Wollondilly Biodiversity Technical Study
Ecological Constraints Assessment – Bargo

Wollondilly Shire Council

ecological AUSTRALIA
A TETRA TECH COMPANY

1300 646 131
www.ecoaus.com.au

DOCUMENT TRACKING

Project Name	Wollondilly Biodiversity Technical Study – Ecological Constraints Assessment for Bargo
Project Number	22SUT 1742
Project Manager	Bethany Lavers
Prepared by	Michael Gregor and Bronwyn Callaghan
Reviewed by	Michelle Frolich
Approved by	Michelle Frolich
Status	**Final**
Version Number	**V2**
Last saved on	**20 September 2022**

This report should be cited as 'Eco Logical Australia 2022. *Wollondilly Biodiversity Technical Study – Ecological Constraints Assessment – Bargo* . Prepared for Wollondilly Shire Council.'

ACKNOWLEDGEMENTS

This document has been prepared by Eco Logical Australia Pty Ltd with support from Wollondilly Shire Council

Contents

List of Figures

List of Tables

Executive Summary

Eco Logical Australia (ELA) was engaged by Wollondilly Shire Council (WSC) to prepare a Biodiversity Technical Study for a selection of properties in Bargo, NSW (the study area).

The aim of this assessment is to assist WSC by reviewing the suitability of the Bargo sites for Light Industrial and other compatible land uses that would be allowable under the proposed rezoning of the indicated land parcels. The study area is currently zoned RU1 – Primary Production under the Wollondilly Local Environment Plan 2011.

This report outlines the terrestrial and riparian ecological constraints across the study area. This includes information relating to relevant environmental planning instruments, threatened species and ecological communities, entry requirements into the Biodiversity Offset Scheme (BOS) and implications this scheme could have on future development.

A desktop review and field survey were undertaken of the study area to identify ecological constraints. The desktop review identified applicable planning instruments, past land use, previous vegetation mapping and records of threatened species previously recorded within and surrounding the study area.

The field survey included validation of previous vegetation mapping and identification of Plant Community Types (PCTs) and vegetation condition zones and fauna habitat assessments.

One PCT was identified, in varying condition types, on the study area:

- PCT 1395 *Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion.*

PCT 1395 is part of a Threatened Ecological Community (TEC), being the Critically Endangered Ecological Community (CEEC), Shale Sandstone Transition Forest in the Sydney Basin Bioregion, listed under the NSW *Biodiversity Conservation Act 2016* (BC Act). PCT 1395 in Intact condition also meets the definition of the TEC under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

No threatened flora or fauna were recorded on the study area during field surveys however, several habitat features were recorded which provides potential habitat for a range of threatened fauna species. This includes the identification of Koala use trees (as defined under the State Environmental Planning Policy (SEPP) (Biodiversity and Conservation) 2021 Chapter 4 – Koala Habitat Protection) on the study area, though no Koalas were observed.

The study area has a number of high constraints for future development should the study area be rezoned. High constraints include the areas mapped as a TEC, areas considered potential Koala habitat, vegetation mapped as Serious and Irreversible Impact (SAII) entity and areas mapped on the NSW Department of Planning and Environment's (DPE) Biodiversity Values (BV) Map. Any impacts on these areas are likely to trigger entry into the NSW Biodiversity Offsets Scheme (BOS), for which assessment using the Biodiversity Assessment Method (BAM) and preparation of a Biodiversity Development Assessment Report (BDAR) would be required. Any residual impacts would be required to be offset.

Impacts on areas considered to be core koala habitat will also require the preparation of a Koala Assessment Report in accordance with the Koala Habitat Protection SEPP.

However, there are areas mapped to have low and moderate constraints that could be suitable for rezoning to Light Industrial and for future development and comprise exotic vegetation and cleared land and houses, and first order watercourses, farm dams and areas of Waterfront land outside the required vegetated riparian zones, respectively.

Depending on the scale of impacts, a referral to the Commonwealth may be required for impacts to Koala habitat and TECs.

1. Introduction

Eco Logical Australia (ELA) was engaged by Wollondilly Shire Council (WSC) to prepare a Biodiversity Technical Study for 560-690 Arina Road, Bargo NSW (the study area). **Table 1** identifies the Lot and DPs which make up the study area and as shown on Figure 1.

Table 1: Lot and DPs making up the study area

Lot	DP	Address
23	10196	560 Arina Road, Bargo
24	10196	570 Arina Road, Bargo
25	10196	580 Arina Road, Bargo
26	10196	590 Arina Road, Bargo
27	10196	600 Arina Road, Bargo
28	10196	610 Arina Road, Bargo
29	10196	620 Arina Road, Bargo
36	10196	690 Arina Road, Bargo
B	354366	630 Arina Road, Bargo
A	354366	636 Arina Road, Bargo
31	10196	115 Reservoir Road, Bargo
32	10196	120 Reservoir Road, Bargo
33	10196	660 Arina Road, Bargo
34	10196	670 Arina Road, Bargo
35	10196	680 Arina Road, Bargo
36	10196	690 Arina Road, Bargo

The study area is zoned RU1 Primary Production under the Wollondilly Local Environment Plan (LEP) 2011. The study area has varied land use including rural living, rural industry (horse agistment and training facilities, dog boarding kennels), other small businesses and various easements for water, electricity, gas and telecommunications. The Hume Highway occurs to east and south with a bushland buffer in between (Figure 1Error! Reference source not found.). The land to the north and west is a mix of rural industry and rural living.

1.1. Purpose

The aim of this assessment is to assist WSC by reviewing the suitability of the Bargo sites for light industrial and other compatible land uses that would be allowable under the proposed rezoning of the indicated land parcels.

This report outlines the terrestrial and riparian ecological constraints across the study area. This includes information relating to relevant environmental planning instruments, threatened species and ecological

communities, entry requirements into the Biodiversity Offset Scheme (BOS) and implications this scheme could have on future development.

Figure 1: Study area location

1.2. Terms and Abbreviations

For the purposes of this assessment, the following terms have been defined:

- **Study area** – the area being directly assessed in this study including the land identified in Table 1, and shown in Figure 1.

Abbreviation	Description
BAM	Biodiversity Assessment Method
BC Act	NSW *Biodiversity Conservation Act 2016*
BC Regulation	NSW *Biodiversity Conservation Regulation 2017*
BDAR	Biodiversity Development Assessment Report
BOS	Biodiversity Offsets Scheme
BS Act	NSW *Biosecurity Act 2015*
BV Map	Biodiversity Values Map
CAA	Controlled Activity Approval
CEEC	Critically Endangered Ecological Community
DA	Development Application
DBH	Diameter at Breast Height
DAWE	Former Commonwealth Department of Agriculture, Water and the Environment (now the DCCEEW)
DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water (the former DAWE)
DCP	Development Control Plan
DPI	Department of Primary Industries (NSW)
DPE	Department of Planning and Environment (NSW)
ELA	Eco Logical Australia Pty Ltd
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environmental Protection Licence
FM Act	NSW *Fisheries Management Act 1994*
GIS	Geographic Information System
LEP	Local Environment Plan
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NRAR	Natural Resource Access Regulator
OEH	Former Office of Environment and Heritage (NSW) (now DPE)
PCT	Plant Community Type
PMST	Protected Matters Search Tool
POEO Act	NSW *Protection of the Environment Operations Act 1977*

Abbreviation	Description
SEPP	State Environmental Planning Policy
SSTF	Shale Sandstone Transition Forest
TEC	Threatened Ecological Community
ToS	Test of Significance
VMP	Vegetation Management Plan
VRZ	Vegetated Riparian Zone
WM Act	NSW *Water Management Act 2000*
WSC	Wollondilly Shire Council

1.3. Limitations

Not all lots within the study area (Table 1) were able to be accessed during the field survey. This was because some landowners had contacted WSC prior to the survey to express their wish for field staff not to visit their property. Many landowners had not contacted WSC prior to the survey to organise suitable dates and times. For these, field staff attempted to make contact with the landowner during the survey through calling or door knocking, which was sometimes successful in making contact. Some of these also expressed a wish for field staff not to access their property. It was not possible to contact some landowners at all and for these properties and the properties for which landowners did not grant access, field staff had to observe vegetation and habitat features from nearby properties. The properties for which access was granted and full field survey was conducted are listed in **Table 2**.

Table 2: Properties for which field staff had full access and full field survey could be conducted

Lot // DP	Address	Field Access
23//10196	560 Arina Road, Bargo	Owner unable to be contacted. Field survey conducted from neighbouring property.
24//10196	570 Arina Road, Bargo	Access granted. Full field survey complete.
25//10196	580 Arina Road, Bargo	Access granted. Full field survey complete.
26//10196	590 Arina Road, Bargo	Owner unable to be contacted. Field survey conducted from neighbouring properties.
27//10196	600 Arina Road, Bargo	Access granted. Full field survey complete.
28//10196	610 Arina Road, Bargo	Owner unable to be contacted. Field survey conducted from neighbouring properties
29//10196	620 Arina Road, Bargo	Currently a construction site. Owner unable to be contacted. Field survey conducted from neighbouring properties.
36//10196	690 Arina Road, Bargo	Access not granted (owner not available during survey period). Field survey conducted from road and neighbouring properties.
B//354366	630 Arina Road, Bargo	Access denied; animals and dogs in the property; Owner can't take the liability. Field survey conducted from neighbouring properties.
A//354366	636 Arina Road, Bargo	Access denied.
31//10196	115 Reservoir Road, Bargo	Owner unable to be contacted. Field survey conducted from road and neighbouring properties.

Lot // DP	Address	Field Access
32//10196	120 Reservoir Road, Bargo	Access denied.
33//10196	660 Arina Road, Bargo	Spoke with Tennant on site. Would not grant access without owner's permission. Unable to contact owner. Field survey conducted from road and neighbouring properties.
34//10196	670 Arina Road, Bargo	Access granted. Full field survey complete.
35//10196	680 Arina Road, Bargo	Access granted. Full field survey complete.
36//10196	690 Arina Road, Bargo	Contacted landowner who did not want to grant access. Field survey conducted from road and neighbouring properties.

2. Legislative Context

Table 3 summarises how relevant legislation may impact future development of the study area.

Table 3: Legislation relevant to the study area

Name	Relevance to the project
	Commonwealth
Environmental Protection and Biodiversity Conservation Act 1999 (EPBC* Act*)	The Commonwealth *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act) aims to protect Matters of National Environmental Significance (MNES), including vegetation communities and species listed under the EPBC Act. If a development is likely to have a significant impact on MNES, it is likely to be considered a 'Controlled Action' by the Commonwealth and requires assessment and approval by the Commonwealth in order to proceed. The MNES that have been considered during this assessment are: • Listed threatened species and communities • Listed migratory species. Depending on the scale of impacts to MNES listed under the EPBC Act, future development may require a referral under the EPBC Act. MNES of particular concern include Koala and threatened ecological communities.
	State
***Environmental Planning and Assessment Act 1979* (EP&A Act)**	The *Environmental Planning and Assessment Act 1979* (EP&A Act) is the principal planning legislation for NSW. It provides a framework for the overall environmental planning and assessment of development proposals. This Act provides for the creation of State Environmental Planning Policies (SEPPs), Local Environmental Plans (LEPs) and Development Control Plans (DCPs). If an LEP is to be amended (e.g., to change the zoning of land), the change is made through the preparation of a planning proposal. The planning proposal explains the intent of the proposed changes and the justification for the LEP amendments. This is required, for example, when a council has endorsed and seeks to implement and give effect to its local housing or employment land strategy. A council may initiate an LEP amendment by drafting a planning proposal and submitting it to the Department of Planning and Environment (DPE) for Gateway determination. Council is responsible for preparing the information and supporting documentation for any council-initiated proposal. Local development is assessed under Part 4 of the EP&A Act. Part 4 assessments must assess whether the proponent will require entry into the BOS. More information on this is discussed below.
***Biodiversity Conservation Act 2016* (BC Act)**	The *Biodiversity Conservation Act 2016* (BC Act) outlines the assessment requirements to determine whether a proposed development (Part 4 of the EP&A Act) is likely to significantly affect threatened species or ecological communities, or their habitats (section 7.3 BC Act) and whether the Biodiversity Offsets Scheme (BOS) will be triggered. Works that exceed the BOS thresholds as set out in Part 7 of the Act and Part 7 of the Biodiversity Conservation Regulation 2017 (BC Regulation), are required to undertake the ecological assessment in accordance with the Biodiversity Assessment Method (BAM), including the preparation of a Biodiversity Development Assessment Report (BDAR). There are three main triggers for entry into the BOS: • Clearing above the area threshold established under section 7.2 of the BC Regulation 2017. This is based on the minimum lot size allowable under the LEP

Name	Relevance to the project
	• Impacting land mapped as 'biodiversity values' under the Biodiversity Values Map (DPE, 2022) • If a proposal is likely to have a significant impact on threatened ecological values following the application of the Test of Significance under Section 7.3 of Part 7 of the Act. Each of these triggers is discussed below.
***Biodiversity Conservation Regulation* 2017**	The clearing threshold triggers are based on the minimum lot size allowable. For a minimum lot size of land less than 40 ha but not less than 1 ha, the BOS is triggered by clearing more than 0.5 ha of native vegetation. The minimum lot size ranges from 16 to 20 ha within the study area, which falls within this 1 ha – 40 ha range, therefore any clearing over 0.5 ha of native vegetation will require the preparation of a BDAR and may require of biodiversity offsets. The Biodiversity Values Map (BV Map) identifies land with high biodiversity value, as defined by the Biodiversity Conservation Regulation 2017. The BV Map has biodiversity values mapped on 11 of the 15 lots (Figure 2). The BOS is triggered by impacting land mapped under the Biodiversity Values Map. Impacts in a mapped area will require the preparation of a BDAR and may require biodiversity offsets. A significant impact triggering the BAM can only be determined through the preparation of a Flora and Fauna Assessment report in relation to a proposed development. If a proposed development within the study area has the potential to significantly impact a threatened entity (as determined through application of the test of significance), the BOS will be triggered.
***Fisheries Management Act 1994* (FM Act)**	The *Fisheries Management Act 1994* (FM Act) governs the management of fish and their habitat in NSW. The schedules of the Act list key threatening processes and threatened species which must be addressed at the DA stage. The FM Act regulates the provision of permits required in relation to harm of protected marine vegetation (seagrass, macroalgae, mangroves and saltmarsh), dredging, reclamation or obstruction of fish passage on or adjacent to Key Fish Habitat (KFH). This includes direct and indirect impacts, whether temporary or permanent. There is no KFH mapped within the study area (Figure 3).
***Biosecurity Act 2015* (BS Act)**	The *Biosecurity Act 2015* provides a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers. Implementation of the Act for weeds is supported by Regional Strategic Weed Management Plans (RSWMP) developed for each region in NSW.
***Protection of the Environment Operations Act 1977* (POEO Act)**	The *Protection of the Environment Operations Act 1977* (POEO Act) is the key environmental protection and pollution statute. The POEO Act is administered by the Department of Planning and Environment (DPE) and establishes a licensing regime for waste, air, water and pollution. Relevant sections of the Act are listed below: • Part 5.3 Water Pollution • Part 5.4 Air Pollution • Part 5.5 Noise Pollution • Part 5.6 Land Pollution and Waste. Any work potentially resulting in pollution must comply with the POEO Act. Relevant licences must be obtained if required. Licence requirements will need to be identified prior to works including an Environmental Protection Licence (EPL).
***Water Management Act 2000* (WM Act)**	The main objective of the *Water Management Act 2000* (WM Act) is to manage NSW water in a sustainable and integrated manner that will benefit current generations without compromising future generations' ability to meet their needs. The WM Act is administered by the Natural Resources Access Regulator (NRAR) and establishes an approval regime for activities within waterfront land, defined as the land 40 m from the highest bank of a river, lake or

Name	Relevance to the project
	estuary. A Controlled Activity Approval (CAA) is typically required for work within waterfront land. The study area contains waterfront land, as shown in Figure 3. Any proposed development within waterfront land will require a Controlled Activity Approval (CAA) and integrated approval under the WM Act. Note that in some cases, 1st order watercourse can be extinguished, following consultation with NRAR, particularly if there are no formed creeks banks and no creek bed. This will require further ground truthing. Any riparian areas that need to be retained will also require vegetated riparian zones (VRZ) either side of the stream, of widths according to their Strahler stream order: • 1st order = 10m • 2nd order = 20m • 3rd order = 30m • 4th order = 40m The width of these VRZs is illustrated in Figure 3.
DRAFT Cumberland Plain Conservation Plan	The NSW Department of Planning and the Environment (DPE) are in the process of preparing the Cumberland Plain Conservation Plan. This strategic assessment was on public exhibition in 2020 but is still in draft form. Once finalised and gazetted, this plan will be the first strategic biodiversity certification under the NSW BC Act. In relation to this plan, the study area has some areas mapped as: • Strategic conservation areas • Important Koala Habitat • NSW Threatened Ecological Community.
Environmental Planning Instruments	
State Environmental Planning Policy (Biodiversity and Conservation) 2021	<u>Chapter 4 – Koala habitat protection 2021</u> The Wollondilly Local Government Area (LGA) is a listed LGA for which the State Environmental Planning Policy (SEPP) (Biodiversity and Conservation) 2021 applies (Koala habitat protection). The aim of this chapter is to protect and provide habitat for koalas. If a local development is proposed to occur within a LGA to which this SEPP applies, before granting development consent, the local Council must assess whether the proposed development is likely to impact koalas or their habitat. A Koala assessment report will be required if the council is satisfied that the development will impact on koalas or koala habitat.
Wollondilly Local Environmental Plan 2011	Land is proposed to be zoned IN2 Light Industrial. The objectives of the zone include: • To provide a wide range of light industrial, warehouse and related land uses. • To encourage employment opportunities and to support the viability of centres. • To minimise any adverse effect of industry on other land uses. • To enable other land uses that provide facilities or services to meet the day to day needs of workers in the area. • To ensure development does not impact on the viability of land within Zone B1 Neighbourhood Centre. The study area is included on the Minimum Lot Size (MLS) maps under the LEP as detailed above. The standard LEP Terrestrial Biodiversity overlay has not been adopted in the Wollondilly LEP and thus does not apply to the study area.

Figure 2: Biodiversity Values Map (DPE 2022)

Figure 3: Water courses in the study area

3. Methodology

3.1. Desktop Assessment

A desktop assessment was undertaken to inform the field assessment. The following resources were consulted to inform this assessment:

- BioNet (Atlas of NSW Wildlife) database search (5 km) for threatened species, endangered populations listed under the BC Act
- EPBC Act Protected Matters Search Tool (PMST) (5km) for Matters of Environmental Significance (MNES) listed under the EPBC Act
- Collation of database results into a 'Likelihood of Occurrence Table'
- Review of applicable SEPP's, in particular the Biodiversity and Conservation SEPP and any other relevant SEPPs applicable to the site
- NSW Government Biodiversity Values Mapping
- State-wide hydroline map of riparian corridors
- DPI Fisheries Spatial Portal for threatened species listed under the Fisheries Management Act 1994 and Key Fish Habitat map
- Aerial photographs, topographical maps and GIS data systems
- Any previous vegetation mapping or ecological studies for the study area and surrounds
- Any additional material relevant to the project such as local and state planning instruments.

3.2. Field Survey

The field survey was conducted on 17th and 23rd May 2022 by ELA Senior Ecologist Bronwyn Callaghan (Accredited BAM Assessor) and ELA Ecologist Michael Gregor. The weather conditions for both survey days was sunny with a top of 21°C on the 17th May 2022 and 20°C on the 23rd May 2022. The site inspection was conducted to:

- Validate existing vegetation mapping (Office of Environment and Heritage, NSW (OEH) 2013), assign vegetation mapping to Plant Community Types (PCTs), determine the condition of PCTs present and assess whether they conform to any Threatened Ecological Communities (TEC). The condition was assigned based on the features listed in (**Table 4**).
- Identify habitat features for potential threatened flora and fauna species within the study area, including hollow bearing trees, woody debris, wetland areas or creek lines.
- Identify areas of potential aquatic habitat in watercourses and dams identified in the study area.

Table 4: Description of vegetation condition zones

Vegetation Zone	Vegetation features
Intact	Dominated by native flora species within all vegetation stratum No to low cover of exotic species
Weedy	Native canopy trees present Substantial cover of exotic flora species in mid-storey and / or ground layer
Canopy only	Native canopy trees present Cleared mid-storey and ground layer, usually regularly mown or containing garden beds

Vegetation Zone	Vegetation features
Derived Native Grassland (DNG)	Native canopy absent Mid-storey sparse, if present, and dominated by native species Ground layer dominated by native grass and forb species

To assist in validating / determining the PCTs, boundaries and condition of the existing vegetation, a series of rapid assessments were conducted across the study area. These rapid assessments involved recording vegetation structure detail (stratum heights and covers) along with compositional detail, including dominant and indicative flora species within an approximate 20 m radius. Other site detail was collected such as landscape position, slope, aspect, and soils, where relevant. These rapid assessment points, along with boundaries between different vegetation communities and conditions, were recorded in field using the ArcGIS Field Maps app on a smart phone.

Important habitat features were also recorded using Field Maps, including detail on the type of feature (e.g. hollow bearing tree), extent / abundance of habitat feature, and other important details (e.g. tree species, height, diameter at breast height (dbh), height of lowest hollow).

No targeted threatened species surveys were undertaken.

4. Results

4.1. Desktop Assessment

4.1.1. Vegetation communities

Vegetation within the study area was previously mapped by OEH (2013) (Figure 4). This shows three PCTs as occurring within the study area:

- PCT 1081 *Red Bloodwood - Grey Gum woodland on the edges of the Cumberland Plain, Sydney Basin Bioregion*
- PCT 1181: *Smooth-barked Apple - Red Bloodwood - Sydney Peppermint heathy open forest on slopes of dry sandstone gullies of western and southern Sydney, Sydney Basin Bioregion*
- PCT 1395: *Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion.*

One of these vegetation communities, PCT 1395, is associated with a Threatened Ecological Community (TEC): *Shale Sandstone Transition Forest in the Sydney Basin Bioregion* (SSTF), which is listed as a Critically Endangered Ecological Community (CEEC) under the BC Act or EPBC Act (DAWE 2022b).

The Protected Matters Search Tool (PMST) identified seven TEC's listed under the EPBC Act that could potentially occur within the 5 km area of the study area (**Appendix A**). Of these, SSTF was found to occur within the study area.

All flora species recorded during the field survey are provided in **Appendix B**.

4.1.2. Threatened species records

The BioNet Atlas (DPE 2022a) and PMST searches (DAWE 2022a) identified a total of 55 threatened fauna species and 23 threatened flora species that were recorded within, or having the potential to occur within, a 5 km radius of the study area (full list in **Appendix A**). Of these, 26 fauna species and nine flora species have records within 5 km radius of the study area (Figure 5 and Figure 6). Using this data, a Likelihood of Occurrence assessment was conducted (**Appendix A**). This assessment was used to inform the likelihood of each species occurring within the study area.

Figure 4: Previous vegetation mapping (OEH 2013)

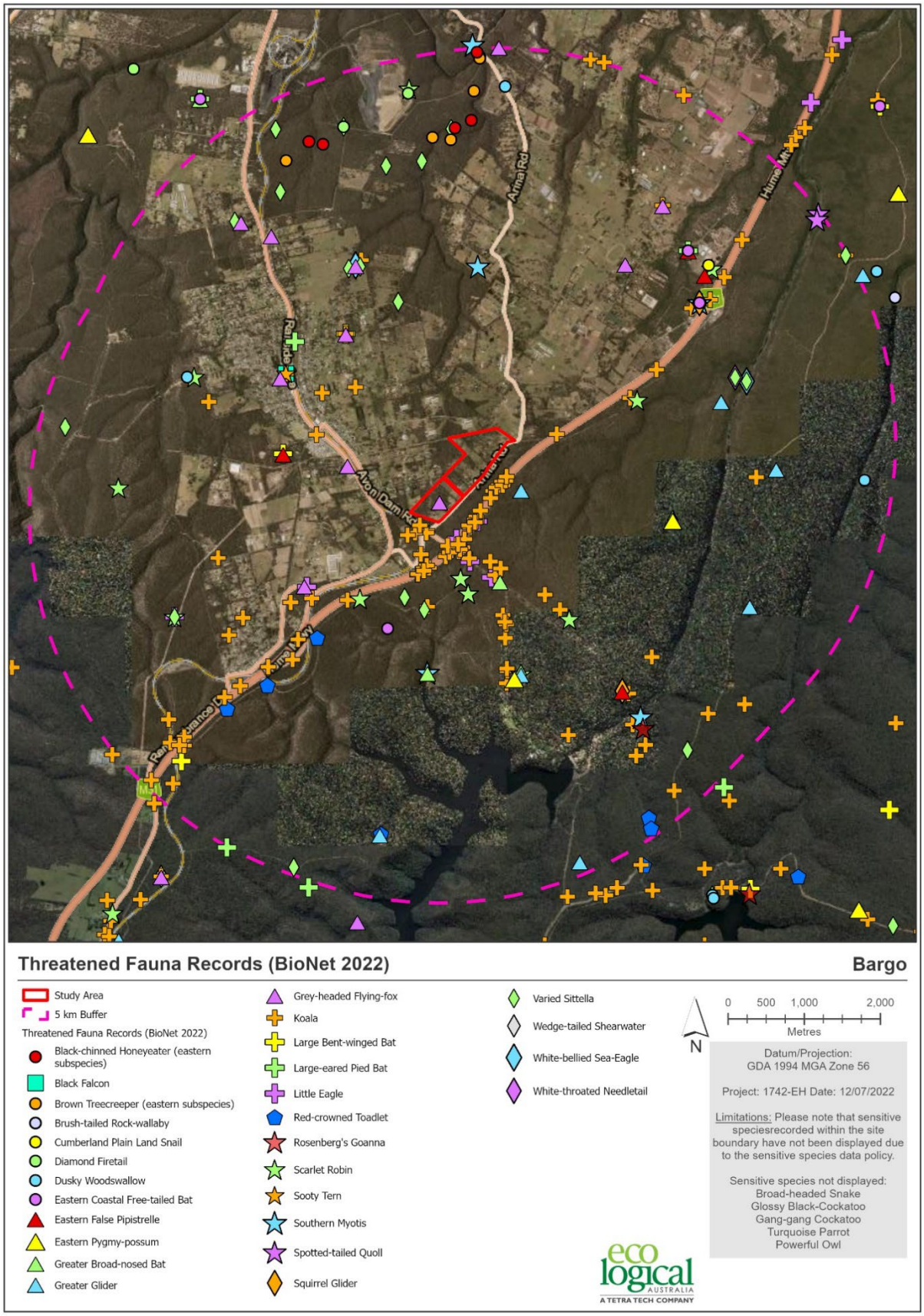

Figure 5: Threatened fauna previously recorded within 5km of the study area

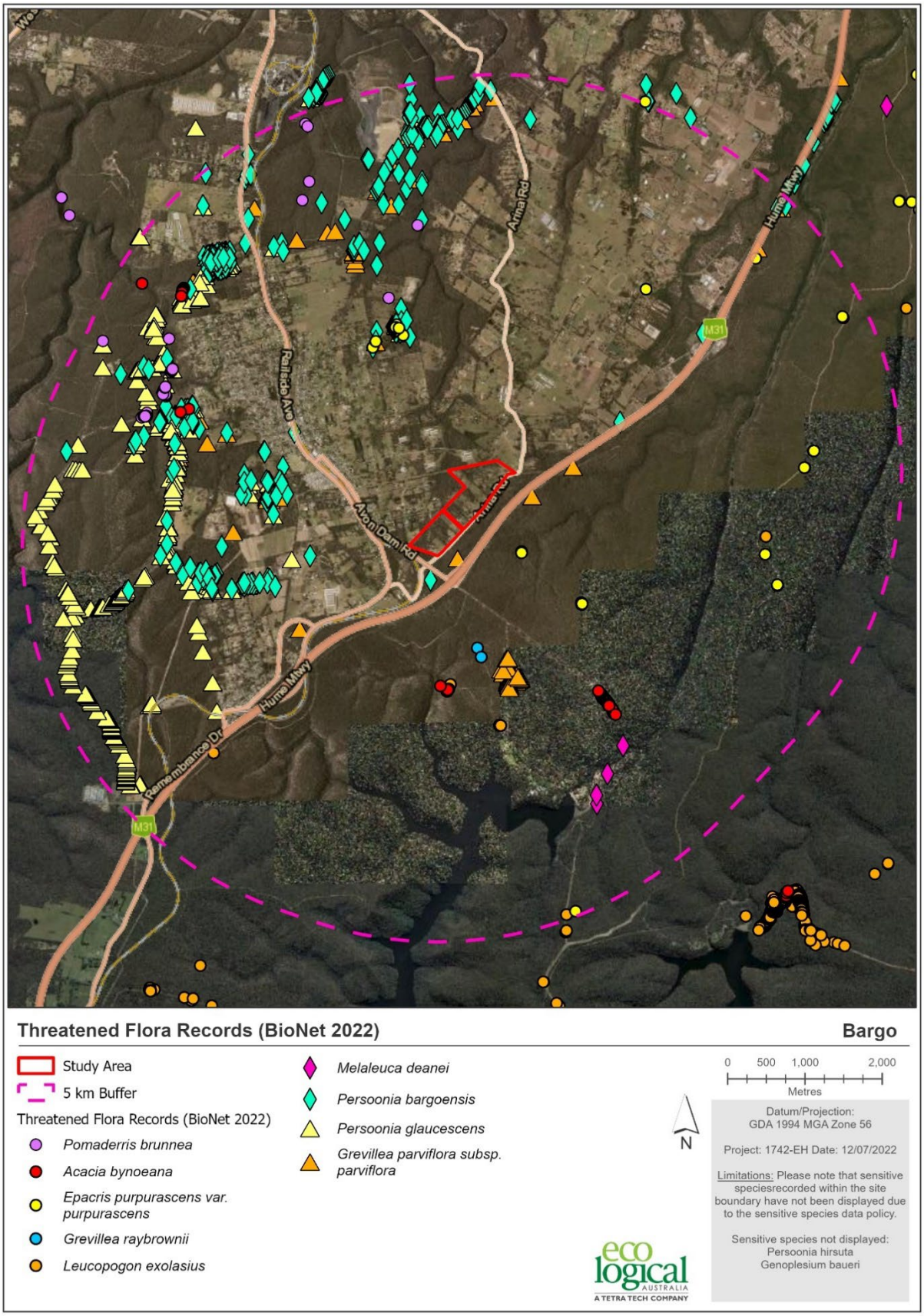

Figure 6: Threatened flora previously recorded within 5km of study area

A single threatened fauna record is located within the study area, although there are multiple records within a 1km radius for several species. This was a record of *Pteropus poliocephalus* (Grey-headed Flying Fox), which was made in 2014, with an accuracy of 30 m and included the sighting of 1 individual. Of the 55 threatened fauna species, 20 were assessed as having the potential to occur on the study area (**Table 5**). Species that were assessed as having potential to occur were those known to occur within the PCTs identified within the study area and for which there was suitable habitat within the study area.

Table 5: Threatened fauna with potential to occur within the study area

Scientific name	Common name	BC Act listing	EPBC Act listing
Chalinolobus dwyeri	Large-eared Pied Bat	V	V
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	V	
Daphoenositta chrysoptera	Varied Sittella	V	
Dasyurus maculatus maculatus (SE mainland population)	Spotted-tailed Quoll	V	E
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	
Hieraaetus morphnoides	Little Eagle	V	
Hoplocephalus bungaroides	Broad-headed Snake	E	V
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	V	
Meridolum corneovirens	Cumberland Plain Land Snail	E	
Miniopterus australis	Little Bentwing-bat	V	
Miniopterus orianaea oceanensis	Large Bent-winged Bat	V	
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	
Myotis macropus	Southern Myotis	V	
Neophema pulchella	Turquoise Parrot	V	
Ninox strenua	Powerful Owl	V	
Petauroides volans	Greater Glider	V	
Petroica boodang	Scarlet Robin	V	
Phascolarctos cinereus	Koala	E	E
Pteropus poliocephalus	Grey-headed Flying-fox	V	V
Scoteanax rueppellii	Greater Broad-nosed Bat	V	
Stagonopleura guttata	Diamond Firetail	V	

Status key: V = Vulnerable; E = Endangered

No threatened flora records were located within the study area, however, several records have been made within close proximity (<1km) of the study area, in particular *Grevillea parviflora* subsp. *parviflora* (Small-flower Grevillea) and *Persoonia bargoensis* (Bargo Geebung). Of the 23 threatened flora species, six species were assessed as having the potential to occur within the study area (**Table 6**). Species that were assessed as having potential to occur were those known to occur within the PCTs identified within the study area and for which there was suitable habitat within the study area.

Table 6: Threatened flora with the potential to occur within the study area

Scientific name	Common name	BC Act listing	EPBC Act listing
Acacia bynoeana	Bynoe's Wattle	E	V
Epacris purpurascens var. *purpurascens*		V	
Genoplesium baueri	Bauer's Midge Orchid	E	E
Grevillea parviflora subsp. *parviflora*	Small-flower Grevillea	V	V
Leucopogon exolasius	Woronora Beard-heath	V	V
Persoonia bargoensis	Bargo Geebung	E	V

Status key: V = Vulnerable; E = Endangered

4.1.3. Biodiversity Values Map

The study area contains three large areas of land mapped under the NSW Biodiversity Values (BV) map (Figure 2). The majority of the Lots within the study area (11 out of 15) contain land mapped on the BV map. These are:

- 23//10196 (560 Arina Road, BARGO)
- 24//10196 (570 Arina Road, BARGO)
- 25//10196 (580 Arina Road, BARGO)
- 26//10196 (590 Arina Road, BARGO)
- 27//10196 (600 Arina Road, BARGO)
- 29//10196 (620 Arina Road, BARGO)
- B//354366 (630 Arina Road, BARGO)
- A//354366 (636 Arina Road, BARGO)
- 31//10196 (115 Reservoir Road, BARGO)
- 32//10196 (120 Reservoir Road, BARGO)
- 36//10196 (690 Arina Road, BARGO).

If any activity is expected to impact land within the BV map, the Biodiversity Offset Scheme (BOS) will be triggered. It is possible to challenge the BV mapping where there are no biodiversity values, however, given most of the current area mapped overlaps with vegetation identified as both a TEC and Serious and Irreversible Impact (SAII) entity (see 4.2.1, below), the success of such a challenge would be unlikely.

4.1.4. State Environmental Planning Policy (Biodiversity and Conservation) 2021

4.1.4.1. Koala Habitat Protection 2021 (Chapter 4)

The Wollondilly Local Government Area (LGA) is listed as one of the LGAs to which Chapter 4 (Koala Habitat Protection SEPP) of the State Environmental Planning Policy (Biodiversity and Conservation) 2021 applies. The Koala Habitat Protection SEPP applies to all zones within the Wollondilly LGA. The principles of this SEPP are "*to help koalas thrive by ensuring koala habitat is properly considered during the development assessment process, and to provide a process for councils to strategically manage koala habitat through the development of koala plans of management*".

The SEPP lists the tree species that considered Koala use trees for the Central Coast koala management area in Schedule 3. Where a development application is likely to have an impact on koala habitat, surveys by a suitably qualified person (as defined by the SEPP) must be undertaken to determine whether the study area contains core koala habitat.

Koala use trees are likely to be present within the study area considering the existing vegetation communities present (Section 4.1.1 above) and the tree species that will likely occur on the study area. If a proposed development will impact on koalas or koala habitat, a Koala Assessment Report will be required and must be lodged with the Development Application (DA) to Council. Council must assess whether any proposed development is likely to impact koalas or their habitat.

4.1.5. Water courses and wetlands

There is one 1st order stream that passes through 560 and 570 Arina Road in the northern section of the study area (Figure 3). This 1st order stream connects with Dogtrap Creek north west of the study area which is mapped as a 2nd order stream. If this 1st order stream meets the definition of a 'river' under the WM Act, it and a 40 m buffer either side of it will be classed as waterfront land. Any proposed works within waterfront land require a Controlled Activity Approval (CAA) under the WM Act. However, many 1st order watercourses do not exhibit features of a defined channel with bed and bank, in which case the NRAR may determine that the watercourse is not waterfront land for the purposes of the WM Act.

4.2. Field Survey Results

4.2.1. Vegetation Communities, Threatened Ecological Communities and SAII entities

The field survey confirmed the presence of only one PCT within the study area, which was divided into four condition zones (Figure 7):

- PCT 1395 *Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion* (Intact)
- PCT 1395 *Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion* (Weedy)
- PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Canopy only)
- PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (DNG).

The study area includes areas of exotic dominated vegetation which cannot be assigned a PCT. These have been mapped as 'Exotic pasture' and 'Exotic gardens and lawns' (Figure 7). The study area also includes a horse training arena which was devoid of vegetation; this has been mapped as 'Cleared'. A description of each PCT and condition zone is provided below, as well as a justification for each condition assigned.

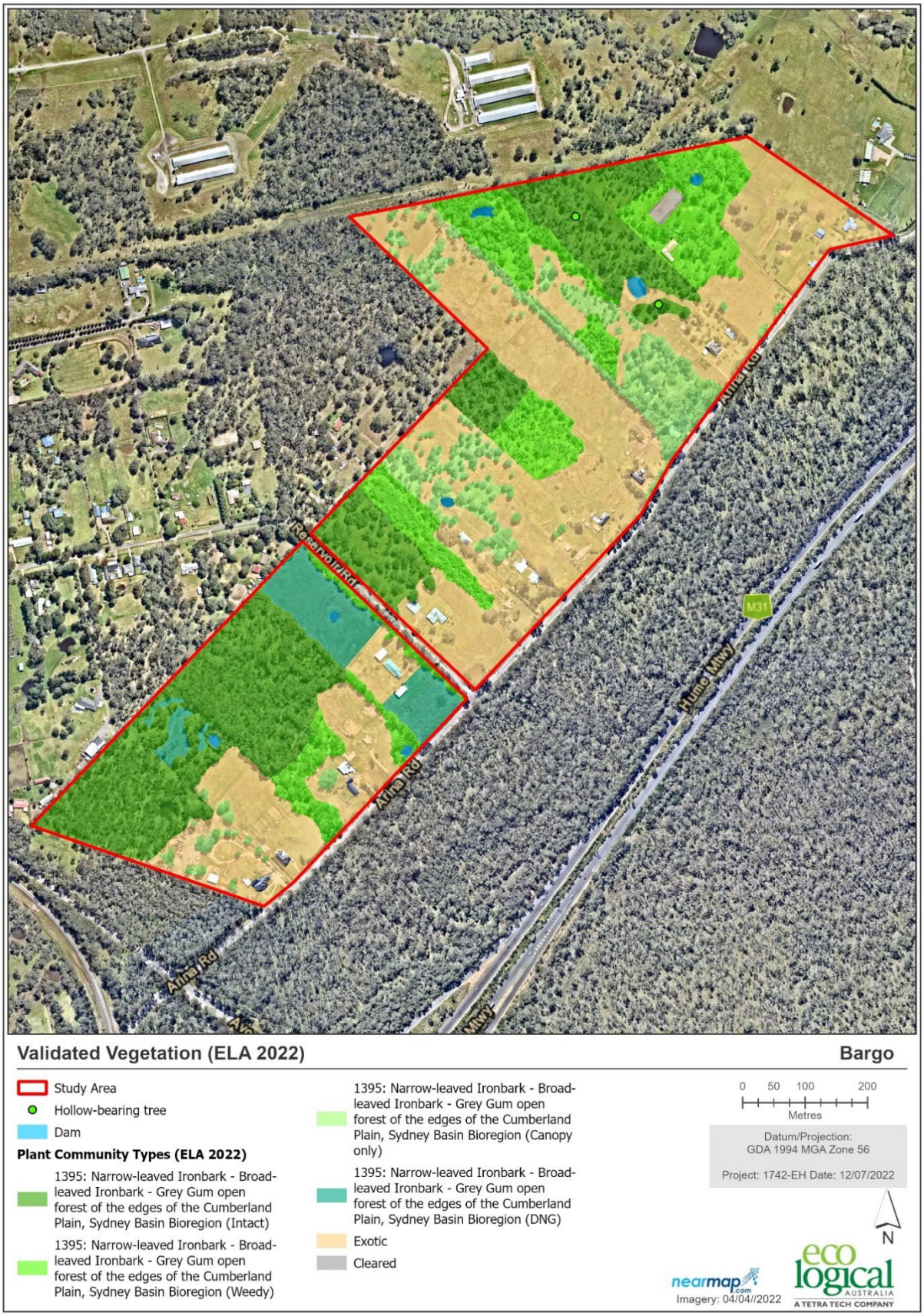

Figure 7: Validated vegetation and Hollow-bearing Trees

As detailed in Section 4.1.1, PCT 1395 is associated with the Critically Endangered Ecological Community (CEEC), *Shale Sandstone Transition Forest in the Sydney Basin Bioregion* (SSTF), listed under both the BC Act and EPBC Act. Given the range of conditions in which this PCT exist within the study area, not all occurrences conform with the definition of their associated TEC. Therefore, the TEC status for each PCT/condition zone combination is addressed following the description, including justification as to why it does or does not conform to the associated TEC. A summary of each PCT/condition zone found within the study area and whether it corresponds to a TEC listed under the BC Act (NSW Scientific Committee 2014) and EPBC Act (TSSC 2014) is shown in **Table 7**. Delineation of these different TEC categories are illustrated in **Table 7** and Figure 8**..**

Table 7: Summary of vegetation condition zones and their correspondence with TECs listed under the BC Act and EPBC Act

PCT	Condition	TEC	Description	BC Act	EPBC Act
1395	Intact	Shale Sandstone Transition Forest	• Canopy contains a mix of species typical of SSTF as listed in BC Act Final Determination and EPBC Act Conservation Advice • Patch sizes > 0.5ha • Perennial understorey native vegetation cover > 50%	Yes	Yes
1395	Weedy	Shale Sandstone Transition Forest	• Canopy contains a mix of species typical of SSTF as listed in BC Act Final Determination and EPBC Act Conservation Advice • Most patch sizes > 0.5ha • Perennial understorey native vegetation cover <30%	Yes	No (Perennial understorey native vegetation cover <30%)
1395	Canopy Only	Shale Sandstone Transition Forest	• Canopy contains a mix of species typical of SSTF as listed in BC Act Final Determination and EPBC Act Conservation Advice • Some patch sizes > 0.5ha • Perennial understorey native vegetation cover < 30%	Yes	No (Perennial understorey native vegetation cover <30%)
1395	DNG	Shale Sandstone Transition Forest	• No canopy • Mid-storey sparse but dominated by native species • Perennial ground cover > 50% native species	No (Final Determination does not include DNG in definition of SSTF	No (key characteristic lists structure as 'Occurs as forest or woodland')

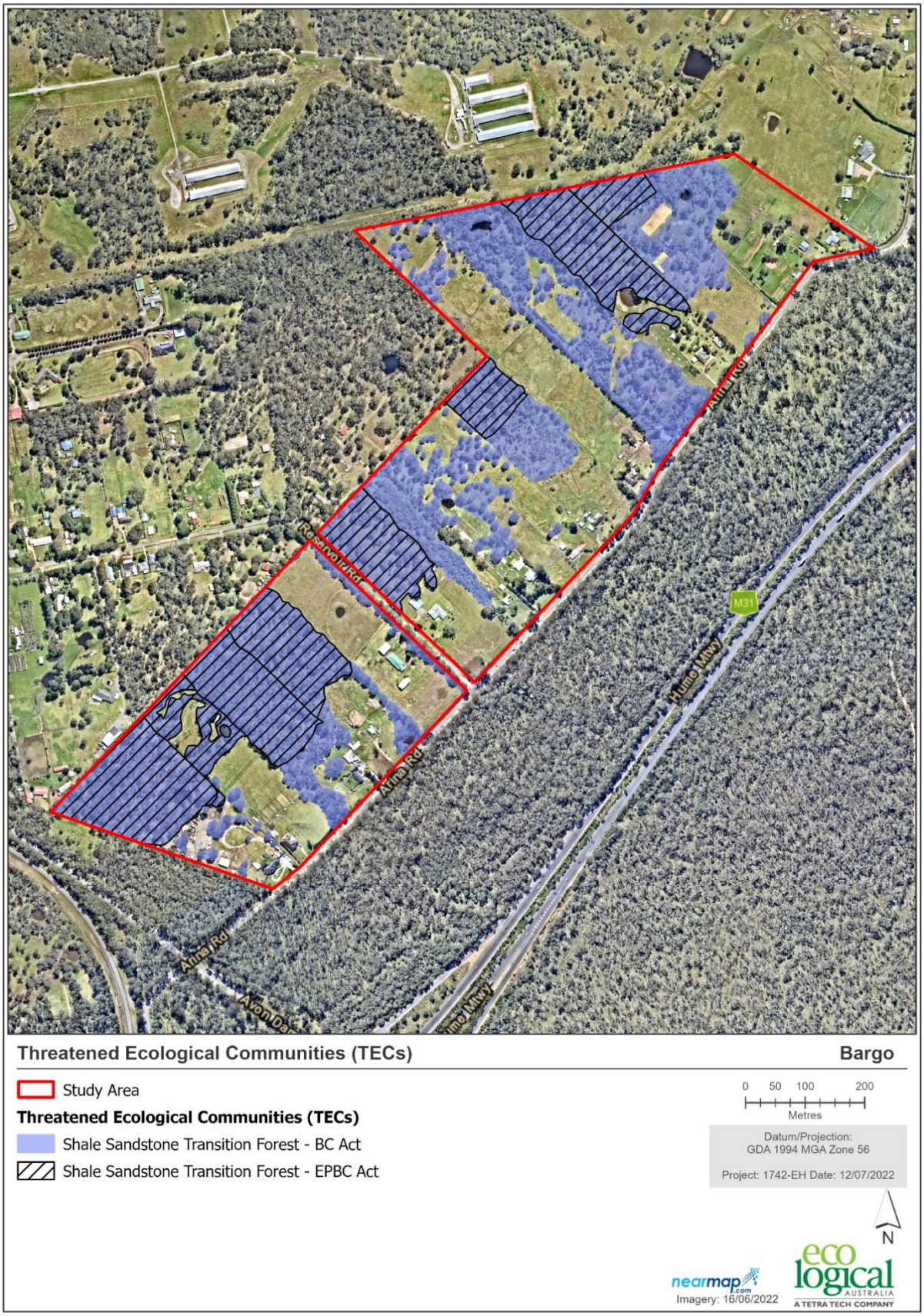

Figure 8: Threatened Ecological Communities, as listed under the BC Act and EPBC Act, within the study area

In addition, SSTF is identified as an entity at risk of serious and irreversible impacts (SAII) under the BOS. SAII entities are those that are most at risk of extinction from potential development. Four principles have been designed to identify impacts which are likely to contribute significantly to the risk of extinction of a threatened species or ecological community in NSW (DPIE 2019). These are impacts that:

1. will cause a further decline of the species or ecological community that is currently observed, estimated, inferred or reasonably suspected to be in a rapid rate of decline
2. will further reduce the population size of the species that is currently observed, estimated, inferred or reasonably suspected to have a very small population size, or will further degrade or disrupt an ecological community that is already observed, inferred or reasonably suspected to be severely degraded or disturbed
3. impact on the habitat of a species or ecological community that is currently observed, estimated, inferred or reasonably suspected to have a very limited geographic distribution
4. impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

Shale Sandstone Transition Forest (SSTF) is a listed ecological community entity at risk of SAII under the BOS, due to meeting the second and third principles outlined above. Therefore, any vegetation within the study area that has been mapped as SSTF (as defined by the BC Act) will be subject to SAII entity requirements, that is any applications for development under Part 4 of the EP&A Act must be refused by the decision-maker if it is determined the proposal is likely to have a serious and irreversible impact on the candidate SAII entity.

4.2.1.1. PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Intact)

Within the study area PCT 1395 (Intact) occurred as four separate patches across nearly half of the lots (Figure 7). The largest continuous patch covered the back half of the four Lots south of Reservoir Rd, i.e. 33//10196, 34//10196, 35//10196, 36//10196 (660, 670, 680 and 690 Arina Rd). Three other separate patches occur north of Reservoir Rd, one each at the back of Lots 31//10196 (115 Reservoir Rd), and 28//10196 (610 Arina Rd) and one extending across the back of Lots 24//10196 and 25//10196 (570 and 580 Arina Road) (Figure 7). PCT 1395 (Intact) within the study area was characterised by a moderately open canopy (30-40% cover) dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *E. globoidea* (White Stringybark), and *E. punctata* (Grey Gum), with *E. amplifolia* (Cabbage Gum), *E. fibrosa* (Red Ironbark) and *E. tereticornis* (Forest Red Gum) occurring less frequently along with the occasional *Corymbia gummifera* (Red Bloodwood) and *E. longifolia* (Woollybutt) (Figure 9). In many cases these were in a regrowth state, being smaller trees to about 10 m tall.

The mid-storey layer was generally open (around 30% cover), although there were locally dense patches, and ranged in height from about 1 m to 3 m. The upper range of height of this layer was dominated by *Acacia* spp. (predominantly *A. decurrens*, *A. implexa*, and *A. parramattensis*), *Allocasuarina littoralis* (Black She-oak) and *Exocarpos cupressiformis* (Cherry Ballart). The lower range of this layer was dominated by *Bursaria spinosa* (Blackthorn), *Kunzea ambigua* (Tick Bush), *Olearia microphylla*, *Pimelea*

linifolia (Rice Flower) and *Pultenaea villosa* (Hairy Bush-pea). At the time of survey, many of these shrubs were covered with the native parasitic vine, *Cassytha pubescens*.

The ground layer was usually a dense layer (70 – 95 % cover), dominated by grasses and sedges / rushes such as *Aristida vagans* (Three-awn Grass), *Austrostipa ramosissima* (Stout Bamboo Grass), *Echinopogon caespitosus* (Hedgehog Grass), *Entolasia marginata* (Bordered Panic), *Lepidosperma laterale*, *Lomandra longifolia* (Spiny-headed Mat-rush), *Microlaena stipoides* (Weeping Grass), *Rytidosperma racemosum* (Wallaby Grass) and *Themeda australis* (Kangaroo Grass). A high diversity of native forbs were also present, such as *Billardiera scandens* (Hairy Apple Berry), *Gonocarpus tetragynus, Hydrocotyle laxiflora* (Stinking Pennywort) and *Lobelia purpurascens* (Whiteroot).

There was very little exotic species (<5%) within PCT 1395 (Intact), with species such as *Lysimachia arvensis* (Pimpernel), *Setaria parviflora* (Pigeon Grass) and *Verbena bonariensis* (Purpletop) occurring at very low densities.

As detailed in Section 4.1.1, this PCT is associated with Shale Sandstone Transition Forest (SSTF), which is listed as a CEEC under both the BC Act and EPBC Act. SSTF occurs at the edges of the Cumberland Plain where clay soils from the shale rock intergrade with earthy and sandy soils from sandstone, or where shale caps overlay sandstone. The boundaries are indistinct, and the species composition varies depending on the soil influences. The main tree species include *Eucalyptus tereticornis* (Forest Red Gum), *E. punctata* (Grey Gum), stringybarks (*E. globoidea* and *E. eugenioides*) and ironbarks (*E. fibrosa* and *E. crebra*). Areas of low sandstone influence (more clay-loam soil texture) have an understorey that is closer to Cumberland Plain Woodland, whilst areas of high sandstone influence include sandstone species, such as *Kunzea ambigua* (Tick bush) and *Persoonia linearis* (Narrow-leaved Geebung) (DEC 2022).

Under the BC Act, the Final Determination for SSTF provides additional information to aid recognition of this community (NSW Scientific Committee 2014). The occurrence of PCT 1395 (Intact) within the study area meets the Final Determination definition of SSTF under the BC Act (NSW Scientific Committee 2014) for the following reasons:

- The patches occur within the Wollondilly LGA, which is one of the LGAs listed in which it occurs
- The patches occur within an elevation of 340 – 360 m, which is within the described range of up to 400 m
- The patches occur within the broad shale/sandstone boundary where the soil and geology profile is linked to both the Wianamatta Shale and underlying sandstone formations
- The species composition within all strata of the patch overlaps very well with the assemblage of species detailed in the Final Determination as being characteristic of SSTF.

Under the EPBC Act, a patch of vegetation must be consistent with the key diagnostic characteristics and condition thresholds for it to be considered SSTF (DAWE 2022b; TSSC 2014). The patches mapped as PCT 1395 (Intact) within the study area align with all the key diagnostic characteristics related to location, soils, structure and species composition of different strata. Condition threshold criteria are based on patch size and the percent cover of perennial understorey vegetation (**Appendix C**). The patches mapped as PCT 1395 (Intact) within the study area does meet the minimum patch-size criteria, i.e. they are all greater than 0.5 ha and, in most cases, had a perennial understorey cover of greater than

50%. Therefore, the patch of PCT 1395 (Intact) represents at least the Moderate condition class of the CEEC *Shale Sandstone Transition Forest in the Sydney Basin Bioregion*, as defined by the EPBC Act.

Figure 9: Example of PCT 1395 (Intact) vegetation within the study area

4.2.1.2. PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Weedy)

Within the study area PCT 1395 (Weedy) occurred as six separate patches across nearly half of the lots (Figure 7). PCT 1395 (Weedy) within the study area was characterised by a moderately open canopy (30-40% cover) dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *E. globoidea* (White Stringybark) and *E. tereticornis* (Forest Red Gum) with *E. moluccana* (Grey Box) occurring less frequently (Figure 10).

Where a mid-storey was present, it was dominated by exotic weed species such as *Rubus fruiticosus* (Blackberry) and *Ligustrum* spp. (Privets). Whilst dominated by exotic species, it did include some native species such as *Acacia decurrens* (Black Wattle)*, Exocarpos cupressiformis* (Cherry Ballart), *Pittosporum undulatum* (Sweet Pittosporum) and *Pultenaea villosa* (Hairy Bush-pea).

The ground cover is these areas was dominated (50-80%) by exotic grasses and weed such *Cenchrus clandestinus* (Kikuyu), *Hypochaeris radicata* (Flatweed), *Paspalum dilatatum* (Paspalum), *Phytolacca octandra* (Ink Weed), *Senecio madagascariensis* (Fireweed), *Seteria parviflora* (Pidgeon Grass) and *Verbena bonariensis* (Purple Top). Common native grass and forb species occurred at low covers amongst the predominantly exotic ground cover, including *Lobelia purpurascens* (Whiteroot), *Microlaena stipoides* (Weeping Grass), and *Oplismenus aemulus* (Basket Grass).

The occurrence of PCT 1395 (Weedy) within the study area meets the Final Determination definition of the EEC SSTF under the BC Act (NSW Scientific Committee 2014) for the following reasons:

- The patch occurs within the Wollondilly LGA, which is one of the LGAs listed in which it occurs
- The patches occur within an elevation of 340 – 360 m, which is within the described range of up to 400 m
- The patch occurs within the broad shale/sandstone boundary where the soil and geology profile is linked to both the Wianamatta Shale and underlying sandstone formations
- The species composition of the canopy overlaps well with the assemblage of species detailed in the Final Determination as being characteristic of SSTF.

Under the EPBC Act, a patch of vegetation must be consistent with the key diagnostic characteristics and condition thresholds for it to be considered SSTF (DAWE 2022b; TSSC 2014). The patch mapped as PCT 1395 (Weedy) within the study area only aligns with the key diagnostic characteristics related to location, soils, and species composition of the canopy. Condition threshold criteria are based on patch size and the percent cover of perennial understorey vegetation (**Appendix C**). Most of the patches mapped as PCT 1395 (Weedy) within the study area meet the patch-size criteria, i.e. greater than 0.5 ha, however, the perennial understorey cover was less than 30%. Therefore, the patch of PCT 1395 (Intact) within the study area does not represent the CEEC *Shale Sandstone Transition Forest in the Sydney Basin Bioregion*, as defined by the EPBC Act.

Figure 10: Example of PCT 1395 (Weedy) vegetation within the study area

4.2.1.3. PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (Canopy only)

Within the study area PCT 1395 (Canopy only) occurred in six of the lots (Figure 7). It is differentiated from PCT 1395 (Weedy) as it is located in a much higher use area, where native vegetation in the understorey is minimal to non-existent. PCT 1395 (Weedy) was characterised in the study area by an isolated canopy trees dominated by *Eucalyptus crebra* (Narrow-leaved Ironbark), *E. globoidea* (White Stringybark) and *E. punctata* (Grey Gum) with occasional *E. tereticornis* (Forest Red Gum). *Allocasuarina littoralis* (Black She-oak) was sometimes present as a canopy or mid-storey species. The ground layer was sometimes completely absent through high use by animals (**Figure 11**) or through replacement with gravel, gardens beds, infrastructure (e.g. boarding kennels) or rubbish. Where vegetation did occur, it was usually entirely exotic species such as *Bidens pilosa* (Cobblers Pegs), *Cenchrus clandestinus* (Kikuyu), *Eragrostis curvula* (African Lovegrass), *Paspalum dilatatum* (Paspalum), *Senecio madagascariensis* (Fireweed) and *Setaria parviflora* (Pigeon Grass).

The occurrence of PCT 1395 (Canopy only) within the study area meets the Final Determination of SSTF under the BC Act (NSW Scientific Committee 2014) for the following reasons:

- The patch occurs within the Wollondilly LGA, which is one of the LGAs listed in which it occurs
- The patches occur within an elevation of 340 – 360 m, which is within the described range of up to 400 m
- The patch occurs within the broad shale/sandstone boundary where the soil and geology profile is linked to both the Wianamatta Shale and underlying sandstone formations
- The species composition of the canopy overlaps well with the assemblage of species detailed in the Final Determination as being characteristic of SSTF.

Under the EPBC Act, the patches mapped as PCT 1395 (Weedy) within the study area only aligns with the key diagnostic characteristics related to location, soils, and species composition of the canopy (DAWE 2022b; TSSC 2014). Condition threshold criteria are based on patch size and the percent cover of perennial understorey vegetation (Appendix C). Only one of the patches mapped as PCT 1395 (Weedy) within the study area meets the patch-size criteria, i.e. greater than 0.5 ha, however, the perennial understorey cover in this patch was less than 30%. Therefore, the patch of PCT 1395 (Intact) within the study area does not represent the CEEC *Shale Sandstone Transition Forest in the Sydney Basin Bioregion*, as defined by the EPBC Act.

Figure 11: Example of PCT 1395 (Canopy only) vegetation within the study area

4.2.1.4. PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion (DNG)

Within the study area, PCT 1395 (DNG) occurs as two large paddocks within one Lot (32//10196 (120 Reservoir Rd)), as well as cleared areas within a large patch of 1395 (Intact) in Lot 35//10196 (680 Arina Rd). PCT 1395 (DNG) within the study area was characterised by a ground layer dominated by native grass species, in particular *Themeda triandra* (Kangaroo Grass), which appeared to comprise 70-80% of the cover in the paddocks at 120 Reservoir Rd at the time of survey. Other native grasses present were *Aristida ramosa* (Purple Wiregrass), *Bothriochloa macra* (Red Grass), *Eragrostis brownii* (Brown's Lovegrass) and *Sporobolus creber* (Slender Rat's Tail Grass). A low cover of exotic species was also present within the ground layer including *Bidens pilosa* (Cobblers Pegs), *Eragrostis curvula* (African Lovegrass), *Senecio madagascariensis* (Fireweed) and *Setaria parviflora* (Pigeon Grass). There was no canopy trees within the patches of PCT 1395 (DNG), however, there were sparse regenerating *Acacia decurrens* (Black Wattle) and *A. implexa* (Hickory Wattle) in the shrub layer.

Under the BC Act, the Final Determination for SSTF provides additional information to aid recognition of this community TEC (NSW Scientific Committee 2014). The Final Determination for SSTF does not provide in its definition the existence of SSTF as a DNG. Therefore, the occurrence of PCT 1395 (DNG) within the study area is not a part of the CEEC under the BC Act.

Under the EPBC Act, a patch of vegetation must be consistent with the key diagnostic characteristics and condition thresholds for it to be considered SSTF (DAWE 2022b; TSSC 2014). The patch mapped as PCT 1395 (DNG) within the study area only aligns with the key diagnostic characteristics related to

location, soils, and species composition of the ground layer. It does not meet the key diagnostic characteristic: '*Occurs as forest or woodland*', and therefore, the patch of PCT 1395 (Intact) within the study area does not represent the CEEC *Shale Sandstone Transition Forest in the Sydney Basin Bioregion*, as defined by the EPBC Act.

4.2.1.5. Exotic

The areas mapped as Exotic within the study area include large cleared areas used predominantly as horse paddocks as well as gardens and lawns around houses composed of predominantly exotic species. All lots within the study area contain areas mapped as Exotic (Figure 7).

The exotic areas used as horse paddocks (Figure 12) had no native canopy or mid-storey and the ground layer was dominated by exotic pasture species such as *Cenchrus clandestinus* (Kikuyu), *Paspalum dilatatum* (Paspalum) and *Setaria parviflora* (Pigeon Grass), and weed species such as *Senecio madagascariensis* (Fireweed), *Bidens pilosa* (Cobblers Pegs) and *Sida rhombifolia* (Paddy's lucerne).

The exotic areas of garden and lawn around the houses generally had regularly mown lawns dominated by *Cenchrus clandestinus* (Kikuyu), *Cynodon dactylon* (Common Couch) and *Paspalum dilatatum* (Paspalum). Gardens comprised a mix of predominantly exotic shrubs and trees, including *Citrus* spp. (Citrus trees).

In addition, there are lines of exotic trees, predominantly *Pinus radiata* (Radiata Pine) and *Cupressus* sp. (Cypress Pine) along some of the boundaries and along the front fences of some of the properties that have been mapped in the 'Exotic' classification.

Figure 12: Example of Exotic vegetation within the study area

4.2.2. Threatened species

There were no threatened fauna species recorded within the study area during the field survey. However, large areas of intact vegetation, waterbodies, connectivity to intact vegetation, large trees and numerous fallen logs provide habitat features for threatened fauna. Many of the species listed in Table 5 would likely use this area for foraging habitat. Habitat for *Phascolarctos cinereus* (Koala) is addressed below in Section 4.2.4.

No threatened flora species were recorded within the study area during the field survey. However, given the large areas of native vegetation, which represent suitable habitat for some of the species listed in Table 6, and that the field survey was conducted in winter, it is possible threatened flora species could not be detected at this time of year. Targeted surveys at the recommended time of year for each species would need to be conducted to discount the presence of any of the species listed in **Table 6**.

4.2.3. Fauna habitat

A list of habitat features recorded in the study area is listed in Table 8 below. Only one hollow-bearing tree (HBT) containing a small-medium (100-200mm) hollow was recorded within the study area during surveys (Figure 7). However, further survey would be required during preparation of an impact assessment to further map hollow bearing trees due to limited access to some of the lots.

Table 8: Habitat features recorded in the study area

Habitat feature	Associated species	Presence
Large expanse of native vegetation	Birds, microchiropteran bats (microbats), megachiropteran bats (fruit bats), arboreal mammals and reptiles	Yes, the western side of most properties in the study area contains large expanses of native vegetation with connectivity with vegetation to the west.
Nectar producing species	Arboreal mammals/birds and fruit bats	Common throughout all areas mapped as PCT 1395.
Hollow-bearing trees	Microbats, birds, mammals, amphibians, reptile	One HBT located within 580 Arina Road containing a small-medium sized hollow.
Coarse woody debris (fallen logs)	Terrestrial mammals, reptiles, invertebrates	Common within PCT 1395 (Intact) and PCT 1395 (Weedy).
Leaf litter	Reptiles, amphibians, invertebrates	Abundant within areas mapped as PCT 1395 (Intact). Scarce elsewhere within the study area.
Water body	Amphibians, reptiles, microbats	Farm dams present on five of the lots.
Rocky outcrops	Microbats, reptiles	Not observed during the field survey.
Mistletoe	Arboreal mammals/birds and fruit bats	Not observed during the field survey.
Winter flowering species	Winter migratory birds, arboreal mammals and megachiropteran bats (fruit bats)	Yes, throughout all the properties.

4.2.4. Koala Habitat

The study area is likely to provide habitat and foraging resources for *Phascolarctos cinereus* (Koala), as there have been many recorded sightings within a 1 km radius, primarily along the roads to the east and south which border large expanses of conservation land. All instances of PCT 1395 that contained a canopy (i.e. all condition zones except DNG) were comprised of the following tree species, that are listed for the Central Coast koala management area in Schedule 3 (Koala use tree species) of the State Environmental Planning Policy (Biodiversity and Conservation) 2021:

- *Eucalyptus amplifolia* (Cabbage Gum)
- *Eucalyptus moluccana* (Grey Box)
- *Eucalyptus crebra* (Narrow-leaved Ironbark)
- *Eucalyptus fibrosa* (Broad-leaved Ironbark)
- *Eucalyptus globoidea* (White Stringybark)
- *Eucalyptus punctata* (Grey Gum)
- *Eucalyptus tereticornis* (Forest Red Gum).

Therefore, all these patches are considered likely koala habitat and Council would need to assess a Koala Assessment Report prepared for any proposed Development Application (DA) that proposed to impact on native vegetation.

The vegetated areas of study area form a north/south koala corridor for passage to other vegetated areas. It is recommended that the vegetation is retained to preserve this koala corridor.

5. Ecological constraints

The ecological constraints of the study area have been assessed based on the ecological features and values criteria listed in **Table 9**. This table has been used to assign the overall ecological constraints of the study area, which are illustrated in Figure 13.

Table 9: Ecological constraint classes, ecological features and report section in which they are addressed

Ecological Constraint	Ecological features/values	Section
Low	• Exotic and non-native vegetation • Highly disturbed landscapes with low fauna habitat value • Cleared land and houses	4.2.1, Figure 7
Moderate	• First order watercourses • Farm dams (potential foraging habitat for threatened species)	4.1.5, Figure 3 4.2.3
High	• Vegetation mapped as TEC under the BC Act or EPBC Act • Vegetation identified as a SAII entity • Land mapped on the Biodiversity Values map • Vegetation considered Koala Habitat	4.2.1, Figure 8 4.2.1 4.1.3, Figure 2 4.1.4.1, 4.2.4

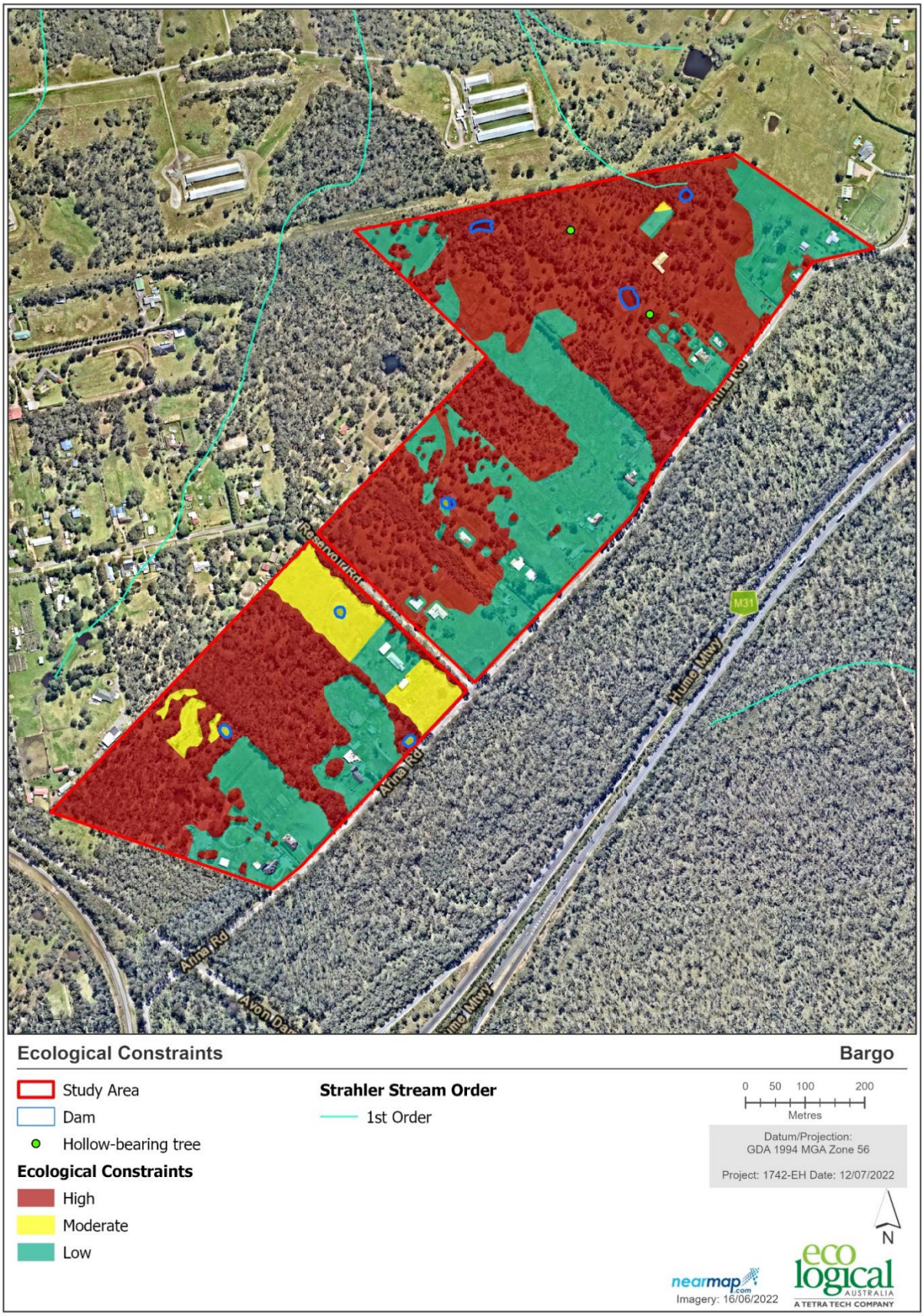

Figure 13: Ecological constraints of the study area

All areas of PCT 1395 which have a canopy within the study area meet the definition of 'high constraint' due to being assessed as representing a TEC listed under the BC Act or both the BC Act and EPBC Act. In addition, as this TEC (Shale Sandstone Transition Forest) is a candidate SAII entity, the consent authority would have to determine that there is no likelihood that any proposed development will have a serious and irreversible impact on these areas. Further, all these areas are composed of native trees species that are listed as Koala use tree species for the Central Coast koala management area. This means that these areas would need further consideration for core koala habitat under the SEPP (Biodiversity and Conservation) 2021 and therefore have been mapped as high constraint.

Whilst areas mapped as PCT 1395 (DNG) were assessed as not defined as a TEC, these have been mapped as moderate constraint, as it is still native vegetation and removal of certain amounts of native vegetation may trigger further assessment under the NSW Biodiversity Offset Scheme (BOS).

Areas mapped on the BV map are considered high constraint and any impacts on these areas automatically triggers entry into the Biodiversity Offset Scheme (BOS). Whilst it is possible to challenge the BV mapping where there are no biodiversity values, given most of the current area mapped overlaps with vegetation identified as both TEC and SAII, the success of such a challenge would be unlikely.

First order watercourses are considered moderate constraint as these can be exempt from Controlled Activity Approval (CAA) requirements if the NRAR is convinced that they don't exhibit features of a defined channel with bed and bank, and therefore is not waterfront land for the purposes of the WM Act. Dams within the study area are considered moderate constraint due as they provide potential foraging habitat for threatened fauna species, which may trigger impact assessment requirements.

Areas of high constraint should be retained and conserved where possible. Proposed development within these areas may pose an approvals risk as impacts to vegetation will likely trigger the NSW Biodiversity Offset Scheme (BOS), including assessment of significance under both the BC Act and the EPBC Act.

The remaining areas have been mapped as low constraint as they do not contain native vegetation, habitat features, waterfront land or riparian corridors. Instead, they are comprised of exotic grasslands, cleared land, houses and highly disturbed landscapes that provide low threatened species habitat.

6. Conclusion

The desktop assessment and field survey identified one PCT, PCT 1395 Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion, on the study area in four condition types. Three of the four condition types of PCT 1395 conform to the listed CEEC, *Shale Sandstone Transition Forest in the Sydney Basin Bioregion*, under either the BC Act or EPBC Act or under both Acts. Whilst no threatened species were identified during the field survey, a number of habitat features were identified that would provide habitat for a number of threatened species, including the presence of Koala use trees listed under the SEPP (Biodiversity and Conservation) 2021 (Chapter 4). The vegetated areas of study area form a north/south koala corridor for passage to other vegetated areas. It is recommended that the vegetation is retained to preserve this koala corridor.

Following the desktop and field surveys of the study area, the ecological constraints were mapped as shown in **Figure 13** and **Table 9**. In summary, the study area has numerous high constraints that would need to be considered for any future development with approval of the rezoning application. All vegetation with a tree canopy is listed as a TEC under the BC Act or both the BC Act and the EPBC Act. In addition, these areas are also a candidate SAII entity under the BOS, is comprised of canopy species that are listed as Koala use trees under the SEPP (Biodiversity and Conservation) 2021 (Chapter 4) and is mapped as Important Koala Habitat under the Draft Cumberland Plain Conservation Plan (DPIE 2020). Any impacts on areas of native vegetation as a result of a future development application are likely to trigger entry into the BOS, require assessment using the BAM and the preparation of a BDAR and may result in residual impacts requiring to be offset. Any impacts on koala habitat that is determined to be core koala habitat will also require the preparation of a Koala Assessment Report in accordance with Chapter 4 of the SEPP (Biodiversity and Conservation) 2021.

Any future development following the rezoning of the study area, may also require referral to the Commonwealth where there are impacts on MNES, including the CEEC Shale Sandstone Transition Forest in the Sydney Basin Bioregion and Koala habitat.

7. References

Department of Agriculture, Water and the Environment (DAWE), 2022a. *EPBC Act Protected Matters Search Tool:* http://www.environment.gov.au/epbc/pmst/. Accessed 1 May 2022.

Department of Agriculture, Water and the Environment (DAWE), 2022b. *Shale Sandstone Transition Forest of the Sydney Basin Bioregion SPRAT Profile:* http://www.environment.gov.au/cgi-bin/sprat/public/publicshowcommunity.pl?id=146&status=Critically+Endangered. Accessed June 2022.

Department of Planning and Environment (DPE), 2022a. *Atlas of NSW Wildlife (BioNet):* http://www.bionet.nsw.gov.au/. Accessed June 2022.

Department of Planning and Environment (DPE), 2022b. *Biodiversity Values Map and Threshold Tool:* https://www.lmbc.nsw.gov.au/Maps/index.html?viewer=BOSETMap. Accessed 15 June 2022.

Department of Planning and Environment (DPE), 2022c. S*hale Sandstone Transition Forest in the Sydney Basin Bioregion – profile.* NSW Office of Environment and Heritage: https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10755. Accessed June 2022.

Department of Planning and Environment (DPE), 2022d. *Vegetation Information System (VIS) Classification (BioNet):* https://www.environment.nsw.gov.au/research/Visclassification.htm. Accessed June 2022.

Department of Primary Industries (DPI), 2022. *Fisheries NSW Spatial Data Portal – Key Fish Habitat layer*: https://webmap.industry.nsw.gov.au/Html5Viewer/index.html?viewer=Fisheries_Data_Portal. Accessed June 2022.

Department of Planning, Industry and Environment (DPIE), 2019. *Guidance to assist a decision-maker to determine a serious and irreversible impact.* Available from: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/guidance-decision-makers-determine-serious-irreversible-impact-190511.pdf. Accessed 27 June 2022

Department of Planning, Industry and Environment (DPIE), 2020. *Draft Cumberland Plain Conservation Plan:* https://www.planning.nsw.gov.au/Policy-and-Legislation/Strategic-conservation-planning/Cumberland-Plain-Conservation-Plan/Draft-Plan-spatial-viewer. Accessed June 2022

Natural Resources Access Regulator (NRAR), 2018. *Guidelines for controlled activities on waterfront land—Riparian corridors.* Published by NSW Department of Industry: INT19/15607.

NSW Government, 2021. ePlanning *Spatial Viewer*: https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address.

NSW Scientific Committee, 2014. *Shale Sandstone Transition Forest in the Sydney Basin Bioregion – critically endangered ecological community listing – Final Determination*. Department of Planning and Environment. https://www.environment.nsw.gov.au/topics/animals-and-plants/threatened-species/nsw-threatened-species-scientific-committee/determinations/final-determinations/2013-

2015/shale-sandstone-transition-forest-critically-endangered-ecological-community-listing. Accessed June 2022.

Office of Environment and Heritage (OEH), 2013. *Remnant Vegetation of the western Cumberland subregion, 2013 Update*. VIS_ID 4207. https://datasets.seed.nsw.gov.au/dataset/remnant-vegetation-of-the-western-cumberland-subregion-2013-update-vis_id-4207fd1f4.

Threatened Species Scientific Committee (TSSC), 2014. *Approved Conservation Advice (including listing advice) for Shale Sandstone Transition Forest of the Sydney Basin Bioregion:* http://www.environment.gov.au/biodiversity/threatened/communities/pubs/146-conservation-advice.pdf. Accessed June 2022.

Wollondilly Shire Council (WSC), 2011. *Wollondilly Local Environment Plan 2011*. https://legislation.nsw.gov.au/view/whole/html/inforce/current/epi-2011-0085. Accessed June 2022

Appendix A: Likelihood of occurrence tables

An assessment of likelihood of occurrence was made for all threatened ecological communities (Table 10), and flora, fauna and migratory species (Table 11) identified from the database search. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the site inspection and professional judgement. Some Migratory or Marine species identified from the Commonwealth database search have been excluded from the assessment, due to lack of habitat. The terms for likelihood of occurrence are defined below:

'known' = the species was or has been observed on the site;

'likely' = a medium to high probability that a species uses the site;

'potential' = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur;

'unlikely' = a very low to low probability that a species uses the site; and

'no' = habitat within the study area and in the vicinity is unsuitable for the species.

A test of significance was conducted for threatened species that were recorded within the study area or had a higher likelihood of occurring and were not recorded during the site visit. It is noted that some threatened fauna species that are highly mobile, wide ranging and vagrant may use portions of the study area intermittently for foraging. For these fauna species, the habitat present and likely to be affected is not considered to be important to the threatened species, particularly in relation to the amount of similar habitat remaining in the surrounding landscape. As such, a test of significance in reference to State or Commonwealth legislation was not considered necessary.

Information provided in the habitat associations' column has primarily been extracted (and modified) from the Commonwealth Species Profile and Threats Database and the NSW Threatened Species Profiles.

Table 10: Likelihood of occurrence table for threatened ecological communities (TEC) listed under the BC Act and EPBC Act

Scientific Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
ECOLOGICAL COMMUNITIES				
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	V / CE	E	Dominated by *Eucalyptus parramattensis* subsp. *parramattensis*, *Angophora bakeri* and *E. sclerophylla*. A small tree stratum of *Melaleuca decora* is sometimes present, generally in areas with poorer drainage. It has a well-developed shrub stratum consisting of sclerophyllous species such as *Banksia spinulosa* var. *spinulosa*, *Melaleuca nodosa*, *Hakea sericea* and *H. dactyloides* (multi-stemmed form). The ground stratum consists of a diverse range of forbs including *Themeda australis*, *Entolasia stricta*, *Cyathochaeta diandra*, *Dianella revoluta* subsp. *revoluta*, *Stylidium graminifolium*, *Platysace ericoides*, *Laxmannia gracilis* and *Aristida warburgii*. Occurs within the local government areas of Bankstown, Blacktown, Campbelltown, Hawkesbury, Liverpool and Penrith. Mainly found in the Castlereagh area of the Cumberland Plain, with small patches occurring at Kemps Creek and Longneck Lagoon; also present around Holsworthy	No - this community was not identified during the field survey
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland			The most widespread and abundant dominant trees include *Eucalyptus robusta* (swamp mahogany), *Melaleuca quinquenervia* (paperbark) and, south from Sydney, *Eucalyptus botryoides* (bangalay) and *Eucalyptus longifolia* (woollybutt). Shrubs include *Acacia longifolia*, *Dodonaea triquetra*, *Ficus coronata*, *Leptospermum polygalifolium* subsp. *polygalifolium* and *Melaleuca* spp. Occasional vines include *Parsonsia straminea*, *Morinda jasminoides* and *Stephania japonica* var. *discolor*. The groundcover is composed of abundant sedges, ferns, forbs, and grasses including *Gahnia clarkei*, *Pteridium esculentum*, *Hypolepis muelleri*, *Calochlaena dubia*, *Dianella caerulea*, *Viola hederacea*, *Lomandra longifolia*, *Entolasia marginata* and *Imperata cylindrica*. Known from parts of the Local Government Areas of Tweed, Byron, Lismore, Ballina, Richmond Valley, Clarence Valley, Coffs Harbour, Bellingen, Nambucca, Kempsey, Hastings, Greater Taree, Great Lakes and Port Stephens, Lake Macquarie, Wyong, Gosford, Hornsby, Pittwater, Warringah, Manly, Liverpool, Rockdale, Botany Bay, Randwick, Sutherland, Wollongong, Shellharbour, Kiama and Shoalhaven.	No - this community was not identified during the field survey
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion	E	CE	Ranges from open forest to low woodland, with a canopy dominated by *Eucalyptus fibrosa* (Broad-leaved Ironbark) and *Melaleuca decora* (Paperbark). The canopy may also include other eucalypts such as *E. longifolia* (Woolybutt). The dense shrubby understorey consists of *Melaleuca nodosa* (Prickly-leaved Paperbark) and *Lissanthe strigosa* (Peach Heath), with a range of 'pea' flower shrubs, such as *Dillwynia tenuifolia*, *Pultenaea villosa* (Hairy Bush-pea) and *Daviesia ulicifolia* (Gorse Bitter Pea). The sparse ground layer contains a range of grasses and herbs. Occurs in western Sydney, with the most extensive stands occurring in the Castlereagh and Holsworthy areas. Smaller remnants occur in the Kemps Creek area and in the eastern section of the Cumberland Plain.	No - this community was not identified during the field survey
River-flat eucalypt forest on coastal	E		The structure of the community may vary from tall open forests (>40m) to woodlands. The most widespread and abundant dominant trees include *Eucalyptus tereticornis* (forest red gum*), E. amplifolia* (cabbage gum), *Angophora*	No - this community was not identified

Scientific Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
floodplains of southern New South Wales and eastern Victoria			*floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple). *Eucalyptus baueriana* (blue box), *E. botryoides* (bangalay) and *E. elata* (river peppermint) may be common south from Sydney. *E. ovata* (swamp gum) occurs on the far south coast, *E. saligna* (Sydney blue gum) and *E. grandis* (flooded gum) may occur north of Sydney, while *E. benthamii* is restricted to the Hawkesbury floodplain. A layer of small trees may be present, including *Melaleuca decora*, *M. styphelioides* (prickly-leaved teatree), *Backhousia myrtifolia* (grey myrtle), *Melia azadarach* (white cedar), *Casuarina cunninghamiana* (river oak) and *C. glauca* (swamp oak). Scattered shrubs include *Bursaria spinosa*, *Solanum prinophyllum*, *Rubus parvifolius, Breynia oblongifolia, Ozothamnus diosmifolius, Hymenanthera dentata, Acacia floribunda* and *Phyllanthus gunnii*. The groundcover is composed of abundant forbs, scramblers and grasses. Found on the river flats of the coastal floodplains. Known from parts of the Local Government Areas of Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Palerang, Eurobodalla and Bega Valley.	during the field survey
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	**CE**	**CE**	**The main tree species include *Eucalyptus tereticornis* (Forest Red Gum), *E. punctata* (Grey Gum), stringybarks (*E. globoidea, E. eugenioides*) and ironbarks (*E. fibrosa and E. crebra*). Areas of low sandstone influence (more clay-loam soil texture) have an understorey that is closer to Cumberland Plain Woodland. Occurs at the edges of the Cumberland Plain in western Sydney, most now occurs in the Hawkesbury, Baulkham Hills, Liverpool, Parramatta, Penrith, Campbelltown and Wollondilly local government areas.**	**Yes – this community was identified during the field survey and desktop assessment**
Western Sydney Dry Rainforest and Moist Woodland on Shale	E	CE	Typically a low closed forest, slightly more open in the moist woodland form, with emergent trees up to 25 m high and a lower tree layer. In sheltered gullies and on lower slopes the canopy layer is typically dominated by *Melaleuca styphelioides* (prickly-leaved paperbark). Other diagnostic tree species include *Acacia implexa*(hickory wattle),*Alectryon subcinereus* (native quince), *Brachychiton populneus* (kurrajong), *Corymbia maculata* (spotted gum), *Melicope micrococca* (white euodia) and *Streblus pendulinus* (whalebone tree).	No - this community was not identified during the field survey
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	E	CE	Open woodland community (sometimes occurring as a forest formation), in which the most obvious species are one or more of the following: *Eucalyptus albens* (White Box), *E. melliodora* (Yellow Box) and *E. blakelyi* (Blakely's Red Gum). Intact sites contain a high diversity of plant species, including the main tree species, additional tree species, some shrub species, several climbing plant species, many grasses and a very high diversity of herbs. Modified sites include areas where the main tree species are present ranging from an open woodland formation to a forest structure, and the groundlayer is predominantly composed of exotic species; and sites where the trees have been removed and only the grassy groundlayer and some herbs remain. Occurs on the Tablelands and Western Slopes of NSW.	No - this community was not identified during the field survey

Status key: V = Vulnerable; E = Endangered; CE= Critically Endangered

Table 11: Likelihood of occurrence table for threatened species and populations listed under the BC Act and EPBC Act

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
Actitis hypoleucos	Common Sandpiper		M	Summer migrant. In NSW, widespread along coastline and also occurs in many areas inland. Coastal wetlands and some inland wetlands, especially muddy margins or rocky shores. Also estuaries and deltas, lakes, pools, billabongs, reservoirs, dams and claypans, mangroves.	Unlikely – the study area lacks suitable habitat for this species.
Anthochaera phrygia	Regent Honeyeater	E4A	CE	Inland slopes of south-east Australia, and less frequently in coastal areas. In NSW, most records are from the North-West Plains, North-West and South-West Slopes, Northern Tablelands, Central Tablelands and Southern Tablelands regions; also recorded in the Central Coast and Hunter Valley regions. Found in eucalypt woodland and open forest, wooded farmland and urban areas with mature eucalypts, and riparian forests of *Casuarina cunninghamiana* (River Oak).	Unlikely – no records of this species have been made within a 5 km radius of the study area. Marginal foraging habitat may be present.
Apus pacificus	Fork-tailed Swift		M	Recorded in all regions of NSW. Found in riparian woodland., swamps, low scrub, heathland, saltmarsh, grassland, Spinifex sandplains, open farmland and inland and coastal sand-dunes.	Unlikely – the study area lacks suitable habitat for this species.
Botaurus poiciloptilus	Australasian Bittern	E1	E	Found over most of NSW except for the far north-west. Permanent freshwater wetlands with tall, dense vegetation, particularly *Typha* spp. (bullrushes) and *Eleocharis* spp. (spikerushes).	Unlikely – the study area lacks suitable habitat for this species.
Bubulcus ibis	Cattle Egret			Grasslands, wooded lands and terrestrial wetlands.	Unlikely – no records of this species have been made within a 5 km radius of the study area. Marginal foraging habitat may be present.
Calidris acuminata	Sharp-tailed Sandpiper		M	Summer migrant. Widespread in most regions of NSW, especially in coastal areas, but sparse in the south-central Western Plain and east Lower Western Regions. Shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	Unlikely – the study area lacks suitable habitat for this species.
Calidris melanotos	Pectoral Sandpiper		M	Summer migrant to Australia. Widespread but scattered in NSW. East of the Great Divide, recorded from Casino and Ballina, south to Ulladulla. West of the Great Divide, widespread in the Riverina and Lower Western regions. Shallow fresh to saline	Unlikely – the study area lacks suitable habitat for this species.

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
				wetlands, including coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	
Callocephalon fimbriatum	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	E2,V		The population is believed to be largely confined to an area bounded by Thornleigh and Wahroonga in the north, Epping and North Epping in the south, Beecroft and Cheltenham in the west and Turramurra/South Turramurra to the east. Forest and woodland, urban fringes.	No – the population for this species is too far from the study area.
Callocephalon fimbriatum	**Gang-gang Cockatoo**	**V**		**In NSW, distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. Isolated records known from as far north as Coffs Harbour and as far west as Mudgee. Tall mountain forests and woodlands in summer; in winter, may occur at lower altitudes in open eucalypt forests and woodlands, and urban areas.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.**
Calyptorhynchus lathami	Glossy Black-Cockatoo, Riverina population	E2,V		Within the Narrandera Range and to the north-west in the Brobenah Hills, McPhersons Range, Cocoparra Range, Lachlan Range and Jimberoo State Forests, and the Naradhan Range. Largely restricted to hills and low ridges where suitable stands of its food plant *Allocasuarina verticillata* (Drooping Sheoak) remain.	No – the population for this species is too far from the study area.
Calyptorhynchus lathami	**Glossy Black-Cockatoo**	**V**		**In NSW, widespread along coast and inland to the southern tablelands and central western plains, with a small population in the Riverina. Open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.**
Cercartetus nanus	Eastern Pygmy-possum	V		In NSW it extents from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Rainforest, sclerophyll forest (including Box-Ironbark), woodland and heath.	Unlikely – records have been made within a 5km radius however it is unlikely the habitat within the study area is suitable.
Chalcites osculans	Black-eared Cuckoo		M	The Black-eared Cuckoo is found in drier country where species such as mulga and mallee form open woodlands and shrublands. It is often found in vegetation along creek beds.	Unlikely – no records of this species have been made within a 5 km radius of the study area.

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
					Marginal foraging habitat may be present.
Chalinolobus dwyeri	**Large-eared Pied Bat**	**V**	**V**	**Recorded from Rockhampton in Qld south to Ulladulla in NSW. Largest concentrations of populations occur in the sandstone escarpments of the Sydney basin and the NSW north-west slopes. Wet and dry sclerophyll forests, Cyprus Pine dominated forest, woodland, sub-alpine woodland, edges of rainforests and sandstone outcrop country.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat and possible roosting habitat.**
Climacteris picumnus victoriae	**Brown Treecreeper (eastern subspecies)**	**V**		**From eastern through central NSW, west to Corowa, Wagga Wagga, Temora, Forbes, Dubbo and Inverell. Eucalypt woodlands and dry open forest.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.**
Daphoenositta chrysoptera	**Varied Sittella**	**V**		**Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, mallee and Acacia woodland.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.**
***Dasyurus maculatus maculatus* (SE mainland population)**	**Spotted-tailed Quoll**	**V**	**E**	**Found on the east coast of NSW, Tasmania, eastern Victoria and north-eastern Qld. Rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area is connected to a large area of habitat to the east.**
Delma impar	Striped Legless Lizard	V	V	In NSW, occurs in the Southern Tablelands, the South West Slopes and possibly on the Riverina.	Unlikely – no records of this species have been made within a 5 km radius of the study area. Study area is outside of known and predicted distribution.
Falco hypoleucos	Grey Falcon	E1		Arid and semi-arid zones. In NSW, found chiefly throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. Shrubland, grassland and	Unlikely – no records have been made within a 5 km radius. The

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
				wooded watercourses, occasionally in open woodlands near the coast, and near wetlands.	study area is unlikely to contain suitable habitat.
Falco subniger	Black Falcon	V		Sparsely distributed in NSW, occurring mostly in inland regions. Shrubland, forests, wetlands, grasslands, woodlands and rainforests.	Unlikely – records of this species have been made within a 5 km radius of the study area. Marginal foraging habitat may be present.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		South-east coast and ranges of Australia, from southern Qld to Victoria and Tasmania. In NSW, records extend to the western slopes of the Great Dividing Range. Tall (greater than 20m) moist habitats.	Unlikely – records have been made within a 5 km radius of the study area however the habitat on site in unlikely to be suitable.
Gallinago hardwickii	Latham's Snipe		M	Migrant to east coast of Australia, extending inland west of the Great Dividing Range in NSW. Freshwater, saline or brackish wetlands up to 2000 m above sea-level; usually freshwater swamps, flooded grasslands or heathlands.	Unlikely – the study area lacks suitable habitat for this species.
Grantiella picta	Painted Honeyeater	V	V	Widely distributed in NSW, predominantly on the inland side of the Great Dividing Range but avoiding arid areas. Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests.	Unlikely – no records have been made for this species within a 5km radius of the study area.
Haliaeetus leucogaster	**White-bellied Sea-Eagle**	**V**		**Distributed along the coastline of mainland Australia and Tasmania, extending inland along some of the larger waterways, especially in eastern Australia. Freshwater swamps, rivers, lakes, reservoirs, billabongs, saltmarsh and sewage ponds and coastal waters. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.**
Heleioporus australiacus	Giant Burrowing Frog	V	V	South eastern NSW and Victoria, in two distinct populations: a northern population in the sandstone geology of the Sydney Basin as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria. Heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	Unlikely – no records have been made for this species within a 5km radius of the study area.
Hieraaetus morphnoides	**Little Eagle**	**V**		**Throughout the Australian mainland, with the exception of the most densely-forested parts of the Dividing Range escarpment. Open eucalypt forest, woodland or open woodland, including sheoak or Acacia woodlands and riparian woodlands of interior NSW.**	**Potential – records have been made for this species within a 5 km radius of the study area. The**

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
					study area likely contains foraging habitat.
Hirundapus caudacutus	White-throated Needletail		M	All coastal regions of NSW, inland to the western slopes and inland plains of the Great Divide. Occur most often over open forest and rainforest, as well as heathland, and remnant vegetation in farmland.	Unlikely – records have been made within a 5 km radius of the study area however the habitat on site in unlikely to be suitable.
Hoplocephalus bungaroides	**Broad-headed Snake**	**E1**	**V**	**Largely confined to Triassic and Permian sandstones within the coast and ranges in an area within approximately 250 km of Sydney. Dry and wet sclerophyll forests, riverine forests, coastal heath swamps, rocky outcrops, heaths, grassy woodlands.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area contains suitable habitat.**
Lathamus discolor	Swift Parrot	E1	CE	Migrates from Tasmania to mainland in Autumn-Winter. In NSW, the species mostly occurs on the coast and south west slopes. Box-ironbark forests and woodlands.	Unlikely – no records of this species have been made within a 5 km radius of the study area. Marginal foraging habitat may be present.
Melithreptus gularis gularis	**Black-chinned Honeyeater (eastern subspecies)**	**V**		**Widespread in NSW from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. Also Richmond and Clarence River areas and a few scattered sites in the Hunter, Central Coast and Illawarra regions.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.**
Meridolum corneovirens	**Cumberland Plain Land Snail**	**E1**		**Areas of the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool, west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. Primarily inhabits Cumberland Plain Woodland. Also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area contains suitable habitat.**
Merops ornatus	Rainbow Bee-eater			Distributed across much of mainland Australia, including NSW. Open forests and woodlands, shrublands, farmland, areas of human habitation, inland and coastal sand dune systems, heathland, sedgeland, vine forest and vine thicket.	Unlikely – no records have been made for this species within a 5km radius of the study area.

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
Miniopterus australis	**Little Bentwing-bat**	**V**		**East coast and ranges south to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains suitable habitat.**
Miniopterus orianaea oceanensis	**Large Bent-winged Bat**	**V**		**Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. Hunt in forested areas, catching moths and other flying insects above the treetops.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains suitable habitat.**
Micronomus norfolkensis	**Eastern Coastal Free-tailed Bat**	**V, P**		**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. Usually solitary but also recorded roosting communally, probably insectivorous.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains suitable habitat.**
Monarcha melanopsis	Black-faced Monarch		M	In NSW, occurs around the eastern slopes and tablelands of the Great Divide, inland to Coutts Crossing, Armidale, Widden Valley, Wollemi National Park and Wombeyan Caves. It is rarely recorded farther inland. Rainforest, open eucalypt forests, dry sclerophyll forests and woodlands, gullies in mountain areas or coastal foothills, Brigalow scrub, coastal scrub, mangroves, parks and gardens.	Unlikely – no records have been made for this species within a 5km radius of the study area.
Motacilla flava	Yellow Wagtail		M	Regular summer migrant to mostly coastal Australia. In NSW recorded Sydney to Newcastle, the Hawkesbury and inland in the Bogan LGA. Swamp margins, sewage ponds, saltmarshes, playing fields, airfields, ploughed land, lawns.	Unlikely – no records have been made for this species within a 5km radius of the study area.
Myiagra cyanoleuca	Satin Flycatcher		M	In NSW, widespread on and east of the Great Divide and sparsely scattered on the western slopes, with very occasional records on the western plains. Eucalypt dominated forests, especially near wetlands, watercourses, and heavily-vegetated gullies.	Unlikely – no records have been made for this species within a 5km radius of the study area.
Myotis macropus	**Southern Myotis**	**V**		**In NSW, found in the coastal band. It is rarely found more than 100 km inland, except along major rivers. Foraging habitat is waterbodies (including streams, or lakes or reservoirs) and fringing areas of vegetation up to 20m.**	**Potential – records have been made for this species within a 5 km radius of the study area. The**

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
					study area contains suitable habitat.
Neophema pulchella	**Turquoise Parrot**	**V**		**Occurs along the length of NSW from the coastal plains to the western slopes of the Great Dividing Range. Eucalypt and cypress pine open forests and woodlands, ecotones between woodland and grassland, or coastal forest and heath.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.**
Ninox strenua	**Powerful Owl**	**V**		**In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains. Woodland, open sclerophyll forest, tall open wet forest and rainforest.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area likely contains foraging habitat.**
Numenius madagascariensis	Eastern Curlew		CE, M	Summer migrant to Australia. Primarily coastal distribution in NSW, with some scattered inland records. Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats or sandflats, ocean beaches, coral reefs, rock platforms, saltmarsh, mangroves, freshwater/brackish lakes, saltworks and sewage farms.	Unlikely – no records have been made for this species within a 5km radius of the study area.
Onychoprion fuscata	Sooty Tern	V		In NSW only known to breed at Lord Howe Island. Occasionally seen along coastal NSW, especially after cyclones. Breeds in large colonies in sand or coral scrapes on offshore islands and cays including Lord Howe and Norfolk Islands	Unlikely – records have been made within a 5 km radius of the study area however the habitat on site in unlikely to be suitable.
Petauroides volans	Greater Glider population in the Eurobodalla local government area	E2	V	This population on the south coast of NSW is bounded by the Moruya River to the north, Coila Lake to the south and the Princes Highway and cleared land exceeding 700 m in width to the west. Eucalypt forests and woodlands.	No – this population is too far from the study area.
Petauroides volans	**Greater Glider**		**V**	**The greater glider is an arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. The greater glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area is connected to a large area of habitat to the east.**

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
Petaurus australis	Yellow-bellied Glider population on the Bago Plateau	E2,V		The endangered population of the Yellow-bellied Glider occurs on the Bago Plateau; a westward extension of the Kosciuszko highlands in southern NSW.	No – this population is too far from the study area.
Petaurus australis	Yellow-bellied Glider	V		Along the eastern coast to the western slopes of the Great Dividing Range, from southern Qld to Victoria. Tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	Unlikely – no records have been made for this species within a 5km radius of the study area.
Petaurus norfolcensis	Squirrel Glider in the Wagga Wagga Local Government Area	E2,V		The extent of the endangered population is legally defined by the boundaries of the Wagga Wagga LGA.	No – this population is too far from the study area.
Petaurus norfolcensis	Squirrel Glider on Barrenjoey Peninsula, north of Bushrangers Hill	E2,V		The endangered population is within the Pittwater Local Government Area on the Barrenjoey Peninsula, north of Bushrangers Hill.	No – this population is too far from the study area.
Petaurus norfolcensis	Squirrel Glider	V		Widely though sparsely distributed on both sides of the Great Dividing Range in eastern Australia, from northern Qld to western Victoria.	Unlikely – records have been made within a 5 km radius of the study area however the habitat on site in unlikely to be suitable.
Petrogale penicillata	Brush-tailed Rock-wallaby	E1	V	In NSW they occur from the Qld border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges.	Unlikely – the study area lacks suitable habitat for this species.
Petroica boodang	**Scarlet Robin**	**V**		**In NSW, it occurs from the coast to the inland slopes. Dry eucalypt forests and woodlands, and occasionally in mallee, wet forest, wetlands and tea-tree swamps.**	**Potential – records have been made for this species within a 5 km radius of the study area. The**

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
					study area likely contains foraging habitat.
Phascolarctos cinereus	**Koala**	**E**	**E**	**In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. There are sparse and possibly disjunct populations in the Bega District, and at several sites on the southern tablelands. Eucalypt woodlands and forests.**	**Likely - records have been made for this species all around the study area. The study area contains suitable habitat.**
Pseudomys novaehollandiae	New Holland Mouse		V	Fragmented distribution across eastern NSW. Open heathlands, woodlands and forests with a heathland understorey, vegetated sand dunes.	Unlikely – no records have been made for this species within a 5km radius of the study area.
Pseudophryne australis	Red-crowned Toadlet	V		Confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. Open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings.	Unlikely – records have been made within a 5 km radius of the study area however the habitat on site in unlikely to be suitable.
Pteropus poliocephalus	**Grey-headed Flying-fox**	**V**	**V**	**Along the eastern coast of Australia, from Bundaberg in Qld to Melbourne in Victoria. Subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.**	**Likely – records have been made within the study area. The study area contains suitable foraging habitat**
Rhipidura rufifrons	Rufous Fantail		M	Coastal and near coastal districts of northern and eastern Australia, including on and east of the Great Divide in NSW. Wet sclerophyll forests, subtropical and temperate rainforests. Sometimes drier sclerophyll forests and woodlands	Unlikely – no records have been made for this species within a 5km radius of the study area.
Rostratula australis	Australian Painted Snipe	E1	E	In NSW most records are from the Murray-Darling Basin. Other recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Swamps, dams and nearby marshy areas.	Unlikely – no records have been made for this species within a 5km radius of the study area.
Scoteanax rueppellii	**Greater Broad-nosed Bat**	**V**		**Both sides of the great divide, from the Atherton Tableland in Qld to north-eastern Victoria, mainly along river systems and gullies. In NSW it is widespread on the New England Tablelands. Woodland, moist and dry eucalypt forest and rainforest.**	**Potential – records have been made for this species within a 5 km radius of the study area. The study area contains suitable habitat.**
Stagonopleura guttata	**Diamond Firetail**	**V**		**Widely distributed in NSW, mainly recorded in the Northern, Central and Southern Tablelands, the Northern, Central and South Western Slopes and the North West**	**Potential – records have been made for this species within a 5**

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
				Plains and Riverina, and less commonly found in coastal areas and further inland. Grassy eucalypt woodlands, open forest, mallee, Natural Temperate Grassland, secondary derived grassland, riparian areas and lightly wooded farmland.	**km radius of the study area. The study area likely contains suitable habitat.**
Varanus rosenbergi	Rosenberg's Goanna	V		In NSW, found on the Sydney Sandstone in Wollemi National Park, in the Goulburn and ACT regions and near Cooma in the south. Also recorded from the South West Slopes near Khancoban and Tooma River. Found in heath, open forest and woodland	Unlikely – records have been made within a 5 km radius of the study area however the habitat on site in unlikely to be suitable.
FLORA					
Acacia bynoeana	**Bynoe's Wattle**	**E1**	**V**	**Found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. Heath or dry sclerophyll forest on sandy soils.**	**Potential – this species is known to occur within the PCTs listed as occurring within the study area.**
Allocasuarina glareicola		E1	E	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Castlereagh woodland on lateritic soil. Found in open woodland with Eucalyptus parramattensis, Eucalyptus fibrosa, Angophora bakeri, Eucalyptus sclerophylla and Melaleuca decora.	Unlikely – there are no records of this species within a 5km radius of the study area.
Commersonia prostrata	Dwarf Kerrawang	E1	E	In NSW, found in the Southern Highlands and Southern Tablelands (Penrose State Forest, Tallong, near the Corang, and Rowes Lagoon), the Thirlmere Lakes area and on the North Coast (Tomago sandbeds north of Newcastle). Occurs on sandy, sometimes peaty soils in a wide variety of habitats.	Unlikely – there are no records of this species within a 5km radius of the study area.
Cynanchum elegans	White-flowered Wax Plant	E1	E	Restricted to eastern NSW, from Brunswick Heads on the north coast to Gerroa in the Illawarra region, and as far west as Merriwa in the upper Hunter River valley. Dry rainforest; littoral rainforest; Leptospermum laevigatum-Banksia integrifolia subsp. integrifolia (Coastal Tea-tree– Coastal Banksia) coastal scrub; Eucalyptus tereticornis (Forest Red Gum) or Corymbia maculata (Spotted Gum) open forest and woodland; and Melaleuca armillaris (Bracelet Honeymyrtle) scrub.	Unlikely – there are no records of this species within a 5km radius of the study area.
Epacris purpurascens* var. *purpurascens		**V**		**Recorded from Gosford in the north, to Narrabeen in the east, Silverdale in the west and Avon Dam vicinity in the South. Found in a range of habitat types, most of which have a strong shale soil influence.**	**Potential – this species is known to occur within the PCTs listed as occurring within the study area.**
Genoplesium baueri	**Bauer's Midge Orchid**	**E1**	**E**	**Has been recorded from locations between Nowra and Pittwater and may occur as far north as Port Stephens. Dry sclerophyll forest and moss gardens over sandstone.**	**Likely - records have been made for this species west of the study**

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
					area. The study area contains suitable habitat.
Grevillea raybrownii		V		Generally occurs on ridgetops and, less often, slopes and benches of Hawkesbury Sandstone and Mittagong Formation. It occurs in Eucalyptus open forest and woodland with a shrubby understorey on sandy, gravelly loam soils derived from sandstone that are low in nutrients	Unlikely – records have been made within a 5 km radius of the study area however the habitat on site in unlikely to be suitable.
Grevillea parviflora subsp. ***parviflora***	**Small-flower Grevillea**	**V**	**V**	**Sporadically distributed throughout the Sydney Basin and in the Hunter in the Cessnock - Kurri Kurri area. Also known from Putty to Wyong and Lake Macquarie on the Central Coast. Heath and shrubby woodland to open forest on sandy or light clay soils usually over thin shales.**	**Potential – records have been made for this species east of the study area. The study area contains suitable habitat.**
Haloragis exalata subsp. *exalata*	Square Raspwort	V	V	Disjunct distribution in the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. Protected and shaded damp situations in riparian habitats.	Unlikely – there are no records of this species within a 5km radius of the study area.
Leucopogon exolasius	**Woronora Beard-heath**	**V**	**V**	**Upper Georges River area and in Heathcote National Park.**	**Potential – this species is known to occur within the PCTs listed as occurring within the study area.**
Melaleuca deanei	Deane's Paperbark	V	V	Ku-ring-gai/Berowra area, Holsworthy/Wedderburn area, Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas. Heath on sandstone.	Unlikely – records have been made within a 5 km radius of the study area however the habitat on site in unlikely to be suitable.
Persicaria elatior	Tall Knotweed	V	V	In south-eastern NSW recorded from Mt Dromedary, Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In northern NSW known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). Beside streams and lakes, swamp forest or disturbed areas.	Unlikely – there are no records of this species within a 5km radius of the study area.
Persoonia bargoensis	**Bargo Geebung**	**E1**	**V**	**Restricted to a small area south-west of Sydney on the western edge of the Woronora Plateau and the northern edge of the Southern Highlands. Woodland or dry sclerophyll forest on sandstone and on heavier, well drained, loamy, gravelly soils of the Wianamatta Shale and Hawkesbury Sandstone.**	**Potential – this species has been known to occur within the PCTs listed as occurring within the study area.**

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
Persoonia glaucescens	Mittagong Geebung	E1	V	Recent surveys place the present southern limit near Berrima and the northern limit near Buxton.	Unlikely – records have been made within a 5 km radius of the study area however the habitat on site in unlikely to be suitable.
Persoonia mollis subsp. *revoluta*		V		Mittagong, Paddys River and High Range in the Southern Highlands with an outlying population in the Bindook Highlands. Mainly on relatively deep sandy soils on broad ridgetops and upper slopes.	Unlikely – there are no records of this species within a 5km radius of the study area.
Pimelea spicata	Spiked Rice-flower	E1	E	Two disjunct areas; the Cumberland Plain (Marayong and Prospect Reservoir south to Narellan and Douglas Park) and the Illawarra (Landsdowne to Shellharbour to northern Kiama).	Unlikely – there are no records of this species within a 5km radius of the study area.
Pomaderris brunnea	Brown Pomaderris	E1	V	In NSW, found around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden. It also occurs near Walcha on the New England tablelands. Moist woodland or forest on clay and alluvial soils of flood plains and creek lines.	Unlikely – records have been made within a 5 km radius of the study area however the habitat on site in unlikely to be suitable.
Pomaderris cotoneaster	Cotoneaster Pomaderris	E1	E	Recorded in NSW from the Nungatta area, northern Kosciuszko National Park (near Tumut), the Tantawangalo area in South-East Forests National Park and adjoining freehold land, Badgery's Lookout near Tallong, the Yerranderie area, the Canyonleigh area and Ettrema Gorge in Morton National Park. Generally dry sclerophyll forest, often on skeletal soil.	Unlikely – there are no records of this species within a 5km radius of the study area
Pterostylis saxicola	Sydney Plains Greenhood	E1	E	Restricted to western Sydney between Freemans Reach in the north and Picton in the south. Small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines, adjacent to sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	Unlikely – there are no records of this species within a 5km radius of the study area
Rhodamnia rubescens	Scrub Turpentine	CE		Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of R. rubescens typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	Unlikely – there are no records of this species within a 5km radius of the study area

Scientific Name	Common Name	BC Act Status	EPBC Act Status	Distribution and Habitat	Likelihood of occurrence
Rhizanthella slateri	Rhizanthella slateri (Rupp) M.A. Clem. & Cribb in the Great Lakes local government area	E2,V	E	The population occurs near Bulahdelah (within the Great Lakes LGA). Sclerophyll forest in shallow to deep loams.	No – this population is too far from the study area
Rhizanthella slateri	Eastern Australian Underground Orchid	V	E	In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. Sclerophyll forest in shallow to deep loams.	Unlikely – there are no records of this species within a 5km radius of the study area
Thelymitra kangaloonica	Kangaloon Sun Orchid	E4A	CE	Only known to occur on the southern tablelands of NSW in the Moss Vale / Kangaloon / Fitzroy Falls area at 550-700 m above sea level. Swamps in sedgelands over grey silty grey loam soils.	Unlikely – there are no records of this species within a 5km radius of the study area
Thesium australe	Austral Toadflax	V	V	In eastern NSW it is found in very small populations scattered along the coast, and from the Northern to Southern Tablelands. Grassland on coastal headlands or grassland and grassy woodland away from the coast.	Unlikely – there are no records of this species within a 5km radius of the study area

Status key: BC Act: E1 = Endangered, E2 = Endangered Population, E4 = Extinct, E4A = Critically Endangered, V = Vulnerable,
EPBC Act: M = Migratory, CD = Conservation Dependent, CE = Critically Endangered, E = Endangered, V = Vulnerable, X = Extinct

Appendix B: Flora species list

Family	Species	Common Name	Growth Form Group
Fabaceae (Mimosoideae)	*Acacia decurrens*	Black Wattle	Tree (TG)
Fabaceae (Mimosoideae)	*Acacia falcata*	Hickory Wattle	Shrub (SG)
Fabaceae (Mimosoideae)	*Acacia implexa*	Hickory Wattle	Shrub (SG)
Fabaceae (Mimosoideae)	*Acacia myrtifolia*	Red-stemmed Wattle	Shrub (SG)
Fabaceae (Mimosoideae)	*Acacia parramattensis*	Parramatta Wattle	Tree (TG)
Casuarinaceae	*Allocasuarina littoralis*	Black She-Oak	Tree (TG)
Casuarinaceae	*Allocasuarina torulosa*	Forest Oak	Tree (TG)
Poaceae	*Aristida ramosa*	Purple Wiregrass	Grass & grasslike (GG)
Poaceae	*Austrostipa ramosissima*	Stout Bamboo Grass	Grass & grasslike (GG)
Poaceae	*Austrostipa* sp.	A Speargrass	Grass & grasslike (GG)
Pittosporaceae	*Billardiera scandens*	Hairy Apple Berry	Other (OG)
Pittosporaceae	*Bursaria spinosa* subsp. *spinosa*	Native Blackthorn	Shrub (SG)
Myrtaceae	*Callistemon linearis*	Narrow-leaved Bottlebrush	Shrub (SG)
Cyperaceae	*Carex appressa*	Tall Sedge	Grass & grasslike (GG)
Lauraceae	*Cassytha pubescens*	Downy Dodder-laurel	Other (OG)
Poaceae	*Cenchrus clandestinus*^*	Kikuyu Grass	
Asteraceae	*Cirsium vulgare**	Spear Thistle	
Myrtaceae	*Corymbia gummifera*	Red Bloodwood	Tree (TG)
Myrtaceae	*Corymbia citriodora*	Lemon-scented Gum	Tree (TG)
Cupressaceae	*Cupressus* sp.*	Cypress Pine	
Phormiaceae	*Dianella longifolia* var. *longifolia*	A Blue Flax Lily	Forb (FG)
Poaceae	*Dichelachne micrantha*	Shorthair Plumegrass	Grass & grasslike (GG)
Poaceae	*Digitaria parviflora*	Small-flowered Finger Grass	Grass & grasslike (GG)
Poaceae	*Echinopogon ovatus*	Forest Hedgehog Grass	Grass & grasslike (GG)
Poaceae	*Entolasia stricta*	Wiry Panic	Grass & grasslike (GG)
Poaceae	*Eragrostis brownii*	Brown's Lovegrass	Grass & grasslike (GG)
Poaceae	*Eragrostis curvula*^*	African Lovegrass	
Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass	Grass & grasslike (GG)
Myrtaceae	*Eucalyptus amplifolia* subsp. *amplifolia*	Cabbage Gum	Tree (TG)
Myrtaceae	*Eucalyptus crebra*	Narrow-leaved Ironbark	Tree (TG)
Myrtaceae	*Eucalyptus fibrosa*	Red Ironbark	Tree (TG)
Myrtaceae	*Eucalyptus globoidea*	White Stringybark	Tree (TG)
Myrtaceae	*Eucalyptus grandis*	Flooded Gum	Tree (TG)
Myrtaceae	*Eucalyptus longifolia*	Woollybutt	Tree (TG)

Family	Species	Common Name	Growth Form Group
Myrtaceae	*Eucalyptus moluccana*	Grey Box	Tree (TG)
Myrtaceae	*Eucalyptus punctata*	Grey Gum	Tree (TG)
Myrtaceae	*Eucalyptus robusta*	Swamp Mahogany	Tree (TG)
Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	Tree (TG)
Santalaceae	*Exocarpos cupressiformis*	Cherry Ballart	Shrub (SG)
Geraniaceae	*Geranium solanderi* var. *solanderi*	Native Geranium	Forb (FG)
Fabaceae (Faboideae)	*Glycine clandestina*	Twining glycine	Other (OG)
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort	Forb (FG)
Proteaceae	*Grevillea robusta*	Silky Oak	Tree (TG)
Proteaceae	*Hakea salicifolia* subsp. *salicifolia*	Willow-leaved Hakea	Shrub (SG)
Fabaceae (Faboideae)	*Hardenbergia violacea*	False Sarsaparilla	Other (OG)
Dilleniaceae	*Hibbertia aspera* subsp. *aspera*	Rough Guinea Flower	Shrub (SG)
Apiaceae	*Hydrocotyle laxiflora*	Stinking Pennywort	Forb (FG)
Clusiaceae	*Hypericum gramineum*	Small St John's Wort	Forb (FG)
Asteraceae	*Hypochaeris radicata**	Catsear	
Poaceae	*Imperata cylindrica*	Blady Grass	Grass & grasslike (GG)
Fabaceae (Faboideae)	*Indigofera australis*	Australian Indigo	Shrub (SG)
Bignoniaceae	*Jacaranda* sp.*	Jacaranda	
Myrtaceae	*Kunzea ambigua*	Tick Bush	Shrub (SG)
Cyperaceae	*Lepidosperma laterale*	Variable Sword-sedge	Grass & grasslike (GG)
Campanulaceae	*Lobelia purpurascens*	whiteroot	Forb (FG)
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush	Grass & grasslike (GG)
Lomandraceae	*Lomandra multiflora* subsp. *multiflora*	Many-flowered Mat-rush	Grass & grasslike (GG)
Primulaceae	*Lysimachia arvensis**	Scarlet Pimpernel	
Myrtaceae	*Melaleuca decora*		Shrub (SG)
Myrtaceae	*Melaleuca linariifolia*	Flax-leaved Paperbark	Shrub (SG)
Myrtaceae	*Melaleuca thymifolia*	Thyme Honey-myrtle	Shrub (SG)
Poaceae	*Microlaena stipoides* var. *stipoides*	Weeping Grass	Grass & grasslike (GG)
Asteraceae	*Olearia microphylla*		Shrub (SG)
Asteraceae	*Olearia viscidula*	Wallaby Weed	Shrub (SG)
Poaceae	*Oplismenus aemulus*	Basket Grass	Grass & grasslike (GG)
Asteraceae	*Ozothamnus diosmifolius*	White Dogwood	Shrub (SG)
Poaceae	*Paspalum dilatatum*^*	Paspalum	
Proteaceae	*Persoonia linearis*	Narrow-leaved Geebung	Shrub (SG)
Phytolaccaceae	*Phytolacca octandra**	Inkweed	
Thymelaeaceae	*Pimelea linifolia* subsp. *linifolia*	Rice Flower	Shrub (SG)

Family	Species	Common Name	Growth Form Group
Pinaceae	*Pinus radiata*^*	Radiata Pine	
Pittosporaceae	*Pittosporum revolutum*	Rough fruit Pittosporum	Shrub (SG)
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum	Shrub (SG)
Polygalaceae	*Polygala myrtifolia*^*		
Rubiaceae	*Pomax umbellata*	Pomax	Forb (FG)
Cyperaceae	*Ptilothrix deusta*		Grass & grasslike (GG)
Fabaceae (Faboideae)	*Pultenaea villosa*	Hairy Bush-pea	Shrub (SG)
Rosaceae	*Rubus anglocandicans*^*	Blackberry	
Polygonaceae	*Rumex brownii*	Swamp Dock	Forb (FG)
Asteraceae	*Senecio angulatus**		
Asteraceae	*Senecio madagascariensis*^*	Fireweed	
Poaceae	*Setaria parviflora**	Pigeon Grass	
Solanaceae	*Solanum aviculare*	Kangaroo Apple	Shrub (SG)
Solanaceae	*Solanum prinophyllum*	Forest Nightshade	Forb (FG)
Solanaceae	*Solanum sisymbriifolium**		
Asteraceae	*Sonchus oleraceus**	Common Sowthistle	
Poaceae	*Sporobolus creber*	Slender Rat's Tail Grass	Grass & grasslike (GG)
Poaceae	*Themeda triandra*	Kangaroo Grass	Grass & grasslike (GG)
Typhaceae	*Typha orientalis*	Broad-leaved Cumbungi	Grass & grasslike (GG)
Verbenaceae	*Verbena bonariensis**	Purpletop	
Verbenaceae	*Verbena rigida* var. *rigida**	Veined Verbena	
Campanulaceae	*Wahlenbergia* sp.	Bluebell	Forb (FG)

** = exotic species*

^ = high threat weed

Appendix C: SSTF Condition Thresholds and categories as defined by the EPBC

Category and Rationale	Thresholds		
A. Moderate condition class Represented by medium to large-size patch as part of a larger native vegetation remnant and/or with mature trees	Patch size ≥0.5ha **And** ≥30% of the perennial understorey vegetation cover is made up of native species. **And**		
	The patch is contiguous with a native vegetation remnant (any native vegetation where cover in each layer present is dominated by native species) ≥1ha in area.	**Or**	The patch has at least one tree with hollows or at least one large locally indigenous tree (>80cm dbh).
B. Moderate condition class Represented by medium to large size patch with high quality native understorey	Patch size ≥0.5ha **And** ≥50% of the perennial understorey vegetation cover is made up of native species.		
C. High condition class Represented by medium to large size patch with very high quality native understorey	Patch size ≥0.5ha **And** ≥70% of the perennial understorey vegetation cover is made up of native species.		
D. High condition class Represented by larger size patch with high quality native understorey	Patch size ≥2ha **And** ≥50% of the perennial understorey vegetation cover is made up of native species.		
Perennial understorey vegetation cover includes vascular plant species of both the ground layer and mid/shrub layer (where present) with a lifecycle of more than two growing seasons. Measurements of perennial understorey vegetation cover exclude annuals, cryptogams, leaf litter or exposed soil. *Contiguous* means the patch of the ecological community is continuous with, or in close proximity (within 100 m) to another area of vegetation that is dominated by native species in each vegetation layer present.			

Figure 14: Condition thresholds and categories for Shale Sandstone Transition Forest ecological community listed under the EPBC act