural water flows and quality and damage to habitat (vegetation removal, disturbance and turbidity) by domestic stock and other agricultural activities. Other threats include dense weed infestations and predation of individuals and destruction of eggs by feral pigs.

Survey Results

The Green-thighed Frog and the Giant Barred Frog were not detected in the subject site during site survey. Site survey was however diurnal and undertaken during the winter months therefore, was at a period of low activity for these species. 55 records of the Giant Barred Frog occur within a 10km radius from the subject site, the nearest record being approximately 600m from the subject site. The Green-thighed Frog has only three records of this species within a 10km study area, however the nearest record is located approximately 2km to the east of the subject site. The subject site contains potential habitat for these threatened species.

EPBC Act Assessment of Significance

Table 4: Significant impact assessment – Giant Barred Frog

Significant Impact Criteria	Details
a) Lead to a long-term decrease in the size of a population of a species	It is estimated that approximately 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation will be removed/modified as a result of the proposal. In addition, the proposed predator proof fence will intersect a total of six separate ephemeral riparian/aquatic habitats across the subject site which may provide potential habitat for this threatened amphibian species. Given the minor loss/disturbance of potential habitats on the subject site for these species, the proposal would not reduce the area of occupancy of a potential population of the Giant Barred Frog. The proposal will thus not lead to a long-term decrease in the size of a potential population for this threatened amphibian.
b) Reduce the area of occupancy of the species	Given the minor loss/disturbance of potential habitats on the subject site for these species, the proposal would not reduce the area of occupancy of a potential population of the Giant Barred Frog, the proposal would not reduce the area of occupancy of the important population.
c) Fragment an existing population into two or more populations	The proposal will not fragment any areas of potential habitat for this species or an existing population of the Giant Barred Frog. Recommendations have been made to suggest that where favoured habitats for this species such as freshwater streams, rainforest and wet sclerophyll riparian vegetation occurs, that the fence mesh contains sections of mesh that are no smaller than 30mm mesh size to allow a semipermeable access for this species and other small fauna. Therefore, the proposal will offer no barrier to movement between a potential population and will not fragment an existing population of the Giant Barred Frog in two or more populations.
d) Adversely affect habitat critical to the survival of a species	The vegetation on site is not considered critical habitat for the subject species. Post-construction, the remainder of the site and other habitats in the study area will retain the potential to support this species, hence helping support the viability of potential local populations.
e) Disrupt the breeding cycle of a population	The habitats in the site to be removed/modified represents marginal potential breeding habitat for the Giant Barred Frog. The elevation of the subject site is above what is generally preferred for this species (DPIE 2021b) and the six aquatic habitats within the subject site lack areas of steep banks and overhangs for which to stick their eggs. The temporary disturbance of these habitats as a result of the proposal is therefore unlikely to disrupt the breeding cycle of the Giant Barred Frog given the marginal area of potential breeding habitats to be disturbed and that recommendations have been made to allow movements of this species through the proposed fence. The proposal is therefore unlikely to disrupt the breeding cycle of a potential population.
f) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The degree of possible vegetation loss imposed by the proposed predator proof fence is not significant enough to affect a potential local population of the Giant Barred Frog to the point that it could cause a decline of the species.
g) Result in invasive species, that are harmful (by competition, modification of habitat, or predation) to Critically Endangered or Endangered species, becoming established in the Critically Endangered or Endangered species' habitat	No new species that affects this threatened amphibian is likely to be introduced as a result of the proposal given that mitigation measures for construction hygiene are followed.
h) Introduce a disease that may cause the species to decline	Amphibians, including the Giant Barred Frog are known to carry chronic infections of the fungal pathogen <i>Batrachochytrium dendrobatidis</i> (Chytrid fungus) that causes chytridiomycosis. This pathogen is a threat as it is a known cause of decline in frog species and may potentially be introduced to the subject site during construction. Mitigation measures have been recommended around construction hygiene protocols. Given these measures are followed, the proposal is not expected to introduce a disease that may cause a decline to the species.
i) Interferes substantially with the recovery of the species	Recovery Plan required, this species had a recovery plan in force at the time the legislation provided for the Minister to decide whether or not to have a recovery plan (19/2/2007). Adopted recovery plan includes Hines, H.B. & the South-east Queensland Threatened Frogs Recovery Team (2002). Recovery plan for Stream Frogs of South-east Queensland 2001-2005. Report to Environment Australia, Canberra. Queensland Parks and Wildlife Service, Brisbane. Available from: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/national-recovery-plan-stream-

Significant Impact Criteria	Details
	<p>frogs-south-east-queensland-2001-2005. In effect under the EPBC Act from 13-Oct-2003 as <i>Mixophyes iteratus</i>.</p> <p>The proposal will result in the removal of a relatively minute area of potential foraging and breeding habitat for the Giant Barred Frog that is not significant enough to interfere with their recovery.</p>
Resulting Impact	No significant impact

A-1-1 Koala (*Phascolarctos cinereus*)

BC Act Status: Endangered

EPBC Act Status: Endangered

Distribution

The listed species range for the Koala is from north-eastern Queensland to the Victorian border, however as a result of translocations, a number of populations can be found outside of this range (DAWE 2020b). In NSW, the distribution of the Koala extends as far west as the Darling River Plains, Cobar Penneplain and Murray-Darling Depression bioregions (DAWE 2021b). Koala distribution is highly dependent on altitude (<800 metres above sea level), temperature and in some instances, leaf moisture (DAWE 2021b). Koala distribution is highly dependent on altitude (<800 metres above sea level), temperature and in some instances, leaf moisture (DAWE 2021b).

The Threatened Species Scientific Committee estimated that the Koala population between 1990 and 2010 in NSW declined at a rate of 33%, with numbers falling from 31,400 to 21,000. These numbers predicted to be much fewer currently (DAWE 2021b).

Koalas are found in a range of Eucalypt forest and woodland communities, including coastal forests, rainforest, riparian areas, swamp sclerophyll forests, heathland and shrubland.

Threats

The key existing threats to the Koala are ongoing habitat loss and fragmentation, vehicle strike and predation by the domestic/feral dog. The Australian Government also recognises the significant threat of extreme environmental conditions (i.e. extreme heat, drought, fire) and disease (in particular Chlamydia infections and Koala Retrovirus) to the Koala (DAWE 2020b).

Survey Results

The Koala was not detected within the subject site by direct observation however, secondary evidence of the Koala was detected by scat within the southern part of the subject site. Numerous records (334) of the Koala occur in the study area with the nearest records occurring approximately 10m from the subject site. Two tree species listed under the DPIE NSW Koala Strategy (DPIE 2021f) as, *High Preferred Use* trees for the Koala in the North Coast Koala Management Area (KMA), these include *Eucalyptus microcorys* (Tallowwood) and *Eucalyptus propinqua* (Small-fruited Grey Gum) were recorded in abundance within the subject site.

EPBC Act Assessment of Significance

Table 5: Significance Assessment- Koala

Significant Impact Criteria	Details
<p>a) Lead to a long-term decrease in the size of a population</p>	<p>The population of koalas that occur within the proposed FPFA are linked to the Coffs Harbour-Bellingen-Nambucca population. The Koala Habitat Study for the Nambucca Shire Council Coastal Area (2015) generation persistence analysis shows koalas are present and have a long history in the area. south-west of Eungai, which is in the vicinity of Ngambaa Nature Reserve (NR). However, Ngambaa NR was not included in the analysis and there were few historical koala records for the reserve (2 observed, 9 heard between 1994 and 2016).</p> <p>The construction footprint of the proposed FPFA fence is estimated to be up to 72 ha (0.7% of the 10,560 ha reserve). This comprises 40 ha fence line clearing (0.3% of reserve vegetation) when considering existing clearing along roads and trails of between 3-8m totalling approximately 10 ha and under scrubbed zone that will have little effect on koala habitat.</p> <p>Direct impacts during the construction of the proposed FPFA will not reduce the population size of koalas in Ngambaa NR. The safeguards and mitigation measures detailed in the REF, including pre-clearing surveys and supervision protocols, will ameliorate direct impacts on koalas during the construction phase. For some individuals part of the home range may be affected, but the proposal will not kill or completely take out the home range.</p> <p>Koala food trees located along the proposed fence line clearing include small-fruited grey gum <i>Eucalyptus propinqua</i> (on ridges) and tallowwood <i>Eucalyptus microcorys</i> (on mid to lower slopes). Survey of the fence line (Biodiversity Australia, 2021) indicated a density of 34 koala food trees per ha (including regrowth). These tree species are mostly found in the grey gum–ironbark–mahogany–spotted gum complex and blackbutt association. The estimated 40 ha of koala habitat affected represents 0.3% of the koala habitat within the reserve and is proportionally much less when considering the habitat available in the surrounding reserve, State Forest and private forest.</p> <p>When applied to the Ngambaa FPFA construction, a conservative average carrying capacity of 0.2 koalas per ha used in the NSW Koala Strategy (2022) results in an estimated reduction of 0.34 % in koala carrying capacity within the Nature Reserve. This translates to a potential reduction in carrying capacity of up to 6.8 koalas out of a potential carrying capacity of up to 2000. However, the number of koalas affected is likely to be less. DPE koala experts suggest the carrying capacity of the reserve is likely to be at the lower end of the range (between 0.06 and 0.1 koalas per ha). The consequences of losing a small proportion of koala habitat from the reserve are likely to be minor given the larger area of adjacent available habitat (nature reserve, State Forests and private forested areas of more than 500,000 ha.)</p> <p>The proposed Ngambaa FPFA is unlikely to lead to the long-term decline of the koala population as:</p> <ul style="list-style-type: none"> - The proposal only affects a small proportion (0.3%) of koala habitat within the reserve - With mitigations, the fence does not create a barrier to koalas dispersing out of the FPFA or fragment populations by impacting identified landscape koala corridors - The breeding cycle is not disrupted - Invasive weeds or diseases will not be introduced or increased - The recovery of the species will not be interfered with; and - Habitat inside the fence is managed to benefit koalas.
<p>b) Reduce the area of occupancy of the species</p>	<p>The proposed FPFA will not significantly reduce the area of occupancy for the koala. There are recent records of koalas identified from scats and passive infrared (PIR) cameras; however, population size or density is unknown (Biodiversity Australia 2021, Koala Recovery Partnership 2021).</p> <p>The construction footprint of the proposed FPFA fence is estimated to be up to 72 ha (0.7% of the 10,560 ha reserve). This comprises 40 ha fence line clearing (0.3% of reserve vegetation) when considering existing clearing along roads and trails of between 3-8m totalling approximately 10 ha and under scrubbed zone that will have little effect on koala habitat.</p> <p>Koala food trees located along the proposed fence line clearing include small-fruited grey gum <i>Eucalyptus propinqua</i> (on ridges) and tallowwood <i>Eucalyptus microcorys</i> (on mid to lower slopes). Survey of the fence line (Biodiversity Australia, 2021) indicated a density of 34 koala food trees per ha (including regrowth). These tree species are mostly found in the grey gum–ironbark–mahogany–spotted gum complex and blackbutt association. The estimated 40 ha of koala habitat affected represents 0.3% of the koala habitat within the reserve and is proportionally much less when considering the habitat available in the surrounding reserve, State Forest and private forest.</p> <p>When applied to the Ngambaa FPFA construction, a conservative average carrying capacity of 0.2 koalas per ha used in the NSW Koala Strategy (2022) results in an estimated reduction of 0.34 % in koala carrying capacity within the Nature Reserve. This translates to a potential reduction in carrying capacity of up to 6.8 koalas out of a potential carrying capacity of up to 2000. However, the number of koalas affected is likely to</p>

	<p>be less. DPE koala experts suggest the carrying capacity of the reserve is likely to be at the lower end of the range (between 0.06 and 0.1 koalas per ha). The consequences of losing a small proportion of koala habitat from the reserve are likely to be minor given the larger area of adjacent available habitat (nature reserve, State Forests and private forested areas of more than 500,000 ha.)</p> <p>The proposed FPFA will continue to offer habitat for koalas remaining in the FPFA once the fence is completed. Using the average koala carrying capacity of 0.2 koalas per ha used in the NSW Koala strategy, the FPFA would have a carrying capacity of approximately 500 koalas. However, based on surveys of the FPFA the actual population that will remain in the fenced area will be much less. Only 14 koala records exist for Ngambaa NR. Although low overall survey effort across decades may partially account for the low numbers, low numbers returned from targeted surveys suggest a smaller than estimated number of koalas will be affected by fencing area.</p> <p>The proposal will remove a small proportion of koala habitat as part of the FPFA fence construction. In relation to the extensive available habitats in the surrounding area, this loss is minimal. The vast majority of habitat potentially utilised by the local population within the study area is not affected by this proposal.</p>
c) Fragment an existing population into two or more populations	<p>The proposed FPFA will not fragment an existing population into two or more populations.</p> <p>The FPFA fence will be a physical barrier for koalas moving into the FPFA, but koalas will be able to climb the fence out of the FPFA (pers comm Ryan Duffy, Project Officer NPWS). Whilst the FPFA fence will create a barrier into the FPFA it will not fragment or divide the larger population. The FPFA does not split the wider koala habitat in two and koalas will be able to move/disperse around the FPFA. The proposed FPFA does not intersect the landscape koala corridors identified in the Koala Habitat Study for the Nambucca Shire Council Coastal Area (2015).</p> <p>NPWS will monitor the population inside and outside of the fenced area as part of the FPFA proposal. The Ngambaa Ecological Health and Monitoring Plan (EHMP) includes monitoring of koalas in and out of the FPFA. If there is any risk to the genetic variability, NPWS will adopt an adaptive approach and consider the exchange (or translocation) of animals in or out of the FPFA. Other mitigations that will be trialled and monitored include koala specific escape poles suspended off the ground that are accessible to koalas but not cats or foxes.</p>
d) Adversely affect habitat critical to the survival of a species	<p>The habitat within the proposed FPFA is considered critical habitat for koalas under the <i>EBPC Act referral guidelines for the vulnerable koala (2014)</i>. However similar habitat adjacent to Ngambaa NR is considered secondary habitat under the Koala Habitat Study for the Nambucca Shire Council Coastal Area (2015). The proposed FPFA contains two key koala food trees (tallowwood and small-fruited grey gum), and wet gullies for sheltering during hot weather and fires. The proposed FPFA is 2503 ha and sits within the Ngambaa NR (10,560ha) and wider forested area of more than 500,000ha made up of national parks, State Forest and private forest containing suitable koala habitat.</p> <p>As detailed above the proposal will only affect less than 34 ha of koala habitat that constitutes 0.3 % of the koala habitat within the reserve. In relation to the extensive available habitats in the surrounding area, this loss is minimal. The vast majority of habitat potentially utilised by the local population within the area is not affected by this proposal. Given the extensive available habitats to be retained for this species, the habitats affected within the subject site are not considered habitat critical to the survival of the koala.</p>
e) Disrupt the breeding cycle of a population	<p>The proposal is not expected to disrupt the breeding cycle of a population given that:</p> <ul style="list-style-type: none"> - The subject site will retain foraging habitat features such as koala food trees - There is sufficient habitat within the proposed FPFA for a breeding population to occur within the FPFA. Using the NSW Koala Strategy carrying capacity estimates of 0.2 koalas per ha, the FPFA could support a population of up to 500 koalas. - Ameliorative measures for maintaining connectivity and movement for the koala in and out of the FPFA through monitoring and translocation are incorporated as part of the proposal. - The FPFA only forms a small proportion of available habitat and does not present a barrier for dispersal or movement to larger areas of habitat during the breeding season. Koalas typically move over distances averaging 3.2km but long-distance dispersal (>11.2km) accounts for ca. 17% of movements (Norman et al 2019). Given the relative frequency of long-distance movements among koalas and extensive area of surrounding habitat, the probability of natural movements being blocked by the FPFA is relatively small - Alternative potential habitat in the study area is extensive.
f) Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>The construction of the proposed FPFA affects an insignificant proportion of koala within Ngambaa NR and wider koala habitat. The quality of the habitat within the FPFA and nature reserve will improve with the weed and predator pest control and fire management and may benefit or increase koalas within this area.</p> <p>The construction footprint of the proposed FPFA fence is estimated to be up to 72 ha (0.7% of the 10,560 ha reserve). This comprises 40 ha fence line clearing (0.3% of reserve vegetation) when considering existing clearing along roads and trails of between 3-8m totalling approximately 10 ha and under scrubbed zone that will have little effect on koala habitat.</p> <p>Koala food trees located along the proposed fence line clearing include small-fruited grey gum <i>Eucalyptus propinqua</i> (on ridges) and tallowwood <i>Eucalyptus microcorys</i> (on mid to lower slopes). Survey of the fence line (Biodiversity Australia, 2021) indicated a density of 34 koala food trees per ha (including regrowth). These tree species are mostly found in the grey gum–ironbark–mahogany–spotted gum complex and</p>

	<p>blackbutt association. The estimated 40 ha of koala habitat affected represents 0.3% of the koala habitat within the reserve and is proportionally much less when considering the habitat available in the surrounding reserve, State Forest and private forest.</p> <p>When applied to the Ngambaa FPFA construction, a conservative carrying capacity of 0.2 koalas per ha used in the NSW Koala Strategy (2022) results in an estimated reduction of 0.34 % in koala carrying capacity within the Ngambaa NR. This translates to a potential reduction in carrying capacity of up to 6.8 koalas out of a potential carrying capacity of up to 2000. However, the number of koalas affected is likely to be less than eight. The carrying capacity of the reserve is likely to be much less than 0.2 koalas per ha given the paucity of records, although this could be an artefact of low survey effort. The consequences of losing a small proportion of koala habitat from inside the fenced area are likely to be minor given the larger area of adjacent available habitat (nature reserve, State Forests and private forested areas of more than 500,000 ha.)</p> <p>Given small proportion of available koala habitat affected by the proposal and the small reduction in potential carrying capacity the proposal FPFA the koalas will not decline in the area from the construction and establishment of a FPFA.</p> <p>The Ngambaa FPFA is located in a rural and remote forested area more than 20km from urban and peri urban areas or major roads. The occurrence of dog attacks and vehicle strike is likely to be low.</p> <p>Weed control, fire management and feral predator control within the FPFA and nature reserve are likely to benefit koalas. Weed control programs targeting areas with a Regional Transforming Weed cover of more than 30% are likely to improve koala habitat (Koala Recovery Partnership, 2021). Prescribed burning and feral predator control is also likely to have a positive effect on koalas within the FPFA and nature reserve reducing the impacts of wildfires and predation from wild dogs.</p>
g) Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat	<p>No invasive species that affect the koala are likely to be introduced as a result of the proposal. The primary objective of the proposal is to provide a feral predator-free area to protect threatened species, from which all invasive feral predators that harm koalas will be removed.</p> <p>In addition, weeds within the fenced area will be controlled where practical</p>
h) Introduce disease that may cause the species to decline, or	<p>No disease that poses a potential risk to this species is likely to be introduced to the site. Koalas on the north coast are known to have chlamydia and it is likely to be present, but asymptomatic.</p> <p>Biosecurity protocols to prevent disease transmission will be addressed as part of translocation plans.</p>
i) Interfere with the recovery of the species	<p>The National Recovery Plan for the Koala <i>Phascolarctos cinereus</i> (combined populations of Queensland, New South Wales and the Australian Capital Territory) was released in March 2022. The proposed FPFA does not interfere with the recovery of the species and implements strategies in the National Recovery Plan (2022), which are to:</p> <ul style="list-style-type: none"> - Build and share knowledge (Strategy 1) - Engage and partner with the community in listed koala conservation (Strategy 2) - Increase the area of protected habitat for the listed koala (Strategy 3) - Integrate listed koala conservation into policy, statutory and land use plans (Strategy 4) - Strategically restore listed koala habitat (Strategy 5) - Actively manage listed koala metapopulations (Strategy 6).
Resulting Impact	No Significant Impact

A-1-2 Spotted-tailed Quoll (*Dasyurus maculatus*)

EPBC Act Status: Endangered

Distribution

The Spotted-tailed Quoll was historically widely distributed across the east of Australia known from as far north as southeast Queensland to as far south as Tasmania (DAWE 2021b). The mainland subspecies however has reduced in population dramatically with this species now generally confined to within 200km of the coast. The Department of Agriculture, Water and the Environment (2021b) list the current known locations as:

- Hunter Valley, Taree, Port Macquarie and Coffs Harbour through to the gorges and escarpments of the New England Tableland;
- Local populations in the south of the state (i.e. Kosciuszko NP and coastal national parks);
- Isolated records near Hay; and
- Disjunct populations between the Border Ranges and the Blue Mountains/Illawarra area.

Female Spotted-tailed Quolls occupy home ranges of 200-500 hectares, while males occupy very large home ranges from 500 to over 4000 hectares. These species are known to traverse their home ranges along densely vegetated creek lines (DPIE 2021b).

Threats

The DPIE (2021b) list the following key threats to the Spotted-tailed Quoll:

- Habitat loss and degradation - clearing, timber harvesting and forest management practices which also result in prey reduction;
- Predation - by Red Foxes, Dingos and domestic dogs;
- Fire - both short and long-term;
- Direct killing - largely by landholders in response to lost poultry;
- Road mortality;
- Poisoning through Cane Toads; and
- 1080 baiting.

Survey Results

Targeted surveys for this species were undertaken by incorporating PIR cameras set with tubes baited with chicken necks to camera trapping surveys for ground-dwelling mammals. The Spotted-tailed Quoll was not recorded during site survey however the Ngambaa Nature Reserve Plan of Management lists the Spotted-tailed Quoll as known to occur (NPWS 2004). A total of 32 records of the Spotted-tailed Quoll occur within a 10km study area with the nearest record being approximately 1km from the subject site (DPIE 2021b).

A potential occurrence assessment for the Spotted-tailed Quoll identified that the site may provide some areas of suitable quality denning and foraging habitat for this species.

EPBC Act Assessment of Significance

Table 6: Significant impact assessment - Spotted-tailed Quoll

Significant Impact Criteria	Details
a) Lead to a long-term decrease in the size of a population of a species	<p>The proposal will result in the removal/modification of approximately 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation. This area is a relatively small area of habitat to be impacted in proportion to the foraging and denning habitats available for this species within the subject site and the broader study area. Potential denning resources in the form of hollows, dead wood and bushrock are recommended to be retained and relocated within the subject site where possible.</p> <p>Hence, the subject site will continue to offer foraging and denning habitat for the Spotted-tailed Quoll as part of a larger home range. The Spotted-tailed Quoll is highly mobile and known to be capable of crossing human-modified habitat, connectivity recommendations have been made to allow movements of this species between habitats post construction therefore, the proposal will not lead to a long-term decrease of an important population.</p>
b) Reduce the area of occupancy of the species	<p>While the proposal will remove/modify a small proportion of the site's potential habitat for the Quoll, this loss is only a minor fraction of a potential territory of a single individual. Extensive rainforest habitats and in-tact sclerophyll forests occur adjacent to the subject site and the broader study area. Consequently, the majority of habitat potentially utilised by the local population is not affected by this proposal and therefore will not significantly reduce the area of occupancy of an important population.</p>
c) Fragment an existing population into two or more populations	<p>The Spotted-tailed Quoll is highly mobile species and known to be capable of crossing human-modified habitat (Smith et al 1995). The proposal will create a physical barrier to movement to the Spotted-tailed Quoll. To maintain connectivity and movements of this species between habitats, monitoring and capture and release programs have been recommended to be incorporated into the rewilding project. Thus, it will not fragment a potential existing important population.</p>
d) Adversely affect habitat critical to the survival of a species	<p>The site only potentially forms a small part of the Spotted-tailed Quoll's wider home range; potential foraging and denning habitat in the subject site and broader study area is relatively extensive and in areas a higher quality. Connectivity across the site and to adjacent habitat will be maintained by monitoring and capture and release programs where required. Additionally, the majority of the site's present habitat value for this species will be retained. Given the extensive available habitats to be retained for this species, the habitats within the subject site are not considered habitat critical to the survival of the Spotted-tailed Quoll.</p>
e) Disrupt the breeding cycle of a population	<p>The proposal is not expected to disrupt the breeding cycle of a population given that:</p> <ul style="list-style-type: none"> • The subject site will retain/relocate habitat features such as hollow-bearing trees and hollow logs for potential habitat for this species; • The potential for this species to occur and breed in the subject site will be retained post construction, being within or outside of the proposed predator proof fence; • The subject site only forms a minute part of their local range, and hence lifecycle requirements. • Alternative potential habitat in the study area is extensive.
f) Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	<p>As detailed previously the proposal will result in the removal/modification of approximately 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation. The degree of possible vegetation loss imposed by the proposed predator proof fence in relation to the extensive areas of habitats to be retained within the subject site and broader study area is not significant enough to affect a potential local population of the Spotted-tailed Quoll to the point that it could cause a decline of the species.</p>
g) Result in invasive species, that are harmful (by competition, modification of habitat, or predation) to Critically Endangered or Endangered species, becoming established in the Critically Endangered or Endangered species' habitat	<p>No invasive species that affects the Spotted-tailed Quoll is likely to be introduced as a direct result of the proposal.</p>
h) Introduce a disease that may cause the species to decline	<p>No disease that poses a potential risk to this species is likely to be introduced to the site.</p>
i) Interferes substantially with the recovery of the species	<p>The proposal will result in the removal of a relatively minute area of foraging habitat for the Spotted-tailed Quoll that is not significant enough to interfere with their recovery.</p>

Significant Impact Criteria	Details
	<p>Adopted/made recovery plan: Department of Environment, Land, Water and Planning (2016). National Recovery Plan for the Spotted-tailed Quoll <i>Dasyurus maculatus</i>. Australian Government, Canberra. Available from: http://www.environment.gov.au/biodiversity/threatened/recovery-plans/spotted-tailed-quoll. In effect under the EPBC Act from 06-May-2016.</p>
<p>Resulting Impact</p>	<p>No significant impact.</p>

A-1-4 Greater Glider (*Petauroides Volans*)

Greater Glider: BC Act Status: Endangered, **EPBC Act Status:** Vulnerable

Distribution

The Greater Glider occurs in forests and woodlands across eastern Australia where it forages on eucalypt leaves and occasionally flowers (TSSC 2016). It requires large tracts of remnant forests which contain old growth trees containing hollows which it uses for denning. Individual home ranges of the Greater Glider are small with an average size of around 1-3 hectares. This species is usually solitary within this home range and is known to be very loyal to their territory (TSSC 2016).

Threats

Key existing threats to these threatened arboreal mammal species includes:

- Habitat loss and degradation
- Fragmentation of habitat;
- Loss of hollow-bearing trees;
- Injury from barbed wire fences; and
- Predation by exotic predators

Survey Results

No Greater Gliders recorded.

EPBC Act Assessment of Significance

Table 7: Significant impact assessment - Greater Glider

Significant Impact Criteria	Details
a) Lead to a long-term decrease in the size of an important population of a species	It is estimated that approximately 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation will be removed/modified as a result of the proposal. The Greater Glider was not recorded within the subject site during site surveys however several local records for this species occurs within 1km of the subject site. The habitat within the subject site would only provide a small area of foraging and denning habitat within hollow-bearing trees for a potential population relative to its ecological requirements and local extent of potential habitat. The removal of this smaller portion of habitat for the Greater Glider is not likely to lead to a long-term decrease in the size of a local population of this species, the local population is likely to be necessary for maintaining genetic diversity amongst the broader population, however provided the recommendations for monitoring and implementing capture and release programs are undertaken where required, the proposal is unlikely to lead to a long-term decrease in the size of an important population.
b) Reduce the area of occupancy of an important population	The loss of habitat in the subject site will see a minor reduction of available foraging habitat in relation to the known area of occupancy of this species and the amount of available habitat in the surrounds. In addition, recommendations to maintain canopy connectivity in some areas above the proposed fence will ensure habitats on either side of the proposed fence line is available and accessible to this species. Consequently, the proposal would not reduce the area of occupancy of the important population.
c) Fragment an existing important population into two or more populations	The Greater Glider relies on canopy connection to move throughout its home range and would rarely come to the ground and cross clearings and open ground. The proposal would remove connective habitat for this species, provided the recommendations for monitoring and implementing capture and release programs are undertaken where required, the proposal is unlikely to fragment an existing population into two or more populations.
d) Adversely affect habitat critical to the survival of a species	No critical habitat for the Greater Glider and is present within the proposal area according to any databases or registers, including the Register of Critical Habitat maintained by the minister under the EPBC Act. However, it is likely that the vegetation on the subject site is considered critical habitat for the Greater Glider. With local records of the species, the vegetation within the study area is likely to support foraging and breeding activities as well as maintaining dispersal and genetic diversity. Due to the narrow, linear nature of the proposal and that vegetation and hollow-bearing trees are to be retained where possible within the subject site and that recommendations have been made to monitor and implement capture and release programs where required, the habitats within the subject site and adjacent habitats in the study area are not expected to be adversely affected such that it would affect the survival of the species.
e) Disrupt the breeding cycle of an important population	The habitat within the subject site represents foraging and breeding habitat for the Greater Glider. Removal of this habitat for the subject site may disrupt breeding by the removal of hollow-bearing trees which are used for denning. Hollow-bearing trees within the subject site are to be retained where possible and recommendations to maintain connectivity for this species have been made. Given this, the proposal is not expected to significantly disrupt the breeding cycle of an important population.
f) 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 estimated that approximately 69.75 ha of native vegetation including up to 0.22 ha of known EEC rainforest vegetation will be removed/modified as a result of the proposal. The vegetation to be removed is small in relation to the extent of available, suitable habitat for the Greater Glider, remaining adjacent to the subject site and the broader study area. A large majority of vegetation within the subject site will be retained. Connectivity will remain through the subject site and into adjoining vegetation provided the recommendations for monitoring and implementing capture and release programs are undertaken where required. The proposal will therefore not isolate any area of habitat or decrease the availability or quality of habitat to the extent that the species is likely to decline.
g) Result in invasive species, that are harmful (by competition, modification of habitat, or predation) to a Vulnerable species, becoming established in the Vulnerable species' habitat	No new species that affects the Greater Glider is likely to be introduced as a direct result of the proposal.
h) Introduce a disease that may cause a species to decline	No disease that poses a potential risk to this species is likely to be introduced to the site.
i) Interferes substantially with the recovery of the species	The proposal will result in the removal of a relatively minute area of foraging habitat and potential nesting habitat in the form of tree hollows for the Greater Glider. Given the extent of these habitats to remain in

Significant Impact Criteria	Details
	<p>the subject site and the broader study area and the recommendations for provided, the proposal is not expected to interfere with the recovery of this species.</p> <p>Recovery Plan required, stopping decline and supporting recovery is complex, due to the requirement for a high level of planning to abate the threats, a high level of support by key stakeholders, a high level of prioritisation and a highly adaptive management process. Existing mechanisms are not adequate to address these needs (2/05/2016) (DAWE 2021b).</p>
Resulting Impact	No significant impact

A-1-5 Migratory Species: Black-faced Monarch (*Monarcha melanopsis*) and Rufous Fantail (*Rhipidura rufifrons*)

The Black-faced Mornarch is widespread in eastern Australia, it occurs mainly in rainforest ecosystems and is sometimes found in nearby open eucalyptus forests where there are gullies with dense understorey. As a migratory species, they spend spring, summer and autumn in eastern Australia, and winter in southern and eastern Papua New Guinea from March to August. They breed from October to March in rainforest habitat within the tree canopy. In New South Wales, eggs have been recorded from October to February (DAWE 2021b).

The Rufous Fantail occurs in coastal and near coastal districts of northern and eastern Australia. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts such as Tallowwood (*Eucalyptus microcorys*), Mountain Grey Gum (*E. cypellocarpa*), Narrow-leaved Peppermint (*E. radiata*), Mountain Ash (*E. regnans*), Alpine Ash (*E. delegatensis*), Blackbutt (*E. pilularis*) or Red Mahogany (*E. resinifera*); with dense shrubby understorey often including ferns. They also occur in subtropical and temperate rainforests. The Rufous Fantail breeds from September to February, with 81% of eggs laid November-December (DAWE 2021b).

The main threat to populations of Rufous Fantail and the Black-faced Monarch is fragmentation and loss of core moist forest breeding habitat through land clearing and urbanisation.

EPBC Act Assessment of Significance

An important area of habitat is defined under the Matters of National Environmental Significance Significant Impact Guidelines 1.1 (DotE 2013) as:

1. Habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or;
2. Habitat utilised by a migratory species which is at the limit of the species range, or;
3. Habitat within an area where the species is declining.

Table 8: Significant impact assessment - Migratory terrestrial species

Significant Impact Criteria	Details
a) Substantially modify (including fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species	The proposal will contribute to the clearing and modification of up to 69.75 ha of native vegetation which includes up to 0.22 ha of Lowland Rainforest EEC potential habitat for these migratory species. Hydrological cycles may be temporarily altered during the construction of the proposed predator proof fence however this is not expected to substantially affect the Black-faced Monarch or the Rufous Fantail. Additionally, the subject site is not considered likely to constitute an important area of habitat given there are no records of either species within the study area and that it is not of sufficient extent to support an ecologically significant proportion of either the Black-faced Monarch or the Rufous Fantail. The subject site is also not located at the limit of either species' range. Extensive vegetation will be retained within and adjacent to the subject site for these migratory species.
b) Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat of the migratory species	An invasive species is one that may become established in the habitat and harm the migratory species by direct competition, modification of habitat, or predation. Provided that the mitigation measures for construction hygiene are followed, it is unlikely to introduce any such invasive species that is harmful or will threaten either the Black-faced Monarch and the Rufous Fantail.
c) Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species	In New South Wales breeding has been recorded from October to February for the Black-faced Monarch. The Rufous Fantail breeds from about September to February, with 81% of eggs laid November-December. No disruption of the lifecycle of these migratory birds is likely as the habitat affected is only a marginal area of the available habitat within the study area, additionally these highly mobile species will relocate to avoid construction impacts and recommendations have been made to minimise impacts to individuals that may potentially be nesting within the subject site during clearing..

Significant Impact Criteria	Details
Conclusion	In view of the above, it is considered unlikely that the Project would significantly impact any migratory species listed under the EPBC Act.



EPBC Act Protected Matters Report

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

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 13/05/21 11:10:04

[Summary](#)

[Details](#)

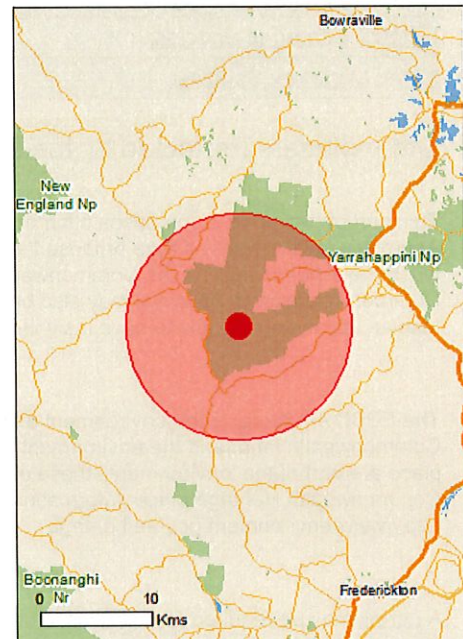
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

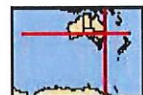
[Acknowledgements](#)



This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

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

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	2
Listed Threatened Species:	41
Listed Migratory Species:	15

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	20
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

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

State and Territory Reserves:	2
Regional Forest Agreements:	1
Invasive Species:	30
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [\[Resource Information \]](#)

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

Name	Status	Type of Presence
Coastal Swamp Oak (<i>Casuarina glauca</i>) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community likely to occur within area

Listed Threatened Species [\[Resource Information \]](#)

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat may occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
<u>Thinornis cucullatus cucullatus</u> Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat may occur within area
Frogs		
<u>Litoria aurea</u> Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat may occur within area
<u>Mixophyes balbus</u> Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
<u>Mixophyes iteratus</u> Giant Barred Frog, Southern Barred Frog [1944]	Endangered	Species or species habitat known to occur within area
Insects		
<u>Argynnis hyperbius inconstans</u> Australian Fritillary [88056]	Critically Endangered	Species or species habitat may occur within area
<u>Phyllodes imperialis smithersi</u> Pink Underwing Moth [86084]	Endangered	Species or species habitat may occur within area
Mammals		
<u>Chalinolobus dwyeri</u> Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat likely to occur within area
<u>Dasyurus maculatus maculatus (SE mainland population)</u> Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
<u>Petauroides volans</u> Greater Glider [254]	Vulnerable	Species or species habitat known to occur within area
<u>Petrogale penicillata</u> Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat likely to occur within area
<u>Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)</u> Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
<u>Potorous tridactylus tridactylus</u> Long-nosed Potoroo (SE Mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
<u>Pseudomys novaehollandiae</u> New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat likely to occur within area
<u>Pteropus poliocephalus</u> Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Plants		
<u>Acronychia littoralis</u> Scented Acronychia [8582]	Endangered	Species or species habitat may occur within area
<u>Arthraxon hispidus</u> Hairy-joint Grass [9338]	Vulnerable	Species or species habitat likely to occur within area
<u>Asperula asthenes</u> Trailing Woodruff [14004]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
Cryptostylis hunteriana Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat may occur within area
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat likely to occur within area
Euphrasia arguta [4325]	Critically Endangered	Species or species habitat may occur within area
Haloragis exalata subsp. velutina Tall Velvet Sea-berry [16839]	Vulnerable	Species or species habitat may occur within area
Macadamia integrifolia Macadamia Nut, Queensland Nut Tree, Smooth-shelled Macadamia, Bush Nut, Nut Oak [7326]	Vulnerable	Species or species habitat may occur within area
Marsdenia longiloba Clear Milkvine [2794]	Vulnerable	Species or species habitat known to occur within area
Parsonsia dorrigoensis Milky Silkpod [64684]	Endangered	Species or species habitat likely to occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat likely to occur within area
Phaius australis Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat known to occur within area
Rhodomyrtus psidioides Native Guava [19162]	Critically Endangered	Species or species habitat known to occur within area
Sarcochilus fitzgeraldii Ravine Orchid [19131]	Vulnerable	Species or species habitat may occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat likely to occur within area
Tylophora woollsii [20503]	Endangered	Species or species habitat likely to occur within area

Listed Migratory Species

[[Resource Information](#)]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		

[Apus pacificus](#)

Fork-tailed Swift [678]

Species or species habitat likely to occur within area

Migratory Terrestrial Species

[Cuculus optatus](#)

Oriental Cuckoo, Horsfield's Cuckoo [86651]

Species or species habitat known to occur within area

[Hirundapus caudacutus](#)

White-throated Needletail [682]

Vulnerable

Species or species habitat known to occur

Name	Threatened	Type of Presence
Monarcha melanopsis Black-faced Monarch [609]		within area Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Name	Threatened	Type of Presence
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within

Name	Threatened	Type of Presence area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Species or species habitat likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Thinornis rubricollis rubricollis Hooded Plover (eastern) [66726]	Vulnerable*	Species or species habitat may occur within area

Extra Information

State and Territory Reserves [\[Resource Information \]](#)

Name	State
LNE Special Management Zone No1	NSW
Ngambaa	NSW

Regional Forest Agreements [\[Resource Information \]](#)

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species

Name	Status	Type of Presence
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat known to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within

Name	Status	Type of Presence
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		area Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

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

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-30.85342 152.76274

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [Office of Environment and Heritage, New South Wales](#)
- [Department of Environment and Primary Industries, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment, Water and Natural Resources, South Australia](#)
- [Department of Land and Resource Management, Northern Territory](#)
- [Department of Environmental and Heritage Protection, Queensland](#)
- [Department of Parks and Wildlife, Western Australia](#)
- [Environment and Planning Directorate, ACT](#)
- [Birdlife Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Museum Victoria](#)
- [Australian Museum](#)
- [South Australian Museum](#)
- [Queensland Museum](#)
- [Online Zoological Collections of Australian Museums](#)
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
- [Northern Territory Herbarium](#)
- [Western Australian Herbarium](#)
- [Australian National Herbarium, Canberra](#)
- [University of New England](#)
- [Ocean Biogeographic Information System](#)
- [Australian Government, Department of Defence Forestry Corporation, NSW](#)
- [Geoscience Australia](#)
- [CSIRO](#)
- [Australian Tropical Herbarium, Cairns](#)
- [eBird Australia](#)
- [Australian Government – Australian Antarctic Data Centre](#)
- [Museum and Art Gallery of the Northern Territory](#)
- [Australian Government National Environmental Science Program](#)
- [Australian Institute of Marine Science](#)
- [Reef Life Survey Australia](#)
- [American Museum of Natural History](#)
- [Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

[© Commonwealth of Australia](#)
Department of Agriculture Water and the Environment
GPO Box 858
Canberra City ACT 2601 Australia
+61 2 6274 1111

DISCLAIMER This report was prepared by Biodiversity Australia in good faith exercising all due care and attention, but no representation or warranty, express or implied, is made as to the relevance, accuracy, completeness or fitness for purpose of this document in respect of any particular user's circumstances. Users of this document should satisfy themselves concerning its application to, and where necessary seek expert advice in respect of, their situation. The views expressed within are not necessarily the views of the Department of Planning and Environment and may not represent Department policy.