Ecological Constraints Assessment Report

9 West Wilchard Road, Castlereagh

Report prepared by Narla Environmental for [redacted]

July 2021

NARLA
environmental

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Glossary

Acronym/ Term	Definition
BAM	Biodiversity Assessment Method
BC Act	New South Wales Biodiversity Conservation Act 2016
BDAR	Biodiversity Development Assessment Report
ECA	Ecological Constraints Assessment
DA	Development Application
Development	The use of land, and the subdivision of land, and the carrying out of a work, and the demolition of a building or work, and the erection of a building, and any other act, matter or thing referred to in section 26 that is controlled by an environmental planning instrument but does not include any development of a class or description prescribed by the regulations for the purposes of this definition (Environmental Planning and Assessment Act 1979).
DEC	Department of Environment and Conservation
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment
EP&A Act	Environmental Planning & Assessment Act 1979
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
FFA	Flora and Fauna Assessment Report
ha	Hectares
km	Kilometre
LGA	Local Government Area
Locality	The area within a 10km radius of the Subject Property. The same meaning when describing a local population of a species or local occurrence of an ecological community.
m	metres
mm	millimetres
NSW	New South Wales
PCT	Plant Community Type
PDCP	Penrith Development Control Plan
PLEP	Penrith Local Environmental Plan
SEPP	State Environmental Planning Policy
Subject Property	9 West Wilchard Road, Castlereagh 2749 (Lot 9/DP 1181666)
TEC	Threatened Ecological Community
Threatened species, populations and ecological communities	Species, populations and ecological communities specified in Schedules 1 and 2 of the BC Act 2016

1. Introduction

1.1 Project Background

Narla Environmental Pty Ltd (Narla) were engaged by [redacted] ('the proponent') to prepare an Ecological Constraints Assessment (ECA) to determine the development potential and ecological constraints at 9 West Wilchard Road, Castlereagh (Lot 9, DP 1181666), hereafter referred to as the 'Subject Property' (**Figure 1**). The Subject Property has been defined by cadastral boundaries (SIX Maps 2021) in conjunction with boundary fencing observed during the site assessment.

It is understood that the proponent wishes to determine the ecological constraints identified within the Subject Property, particularly those associated with environmental planning instruments, as well as Threatened Ecological Communities (TECs) and threatened species listed under the Biodiversity Conservation Act 2016 (BC Act) and the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act).

Narla have produced this report in order to assess any potential impacts associated with future development proposals and to recommend appropriate measures to mitigate any potential ecological impacts.

1.2 Site Description and Location

The Subject Property is located at 9 West Wilchard Road within the locality of Castlereagh in the Penrith City Council Local Government Area (LGA). The Subject Property covers an area of approximately 0.47ha and contains areas of native woodland and historically cleared lawn.

1.3 Topography, Geology and Soil

The Subject Property has a varied topography with elevation ranging from 19m in the south-western extent to approximately 31m in the north-eastern extent (Google Earth Pro 2021).

The Subject Property is situated on the Berkshire soil landscape (Bannerman and Hazelton 2011) according to the Soil Landscapes of Penrith 1:100 000 sheet. The Berkshire soil landscape is characterised as occurring on dissected, gently undulating low rises on the Tertiary terraces of the Hawkesbury/Nepean River system. Soils are weakly pedal orange heavy clays and clayey sands, often mottled. Ironstone nodules common.

1.4 Hydrology

No mapped or unmapped watercourses were identified within the Subject Property.

1.5 Scope of Assessment

The objectives of this ECA were to assess all possible ecological constraints associated with future development within the Subject Property pursuant to Part 4 of the Environmental Planning & Assessment Act 1979 (EP&A Act), the BC Act, the EPBC Act and the local planning provisions of Penrith City Council, including to:

- Undertake background research to determine the likelihood for NSW and/or Commonwealth threatened biota to utilise or occur within the Subject Property during any point of their lifecycles;
- Establish the likelihood of occurrence of migratory species, threatened species, endangered populations and threatened ecological communities as listed under the BC Act and/or the EPBC Act;
- Identify and map the distribution of vegetation communities within the Subject Property and discuss patch size and condition;

- Record presence and the extent of any Priority Weed infestations that require management by law;
- Determine potential ecological impacts or risks that may result due to the proposed works;
- Recommendation of any controls or additional actions to be taken to protect or improve environmental outcomes of the proposed works; and
- Recommend any controls or additional actions to be taken to protect or improve ecological/biodiversity values of the Subject Property.

Figure 1. Location of the Subject Property.

1.6 Relevant Legislation and Policy

The legislation and policy that are addressed in this report are listed in **Table 1.**

Table 1. Relevant legislation and policy addressed

Legislation/ Policy	Relevant Ecological Feature on Site	Triggered	Action Required
Environmental Planning and Assessment Act 1979 (EP&A Act)	All threatened species, populations and ecological communities and their habitat that occur or are likely to occur within the Subject Property during a part of their lifecycle.	Yes	This ecological assessment and all subsequent recommendations relevant to the planning process under 'Part 4 Development assessment and consent'.
Biodiversity Conservation Act (BC Act) (New South Wales)	BC Act threatened species have the potential to occur within the Subject Property. No BC Act listed threatened species were observed within the Subject Property during the site assessment. One (1) BC Act listed threatened ecological community occurs within the Subject Property: ▪ Cumberland Plain Woodland in the Sydney Basin Bioregion Critically Endangered Ecological Community.	Yes	Any future DA will need to be accompanied by a Flora and Fauna Assessment (FFA) including a Test of Significance on BC Act listed threatened species, or a Biodiversity Development Assessment Report (BDAR) with appropriate offsetting.
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) (Commonwealth)	Potential suitable habitat for several EPBC Act listed (Commonwealth) threatened fauna species is present. No EPBC Act listed species or Threatened Ecological Communities were observed within the Subject Site during the site assessment.	Yes	An assessment of significance of impact from the proposed works on Matters of National Environmental Significance (MNES) EPBC Act Assessment of Significant Impact Criteria.
Biosecurity Act 2015 (Bio Act)	One (1) Priority Weed for the Greater Sydney region was identified within the Subject Property: ▪ *Senecio madagascariensis* (Fireweed)	Yes	Priority weeds must be managed in accordance with the Biosecurity Act: ▪ Prohibition on dealings – Must not be imported into the State or sold.
State Environmental Planning Policy (Koala Habitat Protection) 2021	The Subject Property occurs within the Penrith LGA which is not listed in Schedule 1 of the Koala Habitat Protection SEPP 2021 therefore this SEPP does not apply to the Subject Property.	No	None.
State Environmental Planning Policy (Coastal Management) 2018	The Subject Property does not contain areas mapped as 'Coastal Wetlands', 'Littoral Rainforest', proximity to either,	No	None.

Legislation/ Policy	Relevant Ecological Feature on Site	Triggered	Action Required
	'Coastal Environment Area' or 'Coastal Use Area'; therefore, the Coastal Management SEPP (2018) does not apply.		
State Environmental Planning Policy No 19—Bushland in Urban Areas	The Subject Property is privately owned and does not border any areas which adjoins bushland zoned or reserved for public open space purposes.	No	None.
Water Management Act 2000	No mapped hydrolines were identified within the Subject Property. Therefore, the Water Management Act does not apply.	No	None.

1.7 Biodiversity Assessment Pathway

The requirements of the BC Act 2016 and Biodiversity Conservation Regulation 2017 are mandatory for all Development Applications (DA) assessed pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) submitted in the Penrith LGA.

The BC Act and its regulations stipulate clearing 'area threshold' values (**Table 2**) that determine whether a development is required to be assessed in accordance with the 'Biodiversity Offset Scheme' (BOS). Minimum entry thresholds for vegetation clearing depend on the minimum lot size (shown in the Lot Size Maps made under the relevant Local Environmental Plan [LEP]) or actual lot size (where there is no minimum lot size provided for the relevant land under the LEP).

The minimum lot sizes prescribed by the Penrith LEP to the Subject Property is 2 ha. To avoid triggering the Biodiversity Offset Scheme, the proponent must avoid the clearing/management of native vegetation in excess of 0.5 ha per Development Application.

Table 2. Biodiversity Offset Scheme entry thresholds

Minimum lot size associated with the property	Threshold for clearing, above which the BAM and offsets scheme apply
Less than 1 ha	0.25 ha or more
1 ha to less than 40 ha	**0.50 ha or more**
40 ha to less than 1000 ha	1 ha or more
1000 ha or more	2 ha or more

The Subject Property has been mapped as containing 'biodiversity values' within the Biodiversity Values Map (DPIE 2021a) (**Figure 2**). Any impacts to native vegetation (including groundcovers) within purple mapped areas will require a Biodiversity Development Assessment Report (BDAR) and triggers the BOS.

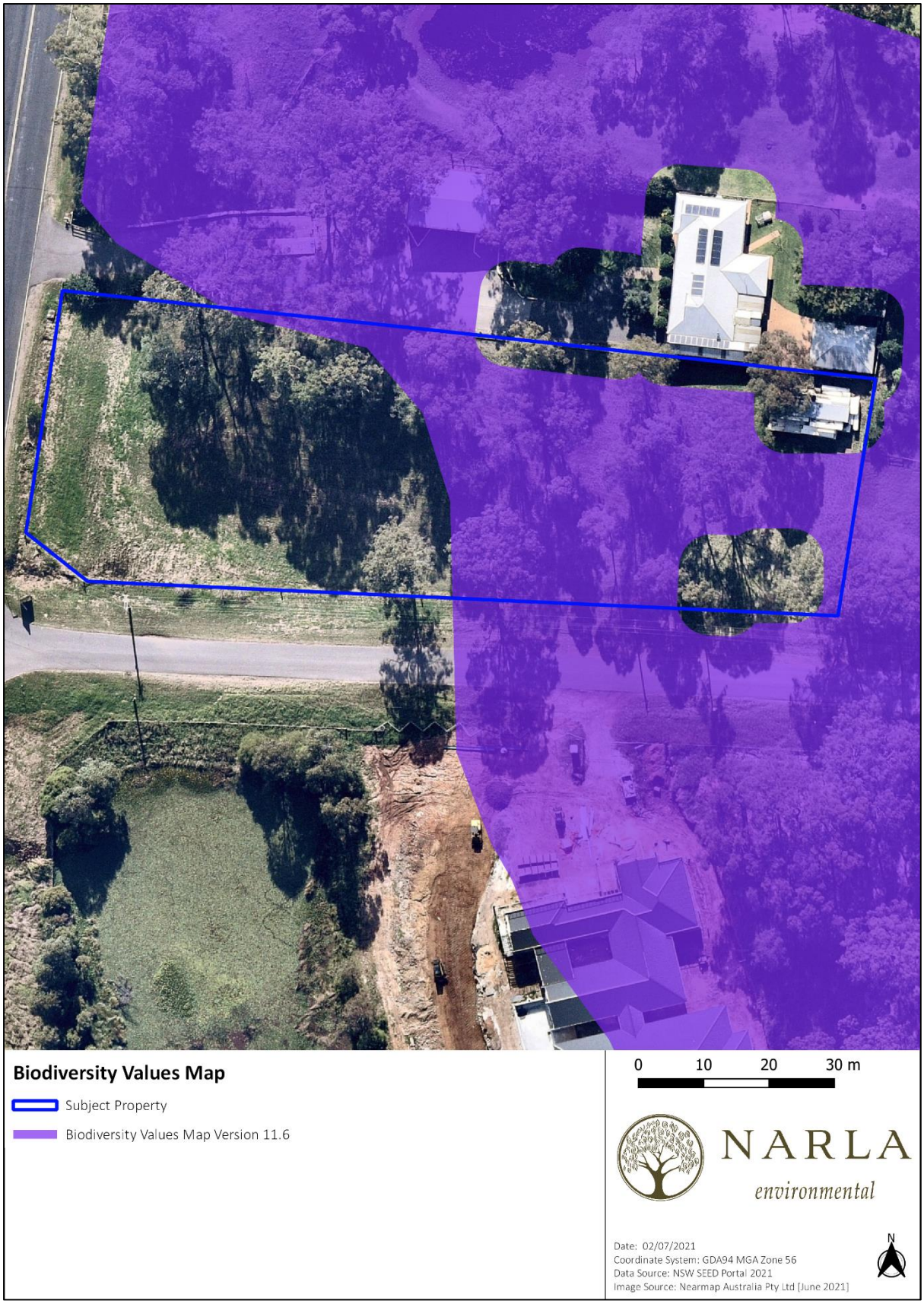

Figure 2. Biodiversity Values within the Subject Property

1.8 Penrith Local Environmental Plan 2010 (PLEP)

1.8.1 Zoning

The Subject Property contains land zoned as 'E4: Environmental Living'.

The PLEP requires that the development satisfies the zone objectives of each zone which are as follows:

- E4: Environmental Living:
    - To provide for low-impact residential development in areas with special ecological, scientific or aesthetic values;
    - To ensure that residential development does not have an adverse effect on those values;
    - To minimise conflict between land uses within the zone and land uses within adjoining zones;
    - To ensure land uses are compatible with the available infrastructure, services and facilities and with the environmental capabilities of the land; and
    - To preserve and improve natural resources through appropriate land management practices.

1.9 Penrith Development Control Plan 2014 (PDCP)

1.9.1 Preservation of Trees and Vegetation (Part C2.1)

The following objectives pertain to tree and vegetation preservation in the PDCP:

a) To protect and conserve the biodiversity values of trees and other vegetation in the City;
b) To maintain the diversity and quality of ecosystems and enhance their capacity to adapt to change;
c) To support conservation and threat abatement action to minimise biodiversity loss and conserve threatened species and ecological communities in nature;
d) To protect and enhance biodiversity corridors, landscape character and scenic values of the City;
e) Recognise the importance and function of trees and other vegetation for Cooling our City;
f) To preserve the amenity of the City through the preservation of trees and other vegetation;
g) To preserve existing trees and other vegetation where possible during the planning, design, development and construction process;
h) To firstly avoid or minimise impacts of a proposed development and land use change on biodiversity and if impacts are unavoidable provide appropriate offsets; and
i) To achieve an appropriate balance between the protection of trees and other vegetation and mitigating risks from natural hazards.

The following developmental controls pertain to tree and vegetation preservation in the PDCP:

<u>General Approval Requirements</u>

a) A person must not remove, clear, prune or otherwise cause harm to any tree or other vegetation prescribed by this Plan without an appropriate approval. This includes the following activities in relation to trees and other vegetation which are not permitted without approval:
    i. Removal by cutting down, clearing, under scrubbing, thinning or any other method
    ii. Removal of bark around part of or full circumference of a tree trunk (i.e. ring-barking)
    iii. Cutting off the top of a tree to reduce its height (i.e. topping)
    iv. Cutting off branches on one side of a tree (i.e. lopping)
    v. Cutting off or pruning branches greater than 50mm diameter

vi. Cutting, removal or otherwise damaging the roots or root system
vii. Poisoning or any other activity

Development Consent

a) A person must not remove, clear, prune or otherwise cause harm to any tree or other vegetation prescribed by this Plan, which is proposed as part of development without Development Consent. These works must be assessed as part of a Development Application.

Native Vegetation Panel Approval

a) If proposed clearing of native vegetation is not associated with development (i.e. not for a purpose requiring development consent) and the proposed area of clearing exceeds the area clearing threshold (see **Table 2**), or the vegetation is identified on the Biodiversity Values Map then approval is required from the Native Vegetation Panel (not Council).
b) The area clearing threshold (see **Table 2**) varies depending on the minimum lot size (shown in the Lot Size Maps made under the relevant Local Environmental Plan), or actual lot size (where there is no minimum lot size provided for the relevant land under the Local Environmental Plan).
c) If the land on which the proposed development is located has different minimum lot sizes the smaller or smallest of those minimum lot sizes is used to determine the area clearing threshold.

Vegetation Permits

a) Where the area clearing threshold is not exceeded (see **Table 2**) and development consent is not required, a person must not remove, clear, prune or otherwise cause harm to any tree or other vegetation prescribed by this Plan without a Vegetation Permit.
b) There are two types of Vegetation Permit Application:
    i. Application to Remove or Prune Tree; or
    ii. Application to Clear Native Vegetation.
c) A Vegetation Permit is not required if works are carried out in accordance with an exemption as detailed in Section 3 – Vegetation Permit Exemptions.

1.9.2 Biodiversity Corridors and Areas of Remnant Indigenous Vegetation in Non-Urban Areas (Part C2.2)

The following objectives pertain to biodiversity corridors and areas of remnant indigenous vegetation in non-urban areas in the PDCP:

a) To promote the establishment and retention of biodiversity corridors and areas of remnant native vegetation that contribute to the long-term survival of native fauna and flora species in the area;
b) To maintain (and where possible increase) the current area of native bushland and retain the natural species diversity of bushland as far as possible;
c) To encourage the planting of a diversity of native species to enhance biodiversity values, scenic quality and landscape character; and
d) To facilitate the implementation of weed control and management measures that act upon the processes causing weed invasion of natural areas.

The following controls pertain to biodiversity corridors and areas of remnant indigenous vegetation in non-urban areas in the PDCP:

Development Consent

a) Biodiversity corridors and areas of remnant native vegetation are shown as natural resources sensitive land on the Penrith LEP 2010 Natural Resources Sensitivity Land Map.
b) In accordance with the 'Development on natural resources sensitive land' clause of Penrith LEP 2010, development consent is required for the following in biodiversity corridors and areas of remnant native vegetation:

    i. the subdivision of land;
    ii. earthworks (including removal of rock or other natural material or alteration of a natural waterway or drainage line);
    iii. the carrying out of a work;
    iv. development site preparation works clearing vegetation (including slashing or under-scrubbing);
    v. irrigation with treated effluent.

c) Clause 1b) iv) above does not include slashing or under-scrubbing undertaken for the purposes of controlling declared pests under the Biosecurity Act 2015 or to maintain dams, fences or asset protection zones.

Matters to be Considered

a) The 'Development on natural resources sensitive land' clause of Penrith LEP 2010 lists matters that must be considered for any new development or work described in clause 1b) above.
b) Council must also be satisfied that any development or work is designed, located and managed to avoid or minimise any potential adverse environmental impact.
c) The matters listed in the 'Development on natural resources sensitive land' clause must be addressed in supporting documentation submitted with the application.

Submission Requirements

a) The level of information required to assess a development or permit application to remove or clear trees or other vegetation will depend on:

    i. the scale and extent of proposed works;
    ii. site location and characteristics;
    iii. whether the site contains any significant trees;
    iv. whether the site contains any threatened species, threatened ecological communities, or protected plants and animals listed under the Biodiversity Conservation Act 2016;
    v. whether the site is identified on the NSW Office of Environment and Heritage Biodiversity Values Map.

b) A report prepared by a suitably qualified and experienced arborist may be required with a tree removal application and as a minimum should address the following in relation to trees:

    i. The location, number and type (species) of trees proposed to be removed;
    ii. A clear site plan identifying tree(s) proposed for removal and other relevant site features such as a dwelling, fences and driveways;
    iii. Details of the proposed works and the reasons for the works;
    iv. The age, health and condition, including structural soundness and the condition of the root zone;
    v. The aesthetic, scientific, ecological and/or historic importance;
    vi. The impact of the proposed work on the appearance, health or stability of trees or vegetation and the general amenity of the surrounding area, including any effect on the streetscape;

vii. In the case of an application to remove a tree(s) or vegetation, whether pruning would be a more practicable and desirable alternative;
viii. Any risk the tree(s) may pose to people, dwellings, structures or services;
ix. The extent of other trees and vegetation on the property;
x. Whether the tree(s) is likely to be used as habitat, or is a source of food or shelter for native animals;
xi. Whether the tree(s) is a threatened species or forms part of a threatened community; and
xii. Whether all alternatives to removing or pruning the tree or vegetation have been considered.

c) A Flora and Fauna Assessment Report including a Test of Significance under Part 7, Division 1, Section 7.3 of the Biodiversity Conservation Act 2016 may be required with an application to remove or clear native trees or other native vegetation. The report must be prepared by a suitably qualified and experienced ecological consultant.
d) A Biodiversity Development Assessment Report (BDAR) will be required for an application to remove or clear native trees or other native vegetation on land identified by the Biodiversity Values Map, or where clearing exceeds the Biodiversity Offset Scheme area clearing thresholds, or after applying the Test of Significance the impacts are likely be significant. A BDAR must be prepared by an accreditor assessor under the Biodiversity Conservation Act 2016.
e) Where vegetation works are proposed on land that is a heritage item or within a heritage conservation area, a Heritage Impact Statement may be required in accordance with Clause 5.10 Heritage conservation of Penrith LEP 2010. In this regard, applicants should consult with Council's Development Services Department.

<u>Protecting and Enhancing Biodiversity Corridors and Areas of Remnant Native Vegetation</u>

a) As the purpose of biodiversity corridors and areas of remnant native vegetation is to conserve native plants and animals, no clearing of native vegetation should occur within these areas.
b) As far as possible, biodiversity corridors and areas of remnant native vegetation should be retained with the smallest possible edge-to-area ratio. Measures must be taken to avoid fragmentation of vegetation by roads, tracks, services and the like.
c) Management of biodiversity corridors and areas of remnant native vegetation must allow natural processes to continue. Measures must be taken to prevent disturbance to existing vegetation, including roots, the hydrological regime and surrounding soil.
d) Management of biodiversity corridors and areas of remnant native vegetation must have regard to the value of the vegetation as fauna habitat. In particular, old trees (both living and dead), fallen logs, bush rock and a diverse vegetation structure, including understorey species, should be maintained for fauna habitat.
e) Where land disturbance occurs, natural regeneration is the preferred method of rehabilitation.
f) Locally native species must be used for revegetation and restoration of biodiversity corridors and areas of remnant native vegetation, if regeneration is unlikely to occur.
g) Where possible, new native vegetation must be planted in clusters and connected to isolated patches of vegetation to enhance the network of biodiversity corridors.
h) Non-native or introduced vegetation removed from a site is to be disposed of away from biodiversity corridors and areas of remnant native vegetation to avoid the spread of seed and regenerative vegetative material.
i) Where possible, structures and any associated fire protection zones must be sited on existing cleared land and not within biodiversity corridors and areas of remnant native vegetation.
j) Regular maintenance is required for existing tracks, especially to control track damage and erosion.
k) Non-essential roads and tracks in biodiversity corridors and areas of remnant native vegetation must be closed and rehabilitated.

l) Road signs should be erected where biodiversity corridors and areas of remnant native vegetation cross roads to alert motorists to the significance of fauna at these sites.

m) Activities such as horse riding and motorcycle riding can cause damage to tracks and native vegetation, spread weeds and introduce nutrients. Therefore, these activities must not occur in biodiversity corridors and areas of remnant native vegetation.

Development Near Biodiversity Corridors and Areas of Remnant Native Vegetation

a) All new development adjacent to biodiversity corridors and areas of remnant native vegetation must be located, designed and constructed to prevent or minimise, as far as possible, adverse impacts on native vegetation, fauna and habitat.

b) The layout of new development is to:

i. Ensure low intensity land uses are situated directly adjacent to the biodiversity corridor or area of remnant native vegetation;
ii. Ensure viability and functionality of the biodiversity corridor or area of remnant native vegetation;
iii. Maximise connectivity to neighbouring biodiversity corridors;
iv. Maximise connectivity to other areas of remnant native vegetation retained on-site or on neighbouring sites;
v. Ensure retained vegetation is configured to provide low edge-to-area ratios and avoid narrowing or bottlenecks within the biodiversity corridor;
vi. Ensure associated road infrastructure avoids core vegetation, or where not possible, provides for wildlife under/overpasses and minimises the intrusion, length and width;
vii. Where possible mitigate or prevent the impact of light pollution on fauna and habitat in adjacent biodiversity corridors and areas of remnant native vegetation.

Natural Regeneration and Planting Native Species

a) Natural regeneration is the preferred method of rehabilitation. However, if planting is to be undertaken, native species related to the local vegetation community should be selected when planting on both public lands and private lands to aid the restoration or expansion of bushland.

Management of Weeds and Invasive Species

a) Weed control refers to the control of non-native or introduced plants, particularly invasive species. Important elements of weed control are gaining an understanding of the causes of weed invasion and taking measures to minimise these causes.

b) Measures are to be taken to prevent the occurrence of factors leading to weed invasion. Weed invasion occurs within native vegetation areas mainly as a result of the following factors:

i. Physical site disturbance:
ii. Increase soil moisture due to runoff from adjacent areas;
iii. Increased nutrients from runoff or waste dumping
iv. Increased light levels due to clearing or dieback; and
v. Increase in weed propagules and seed dispersal agents.

c) Weed Control techniques are to be carried out in a manner that minimised negative environmental impacts. Different techniques are required in varying situations, especially along watercourses, which are very sensitive to pollution impacts. Regular monitoring of weeds is to be carries out on an ongoing basis to identify and respond to the occurrence of new plant species that pose a potential threat to native vegetation.

d) Biosecurity matter declared under the Biosecurity Act 2015 include weed plant species posing a threat to primary production, the environment or human health. Please refer to the Biosecurity Act 2015 for the requirements and a list of biosecurity matter. Further details on weed management in the Hawkesbury River County Council area (which includes the Penrith local government area) can be found at http://hrcc.nsw.gov.au/.

e) Weeds not declared as biosecurity matter (commonly called environmental weeds) should also be controlled as part of a weed management program.

1.9.3 Bushfire Management (Part C2.3)

The following objectives pertain bushfire management in the PDCP:

a) To minimise the risk to life, property and the environment in the event of a bushfire, including the lives of emergency personnel;
b) To ensure that all development on bush fire prone land makes adequate provision for access for emergency personnel, vehicles and equipment;
c) To balance the risk of bushfire to life and property with the other principles in this Plan, including the need to protect and enhance existing vegetation where possible; and
d) To recognise that land not classified as 'bushfire prone land' may still be subject to the impact from bushfire, particularly through ember attack.

The following controls pertain bushfire management in the PDCP:

<u>Planning for Bushfire Protection</u>

a) If land is identified as 'bushfire prone land' on the Bushfire Prone Land Map, then any development application on that land must address the bush fire protection measures set out in the document 'Planning for Bushfire Protection 2006 (PBP).
b) If the development proposes the subdivision of land for residential and rural-residential purposes or is a development which has been identified as 'special fire protection purposes', then the development will be Integrated Development under the Environmental Planning and Assessment Act 1979.
    a. A development identified as 'special fire protection purposes' includes:
        i. a school;
        ii. a child care centre;
        iii. a hospital;
        iv. a hotel, motel or other tourist accommodation;
        v. seniors housing;
        vi. a group home; and
        vii. any other purpose prescribed by section 100B (6) of the Rural Fires Act 1997.

<u>Bushfire Assessment Report</u>

a) A Bushfire Assessment Report, prepared in accordance with the PBP, must accompany all development applications on land identified as bush fire prone land. (For report requirements, see Appendix F3 – DA Submission Requirements).
b) The Single Dwelling Application Kit (available on the Rural Fire Service website www.rfs.nsw.gov.au) provides applicants with a streamlined approach to meeting the requirements of the PBP for single dwellings. It has been designed to assist applicants to provide information in support of a development application and presents options that can be incorporated into the building to mitigate the impact of bush fire on life and property.

Land that is Not Classified as Bushire Prone Land

a) Development on land zoned RU1, RU2, RU4, RU5, E2, E3, E4 and R5, or on land within 250m of any of these zones that is not identified as 'bushfire prone land' on the Bushfire Prone Land Map must consider ways to minimise the risk of ember attack, particularly with regard to roof design, building materials and landscape design. These matters must be addressed in the Statement of Environmental Effects.

Bushfire Hazard Reduction

a) Although consent is not required for bushfire hazard reduction work, it must be authorised by the Rural Fires Act 1997.

2. Methodology

2.1 Desktop Assessment and Literature Review

A thorough literature review of local information relevant to the Penrith City Council area was undertaken. Searches using NSW Wildlife Atlas (BioNet; DPIE 2021b) and the Commonwealth Protected Matters Search Tool (DAWE 2021) were conducted to identify all current threatened flora and fauna, as well as migratory fauna records within a 10km x 10km cell search area centred on the Subject Property. This data was used to assist in establishing the presence or likelihood of any ecological values as occurring on or adjacent to the Subject Property and helped inform our Ecologists on what to look for during the site assessment.

Soil landscape and geological mapping was examined to gain an understanding of the environment on the Subject Property and to assist in determining whether any threatened flora or ecological communities may occur there (Bannerman and Hazleton 2011).

2.2 Ecological Site Assessment

2.2.1 General Survey

A site assessment was undertaken by Narla Ecologist, Ellena Tsanidis, on Thursday the 1st of July. During the site assessments, the following activities were undertaken:

- Identifying and recording the vegetation communities present on the Subject Property, with a focus on identifying any Threatened Ecological Communities (TEC);
- Recording a detailed list of flora species encountered on the Subject Property, with a focus on threatened species, species diagnostic of TECs and Priority Weeds;
- Recording opportunistic sightings of any fauna species seen or heard on or within the immediate surrounds of the Subject Property;
- Identifying and recording the locations of notable fauna habitat such as important nesting, roosting or foraging microhabitats;
- Assessing the connectivity and quality of the vegetation within the Subject Property and surrounding area;
- Any other habitat features that may support fauna (particularly threatened) species; and
- Targeting the habitat of any threatened and regionally significant fauna including:
    - Tree hollows (habitat for threatened large forest owls, parrots, cockatoos and arboreal mammals);
    - Caves and crevices (habitat for threatened reptiles, small mammals and microbats);
    - Termite mounds (habitat for threatened reptiles);
    - Soaks (habitat for threatened frogs);
    - Wetlands (habitat for threatened fish, frogs and water birds);
    - Drainage lines (habitat for threatened fish and frogs);
    - Fruiting trees (food for threatened frugivorous birds and mammals);
    - Flowering trees (food for threatened nectivorous mammals and birds);
    - Trees and shrubs supporting nest structures (habitat for threatened birds and arboreal mammals);
    - Logs, bark and artificial debris (habitat for threatened frogs, reptiles and snails.

2.2.2 Weather Conditions

Weather conditions recorded at the nearest weather station (Penrith NSW) prior to and during the general flora and fauna survey period are provided in **Table 3** (BOM 2021). The data reveals some rainfall leading up to the survey. These weather conditions may be conducive to the emergence of annual herbs.

Table 3. Weather conditions recorded at Penrith NSW (station 067113) preceding and during the site assessments (site assessment dates in bold)

Survey date	Day	Minimum Temp. (°C)	Maximum Temp. (°C)	Rainfall (mm)
24/06/2021	Thursday	8.9	22.5	0
25/06/2021	Friday	8.4	19.9	0.8
26/06/2021	Saturday	7.4	18.7	0
27/06/2021	Sunday	3.0	18.7	0
28/06/2021	Monday	3.8	17.6	0
29/06/2021	Tuesday	6.7	16.1	0
30/06/2021	Wednesday	7.6	18.7	1.2
01/07/2021	**Thursday**	**9.8**	**16.0**	**1.2**

2.2.3 Mapping and Analysis of Vegetation Communities

Narla examined local satellite imagery, geological mapping, soil landscape mapping and topographic mapping, in addition to existing vegetation mapping in order to stratify the Subject Property and guide the site assessment survey efforts. The following documents were consulted during assessment to assist with the identification of vegetation communities present within the Subject Property:

- eSPADE v2.1 (DPIE 2021d);
- Soil Landscapes of the Penrith 1:100,000 Sheet map and report (Bannerman and Hazleton 2011); and
- Tozer, M. (2013) The Native Vegetation of the Cumberland Plain, western Sydney.

3. Native Vegetation

3.1 Vegetation Community

3.1.1 Historically Mapped Vegetation Communities

Vegetation mapping conducted by Tozer (2013) indicated the presence of one (1) Plant Community Type (PCT) community within the Subject Property (**Figure 3**):

- PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

3.1.2 Field Validated Vegetation Communities

Plant Community Type selection for the vegetation community occurring on the Subject Property was undertaken using information and databases provided in the BioNet Vegetation Classification System (DPIE 2021c). The following selection criteria were used in the PCT Filter Tool to develop the PCT shortlist:

- IBRA Bioregion: Sydney Basin
- IBRA Subregion: Cumberland
- Dominant Species: *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus crebra* (Narrow-leaved Ironbark).

This process delivered a selection of ten (10) PCT's that occur within the Cumberland IBRA Subregion (and Sydney Basin Bioregion) that had one of the observed dominant species (i.e., the highest potential of occurring within the Subject Property). The geographical distribution and landscape position characterised by each shortlisted PCT was then compared against the location and landscape of the Subject Property. It was found that the Subject Property was located in the right distribution and contained the appropriate landscape attributes for three (3) candidate PCTs (**Table 4**). The steps taken to justify the presence/absence of the candidate PCT within the Subject Property are detailed in **Table 5.**

A description of the PCT and the historically cleared areas within the Subject Land can be found in **Table 6** and **Table 7.**

Table 4. Output from the PCT Filter Tool (DPIE 2021c) and subsequent shortlisting of candidate PCTs. Green shading indicates the PCTs from the output that occur within the distribution or on the appropriate landscape position of the Subject Property.

Plant Community Type (PCT)	Subject Property within known distribution/ landscape position.	No. of Matches	*Eucalyptus tereticornis*	*Eucalyptus crebra*
PCT 830: Forest Red Gum - Grey Box shrubby woodland on shale of the southern Cumberland Plain, Sydney Basin Bioregion	No. Restricted to rugged areas at higher elevations (50-300m) in the southern half of the Cumberland Plain. The Subject Property occurs on elevations between 19-31m.	1	✓	-

Plant Community Type (PCT)	Subject Property within known distribution/ landscape position.	No. of Matches	*Eucalyptus tereticornis*	*Eucalyptus crebra*
PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	Yes.	1	✓	-
PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	Yes	1	✓	-
PCT 850: Broad-leaved Paperbark - Swamp Oak - Saw Sedge swamp forest on coastal lowlands of the Central Coast and Lower North Coast	No. This PCT is restricted to elevations between 50 and 350m above sea level. The Subject Property occurs on elevations between 19-31m	1	✓	-
PCT 860: Grey Gum - Broad-leaved Ironbark dry open forest on gorge slopes of the Blue Mountains, Sydney Basin Bioregion	No. Occurs on dry hill slopes with loamy soils in gorges of the Blue Mountains, particularly the Burragorang Valley. The Subject Property does not occur within the gorges of the Blue Mountains.	1	-	✓
PCT 862: Grey Gum - Hard-leaved Scribbly Gum woodland of the Coxs River Valley, Sydney Basin Bioregion	No. Mainly occurs in the Kedumba and Megalong valleys on sandy loams derived from Permian sediments at altitudes up to 700m. The Subject Land does not occur within these valleys and is situated on heavy clay soil	1	-	✓
PCT 1319: White Stringybark - Grey Gum grassy forest on shale caps of the Woronora Plateau, Sydney Basin Bioregion	No. Occurs on shale lenses on elevated plateaux of the upper Nepean catchment (Woronora Plateau) between 300 and	1	-	✓

Plant Community Type (PCT)	Subject Property within known distribution/ landscape position.	No. of Matches	*Eucalyptus tereticornis*	*Eucalyptus crebra*
	600m altitude. The Subject Property occurs on elevations between 19-31m			
PCT 1395: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion	No. PCT 1395 is found on the fringes of the Cumberland Plain and is most extensively distributed between Appin and the Holsworthy defence area. The Subject Property does not occur between these two areas.	1	-	✓
PCT 1800: Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	Yes.	1	✓	-
PCT 1847: Smooth-barked Apple - Grey Gum - Forest Red Gum tall open forest on shale bands around the foreshores of the drowned river valleys of Sydney	No. Restricted to elevations between 6 and 20m above sea level and where mean annual rainfall exceeds 1100 millimetres. The Subject Property occurs on elevations between 19-31m and the Castlereagh area receives an average of 835mm of rainfall annually.	1	✓	-

Table 5. PCT Selection criteria and justification. Green indicates the selected PCT

Candidate PCT	Characteristics (DPIE 2021c)	Justification
PCT 835: Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion	**Landscape position/ geology**	Narla have **NOT** assigned this PCT to the vegetation within the Subject Property. This PCT is typically characterised by a canopy which includes one of either rough-barked apple (*Angophora floribunda*) or broad-leaved apple (*Angophora subvelutina*) and one or both of forest red gum (*Eucalyptus tereticornis*) and cabbage gum (*Eucalyptus amplifolia*). The canopy within the Subject Property did not include any *Angophora* spp., and the abundance of *Eucalyptus crebra* is not accounted for with this PCT. This PCT is therefore not the 'best fit' for the vegetation within the Subject Property.
	Cumberland Riverflat Forest (Benson and Howell 1990) is an open eucalypt forest situated on broad alluvial flats of the Hawkesbury and Nepean River systems. It also forms narrower ribbons alongside streams and creeks that drain the Cumberland Plain.	
	Characteristic canopy	
	Eucalyptus tereticornis, Angophora floribunda and *Eucalyptus amplifolia subsp. amplifolia.*	
	Characteristic mid-storey/ shrub	
	Acacia parramattensis, Bursaria spinosa subsp. *spinosa* and *Sigesbeckia orientalis.*	
	Characteristic ground layer	
	Microlaena stipoides, Oplismenus aemulus, Dichondra repens, Entolasia marginata, Solanum prinophyllum, Lobelia purpurascens, Desmodium gunii, Echinopogon ovatus, Commelina cyanea and *Veronica plebeia.*	
PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	**Landscape position/ geology**	Narla have assigned this PCT to the vegetation within the Subject Property as it fits with the landscape profile and comprises a high number of diagnostic canopy and ground layer species. The canopy of this PCT is usually characterised by grey box (*Eucalyptus moluccana*), forest red gum (*Eucalyptus tereticornis*) and ironbark (*Eucalyptus crebra/Eucalyptus fibrosa*). The canopy within the Subject Property contained an abundance of *E. tereticornis* and *E. crebra.* Furthermore, the sparse abundance of *Eucalyptus eugenioides* within the Subject Property is accounted for
	The primary habitat for the community is listed as occurring at elevations less than 150 meters above sea level with some sites occurring at higher elevations where the landscape remains gently inclined. Rainfall is restricted to a narrow band between 750 and 950 millimetres per annum. The community occupies the north-west and west zones of the study area but is widespread elsewhere across the Cumberland Plain.	
	Characteristic canopy	
	Eucalyptus moluccana and *Eucalyptus tereticornis.*	
	Characteristic mid-storey/ shrub	

Candidate PCT	Characteristics (DPIE 2021c)	Justification
	Bursaria spinosa subsp. *spinosa.*	by this PCT as it is noted to occur less frequently (Tozer et al 2010). As such, all canopy species within the Subject Property are considered by this PCT. Characteristic ground layer species included, *Bursaria spinosa* subsp. *spinosa, Dichondra repens, Cheilanthes sieberi, Aristida ramosa, Microlaena stipioides* and *Goodenia hederacea.* Tozer et al. (2010) define the primary habitat for the community as occurring at elevations less than 150 meters above sea level with some sites occurring at higher elevations where the landscape remains gently inclined. Rainfall is restricted to a narrow band between 750 and 950 millimetres per annum. The Subject Property occurs on elevations between 19-31m and the Castlereagh area receives an average of 835mm of rainfall annually. Given the accountability of all canopy species, numerous ground layer species and elevation, landscape and rainfall requirements, this PCT was seen as the best fit for the Subject Property .
	Characteristic ground layer	
	Dichondra repens, Cheilanthes sieberi, Aristida vagans, Microlaena stipoides, Themeda triandra, Brunoniella australis, Desmodium gunnii, Opercularia diphylla, Wahlenbergia gracilis, Dichelachne micrantha, Paspalidium distans, Eragrostis leptostachya, Lomandra filiformis, Lomandra multiflora, Dianella longifolia, Oxalis perennans, Euchiton sphaericus, Goodenia hederacea, Aristida ramosa, Arthropodium milleflorum, Austrodanthosia tenuior, Cymbopogon refractus and *Echinopogon caespitosus.*	
PCT 1800: Swamp Oak open forest on riverflats of the Cumberland Plain and Hunter valley	**Landscape position/ geology**	Narla have **NOT** assigned this PCT to the vegetation within the Subject Property. The distinguishing feature of this PCT is the prominent stands of swamp oak (*Casuarina glauca*) found along or near streams. No *Casuarina glauca* were identified within the Subject Property and as such, this PCT was not deemed the best fit.
	Cumberland Swamp Oak Riparian Forest (NPWS 2002, Tozer 2003) is found on the riverflats of the Cumberland Plain in western Sydney and in the Hunter Valley (NPWS 2000c).	
	Characteristic canopy	
	Casuarina glauca, Eucalyptus moluccana, Angophora floribunda, Eucalyptus baueriana and *Eucalyptus tereticornis.*	
	Characteristic mid-storey/ shrub	

Candidate PCT	Characteristics (DPIE 2021c)	Justification
	Casuarina glauca, Bursaria spinosa, Melaleuca decora, Melaleuca nodosa, Melaleuca styphelioides, Acacia decurrens, Bursaria spinosa, Melaleuca nodosa, Brunoniella australis, Dianella longifolia, Dichondra repens, Lomandra longifolia, Maytenus silvestris, Ozothamnus diosmifolius and *Polyscias sambucifolia.*	
	Characteristic ground layer	
	Entolasia marginata, Einadia hastata, Microlaena stipoides var. *stipoides, Echinopogon ovatus, Lobelia purpurascens, Commelina cyanea, Senecio hispidulus, Veronica plebeia* and *Wahlenbergia gracilis.*	

Table 6. Description of the PCT within the Subject Property.

PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	
	
Extent within Subject Property (approximate)	0.29ha
Description of the Vegetation within the Subject Property	
This vegetation community consisted of a moderate to tall canopy layer, comprised of *Eucalyptus tereticornis, Eucalyptus crebra* and *Eucalyptus eugenioides*. The shrub layer was predominately cleared with very few *Acacia parramattensis* remaining. *Bursaria spinosa* was seen regenerating beneath the dripline of trees throughout the Subject Property. The ground layer comprised of numerous native grasses and forbs such as *Einadia spp., Glycine spp., Dichondra repens, Cheilanthes sieberi* and *Microlaena stipoides.* Exotic species also dominated the groundlayer with large areas of *Bryophyllum delagoense, Ehrharta erecta, Sida rhombifolia* and *Eragrostis curvula* occurring throughout.	
Description from Tozer et al 2010	
Cumberland Shale Plains Woodland (GW p29) is equivalent to GW 29 described by Tindall et al. (2004), and is a eucalypt woodland with an open shrub layer and grassy groundcover. It occurs on clay-loam soils derived from Wianamatta shale and is restricted to the Cumberland Plain, western Sydney. Cumberland Shale Plains Woodland is primarily found below 150m ASL but may occur on flat terrain up to 300m ASL. It lies in a coastal rainshadow receiving 750 – 950 mm mean annual rainfall. Cumberland Shale Plains Woodland grades into Cumberland Shale Hills Woodland (GW p28) as elevation and topographic roughness increase in the southern half of the Cumberland Plain. Towards the margins of the plain Cumberland Shale Plains Woodland grades into Cumberland Shale Sandstone Transition Forest as the depth of the underlying sandstone strata decreases. Cumberland Shale Plains Woodland shares some species with Castlereagh Shale-Gravel Transition Forest (DSF p502), which occurs on shale soils with a high	

PCT 849: Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion	
concentration of iron-indurated gravel or overlain by Tertiary alluvium. Cumberland Shale Plains Woodland, also described by Tozer (2003), was extensively cleared for the rural and urban development of western Sydney. The remaining stands are small fragments threatened by continued clearing, degradation, weed invasion and high fire frequency. A few occurrences are represented within conservation reserves, such as Scheyville National Park.	
Justification of Vegetation Community	The determination of this community was based on the IBRA Bioregion, IBRA Sub-region, landscape attributes including soil landscapes and elevation, and the presence of a large number of diagnostic species (representing each stratum).
BC Act Status	Conforms to the BC Act listed Critically Endangered Community (CEEC) - Cumberland Plain Woodland in the Sydney Basin Bioregion.
EPBC Act Status	Does not conform to the EPBC Act listed CEEC due to poor understory native species cover.
References	Department of Planning, Industry and Environment (DPIE) (2021c) BioNet Vegetation Classification. https://www.environment.nsw.gov.au/research/Visclassification.htm NSW Scientific Committee (2010) Cumberland Plain Woodland in the Sydney Basin Bioregion – critically endangered ecological community listing Threatened Species Scientific Committee (2009). Commonwealth Listing Advice on Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. Department of the Environment, Water, Heritage and the Arts. Canberra, ACT: Department of the Environment, Water, Heritage and the Arts.

Table 7. Description of the Cleared Vegetation occurring within the Subject Property

Historically Cleared Vegetation	
	
Extent within Subject Property (approximate)	0.23ha
Description of the Vegetation within the Subject Property	
There were no native canopy and shrub species within this vegetation zone. Low native species diversity was recorded within the ground layer which included *Dichondra repens* and *Commelina cyanea.* The vast majority of the species diversity and coverage within the zone comprised of exotic species including *Eragrostis curvula, Cenchrus clandestinus, Lolium perenne, Plantago lanceolata, Bryophyllum delagoense* and *Hypochaeris radicata.*	
Justification of Vegetation Community	The majority of ground cover within this zone was exotic. There were only sporadic occurrences of native groundcover species and it was evident that the zone had been regularly mowed.
BC Act Status	There are currently no BC Act listed TECs associated with this Community
EPBC Act Status	There are currently no EPBC Act listed TECs associated with this Community

Figure 3. Historically mapped vegetation communities within the Subject Property (Tozer et al 2013).

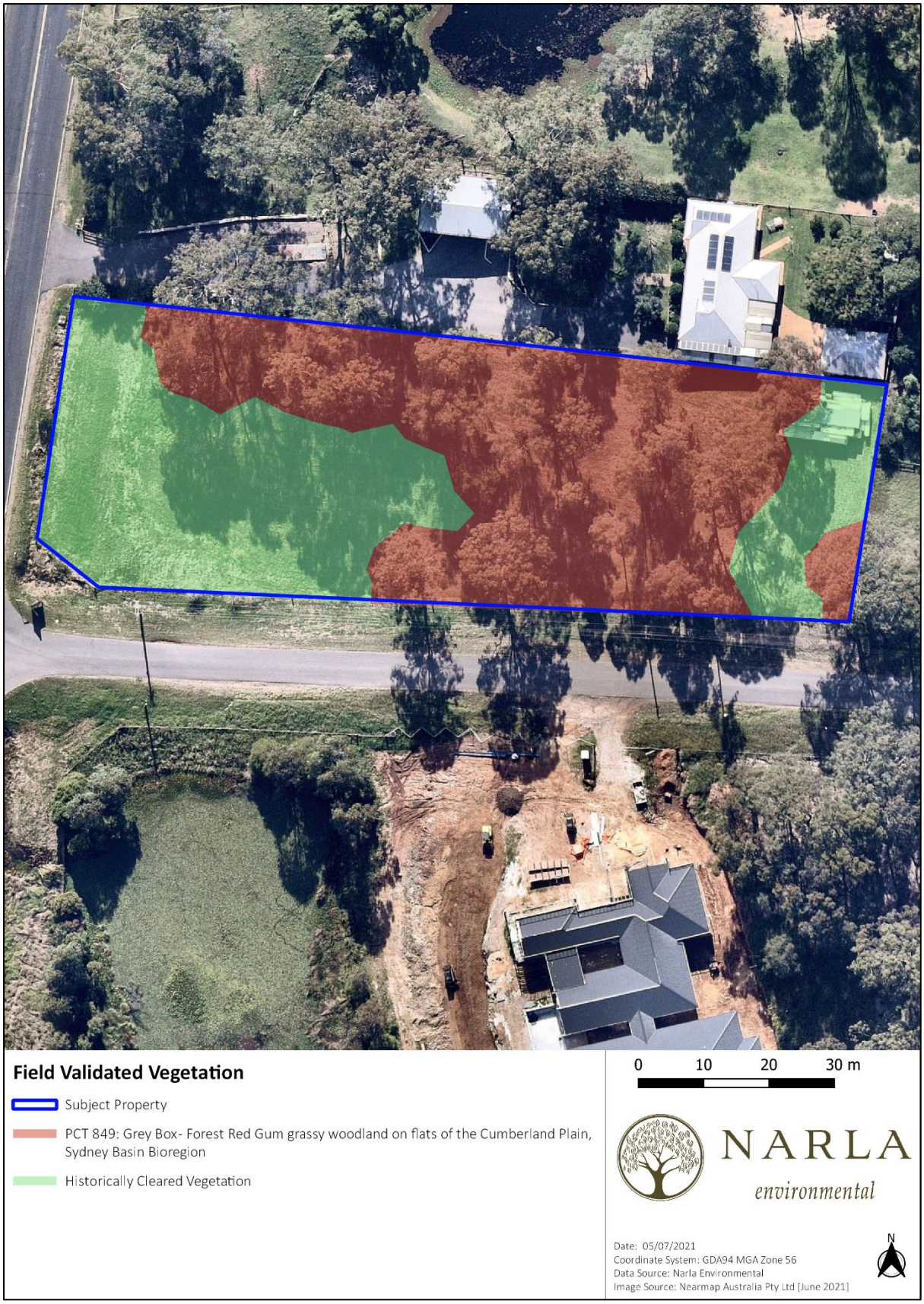

Figure 4. Narla field-validated vegetation communities within the Subject Property.

3.2 Threatened Flora

Desktop analysis revealed a range of threatened flora as occurring or having the potential to occur on or within a 10km radius of the Subject Property. Thorough targeted surveys were undertaken throughout the Subject Property for potentially occurring threatened flora. No threatened flora species were identified within the Subject Property.

The following locally occurring species were assessed for their potential to occur on the Subject Property (**Table 8**).

Table 8. Likelihood of occurrence of threatened flora species within the Subject Property.

Species	BC Act	EPBC Act	Number of historical records within 10km of the Subject Property	Habitat Requirements (DPIE 2021b)	Likelihood of Occurrence
Acacia bynoeana (Bynoe's Wattle)	Endangered	Vulnerable	52	Occurs in heath or dry sclerophyll forest on sandy soils.	Low. The Subject Property occurs on heavy clays. A targeted survey was conducted and no individuals were identified within the Subject Property.
Allocasuarina glareicola	Endangered	Endangered	6	Grows in Castlereagh woodland on lateritic soil. Found in open woodland with *Eucalyptus parramattensis, Eucalyptus fibrosa, Angophora bakeri, Eucalyptus sclerophylla* and *Melaleuca decora.* Common associated understorey species include *Melaleuca nodosa, Hakea dactyloides, Hakea sericea, Dillwynia tenuifolia, Micromyrtus minutiflora, Acacia elongata, Acacia brownei, Themeda australis* and *Xanthorrhoea minor*.	Low. The associated canopy species do not occur within the Subject Property. A targeted survey was conducted and no individuals were identified within the Subject Property.

Species	BC Act	EPBC Act	Number of historical records within 10km of the Subject Property	Habitat Requirements (DPIE 2021b)	Likelihood of Occurrence
Dillwynia tenuifolia	Vulnerable	-	1178	In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	Low to moderate. Whilst potential habitat did exist for this species, targeted surveys were conducted and no individuals were identified within the Subject Property.
Eucalyptus benthami (Camden White Gum)	Vulnerable	Vulnerable	2	Requires a combination of deep alluvial sands and a flooding regime that permits seedling establishment. Recruitment of juveniles appears to be most successful on bare silt deposits in rivers and streams. The recorded elevation range for the species is from 30m ASL at Bents Basin to 750m ASL in the Kedumba population. Most of the individuals are around 60 to 300m ASL.	Low. The Subject Property occurs on heavy clays. A targeted survey was conducted and no individuals were identified.
Grevillea juniperina subsp. juniperina (Juniper-leaved Grevillea)	Vulnerable	-	221	Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels. Recorded from Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest.	Low. Whilst potential habitat did exist for this species, targeted surveys were conducted and no individuals were identified within the Subject Property.
Marsdenia viridiflora	Endangered Population	-	175	Grows in vine thickets and open shale woodland.	Low. No such habitat was present within the Subject Property. A targeted survey was conducted and no individuals were identified.

Species	BC Act	EPBC Act	Number of historical records within 10km of the Subject Property	Habitat Requirements (DPIE 2021b)	Likelihood of Occurrence
Micromyrtus minutiflora	Endangered	Vulnerable	328	Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments.	Low to moderate. Whilst potential habitat did exist for this species, targeted surveys were conducted and no individuals were identified within the Subject Property.
Persoonia hirsuta (Hairy Geebung)	Endangered	Endangered	2	The Hairy Geebung is found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone. It is usually present as isolated individuals or very small populations. It is probably killed by fire (as other Persoonia species are) but will regenerate from seed	Low. The Subject Property occurs on heavy clays. A targeted survey was conducted and no individuals were identified.
Persoonia nutans (Nodding Geebung)	Endangered	Endangered	829	Northern populations are confined to aeolian and alluvial sediments and occur in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland and some in Cooks River / Castlereagh Ironbark Forests. Southern populations also occupy tertiary alluvium, but extend onto shale sandstone transition communities and into Cooks River / Castlereagh Ironbark Forest.	Low. The Subject Property does not occur within Agnes Banks Woodland, Castlereagh Scribbly Gum Woodland or Cooks River / Castlereagh Ironbark Forests. A targeted survey was conducted and no individuals were identified.

Species	BC Act	EPBC Act	Number of historical records within 10km of the Subject Property	Habitat Requirements (DPIE 2021b)	Likelihood of Occurrence
Pultenaea parviflora	Endangered	Vulnerable	227	May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland. *Eucalyptus fibrosa* is usually the dominant canopy species. *Eucalyptus globoidea, E. longifolia, E. parramattensis, E. sclerophylla* and *E. sideroxylon* may also be present or co-dominant, with *Melaleuca decora* frequently forming a secondary canopy layer.	Low. The associated canopy species do not occur within the Subject Property. A targeted survey was conducted and no individuals were identified within the Subject Property.
Pultenaea villifera	Endangered	-	8	Grows in dry sclerophyll forest and woodlands on sandy soil and appears to favour sheltered spots. Flowers all year, with peak flowering July to December. Fire sensitive (although can resprout following low intensity fire), with recruitment occurring from a persistent soil stored seed bank following fire.	Low. The Subject Property occurs on heavy clays. A targeted survey was conducted and no individuals were identified.

4. Fauna

4.1 Fauna Encountered

Native fauna species were identified within and surrounding the Subject Property during the site assessment. All fauna species encountered are presented in Appendix A.

4.2 Threatened Fauna Habitat

Details of the fauna habitat recorded in the Subject Property are included in Table 9. The likelihood of occurrence of threatened fauna species on the Subject Property is presented in Table 10.

Table 9. Fauna habitat values identified within the Subject Property

Habitat component	Site values
Coarse woody debris	Small amounts of debris material was identified throughout the bushland within the Subject Property
Rock outcrops and bush rock	Absent.
Caves, crevices and overhangs	Absent
Culverts, bridges, mine shafts, or abandoned structures	Absent.
Nectar/lerp-bearing Trees	Many nectar-bearing trees were recorded within the Subject Property including *Eucalyptus tereticornis*, *Eucalyptus crebra* and *Eucalyptus eugenioides*. These trees may provide intermittent nectar and/or lerp sources for nomadic nectivores such as Grey-headed Flying-fox.
Nectar-bearing shrubs	Very few *Acacia parramattensis* were recorded within the Subject Property. This shrub may provide intermittent nectar and/or lerp sources for similar nectivores.
Koala Feed Trees	Koala feed tree species were identified within the Subject Property including *Eucalyptus tereticornis*, *Eucalyptus crebra* and *Eucalyptus eugenioides* (Koala SEPP 2021).
Large stick nests	No large stick nests suitable for threatened raptorial birds of prey were observed within the Subject Property.
Sap and gum sources	Native sap and gum source trees were recorded within the Subject Property including *Eucalyptus tereticornis*, *Eucalyptus crebra* and *Eucalyptus eugenioides.*
She-oak fruit (Glossy Black Cockatoo feed)	Absent
Seed-bearing trees and shrubs	Seed-bearing trees such as the Eucalypt species identified within the Subject Property may provide foraging habitat for Gang-gang Cockatoo.
Soft-fruit-bearing trees	Absent.
Dense shrubbery and leaf litter	Absent.
Tree hollows	Absent
Decorticating bark	Absent.

Habitat component	Site values
Wetlands, soaks and streams	Absent
Open water bodies	Absent.
Estuarine, beach, mudflats, and rocky foreshores	Absent.

4.2.1 Migratory Fauna Species

The following EPBC Act listed migratory fauna species were considered to potentially utilise habitat within or around the Subject Property for foraging or passage:

- *Cuculus optatus* (Oriental Cuckoo);
- *Hirundapus caudacutus* (White-throated Needletail);
- *Monarcha melanopsis* (Black-faced Monarch);
- *Monarcha trivirgatus* (Spectacled Monarch);
- *Motacilla flava* (Yellow Wagtail);
- *Myiagra cyanoleuca* (Satin Flycatcher); and
- *Rhipidura rufifrons* (Rufous Fantail).

It is deemed that any potential occurrence of these species would be purely sporadic fly-ins. It is not deemed likely that future development within the Subject Property would result in a significant impact to any of these species.

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Table 10. Likelihood of occurrence of threatened fauna species within the Subject Property.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
Anthochaera Phrygia (Regent Honeyeater)	Critically Endangered	Critically Endangered	4	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. Once recorded between Adelaide and the central coast of Queensland, its range has contracted dramatically in the last 30 years to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. In some years flocks converge on flowering coastal woodlands and forests.	This species is a generalist forager, although it feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Foraging habitat may be present within the Subject Site. There are three known key breeding areas for this species, two of them in NSW - Capertee Valley and Bundarra-Barraba regions. The species breeds in Box-Ironbark and other temperate woodlands and riparian gallery forest dominated by River Sheoak. Regent Honeyeaters usually nest in horizontal branches or forks in tall mature eucalypts and Sheoaks. Also nest in mistletoe haustoria. The Subject Property is not located on the important areas map for this species.	Low to moderate. No suitable breeding habitat exists within the Subject Property however the species might utilise the property for foraging.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
Artamus cyanopterus cyanopterus (Dusky Woodswallow)	Vulnerable	-	18	Dusky Woodswallow's are widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range.	Often inhabit dry, open eucalypt forests and woodlands with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. Has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest	Low to moderate. Sub-optimal breeding habitat exists within the Subject Property however the species might utilise the property for foraging.
Callocephalon fimbriatum (Gang-gang Cockatoo)	Vulnerable	-	8	The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee.	In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. May also occur in sub-alpine Snow Gum (*Eucalyptus pauciflora*) woodland and occasionally in temperate rainforests. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in	Low to moderate. No suitable breeding habitat exists within the Subject Property however the species might utilise the property for foraging.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
					hollows that are 10cm in diameter or larger and at least 9m above the ground in eucalypts.	
Calyptorhynchus lathami (Glossy Black-Cockatoo)	Vulnerable	-	1	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population exists on Kangaroo Island, South Australia.	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of Sheoak occur. Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) are important foods. Inland populations feed on a wide range of Sheoaks, including Drooping Sheoak, *Allocasuarina diminuta*, and *A. gymnathera*. Feeds almost exclusively on the seeds of several species of she-oak (*Casuarina* and *Allocasuarina* species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites. A single egg is laid between March and May.	Low. No suitable breeding or foraging habitat was identified within the Subject Property.
Chalinolobus dwyeri (Large-eared Pied Bat)	Vulnerable	Vulnerable	6	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation	Low. No suitable breeding habitat was identified; however, the species might

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
				very patchy distribution in NSW. There are scattered records from the New England Tablelands and North West Slopes.	dry open forest and woodland close to these features. Found in well-timbered areas containing gullies.	forage within the Subject Property.
Chthonicola sagittata (Speckled Warbler)	Vulnerable	-	4	The Speckled Warbler has a patchy distribution throughout south-eastern Queensland, the eastern half of NSW and into Victoria, as far west as the Grampians. The species is most frequently reported from the hills and tablelands of the Great Dividing Range, and rarely from the coast. There has been a decline in population density throughout its range, with the decline exceeding 40% where no vegetation remnants larger than 100ha survive.	The Speckled Warbler lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees. Pairs are sedentary and occupy a breeding territory of about ten hectares, with a slightly larger home-range when not breeding.	Low to moderate. Sub-optimal breeding habitat exists within the Subject Property given the fragmented nature of the vegetation and the lack of rocky ridges, native grasses and a shrub layer. However, the species might utilise the property for foraging.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
Circus assimilis (Spotted Harrier)	Vulnerable	-	1	The Spotted Harrier occurs throughout the Australian mainland, except in densely forested or wooded habitats of the coast, escarpment and ranges, and rarely in Tasmania. Individuals disperse widely in NSW and comprise a single population.	Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands. Builds a stick nest in a tree and lays eggs in spring (or sometimes autumn), with young remaining in the nest for several months. Preys on terrestrial mammals (e.g. bandicoots, bettongs, and rodents), birds and reptile, occasionally insects and rarely carrion.	Low. Few proximal records however potential habitat was identified within the Subject Property. The species may forage within the Subject Property.
Climacteris picumnus victoriae (Brown Treecreeper [eastern subspecies])	Vulnerable	-	3	The Brown Treecreeper is endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges.	Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species. When foraging in trees and on the ground, they peck and	Low. Minimal proximal records however potential habitat was identified within the Subject Property.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
					probe for insects, mostly ants, amongst the litter, tussocks and fallen timber, and along trunks and lateral branches. Hollows in standing dead or live trees and tree stumps are essential for nesting.	
Daphoenositta chrysoptera (Varied Sittella)	Vulnerable	-	25	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction over the past several decades.	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Builds a cup-shaped nest of plant fibres and cobwebs in an upright tree fork high in the living tree canopy, and often re-uses the same fork or tree in successive years.	Low to Moderate. Sub-optimal breeding habitat exists within the Subject Property given the lack of smooth-barked gums with dead branches. Potential foraging and breeding habitat was identified within the Subject Property.
Dasyurus maculatus (Spotted-tailed Quoll)	Vulnerable	2	89	The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, south-east and north-	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Quolls use	Low. No suitable breeding habitat within the Subject Site. Potential foraging habitat was

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
				eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common.	hollow-bearing trees, fallen logs, other animal burrows, small caves and rock outcrops as den sites. A generalist predator with a preference for medium-sized (500g-5kg) mammals. Consumes a variety of prey, including gliders, possums, small wallabies, rats, birds, bandicoots, rabbits, reptiles and insects. Also eats carrion and takes domestic fowl.	identified within the Subject Property and prey species are likely to utilise the site.
Falco subniger Black Falcon	Vulnerable	-	1	The Black Falcon is widely, but sparsely, distributed in New South Wales, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales are likely to be preferable to the Brown Falcon. In New South Wales there is assumed to be a single population that is continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres (Marchant & Higgins 1993). The Black Falcon occurs as solitary individuals, in pairs, or in	The Black Falcon is found along tree-lined watercourses and in isolated woodlands, mainly in arid and semi-arid areas. It roosts in trees at night and often on power poles by day. Black Falcons nest along tree-lined creeks and rivers of inland drainage systems. Eggs are laid in the abandoned stick nests of other birds, usually high in a tree. The female mainly incubates, broods and feeds the nestlings, while the male brings food. Both parents may bring food when the nestlings are older.	Low to Moderate. Sub-optimal breeding habitat exists within the Subject Property given the fragmented nature of the vegetation. Potential foraging habitat was identified within the Subject Property.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
				family groups of parents and offspring.		
Falsistrellus tasmaniensis (Eastern False Pipistrelle)	Vulnerable	-	7	The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania.	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. Hunts beetles, moths, weevils and other flying insects above or just below the tree canopy.	Low. No suitable breeding habitat. This species may forage within the Subject Property.
Glossopsitta pusilla (Little Lorikeet)	Vulnerable	-	10	The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury.	Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity. Isolated flowering trees in open country, e.g., paddocks, roadside remnants and urban trees also help sustain viable populations of the species. Feeds mostly on nectar and pollen, occasionally on native fruits such as mistletoe, and only rarely in orchards. Nests in proximity to feeding areas if possible, most typically selecting hollows in the limb or trunk of	Low to Moderate. No hollows were located however potential foraging habitat was present within the Subject Property.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
					smooth-barked Eucalypts. Entrance is small (3 cm) and usually high above the ground (2–15 m).	
Haliaeetus leucogaster (White-bellied Sea-Eagle)	Vulnerable	-	3	The White-bellied Sea-eagle is distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin. In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways.	Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Nests are large structures built	Low. Sub-optimal breeding habitat exists within the Subject Property given the lack of emergent dead branches or large dead trees fragmented nature of the vegetation. Potential foraging habitat was identified in close proximity to the Subject Property.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
					from sticks and lined with leaves or grass.	
Heleioporus australiacus (Giant Burrowing Frog)	Vulnerable	Vulnerable	1	The Giant Burrowing Frog is distributed in south eastern NSW and Victoria, and appears to exist as two distinct populations: a northern population largely confined to the sandstone geology of the Sydney Basin and extending as far south as Ulladulla, and a southern population occurring from north of Narooma through to Walhalla, Victoria.	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Individual frogs occupy a series of burrow sites, some of which are used repeatedly. The home ranges of both sexes appear to be non-overlapping suggesting exclusivity of non-breeding habitat. When breeding, frogs will call from open spaces, under vegetation or rocks or from within burrows in the creek bank. Males show strong territoriality at breeding sites. This species breeds mainly in autumn, but has been recorded calling throughout the year. Egg masses are foamy with an average of approximately 500-800 eggs and are laid in burrows or under	Very low. No suitable habitat was identified within the Subject Property.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
					vegetation in small pools. After rains, tadpoles are washed into larger pools where they complete their development in ponds or ponded areas of the creek line. Tadpole development ranges from around 12 weeks duration to up to 12 months with late developing tadpoles overwintering and completing development when warmer temperatures return.	
Lathamus discolor (Swift Parrot)	Endangered	Critically Endangered	3	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes.	Migrates to the Australian south-east mainland between February and October. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany *Eucalyptus robusta*, Spotted Gum *Corymbia maculata*, Red Bloodwood *C. gummifera*, Forest Red Gum *E. tereticornis*, Mugga Ironbark *E. sideroxylon*, and White Box *E. albens*. The Subject Property is not located on	Low. Few proximal records. No hollows were located however potential foraging habitat was present within the Subject Property.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
					the important areas map for this species.	
Litoria aurea (Green and Golden Bell Frog)	Endangered	Vulnerable	3	Formerly distributed from the NSW north coast near Brunswick Heads, southwards along the NSW coast to Victoria where it extends into east Gippsland. Records from west to Bathurst, Tumut and the ACT region. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands.	Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha spp*.) or spikerushes (*Eleocharis spp*.). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (*Gambusia holbrooki*), have a grassy area nearby and diurnal sheltering sites available. Some sites, particularly in the Greater Sydney region occur in highly disturbed areas. The species is active by day and usually breeds in summer when conditions are warm and wet. Males call while floating in water and females produce a raft of eggs that initially float before settling to the bottom, often amongst vegetation.	Very low. No suitable habitat was identified within the Subject Property.
Lophoictinia isura	Vulnerable	-	3	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern	Found in a variety of timbered habitats including dry woodlands and open	Low-moderate. Potential breeding habitat and foraging

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
(Square-tailed Kite)				Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March.	forests. Shows a particular preference for timbered watercourses. In arid north-western NSW, has been observed in stony country with a ground cover of chenopods and grasses, open acacia scrub and patches of low open eucalypt woodland. Is a specialist hunter of passerines, especially honeyeaters, and most particularly nestlings, and insects in the tree canopy, picking most prey items from the outer foliage. Appears to occupy large hunting ranges of more than 100km^2. Breeding is from July to February, with nest sites generally located along or near watercourses, in a fork or on large horizontal limbs.	habitat was identified within the Subject Property.
Meridolum corneovirens (Cumberland Plain Land Snail)	Endangered	-	27	Lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. known from over 100 different locations, but not all are	Primarily inhabits Cumberland Plain Woodland (a critically endangered ecological community). This community is a grassy, open woodland with occasional dense patches of shrubs. It is also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of	Low. Suboptimal foraging habitat was identified within the Subject Property given the lack of leaf litter and bark.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
				currently occupied, and they are usually isolated from each other as a result of land use patterns.	River-flat Eucalypt Forest, which are also listed communities. Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish. Can dig several centimetres into soil to escape drought. Is a fungus specialist. Unlike the Garden Snail, does not eat green plants. It is generally active at night.	
Miniopterus orianae oceanensis (Large Bent-winged Bat)	Vulnerable	-	27	Large Bent-winged Bats occur along the east and north-west coasts of Australia.	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Breeding or roosting colonies can number from 100 to 150,000 individuals. Hunt in forested areas, catching moths and other flying insects above the tree tops.	Low. No suitable breeding habitat was identified within the Subject Property however, species might use the site to forage.
Myotis Macropus (Southern Myotis)	Vulnerable	-	20	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100km inland, except along major rivers.	Generally, roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small	Low. No suitable habitat was identified within the Subject Property.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
					fish by raking their feet across the water surface.	
Neophema pulchella (Turquoise Parrot)	Vulnerable	-	3	The Turquoise Parrot's range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range.	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. Usually seen in pairs or small, possibly family, groups and have also been reported in flocks of up to thirty individuals. Prefers to feed in the shade of a tree and spends most of the day on the ground searching for the seeds or grasses and herbaceous plants, or browsing on vegetable matter. Forages quietly and may be quite tolerant of disturbance. However, if flushed it will fly to a nearby tree and then return to the ground to browse as soon as the danger has passed. Nests in tree hollows, logs or posts, from August to December. It lays four or five white, rounded eggs on a nest of decayed wood dust.	Low. Few proximal records. No hollows were located however potential foraging habitat was present within the Subject Property.
Ninox connivens (Barking Owl)	Vulnerable	-	1	The Barking Owl is found throughout continental Australia	Inhabits woodland and open forest, including fragmented remnants and	Low. Minimal proximal records

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
				except for the central arid regions. Although still common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW.	partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g., western NSW) due to the higher density of prey found on these fertile riparian soils. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Common Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits.	and no suitable breeding habitat within the Property. May forage within the Subject Property on occasion.
Ninox strenua (Powerful Owl)	Vulnerable	-	3	The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains	The species breeds and hunts in open or closed sclerophyll forest or woodlands and hunts small mammals. It roosts by day in dense vegetation comprising species such as Turpentine *Syncarpia glomulifera*, Black She-oak *Allocasuarina littoralis*, Blackwood *Acacia melanoxylon*, Rough-barked Apple *Angophora floribunda*, Cherry Ballart *Exocarpus cupressiformis* and a	Low. Minimal proximal records and no suitable breeding habitat within the Property. May forage within the Subject Property on occasion.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
				suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover.	number of eucalypt species. This species favours hollows >20cm in diameter.	
Petauroides volans (Greater Glider)	-	Vulnerable	1	The Greater Glider is distributed along the east coast of mainland Australia, from central Queensland to central Victoria.	Greater Gliders are forest dependent and prefer older tree age classes in moist forest types. They are obligate users of hollow-bearing trees for shelter and nesting, with each family group using multiple den trees within its home. Greater Glider density varies proportionally to the availability of hollow-bearing trees and do not persist in areas of forest where such trees are absent.	Low. No swamp or bog habitat was identified within the Subject Property.
Petaurus australis (Yellow-bellied Glider)	Vulnerable	-	1	The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria.	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed	Low. Minimal proximal records and no suitable breeding habitat within the Property.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
					primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Den, often in family groups, in hollows of large trees.	
Petaurus norfolcensis (Squirrel Glider)	Vulnerable	-	4	The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria.	Inhabits 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. Prefers mixed species stands with a shrub or Acacia midstorey. Require abundant tree hollows for refuge and nest sites. Diet varies seasonally and consists of Acacia gum, eucalypt sap, nectar, honeydew and manna, with invertebrates and pollen providing protein.	Low. Minimal proximal records and no hollows were identified within the Property. Sub-optimal foraging habitat given the lack of midstorey cover.
Petroica boodang (Scarlet Robin)	Vulnerable	-	5	The Scarlet Robin is found from south east Queensland to south east South Australia and also in Tasmania and south west Western Australia. In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins	The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and regrowth vegetation. It occasionally occurs in mallee or wet forest communities, or in	Moderate. Potential sub-optimal foraging habitat with no abundant logs or fallen timber. Potential breeding habitat

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
				disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter.	wetlands and tea-tree swamps. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. The Scarlet Robin breeds on ridges, hills and foothills of the western slopes, the Great Dividing Range and eastern coastal regions; this species is occasionally found up to 1000 metres in altitude. Birds forage from low perches, fence-posts or on the ground, from where they pounce on small insects and other invertebrates which are taken from the ground, or off tree trunks and logs; they sometimes forage in the shrub or canopy layer.	identified within the Subject Property.
Petroica phoenicea (Flame Robin)	Vulnerable	-	1	In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands.	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Nests are often near the ground and are built in sheltered sites, such as shallow cavities in trees, stumps or banks. Prefers clearings or areas with open understoreys. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or	Moderate. Potential foraging and breeding habitat were identified within the Subject Property.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
					dense. In winter lives in dry forests, open woodlands and in pastures and native grasslands. Birds forage from low perches, from which they sally or pounce onto small invertebrates which they take from the ground or off tree trunks, logs and other coarse woody debris.	
Petroica rodinogaster (Pink Robin)	Vulnerable	-	2	The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW.	Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies. Catches prey by the perch-and-pounce method, foraging more on the ground than the more flycatcher-like Rose Robin. Insects and spiders are the main dietary items. Breeds between October and January and can produce two clutches in a season. The nest is a deep, spherical cup made of green moss bound with cobweb and adorned with camouflaging lichen, and is lined with fur and plant down. It is situated in an upright or oblique fork, from 30cm to 6m above the ground, in deep undergrowth.	Low. No suitable habitat. The Subject Property does not occur within a densely vegetated gully.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
					Females do most or all of the nest building and incubate unaided, but both adults feed the nestlings. The most common call most closely resembles a snapping twig.	
Phascolarctos cinereus (Koala)	Vulnerable	Vulnerable	9	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In New South Wales, koala populations are found on the central and north coasts, southern highlands, southern and northern tablelands, Blue Mountains, southern coastal forests, with some smaller populations on the plains west of the Great Dividing Range.	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Low. Feed trees were present throughout the Subject Property. The most recent proximal record was observed in 2013 more than 3.5km away near a large continuous patch of vegetation.
Pommerhelix duralensis (Dural Land Snail)	Endangered	Endangered	1	The species is definitely found within the Local Government Areas of The Hills Shire, Hawkesbury Shire and Hornsby Shire. Records from the Blue Mountains City, Penrith City and Parramatta City may represent this species. Occurrence	The species has a strong affinity for communities in the interface region between shale-derived and sandstone-derived soils, with forested habitats that have good native cover and woody debris.	Low. No suitable habitat given the lack of native cover, woody debris and rocks.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
				in Wollondilly Shire is considered unlikely in light of current knowledge	It favours sheltering under rocks or inside curled-up bark. It does not burrow nor climb. The species has also been observed resting in exposed areas, such as on exposed rock or leaf litter, however it will also shelter beneath leaves, rocks and light woody debris. Migration and dispersal is limited, with overnight straight-line distances of under 1 metre identified in the literature and studies. The species is active from approximately one hour after dusk until dawn and no confirmed diurnal activity is reported. It exhibits no roost-site behaviour.	
Pseudophryne australis (Red-crowned Toadlet)	Vulnerable	-	4	The Red-crowned Toadlet has a restricted distribution. It is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains.	Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings	Low. No suitable habitat was located within the Subject Property.
Pteropus poliocephalus	Vulnerable	Vulnerable	50	Grey-headed Flying-foxes are generally found within 200km of the eastern coast of Australia, from	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well	Low-Moderate. No roosting camps were observed

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
(Grey-headed Flying Fox)				Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations.	as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. This species feeds on the nectar and pollen of native trees, in particular *Eucalyptus*, *Melaleuca* and *Banksia*, and fruits of rainforest trees and vines.	within the Subject Property although this mobile species may visit the Subject Property to forage.
Saccolaimus flaviventris (Yellow-bellied Sheathtail-bat)	Vulnerable	-	1	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes.	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. When foraging for insects, flies high and fast over the forest canopy, but lower in more open country. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory. Breeding has been recorded from December to mid-March, when a single young is born.	Low. Few proximal records. No breeding habitat. May forage within the Subject Property.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
					Seasonal movements are unknown; there is speculation about a migration to southern Australia in late summer and autumn.	
Scoteanax rueppellii (Greater Broad-nosed Bat)	Vulnerable	-	23	The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however does not occur at altitudes above 500m.	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3 - 6m. Open woodland habitat and dry open forest suits the direct flight of this species as it searches for beetles and other large, slow-flying insects; this species has been known to eat other bat species.	Low. No breeding habitat. May forage within the Subject Property.
Tyto novaehollandiae (Masked Owl)	Vulnerable	-	1	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. There is	Lives in dry eucalypt forests and woodlands from sea level to 1100 m. A forest owl, but often hunts along the edges of forests, including roadsides.	Low. Minimal proximal records and no suitable breeding habitat within the Property.

Species	BC Act	EPBC Act	Number of Historical Records within 10km of the Subject Property	Distribution (DPIE 2021b)	Habitat and Ecology (DPIE 2021b)	Likelihood of Occurrence
				no seasonal variation in its distribution.	The typical diet consists of tree-dwelling and ground mammals, especially rats. Pairs have a large home-range of 500 to 1000 hectares. Roosts and breeds in moist eucalypt forested gullies, using large tree	

5. Recommendations

5.1 Mapped Biodiversity Values

All future developments should aim to avoid impacting native vegetation within areas mapped as containing high biodiversity value (**Figure 2**), this includes for development footprints as well as potential Asset Protection Zones (APZs) and associated infrastructure. Should clearing or vegetation management be required for future development, the impacted vegetation will require offsetting through the retiring of ecosystem and species credits within the Biodiversity Offset Scheme. A Biodiversity Development Assessment Report (BDAR) will also be required to asses these impacts. If future developments are to be situated in this area, they should be located within areas that require minimal vegetation removal.

5.1.1 Potential Offset Obligations

5.1.1.1 Ecosystem Credits

Vegetation Integrity (VI) plots were conducted within the Subject Property to provide the proponent with an indication of the condition of the vegetation present. The data collected for the vegetation plots was then entered into the DPIE payment calculator for an area of 0.1ha to provide an indication of the potential credits that may be required to be offset by future development.

For a development of 0.1ha the proponent will be required to offset the following ecosystem credits:

- 2 ecosystem credits for PCT 849. These credits are worth approximately $34,000/credit (excl gst; accurate only at the time of calculation – 5/07/2021).

5.1.1.2 Species Credits

The payment calculator also identifies species that are known to be associated with the PCT identified within a property. Based on the habitat available a development of 0.1ha would also be required to offset the following species credits:

- 2 species credits for *Caladenia tessellata* (Thick Lip Spider Orchid). These credits are currently valued at $865/credit (excl gst; accurate only at the time of calculation – 5/07/2021).

Species credits are able to removed however if appropriate surveys are conducted within the DPIE approved survey period. For the above species this would include a one (1) day walkover in the months of September or October.

6. Biodiversity Constraints Mapping

Narla has mapped the Subject Property into three (3) levels of 'Biodiversity Development Constraints' (**Figure 5**). The interpretation of each zone is detailed in **Table 11**.

This map was produced using information gathered from both desktop assessment of existing/historical mapping and data obtained from fieldwork undertaken by the Narla Ecologists. It is to be used as a guide only and a strong degree of caution must be expressed when interpreting it.

Table 11. Biodiversity constraints mapping key

Zone	Description
Low Constraints Area - Green	This zone is deemed to have high potential for future development with accompaniment of the appropriate environmental assessments and implementation of appropriate restrictions and guidelines. This zone encompasses: ▪ Historically cleared areas within the Subject Property.
Moderate Constraints Area - Orange	This zone is deemed to have a moderate potential for future development with accompaniment of the appropriate environmental assessments, with potential minor impact mitigation required (such as revegetation). This zone encompasses: ▪ Native vegetation identified as conforming the BC Act listed CEEC Cumberland Plain Woodland in the Sydney Basin Bioregion
High Constraints Area - Red	This zone is deemed to have a low potential for future development without the production of a Biodiversity Development Assessment Report and entry into the Biodiversity Offset Scheme. This zone encompasses: ▪ Areas identified within the Biodiversity Values Map.

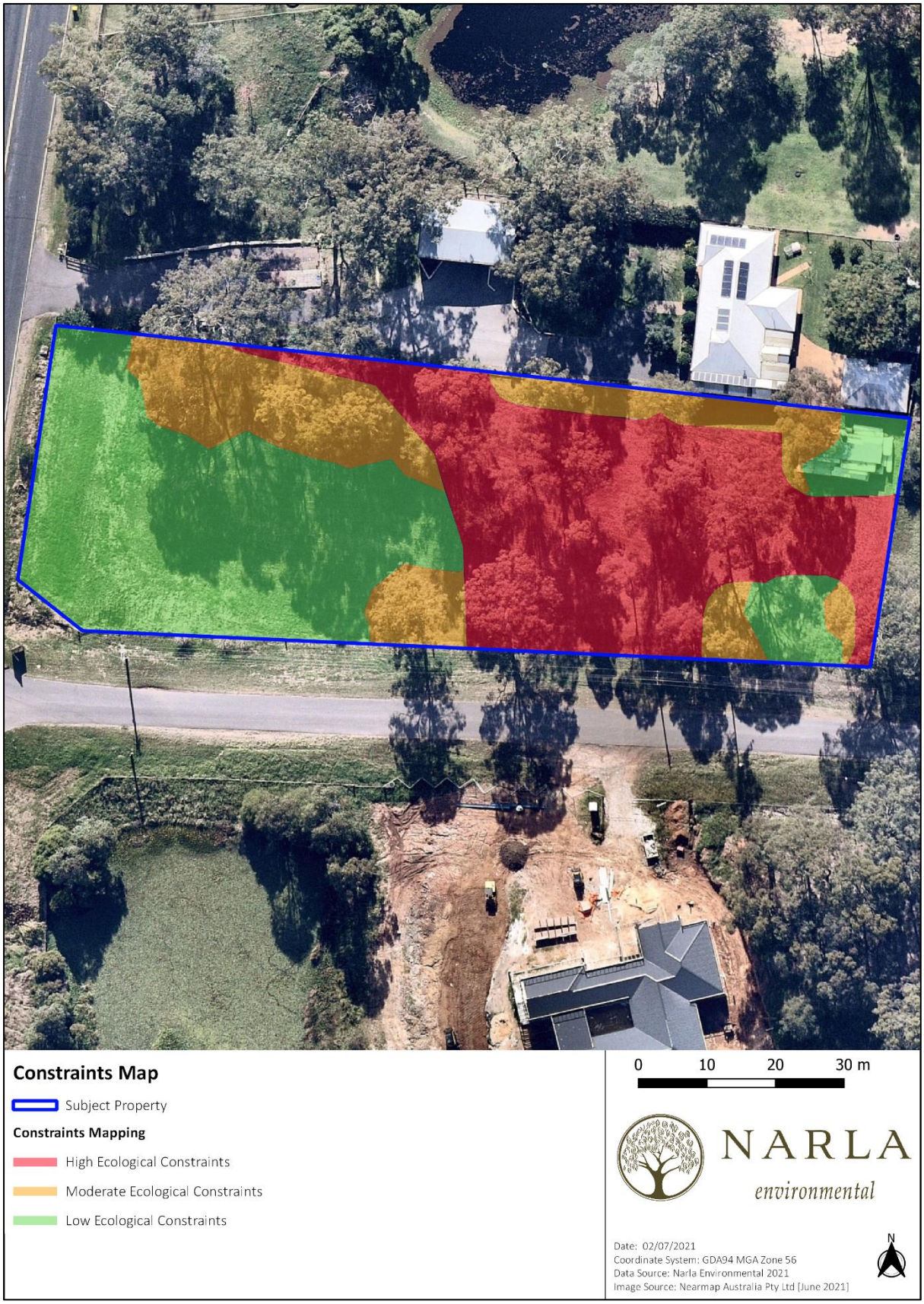

Figure 5. Biodiversity development constraints mapped within the Subject Property.

7. Conclusion

Considering all biodiversity constraints detailed within this report, it is considered feasible that development within the Subject Property can be achieved successfully with minimal impact to the flora and fauna of the Subject Property. Future development should aim to be located within historically cleared land and should avoid impacting vegetation mapped as containing high biodiversity values to avoid entering into the Biodiversity Offset Scheme.

8. References

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9. Appendices

Appendix A. Flora species identified within the Subject Property.

Appendix B. Fauna species identified within and surrounding the Subject Property.

Appendix A. Flora species identified within the Subject Property.

Scientific Name	Canopy	Mid	Ground
Acacia binervia	x		
Acacia parramattensis		x	
*Araujia sericifera**			x
*Arctotheca calendula**			x
Aristida ramosa			x
Avena spp.*			x
*Axonopus fissifolius**			x
*Bromus cartharticus**			x
*Bryophyllum delagoense**			x
Bursaria spinosa		x	
*Cenchrus clandestinus**			x
Cheilanthes sieberi			x
Commelina cyanea			x
*Conyza bonariensis**			x
Dichondra repens			x
*Ehrharta erecta**			x
Einadia spp.			x
*Eragrostis curvula**			x
Eucalyptus crebra	x		
Eucalyptus eugenioides	x		
Eucalyptus tereticornis	x		
*Fumaria officinalis**			x
Gamochaeta spp.*			x
Glycine clandestina			x
Glycine tabacina			x
*Hypochaeris radicata**			x
Jasminium spp.*		x	
*Lolium perenne**			x
*Lotus corniculatus**			x
Microlaena stipoides			x
*Modiola caroliniana**			x
Oxalis spp.			x
Pinus spp.*	x		
*Plantago lanceolata**			x
*Rumex cripsus**			x
*Senecio madagascariensis***			x
*Sida rhombifolia**			x
*Solanum nigrum**			x
*Sonchus oleraceus**			x
Sporobolus africanus			x
*Stellaria media**			x
Stenotaphrum secundatum			x
*Taraxacum officinale**			x
*Trifolium repens**			x

** Denotes exotic species **Denotes priority weed*

Appendix B. Fauna species identified within and surrounding the Subject Property.

Class	Species Name	Common Name	Status
Aves	*Anthochaera carunculata*	Little Wattlebird	Protected
Aves	*Cacatua galerita*	Sulphur-crested Cockatoo	Protected
Aves	*Corvus coronoides*	Australian Raven	Protected
Aves	*Cracticus tibicen*	Australian Magpie	Protected
Aves	*Cracticus torquatus*	Grey Butcherbird	Protected
Aves	*Eolophus roseicapilla*	Galah	Protected
Aves	*Manorina melanocephala*	Noisy Miner	Protected
Aves	*Platycercus elegans*	Crimson Rosella	Protected
Aves	*Spilopelia chinensis*	Spotted Dove	Introduced
Aves	*Strepera graculina*	Pied Currawong	Protected
Aves	*Trichoglossus haematodus*	Rainbow Lorikeet	Protected
Aves	*Vanellus miles*	Masked Lapwing	Protected

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