328-330 Annangrove Road, Rouse Hill

Biodiversity Development Assessment Report

Thomas Baxter c/- Mills Oakley

18 February 2022

Final

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Report No. 20236RP1

The preparation of this report has been in accordance with the brief provided by the Client and has relied upon the data and results collected at or under the times and conditions specified in the report. All findings, conclusions or commendations contained within the report are based only on the aforementioned circumstances. The report has been prepared for use by the Client and no responsibility for its use by other parties is accepted by Cumberland Ecology.

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1	03-12-2021	DR, CEP, GK	Final Report
2	18-02-2022	DR, CEP	Revised Final Report

Approved by:	**David Robertson**
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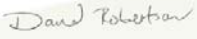
Signed:	
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Glossary

Term / Abbreviation	Definition
Assessment area	Area of land within a 1500 m buffer around the outer boundary of the subject land
BAM	Biodiversity Assessment Method 2020
BAM-C	Biodiversity Assessment Method Calculator
BC Act	*NSW Biodiversity Conservation Act 2016*
BC Regulation	*NSW Biodiversity Conservation Regulation 2017*
BDAR	Biodiversity Development Assessment Report
Biosecurity Act	NSW *Biosecurity Act 2015*
BOS	Biodiversity Offset Scheme
C	Celsius
CEEC	Critically Endangered Ecological Community
Council	The Hills Shire Council
DA	Development Application
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DBH	Diameter at Breast Height
DPIE	NSW Department of Planning, Industry and Environment
EES	Environment, Energy and Science Group
EP&A Act	*NSW Environmental Planning and Assessment Act 1979*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
GIS	Geographic Information System
ha	Hectares
IBRA	Interim Biogeographic Regionalisation for Australia
LEP	Local Environment Plan
LGA	Local Government Area
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
SAII	Serious and Irreversible Impact
Study area	Lot 12 DP833069 and Lot 34 DP834050, also known as 328-330 Annangrove Road, Rouse Hill
Subject land	The land proposed as a development site (see **Figure 1**)
TBDC	Threatened Biodiversity Data Collection
TEC	Threatened Ecological Community
the 'project'	Concept proposal for development of a mixed use/bulky goods commercial centre

1. Introduction

Cumberland Ecology was commissioned by Mills Oakley, on behalf of Thomas Baxter (the 'client'), to prepare a Biodiversity Development Assessment Report (BDAR) to support a concept development application for the proposed mixed-use development of 328-330 Annangrove Road, Rouse Hill (the 'project').

The development application is presently the subject of Class 1 Land and Environment Court (LEC) proceedings 2021/88386, known as Thomas Baxter v The Hills Shire Council (Council). Ecological issues for the development application, as raised in Council's Statement of Facts and Contentions (SoFC), largely relate to the extent of the project's impact on two Critically Endangered Ecological Communities (CEEC) listed under both the NSW *Biodiversity Conservation Act 2016* (BC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act); namely Cumberland Plain Woodland in the Sydney Basin Bioregion ('Cumberland Plain Woodland') and Shale Sandstone Transition Forest in the Sydney Basin Bioregion ('Shale Sandstone Transition Forest').

This BDAR has been prepared to satisfy the matters identified in Contentions 1,2 and 4 of Council's SoFC and forms part of the documentation to support the application for development consent under Part 4 of the New South Wales (NSW) *Environmental Planning and Assessment Act 1979* (EP&A Act) as well as the ecological expert documentation for the LEC proceedings. The BDAR has also been revised to satisfy the matters identified in Contention 1 of Council's Amended SoFC, in relation to impacts to native vegetation associated with a proposed stormwater pipe through the eastern conservation area and within Sydney Water land. For the latter land, permission will be required, and a controlled activities statement will need to be prepared and approved under the *Water Management Act 2000*. A commitment will also be made to avoid all tree impacts to the greatest extent possible within Sydney Water land.

A Vegetation Management Plan (VMP) has also been prepared for the project by Cumberland Ecology (2021) to address rehabilitation, replanting and ongoing management of Cumberland Plain Woodland CEEC and Shale Sandstone Transition Forest CEEC within retained areas of the site.

This BDAR has been prepared in accordance with the 2020 version of the Biodiversity Assessment Method (BAM) (DPIE 2020a) and replaces the BDAR previously prepared by Keystone Ecological (Keystone Ecological. 2020) (the 'Keystone BDAR') for the project. Nonetheless, where relevant, data and results from the Keystone BDAR have been used and relied upon in this BDAR.

Any reference to the BAM in the following report refers to the BAM 2020, unless stated otherwise.

1.1. Requirement for BDAR

Under the BC Act, all development that requires development consent under Part 4 of the EP&A Act that is likely to significantly affect threatened ecological communities (TEC) as set out in Clause 7.3 of the BC Act must be assessed using the BAM with the results presented in a BDAR.

This project has been determined to exceed the native vegetation clearing threshold as the minimum lot size for Lot 12 DP833069 and Lot 34 DP834050 is 0.4 ha (4,000 m^2) and the area of native vegetation proposed to be cleared is approximately 2.03 ha, which exceeds the associated clearing threshold of 0.25 ha. The project will also impact on land mapped on the Biodiversity Values Map (added on 25 August 2017). Hence, this BDAR has been prepared.

1.2. Purpose

The purpose of this BDAR is to document the findings of an assessment undertaken for the project in accordance with Stage 1 (Biodiversity Assessment) and Stage 2 (Impact Assessment) of the BAM. Specifically, the objectives of this BDAR are to:

- Identify the landscape features and site context (native vegetation cover) within the subject land and assessment area;
- Assess native vegetation extent, plant community types (PCTs), threatened ecological communities (TECs) and vegetation integrity (site condition) within the subject land;
- Assess habitat suitability for threatened species that can be predicted by habitat surrogates (ecosystem credits) and for threatened species that cannot be predicted by habitat surrogates (species credit species);
- Identify potential prescribed biodiversity impacts on threatened species;
- Describe measures to avoid and minimise impacts on biodiversity values and prescribed biodiversity impacts during project planning;
- Describe impacts to biodiversity values and prescribed biodiversity impacts and the measures to mitigate and manage such impacts;
- Identify the thresholds for the assessment and offsetting of impacts, including:
    - Impact assessment of potential entities of serious and irreversible impacts (SAII);
    - Impacts for which an offset is required;
    - Impacts for which no further assessment is required; and
- Describe the application of the no net loss standard, including the calculation of the offset requirement.

1.3. Project Description

1.3.1. Location

The project is located at 328-330 Annangrove Road, Rouse Hill, NSW, also known as Lot 12 DP833069 and Lot 34 DP834050 (hereafter referred as the 'study area'). The study area is approximately 3.40 ha and occurs in The Hills Shire Local Government Area (LGA). Most of the study area is zoned as B6 – Enterprise Corridor under *The Hills Local Environmental Plan 2019*, except for a thin strip along Annangrove Road that is zoned as SP2 - Infrastructure. The study area is generally surrounded by rural properties, new approved developments, residential properties, and remnant bushland along Second Ponds Creek. The study area is bounded by a rural property to the north, remnant bushland and Second Ponds Creek to the east, a new approved development to the south, and Annangrove Road to the west.

The proposed development footprint (referred to as the 'subject land') is largely located in the central parts of the study area, within land zoned as B6.

A site map and location map have been prepared in accordance with the BAM and are presented in **Figure 1** and **Figure 2**, respectively.

1.3.2. Project Overview

The project involves a concept proposal for development of a mixed use/bulky goods commercial centre. Specifically, the project proposes areas of various development blocks which are subject to the following indicative uses:

- Neighbourhood shops, bulky good premises and other uses; and
- Food and drink premises;

The concept proposal also includes car parking facilities at ground and lower ground levels, as well as ancillary infrastructure, and landscaping. In addition to this, two areas have been set aside as retention areas for TECs, which will be subject to rehabilitation and management under a Vegetation Management Plan.

The layout of the project is shown in **Figure 3**.

1.3.3. Identification of the Development Site Footprint

The layout of the project is shown in **Figure 3**. The development site footprint comprises 2.77 ha of land directly impacted by the project and is referred to within this BDAR as the subject land. All temporary/ancillary construction facilities and infrastructure will be contained within the development footprint. Therefore, for the purposes of this assessment, the subject land comprises both the construction footprint and the operational footprint of the project.

1.3.4. General Description of the Subject Land

The subject land has been modified as a result of previous land disturbance. Vegetation within the subject land currently comprises a mix of remnant vegetation in various conditions and exotic vegetation and grasslands. Most of the remnant vegetation within the subject land has been subject to modification through weed invasion and/or regular mowing/slashing of the understorey. An existing derelict dwelling occurs in the southern portion of the subject land, which appears to have been abandoned for quite some time, with a second dwelling occurring in the north-western corner of the subject land.

The front section of the subject land, with a frontage to Annangrove Road, is relatively flat at approximately 40 m Australian Height Datum (AHD) before gently sloping towards the south-eastern boundary of the subject land and Second Ponds Creek with a topographic low of 32 m AHD.

The mapping of soil landscapes shows the subject land as occurring at the transition between two soil landscapes, with the western portion of the subject land mapped as part of the Blacktown soil landscape and the eastern portion of the site associated with the Gymea soil landscape. The Blacktown soil landscape is characterised by gently undulating rises on Wianamatta Group shales and Hawkesbury shale, whilst the Gymea soil landscape is described as occurring on undulating to rolling rises and low hills on Hawkesbury Sandstone (Bannerman and Hazelton 1990).

1.4. Information Sources

1.4.1. Databases

A number of databases were utilised during the preparation of this BDAR, including:

- Environment, Energy and Science (EES) BioNet Atlas (EES 2021a);
- EES Threatened Biodiversity Data Collection (TBDC) (EES 2021c);
- EES BioNet Vegetation Classification database (2021b);
- Commonwealth Department of Agriculture, Water and the Environment (DAWE) Species Profile and Threat Database (2021);
- DAWE Protected Matters Search Tool (2021b); and
- DAWE Directory of Important Wetlands in Australia (2021a).

1.4.2. Literature

This BDAR has utilised the results and/or spatial data from the following documents:

- Biodiversity Development Assessment Report prepared by Keystone Ecological (2020);
- Remnant vegetation of the western Cumberland subregion, 2013 Update. VIS_ID 4207 (OEH 2013); and
- NSW Critically Endangered Ecological Community Map. Version 6.0. February 2020 (DPIE 2020b).

Other sources of information have been referenced throughout this BDAR.

1.4.3. Aerial Photography

The aerial imagery utilised in this BDAR is sourced from NearMap and is dated 24 January 2021 and 6 October 2021. Additional aerial images available on NearMap and SixMaps were also consulted.

1.5. Authorship and Personnel

This document has been certified by David Robertson (BAM Accredited Assessor No: BAAS17027) as being prepared in accordance with the BAM as at 18 February 2022.

This BDAR, and associated field surveys and Geographic Information Systems (GIS) mapping, was prepared with the assistance of additional personnel as outlined in **Table 1**.

Table 1 Personnel

Name	Tasks	Relevant Qualifications / Training	BAM Accredited Assessor No.
David Robertson	Document review, document preparation	Doctor of Philosophy. Ecology, University of Melbourne, 1986 Bachelor of Science (Honours) in Ecology, University of Melbourne, 1980 BAM Accredited Assessor Training. Muddy Boots, 2017 BAM Re-accreditation Training, Muddy Boots, 2021	BAAS17027
Cecilia Eriksson Pinatacan	Project management, document preparation, credit calculations, field surveys, GIS mapping	Master of Science (Major in Marine Science and Management). University of Technology, Sydney, 2013 Bachelor of Science (Honours) in Marine Biology. University of Technology, Sydney, 2008 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS19052
Dr Gitanjali Katrak	Document review, BAM-C review	Doctor of Philosophy, Intertidal Wetland Ecology. Flinders University, 2011 Bachelor of Science (Honours) in Biological Sciences. La Trobe University, 2002 BAM Accredited Assessor Training. Muddy Boots, 2017 BAM Re-accreditation Training, Muddy Boots, 2021	BAAS17064
Bryan Furchert	Field surveys, Vegetation descriptions	Bachelor of Biodiversity and Conservation. Macquarie University, 2012 Diploma of Conservation and Land Management. TAFE NSW, 2008 BAM Accredited Assessor Training. Muddy Boots, 2017	BAAS18095
Julian Reyes	Field surveys	Bachelor of Advanced Science (Ecology). University of New South Wales, 2009 Certificate III Conservation and Land Management. TAFE NSW, 2011	-

2. Methodology

2.1. Review of Existing Data

Existing information on biodiversity values within the assessment area was reviewed, which includes:

- Species data that is held in the BioNet Atlas; and
- Vegetation mapping contained within the Remnant vegetation of the western Cumberland subregion, 2013 Update. VIS_ID 4207 (OEH 2013).
- The following existing ecological reports:
    - Biodiversity Development Assessment Report prepared by Keystone Ecological (2020);
    - Aboricultural Impact Assessment prepared by Advanced Treescape Consulting (2021); and
    - Peer Review of Keystone BDAR by Eco Logical Australia (2020).

This existing information was considered and included, where appropriate, into survey design, vegetation mapping and reporting.

2.2. Landscape Features

2.2.1. Landscape Features

Landscape features requiring consideration were initially determined via desktop assessment. Field surveys undertaken on 12 November 2021 sought to verify the following landscape features:

- Rivers, streams and estuaries;
- Important and local wetlands;
- Karsts, caves, crevices, cliffs and areas of geological significance; and
- NSW BioNet Landscapes.

No amendments were required to be made to any of these landscape features following field surveys.

2.2.2. Native Vegetation Cover

The native vegetation cover within the assessment area was determined through the use of existing vegetation mapping data, review of recent aerial imagery and field surveys within the subject land. The existing vegetation mapping data utilised was the *Remnant vegetation of the western Cumberland subregion, 2013 Update. VIS_ID 4207* (OEH 2013). The polygons of native vegetation within this dataset were revised following review of aerial imagery from NearMap dated 6 October 2021. Amendments were also made within the subject land following field surveys undertaken on 12 November 2021 and 3 February 2022 (see ***Section 2.3.1***).

2.3. Native Vegetation Survey

2.3.1. Vegetation Mapping

Broad scale vegetation mapping prepared by OEH (2013) exists for the subject land and surrounds and was reviewed prior to field surveys. Previous detailed vegetation mapping undertaken by Keystone Ecological (2020) and Eco Logical Australia (2020) was also reviewed and considered prior to the field surveys. Cumberland Ecology conducted additional vegetation surveys on 12 November 2021 and 3 February 2022 to verify and update the vegetation extent and PCT mapping. The vegetation within the subject land was ground-truthed to examine and verify the mapping of the condition and extent of the different plant communities. Mapping of plant communities within the subject land was undertaken by random meander surveys through patches of vegetation, noting key characteristics of areas in similar broad condition states such as similar tree cover, shrub cover, ground cover, weediness or combinations of these. Soils were also inspected.

Records of plant community boundaries were made using a hand-held Global Positioning System and mark-up of aerial photographs. The resultant information was synthesised using GIS to create a spatial database that was used to interpret and interpolate the data to produce a vegetation map of the subject land.

2.3.2. Plot-based Vegetation Survey and Vegetation Integrity Assessment

A plot-based vegetation survey and vegetation integrity assessment was undertaken concurrently within the subject land and adjoining area in accordance with the BAM (hereafter referred to as 'BAM plots'). These BAM plots were undertaken in accordance with Section 4.2.1 and Section 4.3.2 of the BAM.

A total of seven BAM plots (P1-P7) were undertaken within the subject land and surrounds on 12 November 2021 and 3 February 2022, and their locations are shown in **Figure 4**. The BAM plots required the establishment of a 20 x 50 m plot with an internal 20 m x 20 m plot. The following data was collected within each of the plots:

- Composition for each growth form group by counting the number of native plant species recorded for each growth form group within a 20 m x 20 m floristic plot;
- Structure of each growth form group as the sum of all the individual projected foliage cover estimates of all native plant species recorded within each growth form group within a 20 m x 20 m floristic plot;
- Cover of 'High Threat Exotic' weed species within a 20 m x 20 m floristic plot;
- Assessment of function attributes within a 20 x 50 m plot, including:
    - Count of number of large trees;
    - Tree stem size classes, measured as 'diameter at breast height over bark' (DBH);
    - Regeneration based on the presence of living trees with stems <5 cm DBH;
    - The total length in metres of fallen logs over 10 cm in diameter;
- Assessment of litter cover within five 1 m x 1 m plots evenly spread within the 20 x 50 m plot; and

- Number of trees with hollows that are visible from the ground within the 20 x 50 m plot.

Table 2 summarises the plot requirements based on the size and number of vegetation zones in the subject land. As shown in this table, the minimum number of plots has been completed for each vegetation zone. It should be noted that not all BAM plots are fully contained within the subject land as shown in **Figure 4**, however all plots are representative of the vegetation zones within the subject land.

Table 2 BAM plot survey requirements

Vegetation Zone	PCT	Condition Name	Area (ha)	Minimum Number of Plots Required	Number of Plots Completed	Plot Name
1	849	Mown	0.15	1	1	P2
2	849	Exotic	0.07	1	1	P3
3	849	DNG	0.06	1	1	P1
4	1395	Intact	0.08	1	1	P4
5	1395	Slashed	1.59	1	1	P5
6	1395	DNG	0.05	1	1	P6
7	835	Moderate	0.01	1	1	P7

2.4. Threatened Flora Species Survey

2.4.1. Habitat Constraints

Desktop assessments and field surveys within the subject land included assessment of habitat constraints and microhabitats for predicted species credit flora species.

2.4.2. Targeted Species Survey

In accordance with the BAM, this BDAR has relied upon previous targeted threatened flora surveys undertaken by Keystone Ecological, as outlined within the Keystone BDAR, for the candidate flora species credit species requiring further assessment (see ***Section 5.3***). As outlined in detail with the Keystone BDAR (Keystone Ecological. 2020), targeted surveys were undertaken within the study area between 2015-2018, and included the completion of targeted random meanders and active searches.

No new targeted threatened flora surveys for candidate flora species credit species were undertaken as part of this BDAR.

2.5. Threatened Fauna Species Survey

2.5.1. Habitat Constraints

Desktop assessments and field surveys within the subject land included assessment of habitat constraints and microhabitats for predicted species credit fauna species. This included desktop assessment of proximity of the

subject land to features such as caves and waterways and field inspection of microhabitats including leaf litter, rocky outcrops and hollow-bearing trees.

2.5.2. Threatened Fauna Species Survey

In accordance with the BAM, this BDAR has relied upon previous targeted threatened fauna surveys undertaken by Keystone Ecological, as outlined within the Keystone BDAR, for the candidate fauna species credit species requiring further assessment (see ***Section 5.3***). As outlined in detail with the Keystone BDAR (Keystone Ecological. 2020) targeted surveys were undertaken within the study area between 2015-2018, and included the completion of:

- Call detection (audio and ultrasonic recorders);
- Visual observation (stag watching, spotlighting, diurnal bird counts); and
- Active habitat searches, including targeted searches for snails.

Detailed information on each of the surveys completed are outlined in the Keystone BDAR (Keystone Ecological. 2020).

No new targeted threatened fauna surveys for candidate fauna species credit species were undertaken as part of this BDAR.

2.6. Weather Conditions

Weather conditions during the field survey was appropriate for detection of a range of flora and fauna species. A summary of weather conditions in the wider locality of the subject land (BOM Weather Station 067104 – Box Hill Mccall Gardens for rainfall; BOM Weather Station 066124 – Parramatta North Masons Drive for temperature) leading up to and during the field survey is provided in **Table 3**.

Table 3 Weather conditions leading to and during field surveys

Date	Temperature Minimum (°C)	Temperature Maximum (°C)	Rainfall (mm)
Preceding Months*			
August 2021	16.9	22.2	52.0
September 2021	18.6	25.2	24.0
October 2021	20.7	28.9	33.0
During Surveys			
12 November 2021	12.0	22.3	21.0
3 February 2022	17.6	24.8	5.0

** For preceding months values, temperatures are provided as a mean value, and rainfall is provided as a total.*

3. Landscape Features

3.1. Assessment Area

The subject land is approximately 2.77 ha in size and is shown in **Figure 1**. As the project is being assessed as a site-based project, the assessment area comprises the area of land within a 1,500 m buffer around the outer boundary of the subject land. The assessment area is approximately 817 ha in size and is shown in **Figure 2**.

3.2. Landscape Features

Landscape features identified within the subject land and assessment area are outlined below. The extent of these features within the subject land is shown in **Figure 1** and the extent within the assessment area is shown in **Figure 2**.

3.2.1. IBRA Bioregions and IBRA Subregions

The subject land and assessment area occur within the Sydney Basin Interim Biogeographic Regionalisation for Australia (IBRA) Bioregion. The subject land, as well as most of the assessment area, occur within the Cumberland Subregion, whilst the eastern portion of the assessment area occurs in the Yengo Subregion.

3.2.2. Rivers, Streams and Estuaries

The subject land and assessment area occur within the Hawkesbury River catchment. No mapped watercourses recognised under the *Water Management Act 2000* occur within the subject land. However, Council's interactive mapping tool maps a first order stream in the north-eastern corner of the subject land that links with a dam along the northern boundary of the subject land. This stream occurs as shallow depressions within areas of cleared, mown grass.

Several streams occur within the assessment area ranging from first to fourth order streams, including Second Ponds Creek which occurs directly east of the subject land as well as Caddies Creek and Cattai Creek. In accordance with Appendix 3 of the BAM, a riparian corridor of 10 m, 20 m, 30m and 40m either side of the waterway applies to first, second, third, and fourth streams within the assessment area, respectively.

3.2.3. Important Wetlands

No important wetlands listed in the Directory of Important Wetlands in Australia or wetlands mapped under the *State Environmental Planning Policy (Coastal Management) 2018* are present in the subject land and/or assessment area. However, several artificial dams are in the assessment area, mainly north-west of the subject land, as well as one small artificial dam within the subject land along the northern boundary.

3.2.4. Habitat Connectivity

The subject land does not form part of a regional biodiversity corridor, flyway for migratory species, riparian buffer or estuary. However, the native vegetation within the subject land is connected with the vegetated riparian corridor associated with Second Ponds Creek, which occurs east of the subject land. The riparian corridor associated with Seconds Ponds Creek provides habitat connectivity in a north-southerly direction throughout the landscape, and links up with larger tracts of bushland outside of the assessment area, in the north-west.

Connectivity in the remainder of the assessment area is limited to stepping-stone habitat in the form of smaller scattered patches of vegetation within a highly urbanised area.

3.2.5. Karsts, Caves, Crevices, Cliffs and Areas of Geological Significance

No karsts, caves, crevices, cliffs or areas of geological significance have been identified within the assessment area based on searches of available aerial imagery from NearMap, or topographic data available from SixMaps.

3.2.6. Areas of Outstanding Biodiversity Value

No Areas of Outstanding Biodiversity Value have been mapped within the subject land and assessment area.

3.2.7. NSW (Mitchell) Landscapes

The subject land is located within the 'Cumberland Plain' NSW (Mitchell) Landscape. Most of the assessment area is also located within the Cumberland Plain NSW (Mitchell) Landscape, except for the eastern portion which occurs in the Blaxlands Ridge NSW (Mitchell) Landscape.

3.2.8. Soil Hazard Features

Soil hazard features have not been identified as the project does not comprise a vegetation clearing proposal.

3.3. Native Vegetation Cover

The native vegetation cover was determined through the use of GIS. To map native vegetation cover within the subject land and assessment area, this assessment utilised the detailed vegetation mapping prepared by Cumberland Ecology in conjunction with broadscale mapping by OEH (2013). The native vegetation cover within the assessment area is shown in **Figure 2**. The assessment area is approximately 817 ha in size, of which approximately 168 ha comprises native vegetation cover, which represents 21% of the assessment area. Therefore, the native vegetation cover value is assigned to the cover class of >10-30%.

The remaining land within the assessment area comprises cleared land, exotic vegetation and dams. No significant differences between the aerial photographs used in this assessment and the native vegetation cover shown in **Figure 2** have been identified.

4. Native Vegetation

4.1. Native Vegetation

4.1.1. Native Vegetation Extent

The subject land was subject to previous detailed surveys by Keystone Ecological, as outlined in their BDAR (2020). Cumberland Ecology also undertook additional flora surveys for the purpose of this BDAR. The native vegetation extent within the subject land was determined through field surveys. The native vegetation extent within the subject land is shown in **Figure 5**. Native vegetation extent has been calculated as occupying approximately 2.03 ha, which represents approximately 73% of the subject land.

The remaining land within the subject land comprises a dam as well as cleared land and exotic vegetation and grassland, totalling an area of approximately 0.74 ha.

No additional differences between the aerial photographs using in this assessment and the native vegetation cover shown in **Figure 5** have been identified.

4.2. Plant Community Types

4.2.1. Overview

The analysis determined that the remnant native vegetation within the subject land aligned with three PCTs held within the BioNet Vegetation Classification database. **Table 4** provides a summary of the PCTs identified within the subject land, whilst the distribution of these PCTs is shown in **Figure 6**. Details of the vegetation within the subject land are outlined below, including justification for PCT selection.

Table 4 Plant community types within the subject land

PCT #	PCT Name	Subject Land (ha)
835	Cumberland Riverflat Forest	0.01
849	Cumberland Shale Plains Woodland	0.29
1395	Cumberland Shale - Sandstone Ironbark forest	1.73

4.2.2. PCT 849: Cumberland Shale Plains Woodland

Vegetation Formation: Grassy Woodlands

Vegetation Class: Coastal Valley Grassy Woodlands

Percent Cleared Value: 93

4.2.2.1. General Description

Within the subject land and wider study area, occurrences of PCT 849 Cumberland Shale Plains Woodland are limited to the western parts of the subject land where soils display a higher influence of shale. It comprises areas of both woodland and grassland. The canopy generally comprises of *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus moluccana* (Grey Box), with some areas mainly comprising generally young trees. The

occurrences of PCT 849 in the subject land are modified by the influence of weeds and regular maintenance measures such as mowing.

4.2.2.2. Condition States

Within the subject land, PCT 849 exists as three broad condition states. Each of the condition states are described below.

i. Mown Understorey

This condition state occurs as three variable sized patches in western extent of the subject land and study area, along the Annangrove Road frontage. A shrub layer is completely absent from the community, with the trees occurring over a ground layer that is maintained by mowing. The canopy layer is dominated by *Eucalyptus tereticornis*, with a number of *Eucalyptus moluccana* also occurring. Other trees include *Acacia parramattensis* (Parramatta Wattle) and *Grevillea robusta* (Silky Oak).

The ground layer is dominated by the native grass species *Microlaena stipoides var. stipoides* (Weeping Grass). Other grasses present include *Dichelachne micrantha* (Shorthair Plumegrass), *Aristida vagans* (Threeawn Speargrass), *Cynodon dactylon* (Common Couch), *Paspalidium distans, Rytidosperma racemosum* (Wallaby Grass), *Schoenus apogon* (Fluke Bogrush) and *Anthosachne scabra* (Wheatgrass).

Other native species present in the ground layer include the forbs *Dichondra repens* (Kidney Weed), *Centella asiatica* (Indian Pennywort), *Oxalis perennans*, *Poranthera microphylla* (Small Poranthera), *Opercularia diphylla* (Stinkweed), *Solanum prinophyllum* (Forest Nightshade), *Solenogyne bellioides* (Solengyne) and *Dianella longifolia* (Blueberry Lily). A number of other native species are present including the fern *Cheilanthes sieberi* (Rock Fern), as well as *Glycine tabacina* (Variable Glycine) and *Glycine microphylla* (Small-leaf Glycine).

Exotic species present in the ground layer include *Paspalum dilatatum* (Paspalum), *Lolium perenne* (Perennial Ryegrass), *Lysimachia arvensis* (Scarlet Pimpernel), *Hypericum perforatum* (St. John Wort), *Asparagus asparagoides* (Bridal Creeper), and *Gamochaeta Americana* (Purple Cudweed).

An example of this condition state is shown in **Photograph 1**.

Photograph 1 Example of PCT 849 with mown understory in the eastern extent of the subject land

ii. Exotic Understorey

This condition state occurs as a larger patch in the eastern extent of the subject land and study area, adjacent to the patches of PCT 849 with mown understorey, as well as a number of smaller patches along the Annangrove Road frontage. The community occurs as trees over an exotic dominated understorey. Dominant trees are *Eucalyptus moluccana* and *Eucalyptus tereticornis.* Other trees present include *Cupaniopsis anacardioides* (Tuckeroo) and planted individual of *Auranticarpa rhombifolia* (Diamond-leaf Pittosporum).

Native species in the shrub layer are limited to scattered occurrences of *Bursaria spinosa* (Native Blackthorn), whilst native grasses present in the ground layer include *Microlaena stipoides var. stipoides, Entolasia marginate* (Bordered Panic), *Paspalidium distans, and Oplismenus aemulus,* and the sedge *Gahnia aspera* (Rough Saw-sedge) is also present. Other native species present in the ground layer include the forbs *Oxalis perennans, Brunoniella australis* (Blue Trumpet), *Centella asiatica, Dianella longifolia* and *Solanum prinophyllum*.

The shrub layer within this condition state is dominated by the exotic species *Olea europaea subsp. cuspidata* (African Olive). Other dominant exotic species in the understorey include *Ehrharta erecta* (Panic Veldtgrass), *Paspalum dilatatum, Sida rhombifolia* (Paddy's Lucerne), *Eragrostis curvula* (Australian Lovegrass), and *Senecio madagascariensis* (Fireweed).

An example of this condition state is shown in **Photograph 2**.

Photograph 2 Example of PCT 849 with exotic understorey in the subject land and study area

iii. Derived Native Grassland

This condition state occurs as small patch in the south-western part of the subject land, adjacent to areas of PCT 849 with a mown understory, which would have been historically occupied by a more intact form of PCT 849.

The dominant grass species for this condition state are *Microlaena stipoides var. stipoides, Paspalidium distans*, *Rytidosperma racemosum* and *Cynodon dactylon*. Other native species occurring include *Glycine tabacina* and *Desmodium varians*, as well as the forbs *Dichondra repens, Oxalis perennans, Solanum prinophyllum* and *Dianella longifolia.*

This condition state is generally invaded by several exotic species including *Avena barbata* (Bearded Oats), *Eragrostis curvula, Paspalum dilatatum, Bromus catharticus* (Praire Grass), *Lolium perenne, Verbena rigida, Cenchrus clandestinus* (Kikuyu Grass), *Cestrum parqui,* and *Cirsium vulgare* (Spear Thistle).

An example of this condition state is shown in **Photograph 3**.

Photograph 3 Example of PCT 849 DNG within the south-western parts of the subject land

4.2.2.3. Justification of PCT Selection

Identification of this PCT within the subject land was guided by review of existing data, and the results of the surveys undertaken by Cumberland Ecology. The data collected during surveys of the subject land was analysed in conjunction with a review of the PCTs held within the BioNet Vegetation Classification database. In selecting searching for suitable PCT, consideration was initially given to the following:

- IBRA subregion: Cumberland;
- Vegetation formation: Grassy Woodlands;
- Alignment with TEC: Cumberland Plain Woodland; and
- Canopy species: *Eucalyptus moluccana* and *Eucalyptus tereticornis.*

PCTs that were associated with these aforementioned parameters include PCT 849 and PCT 850. Review of the landscape position of these PCTs ruled out PCT 850 as it occurs on higher elevations of hills and rises, whilst the subject land occurs on relatively flat land on a lower elevation. Furthermore, the *Remnant vegetation of the western Cumberland subregion (OEH 2013)* maps 'Cumberland Shale Plains Woodland' (PCT 849) in the western areas of the subject land. Cumberland Plain Woodland is described as occurring on Wianamatta Shale derived soils (NSW Scientific Committee. 2009). This matches the soil landscape mapping of the Blacktown soil landscape within the western parts of the subject land, which is associated with Wianamatta Group shales.

Within the subject land, the vegetation within the western parts exists as degraded condition states consisting mostly of trees over exotic dominated ground layers, however both tree species present (*Eucalyptus moluccana* and *Eucalyptus tereticornis)* are consistent with assigning PCT 849 to the vegetation. The location in Western Sydney on the Cumberland Plain is also consistent with the description of this PCT (NSW Scientific Committee. 2009).

Species recorded within the subject land that align with the description of PCT 849 within the BioNet Vegetation Classification database include: *Eucalyptus moluccana, Eucalyptus tereticornis, Bursaria spinosa, Dichondra repens, Cheilanthes sieberi, Aristida vagans, Microlaena stipoides var. stipoides, Brunoniella australis, Opercularia diphylla, Dichelachne micrantha,* and *Dianella longifolia.*

Therefore, based on the existing available information of the subject land and surrounds, it was determined that the vegetation in the western parts of the subject land aligns with PCT 849.

4.2.2.4. Alignment with Threatened Ecological Communities

Within the BioNet Vegetation Classification, PCT 849 is associated with the following TEC:

- Cumberland Plain Woodland in the Sydney Basin Bioregion.

The entire occurrence of PCT 849 within the subject land is considered to be consistent with the Cumberland Plain Woodland TEC as described in the final determination (NSW Scientific Committee. 2009) for the community as listed under the BC Act, due to the presence of the characteristic species *Eucalyptus moluccana* and *Eucalyptus tereticornis* in treed areas and the associated landform. Grassland areas also contain characteristic native ground layer species consistent with the listed community.

The woodland occurrences of PCT 849 (zones 1-2) within the subject land also conforms to the EPBC Act listed community as the patch size is >0.5 ha and the >50% of the perennial understorey vegetation cover is made up of native species. Therefore, approval for the project under the EPBC Act may be required.

4.2.3. PCT 1395: Cumberland Shale - Sandstone Ironbark forest

Vegetation Formation: Grassy Woodlands

Vegetation Class: Coastal Valley Grassy Woodlands

Percent Cleared Value: 80

4.2.3.1. General Description

Within the subject land and wider study area, occurrences of PCT 1395 Cumberland Shale – Sandstone Ironbark Forest occupy the eastern and northern parts of the subject land where a sandstone influence is visible as periodic sandstone outcropping. It comprises areas of both woodland and grassland. The canopy is generally dominated by *Eucalyptus tereticornis,* with other native trees occurring less frequently. Most of the occurrences of PCT 1395 in the subject land are modified by the influence of weeds and regular maintenance measures such as slashing.

4.2.3.2. Condition States

Within the subject land, PCT 1395 exists as three broad condition states. Each of the condition states are described below.

i. Intact

This intact form of PCT 1395 occurs as a small area in the south-eastern corner of the subject land, which links up to vegetation in the riparian corridor associated with Second Ponds Creek. The canopy layer is dominated by *Eucalyptus tereticornis*, with occurrences of *Acacia parramattensis* and *Angophora floribunda* (Rough-barked Apple). Other trees occurring include *Notelaea longifolia.*

The shrub layer is dominated by *Ozothamnus diosmifolius* (White Dogwood), *Leucopogon juniperinus, Exocarpos strictus* (Dwarf Cherry), *Bursaria spinosa* (Native Blackthorn) and *Acacia floribunda* (White Sally).

Dominant grasses in the ground layer include *Microlaena stipoides var. stipoides, Imperata cylindrica* (Blady Grass), *Gahnia aspera* (Rough Saw-sedge), *Digitaria parviflora* (Small-flowered Finger Grass), *Entolasia marginata* and *Lepidosperma laterale* (Variable Sword-sedge). Other native species present in the ground layer include the forbs *Lobelia purpurascens* (Whiteroot), *Poranthera microphylla* (Small Poranthera), *Veronica plebeia* (Trailing Speedwell), *Oxalis perennans,* and *Pomax umbellata* (Pomax), the fern *Cheilanthes sieberi*¸ and the climbers *Glycine clandestina, Glycine microphylla* and *Clematis glycinoides var. glycinoides.*

Exotic species recorded in this condition state include *Lantana camara, Olea europaea subsp. cuspidata, Ligustrum sinense* (Small-leaved Privet), *Cestrum parqui, Cirsium vulgare, Gamochaeta americana* (Purple Cudweed), *Senecio madagascariensis,* and *Ehrharta erecta.*

An example of this condition state is shown in **Photograph 4**.

Photograph 4 Example of PCT 1395 intact form, in the south-eastern corner of the subject land

ii. Slashed

This conditions state covers the majority of the eastern and northern portion of the subject land. A shrub layer is completely absent from the community, with the trees occurring over a ground layer that is maintained by slashing. The canopy layer is dominated by *Eucalyptus tereticornis.*

The ground layer is dominated by the grass species *Microlaena stipoides var. stipoides, Oplismenus aemulus, Cyperus gracilis* (Slender Flat-sedge), *Juncus usitatus, Carex inversa* (Knob Sedge) and *Cynodon dactylon.* Other native species present in the ground-layer include *Glycine tabacina* (Variable Glycine), as well as the forbs *Einadia trigonos* (Fishweed), *Oxalis perennans, Wahlenbergia gracilis* (Sprawling Bluebell), and *Commelina cyanea* (Native Wandering Jew).

Exotic species are frequent in this condition state and include *Olea europaea subsp. cuspidata, Ehrharta erecta, Cestrum parqui, Lysimachia arvensis, Conyza sumatrensis* (Tall Fleabane), *Gamochaeta americana, Asparagus asparagoides, Modiola caroliniana* (Red-flowered Mallow), *Senecio madagascariensis, Sonchus asper* (Prickly Sowthistle), *Verbena rigida (*Veined Verbena), *Verbena bonariensis, Urtica urens* (Small Nettle), and *Juncus bufonius* (Toad Rush).

An example of this condition state is shown in **Photograph 5**.

Photograph 5 Example of slashed form of PCT 1395 in the eastern portion of the subject land

iii. Derived Native Grassland

This condition state occurs as a small patch of derived native grassland among exotic dominated grasslands in the north western portion of the subject land, adjacent to the slashed form of PCT 1395, which would have historically been occupied by a more intact form of PCT 1395.

Dominant native grasses in this condition state include *Microlaena stipoides var. stipoides, Paspalum distichum, Bothriochloa macra* (Red Grass), *Eragrostis brownie* (Brown's Lovegrass), *Eragrostis leptostachya* (Paddock Lovegrass), *Cyperus gracilis* and *Cynodon dactylon.* Native forbs present include *Dichondra repens* (Kidney Weed), *Einadia trigonos* (Fishweed), *Lobelia purpurascens, Wahlenbergia gracilis,* and *Oxalis perennans.* Other native species include *Desmodium varians* (Slender Tick-trefoil), *Glycine tabacina,* as well as the fern *Cheilanthes sieberi* (Rock Fern).

Several weed species occur within this condition state including *Briza subaristata, Eragrostis curvula, Paspalum dilatatum, Hypericum perforatum, Plantago lanceolata* (Lamb's Tongues), *Richardia stellaris, Sida rhombifolia, Solanum sisymbriifolium, Lysimachia arvensis,* and *Senecio madagascariensis.*

An example of this condition state is shown in **Photograph 6**.

Photograph 6 Example of PCT 1395 derived native grassland form in the western part of the subject land

4.2.3.3. Justification of PCT Selection

Identification of this PCT within the subject land was guided by review of existing data, and the results of the surveys undertaken by Cumberland Ecology. The data collected during surveys of the subject land was analysed in conjunction with a review of the PCTs held within the BioNet Vegetation Classification database. In selecting searching for suitable PCT, consideration was initially given to the following:

- IBRA subregion: Cumberland;
- Vegetation formation: Grassy Woodlands; and
- Alignment with TEC: Shale Sandstone Transition Forest.

Three PCTs are aligned with the Shale Sandstone Transition Forest TEC: PCTs 792, 1281 and 1395. Of these three PCTs, 1395 is the PCT that is described as being associated with the occurrences of the TEC on the Cumberland Plain. Species recorded within the subject land that align with the description of PCT 1395 within the BioNet Vegetation Classification database include: *Eucalyptus crebra, Bursaria spinosa, Ozothamnus diosmifolius. Lepidosperma latorale, Cheilanthes sieberi, Microlaena stipoides var. stipoides, Echinopogon caespitosus, Pomax umbellata,* and *Dichondra repens.*

Therefore, based on the existing available information of the subject land and surrounds, it was determined that the vegetation within this community best aligns with PCT 1395.

4.2.3.4. Alignment with Threatened Ecological Communities

Within the BioNet Vegetation Classification, PCT 1395 is associated with the following TEC:

- Shale Sandstone Transition Forest in the Sydney Basin Bioregion.

The intact and slashed zones of PCT 1395 within the subject land are considered to be consistent with the Shale Sanstone Transition Forest TEC as described in the final determination (NSW Scientific Committee 2014) for the community as listed under the BC Act, due to the presence of the characteristic species *Eucalyptus tereticornis* in treed areas, the presence of other characteristic species in other strata, and the occurrence of associated outcropping of sandstone. Grassland areas are not considered to be consistent with the TEC as a Derived Native Grassland form of the TEC is not described in the Final Determination.

The intact and slashed zones of PCT 1395 within the subject land also conforms to the EPBC Act listed community as the patch size is >0.5 ha and the >50% of the perennial understorey vegetation cover is made up of native species. Therefore, approval for the project under the EPBC Act may be required.

4.2.4. PCT 835: Cumberland Riverflat Forest

Vegetation Formation: Forested Wetlands

Vegetation Class: Coastal Floodplain Wetlands

Percent Cleared Value: 93

4.2.4.1. General Description

Within the subject land, occurrences of PCT 835 Cumberland Riverflat Forest occurs in one condition state that occupies the north-eastern corner of the subject land, along Second Ponds Creek. The canopy layer is dominated by *Angophora floribunda* (Rough-barked Apple), with native trees such as *Eucalyptus tereticornis, Eucalyptus amplifolia* (Cabbage Gum), *Acacia parramattensis* (Parramatta Wattle), and *Casuarina cunninghamiana* (River Oak) occurring less frequently.

The shrub layer is dominated by *Bursaria spinosa, Goodenia ovatai* (Hop Goodenia), *Melaleuca linarifolia* (Flax-leaved Paperbark), and *Ozothamnus diosmifolius* (White Dogwood).

Dominant grasses in the ground layer include *Microlaena stipoides var. stipoides, Oplismenus aemulus, Entolasia marginate, Gahnia clarkei,* and *Lomandra longifolia* (Spiny-headed Mat-rush). Other native species present in the ground layer include the forbs *Centella asiatica* (Indian Pennywort), *Dichondra repens,* and *Pratia puspurascens* (Whiteroot), the fern *Cheilanthes sieberi,* and the climbers *Glycine clandestina, Glycine tabacina* and *Clematis glycinoides var. glycinoides.*

Exotic species recorded in this condition state include *Lantana spp., Olea europaea* (Common Olive), *Chloris gayana* (Rhodes Grass), *Phalaris auqatica* (Phalaris), and *Rubus fruticosus* (Blackberry complex).

An example of this condition state is shown in **Photograph 7**.

Photograph 7 Example of PCT 835 in the north-eastern corner of the subject land

4.2.4.2. Justification of PCT Selection

Identification of this PCT within the subject land was guided by review of existing data, and the results of the surveys undertaken by Cumberland Ecology. The data collected during surveys of the subject land was analysed in conjunction with a review of the PCTs held within the BioNet Vegetation Classification database. In selecting searching for suitable PCT, consideration was initially given to the following:

- IBRA subregion: Cumberland;
- Vegetation formation: Forested Wetlands; and
- Alignment with TEC: River-flat Eucalypt Forest.

Three PCTs are aligned with the River-flat Eucalypt Forest TEC: PCTs 835, 941, and 1794. Of these three PCTs, 835 is the PCT that best aligns with the canopy species present within the occurrence in the subject land. Species recorded within the subject land that align with the description of PCT 835 within the BioNet Vegetation Classification database include: *Angophora floribunda, Eucalyptus amplifolia, Acacia parramattensis, Bursaria spinosa, Microlaena stipoides var. stipoides, Oplismenus aemulus, Dichondra repens, Entolasia marginata, Solanum prinophyllum, Pratia purpurascens,* and *Commelina cyanea.*

Therefore, based on the existing available information of the subject land and surrounds, it was determined that the vegetation within this community best aligns with PCT 835.

4.2.4.3. Alignment with Threatened Ecological Communities

Within the BioNet Vegetation Classification, PCT 835 is associated with the following TEC:

- River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions

The occurrence of PCT 835 within the subject land is considered to be consistent with the River-flat Eucalypt Forest TEC described in the final determination for the community as listed under the BC Act, due to the presence of characteristic flora species and the landscape position of which the community occurs in.

The occurrence of PCT 835 in the subject land is also likely to conform to the EPBC Act listed community as River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria.

4.3. Threatened Ecological Communities

All three of the conditions states of PCT 849, as well as two of the conditions states of PCT 1395, identified within the subject land have been assessed as being associated with TECs. The one condition state of PCT 835 also is also associated with a TEC. No other vegetation within the subject land conforms to a TEC under the BC Act and/or EPBC Act. **Table 5** summarises the TECs identified within the subject land and their distribution is shown in **Figure 7**.

Table 5 Threatened ecological communities within the subject land

TEC Name	BC Act Status	EPBC Act Status	Associated PCT	Associated Vegetation Zone	Subject Land (ha)
Cumberland Plain Woodland in the Sydney Basin Bioregion	CEEC	CEEC	849: Cumberland shale plains woodland	1_Mown	0.15
	CEEC	CEEC	849: Cumberland shale plains woodland	2_Exotic	0.07
	CEEC	Not listed	849: Cumberland shale plains woodland	3_DNG	0.06
Shale Sandstone Transition Forest in the Sydney Basin Bioregion	CEEC	CEEC	1395: Cumberland Shale – Sandstone Ironbark Forest	4_Intact	0.08
	CEEC	CEEC	1395: Cumberland Shale – Sandstone Ironbark Forest	5_Slashed	1.57
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	EEC	CEEC	835: Cumberland Riverflat Forest	7_Moderate	0.01

4.4. Vegetation Integrity Assessment

The native vegetation identified within the subject land was assigned to a vegetation zone based on PCT and broad condition states. A patch size was subsequently assigned for the vegetation zones. The extent of these vegetation zones and associated patch size class within the subject land are shown in **Figure 8**.

Each vegetation zone was assessed using survey BAM plots (see ***Section 2.3.2***) to determine the vegetation integrity score. BAM plot data utilised within the BAM-C to determine the vegetation integrity score is provided in **Appendix A**. The vegetation integrity assessment utilised the benchmark data held within the BAM-C (as derived from the BioNet Vegetation Classification). Therefore, this assessment did not utilise local benchmarks.

Vegetation zones, patch sizes and vegetation integrity scores for the subject land are summarised in **Table 6**.

Table 6 Vegetation zones within the subject land

Vegetation Zone	PCT	Condition Name	Area (ha)	Patch Size Class	Vegetation Integrity Score	Hollow-bearing Trees Present?
1	849 - Cumberland shale plains woodland	Mown	0.15	≥100	37.6 (Composition = 21.4, Structure = 45.8, Function = 54.1)	No
2	849 - Cumberland shale plains woodland	Exotic	0.07	≥100	58.0 (Composition = 75.9, Structure = 71.3, Function = 36.1)	No
3	849 - Cumberland shale plains woodland	DNG	0.06	≥100	52.1 (Composition = 35.4, Structure = 43.5 Function = 91.8)	Yes
4	1395 - Cumberland Shale - Sandstone Ironbark forest	Intact	0.08	≥100	80.1 (Composition = 82.0, Structure = 78.9, Function = 79.5)	No
5	1395 - Cumberland Shale - Sandstone Ironbark forest	Slashed	1.59	≥100	47.2 (Composition = 22.3, Structure = 67.1, Function = 70.1)	Yes
6	1395 - Cumberland Shale - Sandstone Ironbark forest	DNG	0.05	≥100	43.2 (Composition = 50.4, Structure = 43.4, Function = 36.9)	No

Vegetation Zone	PCT	Condition Name	Area (ha)	Patch Size Class	Vegetation Integrity Score	Hollow-bearing Trees Present?
7	835 – Cumberland Riverflat Forest	Moderate	0.01	≥100	82.6 (Composition = 86.7, Structure = 65.6, Function = 99.3)	Yes

5. Threatened Species

5.1. Identifying Threatened Species for Assessment

The BAM-C generates a list of threatened species requiring assessment utilising a number of variables. The following criteria have been utilised to predict the threatened species requiring further assessment:

- IBRA subregion: Cumberland;
- Associated PCTs: 835, 849, 1395;
- Percent native vegetation cover in the assessment area: 21%;
- Patch size: ≥100 ha; and
- Credit type: Ecosystem and/or species.

Based on the above variables, the BAM-C generated a list of 35 ecosystem credit species and 57 species credit species. Ecosystem credit species and species credit species are assessed further in ***Section 5.2*** and ***Section 5.3***, respectively.

5.2. Ecosystem Credit Species

5.2.1. Overview

A total of 35 ecosystem credit species are predicted, including 15 dual credit species which are considered as ecosystem credit species for their foraging habitat. **Table 7** lists the predicted ecosystem credit species for the vegetation zones within the subject land, and whether they have been retained within the assessment following consideration of habitat constraints, geographic limitations, vagrancy and quality of microhabitats.

5.2.2. Justification for Removal

One ecosystem credit species has been removed from the assessment, namely the Glossy Black-Cocktoo, due to no *Allocasuarina* or *Casuarina* species being present in the relevant vegetation zones in the subject land. No other ecosystem credit species have been removed from the assessment.

Keystone Ecological noted in their BDAR (2020) that possible calls of either the Eastern False Pipistrelle *(Falsistrellus tasmaniensis)* or Greater Broad-nosed Bat *(Scoteanax rueppellii)* were recorded during surveys in the subject land. Hence, both species were added manually to the list of predicted ecosystem credit species in the BAMC for this assessment resulting in a total of 36 ecosystem credit species being assessed.

Table 7 Predicted ecosystem credit species

Scientific Name	Common Name	Relevant PCT	Relevant Vegetation Zones	Sensitivity to Gain Class	Retained in Assessment?
Anthochaera phrygia	Regent Honeyeater (Foraging)	835,849, 1395	1-7	High	Yes
Artamus cyanopterus cyanopterus	Dusky Woodswallow	835,849. 1395	1-7	Moderate	Yes
Botaurus poiciloptilus	Australiasian Bittern	835	7	Moderate	Yes
Callocephalon fimbriatum	Gang-gang Cockatoo (Foraging)	835, 849, 1395	1-7	Moderate	Yes
Calyptorhynchus lathami	Glossy Black-Cockatoo (Foraging)	1395	4-6	High	No
Chthonicola sagittata	Speckled Warbler	835, 849, 1395	1-7	High	Yes
Circus assimilis	Spotted Harrier	849	1-3	Moderate	Yes
Climacteris picumnus victoriae	Brown Treecreeper (eastern subspecies)	835, 849, 1395	1-7	High	Yes
Daphoenositta chrysoptera	Varied Sittella	835, 849, 1395	1-7	Moderate	Yes
Dasyurus maculatus	Spotted-tailed Quoll	835, 849, 1395	1-7	High	Yes
Falsistrellus tasmaniensis *	Eastern False Pipistrelle	835, 839, 1395	1-7	High	Yes
Glossopsitta pusilla	Little Lorikeet	835, 849, 1395	1-7	High	Yes
Grantiella picta	Painted Honeyeater	835, 849, 1395	1-7	Moderate	Yes
Haliaeetus leucogaster	White-bellied Sea-Eagle (Foraging)	835, 849, 1395	1-7	High	Yes
Hieraaetus morphnoides	Little Eagle (Foraging)	835, 849, 1395	1-7	Moderate	Yes
Hirundapus caudacutus	White-throated Needletail	835, 849, 1395	1-7	High	Yes
Ixobrychus flavicollis	Black Bittern	835	7	Moderate	Yes

Scientific Name	Common Name	Relevant PCT	Relevant Vegetation Zones	Sensitivity to Gain Class	Retained in Assessment?
Lathamus discolor	Swift Parrot (Foraging)	835, 849, 1395	1-7	Moderate	Yes
Lophoictinia isura	Square-tailed Kite (Foraging)	835, 849, 1395	1-7	Moderate	Yes
Melanodryas cucullata cucullata	Hooded Robin (south-eastern form)	835, 849, 1395	1-7	Moderate	Yes
Melithreptus gularis gularis	Black-chinned Honeyeater (eastern subspecies)	835, 849, 1395	1-7	Moderate	Yes
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	835, 849, 1395	1-7	High	Yes
Miniopterus australis	Little Bent-winged Bat (Foraging)	835, 849, 1395	1-7	High	Yes
Miniopterus orianae oceanensis	Large Bent-winged Bat (Foraging)	835, 849, 1395	1-7	High	Yes
Neophema pulchella	Turquoise Parrot	835, 849, 1395	1-7	High	Yes
Ninox connivens	Barking Owl (Foraging)	835, 849, 1395	1-7	High	Yes
Ninox strenua	Powerful Owl (Foraging)	835, 849, 1395	1-7	High	Yes
Pandion cristatus	Eastern Osprey (Foraging)	835	7	Moderate	Yes
Petroica boodang	Scarlet Robin	835, 849, 1395	1-7	Moderate	Yes
Petroica phoenicea	Flame Robin	835, 849, 1395	1-7	Moderate	Yes
Phascolarctos cinereus	Koala (Foraging)	835, 849, 1395	1-7	High	Yes
Pteropus poliocephalus	Grey-headed Flying-fox (Foraging)	835, 849, 1395	1-7	High	Yes
Saccolaimus flaviventris *	Yellow-bellied Sheathtail-bat	835, 849, 1395	1-7	High	Yes
Scoteanax rueppellii	Greater Broad-nosed Bat	835, 849, 1395	1-7	High	Yes
Stagonopleura guttata	Diamond Firetail	835, 849, 1395	1-7	Moderate	Yes
Tyto novaehollandiae	Masked Owl (Foraging)	835, 849, 1395	1-7	High	Yes

Scientific Name	Common Name	Relevant PCT	Relevant Vegetation Zones	Sensitivity to Gain Class	Retained in Assessment?
Varanus rosenbergi	Rosenberg's Goanna	1395	4-6	High	Yes

**Denotes species added manually to the list of predicted ecosystem credit species in BAMC.*

5.3. Species Credit Species

5.3.1. Overview

A total of 57 species credit species are predicted, including 15 dual credit species which are considered as species credit species for their breeding or important habitat.

Table 8 lists the predicted species credit species for the vegetation zones within the subject land, and whether they have been retained within the assessment following consideration of habitat constraints, geographic limitations, vagrancy and quality of microhabitats. Justification is provided below this table for species that have been removed from the assessment in accordance with Steps 1-3 of Section 5.2 of the BAM. All species not removed from consideration (i.e. retained in the assessment) are by default candidate species credit species that require further assessment.

Of the assessed predicted species, 16 species credit species have been retained for further assessment.

Table 8 Predicted species credit species

Scientific Name	Common Name	Relevant PCT	Relevant Vegetation Zones	Sensitivity to Gain Class	Retained in Assessment?
Flora					
Acacia bynoeana	Bynoe's Wattle	849, 1395	1-6	High	No
Acacia pubescens	Downy Wattle	849, 1395	1-6	High	No
Caladenia tessellata	Thick Lip Spider Orchid	849, 1395	1-6	Moderate	No
Callistemon linearifolius	Netted Bottle Brush	835, 1395	4-7	Moderate	No
Cynanchum elegans	White-flowered Wax Plant	835, 849	1-3, 7	High	Yes
Dillwynia tenuifolia	-	849, 1395	1-6	Moderate	No
Dillwynia tenuifolia – endangered population	-	849, 1395	1-6	High	No
Epacris purpurascens var. purpurascens	-	1395	4-6	Moderate	Yes
Eucalyptus benthamii	Camden White Gum	835, 849	1-3, 7	High	No
Grevillea juniperina subsp. juniperina	Juniper-leaved Grevillea	849	1-3	Moderate	Yes
Grevillea parviflora subsp. parviflora	Small-flower Grevillea	1395	4-6	High	No
Grevillea parviflora subsp. supplicans	-	1395	4-6	High	Yes
Gyrostemon thesioides	-	1395	4-6	High	No
Hibbertia puberula	-	1395	4-6	High	No
Hibbertia sp. Bankstown	-	835	7	High	No
Hibbertia spanantha	Julian's Hibbertia	1395	4-6	High	No
Hibbertia superans	-	1395	4-6	High	Yes

Scientific Name	Common Name	Relevant PCT	Relevant Vegetation Zones	Sensitivity to Gain Class	Retained in Assessment?
Leucopogon fletcheri subsp. fletcheri	-	1395	4-6	High	Yes
Marsdenia viridiflora subsp. viridiflora – endangered population	Marsdenia viridiflora R. Br. subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	-	-	Moderate	No
Melaleuca deanei	Deane's Paperbark	1395	4-6	Very High	No
Persicaria elatior	Tall Knotweed	835	7	High	No
Persoonia bargoensis	Bargo Geebung	849, 1395	1-6	High	No
Persoonia hirsuta	Hairy Geebung	835, 1395	4-7	High	No
Persoonia nutans	Nodding Geebung	1395	4-6	Moderate	Yes
Pilularia novae-hollandiae	Austral Pillwort	835	7	High	No
Pimelea cuviflora var. curviflora	-	849, 1395	1-6	High	No
Pimelea spicata	Spiked Rice-flower	849	1-3	High	Yes
Pomaderris brunnea	Brown Pomaderris	835, 1395	4-7	High	No
Pterostylis saxicola	Sydney Plains Greenhood	849, 1395	1-6	Moderate	No
Pultanaea pedunculata	Matted Bush-pea	849, 1395	1-6	High	Yes
Tetratheca glandulosa	-	1395	4-6	High	No
Thesium australe	Austral Toadflax	849	1-3	Moderate	Yes
Wahlenbergia multicaulis – endangered population	Tadgell's Bluebell in the LGAs of Auburn, Bankstown, Baulkham	835	7	High	No

Scientific Name	Common Name	Relevant PCT	Relevant Vegetation Zones	Sensitivity to Gain Class	Retained in Assessment?
	Hills, Canterbury, Hornsby, Parramatta and Strathfield				
Fauna					
Anthochaera phrygia	Regent Honeyeater (Breeding)	835, 849, 1395	1-7	High	No
Burhinus grallarius	Bush Stone-curlew	835, 849, 1395	1-7	High	No
Callocephalon fimbriatum	Gang-gang Cockatoo (Breeding)	835, 849, 1395	1-7	High	No
Calyptohynchus lathami	Glossy Black-Cockatoo (Breeding)	1395	4-6	High	No
Cercartetus nanus	Eastern Pygmy-possum	835, 849, 1395	1-7	High	No
Chalinolobus dwyeri	Large-eared Pied Bat	835, 849, 1395	1-7	Very High	No
Haliaeetus leucogaster	White-bellied Sea-Eagle (Breeding)	849, 1395	1-6	High	Yes
Hieraaetus morphnoides	Little Eagle (Breeding)	835. 849, 1395	1-7	Moderate	Yes
Lathamus discolor	Swift Parrot (Breeding)	835, 849, 1395	1-7	Moderate	No
Litoria aurea	Green and Golden Bell Frog	835, 849, 1395	1-7	High	No
Lophoictinia isura	Square-tailed Kite (Breeding)	835, 849, 1395	1-7	Moderate	Yes
Meridolum corneovirens	Cumberland Plain Land Snail	835,849, 1395	1-7	High	Yes
Miniopterus australis	Little Bent-winged Bat (Breeding)	835, 849, 1395	1-7	Very High	No
Miniopterus orianae oceanensis	Large Bent-winged Bat (Breeding)	835, 849, 1395	1-7	Very High	No
Myotis macropus	Southern Myotis	835, 849, 1395	1-7	High	Yes
Ninox connivens	Barking Owl (Breeding)	835, 849, 1395	1-7	High	No

Scientific Name	Common Name	Relevant PCT	Relevant Vegetation Zones	Sensitivity to Gain Class	Retained in Assessment?
Ninox strenua	Powerful Owl (Breeding)	835, 849, 1395	1-7	High	No
Pandion cristatus	Eastern Osprey (Breeding)	835	7	Moderate	No
Petarus norfolcensis	Squirrel Glider	835, 849, 1395	1-7	High	No
Phascolarctos cinereus	Koala (Breeding)	835, 849, 1395	1-7	High	No
Pommerhelix duralensis	Dural Land Snail	849, 1395	1-6	High	Yes
Pseudophryne australis	Red-crowned Toadlet	1395	4-6	Moderate	No
Pteropus poliocephalus	Grey-headed Flying-fox (Breeding)	835, 849, 1395	1-7	High	No
Tyto novaehollandiae	Masked Owl (Breeding)	835, 849, 1395	1-7	High	No

5.3.2. Justification for Removal

5.3.2.1. Flora Species Credit Species

i. Acacia bynoeana

Acacia bynoeana (Bynoe's Wattle) has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species is known to favour heath or dry sclerophyll forest on sandy soils. Associated overstorey species include *Corymbia gummifera* (Red Bloodwood), *Eucalyptus haemastoma* (Scribbly Gum), *Eucalyptus parramattensis* (Parramatta Red Gum), *Banksia serrata* (Saw Banksia), and *Anghophora bakeri* (Narrow-leaved Apple) (EES 2021c). Such habitats are not present within the subject land.

ii. Acacia pubescens

Acacia pubescens (Downy Wattle) has been removed from the assessment due to the subject land occurring outside of the known distribution. The TBDC notes the distribution to be concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon.

iii. Caladenia tessellata

Caladenia tessellata (Thick-lipped Spider-orchid) has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species is known to favour low, dry sclerophyll woodland (for example open *Kunzea* woodland) with a heathy or sometimes grassy understorey on clay loams or sandy soils, occurring less commonly in heathland on sandy loam soils (Duncan 2010). Such habitats are not present within the subject land.

Furthermore, it is noted that subject land is located outside of the limited known range of the species. Within NSW, *Caladenia tessellata* (Thick-lipped Spider-orchid) is known from two disjunct areas; one population near Braidwood on the Southern Tablelands and three populations in the Wyong area on the Central Coast (OEH 2018).

iv. Callistemon linearifolius

Callistemon linearifolius (Nettles Bottle Brush) has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species is known to favour dry sclerophyll forest on the coast and adjacent ranges (EES 2021c). Such habitats are not present within the subject land.

Furthermore, there are currently only 5-6 populations remaining in the Sydney area. Recent records in the Sydney area are limited to the Hornsby Plateau area near the Hawkesbury River (EES 2021c).

v. Dillwynia tenuifolia

Dillvynia tenuifolia has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species is known to favour scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest, or transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. *Eucalyptus fibrosa* is usually the dominant canopy species, whislt *Eucalyptus globoidea, E. longifolia, E. parramattensis, E. sclerophylla* and *E. sideroxylon* may also be

present or codominant, with *Melaleuca decora* frequently forming a secondary canopy layer (NSW Government 2019). Such habitats are not present within the subject land.

vi. Eucalyptus benthamii

Eucalyptus benthamii (Camden White Gum) has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species is known to occur on the alluvial flats of the Nepean River and its tributaries, with two main subpopulations known from the Kedumba Valley of the Blue Mountains National Park and at Bents Basin State Recreation Area. The species requires a combination of deep alluvial soils and a flooding regime that permits seedling establishment (EES 2021c). Such habitats are not present within the subject land.

vii. Grevillea parviflora subsp. parviflora

Grevillea parviflora subsp parviflora (Small-flower Grevillea) has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. Occurrences of the species in the Sydney region are usually found on soils derived from the Mittagong Formation, within the Lucas Heights or Berkshire Park soil landscapes. Associated species in areas of Shale Sandstone Transition Forest include *Eucalyptus fibrosa*, *E. punctata*, *Corymbia gummifera*, *Pultenaea scabra* var. *biloba*, *Kunzea ambigua*, *Allocasuarina littoralis* and *Themeda australis*. At sites with a stronger sandstone influence *Eucalytpus sclerophylla*, *E. piperita*, *E. oblonga*, *Grevillea diffusa*, *G. mucronulata*, *Acacia suaveolens* and *Persoonia pinifolia* are found (EES 2021c). Such habitats are not present within the subject land.

viii. Gyrostemon thesiodies

Gyrostemon thesioides has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species favours hillsides and riverbanks and may be restricted to fine sandy soils. It is known to be a fire opportunist, with recruitment occurring from a soil stored seed bank following fire (EES 2021c). Such habitats are not present within the subject land.

Furthermore, the species is only known from three sites in NSW; to the west of Sydney near the Colo, Georges and Nepean Rivers.

ix. Hibbertia puberula

Hibbertia puberula has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species favours dry sclerophyll woodland communities and heaths and may also occur in upland swamps (EES 2021c). Such habitats are not present within the subject land.

x. Hibbertia sp. Bankstown

Hibbertia sp. Bankstown has been removed from the assessment due to the subject land occurring outside of the species known distribution. The species is currently known to occur in only one population at Bankstown Airport in Sydney's southern suburbs, in Bankstown LGA (EES 2021c).

xi. Hibbertia spanantha

Hibbertia spanantha (Julian's Hibbertia) has been removed from the assessment due to the absence of microhabitats required by the species within the subject land, and due to the subject land occurring outside

the species known distribution. The species is known to grow in forest with the associated canopy species *Eucalyptus pilularis, E. resinifera, Corymbia gummifera* and *Angophora costata.* None of these species occur within the subject land. Furthermore, the species it restricted to four known locations (EES 2021c). The subject land does not occur near one of these known locations.

xii. Marsdenia viridiflora subsp. viridiflora

Marsdenia viridiflora subsp. viridiflora Endangered Population has been removed from the assessment as the subject land does not occur within one of the relevant listed Local Government Areas of Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith.

xiii. Melaleuca deanei

Melaleuca deanei (Deane's Paperbark) has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species favours ridgetop woodland, with only 5% of sites in heath on sandstone (EES 2021c). Such habitats are not present in the subject land.

Furthermore, the species mainly occurs in two distinct areas, in Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively (EES 2021c).

xiv. Persicaria elatior

Persicaria elatior (Tall Knotweed) has been removed from the assessment due to the subject land occurring outside of the species known distribution. The species is known to occur in south-eastern NSW, in Moruya State Forest near Turlinjah, the Upper Avon River catchment, north of Roberston, Bermagui, and Picton Lakes. In northern NSW, it has been recorded from Raymond Terrace and the Grafton Area (EES 2021c).

xv. Persoonia bargoensis

Persoonia bargoensis (Bargo Geebung) has been removed from the assessment due to the subject land occurring outside of the species known distribution. The species is 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 (EES 2021c).

xvi. Persoonia hirsuta

Persoonia hirsuta (Hairy Geebung) has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species favours dry sclerophyll open forest, woodland and heath primarily on the Mittagong Formation and on the upper Hawkesbury Sandstone (EES 2021c). Such habitats are not present within the subject land.

xvii. Pilularia novae-hollandiae

Pilularia novae-hollandiae (Austral Pillwort) has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species is assumed to be ephemeral and is often recorded in drying mud, in shallow swamps and waterways (EES 2021c). Such habtiats are not present within the subject land.

Furthermore, there are no previous records of the species within a 5km radius of the subject land.

xviii. Pimelea curviflora var. curviflora

Pimelea curviflora var. curviflora has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes (EES 2021c). Such habitats are not present within the subject land.

xix. Pomaderris brunnea

Pomaderris brunnea (Brown Pomaderris) has been removed from the assessment due to the absence of microhabitats required by the species within the subject land and due to the subject land being located outside of the species' known distribution. The species favours moist woodland and forest on clay and alluvial soils of flood plains and creek lines. Furthermore, the species is only found in a very limited area around the Colo, Nepean and Hawkesbury Rivers, including the Bargo area and near Camden (EES 2021c).

xx. Pterostylis saxicola

Pterostylia Saxicola (Sydney Plains Greenhood) has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species occurs in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines (EES 2021c). Such habitats are not present within the subject land.

xxi. Tetratheca glandulosa

Tetratheca glandulosa has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species favours ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Generally found in Sydney Sandstone Ridgetop Woodland, with associated canopy species being *Corymbia gummifera, C. eximia, Eucalyptus haemastoma, E. punctata, E. racemosa, and/or E. sparsifolia (EES 2021c)*. Such habitats are not present within the subject land.

xxii. Wahlenbergia multicaulis – endangered population

Wahlenbergia multicaulis – endangered population (Tadgell's Bluebell in the LGAs of Auburn, Bankstown, Baulkham Hills, Canterbury, Hornsby, Parramatta and Strathfield) has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. In western Sydney, the species is found in remnants of Cooks River/Castlereagh Ironbark Forest and also closely aligned with the Villawood Soil Series *(EES 2021c)*. Such habitats are not present within the subject land.

5.3.2.2. Fauna Species Credit Species

i. Regent Honeyeater (Breeding)

The Regent Honeyeater (*Anthochaera phrygia*) has been removed from the assessment as the subject land is not located within an area on the important habitat map for the species.

ii. Bush Stone-curlew

The Bush Stone-curlew *(Burhinus grallarius)* has been removed from the assessment due to the subject land occurring outside of the species known distribution. The species is mainly found in western slopes and plains and the Riverina with smaller numbers on the Central and North Coast.

iii. Gang-gang Cocktoo (Breeding)

The Gang-gang Cockatoo (*Callocephalon fimbriatum)* has been removed from the assessment due to the absence of suitable habitats within the subject land. The species favours old growth forest and woodland attributes for nesting and roosting (EES 2021c). Such habitats are not present in the subject land.

iv. Glossy Black-Cockatoo (Breeding)

The Glossy Black-Cockatoo (*Calyptorhyncus lathami*) has been removed from the assessment as the habitat constraints for the species are absent from the subject land. The TBDC lists the following habitat constrains for the species breeding habitat: *Living or dead tree with hollows greater than 15cm diameter and greater than 8m above ground.* The subject land does not comprise trees with hollows greater than 15cm diameter.

v. Eastern Pygmy-possum

The Eastern Pygmy-possum *(Cercartetus nanus*) has been removed because the ground stratum and understorey are not suitable for the species. The ground stratum has been slashed regularly in part and the remaining areas cannot be described as a "rich shrub understorey". According to the species profile the species is found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. They may occupy small patches of vegetation in fragmented landscapes and although the species prefers habitat with a rich shrub understory, they are known to occur in grassy woodlands and the presence of Eucalypts alone is sufficient to support populations in low densities.

Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable.

vi. Large-eared Pied Bat

The Large-eared Pied Bat (Chalinolobus dwyeri) has been removed from the assessment as the habitat constraints for the species are absent from the subject land. The TBDC lists the following habitat constraints for the species: Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices, or within two kilometres of old mines or tunnels. The subject land does not occur within 2 km of rocky areas containing caves, overhands, escarpments, outcrops or crevices, or old mines or tunnels. Swift Parrot (Breeding)

The Swift Parrot (*Lathamus discolor*) has been removed from the assessment as the subject land is not located within and area on the important habitat map for the species.

vii. Swift Parrot

The Swift Parrot (*Lathamus discolour)* has been removed from the assessment as the subject land is not located within an area on the important habitat map for the species.

viii. Green and Golden Bell Frog

The Green and Golden Bell Frog *(Litora aurea*) has been removed from the assessment as the species is unlikely to occur within the subject land, as no know population occurs in the vicinity of the subject land and the subject

land is not located close to a known location for the species in NSW. The closest record of the species occurs approximately 3.7 km south-west of the subject land. Furthermore, the artificial dam that occurs within the subject land does not comprise optimum habitat, as it is heavily shaded by surrounding trees and lacks emergent vegetation favoured by the species.

ix. Little Bent-winged Bat (Breeding)

The Little Bent-winged Bat (*Miniopterus australis*) has been removed from the assessment as the habitat constraints for the species are absent from the subject land. The TBDC lists the following habitat constraint for the species: *Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records in BioNet with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals >500; or from the scientific literature.* None of these habitat features, or records held within BioNet, are present within the subject land.

x. Large Bent-winged Bat (Breeding)

The Large Bent-winged Bat (*Miniopterus orianae oceanensis*) has been removed from the assessment as the habitat constraints for the species are absent from the subject land. The TBDC lists the following habitat constraint for the species: *Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave;" observation type code "E nest-roost;" with numbers of individuals >500.* None of these habitat features, or records held within BioNet, are present within the subject land.

xi. Barking Owl (Breeding)

The Barking Owl (*Ninox connivens)* has been removed from the assessment as the habitat constraints for the species are absent from the subject land. The TBDC lists the following habitat constraint for the species as been: *Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground*. The subject land does not comprise trees with hollows greater than 20cm diameter.

xii. Powerful Owl (Breeding)

The Powerful Owl *(Ninox strenua)* has been removed from the assessment as the habitat constraints for the species are absent from the subject land. The TBDC lists the following habitat constraint for the species as been: *Living or dead trees with hollow greater than 20cm diameter*. The subject land does not comprise trees with hollows greater than 20cm diameter.

xiii. Eastern Osprey (Breeding)

The Eastern Osprey (*Pandion cristatus)* has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species is known to favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Breeding occurs in nests high up in trees, usually within one kilometre of the sea (EES 2021c). Such habitats are not present in the subject land.

xiv. Squirrel Glider

The Squirrel Glider *(Petarus norfolcensis)* has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species is known to inhabit mature or old growth Box, Box-Ironbark woodlands and River Red Gum forest west of the Great Dividing Range and

Blackbutt-Bloodwood forest with heath understorey in coastal areas (EES 2021c). Such habitats are not present in the subject land.

xv. Koala (Breeding)

The Koala (*Phascolarctos cinereus)* has been removed from the assessment as it is unlikely to occur within the subject land, based on no records of the species within a 5km radius. The surrounding areas of the subject land are generally farmland that is rapidly changing into urban developments.

xvi. Red-crowned Toadlet

The Red-crowned Toadlet *(Pseudophryne australis)* has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings (EES 2021c). Such habitats are not present in the subject land.

xvii. Grey-headed Flying-fox (Breeding)

The Grey-headed Flying-fox (*Pteropus poliocephalus*) has been removed from the assessment as the subject land does not support a breeding camp.

xviii. Masked Owl (Breeding)

The Masked Owl *(Tyto novahollandiae)* has been removed from the assessment due to the absence of microhabitats required by the species within the subject land. The species breeds in moist eucalypt forested gullies (EES 2021c). Such habitats are not present in the subject land.

5.3.3. Presence of Candidate Species Credit Species

5.3.3.1. Surveys

As outlined in **Chapter 2** of this BDAR, in accordance with the BAM, field survey results from previous surveys undertaken by Keystone Ecological within the study area and subject land were utilised for this BDAR. Surveys were undertaken within the recommended survey period for all species surveyed. Details of the field surveys are outlined in the Keystone BDAR (2020), whilst a summary table is included in **Table 9** below.

Table 9 Summary of targeted threatened species surveys undertaken by Keystone Ecological

Candidate Species	Survey Method	Timing of Complete Surveys	Recommended Survey Period in TBDC
Cynanchum elegans/ White-flowered Wax Plant	Targeted random meander, Active searches	June, July, September and October	All year
Epacris purpurascens var. purpurascens	Targeted random meander, Active searches	June, July, September and October	All year
Grevillea juniperina subsp. juniperina	Targeted random meander, Active searches	July, September, October, December	All year
Grevillea parviflora subsp. supplicans	Targeted random meander, Active searches	July, August, October and December	All year

Candidate Species	Survey Method	Timing of Complete Surveys	Recommended Survey Period in TBDC
Haliaeetus leucogaster/ White-bellied Sea-Eagle (Breeding)	BAR audio recording, Targeted survey, Opportunistic survey	June, September and October	July - December
Hibbertia superans	Targeted random meander, Active searches	June, July, October and December	July - December
Hieraaetus morphnoides/ Little Eagle (Breeding)	BAR audio recording, Targeted survey, Opportunistic survey	July, September and October	August - October
Leucopogon fletcheri subsp. fletcheri	Targeted random meander, Active searches	July, September, October, December	All year
Lophoictinia isura/ Square-tailed Kite (Breeding)	BAR audio recording, Targeted survey, Opportunistic survey	July, September and October	September - January
Meridolum corneovirens/ Cumberland Plain Land Snail	Targeted habitat searches	June, July, September and October	September - January
Myotis Macropus/ Southern Myotis	Ultrasonic audio recording (Anabat express)	July	November - March
Persoonia nutans/ Nodding Geebung	Targeted random meander, Active searches	February, July, August, October and December	All year
Pimelea spicata Spiked Rice-flower	Targeted random meander, Active searches	February, June, July, September and October	All year
Pommerhelix duralensis/ Dural Woodland Snail	Targeted habitat searches	June, July, September and October	All year
Pultenaea pedunculata/ Matted Bush-pea	Targeted random meander, Active searches	September and October	September - November
Thesium austral/ Austral Toadflax	Targeted random meander, Active searches	September and October	September - February

5.3.3.2. Candidate Species Occurrence

Table 10 lists the species credit species assessed as present within the subject land for this assessment, based on species being recorded in the field or assumed present.

Table 10 Species credit species assessed as present within the subject land

Species	Method of Identification	Biodiversity Risk Weighting
Cumberland Plain Land Snail (*Meridolum corneovirens)*	Surveyed	2.00

Southern Myotis (*Myotis macropus)*	Assumed present	2.00

5.3.3.3. Extent of Habitat

The following section outlines the extent and condition of habitat used for the creation of species polygons for candidate species present, or assumed present, within the subject land.

i. Cumberland Plain Land Snail

The Cumberland Plain Land Snail was recorded within the subject land during surveys undertaken by Keystone Ecological (2020). Therefore, a species polygon has been created for this assessment for the purposes of calculating the impacts on the species in terms of species credits.

The species polygon for the Cumberland Plain Land Snail has been created in accordance with the habitat constraints held within the TBDC, and includes the following steps:

- Identify the PCTs/vegetation zones associated with the Cumberland Plain Land Snail in the TBDC;
- Create a shape file for the relevant vegetation zones (using GIS) to create the extent of the final species polygon.

The species polygon was then used to calculate the area of each of the vegetation zones impacted for the purpose of calculating species credits for the Cumberland Plain Land Snail. It should be noted that vegetation zones 3 and 6, which comprise derived native grassland forms of PCTs 849 and 1395, have not been included in the species polygons due to the lack of suitable habitat due to lack of leaf litter and regular mowing/slashing of the understorey.

The habitat condition and area for the species polygon is provided in **Table 11** below, whilst the species polygon for the Cumberland Plain Land Snail is shown in **Figure 9.**

Table 11. Details of Species Polygon for the Cumberland Plain Land Snail

Species Credit Species	Vegetation Zone	Habitat Condition (Vegetation Integrity) Loss	Approximate Area of Habitat Lost
Cumberland Plain Land Snail	1_849_Mown	37.1	0.15
	2_849_Exotic	58.0	0.07
	4_1395_Intact	80.1	0.08
	5_1395_Slashed	47.2	1.59
	7_835_Moderate	82.6	0.01

ii. Southern Myotis

The Southern Myotis was not recorded during surveys undertaken by Keystone Ecological (2020). However, as the surveys were undertaken outside of the recommended survey period and since there is potential suitable habitat present within the subject land, the species has been assumed present as a precautionary measure.

Therefore, a species polygon has been created for this assessment for the purposes of calculating the impacts on the species in terms of species credits.

The species polygon for the Southern Myotis has been created in accordance with the habitat constraints held within the TBDC, and includes the following steps:

- Creating a 200 m buffer around a medium to large permanent creeks, rivers, lakes or other waterways (i.e. with pools/stretches 3 m or wider);
- Identify the PCTs/vegetation zones associated with the Southern Myotis in the TBDC; and
- Clip the polygons for the relevant vegetation zones (using GIS) to the buffer polygons to create the extent of the final species polygon.

The species polygon was then used to calculate the area of each of the vegetation zones impacted for the purpose of calculating species credits for the Southern Myotis.

The habitat condition and area for the species polygon is provided in **Table 12** below, whilst the species polygon for Southern Myotis is shown in **Figure 10.**

Table 12. Details of Species Polygon for Southern Myotis

Species Credit Species	Vegetation Zone	Habitat Condition (Vegetation Integrity) Loss	Approximate Area of Habitat Lost
Southern Myotis	1_849_Mown	37.1	0.15
	2_849_Exotic	58.0	0.07
	3_849_DNG	52.1	0.06
	4_1395_Intact	80.1	0.08
	5_1395_Slashed	47.2	1.59
	6_1395_DNG	43.2	0.05
	7_835_Moderate	82.6	0.01

6. Prescribed Impacts

Prescribed impacts are identified in Clause 6.1 of the *Biodiversity Conservation Regulation 2017* (BC Regulation). Prescribed impacts are those that are additional to the clearing of native vegetation and associated habitat. These include:

- Development on the habitat of threatened species or ecological communities associated with:
  - karst, caves, crevices, cliffs, rock outcrops and other geological features of significance;
  - human-made structures;
  - non-native vegetation;
- Development on areas connecting threatened species habitat, such as movement corridors;
- Development on water quality, water bodies and hydrological processes that sustain threatened species and TECs (including from subsidence or upsidence from underground mining);
- Wind turbine strikes on protected animals; and
- Vehicle strikes on threatened species or on animals that are part of a TEC.

An assessment of the relevance of these prescribed impacts to the project is provided in **Table 13**. The location of prescribed impacts is shown in **Figure 9**.

Table 13 Relevance of prescribed impacts

Prescribed Impact	Relevance to Project	Associated Threatened Entities
Karst, caves, crevices, cliffs, rock outcrops and other geological features of significance	Not relevant. Features are not present within the subject land.	-
Human-made structures	Two existing dwellings are present within the subject land, both of which could provide potential roosting habitat for several threatened bats due to the buildings' poor conditions.	Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Yellow-bellied Sheathtail-bat, Greater Broad-nosed Bat
Non-native vegetation	Non-native vegetation occurring within the subject land comprises areas of managed exotic lawns and limited scattered occurrences of trees and shrubs. This vegetation may provide some low-value habitat for native fauna species, including threatened birds and bats, on occasion. Impacts to non-native vegetation would occur during the	Ecosystem credit fauna species which may utilise the habitat as part of a larger foraging range.

Prescribed Impact	Relevance to Project	Associated Threatened Entities
	construction phase of the project and result in a long-term impact.	
Habitat connectivity	The subject land occurs in a highly urbanised environment. However, the vegetation within the subject land connects with bushland that is part of the habitat corridor that exists along Second Ponds Creek, which provides connectivity in a north-south direction throughout the assessment area. Impacts from the proposed development would reduce the width of the corridor somewhat but would not create a break in the corridor.	Ecosystem credit fauna species which may utilise the habitat as part of a larger foraging range.
Waterbodies, water quality and hydrological processes	One artificial dam is present along the northern boundary of the subject land, which will be removed as part of the development.	Ecosystem credit fauna species which may utilise the habitat as part of a larger foraging range.
Wind turbine strikes	Not relevant. The project does not comprise a wind farm development.	-
Vehicle strikes	Not relevant. Although the project includes the construction of new car parks and access roads, vehicle movement is limited and no impacts to threatened species are predicted.	-

7. Avoid and Minimise Impacts

This section includes demonstration of efforts to avoid and minimise impacts on biodiversity values identified within the subject land, which includes assessment of direct, indirect and prescribed impacts. Any mentioning of the development footprint within this chapter is synonymous with the subject land.

7.1. Avoid and Minimise Direct and Indirect Impacts on Native Vegetation and Habitat

Under the BAM, measures taken to avoid and minimise impacts on biodiversity values from the development need to be documented. Some of the key considerations made when designing the development to minimise ecological impacts are set out below:

i. Conservation Values of TECs

Cumberland Plain Woodland and Shale Sandstone Transition Forest are both CEECs under the BC Act and EPBC Act. For the purposes of considering avoidance, the occurrences of these TECs on site were considered to be of high biodiversity value. That is because they have been extensively cleared historically and now remain largely as small, scattered, fragmented patches.

The patches of CEEC on site are also of conservation significance because they provide potential habitat for several threatened species, including the recorded Cumberland Plain Land Snail. The remainder of the site comprises a mix of exotic grasslands and woody exotic vegetation that is generally considered to be of low biodiversity value, as well as an artificial dam and cleared land.

The two TECs were also considered to have similar conservation values and so efforts were made to retain patches of both communities on site. This created a challenge for design because Cumberland Plain Woodland occurs at the front of the site near Annandale Road, whereas Shale Sandstone occurs at the rear of the subject land. If a strip of vegetation was retained across the subject land it would bisect the site and prevent a feasible design for the subject site.

Nevertheless, since both TECs are also entities for SAII under the BC Act, retention of patches of both communities were prioritised despite the associated problems for the layout design.

ii. Zoning of the Land

The land proposed for development is zoned B6 Enterprise Corridor ("the B6 land"). The objectives of the B6 land do not include conservation, as set out below:

- *To promote businesses along main roads and to encourage a mix of compatible uses.*
- *To provide a range of employment uses (including business, office, retail and light industrial uses).*
- *To maintain the economic strength of centres by limited retailing activity.*

Within the zone, a range of intensive business developments are permissible. Notwithstanding the objectives of the zone, consideration has been made to design a development that maximises the retention of the TECs, while still allowing for a feasible, functional development appropriate to the zone.

iii. No Go Option

The 'no go' option for the project would maintain current vegetation of the TECs on site but would not enable redevelopment to achieve the zone objectives. Under a no-go option, the current areas of mapped Cumberland Plain Woodland and Shale Sandstone Transition Forest would remain and trees in these areas would continue to grow and potentially develop further hollows. However, there would be no requirement to rehabilitate, manage or improve the existing vegetation on site. Mowing and slashing of most of the study area would likely continue, suppressing the understorey of areas of Cumberland Plain Woodland and Shale Sandstone Transition Forest, as would the growth of the weed infestations. If a tree dies or is damaged in a storm there would be no requirement for the tree to be replaced. Therefore, over time, there is potential for the extent of the existing TEC areas to be reduced and for the native vegetation to continue to degrade via weed invasion, edge effects, etc.

iv. Potential reduction of scale of Development

Reductions of the scale and layout of the development were considered, while balancing the need to achieve a viable, functional design for the development.

v. The current design

Despite the information listed above, avoidance and minimising of impacts on TECs can still be achieved to a degree by the modification of the location and design of the project. Several development layout options have been considered as part of the design process of the final concept layout.

The layout that was proposed as part of the lodged DA, as shown in **Figure 12**, incorporated a retention area of Shale Sandstone Transition Forest in the rear of the study area. Following discussions with Council, the development layout has been refined for this BDAR. As a result, the final development layout now includes two main retention areas of TECs; one in the front of the study area to retain areas of Cumberland Plain Woodland and one at the rear of the study area to retain Shale Sandstone Transition Forest, which in total comprises a combined area of approximately 0.58 ha (**Figure 13**). This will result in the retention of approximately 0.20 ha of Cumberland Plain Woodland and 0.30 ha of Shale Sandstone Transition Forest, and the opportunity to replant and rehabilitate the remainder of the 0.08 ha into the TECs. The retention areas will be managed under a Vegetation Management Plan (see ***Section 8.5.7***), and will ensure that the occurrences of Cumberland Plain Woodland and Shale Sandstone Transition Forest will remain within the study area in the longer term.

The current proposal is reduced in size and maintains more vegetation than was proposed in earlier designs. However, with the reduced footprint, there is still a requirement to clear approximately 0.29 ha of Cumberland Plain Woodland and 1.65 ha of Shale Sandstone Transition Forest. An additional 0.03 ha of Shale Sandstone Transition Forest and 0.01 ha of River-flat Eucalypt Forest TEC will also be removed for the construction of a stormwater pipeline through the eastern retention area, as shown in **Figure 13.** However, the impacted areas will be restored under the Vegetation Management Plan. The avoidance and minimising measures adopted for this project is outlined in **Section 7.1.1**, with a summary provided in **Table 14**.

7.1.2. Project Location and Design

Considering the factors outlined above, when determining the location and design of the final development footprint, the project designers have sought to avoid and minimise direct impacts on native vegetation and habitat by:

- Locating part of the project within areas containing exotic dominated vegetation which has previously been cleared where possible;
- Amendments to the overall project location and design to achieve an increased combined retention of Cumberland Plain Woodland and Shale Sandstone Transition Forest compared to earlier iterations of the project layout;
- Incorporation of suitable tree protection zones in the project design to avoid impacts on retained vegetation;
- Amendment of stormwater pipe alignment through the eastern retention area, to avoid impacts on existing native trees;
- Commitment to avoid all impacts to trees associated with the stormwater pipe alignment through Sydney Water land to the extent possible, as determined in separate discussions with Sydney Water;
- Preparation and implementation of a Vegetation Management Plan (Cumberland Ecology. 2021), which will provide for ongoing management, rehabilitation, and protection of a combined area of 0.58 ha of Cumberland Plain Woodland and Shale Sandstone Transition Forest within the study area;
- Design of building location, earthwork batters, and retaining walls outside of the protected vegetation zones including reasonable setbacks; and
- Implementation of a suite of mitigation measures as part of the project (**Sections 8.5-8.6**), to minimise the impacts on biodiversity, including:
    - Weed management;
    - Tree protection measures;
    - Pre-clearance surveys and clearance supervision;
    - Nest box installation; and
    - Sedimentation control measures.

7.2. Avoid and Minimise Prescribed Impacts

7.2.1. Human-made Structures

Two existing vacant dwellings that are proposed to be demolished as part of the project, could potentially provide roosting habitat for the threatened a number of threatened microbats.

Given the limited area of land within the study area on which the project is proposed to be located, as well as the design requirements of the project and the focus on avoiding and minimising impacts on areas of high biodiversity values, impacts to these structures are not able to be avoided as part of the development.

Nevertheless, the human made structures planned to be demolished and removed are not considered to be essential for survival for any of the potentially impacted species, and adequate mitigation measures (as discussed in ***Section 8.5-8.6***) will be implemented to minimise the impact to fauna (if any) that may utilise the existing human-made structures for roosting.

7.2.2. Non-native Vegetation

Areas of non-native vegetation within the study area are predominantly in the form of managed exotic lawns, with some smaller scattered areas of woody vegetation.

Although the non-native vegetation may provide some habitat value for native fauna in terms of shelter and foraging resources, these areas are unlikely to be favoured over the adjoining forest and woodland habitats outside of the study area.

Nevertheless, the location of the project and development design have been focused on avoiding and minimising impacts to areas of native vegetation as a priority. Hence, impacts to the areas of non-native vegetation are not able to be avoided as part of the project.

7.2.3. Habitat Connectivity

The vegetation within the subject land links up with an existing habitat corridor to the west of the subject land, which runs in a north-south direction along Second Ponds Creek. This habitat corridor provides connectivity throughout the assessment area and beyond with larger areas of bushland.

As explained in previous sections, when considering the requirements associated the project in combination the size of the study area and the location of the TECs, there are limited opportunities to avoid all impacts on native vegetation and associated habitat connectivity. Nevertheless, the project has focused on retaining blocks of Cumberland Plain Woodland and Shale Sandstone Transition Forest that can be managed and rehabilitated to improve their value and function as fauna habitat. The impacts of the project will not result in a break in the overall habitat corridor. Therefore, although there will be some reduction in the overall width of the existing habitat corridor along Second Ponds Creek through the removal of vegetation within the subject land, areas of woody vegetation will be retained and improved within the study area and will continue to provide a link for threatened species to the existing habitat corridor.

7.2.4. Waterbodies, water quality and hydrological processes

The waterbody present within the subject land comprises a small artificial dam along the northern boundary, which may provide habitat for some ecosystem credit species.

Although the small artificial dam may provide some habitat value, impacts to this waterbody are not avoidable as part of the project design, as the final project design has been focused on maximising the retention of areas of TECs as a priority. Nevertheless, the dam is considered unlikely to be essential for survival for any threatened

species, and adequate mitigation measures (as discussed in ***Section 8.5-8.6***) will be implemented to minimise the impact to fauna (if any) that may utilise the dam.

Table 14 Summary table of options considered for the project to avoid and minimise impacts on biodiversity

Action	Adopted (Yes/No/In part)	Justification	Timing (if adopted)	Responsibility (if adopted)	Outcome (if adopted)
Implementation of a suite of mitigation measures	Yes	To minimise the impacts on biodiversity, a suite of mitigation measures will be implemented such as weed management, tree protection measures, pre-clearance surveys, and a Vegetation Management Plan.	Pre and post construction and during operation phase	Proponent and consultant team	Minimise impacts on biodiversity
Partial development of the study area to avoid/minimise impacts on biodiversity and achieve greater tree retention	In part	To avoid/minimise impacts on high biodiversity values, such as areas comprising TECs, the development footprint has been modified to retain two areas of native vegetation, comprising Cumberland Plain Woodland and Shale Sandstone Transition Forest.	Pre and post construction and during operation phase	Proponent and consultant team	Increased retention of TECs, to minimise impacts on areas of high biodiversity values
'Do-nothing' option to avoid all impacts on biodiversity	No	The do-nothing option for the project would maintain current tree cover on site but would not enable redevelopment of the study area to meet the objectives of the B6 zoning. Under a no-go option, the current vegetation would remain. However, there would be no obligation to manage and improve the vegetation on site. Therefore, over time, there is potential for the existing extent of the TECs to be reduced and for the native vegetation to be degraded.	-	-	-
Consideration of alternative sites and	In part	Several layout options and alternative locations within the study area were considered as part of	During design and approval	Proponent and consultant team	Maximise retention of TECs in the study area,

Action	Adopted (Yes/No/In part)	Justification	Timing (if adopted)	Responsibility (if adopted)	Outcome (if adopted)
layouts for the project within the study area		the detailed design phase. The final layout has been selected to maximise the retention of TECs, whilst still achieving a feasible development.			whilst achieving a feasible project design.

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8. Assessment of Impacts

8.1. Direct Impacts

8.1.1. Native Vegetation

The direct impact resulting from the proposed development is the loss of vegetation and associated habitat within the subject land. **Table 15** identifies the extent of impacts to vegetation within the subject land.

Table 15 Extent of vegetation impacts within the subject land

Vegetation Zone	PCT	Condition	BC Act Status	Approximate Area (ha)
1	849: Cumberland shale plains woodland	Mown	CEEC	0.15
2	849: Cumberland shale plains woodland	Exotic	CEEC	0.07
3	849: Cumberland shale plains woodland	DNG	CEEC	0.06
4	1395: Cumberland Shale – Sandstone Ironbark Forest	Intact	CEEC	0.08
5	1395: Cumberland Shale – Sandstone Ironbark Forest	Slashed	CEEC	1.59
6	1395: Cumberland Shale – Sandstone Ironbark Forest	DNG	Not listed	0.05
7	835: Cumberland Riverflat Forest	Moderate	CEEC	0.01
Total				**2.03**

8.1.2. Threatened Species

Two threatened species that are species credit species have been assumed to be present in the subject within this assessment. **Table 16** identifies the extent of impacts to these species within the subject land.

Table 16 Extent of threatened species impacts within the subject land

Scientific Name	Common Name	BC Act Status	Area (ha)
Meridolum corneovirens	Cumberland Plain Land Snail	E	1.92
Myotis macropus	Southern Myotis	V	2.03

8.2. Change in Vegetation Integrity Score

Table 17 details the change in vegetation integrity score for each of the vegetation zones within the subject land.

Table 17 Changes in vegetation integrity score

Zone	PCT Name	BC Act Status	BRW	Area (ha)	VI Score			
					Current	Future	Change	Total Change
1	849: Cumberland Shale Plains Woodland	CEEC	2.5	0.15	37.6	0	-37.6	-37.6
2	849: Cumberland Shale Plains Woodland	CEEC	2.5	0.07	58.0	0	-58.0	-58.0
3	849: Cumberland Shale Plains Woodland	CEEC	2.5	0.06	52.1	0	-52.1	-52.1
4	1395: Cumberland Shale – Sandstone Ironbark Forest	CEEC	2.5	0.08	80.1	0	-80.1	-80.1
5	1395: Cumberland Shale – Sandstone Ironbark Forest	CEEC	2.5	1.59	47.2	0	-47.2	-47.2
6	1395: Cumberland Shale – Sandstone Ironbark Forest	Not listed	2.5	0.05	43.2	0	-43.2	-43.2
7	835: Cumberland Riverflat Forest	CEEC	2	0.01	82.6	0	-82.6	-82.6

BRW = Biodiversity Risk Weighting
VI Score = Vegetation Integrity Score

8.3. Indirect Impacts

Table 18 outlines the indirect impacts to native vegetation and habitat. Due to the existing highly modified nature of the vegetation both within and adjacent to the subject land, the indirect impacts of the project are not considered to be significant.

Table 18 Indirect impacts of the project

Indirect Impact	Nature	Extent	Duration	Threatened Entities Likely Affected	Consequences
Inadvertent impacts on adjacent habitat or vegetation	Impact possible. Construction and operational activities may result in inadvertent impacts on retained vegetation in the study area.	Retained vegetation within the study area, and surrounding vegetation along Second Pond Creek	Short term (during construction) and potential long term	Cumberland Plain Woodland and Shale Sandstone Transition Forest	Further reduced condition of the retained areas of Cumberland Plain Woodland and Shale Sandstone Transition Forest, as well as surrounding vegetation.
Reduced viability of adjacent habitat due to edge effects	Impact possible. Construction and operational activities may increase edge effects on retained vegetation in study area.	Retained vegetation within the study area, and surrounding vegetation along Second Pond Creek	Short term (during construction) and potential long term	Cumberland Plain Woodland and Shale Sandstone Transition Forest	Further reduced condition of the retained areas of Cumberland Plain Woodland and Shale Sandstone Transition Forest, as well as surrounding vegetation
Reduced viability of adjacent habitat due to noise, dust or light spill	Impact possible. The construction activities associated with the project are likely to increase the noise, dust and light above current levels within and immediately adjacent the subject land. Some impacts such as noise or light may persist during the operational phase.	Retained vegetation within the study area, and surrounding vegetation along Second Pond Creek	Short term (during construction) and potential long term	Ecosystem credit species	Short term disruption of fauna habitat usage during construction, with potential for ongoing occupation impacts.

Indirect Impact	Nature	Extent	Duration	Threatened Entities Likely Affected	Consequences
Transport of weeds and pathogens from the site to adjacent vegetation	Impact possible. A number of high threat exotic weeds are known to occur within the subject land and may be inadvertently spread to surrounding vegetation.	Retained vegetation within the study area, and surrounding vegetation along Second Pond Creek	Potential long-term	Cumberland Plain Woodland and Shale Sandstone Transition Forest	Further reduced condition of the retained areas of Cumberland Plain Woodland and Shale Sandstone Transition Forest, as well as surrounding vegetation
Increased risk of starvation, exposure and loss of shade or shelter	Impact unlikely. Although some areas of woodland and forest will be cleared as part of the project, the two areas set aside for retention of Cumberland Plain Woodland and Shale Sandstone Transition Forest within the study area will continue to provide habitat, including shade and shelter for species likely to use the site. Connecting bushland will also remain and continue to provide habitat. Hence, the project is unlikely to cause displacement of fauna such that it increases the risk of starvation, exposure and loss of shade or shelter.	-	-	-	-
Loss of breeding habitats	Impact unlikely. Fauna breeding habitat occurs in adjacent vegetation, and includes hollow-bearing trees.	-	-	-	-

Indirect Impact	Nature	Extent	Duration	Threatened Entities Likely Affected	Consequences
	The project is unlikely to result in the loss of breeding habitat within adjacent areas.				
Trampling of threatened flora species	Impact unlikely. No threatened flora species known or likely to occur.	-	-	-	-
Inhibition of nitrogen fixation and increased soil salinity	Impact unlikely. The project is not considered to result in the inhibition of nitrogen fixation and increased soil salinity.	-	-	-	-
Fertiliser drift	Impact unlikely. The project does not involve fertiliser application, therefore the project is not considered to result in this indirect impact.	-	-	-	-
Rubbish dumping	Impact possible. Occupation of the subject land may result in rubbish dumping within adjoining areas of retained woody vegetation in the wider study area.	Retained vegetation within the study area, and surrounding vegetation along Second Pond Creek	Potential long term	Cumberland Plain Woodland and Shale Sandstone Transition Forest	Further reduced condition of the retained areas of Cumberland Plain Woodland and Shale Sandstone Transition Forest, as well as surrounding vegetation
Wood collection	Impact unlikely to occur, considering the commercial nature of the project.	-	-	-	-

Indirect Impact	Nature	Extent	Duration	Threatened Entities Likely Affected	Consequences
Bush rock removal and disturbance	Impact unlikely. No bush rock has been identified within the subject land or study area, therefore the project is not considered to result in this indirect impact.	-	-	-	-
Increase in predatory species populations	Impact unlikely. Considering the modified nature of the subject land in combination with the nature of the project and the highly urbanised surrounding areas, the project is considered unlikely to result in an increase in predatory species populations.	-	-	-	-
Increase in pest animal populations	Impact unlikely. Considering the modified nature of the subject land in combination with the nature of the project and the highly urbanised surrounding areas, the project is considered unlikely to result in an increase in pest animal populations.	-	-	-	-
Increased risk of fire	Impact unlikely. The project is unlikely to increase the risk of bushfire.	-	-	-	-

Indirect Impact	Nature	Extent	Duration	Threatened Entities Likely Affected	Consequences
Disturbance to specialist breeding and foraging habitat	Impact possible. Occupation of the development area may result in disturbance to adjoining foraging habitat	Native vegetation surrounding the subject land	Potential long term	Ecosystem credit species, and Southern Myotis	Further reduced condition of potential foraging habitat.

8.4. Prescribed Impacts

The project has been assessed as resulting in four prescribed impacts (see ***Section 6.1***). An assessment of these prescribed impacts is provided below in accordance with Section 8.3 of the BAM.

8.4.1. Human-made Structures

8.4.1.1. Nature

Human-made structures to be impacted by the project are limited to two vacant dwellings within the subject land; one in the north-western corner of the subject land and one in the south-eastern portion of the subject land.

8.4.1.2. Extent

The impacts will be limited to the two dwellings within the subject land.

8.4.1.3. Duration

Impacts to the human-made structures would occur during the construction phase of the project. The removal of these structures is a long-term impact.

8.4.1.4. Threatened Entities Affected

The habitat provided by the human-made structures may provide potential roosting habitat for a number of threatened microbats, including the Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Yellow-bellied Sheathtail-bat, and Greater Broad-nosed Bat

8.4.1.5. Consequences

The project will result in the loss of two human-made structures in the form of two vacant dwellings, which may provide potential roosting habitat for a number of threatened microbats. Nevertheless, the human made structures to be removed for the proposed development are not considered to form significant roosting habitat for these species and therefore not considered to be dependent on for survival for the Eastern False Pipistrelle, Eastern Coastal Free-tailed Bat, Little Bent-winged Bat, Large Bent-winged Bat, Yellow-bellied Sheathtail-bat, or Greater Broad-nosed Bat. Hence, no significant impacts to these species are expected from the removal of the human made structures on the subject land.

8.4.2. Non-native Vegetation

8.4.2.1. Nature

Non-native vegetation to be impacted by the project occurs mainly as open areas of managed exotic lawns within the subject land, and one smaller area of woody exotic vegetation along the eastern boundary of the subject land.

8.4.2.2. Extent

The project will clear a total of approximately 0.66 ha of non-native vegetation. The majority (0.64 ha) of this comprises exotic dominated grasslands in the form of managed lawns in the western and southern portion of the subject land, which is considered to be of low habitat value.

8.4.2.3. Duration

Impacts to non-native vegetation would occur during the construction phase of the project. The removal of the non-native vegetation is a long-term impact.

8.4.2.4. Threatened Entities Affected

The habitat provided by non-native vegetation may provide some foraging habitat for ecosystem species, such as microchiropteran bats and birds, mainly within the small occurrences of woody exotic vegetation. The non-native vegetation is not considered suitable breeding/nest habitat due to lack of hollows.

8.4.2.5. Consequences

The project will result in a reduction in non-native vegetation by approximately 0.66 ha. The reduction of this small area of habitat is not considered to significantly impact upon the potentially affected threatened entities as other areas of more suitable habitat, in the form of both native and non-native vegetation, will remain within the study area and wider assessment area. Furthermore, the majority of the non-native vegetation to be removed comprises exotic dominated lawns that are considered to be of low habitat value.

8.4.3. Habitat Connectivity

8.4.3.1. Nature

The native vegetation within the subject land links up with the larger habitat corridor that stretches in a north-south direction in association with Second Ponds Creek.

8.4.3.2. Extent

Habitat connectivity may be impacted by the project through the clearing of approximately 1.88 ha of woody native vegetation. Removal of the woody vegetation within the subject land will not result in further fragmentation of habitat in the locality, as it will not create a break in the existing habitat corridor. However, the project will decrease the width of the corridor within the subject land.

8.4.3.3. Duration

Direct impacts to habitat connectivity would occur during the construction and operational phase of the project. The reduction of habitat connectivity is considered to be a long-term impact.

8.4.3.4. Threatened Entities Affected

The habitat provided by woody vegetation may provide foraging habitat for ecosystem species, such as the Grey-headed Flying-fox, microchiropteran bats and birds.

8.4.3.5. Consequences

The project will result in the reduction in woody vegetation by 1.88 ha, represented by vegetation zones 1-2 and 4-5, which occur on the edge of a larger corridor that stretches north-south through the assessment area along Second Ponds Creek. The reduction of this area of habitat is not considered to significantly impact the movement of mobile fauna species as extensive areas of similar vegetation and habitat, including better connected and larger areas of remnant vegetation, will remain as part of the habitat corridor along Second Ponds Creek. The project will not create a break in the corridor, however the width of the corridor will be

reduced within the subject land. Nevertheless, it is considered unlikely that native fauna would be solely reliant on the habitat within the subject land for movement between different areas of habitat.

8.4.4. Waterbodies, water quality and hydrological processes

8.4.4.1. Nature

The waterbody to be impacted by the project occurs as a small artificial dam along the northern boundary of the subject land, which is mainly dominated by *Typha orientalis* (Bulrush).

8.4.4.2. Extent

The project will remove a small artificial dam that is approximately 0.03 ha in size.

8.4.4.3. Duration

Impacts to the waterbody would occur during the construction phase of the project. The removal of the dam is a long-term impact.

8.4.4.4. Threatened Entities Affected

The waterbody has been assessed as having the potential to provide habitat for some ecosystem credit species on a precautionary basis.

8.4.4.5. Consequences

The project will result in the removal of the small (0.03 ha) artificial dam within the subject land. The reduction of this small area of habitat is not considered to cause a significant impact to any threatened entities, as it is unlikely that any threatened species are solely dependent on the dam. Suitable mitigation measures will be implemented for the removal of the dam, to minimise potential impacts to the species (see Section 8.6).

8.5. Mitigation of Impacts to Native Vegetation and Habitat

A range of mitigation measures have been developed for the project to mitigate the impacts to native vegetation and habitat that are unable to be avoided. These include a range of measures to be undertaken before, during and after construction to limit the impact of the project. Each mitigation measure is discussed in detail below, and a summary is provided in **Table 19**.

8.5.1. Weed Management

In order to minimise the spread of weeds throughout the subject land and adjoining areas, appropriate weed control activities will be undertaken prior to vegetation clearing in accordance with the Greater Sydney Management Region and is subject to the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022 (LLS: Greater Sydney 2019) under the NSW *Biosecurity Act 2015*.

The *Biosecurity Act 2015* and regulations provide specific legal requirements for state level priority weeds and high risk activities, as provided in the Appendices of the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022 (LLS: Greater Sydney 2019).To comply with the objectives of the Greater Sydney Regional Strategic Weed Management Plan, it is recommended the following measures be implemented as part of weed management for the subject land.

i. Prevention

Appropriate construction site hygiene measures will be implemented to prevent entry of new weeds to the area such as the cleaning of equipment prior to entering the subject land.

ii. Eradication

Initial weed management will be carried out within the subject land according to best-practice methods under the direction of a suitably qualified bush regenerator. The targeted species will be those listed under Appendices 1 and 2 of the Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022 (LLS: Greater Sydney 2019). Initial weed treatment will include eliminating woody species and targeting large dominant infestations of exotic herbs. This may be achieved via a combination of manual weed removal and herbicide use.

Best-practice bush regeneration should undertake measures to avoid adverse impacts to retained vegetation within the subject land, including not over clearing (remove only targeted species), employment of minimal disturbance techniques to avoid soil and surrounding vegetation disturbance, and replacement of disturbed mulch/leaf-litter.

iii. Containment

Follow-up monitoring and maintenance should be undertaken in the subject land following vegetation clearing activities, to contain any re-emergence of weed species.

8.5.2. Delineation of Clearing Limits

The current limits of clearing will be marked either by high visibility tape on trees or metal/wooden pickets, fencing or an equivalent boundary marker that will be installed prior to clearing. To avoid unnecessary or inadvertent vegetation and habitat removal or impacts on fauna, disturbance must be restricted to the delineated area and no stockpiling of equipment, machinery, soil or vegetation will occur beyond this boundary.

8.5.3. Tree Protection Measures

As outlined in the Arboricultural Impact Assessment prepared by Advanced Treescape Consulting (2021) several tree protection measures are proposed to be implemented to avoid inadvertent impacts to trees that are marked for retention. These measures include the implementation of tree protection fencing, suitable tree protection zones, and temporary ground protection where relevant. Further details on tree protection measures are outlined in the Arboricultural Impact Assessment (2021).

8.5.4. Pre-clearance Surveys

To minimise impacts to fauna species during construction, pre-clearance surveys will be conducted in all areas of vegetation that are required to be cleared. Pre-clearing surveys will be undertaken within one week of clearing activities by a qualified ecologist.

Habitat features to be identified include:

- Hollow-bearing trees;

- Hollow-bearing logs; and
- Nests within tree canopy or shrubs.

Such features have the potential to contain native species. All habitat features will be identified, recorded and flagged with fluorescent marking tape and trees will have an "H" spray painted with marking paint on two sides of the tree.

As part of the pre-clearing surveys, all built structures to be demolished will also be inspected to identify any habitat features that have a high potential to support native fauna species, in particular, microbats. The surveys will include visual roost searches for crevices that a microbat may be able to access and roost in, with the aid of a torch where required, and the use of a hand-held ultrasonic bat detector. If any suitable roost sites are identified, additional surveys comprising roost watches and the deployment of ultrasonic bat detectors will be completed over a period of two nights to detect bats using the buildings. Any roost watches and ultrasonic bat detector surveys should be undertaken during spring/summer when microbats are more likely to leave their roost (and subsequently be detected) and not be carried out during periods of heavy rain. All targeted microbat surveys should be carried out by a qualified ecologist with a minimum of three years' experiences in surveying microbats.

8.5.5. Staging of Clearing

The clearing will be conducted using a two-stage clearing process as follows:

Stage 1: Clearing will commence following the identification of potential habitat features by a qualified ecologist. Hollow-bearing trees marked during pre-clearing will not be cleared during the first stage. However, all vegetation around these trees will be cleared to enable isolation of the feature. Other habitat features, such as hollow-bearing logs, can be removed during Stage 1 only if done under supervision by a qualified ecologist. Identified hollow-bearing trees will be left at a minimum overnight after Stage 1 clearing to allow resident fauna to voluntarily move from the area.

Stage 2: After hollow-bearing trees have been left overnight, the trees will be cleared using the following protocols:

- Trees marked as containing hollows will be shaken by machinery prior to clearing to encourage any animals remaining to leave the hollows and move on;
- Use a bulldozer or excavator to start pushing the tree over. Move the bulldozer over the roots and continue gently pushing the tree over;
- Remove branches with hollows and sections of trunk and set aside for immediate transfer to a storage area for placement within retained vegetation; and
- All hollows will be investigated by an ecologist for the presence of fauna following felling of the tree.

The felled habitat tree will be left overnight to allow any remaining fauna time to leave the hollows and move on.

The two-stage clearing process enables fauna a chance to self-relocate upon nightfall, when foraging typically occurs.

The demolition of built structures will be guided by the results of the pre-clearing surveys. Where suitable bat roost sites and evidence of bat usage is recorded, the relevant built structures should be demolished under supervision of an ecologist. Staging of the built structures may also be required to provide opportunity for any roosting bats to self-relocate. Depending on the location of potential suitable roosting sites, the method for demolition of the existing buildings may involve an initial removal of the roof structures, with the buildings left overnight without roofing. Demolition of the remaining portion of the buildings would then occur on the following day. The specific details of the recommended demolition process will be included in the pre-clearance letter, as required.

Provisions will be made to protect any native fauna during clearing activities by the following means:

- All staff working on the vegetation clearing will be briefed about the possible fauna present and should avoid injuring any present;
- Animals disturbed or dislodged during the clearance but not injured will be assisted to move to adjacent bushland or other specified locations; and
- If animals are injured during the vegetation clearance, appropriate steps will be taken to humanely treat the animal (either taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanised).

Provision of a report following the completion of clearing works will be provided detailing the total number and species of individuals recorded and details of their release/health.

8.5.6. Sedimentation Control Measures

The project may result in erosion and transport of sediments because of soil disturbance during construction. In order to prevent this impact, construction activities will be undertaken in accordance with "The Blue Book" (Landcom 2004). These include implementation of the following measures:

- Installation of sediment control fences;
- Covering soil stockpiles; and
- Avoiding soil disturbance prior to heavy rainfall.

8.5.7. Vegetation Management Plan

A Vegetation Management Plan has been prepared by Cumberland Ecology and will be implemented as part of the project. The Vegetation Management Plan is proposed to remain in force in perpetuity and provides measures to restore and enhance two retained areas of vegetation within the study area, as shown in **Figure 13**. The area to be managed by the Vegetation Management Plan is approximately 0.58 ha, and includes an eastern area of Shale Sandstone Transition Forest and a western area of Cumberland Plain Woodland. The plan

includes details on specific management actions, monitoring and reporting, as well as timing and responsibilities.

The management actions outlined in the Vegetation Management Plan also include the restoration and rehabilitation of areas that will be impacted by the construction of the proposed stormwater pipeline within the eastern retention area of Shale Sandstone Transition Forest. The stormwater pipeline will be emplaced in a trench as described in the Amended DA package. Soil will immediately be replaced once the pipeline is completed, and vegetation will replanted. The regeneration over the pipeline will be managed to check that it is successful, with monitoring measures prescribed by the VMP

Further details are outlined in the Vegetation Management Plan (Cumberland Ecology. 2021).

8.5.8. Dam Decommissioning

Prior to dam dewatering, an appropriate Dam Decommissioning Plan will be prepared, specifying pre-clearance surveys of the dam, and potential relocation of any aquatic fauna in the dam.

Pre-clearance surveys of the dam and surrounding areas will be conducted in accordance with the OEH Threatened Biodiversity Survey and Assessment Guidelines for Development and Activities (DEC (NSW) 2004).

The dam dewatering will necessitate relocation of any potentially occurring native aquatic fauna, aerial imagery of the study area and surrounding locality will be studied to determine presence of publicly accessible water bodies near the site which would be suitable for any potential relocation of aquatic fauna.

The aquatic surveys will consist of a diurnal survey of the dam. During the survey, the following will be conducted:

- Measurement of physio-chemical parameters of the water, such as temperature, turbidity, pH, dissolved oxygen (DO), conductivity and total dissolved solids, using a water quality meter;
- Performance of a diurnal amphibian survey, recording the species of amphibians encountered; and
- Performance of a meander flora survey to identify marginal and emergent aquatic flora species to gain an appreciation of the potential habitat for amphibians that is present.

The water quality assessments and flora surveys will also be conducted at the potential relocation sites to determine that the habitat is of equal to better quality to that of the dam, and therefore suitable for relocation of fauna. Allowance will be made to survey two to three potential relocation areas in the event that a preferred location is of a lesser quality than the dam.

8.5.9. Nest Box Installation

To mitigate any potential impacts on native fauna associated with the removal of any hollow-bearing trees, it is recommended that nest boxes are installed within the retained areas of vegetation in the study area. It is recommended that any removal of hollow-bearing trees is replaced with nest boxes at a ratio of 2:1.

8.5.10. Landscaping

Where possible, it is recommended that native plant species characteristic of Cumberland Plain Woodland and Shale Sandstone Transition Forest be incorporated into the landscape plan for the subject land. A recommended species list is provided in the Vegetation Management Plan prepared by Cumberland Ecology (2021). All native plant species should be sourced from local nurseries or come from seed sourced from the study area.

Table 19 Summary of mitigation measures

Mitigation Measure	Impact Addressed	Proposed Techniques	Timing	Frequency	Responsibility	Risk of Failure	Consequences of Residual Impacts
Weed management	Direct, indirect	Appropriate weed control activities will be undertaken in accordance with the *Greater Sydney Regional Strategic Weed Management Plan 2017 – 2022* (LLS: Greater Sydney 2019).	Construction	Prior to construction, following vegetation clearing	Bush regenerator/ contractor	Moderate	Further Spread of weeds throughout the study area
Delineation of clearing limits	Indirect, prescribed	Clearing limits marked either by high visibility tape on trees of metal/wooden pickets, fencing or an equivalent boundary marker. Disturbance, including stockpiling, restricted to clearing limits.	Construction	Once	Contractor	High	Unnecessary damage to retained trees in adjoining vegetation.
Tree Protection Measures	Indirect, prescribed	Implementation of tree protection measures in accordance with Arboricultural Impact Assessment.	Construction	Prior to construction and vegetation clearing	Project arborist	High	Unnecessary damage to retained trees in the subject land and study area.
Pre-clearance survey	Direct, prescribed	Pre-clearance surveys will be conducted in all areas of vegetation that are required to be cleared. Pre-clearing surveys will be undertaken within one week of clearing. Habitat features will be marked during the pre-clearing survey.	Construction	Once	Contractor/ project ecologist	Moderate	Increased and unnecessary mortality of native fauna.

Mitigation Measure	Impact Addressed	Proposed Techniques	Timing	Frequency	Responsibility	Risk of Failure	Consequences of Residual Impacts
Staging of clearing	Direct, prescribed	Vegetation clearing will be conducted using a two-stage clearing process. Animals disturbed or dislodged during the clearance but not injured will be assisted to move to adjacent bushland or other specified locations If animals are injured during the vegetation clearance, appropriate steps will be taken to humanely treat the animal (either taken to the nearest veterinary clinic for treatment, or if the animal is unlikely to survive, it will be humanely euthanized)	Construction	Once	Contractor/ project ecologist	High	Increased and unnecessary mortality of native fauna.
Sedimentation control	Indirect, prescribed	Construction activities will be undertaken in accordance with "The Blue Book" (Landcom 2004). These include implementation of the following measures: Installation of sediment control fences; Covering soil stockpiles; and Avoiding soil disturbance prior to heavy rainfall	Construction	Throughout construction period	Contractor	Moderate	Sedimentation into adjoining vegetation.
Vegetation Management Plan	Direct, prescribed	Rehabilitation and enhancement of PCT 849 and 1395 in the retention areas to	Construction and Operation	In perpetuity	Bush regenerator	High	Reduced extent and condition of TECs

Mitigation Measure	Impact Addressed	Proposed Techniques	Timing	Frequency	Responsibility	Risk of Failure	Consequences of Residual Impacts
		be undertaken in accordance with Vegetation Management Plan					
Dam Decommissioning	Direct, prescribed	Preparation of Dam Decommissioning Plan prior to construction Pre-clearance survey of dam	Construction	Once	Project ecologist	High	Increased and unnecessary mortality of native fauna.
Nest Box Installation	Direct	Installation of nest boxes within retained areas in the study area, at a ratio of 2:1	Prior to vegetation clearing	Once	Project ecologist	Low	Reduction in available fauna habitat
Landscaping	Direct, prescribed	Landscaping within the subject land to focus on using native flora species sourced from local nurseries and characteristic of PCT 849 and 1395	Operation	Post construction	Contractor	Low	Reduction in available habitat

8.6. Mitigation of Prescribed Impacts

The following mitigation measures, described in ***Section 8.6***, are relevant to the prescribed impacts relevant to the project:

- Delineation of clearing limits;
- Tree protection measures;
- Pre-clearance survey;
- Staging of clearing;
- Sedimentation control measures;
- Dam Decommissioning;
- Vegetation Management Plan; and
- Nest Box Installation.

No additional mitigation measures are proposed for prescribed impacts.

8.7. Adaptive Management for Uncertain Impacts

The project is considered unlikely to result in any uncertain impacts that require adaptive management.

8.8. Use of Biodiversity Credits to Mitigate or Offset Indirect or Prescribed Impacts

Due to the small scale of indirect and prescribed impacts, the project does not propose to use additional biodiversity credits to mitigate or offset these impacts.

9. Thresholds of Assessment

9.1. Introduction

The assessment thresholds that must be considered include the following:

- Impacts on an entity that is at risk of a serious and irreversible impact;
- Impacts for which the assessor is required to determine an offset requirement; and
- Impacts for which the assessor is not required to determine an offset requirement; and
- Impacts that do not require further assessment by the assessor.

The following sections outline these assessment thresholds and their relevance to the project.

9.2. Impacts on Serious and Irreversible Impact Entities

Two candidate SAII entities have been considered as relevant to the project, being Cumberland Plain Woodland TEC and Shale Sandstone Transition Forest TEC. Further consideration of these entities is provided below.

9.2.1. Cumberland Plain Woodland

Cumberland Plain Woodland is confirmed as occurring within the western parts of the subject land includes all and will be impacted by the project. The location of the Cumberland Plain Woodland within the subject land is shown in **Figure 14** and includes all mapped areas of PCT 849.

Approximately 0.29 ha of Cumberland Plain Woodland is proposed to be removed within the subject land for the purpose of this assessment, comprising 0.22 ha of woodland and 0.06 ha derived native grassland. These areas comprise conditions states that have been subject to modifications such as weed invasion and regular mowing. It is also important to note that the Cumberland Plain Woodland on the subject land are currently unmanaged and are adjoined by increasingly developed areas of land.

Section 9.1.1 of the BAM requires the provision of additional information regarding SAII entities that are TECs. The additional information is required to assist the consent authority to evaluate the nature of an impact on a potential entity at risk of a serious and irreversible impact. The additional information requirements are provided in **Table 20**.

9.2.2. Shale Sandstone Transition Forest

Shale Sandstone Transition Forest is confirmed as occurring within the eastern and northern parts of the subject land and will be impacted by the project. The location of the Shale Sandstone Transition Forest within the subject land is shown in **Figure 14**, and includes the woody conditions states of PCT 1395 but excludes the derived native grassland form.

Approximately 1.68 ha of Shale Sandstone has been assessed as proposed to be removed within the subject land for the purpose of this assessment. Most of this area (approximately 1.59) comprise a modified version of the community that has been subject to weed invasion and removal of shrub layer through slashing.

Section 9.1.1 of the BAM requires the provision of additional information regarding SAII entities that are TECs. The additional information is required to assist the consent authority to evaluate the nature of an impact on a

potential entity at risk of a serious and irreversible impact. The additional information requirements are provided in **Table 21**.

Table 20 Additional impact assessment provisions for Cumberland Plain Woodland

Criteria	Additional Impact Assessment Provisions	Response
1	The assessor is required to provide further information in the BDAR or BCAR regarding the impacts on each TEC at risk of an SAII. This must include the action and measures taken to avoid the direct and indirect impact on the TEC at risk of an SAII. Where these have been addressed elsewhere the assessor can refer to the relevant sections of the BDAR and BCAR.	Avoidance of impacts to Cumberland Plain Woodland is addressed in **Chapter 7**.
2	The assessor must consult the TBDC and/or other sources to report on the current status of the TEC including:	-
(a)	Evidence of reduction in geographic distribution (Principle 1, clause 6.7(2)(a) BC Regulation) as the current total geographic extent of the TEC in NSW and the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal)	The current total geographic extent of Cumberland Plain Woodland varies depending on the source interrogated. The current extent of Cumberland Plain Woodland in the TBDC is described as only less than 9% of the original extent remaining and does not include a conclusive total area for the community. BioNet Vegetation Classification Database estimates the current area of occupancy of the community based on the two PCTs (849 and 850) conforming to Cumberland Plain Woodland with available data as approximately 11,200 ha of the original 'Pre-European Extent' published on the database of 71,200 ha. It is noted however, that BioNet Vegetation Classification Database documents two further PCTs as potentially conforming to the BC Act listing of Cumberland Plain Woodland. These PCTs however, do not contain published total areas for the communities. Therefore, the BioNet total current and Pre-European Extent areas of the community cannot be accurately estimated.

Criteria	Additional Impact Assessment Provisions	Response
		Cumberland Plain Woodland is also associated with a targeted recovery plan for the Cumberland Plain that was prepared by the Department of Environment, Climate Change and Water in 2011 (DECCW 2011). This document is the currently accepted standard for the retention and recovery of TECs in the Cumberland Plain. Table 2 of the recovery plan displays an estimated current total of Cumberland Plain Woodland of 24,530 ha, however, it is reported that a small portion of this total does not meet the listing criteria for the TEC. The same table also estimates the 'Pre-1750 (ha)' total of the community at 125,449 ha being a reduction in area to current levels of approximately 20%. Of the current total area, the recovery plan reports approximately 967 ha identified as occurring within reserves. The Final Determination for Cumberland Plain Woodland (NSW Scientific Committee 2009) identifies that the TEC is restricted in geographic distribution to the Sydney Basin Bioregion and was estimated to have an extant area of approximately 11,054 ha (±1,564 ha) according to mapping by Tozer (2003), which covered the Cumberland Plain. This is reported by the final determination as being a reduction from the 'Pre-European distribution' by 8.8% (±1.2%) suggesting the Pre-European distribution of the community to cover approximately 125,613 ha. According to the Map of Critically Endangered Ecological Communities NSW Version 6 dated 25/02/2020 (DPIE 2020b) the current extent of Cumberland Plain Woodland in NSW is approximately 23,020 ha. The mapping layer Threatened Ecological Communities Greater Sydney (DPIE 2021) provides a similar estimate for the current extent of Cumberland Plain Woodland as 21,951 ha. These mapping projects are the most recent and comprehensive published mapping available and could be considered to be most accurate of the sources reviewed.

Criteria	Additional Impact Assessment Provisions	Response
		Following a review of the above information for the extent of Cumberland Plain Woodland, both current and prior to European settlement, it is clear there is some variation in area calculations. It is noted however, that it is unanimously accepted by all sources that the community has suffered extensive clearing to a level that the community requires significant external intervention to maintain and recover the community within the Sydney Basin Bioregion. The estimated reduction in the geographic extent of Cumberland Plain Woodland since 1970 is not available in the TBDC, BioNet Vegetation Classification Database, the final determination or the recovery plan, and was not identified from a search of available literature. Nonetheless, the pre-European extent of Cumberland Plain Woodland is listed as approximately 125,449 ha within the Cumberland Plain Recovery Plan (DECCW 2011). No published data was found in the literature on the 1970 extent of Cumberland Plain Woodland and an accurate estimate of the reduction in distribution between the current extent and the 1970 geographic extent cannot be provided.
(b)	The extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes (Principle 2, clause 6.7(2)(b) BC Regulation) indicated by: i. Change in community structure ii. Change in species composition iii. Disruption of ecological processes iv. Invasion and establishment of exotic species	According to the final determination for Cumberland Plain Woodland (NSW Scientific Committee. 2009), there has been a very large reduction in the ecological function of the community through processes such as: • Extensive removal of large old trees; • Tree-felling for crops and pastures; • Fragmentation of habitat; • Grazing by livestock and rabbits; • Modification of understory, to be dominated by woody exotic species;

Criteria	Additional Impact Assessment Provisions	Response
	v. Degradation of habitat; and vi. Fragmentation of habitat	• Soil chemical and structural modification associated with agricultural uses; • Changes in frequency of fire regimes; • Prevention of recruitment of species, through continued under-scrubbing and mowing; and • Reduction of understorey complexity, through the reduction of native shrub cover, resulting in degradation of habitat.
(c)	Evidence of restricted geographic distribution (Principle 3, clause 6.7(2)(c) BC Regulation), based on the TEC's geographic range in NSW according to the: i. extent of occurrence ii. area of occupancy, and **iii.** number of threat defined locations	Paragraph 11 of the Final Determination for Cumberland Plain Woodland (NSW Scientific Committee 2009) identifies that the community is restricted in geographic distribution to the Sydney Basin Bioregion, however it is noted that this is based on an estimated extant area of 2,810 km^2, which was established from outdated mapping undertaken by Tozer (2003). Based on current available information it is estimated that the current area of occupancy is between approximately 11,000 ha and 25,000 ha according to resources reviewed for Criteria 2(a). No threat defined location are specifically identified in the TBDC, however the ecological community is critically endangered across its range. According to the Final Determination (NSW Scientific Committee 2009), small, protected areas of the community exist in reserves such as Kemps Creek, Mulgoa and Windsor Downs, Scheyville National Park, and Leacock, Rouse Hill and Western Sydney Regional Parks.
(d)	Evidence that the TEC is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation)	This principle is not identified as applicable to BDARs. It is noted that the TEC does respond to management, with several successful management measures outlined in the Best Practice Guidelines for Cumberland Plain Woodland (DEC (NSW) 2005).

Criteria	Additional Impact Assessment Provisions	Response
3	Where the TBDC indicates that data is 'unknown' or 'data deficient' for a TEC for a criterion listed in Section 9.1.1(2), the assessor must record this in the BDAR.	Not applicable.
4 (a)	The impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal: i. in hectares; and ii. as a percentage of the current geographic extent of the TEC in NSW	The proposal will remove or modify approximately 0.29 ha of Cumberland Plain Woodland in the subject land. The extent of the TEC in NSW differs depending on the information source. Based on a review of vegetation mapping layers, the estimated geographic extent in NSW is between approximately 11,000 ha and 25,000 ha according to resources reviewed for Criteria 2(a). However, based on the existing literature, the lowest number quoted for the estimated geographic extent of Cumberland Plain Woodland is 11,054 ha (OEH 2011). Based on the lower of the numbers outlined above, the extent of Cumberland Plain Woodland to be impacted by the project is less than 0.003% of the current geographic extent of the TEC in NSW.
(b)	The extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by:	-
	i. Estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500m of the development footprint or equivalent area for other types of proposals	Based on the mapping of the Cumberland Plains (OEH 2013), there are approximately 4 ha of Cumberland Plain Woodland within 500 m of the subject land, occurring as scattered patches **(Figure 15**). The project is not likely to result in the isolation of an area of Cumberland Plain Woodland from other areas of the community, as there will be an area of approximately 0.20 ha of the TEC retained within the study area. Therefore, the project will result in a

Criteria	Additional Impact Assessment Provisions	Response
		reduction in the overall width of the remaining patch of Cumberland Plain Woodland in the study area, however it will not result in an increase in fragmentation of the TEC or lead to further isolation of patches of the TEC.
	ii. Describing the impacts on connectivity and fragmentation of the remaining areas of the TEC measures by:	-
	▪ Distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and	The distance between the Cumberland Plain Woodland occurrence within the subject land and the nearest discreet remnants of the TEC, which occurs directly north of the subject land on the adjacent property as well as a patch west of Annangrove Road, is approximately 0 m and 30 m respectively. The proposal will increase these distances slightly by approximately 60m and 65 m respectively, if the vegetation within the subject land is removed.
	▪ Estimated maximum dispersal distance for native flora species characteristic of the TEC, and	The main dispersal mechanisms for flora species associated with Cumberland Plain Woodland include one or a combination of the following: • animals, • wind, • water runoff, and • gravity. Eucalypts within the community are likely to rely on animal assisted dispersal by highly mobile vertebrate pollinators (birds and bats) which disperse pollen over large areas when foraging (Southerton S.G. 2003). The maximum dispersal distance for native flora species characteristic of the community is estimated to be at least 100 m and potentially much further.

Criteria	Additional Impact Assessment Provisions	Response
		Based on the estimated distances between patches of the TEC following removal of vegetation within the subject land, the retained patch within the study area will remain within the dispersal distance of surrounding patches.
	• Other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development	The occurrence of Cumberland Plain Woodland within the study area already occurs as a relatively isolated occurrence of the TEC, with other patches of the TEC occurring in surrounding areas as scattered patches. The project will therefore not increase the fragmentation of this TEC however it will reduce the extent of the TEC within the study area by ~0.29 ha.
	Describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone (s) (Section 4.3). The assessor must also include the relevant composition, structure and function condition scores for each vegetation zone.	The Cumberland Plain Woodland in the subject land corresponds to PCT 849/ Zones 1-3. The vegetation integrity score for the TEC is as follows: • Zone 1: Vegetation Integrity Score: 37.6 ○ Composition: 21.4 ○ Structure: 45.8 ○ Function: 54.1 • Zone 2: Vegetation Integrity Score: 58.0 ○ Composition: 75.9 ○ Structure: 71.3 ○ Function: 36.1 • Zone 2: Vegetation Integrity Score: 52.1 ○ Composition: 35.4 ○ Structure: 43.5 ○ Function: 91.8
5	The assessor may also provide new information that demonstrates that the principle identifying that the TEC is at risk of an SAII is not accurate.	Not applicable.

Table 21 Additional impact assessment provisions for Shale Sandstone Transition Forest

Criteria	Additional Impact Assessment Provisions	Response
1	The assessor is required to provide further information in the BDAR or BCAR regarding the impacts on each TEC at risk of an SAII. This must include the action and measures taken to avoid the direct and indirect impact on the TEC at risk of an SAII. Where these have been addressed elsewhere the assessor can refer to the relevant sections of the BDAR and BCAR.	Avoidance of impacts to Shale Sandstone Transition Forest is addressed in **Chapter 7**.
2	The assessor must consult the TBDC and/or other sources to report on the current status of the TEC including:	-
(a)	Evidence of reduction in geographic distribution (Principle 1, clause 6.7(2)(a) BC Regulation) as the current total geographic extent of the TEC in NSW and the estimated reduction in geographic extent of the TEC since 1970 (not including impacts of the proposal)	The current total geographic extent of Shale Sandstone Transition Forest varies depending on the source interrogated. The current extent of Shale Sandstone Transition Forest in the TBDC is described as 22.6% of the original extent remaining, which is stated to represent 9,950 ha. BioNet Vegetation Classification Database estimates the current area of occupancy of the community based on the PCT 1395 conforming to Shale Sandstone Transition Forest with available data as approximately 9,600 ha of the original 'Pre-European Extent' published on the database of 48,000 ha. It is noted however, that BioNet Vegetation Classification Database documents two further PCTs as potentially conforming to the BC Act listing of Shale Sandstone Transition Forest; PCTs 792 and 1281. These PCTs however, are also associated with several other TECs. Therefore, the BioNet total current and Pre-European Extent areas of the community cannot be accurately estimated.

Criteria	Additional Impact Assessment Provisions	Response
		The Final Determination for Shale Sandstone Transition Forest (NSW Scientific Committee 2014) identifies that the TEC is estimated to have an extant area of approximately 9,600 ha according to mapping by Tozer (2010(2003). This is reported by the final determination as representing 20-40% of its 'Pre-European distribution', suggesting the Pre-European distribution of the community to cover approximately 24,000-48,000 ha. Shale Sandstone Transition Forest is also associated with a targeted recovery plan for the Cumberland Plain that was prepared by the Department of Environment, Climate Change and Water in 2011 (DECCW 2011). This document is the currently accepted standard for the retention and recovery of TECs in the Cumberland Plain. Table 2 of the recovery plan displays an estimated current total of Shale Sandstone Transition Forest of 9,642 ha. The same table also estimates the 'Pre-1750 (ha)' total of the community at 43,355 ha. Of the current total area, the recovery plan reports approximately 420 ha identified as occurring within reserves. According to the Map of Critically Endangered Ecological Communities NSW Version 6 dated 25/02/2020 (DPIE 2020b) the current extent of Shale Sandstone Transition Forest in NSW is approximately 18,131 ha. The mapping layer Threatened Ecological Communities Greater Sydney (DPIE 2021) provides a similar estimate for the current extent of Shale Sandstone Transition Forest as 19,520 ha. These mapping projects are the most recent and comprehensive published mapping available and could be considered to be most accurate of the sources reviewed. Following a review of the above information for the extent of Shale Sandstone Transition Forest both current and prior to European settlement, it is clear there is some

Criteria	Additional Impact Assessment Provisions	Response
		variation in area calculations. It is noted however, that it is unanimously accepted by all sources that the community has suffered extensive clearing to a level that the community requires significant external intervention to maintain and recover the community within the Sydney Basin Bioregion. The estimated reduction in the geographic extent of the TEC since 1970 is not available in the TBDC, BioNet Vegetation Classification Database, or the final determination, and was not identified from a search of available literature. Nonetheless, the pre-European extent of Shale Sandstone Transition Forest is estimated as 24,000-48,000 ha based on the final determination. No published data was found in the literature on the 1970 extent of the TEC and an accurate estimate of the reduction in distribution between the current extent and the 1970 geographic extent cannot be provided.
(b)	The extent of reduction in ecological function for the TEC using evidence that describes the degree of environmental degradation or disruption to biotic processes (Principle 2, clause 6.7(2)(b) BC Regulation) indicated by: i. Change in community structure ii. Change in species composition iii. Disruption of ecological processes iv. Invasion and establishment of exotic species v. Degradation of habitat; and vi. Fragmentation of habitat	According to the final determination for Shale Sandstone Transition Forest (NSW Scientific Committee 2014), there has been a very large reduction in the ecological function of the community through processes such as: • Clearing associated with urban development; • Inappropriate fire regimes; • Anthropogenic climate change; • Removal of wood; • Physical damage from recreational activities; • Rubbish dumping; and • Mowing and weed invasion.

Criteria	Additional Impact Assessment Provisions	Response
(c)	Evidence of restricted geographic distribution (Principle 3, clause 6.7(2)(c) BC Regulation), based on the TEC's geographic range in NSW according to the: **i.** extent of occurrence **ii.** area of occupancy, and **iii.** number of threat defined locations	The TEC is noted as occurring on the margins of the Cumberland Plain. It is noted in the final determination as occurring within 20-40% of the TECs original extent. Based on current available information it is estimated that the current area of occupancy is between approximately 9,600 ha and 19,520 ha according to resources reviewed for Criteria 2(a). No threat defined location are specifically identified in the TBDC, however the ecological community is critically endangered across its range. According to the Final Determination (NSW Scientific Committee 2014) approximately 260 ha of the TEC is currently represented in conservation reserves, which represents <2% of its original extent.
(d)	Evidence that the TEC is unlikely to respond to management (Principle 4, clause 6.7(2)(d) BC Regulation)	This principle is not identified as applicable to BDARs. It is noted that the TEC does respond to management, with several successful restoration and rehabilitations of the TEC being completed for similar projects.
3	Where the TBDC indicates that data is 'unknown' or 'data deficient' for a TEC for a criterion listed in Section 9.1.1(2), the assessor must record this in the BDAR.	Not applicable.
4 (a)	The impact on the geographic extent of the TEC (Principles 1 and 3) by estimating the total area of the TEC to be impacted by the proposal: i. in hectares; and ii. as a percentage of the current geographic extent of the TEC in NSW	The proposal will remove or modify approximately 1.68 ha of Shale Sandstone Transition Forest in the subject land. The extent of the TEC in NSW differs depending on the information source. Based on a review of vegetation mapping layers, the estimated geographic extent in NSW is between approximately 9,600 ha and 19,500 ha according to resources reviewed for Criteria 2(a). However, based on the existing literature, the lowest number quoted for the estimated geographic extent of Shale Sandstone Transition Forest is 9,600 ha.

Criteria	Additional Impact Assessment Provisions	Response
		Based on the lower of the numbers outlined above, the extent of Shale Sandstone Transition Forest to be impacted by the project is less than 0.02% of the current geographic extent of the TEC in NSW.
(b)	The extent that the proposed impacts are likely to contribute to further environmental degradation or the disruption of biotic processes (Principle 2) of the TEC by:	-
	i. Estimating the size of any remaining, but now isolated, areas of the TEC; including areas of the TEC within 500m of the development footprint or equivalent area for other types of proposals	Based on the mapping of the Cumberland Plains (OEH 2013), there are approximately 10 ha of Shale Sandstone Transition Forest within 500 m of the subject land, occurring mainly in association with Second Ponds Creek (**Figure 15**). The project is not likely to result in the isolation of an area of Shale Sandstone Transition Forest from other areas of the community, as there will be an area of approximately 0.30 ha of the TEC retained within the study area, which will be connected with the occurrences of the TEC outside of the study area. Therefore, the project will result in a reduction in the overall width of the remaining patch of Shale Sandstone Transition Forest in the study area, however it will not result in an increase in fragmentation of the TEC or lead to further isolation of patches of the TEC.
	ii. Describing the impacts on connectivity and fragmentation of the remaining areas of the TEC measures by:	-
	▪ Distance between isolated areas of the TEC, presented as the average distance if the remnant is retained AND the average distance if the remnant is removed as proposed, and	The distance between the Shale Sandstone Transition Forest occurrence within the subject land and the nearest discreet remnants of the TEC, which occurs directly east of the subject land as part of the same connected patch, is 0m. The retained patch of the TEC within the study area will continue to be directly connected to this surrounding

Criteria	Additional Impact Assessment Provisions	Response
		patch, hence there will be no change in the average distance to the nearest remnant of Shale Sandstone Transition Forest if the remnant in the subject land is removed. Although the distance to a patch of the TEC on the western side of Annangrove Road will increase from approximately 330m to 380, other patches of the TEC outside the subject land occur at less distance to this specific patch compared to occurrences in the subject land, which will not change if the remnant is removed in the subject land.
	▪ Estimated maximum dispersal distance for native flora species characteristic of the TEC, and	The main dispersal mechanisms for flora species associated with Shale Sandstone Transition Forest include one or a combination of the following: • animals, • wind, • water runoff, and • gravity. Eucalypts within the community are likely to rely on animal assisted dispersal by highly mobile vertebrate pollinators (birds and bats) which disperse pollen over large areas when foraging (Southerton S.G. 2003). The maximum dispersal distance for native flora species characteristic of the community is estimated to be at least 100 m and potentially much further.
	iii. Other information relevant to describing the impact on connectivity and fragmentation, such as the area to perimeter ratio for remaining areas of the TEC as a result of the development	The subject land is part of a larger patch of remnant vegetation, linking up with the vegetated riparian corridor of Second Ponds Creek. The project is not considered to significantly affect the connectivity of the TEC, as the vegetation proposed for removal occurs on the edge of a larger patch of the TEC (and other vegetation communities).
	Describing the condition of the TEC according to the vegetation integrity score for the relevant vegetation zone (s) (Section 4.3). The assessor must also include the relevant composition,	The Shale Sandstone Transition Forest in the subject land corresponds to PCT 1395/ Zones 4-5. The vegetation integrity score for the TEC is as follows: • Zone 4: Vegetation Integrity Score: 80.1

Criteria	Additional Impact Assessment Provisions	Response
	structure and function condition scores for each vegetation zone.	○ Composition: 82.0 ○ Structure: 78.9 ○ Function: 79.5 • Zone 5: Vegetation Integrity Score: 47.2 ○ Composition: 22.3 ○ Structure: 67.1 ○ Function: 70.1
5	The assessor may also provide new information that demonstrates that the principle identifying that the TEC is at risk of an SAII is not accurate.	Not applicable.

9.3. Impacts that Require an Offset

9.3.1. Native Vegetation

In accordance with the BAM, the project requires offsets for the clearing of native vegetation as the following criteria are met:

- A vegetation zone that has a vegetation integrity score ≥15 where the PCT is representative of an EEC or CEEC.

The PCTs and vegetation zones requiring offsets are documented in **Table 22**. These areas are mapped in **Figure 16**.

Table 22 Summary of impact to native vegetation requiring an offset

Vegetation Zone	PCT	Condition Name	Area (ha)	Patch Size Class	Vegetation Integrity Score	Credit
1	849: Cumberland shale plains woodland	Mown	0.15	>100	37.6	4
2	849: Cumberland shale plains woodland	Exotic	0.07	>100	58.0	3
3	849: Cumberland shale plains woodland	DNG	0.06	>100	52.1	2
4	1395: Cumberland Shale – Sandstone Ironbark Forest	Intact	0.08	>100	80.1	4
5	1395: Cumberland Shale – Sandstone Ironbark Forest	Slashed	1.59	>100	47.2	47
6	1395: Cumberland Shale – Sandstone Ironbark Forest	DNG	0.05	>100	43.2	1
7	835: Cumberland Riverflat Forest	Moderate	0.01	>100	82.6	1

9.3.2. Threatened Species

In accordance with the BAM, the project requires offsets for the clearing of species credit species habitat. The species requiring an offset is documented in **Table 23**, and the areas subject to threatened species offsetting is shown in **Figures 9-10**.

Table 23 Threatened species requiring an offset

Scientific Name	Common Name	Biodiversity Risk Weighting	Area (ha)	Credits
Meridolum corneovirens	Cumberland Plain Land Snail	2.00	1.92	46
Myotis macropus	Southern Myotis	2.00	2.03	49

9.4. Impacts that do not Require an Offset

No areas of impacts that do not require an offset have been identified.

9.5. Impacts that do not Require Further Assessment

All areas identified as 'Cleared', 'Exotic Vegetation', and 'Dam' that occur within the subject land do not require further assessment. These areas comprise approximately 0.74 ha, as shown on **Figure 16**.

9.6. Application of the No Net Loss Standard

The BAM sets a standard that will result in no net loss of biodiversity values where the impacts on biodiversity values are avoided, minimised and mitigation, and all residual impacts are offset by retirement of the required number of biodiversity credits.

The ecosystem credit requirement for the project is summarised in **Table 24**.

A credit summary report from the BAMC has been included in **Appendix C,** including the 'like for like' offsetting options for the ecosystem credits and species credits.

Table 24. Summary of credit liability

Entity	Status	Credits Required
PCT 835: Cumberland Riverflat Forest	EEC – BC Act CEEC – EPBC Act	1
PCT 849: Cumberland Shale Plains Woodland	CEEC – BC Act CEEC – EPBC Act	9
PCT 1395: Cumberland Shale – Sandstone Ironbark Forest	CEEC – BC Act CEEC – EPBC Act	51
PCT 1395: Cumberland Shale – Sandstone Ironbark Forest	Not listed	1
Cumberland Plain Land Snail	E – BC Act	46
Southern Myotis	V – BC Act	49

CEEC – Critically Endangered Ecological Community, EEC – Endangered Ecological Community, E – Endangered, V - Vulnerable

10. Conclusion

This BDAR has been prepared to assess the impacts of the proposed development on biodiversity values, in accordance with the BAM. The project involves the development of a mixed use/bulky goods commercial centre.

Native vegetation occurring within the subject land includes occurrences of Cumberland Plain Woodland CEEC (approximately 0.29 ha) and Shale Sandstone Transition Forest (approximately 1.65 ha), as well as a small area of non-listed derived native grassland. The remainder of the subject land comprises areas of exotic mown lawn and smaller areas of exotic woody vegetation as well as an artificial dam, however the ecological value associated with this vegetation is low.

As the project includes the removal of an area of native vegetation, offsets are required in the form of ecosystem credits. This assessment indicates that the removal of the native vegetation within the subject land required a total of 1 ecosystem credit of PCT 835, 9 ecosystem credits of PCT 849 and 52 ecosystem credits of PCT 1395.

No threatened flora species that are considered as species credit species were recorded within the subject land However, one threatened fauna species credit species was recorded within the subject land by Keystone Ecological, and two additional species were assumed present. As a result, 95 species credits are required to be offset for the project for impacts on the Cumberland Plain Land Snail and Southern Myotis.

Measures to avoid and minimise impacts to the biodiversity values of the study area have been implemented and include detailed consideration of the project location and design. However, when considering the requirements of achieving a feasible development, as well as the relatively small size of the site and the locations of the TEC occurrences, opportunities to avoid all impacts on Cumberland Plain Woodland and Shale Sandstone Transition Forest TECs are limited. Nonetheless, approximately 0.50 ha of the TECs will be retained and managed, with an additional 0.08 ha to replanted within the areas to be managed under a Vegetation Management Plan.

Further impacts of the project may entail potential indirect impacts, including inadvertent impacts on adjacent habitat and reduced viability of adjacent habitat due to noise, dust or light spill, and prescribed impacts such as impacts to non-native vegetation and connectivity of different areas of habitat that facilitates movement across a species range have been considered.

A suite of mitigation measures is proposed to minimise and manage the impacts to biodiversity values, such as, tree protection measures, weed management, pre-clearance surveys, sediment management and nest box installation. Restoration of retained areas of TECs are proposed to be managed and protected under a Vegetation Management Plan.

With the implementation of the proposed mitigation measures and the offsetting described previously, it is considered that the impacts of this project on biodiversity on Cumberland Plain Woodland and Shale Sandstone Transition Forest, will be limited and retained vegetation will be subject to active management. Although the occurrences of the TECs within the study area will be reduced as part of the project, an overall area of 0.58 ha will be set aside and managed under a Vegetation Management Plan to ensure that occurrences of Cumberland Plain Woodland and Shale Sandstone Transition Forest will persist within the study area in the future.

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APPENDIX A :
BAM Plot Data

Table 25 BAM Plot data used in the BAMC

plot	pct	area	patchsize	conditionclass	Easting	Northing	Bearing	compTree	compShrub	compGrass	compForbs	compFerns	compOther	strucTree	strucShrub	strucGrass	strucForbs	strucFerns	strucOther	funLargeTrees	funHollowTrees	funLitterCover	funLitterFallenLogs	funTreeSems20to30	funTreeSems30to20	funTreeSems20to30	funTreeSems30to50	funTreeSems50to80	funTreeRegen	funHighThreatExotic
1	849	0.15	101	Mown	306829	6272633	78	2	1	4	4	0	2	12	0.3	70.3	0.4	0	0.2	1	0	28.4	3	1	1	1	1	1	1	10.5
2	849	0.07	101	Exotic	306833	6272650	133	4	1	8	13	1	4	34.2	0.1	69.4	1.5	0.1	0.4	0	0	57	14	1	1	1	1	0	0	2.5
3	849	0.06	101	DNG	306791	6272611	126	4	1	6	5	0	1	36.1	0.2	21.3	0.6	0	0.1	4	1	82	20	1	1	1	1	1	1	19.0
4	1395	0.08	101	Intact	306975	6272502	56	4	6	8	9	1	3	30.75	12.2	96.2	0.9	0.1	1.2	2	0	59	55	1	1	1	1	1	0	1.0
5	1395	1.57	101	Slashed	306963	6272620	51	1	0	6	4	0	1	30	0	72.4	0.6	0	0.1	7	0	35	10	0	0	0	1	1	1	25.4
6	1395	0.05	101	DNG	306869	6272661	131	3	0	7	7	1	2	6.1	0	70.1	2.6	0.1	0.2	0	0	23	5	0	0	1	1	0	1	17.3
7	835	0.01	101	Moderate	307050	6272628	200	6	4	7	9	1	5	28.3	3.2	42.1	14.41	0.1	31.21	4	1	67	10	1	1	1	1	1	1	11.1

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APPENDIX B :
Field Datasheets

Date: 12/11/2021	Project #: 20236	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: BE, JR, CE	Plot ID: P 1	Start:	315			
Photos: 146 - 149	Orientation (°): 78	End:	316			Sheet: 1 of 1
Dimensions: □20x20, □10x40	PCT: CPW - DNG					

	Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1	Paspalum dilatatum	5	500				
2	Micro. stip stip.	65	6500				
3	E. cyrostis curvula	3	2000				
4	Dichondra repens	0.1	30				
5	Eue. tenef.	10	6				
6	Verbena rigida	0.2	30				
7	Senecio madagasc.	0.1	10				
8	Plantago lanc.	0.5	100				
9	Byttlosp. racemos.	0.2	20				
10	Hypericum perfor.	2	200				
11	Solanum sisymbrii	0.1	5				
12	Avena barb.	5	500				
13	Olea europ. cuspi.	1	3				
14	Sida rhomb.	0.1	20				
15	Glycine tabacina	0.1	30				
16	Acacia parra	2	15				
17	Coostrum parqui.	0.2	1				
18	cirsium vulgare	0.7	3				
19	Gamochaeta americ	0.1	20				
20	Oxalis perennans	0.1	10				
21	Bursaria spinosa	0.3	3				
22	Desmodium varians	0.1	5				
23	Lolium perenne	1	100				
24	Bromus cath.	1	100				
25	Cynodon dactylon	5	500				
26	Solanum pinnatifl.	0.1	1				
27	Verbena bonariensis	0.1	2				
28	Hypochaeris radicata	0.1	10				
29	Paspalidium distans	0.1	10				
30	Cenchrus clandi.	0.2	30				
31	Hypochaeris micro.	0.1	2				
32	Modiola carol	0.1	1				
33	Rumex long	0.1	1				
34							
35							
36							
37							
38							
39							
40							

Cover (%): **0.1, 0.2, 0.3**...etc. up to **1, 2, 3**...etc. up to **10, 15, 20, 25**...etc. up to **100**
Abundance (Count): **1, 2, 3**... up to **10, 20, 30**...up to **100, 200**... up to **1,000**...etc.

GF Group: TG=Tree, **SG**=Shrub, **GG**=Grass, **FG**=Forb, **EG**=Fern, **OG**=Other
Stratum: C = Canopy, **SC** = Sub-canopy, **S** = Shrub, **G** = Ground

Cover Note: *0.1% = approx 63 cm² or circle with 71cm diameter, 0.5% = approx 1.4m², 1% = approx 2m², 5% = approx 4.5m², 25% = approx 10m²*

Date: 12/11/2021	Project #: 20236	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: BF, SE, DR	Plot ID: P 2	Start:	317			
Photos: 150 - 153	Orientation (°): 133	End:	315°			Sheet: 1 of 2
Dimensions: ☑20x20, □10x40	PCT: CPW-Slabbed.					

	Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1	Olea europea subsp cusp.	1	6				
2	Eucalyptus tereticornis	30	20				
3	Microlaena stip stip	65	6500				
4	Paspalum dilatatum	2	200				
5	Dichondra repens	0.2	200				
6	Glycine tabacina	0.1	50				
7	D. Echelaehne micrantha	1	100				
8	Cirsium vulgare	0.1	3				
9	Hypericum gramineum	0.1	5				
10	Glycine micro.	0.1	20				
11	Hypericum perforatum	0.1	20				
12	Cynodon dactylon	1	100				
13	Paspalidium distans	0.1	30				
14	Solenogyne bellioides	0.1	5				
15	Alisma vagans	2	200				
16	Hyoch. radic.	0.1	10				
17	Richardia stell	0.1	5				
18	Eragrostis curvula	0.2	20				
19	Centaurium tenuiflor.	0.1	10				
20	Lysimachia arvensis	0.1	10				
21	Lolium perenne	0.1	20				
22	Sonchus oleraceus	0.1	1				
23	Phyllanthus virgatus	0.1	2				
24	Anthoseahne Scab.	0.1	5				
25	Desmodium varians	0.1	2				
26	Diamella sng.	0.1	5				
27	Rutidosperma calamos.	0.1	20				
28	Solanum prinoph.	0.2	5				
29	Schoenus apogon	0.1	10				
30	Gamochaeta americ.	0.1	5				
31	Opercularia diphylla	0.1	1				
32	Medicago polym.	0.1	5				
33	Paraneura micro	0.1	10				
34	Centella asiatica	0.1	20				
35	Grevillea robusta	0.1	1				
36	Acacia parra	0.1	1				
37	Stalip perennans	0.1	10				
38	Bursaria spinosa	0.1	2				
39	Veronica plebeia	0.1	1				
40	Lagenophora stip.	0.1	10				

Cover (%): **0.1, 0.2, 0.3**...etc. up to **1, 2, 3**...etc. up to **10, 15, 20, 25**...etc. up to **100**
Abundance (Count): **1, 2, 3**... up to **10, 20, 30**...up to **100, 200**... up to **1,000**...etc.

GF Group: TG=Tree, **SG**=Shrub, **GG**=Grass, **FG**=Forb, **EG**=Fern, **OG**=Other
Stratum: C = Canopy, **SC** = Sub-canopy, **S** = Shrub, **G** = Ground

Cover Note: 0.1% = approx 63 cm² or circle with 71cm diameter, 0.5% = approx 1.4m², 1% = approx 2m², 5% = approx 4.5m², 25% = approx 10m²

Date: 12/11/2021	Project #: 20236	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: ___,___,___	Plot ID: P 2__	Start:	____	_____	_____	
Photos: ____-____	Orientation (°): ___	End:	____	_____	_____	Sheet: 2 of 2
Dimensions: □20x20, □10x40	PCT: CAW - Slatted					

	Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1	Solanum pseudocap.	0.1	3				
2	Asparagus asparagoides	0.1	5				
3	Cheilanthes sieberi	0.1	5				
4	Hypochaeris micr.	0.1	2				
5	Clematis aligc. glyc	0.1	1				
6	Brunoniella australis	0.1	3				
7	Senecio mad.	0.1	2				
8	Eucalyptus moluc.	4	2				
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
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29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							

Cover (%): **0.1, 0.2, 0.3**...etc. up to **1, 2, 3**...etc. up to **10, 15, 20, 25**...etc. up to **100**
Abundance (Count): **1, 2, 3**... up to **10, 20, 30**...up to **100, 200**... up to **1,000**...etc.

GF Group: TG=Tree, **SG**=Shrub, **GG**=Grass, **FG**=Forb, **EG**=Fern, **OG**=Other
Stratum: C = Canopy, **SC** = Sub-canopy, **S** = Shrub, **G** = Ground

Cover Note: *0.1% = approx 63 cm² or circle with 71cm diameter, 0.5% = approx 1.4m², 1% = approx 2m², 5% = approx 4.5m², 25% = approx 10m²*

Date: 15/11/2021	Project #: 20236	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: BF, JR, CE	Plot ID: P 3	Start:	318	319	------	
Photos: 154 - 157	Orientation (°): 126	End:	324	320	------	Sheet: 1 of 1

Dimensions: □20x20, □10x40 **PCT:** CPW – Not slashed – olive understor.

	Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1	Glyc micro	0.1	20				
2	Oplismenus aem.	0.1	20				
3	Olea europea cusp.	45	2000				
4	Micro stip stip	15	1500				
5	Eucalypt. moluc.	25	6				
6	Sida rhomb	1	200				
7	Brunon aust.	0.1	30				
8	Asparagus aspar.	0.2	10				
9	Paspalum dil.	1	100				
10	Ehrharta erecta	15	1500				
11	Burs. spinos.	0.2	4				
12	Oxalis perenn	0.1	30				
13	Entolasia marg	5	500				
14	Solanum prinoph	0.2	10				
15	Setaria parv.	0.2	20				
16	Eragrost. curvula	1	50				
17	Senecio madagasc.	0.2	20				
18	Paspalidium dist.	1	106				
19	Lysimach arvensis	0.2	50				
20	~~"Pittosporum-like fruit exotic"~~ = Pittosp. rhombifol.	1	1				
21	Cirsium vulgare	0.1	2				
22	Asparagus aethiop.	0.2	1				
23	Acacia sericif.	0.3	20				
24	Eucalyptus tereti.	10	3				
25	Gahnia aspera	0.1	1				
26	Ligustrum lucidum	0.75	1				
27	Carex inversa	0.1	5				
28	Dianella long.	0.1	2				
29	Hypericum perf.	0.1	10				
30	Centella asiatica	0.1	5				
31	Plantago lanc.	0.1	10				
32	Cupaniopsis anacard.	0.1	1				
33	Ligust sinense	0.5	1				
34							
35							
36							
37							
38							
39							
40							

Cover (%): **0.1, 0.2, 0.3**...etc. up to **1, 2, 3**...etc. up to **10, 15, 20, 25**...etc. up to **100** **GF Group: TG**=Tree, **SG**=Shrub, **GG**=Grass, **FG**=Forb, **EG**=Fern, **OG**=Other
Abundance (Count): **1, 2, 3**... up to **10, 20, 30**...up to **100, 200**... up to **1,000**...etc. **Stratum: C** = Canopy, **SC** = Sub-canopy, **S** = Shrub, **G** = Ground

Cover Note: 0.1% = approx 63 cm² or circle with 71cm diameter, 0.5% = approx 1.4m², 1% = approx 2m², 5% = approx 4.5m², 25% = approx 10m²

Date: 12/11/2021	Project #: 20236	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: BE, SR, CE	Plot ID: P 4	Start:	321	------	------	
Photos: 153 - 161	Orientation (°): 56	End:	322	------	------	Sheet: 1 of 2
Dimensions: □20x20, □10x40	PCT: SSTF - Intact					

Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1 Ligust sinense	0.2	1				
2 Eucalyptus teret.	30	20				
3 Leucopogon juniperin.	3	15				
4 Imperata cyl.	20	2000				
5 Bursaria spin	1	5				
6 Hibbertia diffusa	0.2	10				
7 Clematis glyc. glyc.	1	20				
8 Ozothamnus diosmifol.	5	20				
9 Gahnia aspera	20	200				
10 Acacia parra	0.25	1				
11 Entolas. mars.	5	500				
12 Olea europ. cusp.	0.3	2				
13 Senecio madag.	0.1	3				
14 Conyza sumatr.						
15 Micro stip stip.	45	4500				
16 Solanum prinoph.	0.1	5				
17 Lantana camara	0.25	3				
18 Aira caryoph.	0.1	2				
19 Passiflora suberosa	0.1	1				
20 Lepidosp. laterale	1	100				
21 Glycine micro.	0.1	10				
22 Lobelia purpur.						
23 Brunoniella micro.	0.1	20				
24 Cheilanthes sieber.	0.1	20				
25 Gamochaeta americ.	0.1	10				
26 Acacia floribunda	1	5				
27 Commelina cyanea	0.1	5				
28 Pomax umbellata	0.1	10				
29 Cirsium vulgare	0.2	2				
30 Exocarpos stricta	2	7				
31 Lobelia purpur.	0.1	50				
32 Oxalis perennans	0.1	10				
33 Veronica plebeia	0.1	20				
34 Solanum sisymbr.	0.1	1				
35 Echinopogon caespit.	0.1	10				
36 Cassinia parvif. Vittat.	0.1	1				
37 Digitaria parvif.	5	500				
38 Arthropodium floribund.	0.3	1				
39 Glycine clandest.	0.1	2				
40 Oplismenus aemulus	0.1	20				

Cover (%): 0.1, 0.2, 0.3...etc. up to 1, 2, 3...etc. up to 10, 15, 20, 25... etc. up to 100 | GF Group: TG=Tree, SG=Shrub, GG=Grass, FG=Forb, EG=Fern, OG=Other

Abundance (Count): 1, 2, 3... up to 10, 20, 30...up to 100, 200... up to 1,000...etc. | Stratum: C = Canopy, SC = Sub-canopy, S = Shrub, G = Ground

Cover Note: 0.1% = approx 63 cm² or circle with 71cm diameter, 0.5% = approx 1.4m², 1% = approx 2m², 5% = approx 4.5m², 25% = approx 10m²

Date: 12/11/2021	Project #: 20236	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: __, __, __	Plot ID: P 4	Start:	____	______	______	
Photos: ____-____	Orientation (°): ___	End:	____	______	______	Sheet: 2 of 2
Dimensions: □20x20, □10x40	PCT:					

	Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1	Hypochaeris radic.	0.1	3				
2	Cestrum parqui	0.2	1				
3	Ehrharta erecta	0.1	5.				
4	Einadia hastata	0.1	1				
5	Conyza sumatrensis	0.1	1				
6	Notelaea long	0.2	1				
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							

Cover (%): **0.1, 0.2, 0.3**...etc. up to **1, 2, 3**...etc. up to **10, 15, 20, 25**...etc. up to **100**	**GF Group**: **TG**=Tree, **SG**=Shrub, **GG**=Grass, **FG**=Forb, **EG**=Fern, **OG**=Other
Abundance (Count): **1, 2, 3**... up to **10, 20, 30**...up to **100, 200**... up to **1,000**...etc.	**Stratum**: **C** = Canopy, **SC** = Sub-canopy, **S** = Shrub, **G** = Ground

Cover Note: *0.1% = approx 63 cm² or circle with 71cm diameter, 0.5% = approx 1.4m², 1% = approx 2m², 5% = approx 4.5m², 25% = approx 10m²*

Date: 12/11/2021	Project #: 22236	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: BE, CE, JR	Plot ID: P 5	Start:	323			
Photos: 162 - 164	Orientation (°): 51	End:	324			Sheet: 1 of 1
Dimensions: □20x20, □10x40	PCT: SSTF - Slashed understory					

	Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1	Microlaena stip. stip	70	8000				
2	Oestrum parqui	10	200				
3	Verbena rigida	0.1	10				
4	Cirsium vulgare	0.25	5				
5	Modiola caroliniana	0.2	30				
6	Sida rhomb.	0.2	50				
7	Conyza sumatr.	1	500				
8	Commelina cyanea	0.1	30				
9	Senecio madag.	0.1	20				
10	Hypochaeris arvensis	0.5	200				
11	Sonchus asper	0.1	10				
12	Glycine tabacina	0.1	20				
13	Juncus bufonius	0.1	5				
14	Ehrharta erecta	10	1000				
15	Einadia trigonos	0.25	100				
16	Gamochaeta americ.	0.1	30				
17	Verbena bonariensis	0.1	5				
18	Cyperus gracilis	0.1	50				
19	Asparagus asparagoides	0.2	80				
20	Olea europea cuspidata	10	30				
21	Cyperus eragrostis	0.1	3				
22	Avena sterilis	0.2	10				
23	Juncus usitatus	0.2	5				
24	Cynodon dactylon	1	100				
25	Cirsium vulgare	0.1	10				
26	Eragrostis curvula	5.0	500				
27	Oxalis perennans	0.1	20				
28	Eucalyptus tereticornis	30	5				
29	Oplismenus aemulus	1	60				
30	Facelis retusa	0.1	10				
31	Hypochaeris radic.	0.1	5				
32	Wahlenbergia gracilis	0.1	2				
33							
34							
35							
36							
37							
38							
39							
40							

Cover (%): **0.1, 0.2, 0.3**...etc. up to **1, 2, 3**...etc. up to **10, 15, 20, 25**...etc. up to **100**
Abundance (Count): **1, 2, 3**... up to **10, 20, 30**...up to **100, 200**... up to **1,000**...etc.

GF Group: TG=Tree, **SG**=Shrub, **GG**=Grass, **FG**=Forb, **EG**=Fern, **OG**=Other
Stratum: C = Canopy, **SC** = Sub-canopy, **S** = Shrub, **G** = Ground

Cover Note: *0.1% = approx 63 cm² or circle with 71cm diameter, 0.5% = approx 1.4m², 1% = approx 2m², 5% = approx 4.5m², 25% = approx 10m²*

Date: 12/11/2021	Project #: 20236	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: BE, CE, JR	Plot ID: P _6_	Start:	325			
Photos: 165 - 168	Orientation (°): 131	End:	326			Sheet: 1 of __
Dimensions: □20x20, □10x40	PCT: SSTF - grassland					

#	Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1	Eucalyptus crebra	5	1				
2	Micro stip stip	60	6000				
3	Eucalyptus tereti	1	4				
4	Plantago lanceolata	0.1	30				
5	Paspalidium distans	2	500				
6	Dichondra repens	0.1	50				
7	Bothriochloa macra	1	100				
8	Senecio madagasc.	0.1	20				
9	Paspalum dilatatum	2	200				
10	Modiola carolin.	0.1	10				
11	Acacia parra.	0.1	2				
12	Eragrostis brownii	1	100				
13	Cheilanthes sieberi	0.1	10				
14	Briza subaristata	10	1000				
15	Richardia stellaris	0.1	20				
16	Cynodon dactylon	5	500				
17	Gamochaeta americana	0.1	10				
18	Glycine tabacina	0.1	30				
19	Lysimachia arvensis	0.1	20				
20	Desmodium varians	0.1	3				
21	Oxalis perennans	0.1	10				
22	Sida rhombifolia	0.1	50				
23	~~Cheilanthes sieberi~~						
24	Eragrostis curvula	5	500				
25	Hypericum perforatum	0.2	50				
26	Wahlenbergia gracilis	0.1	10				
27	Einadia trigonos	0.1	20				
28	Eragrostis leptostachya	1	100				
29	Lagenophora stipitata	0.1	3				
30	Cathrochaeta pagilvarium	0.1	5				
31	Solanum sisymb	0.1	1				
32	Olea europaea subsp. cusp.	0.1	1				
33	Cyperus grac.	0.1	10				
34	Lobelia purpurascens	0.1	10				
35	Solanum prinophyll.	2.0	0				
36							
37							
38							
39							
40							

Cover (%): **0.1, 0.2, 0.3**...etc. up to **1, 2, 3**...etc. up to **10, 15, 20, 25**...etc. up to **100**	**GF Group: TG**=Tree, **SG**=Shrub, **GG**=Grass, **FG**=Forb, **EG**=Fern, **OG**=Other
Abundance (Count): **1, 2, 3**... up to **10, 20, 30**...up to **100, 200**... up to **1,000**...etc.	**Stratum: C** = Canopy, **SC** = Sub-canopy, **S** = Shrub, **G** = Ground

Cover Note: *0.1% = approx 63 cm² or circle with 71cm diameter, 0.5% = approx 1.4m², 1% = approx 2m², 5% = approx 4.5m², 25% = approx 10m²*

Date: 12/11/2021	Project #: 20236	cumberland ecology
Personnel: CE.BE.JR	Plot ID: P 01	

Large Trees / Stem Classes / Hollows

DBH[1]	Stem Class Present[2]	Stem Class Count[2, 3]	Hollow-bearing Tree Count[4]
80+ cm	☐ Yes ☐ No		
50-79 cm	☑ Yes ☐ No	1	
30-49 cm	☑ Yes ☐ No		
20-29 cm	☑ Yes ☐ No		
10-19 cm	☑ Yes ☐ No		
5-9 cm	☑ Yes ☐ No		
<5 cm	☑ Yes ☐ No		
Are there hollow-bearing trees within the zone?[5]			☐ Yes ☐ No

1. DBH measured at 1.3m above ground.
2. Only living, native, tree species are to be recorded.
3. Exact stem counts must be provided for stems in the following classes: 50-79cm and 80+ cm (or additional classes for a PCT which has a smaller large tree threshold – e.g. heathlands). Include estimates of stem counts of other classes where there is extensive regeneration.
4. Hollow-bearing trees include living and dead native species allocated to the tree and shrub growth form groups. Hollow-bearing trees rooted within the plot with hollows that are visible from the ground must be included.
5. Where there are no hollow-bearing trees within a plot, but they are present within the vegetation zone, a value of 1 is to be entered in the BAMC.

Logs

Length of logs[6, 7]	(≥10cm diameter, >50cm in length)
Tally	2+1
Total (m)	

6. Dead native and exotic species recorded.
7. Logs must be entirely or partially on the ground within the plot, and only the length within the plot is recorded.

Subplots (1x1m)

Subplot	Litter Cover (%)[9, 10]	Bare Ground Cover (%)	Cryptogram Cover (%)	Rock Cover (%)
1 x 1m Score[8]	12 15 25 30 40	5 0 0 0 15	0 0 0 0 0	0 0 0 0 0
Average Score				

8. Scores must be provided for litter cover. Include scores for other variables where supplementary information is required.
9. Litter includes leaves, seeds, twigs, branchlets and branches (<10cm diameter) from native and exotic species.
10. Must include all plant material detached from a plant and forms part of the litter layer on the ground surface. Material that is not detached is assessed as growth form foliage cover.

Composition and Structure Summary

Attribute		Value
Count of Native Richness (Composition)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Native Cover (Structure)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed Cover		

Additional Notes

DNH FROM 849, WITH TREES FALLING INTO PLOT

Date: 12/11/2021	Project #: 2023G	cumberland ecology
Personnel: CE, BF, JR	Plot ID: P 02	

Large Trees / Stem Classes / Hollows

DBH[1]	Stem Class Present[2]	Stem Class Count[2, 3]	Hollow-bearing Tree Count[4]
80+ cm	☐ Yes ☐ No		
50-79 cm	☐ Yes ☐ No		
30-49 cm	☑ Yes ☐ No		
20-29 cm	☑ Yes ☐ No		
10-19 cm	☑ Yes ☐ No		
5-9 cm	☑ Yes ☐ No		
<5 cm	☐ Yes ☐ No		
Are there hollow-bearing trees within the zone?[5]			☐ Yes ☐ No

1. DBH measured at 1.3m above ground.
2. Only living, native, tree species are to be recorded.
3. Exact stem counts must be provided for stems in the following classes: 50-79cm and 80+ cm (or additional classes for a PCT which has a smaller large tree threshold – e.g. heathlands). Include estimates of stem counts of other classes where there is extensive regeneration.
4. Hollow-bearing trees include living and dead native species allocated to the tree and shrub growth form groups. Hollow-bearing trees rooted within the plot with hollows that are visible from the ground must be included.
5. Where there are no hollow-bearing trees within a plot, but they are present within the vegetation zone, a value of 1 is to be entered in the BAMC.

Logs

Length of logs[6, 7]	(≥10cm diameter, >50cm in length)
Tally	1 + 13
Total (m)	

6. Dead native and exotic species recorded.
7. Logs must be entirely or partially on the ground within the plot, and only the length within the plot is recorded.

Subplots (1x1m)

Subplot	Litter Cover (%)[9, 10]	Bare Ground Cover (%)	Cryptogram Cover (%)	Rock Cover (%)
1 x 1m Score[8]	50 40 60 65 70	0 20 0 0 0	0 0 0 0 0	0 0 0 0 0
Average Score				

8. Scores must be provided for litter cover. Include scores for other variables where supplementary information is required.
9. Litter includes leaves, seeds, twigs, branchlets and branches (<10cm diameter) from native and exotic species.
10. Must include all plant material detached from a plant and forms part of the litter layer on the ground surface. Material that is not detached is assessed as growth form foliage cover.

Composition and Structure Summary

Attribute		Value
Count of Native Richness (Composition)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Native Cover (Structure)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed Cover		

Additional Notes

Date: 12/11/2021	Project #: 20236	cumberland ecology
Personnel: CE, BE, JR	Plot ID: P 3	

Large Trees / Stem Classes / Hollows

DBH[1]	Stem Class Present[2]	Stem Class Count[2, 3]	Hollow-bearing Tree Count[4]
80+ cm	☑ Yes ☐ No	1	
50-79 cm	☑ Yes ☐ No	III	1
30-49 cm	☑ Yes ☐ No		
20-29 cm	☑ Yes ☐ No		
10-19 cm	☑ Yes ☐ No		
5-9 cm	☑ Yes ☐ No		
<5 cm	☑ Yes ☐ No		
Are there hollow-bearing trees within the zone?[5]			☑ Yes ☐ No

1. DBH measured at 1.3m above ground.
2. Only living, native, tree species are to be recorded.
3. Exact stem counts must be provided for stems in the following classes: 50-79cm and 80+ cm (or additional classes for a PCT which has a smaller large tree threshold – e.g. heathlands). Include estimates of stem counts of other classes where there is extensive regeneration.
4. Hollow-bearing trees include living and dead native species allocated to the tree and shrub growth form groups. Hollow-bearing trees rooted within the plot with hollows that are visible from the ground must be included.
5. Where there are no hollow-bearing trees within a plot, but they are present within the vegetation zone, a value of 1 is to be entered in the BAMC.

Logs

Length of logs[6, 7]	(≥10cm diameter, >50cm in length)
Tally	1 + 1.5 + 2.5 + 15
Total (m)	

6. Dead native and exotic species recorded.
7. Logs must be entirely or partially on the ground within the plot, and only the length within the plot is recorded.

Subplots (1x1m)

Subplot	Litter Cover (%)[9, 10]	Bare Ground Cover (%)	Cryptogram Cover (%)	Rock Cover (%)
1 x 1m Score[8]	100 100 70 70 70	0 0 0 0 0	0 0 0 0 0	0 0 0 0 0
Average Score				

8. Scores must be provided for litter cover. Include scores for other variables where supplementary information is required.
9. Litter includes leaves, seeds, twigs, branchlets and branches (<10cm diameter) from native and exotic species.
10. Must include all plant material detached from a plant and forms part of the litter layer on the ground surface. Material that is not detached is assessed as growth form foliage cover.

Composition and Structure Summary

Attribute		Value
Count of Native Richness (Composition)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Native Cover (Structure)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed Cover		

Additional Notes

Date: 12/11/2021	Project #: 20236	cumberland ecology
Personnel: CE, BF, JR	Plot ID: P 04	

Large Trees / Stem Classes / Hollows

DBH[1]	Stem Class Present[2]	Stem Class Count[2, 3]	Hollow-bearing Tree Count[4]
80+ cm	☐ Yes ☐ No		
50-79 cm	☑ Yes ☐ No	11	
30-49 cm	☑ Yes ☐ No		
20-29 cm	☑ Yes ☐ No		
10-19 cm	☑ Yes ☐ No		
5-9 cm	☑ Yes ☐ No		
<5 cm	☐ Yes ☐ No		
Are there hollow-bearing trees within the zone?[5]			☐ Yes ☐ No

1. DBH measured at 1.3m above ground.
2. Only living, native, tree species are to be recorded.
3. Exact stem counts must be provided for stems in the following classes: 50-79cm and 80+ cm (or additional classes for a PCT which has a smaller large tree threshold – e.g. heathlands). Include estimates of stem counts of other classes where there is extensive regeneration.
4. Hollow-bearing trees include living and dead native species allocated to the tree and shrub growth form groups. Hollow-bearing trees rooted within the plot with hollows that are visible from the ground must be included.
5. Where there are no hollow-bearing trees within a plot, but they are present within the vegetation zone, a value of 1 is to be entered in the BAMC.

Logs

Length of logs[6, 7]	(≥10cm diameter, >50cm in length)
Tally	25 +30
Total (m)	

6. Dead native and exotic species recorded.
7. Logs must be entirely or partially on the ground within the plot, and only the length within the plot is recorded.

Subplots (1x1m)

Subplot	Litter Cover (%)[9, 10]	Bare Ground Cover (%)	Cryptogram Cover (%)	Rock Cover (%)
1 x 1m Score[8]	70 85 70 30 40	0 0 0 10 0	0 0 0 0 0	0 0 0 10 0
Average Score				

8. Scores must be provided for litter cover. Include scores for other variables where supplementary information is required.
9. Litter includes leaves, seeds, twigs, branchlets and branches (<10cm diameter) from native and exotic species.
10. Must include all plant material detached from a plant and forms part of the litter layer on the ground surface. Material that is not detached is assessed as growth form foliage cover.

Composition and Structure Summary

Attribute		Value
Count of Native Richness (Composition)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Native Cover (Structure)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed Cover		

Additional Notes

Date: 12/21/2021	Project #: 20236	cumberland ecology
Personnel: CE, BF, JR	Plot ID: P 05	

Large Trees / Stem Classes / Hollows

DBH[1]	Stem Class Present[2]	Stem Class Count[2, 3]	Hollow-bearing Tree Count[4]
80+ cm	☑ Yes ☐ No	1	
50-79 cm	☑ Yes ☐ No	LHH1	
30-49 cm	☑ Yes ☐ No		
20-29 cm	☐ Yes ☐ No		
10-19 cm	☐ Yes ☐ No		
5-9 cm	☐ Yes ☐ No		
<5 cm	☑ Yes ☐ No		
Are there hollow-bearing trees within the zone?[5]			☐ Yes ☐ No

1. DBH measured at 1.3m above ground.
2. Only living, native, tree species are to be recorded.
3. Exact stem counts must be provided for stems in the following classes: 50-79cm and 80+ cm (or additional classes for a PCT which has a smaller large tree threshold – e.g. heathlands). Include estimates of stem counts of other classes where there is extensive regeneration.
4. Hollow-bearing trees include living and dead native species allocated to the tree and shrub growth form groups. Hollow-bearing trees rooted within the plot with hollows that are visible from the ground must be included.
5. Where there are no hollow-bearing trees within a plot, but they are present within the vegetation zone, a value of 1 is to be entered in the BAMC.

Logs

Length of logs[6, 7]	(≥10cm diameter, >50cm in length)
Tally	10
Total (m)	

6. Dead native and exotic species recorded.
7. Logs must be entirely or partially on the ground within the plot, and only the length within the plot is recorded.

Subplots (1x1m)

Subplot	Litter Cover (%)[9, 10]	Bare Ground Cover (%)	Cryptogram Cover (%)	Rock Cover (%)
1 x 1m Score[8]	30 40 30 35 40	0 0 25 0 10	0 0 0 0 3	0 05 05
Average Score				

8. Scores must be provided for litter cover. Include scores for other variables where supplementary information is required.
9. Litter includes leaves, seeds, twigs, branchlets and branches (<10cm diameter) from native and exotic species.
10. Must include all plant material detached from a plant and forms part of the litter layer on the ground surface. Material that is not detached is assessed as growth form foliage cover.

Composition and Structure Summary

Attribute		Value
Count of Native Richness (Composition)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Native Cover (Structure)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed Cover		

Additional Notes

Date: 12/11/2021	Project #: 20236	cumberland ecology
Personnel: CB, BE, JR	Plot ID: P06	

Large Trees / Stem Classes / Hollows

DBH[1]	Stem Class Present[2]	Stem Class Count[2, 3]	Hollow-bearing Tree Count[4]
80+ cm	☐ Yes ☐ No		
50-79 cm	☐ Yes ☐ No		
30-49 cm	☑ Yes ☐ No		
20-29 cm	☑ Yes ☐ No		
10-19 cm	☐ Yes ☐ No		
5-9 cm	☐ Yes ☐ No		
<5 cm	☑ Yes ☐ No		
Are there hollow-bearing trees within the zone?[5]			☐ Yes ☑ No

1. DBH measured at 1.3m above ground.
2. Only living, native tree species are to be recorded.
3. Exact stem counts must be provided for stems in the following classes: 50-79cm and 80+ cm (or additional classes for a PCT which has a smaller large tree threshold – e.g. heathlands). Include estimates of stem counts of other classes where there is extensive regeneration.
4. Hollow-bearing trees include living and dead native species allocated to the tree and shrub growth form groups. Hollow-bearing trees rooted within the plot with hollows that are visible from the ground must be included.
5. Where there are no hollow-bearing trees within a plot, but they are present within the vegetation zone, a value of 1 is to be entered in the BAM.

Logs

Length of logs[6, 7]	(≥10cm diameter, >50cm in length)
Tally	5
Total (m)	

6. Dead native and exotic species recorded.
7. Logs must be entirely or partially on the ground within the plot, and only the length within the plot is recorded.

Subplots (1x1m)

Subplot	Litter Cover (%)[9, 10]					Bare Ground Cover (%)					Cryptogram Cover (%)					Rock Cover (%)				
1 x 1m Score[8]	20	10	15	50	10	20	40	0	0	10	0	0	0	0	0	0	0	0	0	0
Average Score																				

8. Scores must be provided for litter cover. Include scores for other variables where supplementary information is required.
9. Litter includes leaves, seeds, twigs, branchlets and branches (<10cm diameter) from native and exotic species.
10. Must include all plant material detached from a plant and forms part of the litter layer on the ground surface. Material that is not detached is assessed as growth form foliage cover.

Composition and Structure Summary

Attribute		Value
Count of Native Richness (Composition)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Native Cover (Structure)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed Cover		

Additional Notes

Annanglove Road

Date: 3/2/2022	Project #: 20236	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: DR, MD, __	Plot ID: P 7 __	Start:	16 __	_____	_____	
Photos: 101229 - 101234	Orientation (°): ___	End:	17 __	_____	_____	
Dimensions: ☑20x20, ☐10x40	PCT: 18 35 ?	River Flat Euc. forest				Sheet: 1 of 2

	Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1	E tecticonis	2	1				
2	Angoplora flonbunda	25	60				
3	Bursaria spinosa	~~0.1~~ 2	~~1~~ 7				
4	Acacia paramattensis	0.1	3				
5	Olea europaeus	10	2				
6	Eucalyptus amplifolia	1	4				
7	Melaleuca linearifolia	1	1				
8	Notelea sp	0.1	1				
9	Daisy Bush	0.01	1				
10	Lomandra longifolia	1	10				
11	Micro. stipoides	30	2000+				
12	Gahnia clarkei (?)	1	10				
13	Pratia purpurascens	1	200+				
14	Centella asiatica	5	1000+				
15	Glycine clandestina	0.1	50				
16	Commelina cyanea	1	20				
17	Entolasia marginata	5	100				
18	Solanum prinophyllum (?)	0.1	5				
19	Bidens pilosa	0.1	5				
20	Cheilanthes sieberana	0.1	5				
21	Clematis ~~microphylla~~ glycinoides	1	20				
22	~~Histiopteris incisa ?~~	30	1000+				
23	Oplismenus aemula.	5	200				
24	Dichondra repens	1	400				
25	Hydrocotyle	0.1	20				
26	Hypoxis	0.01	5				
27	Sida rhombifolia	0.01	2				
28	Hypochaeris radicata	0.01	2				
29	Rubus fruticosus (blackberry)	0.1	3				
30	Schoenoplectus validus	0.1	20+				
31	Goodenia ovata	0.1	4				
32	Secamone marlagascariensis	0.01	1				
33	Persicaria (exotic ?)	0.1	30				
34	Alisma plantago aquatica	0.1	4				
35	Glycine tabacina	0.1	10				
36	Chloris gayana	1	20				
37	Palm species ??	0.01	1				
38	Casuarina cunninghamiana	0.1	1				
39	Lantana	0.1	1				
40	Phalaris						

Cover (%): **0.1, 0.2, 0.3**...etc. up to **1, 2, 3**...etc. up to **10, 15, 20, 25**...etc. up to **100**
Abundance (Count): **1, 2, 3**... up to **10, 20, 30**...up to **100, 200**... up to **1,000**...etc.

GF Group: **TG**=Tree, **SG**=Shrub, **GG**=Grass, **FG**=Forb, **EG**=Fern, **OG**=Other
Stratum: **C** = Canopy, **SC** = Sub-canopy, **S** = Shrub, **G** = Ground

Cover Note: *0.1% = approx 63 cm² or circle with 71cm diameter, 0.5% = approx 1.4m², 1% = approx 2m², 5% = approx 4.5m², 25% = approx 10m²*

Calochlaena dubia (site is an ecotone between river flat and shale sandstone transition forest)

Date: 03/02/2022	Project #: 20236	Location	Waypoint	Easting	Northing	cumberland ecology
Personnel: DE, MD, __	Plot ID: P 7__	Start:	16__	_____	_____	
Photos: 101229 – 101234	Orientation (°): ___	End:	17__	_____	_____	
Dimensions: ☒20x20, □10x40	PCT: 835?					Sheet: 2 of 2

	Species	Cover	Abundance	N, E, HTE	GF Group	Stratum	Voucher
1	Juncus usitatus	0.01	1				
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
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33							
34							
35							
36							
37							
38							
39							
40							

Cover (%): **0.1, 0.2, 0.3**...etc. up to **1, 2, 3**...etc. up to **10, 15, 20, 25**...etc. up to **100**	**GF Group: TG**=Tree, **SG**=Shrub, **GG**=Grass, **FG**=Forb, **EG**=Fern, **OG**=Other
Abundance (Count): **1, 2, 3**... up to **10, 20, 30**...up to **100, 200**... up to **1,000**...etc.	**Stratum: C** = Canopy, **SC** = Sub-canopy, **S** = Shrub, **G** = Ground

Cover Note: *0.1% = approx 63 cm² or circle with 71cm diameter, 0.5% = approx 1.4m², 1% = approx 2m², 5% = approx 4.5m², 25% = approx 10m²*

Date: 03/02/2022	Project #: 20236	cumberland ecology
Personnel: PR, MD, __	Plot ID: P 7__	

Large Trees / Stem Classes / Hollows

WPS 16,17

DBH[1]	Stem Class Present[2]	Stem Class Count[2, 3]	Hollow-bearing Tree Count[4]
80+ cm	☐ Yes ☐ No		
50-79 cm	☑ Yes ☐ No	IIII	
30-49 cm	☑ Yes ☐ No		1
20-29 cm	☑ Yes ☐ No		
10-19 cm	☑ Yes ☐ No		
5-9 cm	☑ Yes ☐ No		
<5 cm	☑ Yes ☐ No		
Are there hollow-bearing trees within the zone?[5]			☑ Yes ☒ No

1. DBH measured at 1.3m above ground.
2. Only living, native, tree species are to be recorded.
3. Exact stem counts must be provided for stems in the following classes: 50-79cm and 80+ cm (or additional classes for a PCT which has a smaller large tree threshold – e.g. heathlands). Include estimates of stem counts of other classes where there is extensive regeneration.
4. Hollow-bearing trees include living and dead native species allocated to the tree and shrub growth form groups. Hollow-bearing trees rooted within the plot with hollows that are visible from the ground must be included.
5. Where there are no hollow-bearing trees within a plot, but they are present within the vegetation zone, a value of 1 is to be entered in the BAMC.

Logs

Length of logs[6, 7]	(≥10cm diameter, >50cm in length)
Tally	4, 1, 5
Total (m)	10

6. Dead native and exotic species recorded.
7. Logs must be entirely or partially on the ground within the plot, and only the length within the plot is recorded.

Subplots (1x1m)

Subplot	Litter Cover (%)[9, 10]	Bare Ground Cover (%)	Cryptogram Cover (%)	Rock Cover (%)
1 x 1m Score[8]	60 75 55 65 80	0 0 0 0 5	0 0 0 0 0	0 0 0 0 0
Average Score	67	1	0	0

8. Scores must be provided for litter cover. Include scores for other variables where supplementary information is required.
9. Litter includes leaves, seeds, twigs, branchlets and branches (<10cm diameter) from native and exotic species.
10. Must include all plant material detached from a plant and forms part of the litter layer on the ground surface. Material that is not detached is assessed as growth form foliage cover.

Composition and Structure Summary

Attribute		Value
Count of Native Richness (Composition)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
Sum of Native Cover (Structure)	Trees	
	Shrubs	
	Grasses etc.	
	Forbs	
	Ferns	
	Other	
High Threat Weed Cover		

Additional Notes

APPENDIX C :
BAMC Credit Report

BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00029798/BAAS17027/21/00029799	20236 - Development	24/11/2021
Assessor Name	Report Created	BAM Data version *
David Robertson	18/02/2022	50
Assessor Number	BAM Case Status	Date Finalised
BAAS17027	Finalised	18/02/2022
Assessment Revision	Assessment Type	BOS entry trigger
1	Part 4 Developments (General)	BOS Threshold: Area clearing threshold

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

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

Zone	Vegetation zone name	TEC name	Current Vegetation integrity score	Change in Vegetation integrity (loss / gain)	Area (ha)	Sensitivity to loss (Justification)	Species sensitivity to gain class	BC Act Listing status	EPBC Act listing status	Biodiversity risk weighting	Potential SAII	Ecosystem credits

Cumberland riverflat forest											
7	835_Moderate	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	82.6	82.6	0.01	PCT Cleared - 93%	High Sensitivity to Potential Gain	Endangered Ecological Community	Critically Endangered	2.00		1
											Subtotal	**1**
Cumberland shale - sandstone Ironbark forest											
4	1395_Intact	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	80.1	80.1	0.08	PCT Cleared - 80%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	4
5	1395_Slashed01	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	47.2	47.2	1.6	PCT Cleared - 80%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	47
											Subtotal	**51**

Cumberland shale - sandstone Ironbark forest											
6	1395_DNG	Not a TEC	43.2	43.2	0.05	PCT Cleared - 80%	High Sensitivity to Potential Gain			2.00		1
											Subtotal	**1**
Cumberland shale plains woodland												
1	849_Mown	Cumberland Plain Woodland in the Sydney Basin Bioregion	37.6	37.6	0.15	PCT Cleared - 93%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	4
2	849_Exotic	Cumberland Plain Woodland in the Sydney Basin Bioregion	58	58.0	0.07	PCT Cleared - 93%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	3
3	849_DNG	Cumberland Plain Woodland in the Sydney Basin Bioregion	52.1	52.1	0.06	PCT Cleared - 93%	High Sensitivity to Potential Gain	Critically Endangered Ecological Community	Critically Endangered	2.50	TRUE	2
											Subtotal	**9**
											Total	**62**

Species credits for threatened species

Vegetation zone name	Habitat condition (Vegetation Integrity)	Change in habitat condition	Area (ha)/Count (no. individuals)	Sensitivity to loss (Justification)	Sensitivity to gain (Justification)	BC Act Listing status	EPBC Act listing status	Potential SAII	Species credits

Meridolum corneovirens / Cumberland Plain Land Snail (Fauna)									
849_Mown	37.6	37.6	0.15			Endangered	Not Listed	False	3
849_Exotic	58.0	58.0	0.07			Endangered	Not Listed	False	2
1395_Intact	80.1	80.1	0.08			Endangered	Not Listed	False	3
1395_Slashed01	47.2	47.2	1.6			Endangered	Not Listed	False	37
835_Moderate	82.6	82.6	0.01			Endangered	Not Listed	False	1
								Subtotal	**46**
Myotis macropus / Southern Myotis (Fauna)									
849_Mown	37.6	37.6	0.15			Vulnerable	Not Listed	False	3
849_Exotic	58.0	58.0	0.07			Vulnerable	Not Listed	False	2
849_DNG	52.1	52.1	0.06			Vulnerable	Not Listed	False	2
1395_Intact	80.1	80.1	0.08			Vulnerable	Not Listed	False	3
1395_Slashed01	47.2	47.2	1.6			Vulnerable	Not Listed	False	37
1395_DNG	43.2	43.2	0.05			Vulnerable	Not Listed	False	1
835_Moderate	82.6	82.6	0.01			Vulnerable	Not Listed	False	1
								Subtotal	**49**

BAM Biodiversity Credit Report (Like for like)

Proposal Details

Assessment Id 00029798/BAAS17027/21/00029799	Proposal Name 20236 - Development	BAM data last updated * 24/11/2021
Assessor Name David Robertson	Assessor Number BAAS17027	BAM Data version * 50
Proponent Names	Report Created 18/02/2022	BAM Case Status Finalised
Assessment Revision 1	Assessment Type Part 4 Developments (General)	Date Finalised 18/02/2022
BOS entry trigger BOS Threshold: Area clearing threshold	* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.	

Potential Serious and Irreversible Impacts

Name of threatened ecological community	Listing status	Name of Plant Community Type/ID
Cumberland Plain Woodland in the Sydney Basin Bioregion	Critically Endangered Ecological Community	849-Cumberland shale plains woodland
Shale Sandstone Transition Forest in the Sydney Basin Bioregion	Critically Endangered Ecological Community	1395-Cumberland shale - sandstone Ironbark forest
Species		

Nil

Additional Information for Approval

PCT Outside Ibra Added

None added

PCTs With Customized Benchmarks

PCT
No Changes

Predicted Threatened Species Not On Site

Name
Calyptorhynchus lathami / Glossy Black-Cockatoo

Ecosystem Credit Summary (Number and class of biodiversity credits to be retired)

BAM Biodiversity Credit Report (Like for like)

Name of Plant Community Type/ID	Name of threatened ecological community	Area of impact	HBT Cr	No HBT Cr	Total credits to be retired
849-Cumberland shale plains woodland	Cumberland Plain Woodland in the Sydney Basin Bioregion	0.3	2	7	9
1395-Cumberland shale - sandstone Ironbark forest	Shale Sandstone Transition Forest in the Sydney Basin Bioregion	1.7	0	51	51
1395-Cumberland shale - sandstone Ironbark forest	Not a TEC	0.1	0	1	1
835-Cumberland riverflat forest	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	0.0	1	0	1

835-Cumberland riverflat forest

Like-for-like credit retirement options

Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region

	River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions This includes PCT's: 686, 828, 835, 941, 1108, 1109, 1212, 1228, 1293, 1318, 1326, 1386, 1504, 1556, 1594, 1618, 1720, 1794	-	835_Moderate	Yes	1	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

849-Cumberland shale plains woodland	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Mown	No	4	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_Exotic	No	3	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
	Cumberland Plain Woodland in the Sydney Basin Bioregion This includes PCT's: 849, 850	-	849_DNG	Yes	2	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.
1395-Cumberland shale - sandstone Ironbark forest	**Like-for-like credit retirement options**					
	Name of offset trading group	Trading group	Zone	HBT	Credits	IBRA region
	Shale Sandstone Transition Forest in the Sydney Basin Bioregion This includes PCT's: 792, 1281, 1395	-	1395_Intact	No	4	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

	Shale Sandstone Transition Forest in the Sydney Basin Bioregion This includes PCT's: 792, 1281, 1395	-	1395_Slashed01	No	47	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

1395-Cumberland shale - sandstone Ironbark forest	**Like-for-like credit retirement options**					
	Class	Trading group	Zone	HBT	Credits	IBRA region
	Coastal Valley Grassy Woodlands This includes PCT's: 116, 618, 760, 761, 762, 830, 834, 838, 849, 850, 1326, 1395, 1603, 1604, 1691	Coastal Valley Grassy Woodlands >=70% and <90%	1395_DNG	No	1	Cumberland, Burragorang, Pittwater, Sydney Cataract, Wollemi and Yengo. or Any IBRA subregion that is within 100 kilometers of the outer edge of the impacted site.

Species Credit Summary

Species	Vegetation Zone/s	Area / Count	Credits
Meridolum corneovirens / Cumberland Plain Land Snail	**849_Mown, 849_Exotic, 1395_Intact, 1395_Slashed01, 835_Moderate**	1.9	46.00

Myotis macropus / Southern Myotis	**849_Mown, 849_Exotic, 849_DNG, 1395_Intact, 1395_Slashed01, 1395_DNG, 835_Moderate**	2.0	49.00

Credit Retirement Options

Like-for-like credit retirement options

Meridolum corneovirens / Cumberland Plain Land Snail	Spp	IBRA subregion
	Meridolum corneovirens / Cumberland Plain Land Snail	Any in NSW
Myotis macropus / Southern Myotis	Spp	IBRA subregion
	Myotis macropus / Southern Myotis	Any in NSW

FIGURES

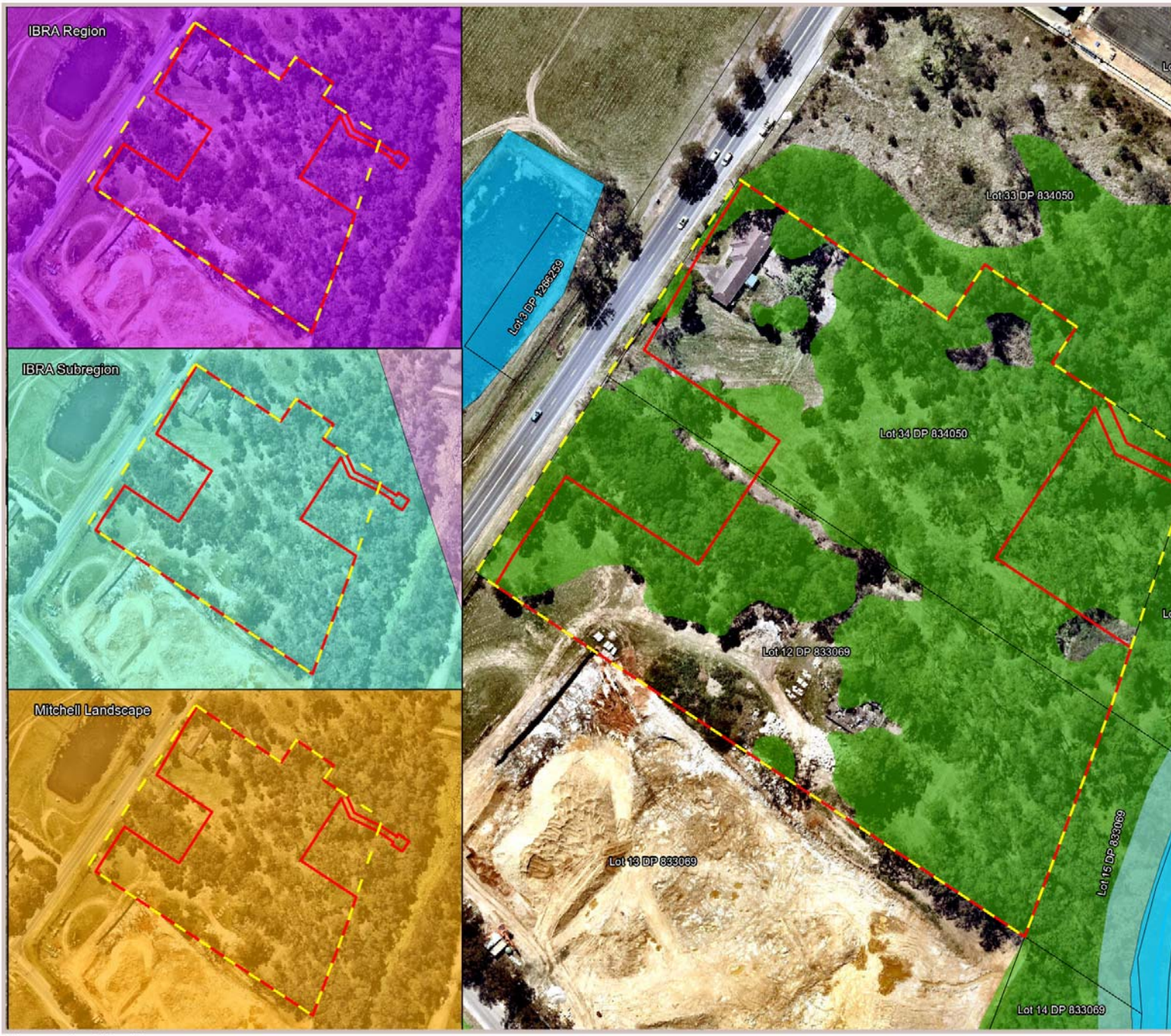

Figure 1. Site Map

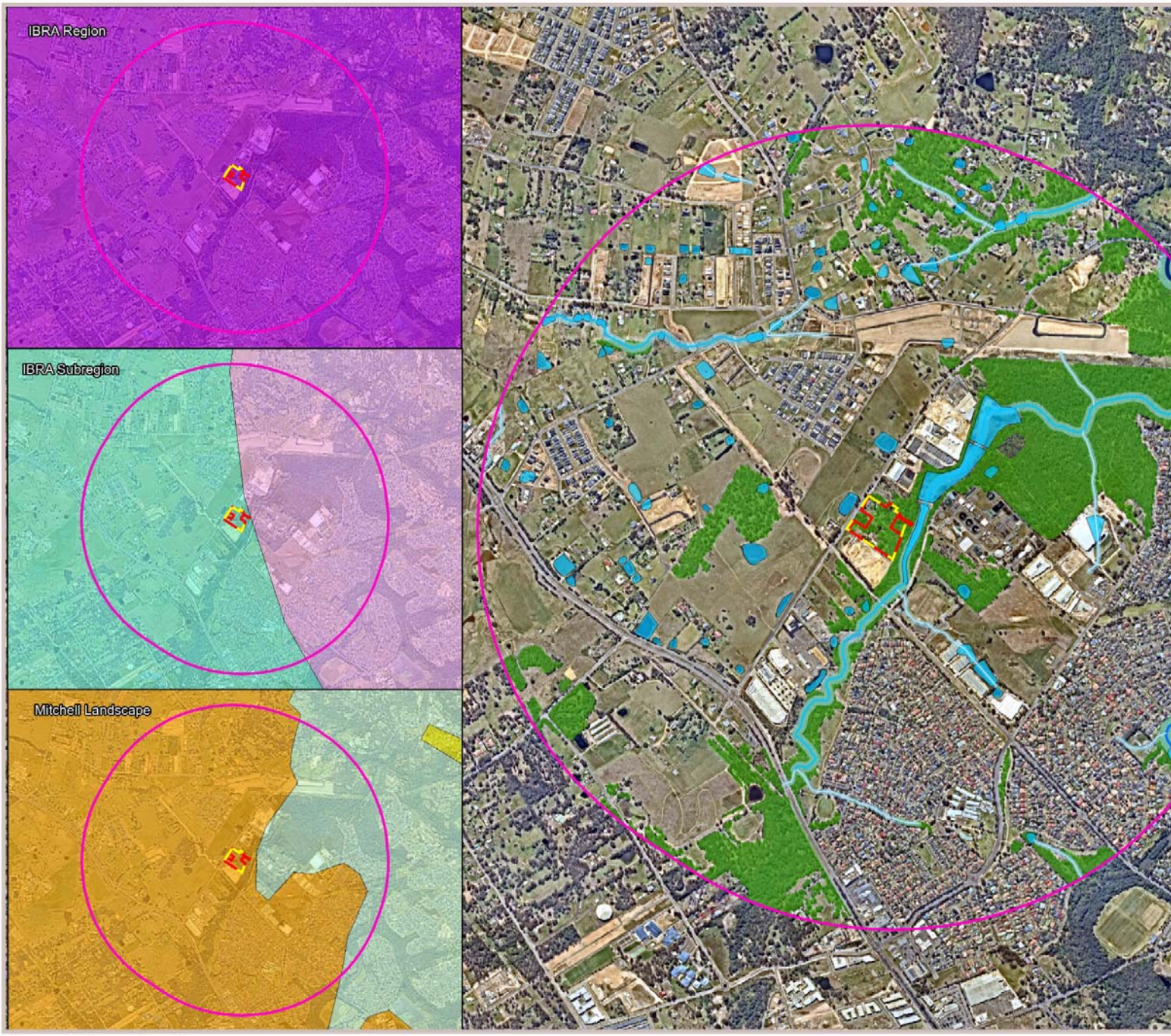

Figure 2. Location Map

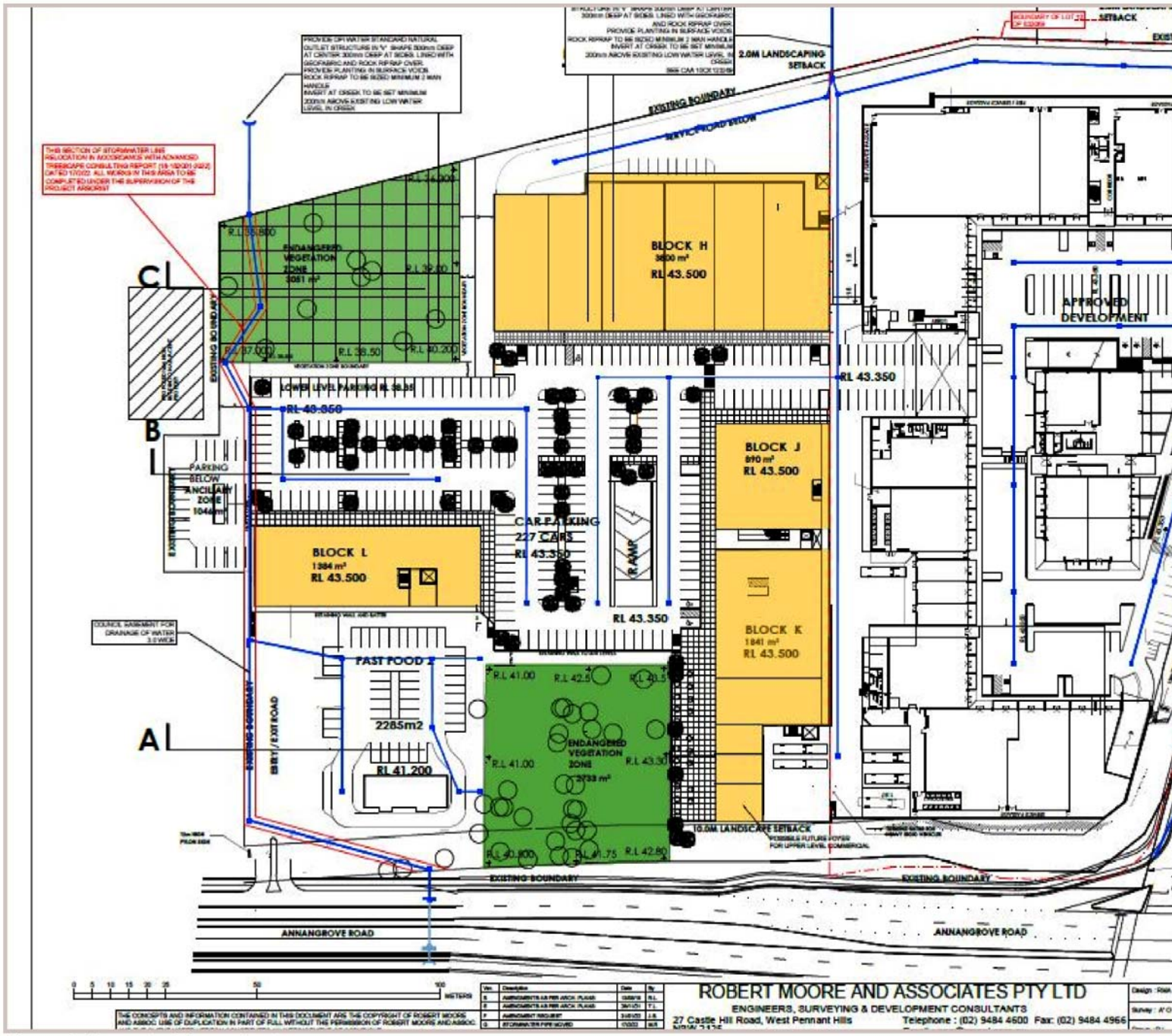

Figure 3. Layout of the project

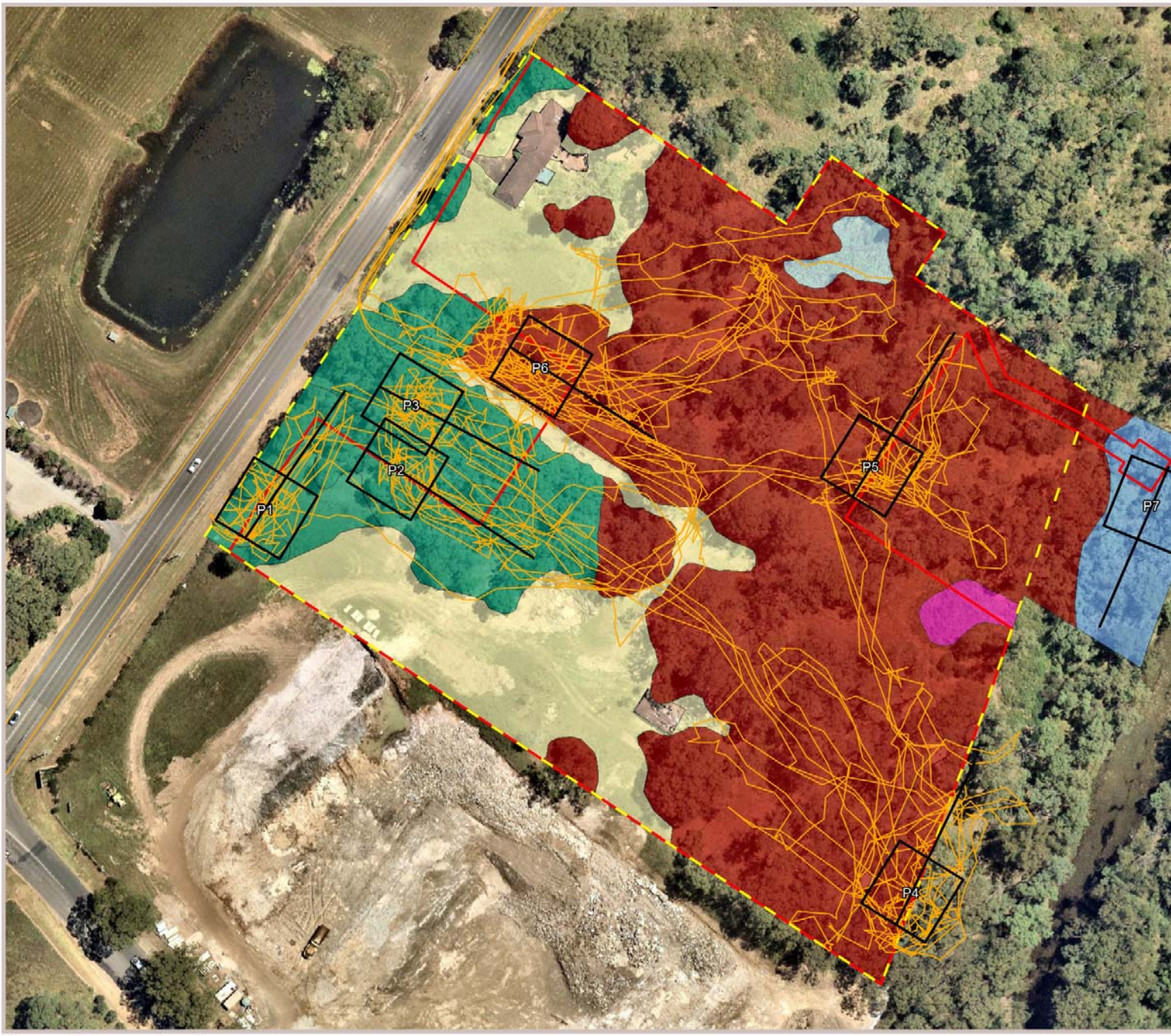

Figure 4. Survey locations

Figure 5. Native vegetation extent in the subject land

Figure 6. Plant community types in the subject land

Figure 7. Threatened Ecological Communities in the subject land

Figure 8. Vegetation zones in the subject land

Figure 9. Species polygon: Cumberland Plain Land Snail

Figure 10. Species polygon: Southern Myotis

Figure 11. Prescribed impacts

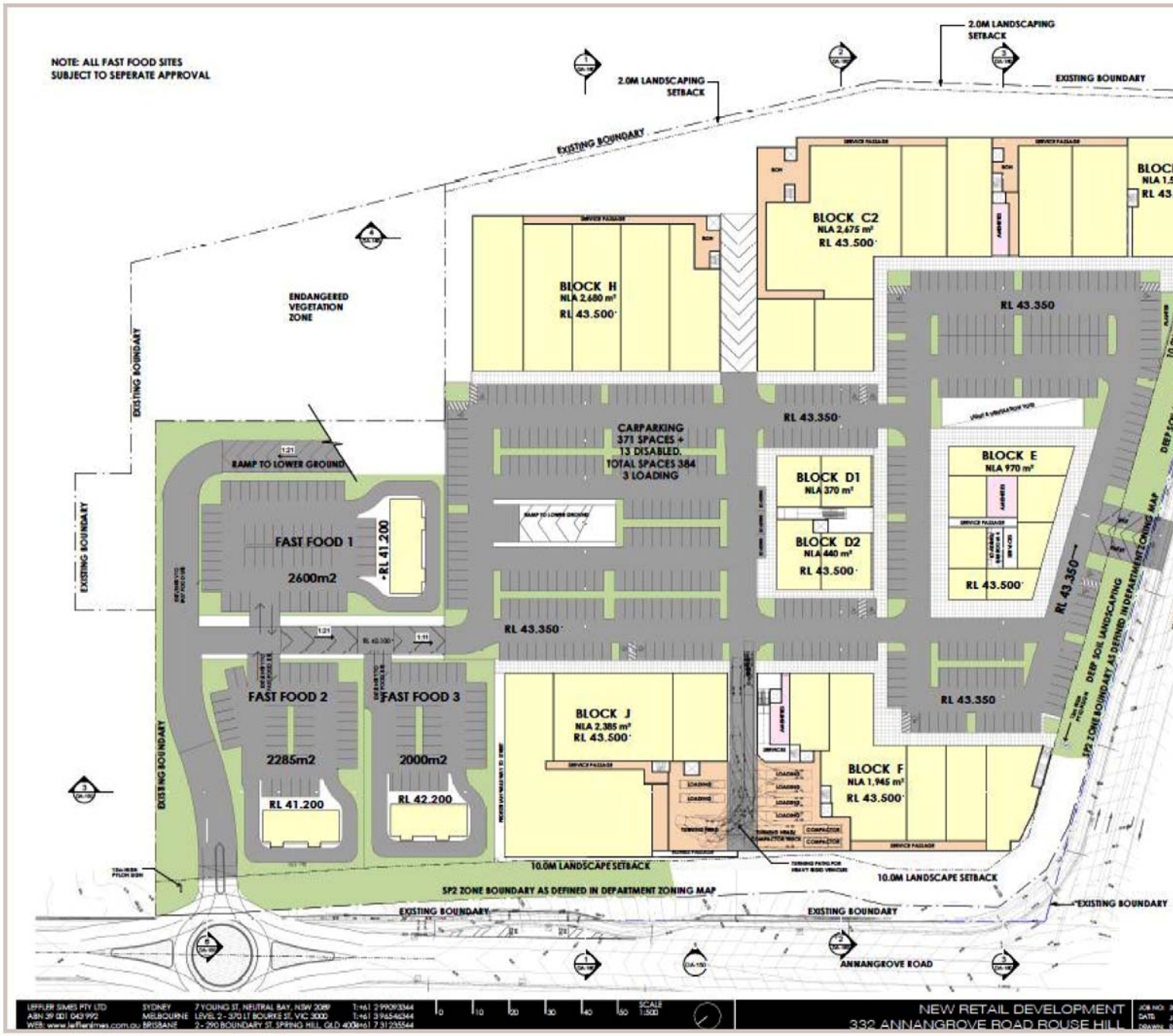

Figure 12. Previous layout of the project

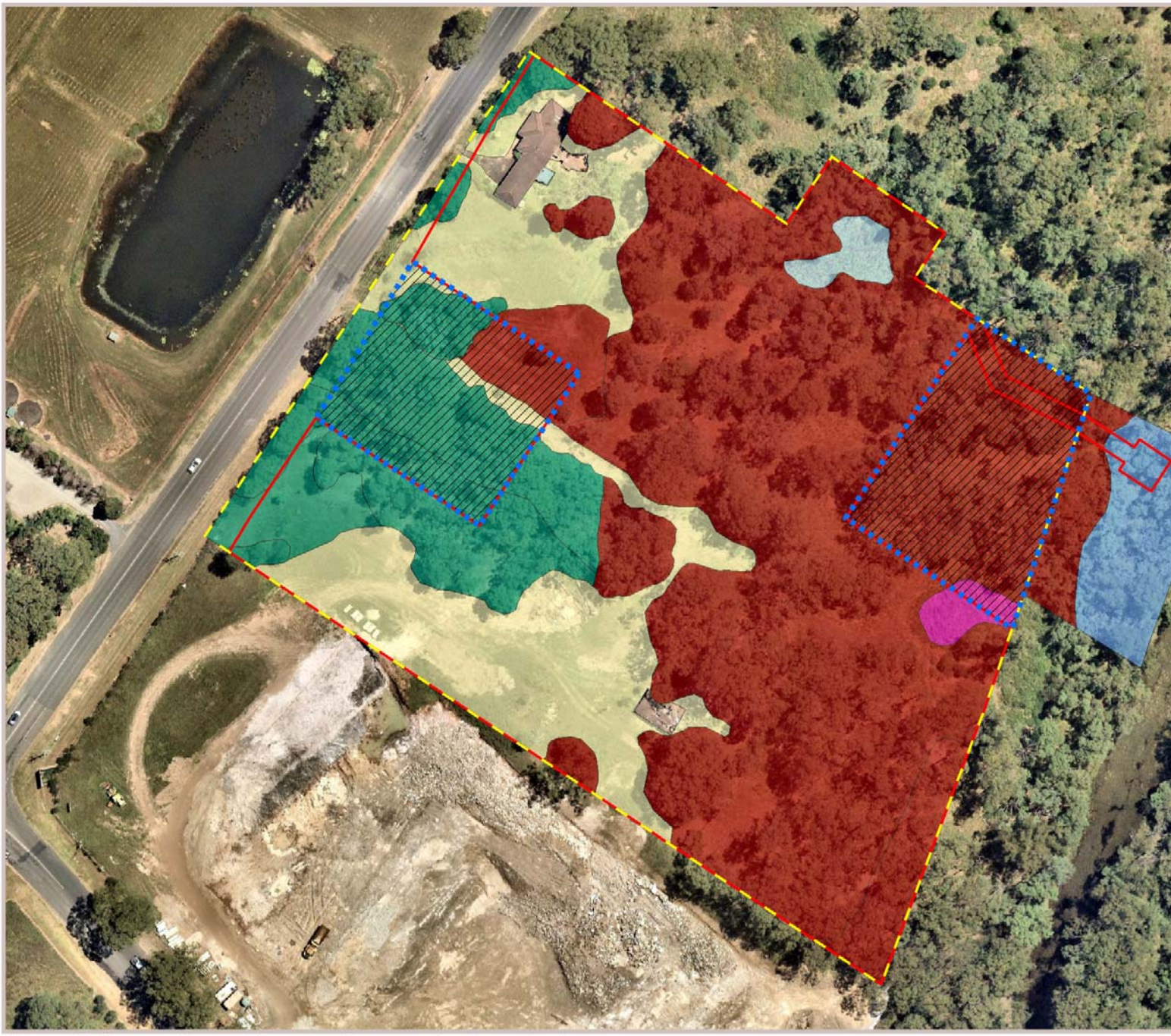

Figure 13. Proposed vegetation retention areas for the project

Figure 14. Serious and irreversible impact entities to be impacted by the project

Figure 15. Cumberland Plain Woodland and Shale Sandstone Transition Forest surrounding the subject land

Figure 16. Thresholds for assessment