Denmark Link Road
Biodiversity Assessment

October 2020

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Transport for NSW

Denmark Link Road

Biodiversity Assessment

October 2020

Prepared by: Lesryk Environmental Pty Ltd
Cover photo: Character of the proposed alignment of the connection road from Denmark Road. Photo taken looking north-west towards Denmark Road.

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			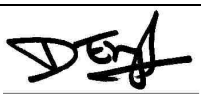	

Executive summary

Transport for NSW proposes to build a local link road from the intersection of Garfield Road West and Denmark Road, Riverstone, to the Westminster Street bridge, Schofields (the proposal). The proposal involves upgrading existing local roads and the building of new section of road to complete the link which is about 1.9 kilometres long.

This Biodiversity Assessment has been carried out by Lesryk Environmental Pty Ltd and forms part of the Review of Environmental Factors that is being prepared for the proposal. This report assesses the biodiversity impact of the proposal to meet the requirements of the New South Wales *Environment Planning and Assessment Act 1979.*

By the completion of the field investigations, two threatened ecological communities and two State listed threatened animals were recorded, these being:

- River-flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions, listed as an Endangered Ecological Community under the New South Wales *Biodiversity Conservation Act 2016*
- Cumberland Plain Woodland listed as a Critically Endangered Ecological Community in the Sydney Basin Bioregion under the New South Wales *Biodiversity Conservation Act 2016*
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) - listed as Vulnerable under the New South Wales *Biodiversity Conservation Act 2016*
- Cumberland Plain Land Snail (*Meridolum corneovirens*) - listed as Vulnerable under the New South Wales *Biodiversity Conservation Act 2016*.

Based on the adoption of a precautionary approach, as targeted surveys were not conducted and as fifteen hollow-bearing trees would require removal, it is assumed that the following threatened microbats (all of which are listed as Vulnerable under the New South Wales *Biodiversity Conservation Act 2016*) are present within, or close to, the proposed road corridor:

- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*).

Assessments referring to the criteria provided under Part 7, Section 7.3 of the New South Wales *Biodiversity Conservation Act 2016*, were conducted on these threatened ecological communities and species. These assessments concluded that the proposal would not have a significant impact on these ecological communities or any of the threatened animals recorded or potentially occurring; as such, the preparation of a Species Impact Statement or Biodiversity Development Assessment Report is not considered necessary.

No threatened flora species or populations listed, or considered for listing, under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and/or New South Wales *Biodiversity Conservation Act 2016* were recorded. Similarly, none were considered likely to occur or rely upon the habitat to be disturbed/removed for any of their necessary lifecycle requirements.

Referrals under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* are no longer required for Transport for New South Wales proposals under Part 5 of the *Environmental Planning and Assessment Act 1979* in accordance with the Strategic Assessment process. In any case, a referral to the Federal Minister for the Environment for further consideration or approval of the project is not required.

With regard to the New South Wales *Fisheries Management Act 1994*, no threatened aquatic species, populations, ecological communities or habitats are present within, or in proximity to, the proposal footprint.

The adoption of those mitigation measures provided would ensure that the work proposed is carried out in an ecologically sustainable manner.

A biodiversity offset strategy may need to be prepared to satisfy the requirements of the Growth Centres Biodiversity Certification Order.

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Glossary of terms

Definitions	
Areas of outstanding biodiversity	An area of outstanding biodiversity value is: ○ An area important at a State, national or global scale ○ An area that makes a significant contribution to the persistence of at least one of the following: i. Multiple species or at least one threatened species or ecological community ii. Irreplaceable biological distinctiveness iii. Ecological processes or ecological integrity iv. Outstanding ecological value for education or scientific research. ○ The declaration of an area may relate, but is not limited, to protecting threatened species or ecological communities, connectivity, climate refuges and migratory species (BC Act 2016).
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impact can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Are those that directly affect the habitat of species and ecological communities and of individuals using the study area. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat (OEH 2018a).
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (OEH 2018b).
Important population	Is a population that is necessary for a species' long-term survival and recovery; this may include populations identified as such in recovery plans, and/or that are: ○ Key source populations either for breeding or dispersal ○ Populations that are necessary for maintaining genetic diversity ○ Populations that are near the limit of the species range (DE 2013).
Indirect impact	Occur when project-related activities affect species or ecological communities in a manner other than direct loss within the subject site. Indirect impacts may sterilise or reduce the habitability of adjacent or connected habitats. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, reduction in viability of adjacent habitat due to edge effects, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, noise, light spill, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas (OEH 2018a).
Invasive species	Is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources, or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.
Local population (in regards to a threatened species)	Comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area (DECC 2007a).
Mitchell landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (OEH 2018b).
Mitigation	Action to reduce the severity of an impact.
Mitigation measure	Any measure that facilitates the safe movement of wildlife and/or prevents wildlife mortality.
Population	All the individuals that interbreed within a given area.

Definitions	
Proposal area/ Proposal site	Is considered to include 'all activities likely to be undertaken within the development footprint to achieve the objective of the proposed development' (DECC 2007a).
Study area	Means the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly (OEH 2018a).
Study region	Is considered to 'include the lands that surround the subject site for a distance of 10 km' (DECC 2007a).
Target species	A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure.

Abbreviations	
^{0}C	Degrees Celsius
AOBV	Areas of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method (as per the BC Act)
BC Act	NSW *Biodiversity Conservation Act 2016*
BDAR	Biodiversity Development Assessment Report
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
CPLS	Cumberland Plain Land Snail
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DE	Commonwealth Department of the Environment (now known as the Commonwealth Department of Agriculture, Water and the Environment)
DEC	NSW Department of Environment and Conservation (now known as the NSW Department of Planning, Industry and Environment)
DECC	NSW Department of Environment and Climate Change (now known as the NSW Department of Planning, Industry and Environment)
DEE	Commonwealth Department of the Environment and Energy (now known as Commonwealth Department of Agriculture, Water and the Environment)
DPI	Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment
EEC	Endangered ecological community
EPA Act	NSW *Environmental Planning and Assessment Act 1979*
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999* (Federal).
FM Act	NSW *Fisheries Management Act 1994*
GC SEPP	NSW *State Environmental Planning Policy (Sydney Region Growth Centres) 2006*
GDE	Groundwater dependent ecosystems
GPS	Global Positioning System
IBRA	Interim Biogeographically Regionalisation of Australia
KTP	Key Threatening Process
Lesryk	Lesryk Environmental Pty Ltd
LEP	Local Environment Plan
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NSW	New South Wales
OEH	Office of Environment and Heritage
PCT	Plant Community Type
PMST	Protected Matters Search Tool

Abbreviations	
REF	Review of Environmental Factors
Roads and Maritime	NSW Roads and Maritime Services (now known as Transport for New South Wales)
RoTAP	Rare of Threatened Australian Plant
RTA	NSW Roads and Traffic Authority (now known as Transport for New South Wales)
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
TECs	Threatened Ecological Communities
TfNSW	Transport for NSW
TSC Act	NSW *Threatened Species Conservation Act 1995* (now repealed by the BC Act)
TSPD	Threatened Species Profile Database
WoNS	Weeds of National Significance

1 Introduction

1.1 Proposal background

Transport for NSW (TfNSW) proposes to build a local link road from the intersection of Garfield Road West and Denmark Road, Riverstone, to the Westminster Street bridge, Schofields (the proposal). The proposal involves upgrading existing local roads and the building of new sections of road to complete the link which is about 1.9 kilometres long (Figure 1.1).

The proposal is one of the identified short-term works in the North West Growth Centre Road Network Strategy and would:

- Reduce the congestion and delays that are currently being experienced at the Garfield Road railway level crossing at Riverstone
- Provide a local road connection for motorists wishing to use the Westminster Street bridge, alleviating congestion on Garfield Road.

A Biodiversity Assessment has been carried out to accompany the Review of Environmental Factors (REF), and to consider and assess any ecological impact associated with the proposal.

Lesryk Environmental Pty Ltd (Lesryk) has previously carried out an ecological investigation within the surrounding area during May 2020 (Lesryk 2020). Where applicable, the results of that investigation have been drawn upon and incorporated into the ecological component of this report.

1.2 The proposal

Key features of the proposal would include:

- A new right-turn bay along Garfield Road West eastbound for traffic waiting to enter Denmark Road at Riverstone
- Improvements to the existing Denmark Road including new road pavement widening, resurfacing and kerbing at the northern extent, and a new section of road at the southern extent
- A new two-lane link road (one lane in each direction) about 320 metres long between Denmark Road and Carlton Street
- Improvements to Carlton Street between the new link to the south and Trevithick Street to the north, including new road pavement and kerbing
- Improvements to Trevithick Street between Carlton Street and West Parade, including new road pavement widening, resurfacing and kerbing
- Two new T-intersections for the new link at Denmark Road and Carlton Street, and modifications to three existing T-intersections
- Improvements to West Parade south of Trevithick Street, including new pavement widening, resurfacing and kerbing, and a new section of road to connect to Bridge Street (near the Westminster Street bridge) at Schofields

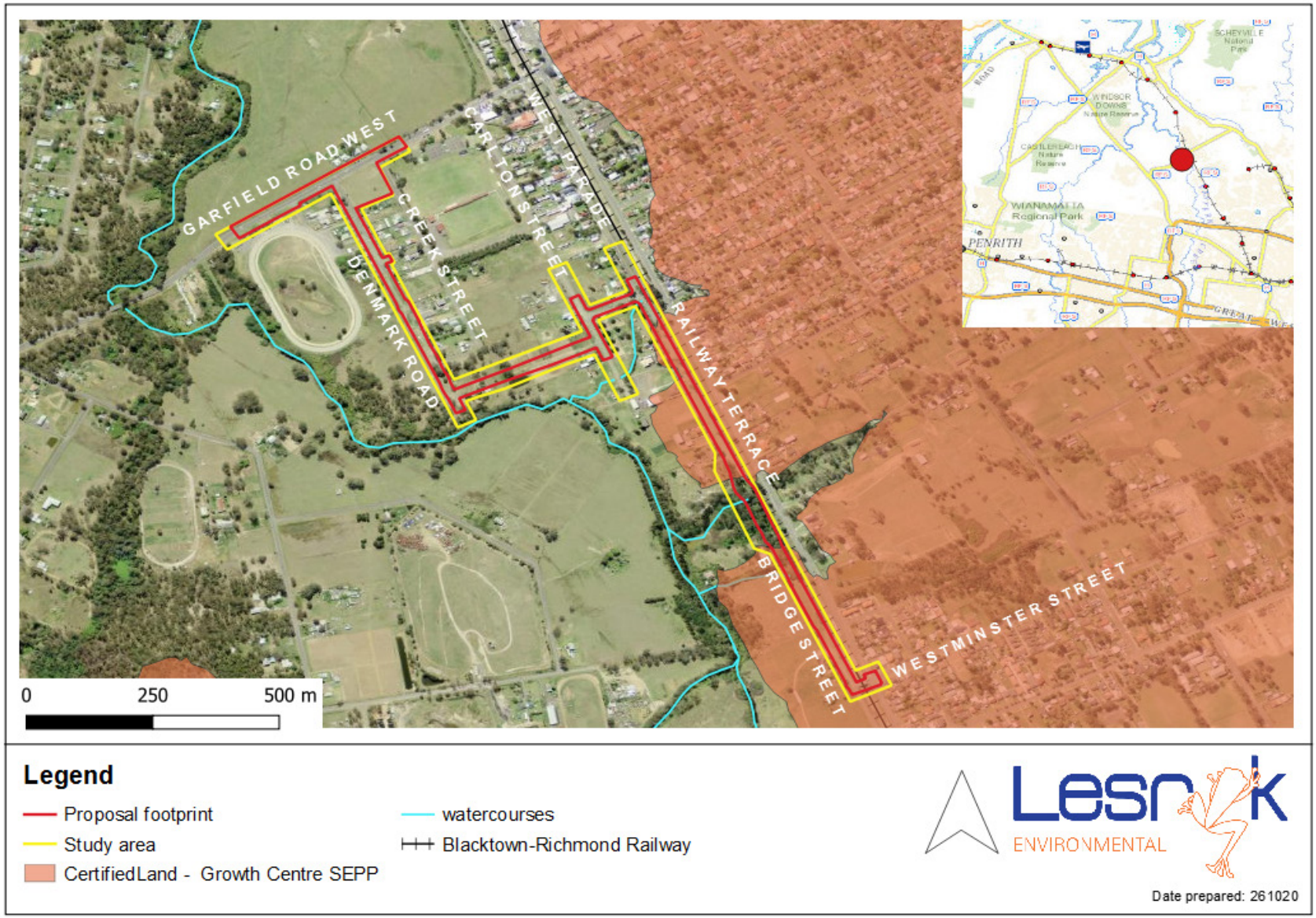

Figure 1.1 Proposal area

- Street lighting at all intersections
- Drainage work including sections of kerb, open drainage and a new reinforced concrete box culvert at the crossing of the Eastern Creek tributary on West Parade
- New line marking and signage (including signage to assist wayfinding).

Additional features of the proposal include:

- Utility adjustments (primarily minor power pole relocations)
- Minor property adjustments such as reforming of driveway accesses and relocation of property fences
- Temporary ancillary facilities including a site compound on the south-east corner of the Garfield Road West/Denmark Road intersection
- Rehabilitation of disturbed areas following construction.

The area to be disturbed (the proposal footprint) and duration of the proposed work can be found in the REF.

The total proposal footprint is about 3.84 hectares in size, this generally restricted to the proposed road work alignment being about 1.9 kilometres in length. Based on a worst-case estimate, the proposed work would require the removal of about one hectare of native vegetation, including the removal of about 15 hollow-bearing trees.

For the purpose of the field survey, the area investigated encompassed:

- The proposed road work alignment (the proposal footprint)
- An area of up to 10 metres beyond the likely footprint of the proposed work.

These areas will hereafter be referred to as the study area.

1.3 Legislative context

A REF is prepared to satisfy TfNSW duties under s.5.5 of the *Environmental Planning and Assessment Act 1979* (EPA Act) to “examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity” and s.5.7 in making decisions on the likely significance of any environmental impact. This biodiversity impact assessment forms part of the REF being prepared for the Denmark Link Road and assesses the biodiversity impact of the proposal to meet the requirements of the EPA Act.

Section 7.3 of the *Biodiversity Conservation Act 2016* (BC Act) and Part 7A, Division 12, Subdivision 221ZV of the *Fisheries Management Act 1994* (FM Act) requires that the significance of the impact on threatened species, populations and endangered ecological communities (EECs) listed under the BC or FM Acts is assessed using a five and seven-part test, respectively. If the activity is likely to have a significant impact, or would be carried out in a declared Area of Outstanding Biodiversity Value (AOBV), the proponent must prepare a

Species Impact Statement (SIS) in accordance with the Environment Agency Head requirements. Alternatively, under the BC Act only, TfNSW may opt to prepare a Biodiversity Development Assessment Report (BDAR) (this including the Biodiversity Offsets Scheme).

In September 2015, a “strategic assessment” approval was granted by the Federal Minister in accordance with the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The approval applies to TfNSW activities being assessed under Division 5.1 of the EPA Act with respect to potential impact on nationally listed threatened species, ecological communities and migratory species.

As a result, TfNSW proposals assessed via a REF:

- Must address and consider potential impact on nationally listed threatened species, populations, ecological communities and migratory species, including application of the “avoid, minimise, mitigate and offset” hierarchy
- Do not require referral to the Federal Department of the Environment for these matters, even if the activity is likely to have a significant impact.

TfNSW must consider impacts to nationally listed threatened species, ecological communities and migratory species as part of the approval process under the strategic assessment. To assist with this, assessments are required in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (Department of the Environment [DE] 2013).

A number of Commonwealth, State and local Acts, policies and documents are relevant to the proposal and its possible impact on the ecology of both the study area and locality. The most relevant of these are listed in Table 1.1.

Table 1.1 Summary of legislative and policy requirements

Level	Relevant Legislation/Policy	Relevance to study area
Commonwealth	*Environment Protection and Biodiversity Conservation Act 1999*	Matters of National Environmental Significance (MNES) include listed threatened species and ecological communities, migratory species and wetlands of international importance protected under international agreements. Where applicable, the assessment criteria relevant to this Act must be drawn upon to determine whether there would be a significant effect on these species.
State	New South Wales (NSW) *Environmental Planning and Assessment Act 1979*	Division 5.1 of this Act requires that a determination be made as to whether a proposed action is likely to significantly affect threatened species or ecological communities, or their habitats listed on Schedule 1 and 2 of the BC Act. Where found, the assessment criteria under Part 7 Section 7.3 of the BC Act (the 'Assessment of Significance') will be drawn upon to determine whether there would be a significant effect on these species and hence whether a SIS [or Biodiversity Development Assessment Report (BDAR) should TfNSW elect that option] is required.
	NSW *Biodiversity Conservation Act 2016*	The purpose of this Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development. This Act defines those species listed as protected in NSW. Part 7.2 of this Act requires assessment of whether a development or activity "likely to significantly affect threatened species."
	NSW *State Environmental Planning Policy (Sydney Region Growth Centres) 2006*	In addition to numerous other aims, this policy aims to protect and enhance land with natural and cultural heritage value; and to provide land use and development controls that will contribute to the conservation of biodiversity. Under the *Threatened Species Conservation Act* (TSC Act) (and now adopted under the *Biodiversity Conservation Act*), Biodiversity Certification was conferred on the Growth Centres [GC] State Environmental Planning Policy (SEPP). This has the effect that certified land within the Growth Centres is not subject to Part 7.2 of the BC Act. In relation to essential infrastructure proposals, Clause 11 of the Biodiversity Certification Order requires offsetting for clearing of existing native vegetation in the non-certified areas that does not require development consent under the SEPP.

Level	Relevant Legislation/Policy	Relevance to study area
	NSW *National Parks and Wildlife Act 1974*	In addition to a range of other objectives, this Act aims to conserve nature (such as habitat, ecosystems and ecosystem processes, biological diversity, landforms of significance, wilderness) and objects, places or features (including biological diversity) of cultural value by applying the principles of ecologically sustainable development. No assessment is required under this Act; however, potential impacts of the proposed work on these values will be considered.
	NSW *Biosecurity Act 2015*	Part 3, Clause 22 of this Act states 'any person who deals with biosecurity matter or a carrier and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter, carrier or dealing has a biosecurity duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised'. This includes pest animal and plants species as defined under Clause 15 of the Act and anything declared by the regulations to be a pest for the purposes of this Act.
	NSW *Fisheries Management Act 1994*	The FM Act provides for the protection, conservation, and recovery of threatened species, populations and ecological communities of fish and marine vegetation and fish habitats, as well as promoting the development and sharing of fishery resources in NSW. Under Section 199 of the Act, a public authority (other than a local government authority) must, before it carries out or authorises the carrying out of dredging or reclamation work: (a) give the Minister written notice of the proposed work, and (b) consider any matters concerning the proposed work that are raised by the Minister within 28 days after the giving of the notice (or such other period as is agreed between the Minister and the public authority). A permit under Section 37 of the Act must be obtained by the Minister for Primary Industries for any activity that involves taking or possessing fish or marine vegetation that would otherwise be unlawful under the Act.
Local	*Blacktown Local Environmental Plan 2015*	This plan aims to make local environmental planning provisions for land in Shoalhaven in accordance with the relevant standard environmental planning instrument under Section 3.20 of the EPA Act.

Level	Relevant Legislation/Policy	Relevance to study area
		Particular aims of this plan that are relevant to the proposed work are: (a) to provide for infrastructure to maintain and meet demands arising from housing and employment growth (b) to conserve and enhance Blacktown's built, natural and cultural heritage (c) to conserve, restore and enhance biological diversity and ecosystem health, particularly threatened species, populations and communities.

2 Methods

2.1 Personnel

The personnel responsible for the carrying out of this ecological study, and their responsibilities, were:

- Mr Deryk Engel B.Env.Sc. (Hons): Project management, client and government agency consultation, site investigation [fauna], document preparation, review and quality assurance
- Mr Paul Burcher B.App.Sc: Site investigation [flora], document preparation, review and quality assurance.

2.2 Background research

Prior to carrying out fieldwork, previous studies conducted in the region and known databases were reviewed to identify the diversity of ecological communities, flora and fauna species known for, or potentially occurring in, the study region. The identification of those known or potentially occurring native species and communities within this portion of the Blacktown City Local Government Area (LGA), particularly those listed under the Schedules to the EPBC, BC and/or FM Acts, permits the tailoring of the field survey strategies to the detection of these plants and animals, their vegetation associations and/or necessary habitat requirements. By identifying likely species, particularly any threatened plants and animals, the most appropriate species-specific survey techniques may be selected [should their associated vegetation communities/habitat requirements be present] or a precautionary approach to their presence adopted.

The carrying out of a literature search also ensures that the results from surveys conducted during different climatic, seasonal and date periods are considered and drawn upon as required. This approach therefore increases the probability of considering the presence of, and possible impact on, all known and likely native species, particularly any plants and animals that are of regional, State and/or national conservation concern. This approach also avoids issues inherent with a one off ‘snap-shot’ study.

A list of all databases, date these were accessed, and the search area employed is provided in Table 2.1.

Other reports and documents referred to are provided within the bibliography section of this report.

All these databases and reports were reviewed and drawn upon where relevant. While reviewing these documents, particular attention was paid to identifying relevant ecological matters listed, or currently being considered for listing, under the Schedules of the EPBC, BC and/or FM Acts, plants, animals and ecological communities that have been recorded in the region and which may occur within, or in the vicinity of, the proposal area.

Table 2.1 Database searches

Database	Date accessed	Search area
Department of Agriculture, Water and the Environment (DAWE)'s Protected Matters Search Tool (PMST) (DAWE 2020b)	18 June 2020	10 kilometres buffer
Office of Environment and Heritage (OEH) BioNet database [Atlas of NSW Wildlife] (OEH 2020a)	22 July 2020	10 kilometres buffer
BioNet Vegetation Classification (OEH 2020c)	June 2020	Not applicable (N/A)
DPI WeedWise Database (DPI 2020a)	June 2020	Greater Sydney (includes Blacktown LGA)
DPIE Area of Outstanding Biodiversity Value register (NSW DPIE 2020a)	July 2020	Locality
DAWE Register of Critical Habitat (DAWE 2020c)	July 2020	Locality

Field guides and standard texts used were:

- Royal Botanic Gardens and Domain Trust (2020), Fairley and Moore (2010) and Robinson (2003). [used for the identification of plants]
- Cogger (2014) [reptiles and frogs]
- Anstis (2017) [frogs]
- Churchill (2008) [flying mammals]
- Simpson and Day (2010) [birds]
- Van Dyck and Strahan (2008) [non-flying mammals]
- Triggs (1996) [identification of scats, tracks and markings].

The naming of those species recorded or known for the region follows the nomenclature as noted within the EPBC, BC and/or FM Acts (animals, populations and ecological communities) or as presented in the above texts.

It is noted that the current accepted scientific names for some of the threatened fauna species previously recorded in this locality are not consistent with the names used/provided under the EPBC, BC and/or FM Acts. In these instances, nomenclature used within this report follows the current approved scientific conventions.

Where applicable, any EECs were classified and named according to the NSW Scientific Committee's Final and Preliminary Determinations [various dates].

The conservation significance of those ecological communities, plants and animals recorded is made with reference to:

- The RoTAP publication (Briggs and Leigh 1996)
- The EPBC, BC and/or FM Acts
- Vegetation mapping of the study region (OEH 2013)
- The BioNet Vegetation Classification database (OEH 2020c).

2.3 Habitat assessment

An assessment of available habitat for each threatened species, population or community identified in the database searches, and their likelihood of occurrence, is provided in Appendix A.

2.4 Field survey

Flora and fauna investigations of the study area were carried out by Deryk Engel (B.Env.Sc. [Hons]) [Senior Ecologist] and Paul Burcher (B.App.Sc) [Botanist] on 28 July 2020 and 21 September, 2020. For reference, the weather conditions experienced during each site investigation were:

- 28/7/20: cool temperatures (17ºC), overcast skies (90% cloud cover) and still conditions
- 21/9/20: warm temperatures (26ºC), clear skies (0% cloud cover) and slight breezes.

The purpose of the field survey was to identify those vegetation communities, fauna habitats, plants and animals present within, and in close proximity to, the proposed road work area that are of State and/or national conservation significance as listed under the Schedules to the EPBC, BC and/or FM Acts.

While conducting the habitat assessments, efforts were made to identify features such as known vegetation associations, geological features, feed trees, mature trees with hollows, connectivity of fauna corridors, aquatic environments and other habitat features important to the lifecycle requirements of those threatened plants and animals previously recorded in the study region (as listed in Appendix A).

The survey methods employed during the field investigations were:

- The identification of vascular plants, including any areas affected by direct and indirect impacts
- The identification of the structure of those vegetation communities and fauna habitats present at the site
- The direct observation of those fauna species present within, next to, or in close proximity to the proposal footprint
- Diurnal call identifications of fauna species, with all calls being identified in the field

- The identification of any indirect evidence such as tracks, scats, scratchings and diggings that would suggest the presence of a particular fauna species
- Leaf litter and ground debris searches for sheltering reptiles and amphibians, and the State listed Cumberland Plain Land Snail (CPLS [*Meridolum corneovirens*])[1].

Where required, a more detailed description on one or more of the survey methods employed is provided below.

The survey methods employed and level of effort required were generally based on the descriptions provided in the following:

- The OEH survey guidelines for threatened plants (OEH 2016)
- The DEC 2004 publication
- The DEWHA survey guidelines for Australia's threatened bats, bird and frogs (DEWHA 2010a, DEWHA 2010b)
- The DSEWPC survey guidelines for Australia's threatened mammals and reptiles (DSEWPC 2011a, DSEWPC 2011b).

2.4.1 Targeted flora surveys

Based on the results of the literature review, combined with a consideration of the habitat requirements of those flora species identified as potentially occurring (see Appendix A), in association with aerial photography interpretation and a review of the construction plans provided, targeted investigations for threatened flora species were carried out where areas of suitable habitat were observed.

In addition to the targeted threatened species searches, general botanical surveys were conducted within all parts of the study area, including the ancillary parking/storage area.

Numerous plant samples were collected [as per approval granted in accordance with OEH Scientific licence SL10642] for later identification using standard texts.

In accordance with the brief, a 0.1 hectares (50 metres x 20 metres) Biodiversity Assessment Method (BAM) survey plot was surveyed in the Department of Planning, Industry and Environment (DPIE) land. In this plot, the following data were recorded:

- The cover abundance and estimate of the number of all individual plants within a 20 metres x 20 metres sub-plot
- Number of large trees; presence/absence of hollow-bearing trees; stem size class and tree regeneration; and length of logs
- Average litter cover and other optional groundcover components.

The plot results are provided in Appendix E.

[1] This being the only invertebrate targeted due to its listing as Vulnerable under the BC Act.

2.4.2 Targeted fauna surveys

Diurnal bird investigation

During the field investigations birds were identified using visual identification of observed individuals or aural identification of their vocalisations. Any opportunistic observations obtained while carrying out other field activities were also recorded.

Ground debris searches

Ground debris searches were carried out on foot within the vegetated portions of the proposal footprint. This involved conducting random meanders through this area and turning any occurrences of natural debris or urban refuse.

While conducting the ground debris searches, tracks, diggings and characteristic scats were also searched for, and identified in the field.

While conducting the ground debris searches, approximately 40 minutes of targeted surveys for the CPLS were conducted. These searches involved lifting and looking underneath rocks, logs and natural/artificial ground debris, as well as raking the leaf litter accumulations that occur around the bases of those eucalypts present. The searches were conducted until:

- A Land Snail was identified (either a living individual or discarded shell)
- An interval of 20 person minutes surveying a randomly selected portion of the study area had passed.

Several discarded snail shells were collected during the targeted surveys. Though considered to be those indicative of the presence of the CPLS, these were sent to the Australian Museum for identification. Due to Covid-19 restrictions, over the counter submission of specimens to the museum was not available at the time of the investigation, the only option being the provision of a photographic record (emailed). Several photographs of the snail shell collected were obtained; these being emailed [on 11 August 2020] to the Australian Museum. A reply from the Australian Museum was received 12 August 2020.

Fauna habitat assessment

An assessment of the accessible portions of the road corridor/areas of likely direct or indirect disturbance for important fauna habitat features such as tree hollows (potentially used by insectivorous bats [microchiropterans], birds and arboreal mammals) was conducted. Other features such as the presence of water bodies, suitable cave-substitutes (culverts) and large logs were also assessed.

By the completion of the investigations, 21 hollow-bearing trees that may be used by those hollow-dependent species (i.e. microchiropterans) known to occur in the surrounding region, particularly those that are of conservation significance, were observed; these primarily located along the proposed alignment between West Parade and Bridge Street and between Denmark Road and Creek Street (Figure 2.1).

Source: Hills Environmental

Figure 2.1 Hollow-bearing trees observed

Global Positioning System[2] (GPS) coordinates for those hollow-bearing trees recorded are provided in Table 2.2.

Table 2.2 GPS locations for hollow-bearing trees observed within the study area

General description	Hollow diameter	Removal required ?	Easting	Northing
HBT 1 - alive	10 centimetres	Yes	302129	6270301
HBT 2 - alive, vertical hollow	10 centimetres	Yes	302129	6270311
HBT 3 - alive, vertical hollow	10 centimetres	Yes	302129	6270315
HBT 4 - vertical hollow	10 centimetres	Yes	302109	6270339
HBT 5 - alive, vertical hollow	10 centimetres	Yes	302157	6270262
HBT 6 - alive	15 centimetres	Yes	302142	6270279
HBT 7 - alive, vertical hollow	10 centimetres	Yes	302188	6270195
HBT 7 - alive, vertical hollow	10 centimetres	Yes	302202	6270157
HBT 9 - dead, numerous vertical hollows	five centimetres	Yes	301264	6270993
HBT 10 – alive, vertical hollow	five centimetres	Yes	301651	6270576
HBT 11 – alive, vertical hollow	five centimetres	Yes	301641	6270600
HBT 12 – dead, horizontal	five - 10 centimetres	Yes	301649	6270591
HBT 13 – alive, vertical hollow	five centimetres	No	301584	6270614
HBT 14 – alive, vertical hollow	five centimetres	No	301564	6270588
HBT 15 – alive, vertical hollow	five centimetres	No	301574	6270601
HBT 16 – alive, vertical hollow	10 centimetres	No	301576	6270591
HBT 17 – alive, vertical hollow	five – 10 centimetres	Yes	301591	6270473
HBT 18 – alive, vertical hollow	five – 10 centimetres	No	301541	6270537
HBT 19 – alive, vertical hollow	five centimetres	Yes	301538	6270563
HBT 20 – alive, vertical hollow	five centimetres	Yes	301539	6270564
HBT 21 – alive, vertical hollow	five – 10 centimetres	No	301571	6270520

One permanent waterbody occurs in proximity of the study area, this being Eastern Creek; located about 80 metres south of the proposed connection road work, while three of its tributaries are in proximity to the proposed work along West Parade.

If suitable cavities are present, the hollow-bearing trees identified would only be occupied by small to medium sized species such as birds and bats. The hollow-diameters observed (refer to Table 2.2) would not be suitable for occupation by large species such as owls.

The determination of whether a tree was hollow-bearing or not was made from the ground; while binoculars were used to assist with this determination, the orientation of most of the limbs inspected is vertical (Table 2.2). In these instances, a precautionary approach to the presence of hollows has been adopted. As such, 18 trees that support vertical limbs and branches have been flagged as being hollow-bearing. Should the trees be scaled, and the 'hollows' inspected, it may be possible to revise (reduce) this number. It is noted that, as rain can enter these features, thereby filling them, if there are no opportunities for the water to escape, and heat rises, it is expected that vertical hollows are unsuitable for occupation by some species (particularly microbats that require specific microclimates).

As part of the project's vegetation removal work, it is recommended that each hollow-bearing tree be inspected through use of an elevated work platform or similar'. If the vertical limbs are

[2] Coordinate system used: GDA94. Accuracy: ± 5 m to 10 m.

hollow-bearing these should be inspected by a torch and, if occupied by a native animal, the following approach adopted:

- Hollow-entrance to be plugged, a breathable material being placed in the entrance
- Soft felling techniques to be employed
- Through use of ropes and a chainsaw, the limb/branch is to be cut and lowered to the ground
- Either an ecologist or similar to collect and relocate the sheltering animal or, the limb/branch to be placed on the ground beyond the limits of the road corridor and the plug removed half an hour before dusk
- Any injured native fauna should be taken to a local veterinarian or wildlife carer for treatment
- Introduced species should be collected and taken to a local veterinarian for euthanizing.

Culvert inspection

An active search of those culverts present in association with the existing road network within the study area was conducted during the investigations. The visual inspection involved using a hand-held torch (163 lumen hand-held spotlights) to inspect and determine if the structures supported suitable habitat for cave-dependent microchiropteran (such as small crevices) and if there was any evidence of bat guano. When considering the habitat value of these features for cave dependent/suitable cave-substitute utilising microbats, the presence of water, anthropogenic and natural barriers, dense vegetation growth and/or spider webs across the openings were looked for, the occurrence of these negating access to/occupation of the culverts by bats.

2.4.3 Aquatic Surveys

As components of the proposed work would be carried out within and/or in close proximity to three drainage lines, an aquatic study was broadly performed in accordance with the publication titled Aquatic Ecology in Environmental Impact Assessment (Lincoln-Smith 2003).

The investigations involved traversing those accessible portions of each drainage line present, with notes taken on the; habitats observed within the sections being ‘disturbed’, the structure of their banks, the riparian communities, their course, and the presence of any snags or other features important to the lifecycle requirements of those aquatic species present, or considered likely to occur.

In addition, information referred to, included:

- A literature search of any relevant previous aquatic studies
- Discussions held with the relevant NSW Fisheries Conservation Manager
- Identification of known or expected aquatic species and their habitats, particularly those of conservation concern
- A review of existing information on the in-stream ecology of the drainage lines and consultation with the relevant NSW Fisheries Zone.

Based on a qualitative assessment of the water that was flowing along the drainage lines at the time of the field investigations, a consideration of the scope of work proposed at this site and the 'short-term' nature of the proposal [it is expected that, post-development, the site would generally reflect its pre-disturbance character], the work will not erect any additional barriers to fish movement (beyond those currently in place) nor would it cause the isolation or fragmentation of any aquatic environments]. It was not considered that any specific surveys (i.e. netting, trapping or electric fishing) targeting those aquatic species present, or considered likely to occur, were necessary.

2.4.4 Summary of survey effort

By the completion of the field investigations, about eight person hours of active searches had been accumulated. Given the physical condition and size of the area that required investigation, this length of time is considered adequate when endeavouring to determine the diversity of native species present, the structure and character of the vegetation communities and fauna habitats present and the conservation status of these.

2.5 Limitations

During the field investigations no adverse weather conditions were encountered.

Access to most of the proposed connection road alignment was possible; however, permission to enter the property between Creek and Carlton Streets had not been granted at the time of the field investigations. Though access to this property was not granted, visual inspections made from Carlton Street and the southern end of Creek Street indicated it is primarily cleared and devoid of native vegetation. Isolated trees do occur, as does a farm dam, inspections of these possible from beyond the limits of the property. The remainder of the property appears to support exotic grasslands and planted fruit trees.

While not considered to compromise the scientific rigour of the field assessment, no species-specific surveys (i.e. live trapping, nocturnal work, echolocation) were carried out. To overcome these 'limitations':

- Database searches were conducted for threatened species, populations and ecological communities known to occur within the region
- The precautionary approach was adopted where necessary (i.e. suitable habitat for those threatened species known to occur, or that have been previously recorded within the surrounding locality, was identified).

Not all animals and plants can be fully accounted for within any given study area. The presence of threatened species is not static; it changes across time, often in response to longer term natural forces that can, at any time, be dramatically influenced by human-made disturbances.

This report is based upon data acquired from the current investigations; however, it should be recognised that the data gathered is indicative of the environmental conditions of the site at the time the field work was conducted.

3 Existing environment

For reference, a photographic record of the area investigated has been provided (Appendix B).

The proposal footprint is located within a semi-rural landscape, between the Riverstone Trotting Track and West Parade, Riverstone, and south-east along this road towards the suburb of Schofields; about 9.4 kilometres north north-west of the Blacktown central business district, within the Blacktown City Council LGA (Figure 1.1).

For reference, Table 3.1 describes the existing attributes of the site investigated.

Table 3.1 Site attributes

Site Attribute	Denmark Link Road study area
Soil landscapes[3]	Blacktown and South Creek
Water bodies	Eastern Creek is the only permanent waterbody present
Above Sea Level	Between 12 metres - 30 metres
Climate[4]	Mean summer high – 29.4 °C Mean winter low – 3.2 °C Average annual rainfall – 797 millimetres
Critical habitat	None
Interim Biogeographically Regionalisation of Australia (IBRA) Bioregion/Subregion	Sydney Basin – Cumberland [Figure 3.1]
Mitchell Landscape Unit	SB Cumberland [Figure 3.2]

Additional surrounding land uses include:

- Residential properties
- Riverstone Park [including recreational sport fields], about 125 metres east of Denmark Road
- Collex Waste Management Facility, about 285 metres south of the proposed connection (i.e. 'link') road
- Blacktown-Richmond Railway, east adjacent to West Parade
- Light industrial properties
- Urban infrastructure.

The study area does not occur within, or next to, a conservation reserve. The nearest reserve is Windsor Downs Nature Reserve (covering an area of 361 hectares); located about five kilometres north-west of Denmark Road.

[3] Refer to Appendix C for soil landscape notes
[4] Richmond (UWS Hawkesbury), the nearest operating weather station to the area investigated (BOM 2020)

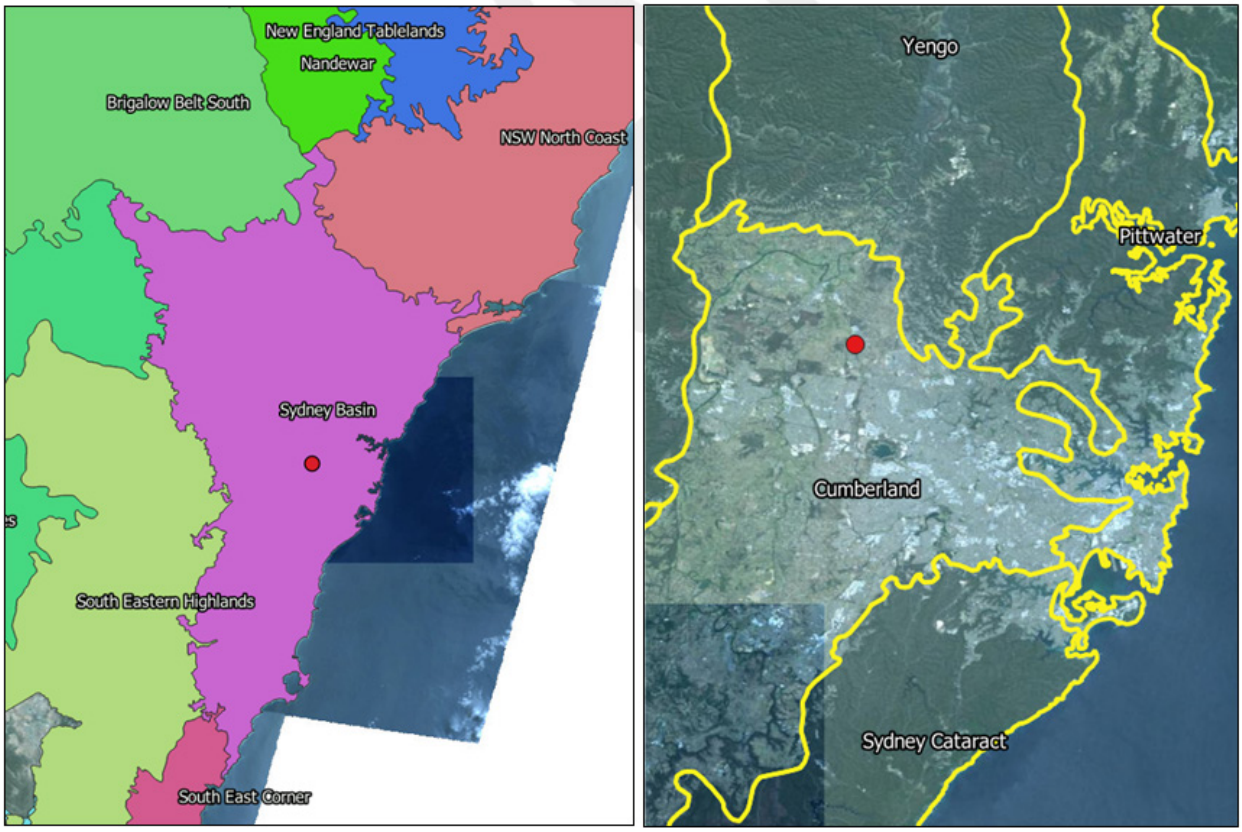

Figure 3.1 IBRA region and sub-region (project area = red circle)

The proposed road work alignment is located within remnant bushland, previously modified areas (i.e. existing roads) and within former or extant agricultural land. The existing road network generally has unformed edges, the verges being maintained, with areas of rank exotic weeds to 0.3 metres high.

One permanent waterbody, Eastern Creek, is generally located south and west of the proposal footprint, coming within about 80 metres between Denmark Road and Carlton Street. Within this locality the creek is about five metres wide, with earthen banks lined by Casuarinas to eight m in height and Eucalypts to 15 metres. No rocks were observed within the creek, though small occurrences of emergent vegetation were noted. The understorey is comprised of weeds to 1.5 metres high, while the groundcover is either earth or a medium density of weeds. Leaf litter and ground debris is common, with some large woody debris present within the creek. The surrounding area is observed to be grazed by horses.

From the southern end of Denmark Road the observed farm dam is an open expanse of water, about 820 square metres in size; no reed beds identified therein, and set among exotic grassland.

Cleared, slashed exotic grassland is present to one metre high, with isolated Eucalypts to 20 metres; some of which were hollow-bearing. Also present were isolated saplings, exotic shrubs, fruit trees, and areas of existing citrus fruit orchards; this generally extending towards Carlton Street where cleared paddocks also exist.

Figure 3.2 Mitchell Landscapes

The low woodland towards the southern end of Denmark Road supports trees between 10-15 metres in height; a number of which were observed to be hollow-bearing (hollow diameter 5-10 centimetres). A semi-mature, scattered Eucalypt middlestorey is present to eight metres high; the understorey being composed of a sparse to medium density of Eucalypt saplings and native shrubs to two metres. A high-density groundcover of weeds to 0.5 metres is present; with leaf litter, ground debris and wind-blown dumped urban refuse observed.

Within this southern extent the road reserves were noted to have been incorporated into adjacent properties and utilised for horse grazing and storage (i.e. equipment, materials).

Three drainage lines [of Eastern Creek] are near the proposed work on West Parade. The drainage line predominantly present within the eucalypt woodland between West Parade and Bridge Street is about four metres wide and composed of earthen banks. No aquatic vegetation or instream woody debris was present; the drainage line having been cleared, with sediment removed and dumped on the southern bank. This drainage line was observed to be flowing at the time of the investigations.

South of this drainage line, a stormwater drain is present about five metres north of Bridge Street (along the alignment); this circular culvert being about 0.5 metres in diameter. This drainage line is about one metre wide by 20 centimetres deep and was flowing at the time of the investigations. Adjacent earthen banks are dominated by weeds.

Between West Parade and Bridge Street, the woodland adjacent to the drainage line supports eucalypts between 10-20 metres in height, several of which were identified as being hollow-bearing (hollows to 15 centimetres in diameter). The understorey is composed of a medium to high density of exotics to five metres high; the groundcover consisting of a high density of weeds and vines. Leaf litter and ground debris is common, while some dumped urban refuse was observed. It is noted that a strip of woodland has been cleared to accommodate a powerline easement. The southern extent of this woodland, while the same eucalypt over storey, has a denser, weedier understorey.

The culvert present beneath West Parade (near Trevithick Street) is surrounded by cleared, mown edges. Within the drainage line no aquatic vegetation was observed or any large woody debris. The banks were earthen; the bed composed of silt and road base.

At the northern end of Bridge Street, high density rank grassland to 0.5 metres high is present. A line of planted Casuarinas is present adjacent to the rail line, these being to 10 metres; the understorey comprised of isolated Casuarina saplings to two metres high, with a groundcover of rank weeds. Within this area an ephemeral drainage swale is present, being about two metres wide; this supporting standing water at the time of the field investigations. Emergent vegetation consists of weeds or grasses.

3.1 Plant community types

With reference to the vegetation mapping prepared for the Cumberland Plain West (OEH 2013), the vegetation communities mapped within, and in close proximity to, the proposal footprint are illustrated on Figure 3.3, these being:

Figure 3.3 Vegetation mapping of the study area (OEH 2013)

- Alluvial Woodland which, under the BioNet Vegetation Classification system (OEH 2020c), is now referred to as Plant Community Type (PCT) 835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin.
- Shale Plains Woodland which, under the BioNet Vegetation Classification system (OEH 2020c), is now referred to as PCT 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion.

The field investigations to date have found that three vegetation communities/habitat types occur within the study area, these being:

- Forest Red Gum - Cabbage Gum Open Forest
- Forest Red Gum - Grey Box Woodland
- Exotic grassland/disturbed environment.

For reference, a description of these, and the dominant plants within each vegetation layer (or stratum), is provided below. When reading the following descriptions, it is recommended that these be read in conjunction with a review of the photographic record provided in Appendix B.

3.1.1 Forest Red Gum – Cabbage Gum Open Forest

Occurrence	This community occurs either side of the tributary of Eastern Creek that traverses the West Parade road corridor in the south-east of the study area and in the DPIE land between Denmark Road and Park Street (Figure 3.4). The vegetation condition is poor with the small tree, shrub and groundcover strata dominated by weeds.
	Dominant species (* = introduced)
Canopy to 20 m	Forest Red Gum (*Eucalyptus tereticornis*) Cabbage Gum (*E.amplifolia*)
Small Tree Layer Where present, moderate to high density to 8 m	Large-leaf Privet (*Ligustrum lucidum*)*
Shrubs Where present, moderate density to 2 m	Green Cestrum (*Cestrum parqui*)* *Solanum sisymbrifolium**
Climbers/Scramblers High density where present	Balloon Vine (*Cardiospermum grandiflorum*)*
Groundcover Low – moderate density where present 0.5 m	Bridal Creeper (*Asparagus asparagoides*)* Cobbler's Pegs (*Bidens pilosa*)* Kikuyu Grass (*Cenchrus clandestinum*)* Parramatta Grass (*Sprobolus creber*)* Weeping Meadow Grass (*Microlaena stipoides*) Couch (*Cynodon dactylon*) Privet (*Ligustrum* spp) seedlings
Leaf litter and ground debris	Nil to moderate
Hollow-bearing trees	Yes (refer Figure 2.1)
Other significant habitat features (i.e. water bodies, caves, rock outcrops)	2nd order watercourse that is a tributary of Eastern Creek.
Map Unit Name (OEH 2013)	Alluvial Woodland
Class (Keith 2004)	Coastal Floodplain Wetlands
PCT (OEH 2020b)	835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin (Cumberland riverflat forest).
EPBC and/or BC Acts?	Yes. Considered to be a part of the River-flat Eucalypt Forest on Coastal Floodplains listed as endangered under the BC Act.

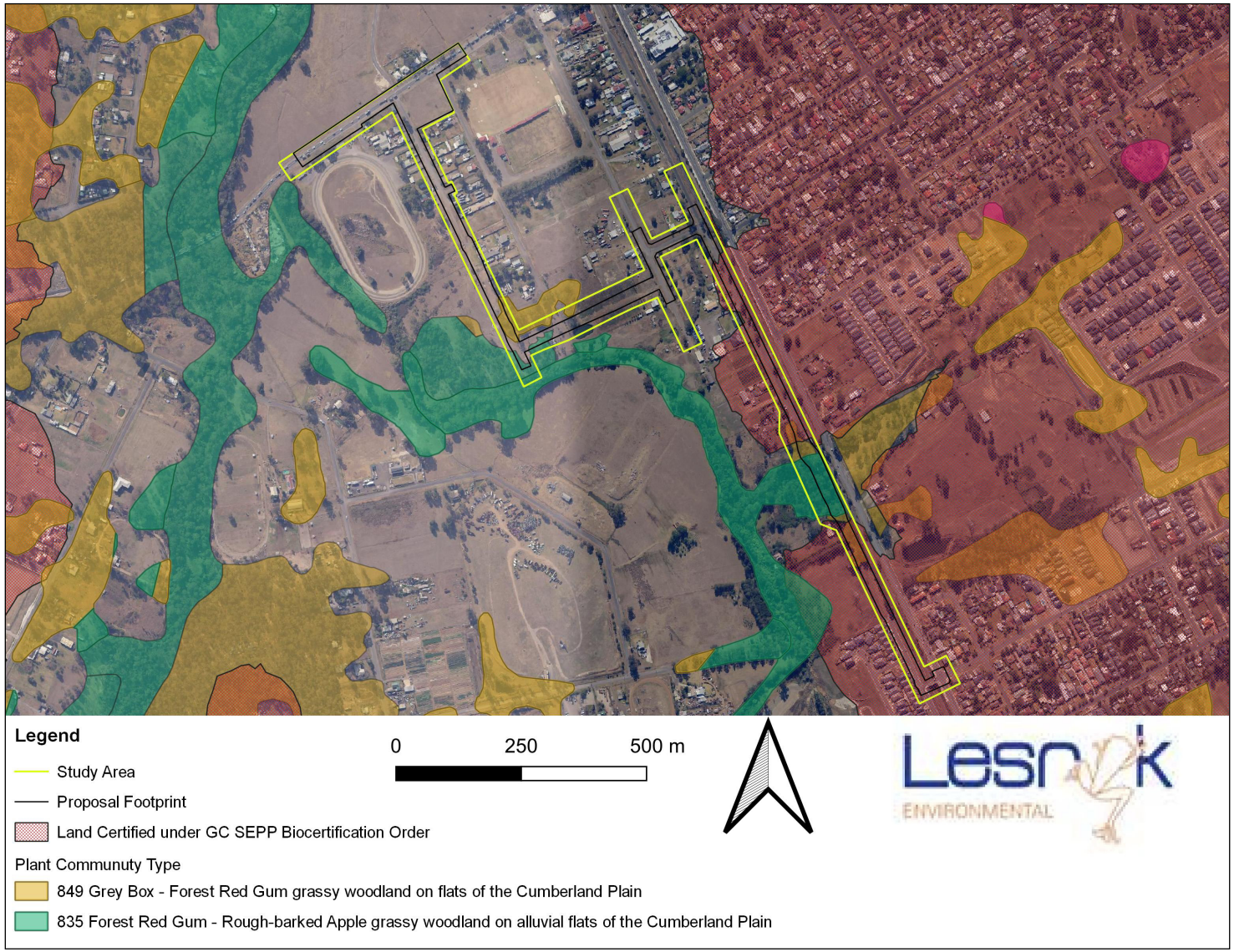

Figure 3.4 Location of ground-truthed PCTs in relation to the proposal

3.1.2 Forest Red Gum – Grey Box Woodland

Occurrence	This community occurs in the unformed section of Denmark Road extending into the adjacent DPIE land and upslope of the tributary of Eastern Creek that traverses the West Parade road corridor in the south-east of the study area. It is not as extensive as depicted by OEH (2013), areas near the Eastern Creek tributary instead being Forest Red Gum – Cabbage Gum Open Forest (Figure 3.4).
	Dominant species (* = introduced)
Canopy to 20 m	Forest Red Gum (*Eucalyptus tereticornis*) Grey Box (*E.moluccana*)
Shrubs Where present, moderate density to 2 m	Blackthorn (*Bursaria spinosa*)
Groundcover low density 0.5 m	African Lovegrass (*Eragrostis curvula*)* Greater Periwinkle (*Vinca major*)* Kikuyu Grass (*Cenchrus clandestinum*)* Parramatta Grass (*Sporobolus creber)** Weeping Meadow Grass (*Microlaena stipoides*)
Leaf litter and ground debris	Moderate
Hollow-bearing trees	Yes
Other significant habitat features (i.e. water bodies, caves, rock outcrops)	No
Map Unit Name (OEH 2013)	Cumberland Shale Plains Woodland
Class (Keith 2004)	Coastal Valley Grassy Woodlands
PCT (OEH 2020c)	849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion
EPBC and/or BC Acts?	BC Act Cumberland Plain Woodland Critically Endangered Ecological Community (CEEC). Due to the high level of weed invasion, the subject stands near the tributary of Eastern Creek and at the southern end of Denmark Road and in the adjacent DPIE land do not meet the EPBC Act criteria for the Cumberland Plain Woodland/ Shale Gravel Forest CEEC.

3.1.3 Exotic grassland / disturbed environment

Occurrence	Slashed road verges, unnamed sections of road and previously cleared farmland.
Groundcover medium/high density 0.3 m	Dominant species (* = introduced) Rhodes Grass (*Chloris gayana*)* Paspalum (*Paspalum dilatatum*)* Kikuyu Grass* (*Cenchrus clandestinum*)* Couch (*Cynodon dactylon*)*
Leaf litter and ground debris	No
Hollow-bearing trees	Yes (1 recorded adjacent Garfield Road West: Figure 2.1)
Other significant habitat features (i.e. water bodies, caves, rock outcrops)	None present within the portion of this community investigated.
Map Unit Name (OEH 2017)	N/A
Class (Keith 2004)	N/A
PCT (OEH 2018c)	N/A
EPBC and/or BC Acts?	No

3.2 Threatened ecological communities

With reference to the BioNet Vegetation Classification system (OEH 2020c):

- PCT 835 is a component of River-flat Eucalypt Forest (RFEF) on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions, listed as an EEC under the BC Act
- PCT 849 is a component of the BC Act listed CEEC Cumberland Plain Woodland (CPW).

Approximately 0.5 hectares of RFEF and 0.25 hectares of CPW not certified under the GC Biocertification Order would be affected by the proposal. With reference to the criteria provided under Part 7, Section 7.3 of the BC Act, assessments for a CEEC and EEC were carried out (Appendix D).

3.3 Groundwater dependent ecosystems

Groundwater Dependent Ecosystems (GDEs) are communities of plants, animals and other organisms whose extent and life processes are dependent on groundwater. Some examples of ecosystems which depend on groundwater are:

- Wetlands
- Red Gum forests
- Vegetation on coastal sand dunes and other terrestrial vegetation
- Ecosystems in streams fed by groundwater
- Limestone cave systems
- Hanging valleys and swamps.

GDEs are therefore ecosystems that have their species composition and their natural ecological processes determined by groundwater (DLWC 2002).

The Bureau of Meteorology Atlas of GDEs (Bureau of Meteorology 2020b) was reviewed to identify those aquatic and terrestrial ecosystems that are potentially groundwater dependent within the study area.

No aquatic GDE's were identified within the area investigated; however, 'high potential' Terrestrial GDEs occur within the study area (Bureau of Meteorology 2020b). Terrestrial GDEs rely on the subsurface presence of groundwater (this includes all vegetation ecosystems [Bureau of Meteorology 2020b]). The proposal would not impact subsurface groundwater.

3.4 Threatened species

Prior to conducting the field investigations, a review of the DAWE and BioNet database (DEE 2020, OEH 2020a) identified a large number of threatened flora and fauna species listed under the EPBC, BC and/or FM Acts that have been previously recorded or have habitat within 10 kilometres of the study area (Appendix A). During the site investigations, consideration was given to identifying the presence of these species, or occurrences of their necessary vegetation associations/habitats. Due to a lack of their necessary habitats within the area investigated, oceanic or estuarine species were not considered.

It is acknowledged that while previously recorded within and/or predicted as having habitat in the study region, most species listed in Appendix A would not occur within, or be reliant upon, the study area. These animals and plants have specific habitat requirement (as identified in Appendix A), no components of which were considered to occur in the study area.

A number of threatened species may traverse the study area during their migratory, interbreeding or, foraging/dispersal periods (primarily those that fly); however, the scale of work proposed is not considered to have an adverse impact on any of these species. Given their ability to easily negotiate urban infrastructure and the lack of any important habitat resources within the area investigated, these species would not occupy or utilise any of the resources provided by the study area.

3.4.1 Flora species recorded

By the completion of the field survey several native and exotic plants had been recorded within the area investigated (Appendix E). It is noted that this is not intended to be a comprehensive list of all species present within the study area, and only represents those plants that were recorded while carrying out searches for:

- Native plant species and ecological communities of State and/or national conservation concern that are known, or expected to occur, in the locality
- Weeds of significance that would require treatment.

In regard to those plants recorded, none are:

- Listed, or currently being considered for listing, on the Schedules to the EPBC or BC Acts
- Identified as a ROTAP (Briggs and Leigh 1996).

As no threatened plants are considered to be adversely impacted on by the proposal, the conducting of assessments referring to the EPBC Act's Significant Impact Guidelines and Section 7.3 of the BC Act is not required.

3.4.2 Fauna species recorded

By the completion of the field survey, two native mammals, 38 native birds, two reptiles, four amphibians and two native snails [the identification of which was provided/confirmed by the Australian Museum] were recorded within, or in proximity to, the study area (Table 3.2). Several introduced species were also detected.

Table 3.2 Fauna species recorded within the study area

Key
v - vulnerable (BC Act)
* - introduced species

Common name	Scientific Name	Method of Detection
MAMMAL		
Eastern Grey Kangaroo	*Macropus giganteus*	Observed
Common Brushtail Possum	*Trichosurus vulpecula*	Distinctive scratchings on smooth barked trees
* Rabbit	*Oryctolagus cuniculus*	Scats
* Fox	*Vulpes vulpes*	Scats
BIRDS		
Cattle Egret	*Ardea ibis*	Observed
Chestnut Teal	*Anas castanea*	Observed
Purple Swamphen	*Porphyrio porphyrio*	Observed
* Rock Dove	*Columba livia*	Observed
* Spotted Dove	*Streptopelia chinensis*	Observed
Brown Goshawk	*Accipiter fasciatus*	Observed
Crested Pigeon	*Ocyphaps lophotes*	Observed
Australian White Ibis	*Threskiornis molucca*	Observed
Straw-necked Ibis	*Threskiornis spinicollis*	Observed
Masked Lapwing	*Vanellus miles*	Heard
Galah	*Eolophus roseicapillus*	Heard
Sulphur-crested Cockatoo	*Cacatua galerita*	Observed
Rainbow Lorikeet	*Trichoglossus moluccanus*	Heard
Musk Lorikeet	*Glossopsitta concinna*	Observed
Red-rumped Parrot	*Psephotus haematonotus*	Heard
Eastern Rosella	*Platycercus eximius*	Heard
Laughing Kookaburra	*Dacelo novaeguineae*	Heard
Fan-tailed Cuckoo	*Cacomantis flabelliformis*	Heard

Common name	Scientific Name	Method of Detection
Spotted Pardalote	*Pardalotus punctatus*	Observed
Red Wattlebird	*Anthochaera carunculata*	Observed
Noisy Friarbird	*Philemon corniculatus*	Observed
Bell Miner	*Manorina melanophyrys*	Observed
Noisy Miner	*Manorina melanocephala*	Observed
Eastern Whipbird	*Psophodes olivaceus*	Heard
Superb Fairy-wren	*Malurus cyaneus*	Observed
Yellow-faced Honeyeater	*Lichenostomus chrysops*	Observed
Eastern Spinebill	*Acanthorhynchus tenuirostris*	Observed
Yellow Thornbill	*Acanthiza nana*	Observed
Olive-backed Oriole	*Oriolus sagittatus*	Observed
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*	Observed
v Dusky Woodswallow	*Artamus cyanopterus cyanopterus*	Observed
Grey Butcherbird	*Cracticus torquatus*	Heard
Australian Magpie	*Cracticus tibicen*	Heard
Pied Currawong	*Strepera graculina*	Observed
Australian Raven	*Corvus coronoides*	Observed
Magpie-lark	*Grallina cyanoleuca*	Observed
Willie Wagtail	*Rhipidura leucophrys*	Observed
Eastern Yellow Robin	*Eopsaltria australis*	Observed
Welcome Swallow	*Hirundo neoxena*	Observed
Silvereye	*Zosterops lateralis*	Observed
* Red-whiskered Bulbul	*Pycnonotus jocosus*	Heard
* Common Blackbird	*Turdus merula*	Observed
* Common Starling	*Sturnus vulgaris*	Observed
* Common Myna	*Sturnus tristis*	Heard
REPTILE		
Striped Snake-eyed Skink	*Cryptoblepharus virgatus*	Observed
Eastern Water Skink	*Eulamprus quoyii*	Observed
AMPHIBIAN		
Common Eastern Froglet	*Crinia signifera*	Heard
Green Tree Frog	*Litoria caerulea*	Ground debris searches
Bleating Tree Frog	*Litoria dentata*	Heard
Eastern Dwarf Tree Frog	*Litoria fallax*	Heard
SNAILS		
Southern Carnivorous Snail	*Austrorhytida capillacea*[5]	Ground debris searches
v Cumberland Plain Land Snail	*Meridolum corneovirens*[5]	Ground debris searches
* Common Garden Snail	*Helix aspersa*	Ground debris searches

No fish were observed within any of the drainage lines surveyed. Similarly, no large bird nests indicative of the breeding behaviour of raptors were seen.

Additional fauna species recorded during a previous survey near Garfield Road West (Lesryk 2020) include the following six native birds: Little Pied Cormorant (*Microcarbo melanoleucos*), Collared Sparrowhawk (*Accipiter cirrocephalus*), White-naped Honeyeater (*Melithreptus lunatus*) and Restless Flycatcher (*Myiagra inquieta*).

[5] Identification provided/confirmed by the Australian Museum

Two of the species recorded during the current investigations are listed as vulnerable under the Schedules to the BC Act, these being the:

- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)
- CPLS.

A small flock of Dusky Woodswallows were seen flying over the site between West Parade and Bridge Street at Easting [E] 302129; Northing [N] 6270301 (Figure 3.5).

One discarded CPLS shell was collected within the southern limits of Denmark Road, within the section of roadway that would be constructed between Denmark Road and Creek Street (at E301587; N6270480). This shell was found under a piece of fallen tree branch. Several discarded CPLS shells were also collected within the area that is present between Bridge Street and West Parade (at E302212; N6270156). At this location, the shells were collected from under a sheet of synthetic material (a plastic tarpaulin). Though targeted, no living CPLS were recorded within any of the woodland sites surveyed.

Based on the adoption of a precautionary approach, as targeted surveys were not conducted, it is assumed that the following threatened microbats that have been previously recorded in the surrounding region are present within, and adjacent to, the proposed road corridor:

- Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*) (7 records in region)
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) (9 records in region)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) (13 records in region)
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) (30 records in region).

As these microchiropterans all have similar habitat requirements (i.e. rely on tree hollows for their sheltering and breeding needs) they have been assessed collectively as 'hollow-dependent bats'[6].

To further consider the impact of the proposal on the Dusky Woodswallow, CPLS and hollow-dependent microbats, assessments drawing on the criteria provided under Section 7.3 of the BC Act have been carried out (Appendix D).

The outcomes of these assessments concluded that the proposal would not have a significant impact on the Dusky Woodswallow, CPLS, hollow-dependent microbats or the viability of their local populations. As such, the preparation of a SIS [or Biodiversity Development Assessment Report (BDAR) if TfNSW elects that option] that further considers the impact of the proposal on these species is not required.

[6] This approach is in line with the guidelines provided by DPIE (then DECC) on the Assessment of Significance (DECC 2007).

Figure 3.5 Location of threatened fauna species recorded

The carrying out of the proposed work within the area surveyed is not considered to remove any resources important to the potentially occurring threatened species listed in Appendix A, nor is it expected to limit the diversity of any of these animals foraging, sheltering or breeding sites. The work would not fragment or isolate any of these species' habitats, nor present any barriers to their breeding or movement requirements. None of the species listed in Appendix A would be solely reliant upon the resources present within, or close to, the proposed work such that the proposal would have a significant impact on the local or regional viability of these species, or their habitats.

The remaining native species recorded are protected, as defined by the BC Act, but considered to be common to abundant throughout the surrounding region. Within the surrounding region, these species have been recorded in association with a range of woodland habitats, as well as urban environments. The species recorded would not be solely reliant upon those habitats present within, or near, the proposal footprint, such that the removal or further disturbance of these would threaten the 'local' occurrence of these animals. The species recorded are all expected to be present within both the study area and surrounding locality post-work.

Given the extent of work proposed, the habitats to be affected and the land use history of the area investigated, it is considered unnecessary that any further assessments (i.e. reference to the EPBC Act's Significant Impact Guidelines or Section 221ZV (Part 7A) of the FM Act) of likely impact on any of the animals listed in Appendix A that could potentially occur, are required.

3.5 Areas of Outstanding Biodiversity Value

None of the AOBVs listed under Part 3 of the Biodiversity Conservation Regulation 2017 occur within, or in the vicinity of, the study area.

Reference to the Critical Habitat and AOBV registers (DAWE 2020b, DPIE 2020a) indicated no such area occurs in or near to the study area.

3.6 Wildlife connectivity corridors

The area investigated is not part of a significant vegetation corridor; the proposal footprint being partially located within an existing road network and a highly fragmented landscape. Isolated stands of woodland and parcels of bushland within the surrounding area provide a fragmented link to conservation areas within the region (over 15 kilometres beyond the proposal footprint).

When combined with the urbanised nature of the landscape (i.e. existing road and rail infrastructure), it is considered that there are limited opportunities for the dispersal and movement needs of ground dwelling, arboreal or gliding mammals. Primary connectivity within the study area is a vegetated corridor that exists along Eastern Creek; this dispersing north and south of the study area.

It is acknowledged that Eastern Creek is mapped by Department of Primary Industries (DPI) as Key Fish Habitat (DPI 2020b).

The proposal would require a total disturbance footprint of about 3.84 hectares, this including the clearing of approximately one hectare of native vegetation, composed of mature trees with a heavily weed-infested understorey. Broadly, the resultant gap width between canopies on either side of the proposed road alignment (where present) would remain the same. As such, the work proposed would not isolate or further fragment any habitat areas, nor erect any additional barriers to the movement and dispersal patterns of flying species (i.e. birds, bats), nor any gliding arboreal mammals, that may be currently negotiating the existing road network at this location. Ground traversing species, including nocturnal mammals, if currently doing so, would still be able to negotiate the roadways.

Given the scope of the proposal, all of the animals currently traversing the study area are also expected to do so post-work. The proposed work is not considered to have an adverse cumulative impact when associated with the existing environments that surround the locality.

3.7 Matters of National Environmental Significance

By the completion of the field investigations, PCT 849 Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion was recorded. Occurrences of PCT 849 in the study area do not meet the condition threshold for them to be considered components of the EPBC Act listed CEEC Cumberland Plain Shale Woodlands and Shale/Gravel Transition Forest.

No threatened flora or fauna species, or their populations listed under this Act had been recorded within, or in close proximity to, the study area. Similarly, none were considered likely to occur or rely upon the habitat(s) to be disturbed for any of their necessary lifecycle requirements. As such, assessments referring to the EPBC's Significant Impact Guidelines were not considered necessary. Referrals under the EPBC Act are no longer required for TfNSW proposals under Part 5 of the EPA Act in accordance with the Strategic Assessment process. Nevertheless, a referral to the Federal Minister for the Environment for further consideration or approval of the proposal is not required.

4 Impact assessment

4.1 Construction impact

4.1.1 Removal of native vegetation

Approximately one hectare of native vegetation composed of mature trees with a heavily weed-infested understorey would be removed; 0.25 hectares of this vegetation is covered by the Biodiversity Certification Order and does not require assessment under Section 7.2 of the BC Act.

It is expected that appropriate personnel movement fences would be erected if required, and sediment barriers would be installed at stockpile sites to protect nearby waterways.

Clearing within the site would be carried out in accordance with the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (NSW Roads and Traffic Authority [RTA], 2011) to minimise disturbance to surrounding flora and fauna habitats.

4.1.2 Removal of threatened fauna habitat

Twenty-one hollow-bearing trees (hollow diameter up to 15 centimetres) were observed during the investigations; these potentially occupied by threatened microchiropteran. It is expected that about 15 of these trees would require removal for the proposal.

Hollow-bearing trees were observed beyond the limits of the development footprint.

At the site where the CPLS was collected a limited amount of woodland habitat would be cleared. This woodland is present along the eastern edge of a vegetated band, with no connectivity (from the snail's perspective) to the east. Establishment of the proposed road would not fragment or isolate any habitat for the CPLS, its primary impact being a slight reduction in the overall area available to this species. West of the scope of the proposal footprint, larger areas of better developed woodland are present.

4.1.3 Removal of threatened flora

No threatened plants were recorded or considered likely to occur within the area investigated; as such, as no threatened species are considered to be adversely impacted on by the proposal, the conducting of assessments referring to the EPBC Act's Significant Impact Guidelines and Section 7.3 of the BC Act is not required.

4.1.4 Injury and mortality

Vegetation clearing to permit the proposal would require the removal of numerous trees; the work also affecting both groundcover and understorey vegetation, which is dominated by introduced plant species.

There is the potential that sheltering animals could be injured during this work. Additionally, given the proposal would involve habitat clearing directly next to the existing road network, this may result in an increase in individuals being injured or killed by vehicles in the short term.

During the construction phase of the project, some adaptable species [such as reptiles, frog and ground-traversing mammals] could be present. Recommendations, such as checking under vehicles/machinery prior to their use, have been provided to address this matter.

Twenty-one hollow-bearing trees were recorded during the investigations; 15 of which are expected to require removal. As such, clearing of these trees may result in injury and mortality to any hollow-dependent animals present. Recommendations have been presented to minimise the impact of the work.

Though no living individuals were recorded, the clearing of vegetation has the potential to cause injury and mortality to those CPLS individuals present. To minimise the impact of the work on this species, recommendations have been provided.

No fauna species listed under the EPBC or FM Acts are considered to reside within those portions of the study area that are likely to be affected. As such, the work is not considered to cause injury or mortality to any of those aquatic or nationally significant threatened species previously recorded within the study region.

Beyond current levels of impact due to the existing presence of the road network and the volume of traffic that traverses this, the proposed work is not expected to significantly increase injury or mortality of fauna.

4.2 Indirect/operational impact

4.2.1 Wildlife connectivity and habitat fragmentation

Given the proposal footprint is partially located within an existing road network and a highly fragmented landscape, there is currently only limited connectivity between isolated stands of woodland and those parcels of bushland and the vegetated corridor that exists along Eastern Creek that eventually link to conservation areas within the region (over 15 kilometres beyond the proposal footprint).

The proposal is not considered to further fragment any habitat areas or erect any additional barriers to the movement and dispersal patterns of flying species (i.e. birds, bats), nor any gliding arboreal mammals, that may be currently negotiating the study area. Ground traversing species, including nocturnal mammals, if currently doing so, would remain able to negotiate the roadways.

4.2.2 Edge effects on adjacent native vegetation and habitat

Weeds are already prevalent throughout the study area. The proposed work is not expected to exacerbate the current situation such that the integrity of the native vegetation communities in nearby areas would be compromised.

4.2.3 Invasion and spread of weeds

Under the *Biosecurity Act 2015*, which came into effect on 1 July 2017, ‘all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable.’

Of the introduced plant species recorded, four are listed:

- Under Schedule 3 of the NSW Biosecurity Regulation 2017
- As a 'priority weed' in the Greater Sydney region (which includes the Blacktown LGA) (DPI 2020a) and/or
- As a Weeds of National Significance[7] (WoNS) (AG 2020).

For reference, these species and relevant legal requirement(s) are provided in Table 4.1.

Table 4.1 Weeds of significance recorded on site

Species	Listed	Biosecurity duty
Blackberry *Rubus fruticosus* agg. spp.	NSW *Biosecurity Regulation 2017* / DPI (2020) / WoNS	Prohibition on dealings Must not be imported into the State or sold.
Bridal Creeper *Asparagus asparagoides*	NSW *Biosecurity Regulation 2017* / DPI (2020) / WoNS	Prohibition on dealings Must not be imported into the State or sold.
Green Cestrum *Cestrum parqui*	NSW *Biosecurity Regulation 2017/ DPI (2020)*	Regional Recommended Measure Land managers should mitigate the risk of new weeds being introduced to land used for grazing livestock. Land managers should mitigate spread from their land. Plant should not be bought, sold, grown, carried or released into the environment.
Lantana *Lantana camara*	NSW *Biosecurity Regulation 2017* / DPI (2020) / WoNS	Prohibition on dealings Must not be imported into the State or sold.

Where these weeds occur on site they must be controlled to result in their suppression. This should be done prior to the commencement of the proposed work to avoid the further spread of these plants.

Where weed material is removed as part of the work, this should be disposed of at a licensed waste facility.

4.2.4 Invasion and spread of pests

One introduced animal, the Rabbit, was recorded within the study area. Based on the author's knowledge of the study area, pest species that would be present include the Feral Cat (*Felis catus*), Dog (*Canis lupus familiaris*) and European Red Fox (*Vulpes vulpes*).

Beyond existing levels, the proposal is unlikely to increase the presence of pest species within the study area.

[7] The list of WoNS is part of a combined State and Commonwealth initiative to combat invasive species.

4.2.5 Invasion and spread of pathogens and disease

There is a risk that the proposal would introduce, spread or exacerbate the plant diseases caused by *Phytophthora cinnamomi* and Myrtle Rust (*Puccinia psidii*). These diseases are most likely introduced or spread through the importation or movement of soil, water and landscaping materials, either directly or through incidental attachment to machinery.

4.2.6 Changes to hydrology

The proposed work would not result in any changes to hydrology. While one permanent water body, Eastern Creek, is present south and west of the proposed work, and three of its drainage lines occur in proximity to the West Parade proposed work, none of these would be significantly affected by the proposed work such that the hydrology and quality of Eastern Creek would be affected.

4.2.7 Noise, light and vibration

During construction, activities associated with the proposal would cause additional noise and vibration; however, given the presence and proximity of the existing road network, it is not considered that the proposal would result in changes to existing levels of noise, vibration and light from the existing road network and surrounding environment such that there would be a significant impact to native fauna species.

4.3 Cumulative impact

Given the surrounding land uses adjacent to the existing road network, the proposed work is not considered to contribute to a cumulative ecological impact in a local and regional context.

The work is not considered to further contribute to the decline of any threatened species, populations or ecological communities within the locality.

4.4 Assessments of significance

By the completion of the field investigations conducted to date two threatened ecological communities (TECs) and two threatened animals were recorded, these being:

- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions - listed as an EEC under the BC Act
- Cumberland Plain Woodland - listed as a CEEC under the BC Act
- Dusky Woodswallow - listed as Vulnerable under the BC Act
- CPLS - listed as Vulnerable under the BC Act.

No threatened flora species or their populations were recorded or considered likely to occur. Similarly, none are expected to rely upon the habitats or vegetation communities proposed to be disturbed for any of their necessary or significant lifecycle requirements.

To consider the impact of the proposal on the TECs and threatened species recorded, assessments referring to the criteria provided under Section 7.3 of the BC Act were conducted, these concluding that the proposal would not have a significant impact on these

matters; as such, the preparation of an SIS [or BDAR should TfNSW elect that option] to further assess the scope of work proposed is not considered necessary.

As no threatened fish would occur as resident populations within any of the drainage lines or water bodies within the study area (given their highly disturbed and ephemeral nature), the conducting of an assessment drawing on the criteria provided under Part 7A, Division 12, Subdivision 221ZV of the FM Act (these commonly referred to as the ‘seven part test’) is not required. As such, the preparation of a SIS that further considers the impact of the proposal on fish is not required.

4.5 Impact summary

Table 4.2 provides a summary of impact that has been considered as part of this proposal.

Table 4.2 Summary of impact

Impact	Biodiversity values	Nature of impact	Extent of impact	Duration	Does the proposal constitute or exacerbate a key threatening process?	Confidence in assessment
Removal of native vegetation	Native vegetation	Direct	Site based	Long term	Clearing of native vegetation	Irreversible
Removal of threatened fauna habitat	Native vegetation	Direct	Site based	Long term	Clearing of native vegetation	Irreversible
Removal of threatened flora	N/A					
Injury and mortality of fauna	Native fauna	Direct	Site based	Short term	No	Unpredictable
Fragmentation of identified biodiversity links and habitat corridors	Biodiversity corridors	Direct/indirect	Regional	Long term	No	Irreversible
Edge effects on adjacent native vegetation and habitat	Native vegetation and habitat	Potential indirect	Site based	Short term	• Invasion and establishment of exotic vines and scramblers. • Invasion, establishment and spread of *Lantana camara.* • Invasion of native plant communities by exotic perennial grasses.	Unpredictable
Invasion and spread of weeds	Impact on habitat	Potential indirect	Site based	Long term	• Invasion and establishment of exotic vines and scramblers • Invasion, establishment and spread of *Lantana camara* • Invasion of native plant communities by exotic perennial grasses	Unpredictable
Invasion and spread of pests	Native fauna	Indirect	Site based	Long term	• Competition and grazing by the feral European rabbit (*Oryctolagus cuniculus*) • Predation and hybridisation of feral dogs (*Canis lupus familiaris*)	Unpredictable

Impact	Biodiversity values	Nature of impact	Extent of impact	Duration	Does the proposal constitute or exacerbate a key threatening process?	Confidence in assessment
					• Predation by the European red fox (*Vulpes vulpes*) • Predation by the feral cat (*Felis catus*)	
Invasion and spread of pathogens and disease	Native flora and fauna	Indirect	Site based	Long term	• Infection of native plants by *Phytophthora cinnamomi* • Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae • Infection by psittacine circoviral (beak and feather) disease affecting endangered psittacine species and populations • Infection of frogs by amphibian chytrid causing the disease chytridiomycosis	Unpredictable
Noise, light and vibration	Native fauna	Direct/ indirect	Local	Short term	No	Unpredictable

5 Avoid, minimise and mitigate impact

5.1 Avoidance and minimisation

The key principles of the Roads and Maritime Biodiversity Guidelines (RTA 2011), with regard to managing biodiversity for road projects and the associated impact on the natural and social environment, is that TfNSW should aim to:

- Avoid and minimise the impact first.
- Mitigate the impact where avoidance is not possible.
- Offset where residual impact cannot be avoided.

The proposed work is taking place primarily along the corridor of the existing road network and as such, the potential to avoid an overall impact to biodiversity is high. While disturbance/removal of vegetation as a result of the proposal is unavoidable, the one hectare of vegetation that would be cleared is considered to provide minimal habitat resources for those species recorded or expected.

To minimise the impact on native vegetation and fauna habitat adjacent to the work area, and the proposed work compound it is expected that TfNSW would:

- Prepare a Construction Environmental Management Plan (CEMP) to limit soil erosion and sediment transfer off-site
- Limit vegetation clearing to the minimum required to successfully complete the proposal
- Identify the limits of clearing; these should be provided to the construction contractor, identified both on site maps/plans and on site through the erection of temporary fencing, bunting or similar. Fencing etc. should be established at the outer limits of the drip line of any retained trees present. These areas should be marked as ‘no-go zones’
- Identify the location of those hollow-bearing trees to be cleared
- Where possible, locally relocate any felled trees as opposed to the mulching of these plants. Relocation of the felled trees should aim at providing habitat for native species and their prey (as per DEC 2004, Roads and Traffic Authority 2011)
- An ecologist or similar to supervise the clearing of those hollow-bearing trees present
- Any injured native fauna should be taken to a local veterinarian or wildlife carer for treatment
- Introduced species should be collected and taken to a local veterinarian for euthanising
- Conduct pre-clearing surveys for the CPLS
- Restrict the location of the ancillary site to the designated existing cleared area to avoid unnecessary impact to vegetation and habitat
- Store/park vehicles and machinery in designated areas devoid of shrub and canopy species
- Collect and take to a local veterinarian or wildlife carer any animals injured during the clearing work
- In accordance with the NSW *Biosecurity Act 2015*, occurrences of Bridal Creeper, Blackberry, Green Cestrum and Lantana identified on site would be controlled to result in the suppression of these species
- Implement measures to disinfect vehicles and machinery prior to their use.

5.2 Mitigation measures

Table 5.1 provides a number of mitigation measures that aim to ensure that the proposed work carried out within the proposal footprint does not have an adverse impact on those environments that occur within, or in close proximity to, it.

Table 5.1 Mitigation measures

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impact anticipated
Removal and disturbance of native vegetation	Native vegetation removal will be minimised through detailed design.	Detailed design	Effective	There would be residual impact from the loss of about one hectare of native vegetation.
	Pre-clearing surveys will be carried out in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Prior to construction	Effective	
	The boundary between the limit of work and the exclusion zone will be indicated on plans and clearly demarcated on site with flagging or similar. The exclusion zone will be established as per *Guide 2: Biodiversity Guidelines Protecting and managing biodiversity on RTA projects* (RTA 2011).	Prior to construction	Effective	
	Vegetation removal will be carried out in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	
	Native vegetation will be re-established in accordance with *Guide 3: Re-establishment of native vegetation* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Post construction	Effective	
	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	
Hollow-bearing tree and 'large' ground debris removal	Immediately prior to clearing, a pre-clearing process must be carried out in accordance with Biodiversity Guidelines: Guide 1. Clearing will be carried out in accordance with the requirements stipulated within the Roads and Maritime Biodiversity Guidelines - Guide 4 (Fauna clearing of vegetation and removal of bush rock); including: Preparation of a clearing and grubbing plan in accordance with Roads and Maritime Specification G40 Staging of habitat removal.	Detailed design During construction	Effective	Loss of 15 hollow-bearing trees

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impact anticipated
	Supervision of clearing of hollow-bearing trees, with collection and local relocation of any sheltering native wildlife. Fauna handling must be carried out in accordance with the requirements stipulated within the Roads and Maritime Biodiversity Guidelines - Guide 9 (Fauna Handling). If any native species are present an appropriately licenced ecologists or wildlife carer must collect the animal and relocate it locally (if uninjured). Exotic injured wildlife to be ethically euthanised. Injured native wildlife to be taken for assessment and treatment (if appropriate) by local veterinarian. Re-use of large woody debris must be managed in accordance with Roads and Maritime Biodiversity Guidelines - Guide 5 to minimise loss or damage to native flora and fauna habitats.			
Removal of threatened species habitat and habitat features	Pre-clearing survey conducted to collect and relocate locally any living CPLS individuals present within the woodland portions of the road corridor.	Prior to construction	Effective	Retention of species in locality
	Habitat removal will be minimised through detailed design.	Detailed design	Effective	There would be residual impact on fauna habitat from the loss of about one hectare of native vegetation.
	Habitat removal will be carried out in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	
	Habitat will be replaced or re-instated in accordance with *Guide 5: Re-use of woody debris and bushrock* and *Guide 8: Nest boxes* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Proven	
	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	
	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened flora species, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impact anticipated
Fragmentation of identified habitat corridors	Connectivity measures will be implemented in accordance with the *Wildlife Connectivity Guidelines for Road Projects* (RTA 2011).	Detailed design, during construction and post construction	Effective	None beyond current situation.
Edge effects on adjacent native vegetation and habitat	Exclusion zones will be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	Some weed invasion in cleared areas.
Injury and mortality of fauna	Fauna will be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None
	Inspections for the presence of any sheltering native species should be carried out under vehicles and machinery prior to their use.	During construction	Effective	None
Invasion and spread of weeds	Weed species will be managed in accordance with *Guide 6: Weed management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) and the Biosecurity Act 2015 [weeds identified on site must be controlled to result in their suppression]	During construction	Effective	Some weed invasion in cleared areas.
Invasion and spread of pests	Pest species will be managed within the proposal site.	During construction	Effective	None
Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) and *Guide 7: Pathogen Management of the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	None
	All equipment and vehicles are to be washed before entering the site to prevent the introduction and spread of weed seeds. Similarly, vehicles transporting any exotic vegetation off site should ensure that their loads are covered.	During construction	Effective	None
	Phytophthora cinnamomi is a microscopic organism that lives in soils and plant roots and is the key organism associated with the dieback of native plant species in Australia. Work must therefore avoid the potential spread of this organism as far as possible. Contractors would need to adhere to the following hygiene protocols:	During construction	Effective	None

Impact	Mitigation measures	Timing and duration	Likely efficacy of mitigation	Residual impact anticipated
	• Before personnel enter the work site, they are to remove excess soil and mud and then spray boots, tools, gloves and small equipment with recommended disinfectant supplied by the contractor (70% Methylated spirits/30% Water) until runoff is clear • When leaving work sites, personnel are to remove excess soil and mud and then spray boots, tools, gloves and small equipment with recommended disinfectant until runoff is clear • Avoid unnecessary soil disturbance.			
Noise, light and vibration	Noise and vibration impact would be minimised through detailed design.	Detailed design	Effective	Increase in noise, light and vibration during construction.

6 Offset strategy

6.1 Quantification of impact

TfNSW is committed to offsetting impacts associated with a proposal in line with its biodiversity offsetting guidelines (Roads and Maritime 2016) and in general accordance with the OEH principles for the use of biodiversity offsets in NSW.

The Guideline for Biodiversity Offsets V2.0 (Roads and Maritime 2016) provides offset thresholds which are appropriate and proportional for the scale of EPA Act Division 5.1 assessments, and the activity's expected impact on biodiversity. Table 1, within Section 4.2 of the biodiversity offsetting guidelines, outlines the offsetting thresholds for REFs. The thresholds relevant to this proposal are outlined within Table 6.1.

Table 6.1 Biodiversity offset thresholds

Description of activity or impact	Consider offsets or supplementary measures	Subject species/Subject EEC meeting threshold
Activities in accordance with Roads and Maritime Services Environmental assessment procedure: Routine and Minor Works (RTA 2011)	No	N/A
Works on cleared land, plantations, exotic vegetation where there are no threatened species or habitat present	No	N/A
Works involving clearing of vegetation planted as part of a road corridor landscaping program (this includes where threatened species or species comprising listed ecological communities have been used for landscaping purposes)	No. Only hybrid native or exotic plantings being removed. Landscaping not part of fauna dispersal corridor.	N/A
Works involving clearing of national or NSW listed critically endangered ecological communities (CEEC)	Where there is any clearing of an CEEC in moderate to good condition	No. While approximately 0.5 hectare of the BC Act CEEC CPW would be cleared, it is in low condition.[8]
Works involving clearing of nationally listed TEC or nationally listed threatened species habitat	Where clearing > one hectare of a TEC or habitat in moderate to good condition	N/A. No nationally listed TEC recorded.
Works involving clearing of NSW endangered or vulnerable ecological community	Where clearing > five hectares or where the ecological community is subject to an SIS	No. About 0.5 hectare of CPW and 0.5 hectare of RFEF would be removed.
Works involving clearing of NSW listed threatened species habitat where the species is a species credit species as defined in the OEH Threatened Species Profile Database (TSPD)	Where clearing > one hectare or where the species is the subject of an SIS	No. A small area (< one hectare) of habitat potentially occupied by the CPLS (a species credit species) will be cleared.

[8] Low condition vegetation (as defined in the BAM [OEH 2017]) "is expected to have a modified pollinator fauna, modified soil seed banks, soil nutrient levels, soil microbial composition and soil structure. Recovery without active intervention (modification to soils, weed competition, seed and plant addition) is highly uncertain in such situations." Given its location, small size, high edge to volume ratio and mapping by OEH (2013) as degraded, it is considered likely that the Cumberland Plain Woodland patch in and adjacent to the DPIE land is in low condition, similar to that along West Parade in the south-east of the study area.

Works involving clearing of NSW listed threatened species habitat and the species is an ecosystem credit species as defined in OEH's Threatened Species Profile Database (TSPD)	Where clearing > five hectares or where the species is the subject of an SIS	No
Type 1 or Type 2 key fish habitats (as defined by NSW Fisheries)	Where there is any net loss of habitat	No

Given the outcomes of Table 6.1, a biodiversity offset strategy with regard to TfNSW's guidelines is not required.

6.2 Growth Centre SEPP Biocertification Order

Under the TSC Act (and now adopted under the BC Act), Biodiversity Certification was conferred on the GC SEPP. This has the effect that certified land within the Growth Centres is not subject to Part 7.2 of the BC Act.

Clause 11 of the biocertification order states:

> Where there are essential infrastructure proposals, including but not limited to proposals under Part 3A of the *Environmental Planning and Assessment Act 1979*, that involve clearing of existing native vegetation[9] in the non-certified areas and that do not require development consent under the SEPP, such clearing must be offset by applying the same requirements specified in condition 8 above.

Condition 8 of the order outlines the offsetting requirements which, in short, are the protection of an equal or greater area of existing native vegetation elsewhere in the Growth Centres or revegetation and/or restoration at a ratio of at least 3:1.

The proposed work at the southern end of Denmark Road and the extension of West Parade in the south-east of the subject site would require the removal of 6821 square metres of Existing Native Vegetation (Figure 6.1).

6.3 Biodiversity Offset strategy

A Biodiversity Offset strategy may need to be prepared in relation to the removal of Existing Native Vegetation as per the Biodiversity Conservation Order of the GC SEPP.

[9] Existing native vegetation refers to vegetation identified on maps prepared by DPIE.

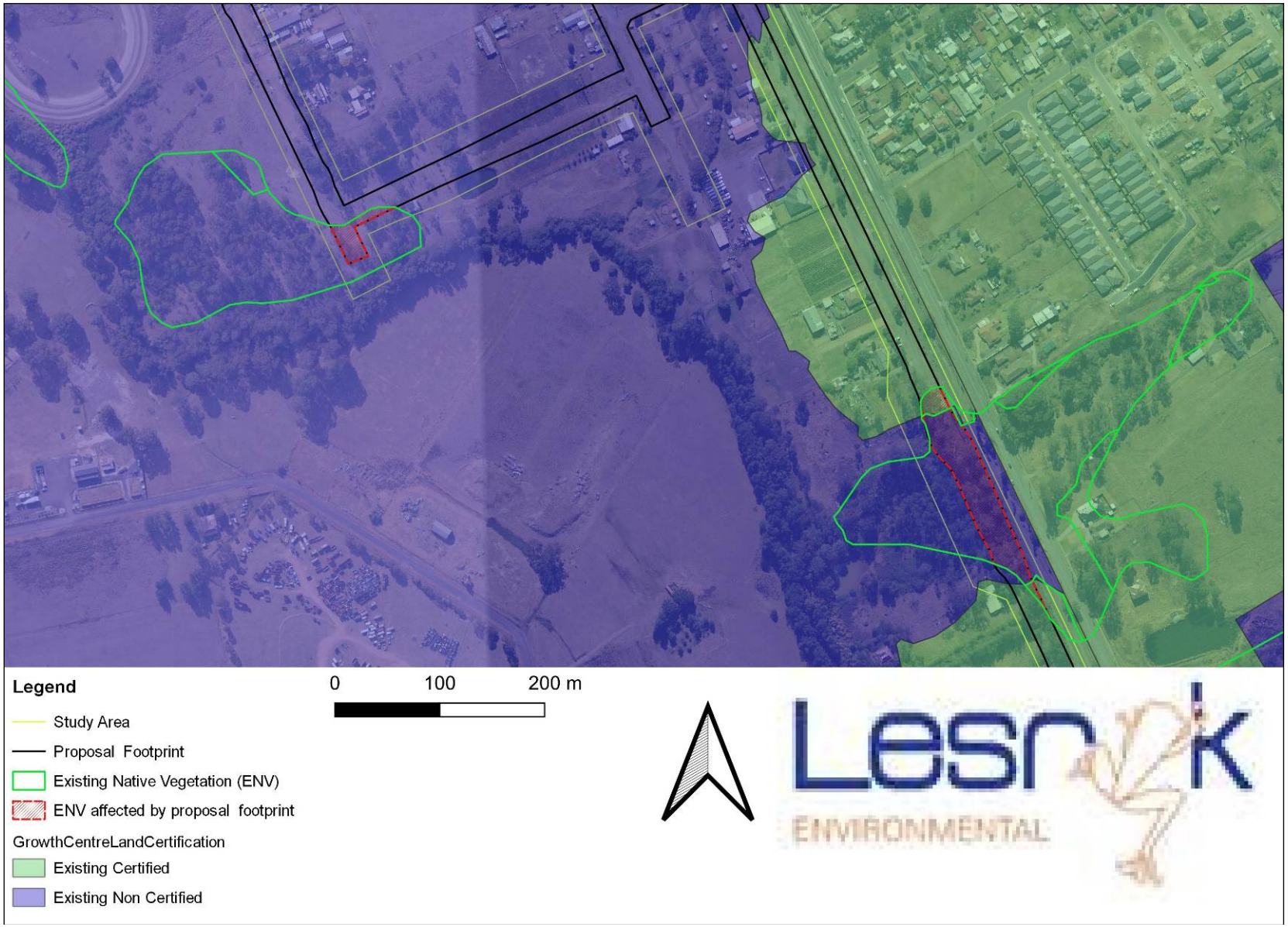

Figure 6.1 Existing Native Vegetation in the vicinity of Denmark Road and the West Parade Extension

7 Conclusion

An ecological investigation has been carried out as TfNSW, as part of the North West Growth Centre Road Network Strategy and Riverstone Traffic Improvements Package, in order to alleviate traffic congestion and delays along Garfield Road West, and align with future traffic needs for the area, are proposing to construct a connection road from Garfield Road West via the Denmark Road intersection to West Parade, Riverstone, and along this road towards the suburb of Schofields, NSW.

By the completion of the field investigations two TECs and two State listed threatened animals were recorded, these being:

- River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions - listed as an EEC under the BC Act
- Cumberland Plain Woodland - listed as a CEEC under the BC Act
- Dusky Woodswallow - listed as Vulnerable under the BC Act
- Cumberland Plain Land Snail - listed as Vulnerable under the BC Act.

To consider the impact of the proposal on the TECs and threatened species recorded, assessments referring to the criteria provided under Section 7.3 of the BC Act were conducted, these concluding that the proposal would not have a significant impact on these TECs or animals; as such, it is not necessary to prepare a SIS [or BDAR should TfNSW elect that option] to further assess the scope of work proposed.

No threatened flora species or their populations listed, or considered for listing, under the EPBC or BC Acts were recorded or considered likely to occur. Similarly, none are expected to rely upon the habitats or vegetation communities proposed to be disturbed for any of their necessary or significant lifecycle requirements.

Referrals under the EPBC Act are no longer required for TfNSW proposals under Part 5 of the EP&A Act in accordance with the Strategic Assessment process. In any case, a referral to the Federal Minister for the Environment for further consideration or approval is not required.

The proposal, being the construction of a connection road, would not have a significant effect on the environment such that an Environmental Impact Statement is required. Based on a worst-case estimate, the extent of the impact would require a total disturbance footprint of about 3.84 hectares, the proposal requiring the removal of about one hectare of native vegetation; this including the removal of 15 hollow-bearing trees.

Of the one hectare of native vegetation to be removed, 6821 square metres is mapped as Existing Native Vegetation requiring offsetting under the Biodiversity Conservation Order of the GC SEPP.

Mitigation measures have been recommended to reduce any impact on threatened species, communities and their habitats. The two most important measures include:

- Minimising impact through detail design.
- Adhering to the Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects (RTA 2011).

Based on the principles of Ecologically Sustainable Development, as identified in Schedule 2 of the Environmental Planning and Assessment Regulation, the following recommendations are provided:

- Prepare a CEMP to limit soil erosion and sediment transfer off-site
- Limit vegetation clearing to the minimum required to successfully complete the proposal
- Identify the limits of clearing; these should be provided to the construction contractor, identified both on site maps/plans and on site through the erection of temporary fencing, bunting or similar. Fencing etc. should be established at the outer limits of the drip line of any retained trees present. These areas should be marked as 'no-go zones'
- Identify the location of those hollow-bearing trees to be cleared
- Where possible, locally relocate any felled trees as opposed to the mulching of these plants. Relocation of the felled trees should aim at providing habitat for native species and their prey (as per DEC 2004, Roads and Traffic Authority 2011)
- An ecologist or similar to supervise the clearing of those hollow-bearing trees present
- Any injured native fauna should be taken to a local veterinarian or wildlife carer for treatment
- Introduced species should be collected and taken to a local veterinarian for euthanising
- Conduct pre-clearing surveys for the CPLS
- Restrict the location of the ancillary site to the designated existing cleared area to avoid unnecessary impact to vegetation and habitat
- Store/park vehicles and machinery in designated areas devoid of shrub and canopy species.
- Collect and take to a local veterinarian or wildlife carer any animals injured during the clearing work.
- In accordance with the NSW *Biosecurity Act 2015*, occurrences of Bridal Creeper, Blackberry, Green Cestrum and Lantana identified on site would be controlled to result in the suppression of these species
- Implement measures to disinfect vehicles and machinery prior to their use.

By the completion of the field investigations, no limitations to the proposal proceeding as planned were identified. With adherence to those recommendations provided in this report, no ecological constraints to the proposal proceeding as planned were identified or considered likely to occur.

The adoption of those mitigation measures provided would ensure that the proposal is carried out in an ecologically sustainable manner.

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Appendix A – Habitat assessment table

Likelihood of occurrence criteria

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey
High	It is highly likely that a species inhabits the study area and is dependent on identified suitable habitat (i.e. for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the locality (10 kilometres) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the study area during regular seasonal movements or migration.
Moderate	Potential habitat is present in the study area. Species unlikely to maintain sedentary populations; however, may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the study area and has not been recorded recently in the locality (10 kilometres). It may be an occasional visitor, but habitat similar to the study area is widely distributed in the local area, meaning that the species is not dependent (i.e. for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the study area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
None	Suitable habitat is absent from the study area.

Key

V - vulnerable E - endangered CE - critically endangered M - migratory

Note: Species underlined are those which only the EPBC PMST predicted as having habitat in the search area. All other species have been recorded within 10 km of the study area.

Note: As these habitats are not present, no pelagic, estuarine or wetland species have been included in the following table.

Given that the proposed work is not located within the Commonwealth marine area, this being from 3 to 200 nautical miles from the coast, no species listed as marine under the EPBC Act have been considered; nor has the marine status of any species been acknowledged.

* - habitat requirements were generally extracted from DAWE (2020a), OEH (2020b), Harden (1992-2002), Frith (2007), Churchill (2008), Cogger (2014) and Van Dyck and Strahan (2008) with other references used being identified in the bibliography.

Species	Legislation		Primary habitat requirement	Likelihood of Occurrence[10]
	EPBC Act	BC & FM Acts		
PLANTS				
Bynoe's Wattle *Acacia bynoeana*	V	E	Occurs in heath or dry sclerophyll forest on sandy soils.	Low. No suitable habitat present.
Acacia gordonii	E	E	Restricted to the north-west of Sydney, it has a disjunct distribution occurring in the lower Blue Mountains in the west, and in the Maroota/Glenorie area in the east. Grows in dry sclerophyll forest and heathlands amongst or within rock platforms on sandstone outcrops.	Low. No suitable habitat present.
Downy Wattle *Acacia pubescens*	V	V	Occurs in open woodland and forest, usually at or near the interface of shale and sandstone or shale and gravel.	Low. No suitable habitat present.
Allocasuarina glareicola	E	E	Primarily restricted to the Richmond district, with an outlier population found at Voyager Point, Liverpool. Grows in Castlereagh woodland on lateritic soil. Found in open woodland.	Low. No suitable habitat present.
Asterolasia elegans	E	E	Found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest.	Low. No suitable habitat present.
Leafless Tongue Orchid *Cryptostylis hunteriana*	V	V	Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland.	Low. No suitable habitat present.
White-flowered Waxplant *Cynanchum elegans*	E	E	Usually occurs on the edge of dry rainforest vegetation but also in littoral rainforest, coastal scrub and aligned open forest and woodland.	Low. No suitable habitat present.
Darwinia biflora	V	V	Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone.	Low. No suitable habitat present.

[10] as a resident population

Species	Legislation		Primary habitat requirement	Likelihood of Occurrence[10]
	EPBC Act	BC & FM Acts		
Dillwynia tenuifolia		V	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. No suitable habitat present.
Eucalyptus sp. Cattai (Gregson s.n., 28 Aug 1954)	CE	CE	Occurs in The Hills Local Government Area, with known populations occurring within the area bounded by Kellyville - Maraylya - Glenorie. Occurs as a rare emergent tree in scrub, heath and low woodland on sandy soils, usually as isolated individuals or occasionally in small clustered groups. The sites at which it occurs are generally flat and on ridge tops.	Low. No suitable habitat present.
Bauer's Midge Orchid *Genoplesium baueri*	E	E	Grows in dry sclerophyll forest and moss gardens over sandstone.	Low. No suitable habitat present.
Juniper-leaved Grevillea *Grevillea juniperina subsp. juniperina*		V	Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels.	Low. Formerly suitable habitat now degraded.
Wingless Raspwort *Haloragis exalata* subsp. *exalata*	V	V	Appears to require protected and shaded damp situations in riparian habitats.	Low. Formerly suitable habitat now degraded.
Marsdenia viridiflora R. Br. subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas		EP	Grows in vine thickets and open shale woodland.	Low. Formerly suitable habitat now degraded.
Deane's Melaleuca *Melaleuca deanei*	V	V	Occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas. Occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone.	Low. No suitable habitat present.
Micromyrtus minutiflora	V	E	Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel	Low. No suitable habitat present.

Species	Legislation		Primary habitat requirement	Likelihood of Occurrence[10]
	EPBC Act	BC & FM Acts		
			Transition Forest, open forest on tertiary alluvium and consolidated river sediments.	
Olearia cordata	V	V	Populations are typically small and scattered. Grows in dry open sclerophyll forest and open shrubland, on sandstone ridges.	Low. No suitable habitat present.
Tall Knotweed *Persicaria elatior*	V	V	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	Low. No suitable habitat present.
Hairy Geenbung *Persoonia hirsuta*	E	E	Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	Low. No suitable habitat present.
Nodding Geebung *Persoonia nutans*	E	E	Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south. Southern populations occupy tertiary alluvium, but extend onto shale sandstone transition communities and into Cooks River/Castlereagh Ironbark Forest.	Low. No suitable habitat present.
Pimelea curviflora var. curviflora	V	V	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	Low. No suitable habitat present.
Spiked Rice-flower *Pimelea spicata*	E	E	Found on well-structured clay soils. On the Cumberland Plain it is associated with Grey Box communities (particularly Cumberland Plain Woodland variants and Moist Shale Woodland) and in areas of ironbark.	Low. Formerly suitable habitat now degraded.
Illawarra Greenhood *Pterostylis gibbosa*	E	E	All known populations grow in open forest or woodland, on flat or gently sloping land with poor drainage. Near Nowra, the species grows in an open forest of Spotted Gum *Corymbia maculata*, Forest Red Gum and Grey Ironbark *E. paniculata*.	Low. No suitable habitat present.
Sydney Plains Greenhood *Pterostylis saxicola*	E	E	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines.	Low. No suitable habitat present.

Species	Legislation		Primary habitat requirement	Likelihood of Occurrence[10]
	EPBC Act	BC & FM Acts		
Pultenaea parviflora	V	E	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. No suitable habitat present.
Magenta Lilly Pilly *Syzygium paniculatum*	V	E	Found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest.	Low. No suitable habitat present.
Austral Toadflax *Thesium australe*	V	V	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.	Low. No suitable habitat present.
Zieria involucrata	V	E	Occurs primarily on Hawkesbury sandstone. Also occurs on Narrabeen Group sandstone and on Quaternary alluvium. Found primarily in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest, although some populations extend upslope into drier vegetation.	Low. No suitable habitat present.
MAMMALS				
Spotted-tailed Quoll *Dasyurus maculatus*	E	V	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.	Low. No suitable habitat.
Koala *Phascolarctos cinereus*	V	V	Open eucalypt forest and woodland, containing a variety of 'preferred' food tree species.	Low. No suitable habitat.
Squirrel Glider *Petaurus norfolcensis*		V	Inhabits woodlands and dry sclerophyll forests, usually in diverse stands of shrubs and trees. Shelters and breeds in tree hollows, and	Low. No suitable habitat.

Species	Legislation		Primary habitat requirement	Likelihood of Occurrence[10]
	EPBC Act	BC & FM Acts		
			is primarily an insectivorous animal but, has also been known to ingest plant exudates.	
Greater Glider *Petauroides volans*	V		Largely restricted to eucalypt forests and woodlands, utilising tree hollows.	Low. No suitable habitat.
Brush-tailed Rock-wallaby *Petrogale penicillata*	V	E	Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges.	Low. No suitable habitat.
Grey-headed Flying-fox *Pteropus poliocephalus*	V	V	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	Low. May fly across the study area; however, would not be reliant upon those environments to be disturbed by the proposal for any of its lifecycle requirements.
Yellow-bellied Sheathtail-bat *Saccolaimus flaviventris*		V	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	May occupy one or more of the hollow-bearing trees present. Assessment conducted (Appendix D).
Large-eared Pied Bat *Chalinolobus dwyeri*	V	V	Cave-roosting bat that forages in timbered woodland and dry sclerophyll forest.	Low. No suitable habitat.
Eastern False Pipistrelle *Falsistrellus tasmaniensis*		V	Prefers moist habitats, with trees taller than 20 m. Generally roosts in hollow-bearing trees (eucalypts), but has also been found under loose bark on trees or in buildings.	May occupy one or more of the hollow-bearing trees present. Assessment conducted (Appendix D).
Southern Myotis *Myotis macropus*		V	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 fish by raking their feet across the water surface.	Low. No suitable habitat.
Greater Broad-nosed Bat *Scoteanax rueppellii*		V	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in	May occupy one or more of the hollow-bearing trees present. Assessment conducted (Appendix D).

Species	Legislation		Primary habitat requirement	Likelihood of Occurrence[10]
	EPBC Act	BC & FM Acts		
			tall wet forest. Usually roosts in tree hollows but also in buildings.	
Little Bent-winged Bat *Miniopterus australis*		V	Generally found in well-timbered areas. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day.	May occupy one or more of the hollow-bearing trees present.
Large Bent-winged Bat *Miniopterus orianae oceanensis*		V	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	Low. No suitable habitat.
Eastern Coastal Free-tailed Bat *Mormopterus norfolkensis*		V	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	May occupy one or more of the hollow-bearing trees present. Assessment conducted (Appendix D).
New Holland Mouse *Pseudomys novaehollandiae*	V		Open heathland, open woodland with a heathland understorey and vegetated sand dunes.	Low. No suitable habitat.
BIRDS				
Blue-billed Duck *Oxyura australis*		V	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation.	Low. No suitable habitat.
White-throated Needletail *Hirundapus caudacutus*	V, M		Almost exclusively aerial. Takes insects on wing over a range of habitat types. Recorded most often above wooded areas, including open forest and rainforest.	Low. No suitable habitat.
Fork-tailed Swift *Apus pacificus*	M		Almost exclusively aerial. Takes insects on wing over a range of habitat types, but also less than 1 m above open areas or over water. Mostly occur over inland plains but sometimes above foothills or coastal areas.	Low. No suitable habitat.
Spotted Harrier *Circus assimilis*		V	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	Low. No suitable habitat.

Species	Legislation		Primary habitat requirement	Likelihood of Occurrence[10]
	EPBC Act	BC & FM Acts		
			open habitats including edges of inland wetlands.	
Australian Painted Snipe *Rostratula australis*	E	E	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	Low. No suitable habitat.
Latham's Snipe *Gallinago hardwickii*	M		Wet, treeless, tussocky grasslands, short grasses and/or marshes along freshwater streams and channels, though it can also be found in any vegetation around freshwater wetlands, in sedges, grasses, lignum, reeds and rushes, saltmarshes, creek edges, crops and pastures.	Low. No suitable habitat.
Eastern Osprey *Pandion cristatus*	M	V	Occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands.	Low. No suitable habitat.
Square-tailed Kite *Lophoictinia isura*		V	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	Low. No suitable habitat.
White-bellied Sea-eagle *Haliaeetus leucogaster*		V	Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia.	Low. No suitable habitat.
Little Eagle *Hieraaetus morphnoides*		V	Occupies open eucalypt forest, woodland or open woodland. Sheoak or *Acacia* woodlands and riparian woodlands of interior NSW are also used.	Low. No suitable habitat.
Black Falcon *Falco subniger*		V	Found along tree-lined watercourses and in isolated stands of trees, mainly in arid and semi-arid areas.	Low. No suitable habitat.
Gang-gang Cockatoo *Callocephalon fimbriatum*		V	Prefers tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests during summer, these being at higher altitudes. In winter, occurs at lower altitudes in drier, more open eucalypt	Low. No suitable habitat.

Species	Legislation		Primary habitat requirement	Likelihood of Occurrence[10]
	EPBC Act	BC & FM Acts		
			forests and woodlands, or in dry forest in coastal areas.	
Glossy Black-cockatoo *Calyptorhynchus lathami*		V	Inhabits eucalypt woodland and feeds almost exclusively on Casuarina fruits.	Low. No suitable habitat.
Little Lorikeet *Glossopsitta pusilla*		V	Forages primarily in the open Eucalypt forest and woodland canopies, particularly along water courses; occasionally in Angophoras, Melaleucas and other tree species, also riparian habitats are used.	Low. No suitable habitat.
Swift Parrot *Lathamus discolour*	CE	E	Eucalypt forests. When over-wintering on the mainland, this species is dependent on winter-flowering eucalypt species.	Low. No suitable habitat.
Turquoise Parrot *Neophema pulchella*		V	Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland.	Low. No suitable habitat.
Oriental Cuckoo *Cuculus optatus*	M		Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland.	Low. No suitable habitat.
Powerful Owl *Ninox strenua*		V	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest.	Low. No suitable habitat.
Speckled Warbler *Chthonicola Sagittata*		V	Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	Low. No suitable habitat.
Regent Honeyeater *Anthochaera phrygia*	CE	CE	Inhabits dry open forest and woodland. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	Low. No suitable habitat.
Painted Honeyeater *Grantiella picta*	V	V	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus *Amyema*.	Low. No suitable habitat.
Black-chinned Honeyeater *Melithreptus gularis gularis*		V	Occupies mostly upper levels of drier open forests or woodlands dominated by box and	Low. No suitable habitat.

Species	Legislation		Primary habitat requirement	Likelihood of Occurrence[10]
	EPBC Act	BC & FM Acts		
			ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (*E. microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*).	
Varied Sittella *Daphoenositta chrysoptera*		V	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland.	Low. No suitable habitat.
Dusky Woodswallow *Artamus cyanopterus cyanopterus*		V	Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris.	Species recorded. Assessment conducted (Appendix D).
Scarlet Robin *Petroica boodang*		V	Lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	Low. No suitable habitat.
Yellow Wagtail *Motacilla flava*	M		Open country near swamps, salt marshes and sewage ponds.	Low. No suitable habitat.
Rufous Fantail *Rhipidura rufifrons*	M		Mainly inhabits wet sclerophyll forests, often in gullies dominated by eucalypts.	Low. No suitable habitat.
Satin Flycatcher *Myiagra cyanoleuca*	M		Mainly inhabit eucalypt forests, often near wetlands or watercourses.	Low. No suitable habitat.
Black-faced Monarch *Monarcha melanopsis*	M		Rainforest and wet eucalypt forest.	Low. No suitable habitat.
Spectacled Monarch *Monarcha trivirgatus*	M		Rainforest, mangroves and moist gloomy gullies of dense eucalypt forest.	Low. No suitable habitat.
AMPHIBIANS				
Giant Burrowing Frog *Heleioporus australiacus*	V	V	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	Low. No suitable habitat.
Green and Golden Bell Frog *Litoria aurea*	V	E	Inhabits a variety of environments, including disturbed sites, ephemeral ponds, wetlands,	Low. No suitable habitat.

Species	Legislation		Primary habitat requirement	Likelihood of Occurrence[10]
	EPBC Act	BC & FM Acts		
			marshes, dams and stream-sides, particularly those that contain one or more of the following aquatic plants: bullrush (*Typha* spp.), spikerush (*Eleocharis* spp.), *Juncus kraussii*, *Schoenoplectus littoralis* and *Sporobolus virginicus*.	
FISH				
Black Rockcod *Epinephelus daemelii*	V	V	Large, reef-dwelling species which is found in warm temperate and subtropical parts of the south-western Pacific.	Low. No suitable habitat.
Macquarie Perch *Macquaria australasica*	E	E	Endemic to the southern tributaries of the Murray-Darling River System, and is also found in the Hawkesbury-Nepean and Shoalhaven river systems in the eastern drainage in New South Wales. Prefers clear water and deep, rocky holes with lots of cover.	Low. No suitable habitat.
Australian Grayling *Prototroctes maraena*	V	V	Spawning occurs in the lower freshwater reaches of rivers. Larvae drift/disperse into marine waters before migrating back into freshwaters; individuals then remain within freshwater habitats for the remainder of their lives. During freshwater phase of the life-cycle, inhabit both large rivers and smaller streams, and in relatively undisturbed/highly disturbed catchments.	Low. No suitable habitat.
INVERTERBRATES				
Cumberland Land Snail *Meridolum corneovirens*		E	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. Primarily inhabits Cumberland Plain Woodland; lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	Targeted and recorded. Presence confirmed by the Australian Museum. Assessment conducted (Appendix D).

Species	Legislation		Primary habitat requirement	Likelihood of Occurrence[10]
	EPBC Act	BC & FM Acts		
Dural Land Snail *Pommerhelix duralensis*	E	E	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. It favours sheltering under rocks or inside curled-up bark.	Low. Targeted but not recorded.
INSECTA				
Golden Sun Moth *Synemon plana*	CE	E	Occurs in Natural Temperate Grasslands and grassy Box-Gum Woodlands in which ground layer is dominated by wallaby grasses *Austrodanthonia* spp.	Low. No suitable habitat.

Appendix B – Photographic recorded

	Character of Garfield Road West and intersection with Denmark Road. Photo taken looking west.
	Character of the south-eastern limits of Denmark Road; photo taken looking north-west back along Denmark Road.
	Character of the proposed alignment of the connection road from the south-eastern limit of Denmark Road. Photo taken looking south-east.

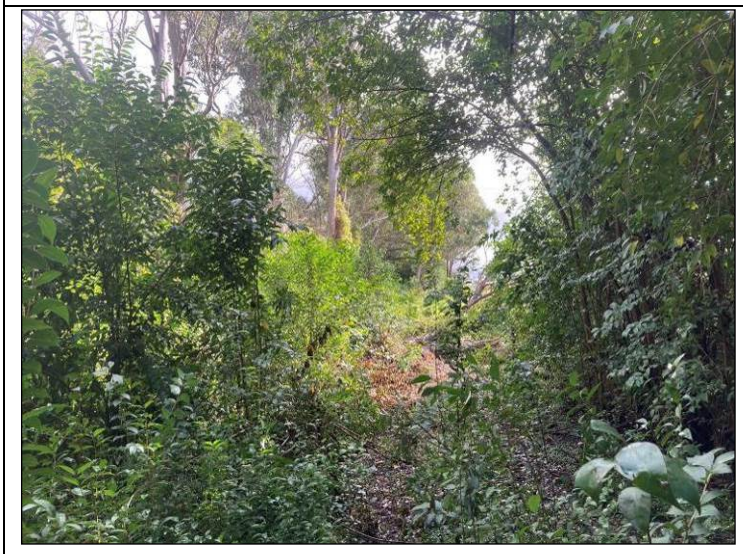
	Looking north [from within the southern extent of the proposed work] towards Denmark Road.
 	Character of Eastern Creek and it's adjacent vegetation.

	Character of the vegetation, looking south-west from Creek Street.
	View looking east through towards Carlton Street.
	Photo taken at 56 Carlton Street looking west along the proposed road alignment.

	Character of Carlton Street, about 67 m south of its intersection with Trevithick Street. Photo taken looking north north-west.
 	Character of existing culvert near the intersection of Trevithick Street and West Parade.

	South-eastern end of West Parade looking back towards the north north-west.
	Character of the vegetation at the south-eastern end of West Parade, along the proposed road alignment.
	Character of the drainage line and culvert in the vicinity of the south-eastern end of West Parade [and within the proposed alignment], and photos of the surrounding vegetation from the northern and southern banks, respectively.

 	
	Character of vegetation north and north-west of the [above mentioned] drainage line.

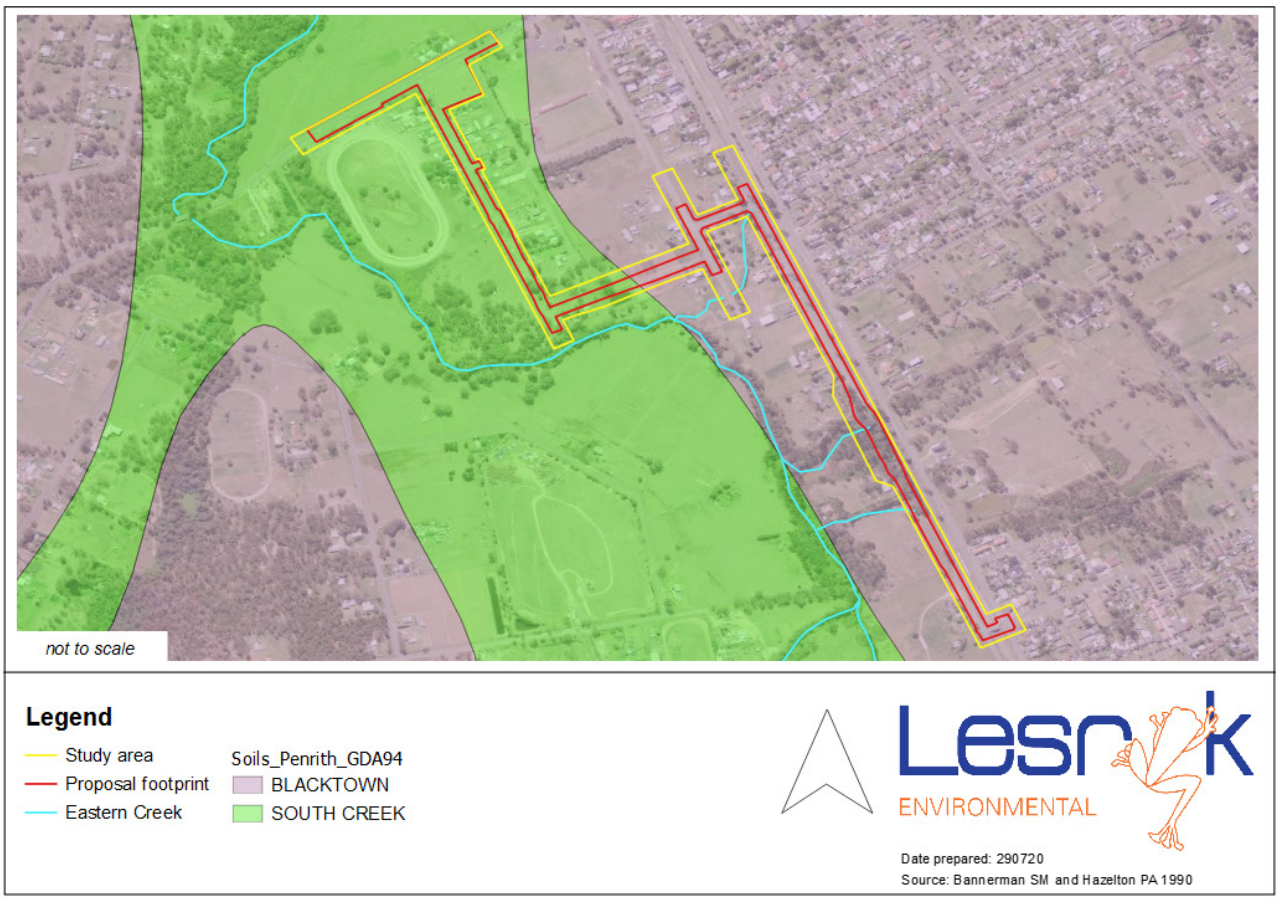
	
 	Character of vegetation along the alignment, south of the [above mentioned] drainage line but north-west of Bridge Street.

	Character of the vegetation in which the discarded Cumberland Plain Land Snail shells were collected.
 	Character of the drainage line and culvert beneath the proposed alignment north-west of Bridge Street.

 	Character of the existing north-western end of Bridge Street; and the proposed alignment along the unformed ‘road’.

Appendix C – Soil Landscapes

The study area has been mapped within the following soil landscapes (Bannerman and Hazelton 1990).



Blacktown

The geology of this landscape is Wianamatta Group - Ashfield Shale consisting of laminate and dark grey siltstone, Bringelly Shale which consists of shale with occasional calcareous claystone, laminate and infrequent coal, and Minchinbury Sandstone consisting of fine to medium-grained quartz lithic sandstone (Bannerman and Hazelton 1990). The landscape is gently undulating rises on Wianamatta Group shales; cleared eucalypt woodland and tall open-forest (dry sclerophyll forest) (Bannerman and Hazelton 1990). Soils are shallow to moderately deep hard-setting mottled texture contrast soils, red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines (Bannerman and Hazelton 1990). Limitations are moderately reactive highly plastic subsoil, low soil fertility and poor soil drainage (Bannerman and Hazelton 1990).

South Creek

The geology of this landscape is Quaternary alluvium derived from Wianamatta Group shales and Hawkesbury Sandstone (Bannerman and Hazelton 1990). The landscape is floodplains, valley flats and drainage depressions of the channels on the Cumberland Plains (Bannerman and Hazelton 1990). Soils are often very deep layered sediments over bedrock or relict soils; where pedogenesis has occurred structured plastic clays or structured loams in and immediately adjacent to drainage lines; red and yellow podzolic soils are most common on terraces with small areas of structured grey clays, leached clay and yellow podzolic soils (Bannerman and Hazelton 1990). Imitations are erosion hazard and frequent flooding (Bannerman and Hazelton 1990).

Appendix D – Ecological Assessments

1. State - *Biodiversity Conservation Act 2016*

By the completion of the field investigations, two TECs and two vulnerable fauna species listed under this Act had been recorded within the study area, these being:

- River-flat Eucalypt Forest (RFEF) on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions - EEC
- Cumberland Plain Woodland in the Sydney Basin Bioregion - CEEC
- Dusky Woodswallow – vulnerable
- Cumberland Plain Land Snail – vulnerable.

In addition, as targeted surveys were not conducted and given 15 of the 21 hollow-bearing trees observed are to be removed, a precautionary approach has been adopted in regards to the presence of the:

- Yellow-bellied Sheathtail-bat – vulnerable
- Eastern False Pipistrelle – vulnerable
- Greater Broad-nosed Bat – vulnerable
- Eastern Coastal Free-tailed Bat – vulnerable.

The potential impact associated with the proposal on the TECs and threatened fauna species listed above is considered with reference to the assessment criteria provided under Section 7.3 of the BC Act. These criteria consider factors that trigger the likelihood of a development to have a significant effect on threatened species or their habitats, and consequently whether a SIS [or BDAR should TfNSW elect that option] is required.

In line with the guidelines provided by OEH (then Department of Environment and Climate Change [DECC]) on the Assessment of Significance (DECC 2007), due to the similarity of their habitat requirements, an assessment has been conducted on hollow-dependent bats as opposed to assessments being carried out on individual species.

The potential impact associated with the proposal on the TECs and threatened fauna species listed above is considered with reference to the assessment criteria provided under Section 7.3 of the BC Act. These criteria consider factors that trigger the likelihood of a development to have a significant effect on threatened species or their habitats, and consequently whether a SIS [or BDAR should TfNSW elect that option] is required.

1. (a). River-flat Eucalypt Forest (RFEF) on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions – EEC

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable to an EEC.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

The proposed work that is to take place within the RFEF would remove approximately 0.5 hectares of the community composed of mature trees over a heavily weed-infested understorey.

Given the small area affected and its degraded condition, it is unlikely that the local occurrence of the community would be placed at risk of extinction.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

The affected remnant of RFEF is already heavily modified due to previous land use practices. RFEF remaining after the proposed work is completed is unlikely to be further modified as a result of the proposed action.

(c) in relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity,

The proposal would require the disturbance of a maximum of 0.5 hectares of RFEF characterised by mature trees above weeds.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity,

RFEF along the tributary of Eastern Creek is already fragmented by the railway, roads and clearing. The proposed action would contribute in a minor manner to fragmentation.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

The proposal is not considered to remove, modify, fragment or isolate RFEF habitat such that its long-term survival in the locality is jeopardised.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The study area is not listed as a declared AOBV under Part 3 of the BC Regulation 2017. No declared AOBV would be directly or indirectly affected by the proposal.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

Currently 35 Key Threatening Process (KTP) for mainland NSW are listed under Schedule 4 of the BC Act. Of these, the following are applicable to the proposal:

- Clearing of native vegetation
- Invasion and establishment of exotic vines and scramblers.
- Invasion, establishment and spread of *Lantana camara*.
- Invasion of native plant communities by exotic perennial grasses.

Each of these processes is currently occurring. The proposed work is not expected to result in the further introduction of exotic vines and scramblers, Lantana or exotic perennial grasses beyond

those that currently exist. The proposed work is not expected to significantly contribute to, or increase the impact of, these KTPs.

Expected impact on River-flat Eucalypt Forest on Coastal Floodplains

Considering the scope of work proposed, no significant areas of RFEF on Coastal Floodplains would be removed or affected by the proposed work. The expected impact associated with the proposal on RFEF on Coastal Floodplains is not considered to be significant and therefore the preparation of a SIS [or BDAR if TfNSW elect that option] is not considered necessary.

1. (b). Cumberland Plain Woodland (CPW) in the Sydney Basin Bioregion - CEEC

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Not applicable to an ecological community.

(b) *in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed*:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or

The proposal would require the disturbance of a maximum of 0.5 hectares of CPW characterised by mature trees above weeds. It is acknowledged 0.25 hectares of this CPW is covered by the Biodiversity Certification Order and does not require assessment.

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

The affected remnants of CPW are already heavily modified due to previous land use practices. CPW remaining after the proposed work is completed is unlikely to be further modified as a result of the proposed action.

(c) in relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity,

The proposal would require the disturbance of a maximum of 0.25 hectares of non-certified CPW characterised by mature trees above weeds.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity,

CPW in the locality is already fragmented by the railway, roads and clearing. The proposed action would contribute in a minor manner to fragmentation.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality,

Given their degraded state, it is unlikely that the subject patches of CPW are important to the survival of the community in the locality. Nevertheless, the proposal is not considered to remove, modify, fragment or isolate CPW habitat such that its long-term survival in the locality is jeopardised.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

The study area is not listed as a declared AOBV under Part 3 of the BC Regulation 2017. No declared AOBV would be directly or indirectly affected by the proposal.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

Currently 35 KTP for mainland NSW are listed under Schedule 4 of the BC Act. Of these, the following are applicable to the proposal:

- Clearing of native vegetation
- Invasion and establishment of exotic vines and scramblers.
- Invasion, establishment and spread of *Lantana camara*.
- Invasion of native plant communities by exotic perennial grasses.

Each of these processes is currently occurring. The proposed work is not expected to result in the further introduction of exotic vines and scramblers, Lantana or exotic perennial grasses beyond those that currently exist. The proposed work is not expected to significantly contribute to, or increase the impact of, these KTPs.

Expected impact on Cumberland Plain Woodland

The proposal is considered unlikely to have a significant effect on CPW, or its habitat; therefore, the preparation of a SIS [or BDAR if TfNSW elect that option] is not required.

1. (c). Dusky Woodswallow - vulnerable

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

The Dusky Woodswallow was observed flying above the site between West Parade and Bridge Street. During the field investigations, no individuals of this nomadic species were observed roosting or perched within the study area. The scope of work proposed, including the clearing of some vegetation from the road corridor, will not have an adverse effect on the lifecycle of this species such that a viable local population is likely to be placed at risk of extinction

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable to threatened species.

(c) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity,

Approximately one hectare of native vegetation would be cleared.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity,

The loss of some native vegetation is not expected to result in the disturbance to this species' dispersal or movement patterns. This species is known to easily negotiate and be able to traverse and disperse across open space areas. Suitable habitat for this species would be retained within the study area and the surrounding locality. As such, the proposal would not cause any further fragmentation of, or isolation to, any areas of habitat used by the Dusky Woodswallow.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The proposal is not considered to remove, modify, fragment or isolate a significant amount of vegetation such that the long-term survival of the Dusky Woodswallow would be jeopardised. The habitats within the study area extend beyond the limits of the proposal. Given that no major components of this species' habitat are to be further isolated or fragmented, it is not considered that the proposal would have an impact on the Dusky Woodswallow such that the long-term survival of this species in the locality would be adversely affected.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared AOBV would be directly or indirectly affected by the proposal. The study area is not listed as a declared AOBV under Part 3 of the BC Regulation 2017.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

Currently 35 KTP for mainland NSW are listed under Schedule 4 of the BC Act. Of these, the 'clearing of native vegetation', 'loss of hollow-bearing trees' and 'removal of dead wood and dead trees' would be applicable to the proposal. While it is acknowledged that the proposal would result in the removal of a small amount of vegetation, it is not considered that this clearance would significantly contribute to a KTP such that the lifecycle requirements of the Dusky Woodswallow would be compromised.

Expected impact on the Dusky Woodswallow

The conducting of the proposal would not disturb, remove, modify or fragment any habitats critical to the lifecycle requirements of the Dusky Woodswallow. It is considered that the proposal would not have a significant impact on this threatened species, or its habitat.

1. (d). Cumberland Plain Land Snail - vulnerable

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

While no living individuals were found, discarded shells indicating the presence of the CPLS were collected from under a tarpaulin between Bridge Street and West Parade. At this site, a linear band of native and exotic vegetation that is present immediately adjacent to the railway corridor will require clearing. West of the proposed road corridor, similar vegetation is present.

While the scope of work proposed would clear some vegetation from the road corridor, the removal of this will not have an adverse effect on the lifecycle of this species such that a viable local population is likely to be placed at risk of extinction

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or
(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction

Not applicable to threatened species.

(c) in relation to the habitat of a threatened species, population or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity,

Approximately one hectare of native vegetation will be cleared.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity,

The vegetation that is to be cleared is present immediately west of an existing railway corridor. As such, links east of this are non-existent. Similarly, due to existing land use practices, there is no bushland connectivity north and south of the location where the snail was found. The vegetation in which the snail was collected is present along the eastern edge of a stand of similar bushland. As such, there will be no fragmentation or isolation of this species habitat, more so a slight reduction in its width.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The understorey and ground cover with the bushland in which the CPLS was recorded is dominated by the introduced species Privet (*Ligustrum* sp.). The site was also previously utilised as a nursery. As such, the habitat that will be cleared is not considered important to the long-term survival of this species in this locality.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared AOBV would be directly or indirectly affected by the proposal. The study area is not listed as a declared AOBV under Part 3 of the BC Regulation 2017.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

Currently 35 KTP for mainland NSW are listed under Schedule 4 of the BC Act. Of these, the 'clearing of native vegetation', 'loss of hollow-bearing trees' and 'removal of dead wood and dead trees' would be applicable to the proposal. While it is acknowledged that the proposal would result in the removal of a small amount of vegetation, it is not considered that this clearance would significantly contribute to a KTP such that the lifecycle requirements of the CPLS would be compromised. The retention of woody debris within the road corridor is encouraged.

Expected impact on the Cumberland Plain Land Snail

The conducting of the proposal would not disturb, remove, modify or fragment any habitats critical to the lifecycle requirements of the CPLS. It is considered that the proposal would not have a significant impact on this threatened species, or its habitat. As such, the preparation of a SIS [or BDAR if TfNSW elect that option] that further considers the impact of the proposed road work on the CPLS is not required.

1. (e). Hollow-dependent microchiropterans - vulnerable

(a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,

Twenty-one hollow-bearing trees were located within and close to the proposed road alignment, 15 of which will require clearing. Beyond the limits of the area investigated, similar hollow-bearing trees are present, particularly adjacent to Eastern Creek and south-west of West Parade. Hollow-dependent microchiropteran are expected to be using those hollow-bearing plants that will be cleared, but the loss of these will not limit or significantly reduced the overall extent of roosting opportunities available in this locality. The loss of the 15 trees would not adversely affect the lifecycle of any of those hollow-dependent microchiropterans potentially present near the proposal footprint such that the viability of their local populations will be placed at risk of extinction.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

- *(i) is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or*
- *(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction*

Not applicable to threatened species.

(c) in relation to the habitat of a threatened species, population or ecological community:

- *(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity,*

Fifteen hollow-bearing trees and one hectare of native vegetation will be cleared.

(ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity,

Hollow-dependent microchiropteran can easily negotiate open areas and have been recorded flying over open spaces (author's field notes); as such, the loss of some native vegetation, this including 15 hollow-bearing trees and one hectare of insect attracting plants, is not expected to result in the disturbance to the Yellow-bellied Sheathtail-bat, Eastern False Pipistrelle, Greater Broad-nosed Bat or Eastern Coastal Free-tailed Bat's dispersal or movement patterns; these species being able to easily negotiate/traverse the study area post disturbance. Suitable habitat for these species would be retained within the study area and surrounding bushland area; as such, the proposed road work would not cause any further fragmentation of, or isolation to, any areas of habitat used by hollow-dependent microchiropterans.

(iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality,

The proposal is not considered to remove, modify, fragment or isolate a significant amount of vegetation such that the long-term survival of hollow-dependent microchiropterans would be jeopardised. While 15 hollow-bearing trees do require removal, the habitats within the study area extend well beyond the limits of the proposal; including within the surrounding conservation reserves and other protected lands, where similar resources are present. Given that no major components of these species' habitat are to be further isolated or fragmented, it is not considered that the proposal would have an impact on the Yellow-bellied Sheathtail-bat, Eastern False Pipistrelle, Greater Broad-nosed Bat or Eastern Coastal Free-tailed Bat such that the long-term survival of these species in the locality would be adversely affected.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

No declared AOBV would be directly or indirectly affected by the proposal. The study area is not listed as a declared AOBV under Part 3 of the BC Regulation 2017.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process

Currently 35 KTP for mainland NSW are listed under Schedule 4 of the BC Act. Of these, the 'clearing of native vegetation', 'loss of hollow-bearing trees' and 'removal of dead wood and dead trees' would be applicable to the proposal. While it is acknowledged that the proposed road work will result in the removal of some native vegetation, this including insect attracting plants and 15 hollow-bearing trees, it is not considered that this clearance would significantly contribute to any of these KTP such that the life cycle requirements of the Yellow-bellied Sheathtail-bat, Eastern False Pipistrelle, Greater Broad-nosed Bat or Eastern Coastal Free-tailed Bat would be compromised.

Expected impact on hollow-dependent microchiropterans

The conducting of the proposal would not disturb, remove, modify or fragment any habitats critical to the lifecycle requirements of any species of hollow-dependent microchiropteran. Given the extent of suitable habitat being retained within both the study area and the surrounding bushland, the removal of some vegetation, this including insect attracting plants and 15 hollow-bearing trees, is not considered to have a significant impact on the Yellow-bellied Sheathtail-bat, Eastern False Pipistrelle, Greater Broad-nosed Bat or Eastern Coastal Free-tailed Bat or their habitat. As such, the preparation of a SIS [or BDAR if TfNSW elect that option] that further considers the impact of the proposed road work on hollow-dependent microchiropterans is not required.

Appendix E – Flora species recorded

Key
* - introduced species
S – weed of significance
P - planted

FAMILY	Scientific Name	Common Name
MAGNOLIOPSIDA - DICOTYLEDONS		
Anacardiaceae	*Toxicodendron succedaneum**	Rhus Tree
Apiaceae	*Foeniculum vulgare**	Fennell
Apocynaceae	*Araujia sericifera **	Moth Plant
	*Vinca major**	Greater Periwinkle
Araliaceae	*Cardiospermum grandiflorum**	Balloon Vine
Asteraceae	*Bidens pilosa **	Farmer's Friend
	*Cirsium vulgare **	Scotch Thistle
	*Conyza bonariensis **	Fleabane
	*Gamochaeta sp**	Cudweed
	*Hypochaeris radicata **	Catsear
	*Senecio madagascariensis**	Fireweed
	Sigesbeckia orientalis	Indian Weed
	*Soliva sessilis**	Bindy
	*Sonchus oleraceus **	Sowthistle
Campanulaceae	*Wahlenbergia stricta*	Native Bluebell
Casuarinaceae	*Casuarina glauca*	Swamp Oak
Chenopodiaceae	*Einadia nutans*	Climbing Saltbush
Convolvulaceae	*Dichondra repens*	Kidney Weed
	*Ipomoea indica**	Morning Glory
Euphorbiaceae	*Euphorbia sp**	
	*Schinus molle var. areira**	Pepper Tree
Fabaceae: Caesalpinoideae	*Senna pendula var. glabrata**	
Fabaceae: Faboideae	*Erythrina x sykesii**	Coral Tree
	Glycine clandestina	
	Glycine tabacina	
	*Medicago sp**	Medic
	*Trifolium sp **	Clover
Fabaceae: Mimosoideae	*Acacia decurrens*	Early Green Wattle
	Acacia parramattensis	Parramatta Green Wattle
Fumariaceae	*Fumaria sp**	Fumitory
Loranthaceae	*Amyema miquelii*	A mistletoe
Malvaceae	*Modiola caroliniana **	Carolina Mallow
	*Pavonia hastata**	
	*Sida rhombifolia **	Paddy's Lucerne
Moraceae	*Morus alba**	White Mulberry
Myrtaceae	*Callistemon sp?*[P]	Bottlebrush
	Eucalyptus eugenioides	Thin-leaved Stringybark
	Eucalyptus moluccana	Grey Box
	Eucalyptus tereticornis	Forest Red Gum
	Melaleuca styphelioides	Prickly-leaved Tea Tree
Oleaceae	*Ligustrum lucidum **	Large-leaved Privet
	*Ligustrum sinense **	Small-leaved Privet
Onagraceae	*Hypericum perforatum**	St John's Wort
Pittosporaceae	*Bursaria spinosa* subsp. *spinosa*	Blackthorn
Plantaginaceae	*Plantago debilis*	
	*Plantago lanceolata **	Lamb's Tongue

FAMILY	Scientific Name	Common Name
Polygonaceae	*Rumex crispus* *	Curled Dock
Primulaceae	*Lysimachia arvensis**	Blue Pimpernel
Proteaceae	*Grevillea robusta*[P]	Silky Oak
Rosaceae	*Rubus fruticosus* agg. spp. *[S]	Blackberry
Rubiaceae	*Galium aparine**	Cleavers
Solanaceae	*Cestrum parqui**[S]	Green Cestrum
	Solanum nigrum *	Blackberry Nightshade
	*Solanum seaforthianum**	
	*Solanum sisymbriifolium**	
Ulmaceae	*Ulmus parvifolia**	Chinese Elm
Urticaeae	*Urtica dioica**	Stinging Nettle
Verbenaceae	*Lantana camara**[S]	Lantana
	Verbena bonariensis *	Purpletop
	*Verbena rigida**	
MONOCOTYLEDONS		
Asparagaceae	*Asparagus asparagoides**[S]	Bridal Creeper
Commelinaceae	*Tradescantia albiflora**	Trad
Cyperaceae	*Cyperus eragrostis**	Umbrella Sedge
	Cyperus gracilis	
Iridaceae	*Romulea rosea**,	Onion Grass
Lomandraceae	*Lomandar multiflora*	Many-flowered Mat-rush
Poaceae	*Cenchrus clandestinus* *	Kikuyu Grass
	Chloris gayana *	Rhodes grass
	Cynodon dactylon	Couch
	Ehrharta erecta *	Panic Veldt Grass
	Eragrostis curvula *	African Love Grass
	Microlaena stipoides	Weeping Meadow Grass
	Oplismenus aemulus	Basket Grass
	Paspalum dilatatum *	Paspalum
	Sporobolus creber	
	Sporobolus africanus *	Parramatta Grass
Typhaceae	*Typha orientalis*	Cumbungi

BAM Plot - Field Survey Form

		Survey Name		Plot Id		Surveyor(s)		
Date	21/09/2020	DENMARK LINK ROAD		DL01		Paul Burcher/Deryk Engel		
Zone: 56	Datum: GDA94	**IBRA region**	Sydney Basin	**Photo #**	1	Zone ID	1	
Easting: 301607	Northing: 6270565	**Plot Dimensions** (i.e. 20 x 20 in 20 x 50)	20 m x 20 m		**Orientation of midline from the 0 m point**	Magnetic °		
Likely Vegetation Class		Coastal Floodplain Wetlands					Confidence	H M L
Plant Community Type		835 Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin.			EEC: YES		Confidence	H M L

Record Easting and Northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.

Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline

BAM Attribute (400 m² plot)		Sum values
Count of **Native Richness**	**Trees**	2
	Shrubs	1
	Grasses etc.	1
	Forbs	1
	Ferns	
	Other	2
Sum of **Cover** of native vascular plants by growth form group	**Trees**	21
	Shrubs	0.2
	Grasses etc.	40
	Forbs	0.1
	Ferns	
	Other	0.1
High Threat Weed cover %		12.3

This table can be completed after entering data into available tools. It is not required in the field.

BAM Attribute (20 x 50 m plot)			
Stem classes			Record living stems only. Data needed is presence only (tick) unless a large tree for that veg class. # Count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.
dbh cm	Tree	Hollows#	
80 +		0	
50 - 79	Y		
30 - 49		Hollows 20cm+	
20 - 29			
10 - 19	Y		
5 - 9	Y		
< 5	Y	Re: tree regeneration	
Length of logs (m) (≥10 cm diameter, >50 cm in length			Total 7

Each size class is noted as present by the living tree stems only. Depending on the Vegetation Class, DBH values and count may be needed for a size class. For a **multi-stemmed tree**, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class.

Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

Bam Attribute (1 x 1 m plots)	Cover																			
	Litter					Bare ground					Cryptogram					Rock				
Subplot score (% in each)	20	30	10	0	5	25	5	5	0	0	a	b	c	d	e	a	b	c	d	e
Average of the 5 subplots	13					7														

Floristic Composition: **Site No: DL01**

No.	Species	Cover	No.	GFG	N, E, HTE
1	*Eucalyptus amplifolia*	20	10	TG	N
2	*Eucalyptus tereticornis*	1	2	TG	N
3	*Cynodon dactylon*	40	1000	GG	E
4	*Microlaena stipoides*	40	1000	GG	N
5	*Hypericum perforatum*	10	200	FG	HTE
6	*Medicago sp*	2	100	FG	E
7	*Senecio madagascariensis*	2	40	FG	HTE
8	*Solanum sisymbrlifolium*	5	30	FG	E
9	*Wahlenbergia stricta*	0.1	20	FG	N
10	*Sida rhombifolia*	0.2	40	SG	E
11	*Verbena rigida*	0.1	10	FG	E
12	*Glycine tabacina*	0.1	10	OG	N
13	*Euphorbia sp*	0.1	100	FG	E
14	*Solanum nigrum*	0.1	5	FG	E
15	*Gamochaeta sp*	0.1	20	FG	E
16	*Glycine clandestina*	0.1	5	OG	N
17	*Setaria sp*	0.1	100	GG	E
18	*Cestrum parqui*	0.1	1	SG	HTE
19	*Modiola caroliniana*	0.1	20	FG	E
20	*Lysimachia arvensis*	0.1	50	FG	E
21	*Sonchus oleraceus*	0.1	2	FG	E
22	*Aruajia sericifera*	0.1	2	OG	HTE
23	*Cenchrus clandestinum*	0.1	1	GG	HTE
24	*Cirsium vulgare*	0.1	2	FG	E
25	*Bursaria spinosa*	0.2	1	SG	N
26	*Soliva sessilis*	0.1	100	FG	E
27	*Pavonia hastata*	0.1	1	Fg	E
28					
29					
30					

Acronyms	
GFG	Growth Form Group
N	Native
E	Exotic
HTE	High Threat Exotic

Cover	0.1, 0.2, 0.3, 0.4, 0.5,….1, 2, 3,…..10, 15, 20, 25,…..100%

No.	1, 2, 3,…10, 20, 30,…100, 500, 1000, 2000,….3000

Appendix F – Fauna species previously recorded in the vicinity of the study area

Data from the BioNet Atlas website, which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory and may contain errors and omissions. Species listed under the Sensitive Species Data Policy may have their locations denatured (^ rounded to 0.1°C; ^^ rounded to 0.01°C. Copyright the State of NSW through the Department of Planning, Industry and Environment. Search criteria : Public Report of all Valid Records of Animals in selected area [North: -33.64 West: 150.81 East: 150.91 South: -33.74] returned a total of 11,292 records of 380 species.

Kingdom	Class	Family	Species Code	Scientific Name	Exotic	Common Name	NSW status	Comm. status	Records
Animalia	Actinopterygii	Anguillidae	T056	*Anguilla reinhardtii*		longfin eel			10
Animalia	Actinopterygii	Anguillidae	T075	*Anguilla sp.*		Shortfin Eel			3
Animalia	Actinopterygii	Cyprinidae	T044	*Cyprinus carpio*	*	Carp			8
Animalia	Malacostraca	Parastacidae	T904	*Cherax destructor*		Dam Yabby			1
Animalia	Actinopterygii	Poeciliidae	T013	*Gambusia holbrooki*	*	Mosquito Fish			7
Animalia	Actinopterygii	Poeciliidae	T1038	*Gambusia sp.*	*	Gambusia			1
Animalia	Amphibia	Myobatrachidae	3134	*Crinia signifera*		Common Eastern Froglet	P		61
Animalia	Amphibia	Myobatrachidae	3042	*Heleioporus australiacus*		Giant Burrowing Frog	V,P	V	1
Animalia	Amphibia	Myobatrachidae	3058	*Limnodynastes dumerilii*		Eastern Banjo Frog	P		1
Animalia	Amphibia	Myobatrachidae	3061	*Limnodynastes peronii*		Brown-striped Frog	P		28
Animalia	Amphibia	Myobatrachidae	3063	*Limnodynastes tasmaniensis*		Spotted Grass Frog	P		13
Animalia	Amphibia	Myobatrachidae	T119	*Pseudophryne sp.*			P		1
Animalia	Amphibia	Myobatrachidae	3158	*Uperoleia laevigata*		Smooth Toadlet	P		4
Animalia	Amphibia	Myobatrachidae	3151	*Uperoleia rugosa*		Wrinkled Toadlet	P		1
Animalia	Amphibia	Hylidae	3166	*Litoria aurea*		Green and Golden Bell Frog	E1,P	V	6
Animalia	Amphibia	Hylidae	3171	*Litoria caerulea*		Green Tree Frog	P		14
Animalia	Amphibia	Hylidae	3180	*Litoria dentata*		Bleating Tree Frog	P		9

Animalia	Amphibia	Hylidae	3183	*Litoria fallax*	Eastern Dwarf Tree Frog	P	27
Animalia	Amphibia	Hylidae	3191	*Litoria latopalmata*	Broad-palmed Frog	P	1
Animalia	Amphibia	Hylidae	3204	*Litoria peronii*	Peron's Tree Frog	P	27
Animalia	Amphibia	Hylidae	3214	*Litoria tyleri*	Tyler's Tree Frog	P	1
Animalia	Amphibia	Hylidae	3215	*Litoria verreauxii*	Verreaux's Frog	P	15
Animalia	Amphibia	Hylidae	3906	*Litoria verreauxii verreauxii*	Verreaux's Tree Frog (subsp)	P	1
Animalia	Reptilia	Chelidae	2017	*Chelodina longicollis*	Eastern Snake-necked Turtle	P	97
Animalia	Reptilia	Chelidae	2034	*Emydura macquarii*	Macquarie Turtle	P	1
Animalia	Reptilia	Chelidae	2951	*Emydura macquarii macquarii*	Macquarie River Turtle	P	1
Animalia	Reptilia	Gekkonidae	2077	*Diplodactylus vittatus*	Wood Gecko	P	3
Animalia	Reptilia	Scincidae	2464	*Acritoscincus platynota*	Red-throated Skink	P	1
Animalia	Reptilia	Scincidae	5170	*Cryptoblepharus pulcher*	Elegant Snake-eyed Skink	P	1
Animalia	Reptilia	Scincidae	2331	*Cryptoblepharus virgatus*	Cream-striped Shinning-skink	P	21
Animalia	Reptilia	Scincidae	2375	*Ctenotus robustus*	Robust Ctenotus	P	6
Animalia	Reptilia	Scincidae	2386	*Ctenotus taeniolatus*	Copper-tailed Skink	P	6
Animalia	Reptilia	Scincidae	2557	*Eulamprus quoyii*	Eastern Water-skink	P	27
Animalia	Reptilia	Scincidae	T115	*Eulamprus sp.*	Unidentified Eulamprus	P	1
Animalia	Reptilia	Scincidae	2559	*Eulamprus tenuis*	Barred-sided Skink	P	5
Animalia	Reptilia	Scincidae	2450	*Lampropholis delicata*	Dark-flecked Garden Sunskink	P	45
Animalia	Reptilia	Scincidae	2451	*Lampropholis guichenoti*	Pale-flecked Garden Sunskink	P	29
Animalia	Reptilia	Scincidae	T117	*Lampropholis sp.*	unidentified grass skink	P	12
Animalia	Reptilia	Scincidae	2307	*Lygisaurus foliorum*	Tree-base Litter-skink	P	1
Animalia	Reptilia	Scincidae	2452	*Saproscincus mustelinus*	Weasel Skink	P	4
Animalia	Reptilia	Scincidae	2580	*Tiliqua scincoides*	Eastern Blue-tongue	P	275

Animalia	Reptilia	Agamidae	2194	*Amphibolurus muricatus*		Jacky Lizard	P	3
Animalia	Reptilia	Agamidae	2252	*Intellagama lesueurii*		Eastern Water Dragon	P	21
Animalia	Reptilia	Agamidae	2177	*Pogona barbata*		Bearded Dragon	P	24
Animalia	Reptilia	Varanidae	2283	*Varanus varius*		Lace Monitor	P	15
Animalia	Reptilia	Pythonidae	5096	*Morelia spilota spilota*		Diamond Python	P	4
Animalia	Reptilia	Colubridae	2633	*Dendrelaphis punctulatus*		Common Tree Snake	P	7
Animalia	Reptilia	Colubridae	T441	*Pantherophis guttatus*	*	American Corn Snake		2
Animalia	Reptilia	Elapidae	2647	*Cacophis squamulosus*		Golden-crowned Snake	P	2
Animalia	Reptilia	Elapidae	2805	*Drysdalia rhodogaster*		Mustard-bellied Snake	P	1
Animalia	Reptilia	Elapidae	2669	*Furina diadema*		Red-naped Snake	P	3
Animalia	Reptilia	Elapidae	2681	*Notechis scutatus*		Tiger Snake	P	3
Animalia	Reptilia	Elapidae	2693	*Pseudechis porphyriacus*		Red-bellied Black Snake	P	278
Animalia	Reptilia	Elapidae	2699	*Pseudonaja textilis*		Eastern Brown Snake	P	107
Animalia	Aves	Casuariidae	0001	*Dromaius novaehollandiae*		Emu	P	5
Animalia	Aves	Megapodiidae	0008	*Alectura lathami*		Australian Brush-turkey	P	2
Animalia	Aves	Phasianidae	0009	*Coturnix pectoralis*		Stubble Quail	P	9
Animalia	Aves	Phasianidae	9046	*Coturnix sp.*		Unidentified Quail	P	3
Animalia	Aves	Phasianidae	0011	*Coturnix ypsilophora*		Brown Quail	P	6
Animalia	Aves	Phasianidae	0012	*Excalfactoria chinensis*		King Quail	P	3
Animalia	Aves	Phasianidae	0902	*Gallus gallus*	*	Red Junglefowl		4
Animalia	Aves	Phasianidae	1914	*Gallus sp.*	*	Domestic fowl		2
Animalia	Aves	Phasianidae	0903	*Pavo cristatus*	*	Indian Peafowl		1
Animalia	Aves	Anatidae	0210	*Anas castanea*		Chestnut Teal	P	66
Animalia	Aves	Anatidae	0211	*Anas gracilis*		Grey Teal	P	76
Animalia	Aves	Anatidae	0948	*Anas platyrhynchos*	*	Mallard		1
Animalia	Aves	Anatidae	0212	*Anas rhynchotis*		Australasian Shoveler	P	44
Animalia	Aves	Anatidae	0208	*Anas superciliosa*		Pacific Black Duck	P	149

Animalia	Aves	Anatidae	0215	*Aythya australis*		Hardhead	P		24
Animalia	Aves	Anatidae	0202	*Chenonetta jubata*		Australian Wood Duck	P		134
Animalia	Aves	Anatidae	0203	*Cygnus atratus*		Black Swan	P		41
Animalia	Aves	Anatidae	0205	*Dendrocygna eytoni*		Plumed Whistling-Duck	P		2
Animalia	Aves	Anatidae	0213	*Malacorhynchus membranaceus*		Pink-eared Duck	P		38
Animalia	Aves	Anatidae	0216	*Oxyura australis*		Blue-billed Duck	V,P		2
Animalia	Aves	Anatidae	0207	*Tadorna tadornoides*		Australian Shelduck	P		1
Animalia	Aves	Podicipedidae	0062	*Poliocephalus poliocephalus*		Hoary-headed Grebe	P		27
Animalia	Aves	Podicipedidae	0061	*Tachybaptus novaehollandiae*		Australasian Grebe	P		45
Animalia	Aves	Columbidae	0028	*Columba leucomela*		White-headed Pigeon	P		1
Animalia	Aves	Columbidae	0957	*Columba livia*	*	Rock Dove			41
Animalia	Aves	Columbidae	0031	*Geopelia cuneata*		Diamond Dove	P		1
Animalia	Aves	Columbidae	0032	*Geopelia humeralis*		Bar-shouldered Dove	P		5
Animalia	Aves	Columbidae	9931	*Geopelia striata*		Peaceful Dove	P		9
Animalia	Aves	Columbidae	0027	*Lopholaimus antarcticus*		Topknot Pigeon	P		3
Animalia	Aves	Columbidae	0029	*Macropygia amboinensis*		Brown Cuckoo-Dove	P		1
Animalia	Aves	Columbidae	0043	*Ocyphaps lophotes*		Crested Pigeon	P		120
Animalia	Aves	Columbidae	0989	*Streptopelia chinensis*	*	Spotted Turtle-Dove			174
Animalia	Aves	Podargidae	0313	*Podargus strigoides*		Tawny Frogmouth	P		128
Animalia	Aves	Aegothelidae	0317	*Aegotheles cristatus*		Australian Owlet-nightjar	P		6
Animalia	Aves	Apodidae	0335	*Apus pacificus*		Fork-tailed Swift	P	C,J,K	2
Animalia	Aves	Apodidae	0334	*Hirundapus caudacutus*		White-throated Needletail	P	V,C,J,K	2
Animalia	Aves	Anhingidae	8731	*Anhinga novaehollandiae*		Australasian Darter	P		15
Animalia	Aves	Phalacrocoracidae	0100	*Microcarbo melanoleucos*		Little Pied Cormorant	P		44

Animalia	Aves	Phalacrocoracidae	0096	*Phalacrocorax carbo*	Great Cormorant	P		4
Animalia	Aves	Phalacrocoracidae	T021	*Phalacrocorax sp.*	Unidentified Cormorant	P		1
Animalia	Aves	Phalacrocoracidae	0097	*Phalacrocorax sulcirostris*	Little Black Cormorant	P		23
Animalia	Aves	Phalacrocoracidae	0099	*Phalacrocorax varius*	Pied Cormorant	P		4
Animalia	Aves	Pelecanidae	0106	*Pelecanus conspicillatus*	Australian Pelican	P		27
Animalia	Aves	Ardeidae	0977	*Ardea ibis*	Cattle Egret	P		61
Animalia	Aves	Ardeidae	0186	*Ardea intermedia*	Intermediate Egret	P		6
Animalia	Aves	Ardeidae	8712	*Ardea modesta*	Eastern Great Egret	P		20
Animalia	Aves	Ardeidae	0189	*Ardea pacifica*	White-necked Heron	P		39
Animalia	Aves	Ardeidae	T179	*Ardea/Egretta sp.*	Unidentified Egret	P		1
Animalia	Aves	Ardeidae	0197	*Botaurus poiciloptilus*	Australasian Bittern	E1,P	E	1
Animalia	Aves	Ardeidae	0185	*Egretta garzetta*	Little Egret	P		2
Animalia	Aves	Ardeidae	0188	*Egretta novaehollandiae*	White-faced Heron	P		91
Animalia	Aves	Ardeidae	0192	*Nycticorax caledonicus*	Nankeen Night Heron	P		5
Animalia	Aves	Threskiornithidae	0182	*Platalea flavipes*	Yellow-billed Spoonbill	P		28
Animalia	Aves	Threskiornithidae	0181	*Platalea regia*	Royal Spoonbill	P		14
Animalia	Aves	Threskiornithidae	0178	*Plegadis falcinellus*	Glossy Ibis	P		2
Animalia	Aves	Threskiornithidae	0179	*Threskiornis molucca*	Australian White Ibis	P		53
Animalia	Aves	Threskiornithidae	0180	*Threskiornis spinicollis*	Straw-necked Ibis	P		44
Animalia	Aves	Accipitridae	0222	*Accipiter cirrocephalus*	Collared Sparrowhawk	P		8
Animalia	Aves	Accipitridae	0221	*Accipiter fasciatus*	Brown Goshawk	P		73
Animalia	Aves	Accipitridae	0220	*Accipiter novaehollandiae*	Grey Goshawk	P		5
Animalia	Aves	Accipitridae	T047	*Accipiter sp.*	Unidentified goshawk	P		2
Animalia	Aves	Accipitridae	0224	*Aquila audax*	Wedge-tailed Eagle	P		14
Animalia	Aves	Accipitridae	0234	*Aviceda subcristata*	Pacific Baza	P		3
Animalia	Aves	Accipitridae	0219	*Circus approximans*	Swamp Harrier	P		5
Animalia	Aves	Accipitridae	0218	*Circus assimilis*	Spotted Harrier	V,P		3

Animalia	Aves	Accipitridae	0232	*Elanus axillaris*	Black-shouldered Kite	P		34
Animalia	Aves	Accipitridae	0226	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	V,P		5
Animalia	Aves	Accipitridae	0228	*Haliastur sphenurus*	Whistling Kite	P		14
Animalia	Aves	Accipitridae	0225	*Hieraaetus morphnoides*	Little Eagle	V,P		10
Animalia	Aves	Accipitridae	0230	*^^Lophoictinia isura*	Square-tailed Kite	V,P,3		2
Animalia	Aves	Falconidae	0239	*Falco berigora*	Brown Falcon	P		21
Animalia	Aves	Falconidae	0240	*Falco cenchroides*	Nankeen Kestrel	P		51
Animalia	Aves	Falconidae	0235	*Falco longipennis*	Australian Hobby	P		13
Animalia	Aves	Falconidae	0237	*Falco peregrinus*	Peregrine Falcon	P		22
Animalia	Aves	Falconidae	0238	*Falco subniger*	Black Falcon	V,P		1
Animalia	Aves	Rallidae	0059	*Fulica atra*	Eurasian Coot	P		39
Animalia	Aves	Rallidae	0056	*Gallinula tenebrosa*	Dusky Moorhen	P		63
Animalia	Aves	Rallidae	0046	*Gallirallus philippensis*	Buff-banded Rail	P		9
Animalia	Aves	Rallidae	0058	*Porphyrio porphyrio*	Purple Swamphen	P		69
Animalia	Aves	Rallidae	0049	*Porzana fluminea*	Australian Spotted Crake	P		8
Animalia	Aves	Rallidae	0050	*Porzana pusilla*	Baillon's Crake	P		7
Animalia	Aves	Rallidae	0051	*Porzana tabuensis*	Spotless Crake	P		44
Animalia	Aves	Recurvirostridae	0146	*Himantopus himantopus*	Black-winged Stilt	P		72
Animalia	Aves	Recurvirostridae	0148	*Recurvirostra novaehollandiae*	Red-necked Avocet	P		2
Animalia	Aves	Charadriidae	0140	*Charadrius bicinctus*	Double-banded Plover	P		1
Animalia	Aves	Charadriidae	0143	*Charadrius ruficapillus*	Red-capped Plover	P		9
Animalia	Aves	Charadriidae	0144	*Elseyornis melanops*	Black-fronted Dotterel	P		62
Animalia	Aves	Charadriidae	0132	*Erythrogonys cinctus*	Red-kneed Dotterel	P		27
Animalia	Aves	Charadriidae	8006	*Pluvialis fulva*	Pacific Golden Plover	P	C,J,K	8
Animalia	Aves	Charadriidae	0133	*Vanellus miles*	Masked Lapwing	P		183
Animalia	Aves	Rostratulidae	0170	*Rostratula australis*	Australian Painted Snipe	E1,P	E	5
Animalia	Aves	Scolopacidae	0163	*Calidris acuminata*	Sharp-tailed Sandpiper	P	C,J,K	48

Animalia	Aves	Scolopacidae	0161	*Calidris ferruginea*	Curlew Sandpiper	E1,P	CE,C,J,K	4
Animalia	Aves	Scolopacidae	0978	*Calidris melanotos*	Pectoral Sandpiper	P	J,K	10
Animalia	Aves	Scolopacidae	0162	*Calidris ruficollis*	Red-necked Stint	P	C,J,K	11
Animalia	Aves	Scolopacidae	0168	*Gallinago hardwickii*	Latham's Snipe	P	J,K	12
Animalia	Aves	Scolopacidae	0154	*Tringa glareola*	Wood Sandpiper	P	C,J,K	6
Animalia	Aves	Scolopacidae	0158	*Tringa nebularia*	Common Greenshank	P	C,J,K	1
Animalia	Aves	Scolopacidae	0159	*Tringa stagnatilis*	Marsh Sandpiper	P	C,J,K	3
Animalia	Aves	Turnicidae	0014	*Turnix varius*	Painted Button-quail	P		4
Animalia	Aves	Glareolidae	0173	*Stiltia isabella*	Australian Pratincole	P		3
Animalia	Aves	Laridae	0125	*Chroicocephalus novaehollandiae*	Silver Gull	P		2
Animalia	Aves	Cacatuidae	0269	*Cacatua galerita*	Sulphur-crested Cockatoo	P		126
Animalia	Aves	Cacatuidae	0271	*Cacatua sanguinea*	Little Corella	P		63
Animalia	Aves	Cacatuidae	T187	*Cacatua sp.*		P		7
Animalia	Aves	Cacatuidae	0272	*Cacatua tenuirostris*	Long-billed Corella	P		21
Animalia	Aves	Cacatuidae	0268	*^^Callocephalon fimbriatum*	Gang-gang Cockatoo	V,P,3		1
Animalia	Aves	Cacatuidae	0267	*Calyptorhynchus funereus*	Yellow-tailed Black-Cockatoo	P		16
Animalia	Aves	Cacatuidae	0265	*^Calyptorhynchus lathami*	Glossy Black-Cockatoo	V,P,2		1
Animalia	Aves	Cacatuidae	9070	*Calyptorhynchus sp.*	Unidentified Black-cockatoo	P		1
Animalia	Aves	Cacatuidae	0273	*Eolophus roseicapillus*	Galah	P		143
Animalia	Aves	Cacatuidae	0274	*Nymphicus hollandicus*	Cockatiel	P		6
Animalia	Aves	Psittacidae	0281	*Alisterus scapularis*	Australian King-Parrot	P		7
Animalia	Aves	Psittacidae	0294	*Barnardius zonarius*	Australian Ringneck	P		1
Animalia	Aves	Psittacidae	0258	*Glossopsitta concinna*	Musk Lorikeet	P		30
Animalia	Aves	Psittacidae	0260	*Glossopsitta pusilla*	Little Lorikeet	V,P		5
Animalia	Aves	Psittacidae	0309	*^^Lathamus discolor*	Swift Parrot	E1,P,3	CE	12

Animalia	Aves	Psittacidae	0310	*Melopsittacus undulatus*	Budgerigar	P	3
Animalia	Aves	Psittacidae	0302	*^^Neophema pulchella*	Turquoise Parrot	V,P,3	1
Animalia	Aves	Psittacidae	0297	*Northiella haematogaster*	Blue Bonnet	P	1
Animalia	Aves	Psittacidae	0282	*Platycercus elegans*	Crimson Rosella	P	11
Animalia	Aves	Psittacidae	0288	*Platycercus eximius*	Eastern Rosella	P	117
Animalia	Aves	Psittacidae	T039	*Platycercus sp.*	Unidentified Rosella	P	9
Animalia	Aves	Psittacidae	0295	*Psephotus haematonotus*	Red-rumped Parrot	P	115
Animalia	Aves	Psittacidae	0256	*Trichoglossus chlorolepidotus*	Scaly-breasted Lorikeet	P	2
Animalia	Aves	Psittacidae	9947	*Trichoglossus haematodus*	Rainbow Lorikeet	P	309
Animalia	Aves	Psittacidae	8882	*Trichoglossus haematodus moluccanus*		P	1
Animalia	Aves	Cuculidae	0338	*Cacomantis flabelliformis*	Fan-tailed Cuckoo	P	25
Animalia	Aves	Cuculidae	0337	*Cacomantis pallidus*	Pallid Cuckoo	P	23
Animalia	Aves	Cuculidae	0339	*Cacomantis variolosus*	Brush Cuckoo	P	2
Animalia	Aves	Cuculidae	0342	*Chalcites basalis*	Horsfield's Bronze-Cuckoo	P	14
Animalia	Aves	Cuculidae	0343	*Chalcites lucidus*	Shining Bronze-Cuckoo	P	12
Animalia	Aves	Cuculidae	0347	*Eudynamys orientalis*	Eastern Koel	P	30
Animalia	Aves	Cuculidae	0348	*Scythrops novaehollandiae*	Channel-billed Cuckoo	P	9
Animalia	Aves	Strigidae	9922	*Ninox novaeseelandiae*	Southern Boobook	P	9
Animalia	Aves	Strigidae	0248	*^^Ninox strenua*	Powerful Owl	V,P,3	1
Animalia	Aves	Tytonidae	9923	*Tyto javanica*	Eastern Barn Owl	P	11
Animalia	Aves	Alcedinidae	0319	*Ceyx azureus*	Azure Kingfisher	P	19
Animalia	Aves	Alcedinidae	0322	*Dacelo novaeguineae*	Laughing Kookaburra	P	127

Animalia	Aves	Alcedinidae	0326	*Todiramphus sanctus*	Sacred Kingfisher	P	20
Animalia	Aves	Meropidae	0329	*Merops ornatus*	Rainbow Bee-eater	P	3
Animalia	Aves	Coraciidae	0318	*Eurystomus orientalis*	Dollarbird	P	16
Animalia	Aves	Climacteridae	0558	*Cormobates leucophaea*	White-throated Treecreeper	P	5
Animalia	Aves	Ptilonorhynchidae	0679	*Ptilonorhynchus violaceus*	Satin Bowerbird	P	1
Animalia	Aves	Maluridae	0529	*Malurus cyaneus*	Superb Fairy-wren	P	151
Animalia	Aves	Maluridae	0536	*Malurus lamberti*	Variegated Fairy-wren	P	3
Animalia	Aves	Maluridae	9038	*Malurus sp.*	Unidentified Fairy-wren	P	2
Animalia	Aves	Acanthizidae	0486	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill	P	19
Animalia	Aves	Acanthizidae	0470	*Acanthiza lineata*	Striated Thornbill	P	22
Animalia	Aves	Acanthizidae	0471	*Acanthiza nana*	Yellow Thornbill	P	108
Animalia	Aves	Acanthizidae	0475	*Acanthiza pusilla*	Brown Thornbill	P	9
Animalia	Aves	Acanthizidae	0484	*Acanthiza reguloides*	Buff-rumped Thornbill	P	4
Animalia	Aves	Acanthizidae	9042	*Acanthiza sp.*	Unidentified Thornbill	P	2
Animalia	Aves	Acanthizidae	0504	*Chthonicola sagittata*	Speckled Warbler	V,P	1
Animalia	Aves	Acanthizidae	0454	*Gerygone mouki*	Brown Gerygone	P	2
Animalia	Aves	Acanthizidae	0453	*Gerygone olivacea*	White-throated Gerygone	P	53
Animalia	Aves	Acanthizidae	0493	*Sericornis citreogularis*	Yellow-throated Scrubwren	P	1
Animalia	Aves	Acanthizidae	0488	*Sericornis frontalis*	White-browed Scrubwren	P	22
Animalia	Aves	Acanthizidae	0465	*Smicrornis brevirostris*	Weebill	P	67
Animalia	Aves	Pardalotidae	0565	*Pardalotus punctatus*	Spotted Pardalote	P	79
Animalia	Aves	Pardalotidae	0976	*Pardalotus striatus*	Striated Pardalote	P	32
Animalia	Aves	Meliphagidae	0591	*Acanthorhynchus tenuirostris*	Eastern Spinebill	P	55
Animalia	Aves	Meliphagidae	0638	*Anthochaera carunculata*	Red Wattlebird	P	77

Animalia	Aves	Meliphagidae	0710	*Anthochaera chrysoptera*	Little Wattlebird	P		17
Animalia	Aves	Meliphagidae	0603	*Anthochaera phrygia*	Regent Honeyeater	E4A,P	CE	1
Animalia	Aves	Meliphagidae	T210	*Anthochaera sp.*	Unidentified Wattlebird	P		8
Animalia	Aves	Meliphagidae	0614	*Caligavis chrysops*	Yellow-faced Honeyeater	P		90
Animalia	Aves	Meliphagidae	0597	*Lichmera indistincta*	Brown Honeyeater	P		2
Animalia	Aves	Meliphagidae	0634	*Manorina melanocephala*	Noisy Miner	P		255
Animalia	Aves	Meliphagidae	0633	*Manorina melanophrys*	Bell Miner	P		86
Animalia	Aves	Meliphagidae	0605	*Meliphaga lewinii*	Lewin's Honeyeater	P		3
Animalia	Aves	Meliphagidae	0583	*Melithreptus brevirostris*	Brown-headed Honeyeater	P		22
Animalia	Aves	Meliphagidae	8303	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V,P		3
Animalia	Aves	Meliphagidae	0578	*Melithreptus lunatus*	White-naped Honeyeater	P		10
Animalia	Aves	Meliphagidae	0586	*Myzomela sanguinolenta*	Scarlet Honeyeater	P		45
Animalia	Aves	Meliphagidae	0617	*Nesoptilotis leucotis*	White-eared Honeyeater	P		3
Animalia	Aves	Meliphagidae	0645	*Philemon corniculatus*	Noisy Friarbird	P		47
Animalia	Aves	Meliphagidae	0632	*Phylidonyris niger*	White-cheeked Honeyeater	P		3
Animalia	Aves	Meliphagidae	0631	*Phylidonyris novaehollandiae*	New Holland Honeyeater	P		3
Animalia	Aves	Meliphagidae	0613	*Ptilotula fuscus*	Fuscous Honeyeater	P		3
Animalia	Aves	Meliphagidae	0625	*Ptilotula penicillatus*	White-plumed Honeyeater	P		80
Animalia	Aves	Psophodidae	0421	*Psophodes olivaceus*	Eastern Whipbird	P		34
Animalia	Aves	Neosittidae	0549	*Daphoenositta chrysoptera*	Varied Sittella	V,P		38
Animalia	Aves	Campephagidae	0424	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	P		88

Animalia	Aves	Campephagidae	0425	*Coracina papuensis*	White-bellied Cuckoo-shrike	P	3
Animalia	Aves	Campephagidae	0429	*Coracina tenuirostris*	Cicadabird	P	1
Animalia	Aves	Campephagidae	0431	*Lalage leucomela*	Varied Triller	P	1
Animalia	Aves	Campephagidae	0430	*Lalage sueurii*	White-winged Triller	P	19
Animalia	Aves	Pachycephalidae	0408	*Colluricincla harmonica*	Grey Shrike-thrush	P	63
Animalia	Aves	Pachycephalidae	9951	*Falcunculus frontatus*		P	3
Animalia	Aves	Pachycephalidae	0416	*Falcunculus frontatus frontatus*	Eastern Shrike-tit	P	41
Animalia	Aves	Pachycephalidae	0398	*Pachycephala pectoralis*	Golden Whistler	P	62
Animalia	Aves	Pachycephalidae	0401	*Pachycephala rufiventris*	Rufous Whistler	P	76
Animalia	Aves	Oriolidae	0671	*Oriolus sagittatus*	Olive-backed Oriole	P	39
Animalia	Aves	Oriolidae	0432	*Sphecotheres vieilloti*	Australasian Figbird	P	4
Animalia	Aves	Artamidae	8519	*Artamus cyanopterus cyanopterus*	Dusky Woodswallow	V,P	36
Animalia	Aves	Artamidae	0544	*Artamus personatus*	Masked Woodswallow	P	2
Animalia	Aves	Artamidae	T040	*Artamus sp.*		P	2
Animalia	Aves	Artamidae	0545	*Artamus superciliosus*	White-browed Woodswallow	P	5
Animalia	Aves	Artamidae	0700	*Cracticus nigrogularis*	Pied Butcherbird	P	4
Animalia	Aves	Artamidae	T022	*Cracticus sp.*	Unidentified Butcherbird	P	5
Animalia	Aves	Artamidae	0705	*Cracticus tibicen*	Australian Magpie	P	288
Animalia	Aves	Artamidae	0702	*Cracticus torquatus*	Grey Butcherbird	P	106
Animalia	Aves	Artamidae	0694	*Strepera graculina*	Pied Currawong	P	80
Animalia	Aves	Artamidae	T906	*Strepera sp.*		P	9
Animalia	Aves	Artamidae	0697	*Strepera versicolor*	Grey Currawong	P	1
Animalia	Aves	Dicruridae	0673	*Dicrurus bracteatus*	Spangled Drongo	P	1
Animalia	Aves	Rhipiduridae	0361	*Rhipidura albiscapa*	Grey Fantail	P	93
Animalia	Aves	Rhipiduridae	8447	*Rhipidura albiscapa alisteri*		P	2

Animalia	Aves	Rhipiduridae	0364	*Rhipidura leucophrys*		Willie Wagtail	P	145
Animalia	Aves	Rhipiduridae	0362	*Rhipidura rufifrons*		Rufous Fantail	P	6
Animalia	Aves	Corvidae	0930	*Corvus coronoides*		Australian Raven	P	182
Animalia	Aves	Corvidae	9067	*Corvus sp.*		Unidentified Corvid	P	10
Animalia	Aves	Monarchidae	0415	*Grallina cyanoleuca*		Magpie-lark	P	219
Animalia	Aves	Monarchidae	0373	*Monarcha melanopsis*		Black-faced Monarch	P	6
Animalia	Aves	Monarchidae	0366	*Myiagra cyanoleuca*		Satin Flycatcher	P	1
Animalia	Aves	Monarchidae	9955	*Myiagra inquieta*		Restless Flycatcher	P	31
Animalia	Aves	Monarchidae	0365	*Myiagra rubecula*		Leaden Flycatcher	P	3
Animalia	Aves	Corcoracidae	0693	*Corcorax melanorhamphos*		White-winged Chough	P	73
Animalia	Aves	Petroicidae	0392	*Eopsaltria australis*		Eastern Yellow Robin	P	86
Animalia	Aves	Petroicidae	0377	*Microeca fascinans*		Jacky Winter	P	3
Animalia	Aves	Petroicidae	0380	*Petroica boodang*		Scarlet Robin	V,P	2
Animalia	Aves	Petroicidae	0384	*Petroica rosea*		Rose Robin	P	9
Animalia	Aves	Alaudidae	0993	*Alauda arvensis*	*	Eurasian Skylark		6
Animalia	Aves	Cisticolidae	0525	*Cisticola exilis*		Golden-headed Cisticola	P	55
Animalia	Aves	Acrocephalidae	0524	*Acrocephalus australis*		Australian Reed-Warbler	P	57
Animalia	Aves	Megaluridae	0508	*Cincloramphus cruralis*		Brown Songlark	P	16
Animalia	Aves	Megaluridae	0509	*Cincloramphus mathewsi*		Rufous Songlark	P	4
Animalia	Aves	Megaluridae	0522	*Megalurus gramineus*		Little Grassbird	P	41
Animalia	Aves	Megaluridae	0523	*Megalurus timoriensis*		Tawny Grassbird	P	2
Animalia	Aves	Timaliidae	0574	*Zosterops lateralis*		Silvereye	P	93
Animalia	Aves	Hirundinidae	0357	*Hirundo neoxena*		Welcome Swallow	P	113
Animalia	Aves	Hirundinidae	0360	*Petrochelidon ariel*		Fairy Martin	P	65
Animalia	Aves	Hirundinidae	0359	*Petrochelidon nigricans*		Tree Martin	P	21
Animalia	Aves	Pycnonotidae	0990	*Pycnonotus jocosus*	*	Red-whiskered Bulbul		73
Animalia	Aves	Turdidae	0991	*Turdus merula*	*	Eurasian Blackbird		65
Animalia	Aves	Sturnidae	0998	*Sturnus tristis*	*	Common Myna		185

Animalia	Aves	Sturnidae	0999	*Sturnus vulgaris*	*	Common Starling			118
Animalia	Aves	Nectariniidae	0564	*Dicaeum hirundinaceum*		Mistletoebird	P		41
Animalia	Aves	Estrildidae	0657	*Lonchura castaneothorax*		Chestnut-breasted Mannikin	P		1
Animalia	Aves	Estrildidae	0983	*Lonchura punctulata*	*	Nutmeg Mannikin			4
Animalia	Aves	Estrildidae	0662	*Neochmia temporalis*		Red-browed Finch	P		101
Animalia	Aves	Estrildidae	0655	*Taeniopygia bichenovii*		Double-barred Finch	P		62
Animalia	Aves	Estrildidae	0653	*Taeniopygia guttata*		Zebra Finch	P		7
Animalia	Aves	Passeridae	0995	*Passer domesticus*	*	House Sparrow			76
Animalia	Aves	Motacillidae	0647	*Anthus novaeseelandiae*		Australian Pipit	P		67
Animalia	Aves	Fringillidae	0996	*Carduelis carduelis*	*	European Goldfinch			14
Animalia	Mammalia	Tachyglossidae	1003	*Tachyglossus aculeatus*		Short-beaked Echidna	P		11
Animalia	Mammalia	Phascolarctidae	1162	*Phascolarctos cinereus*		Koala	V,P	V	1
Animalia	Mammalia	Vombatidae	1165	*Vombatus ursinus*		Common Wombat	P		1
Animalia	Mammalia	Petauridae	1138	*Petaurus breviceps*		Sugar Glider	P		19
Animalia	Mammalia	Petauridae	1137	*Petaurus norfolcensis*		Squirrel Glider	V,P		1
Animalia	Mammalia	Pseudocheiridae	1129	*Pseudocheirus peregrinus*		Common Ringtail Possum	P		69
Animalia	Mammalia	Acrobatidae	1147	*Acrobates pygmaeus*		Feathertail Glider	P		2
Animalia	Mammalia	Phalangeridae	T082	*Trichosurus sp.*		brushtail possum	P		14
Animalia	Mammalia	Phalangeridae	1113	*Trichosurus vulpecula*		Common Brushtail Possum	P		69
Animalia	Mammalia	Macropodidae	T108	*Macropod sp.*		unidentified macropod	P		10
Animalia	Mammalia	Macropodidae	1265	*Macropus giganteus*		Eastern Grey Kangaroo	P		96
Animalia	Mammalia	Macropodidae	1266	*Macropus robustus*		Common Wallaroo	P		3
Animalia	Mammalia	Macropodidae	1261	*Macropus rufogriseus*		Red-necked Wallaby	P		4
Animalia	Mammalia	Macropodidae	T085	*Macropus sp.*		kangaroo / wallaby	P		97
Animalia	Mammalia	Macropodidae	1242	*Wallabia bicolor*		Swamp Wallaby	P		10
Animalia	Mammalia	Pteropodidae	1282	*Pteropus alecto*		Black Flying-fox	P		1

Animalia	Mammalia	Pteropodidae	1280	*Pteropus poliocephalus*	Grey-headed Flying-fox	V,P	V	91
Animalia	Mammalia	Pteropodidae	T087	*Pteropus sp.*	Flying-fox	P		40
Animalia	Mammalia	Rhinolophidae	1303	*Rhinolophus megaphyllus*	Eastern Horseshoe-bat	P		2
Animalia	Mammalia	Emballonuridae	1321	*Saccolaimus flaviventris*	Yellow-bellied Sheathtail-bat	V,P		7
Animalia	Mammalia	Molossidae	1324	*Austronomus australis*	White-striped Freetail-bat	P		37
Animalia	Mammalia	Molossidae	1329	*Micronomus norfolkensis*	Eastern Coastal Free-tailed Bat	V,P		30
Animalia	Mammalia	Molossidae	1326	*Mormopterus planiceps*	Little Mastiff-bat	P		10
Animalia	Mammalia	Molossidae	1938	*Mormopterus ridei*	Eastern Free-tailed Bat	P		32
Animalia	Mammalia	Molossidae	T091	*Mormopterus sp.*	mastiff-bat	P		4
Animalia	Mammalia	Vespertilionidae	1353	*Chalinolobus dwyeri*	Large-eared Pied Bat	V,P	V	4
Animalia	Mammalia	Vespertilionidae	1349	*Chalinolobus gouldii*	Gould's Wattled Bat	P		59
Animalia	Mammalia	Vespertilionidae	1351	*Chalinolobus morio*	Chocolate Wattled Bat	P		24
Animalia	Mammalia	Vespertilionidae	1372	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V,P		9
Animalia	Mammalia	Vespertilionidae	1357	*Myotis macropus*	Southern Myotis	V,P		22
Animalia	Mammalia	Vespertilionidae	1335	*Nyctophilus geoffroyi*	Lesser Long-eared Bat	P		29
Animalia	Mammalia	Vespertilionidae	1334	*Nyctophilus gouldi*	Gould's Long-eared Bat	P		5
Animalia	Mammalia	Vespertilionidae	T092	*Nyctophilus sp.*	long-eared bat	P		9
Animalia	Mammalia	Vespertilionidae	1361	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V,P		13
Animalia	Mammalia	Vespertilionidae	1365	*Scotorepens orion*	Eastern Broad-nosed Bat	P		25
Animalia	Mammalia	Vespertilionidae	1022	*Vespadelus darlingtoni*	Large Forest Bat	P		4
Animalia	Mammalia	Vespertilionidae	1377	*Vespadelus pumilus*	Eastern Forest Bat	P		4
Animalia	Mammalia	Vespertilionidae	1378	*Vespadelus regulus*	Southern Forest Bat	P		11
Animalia	Mammalia	Vespertilionidae	T088	*Vespadelus sp.*	Unidentified Eptesicus	P		3
Animalia	Mammalia	Vespertilionidae	1379	*Vespadelus vulturnus*	Little Forest Bat	P		28
Animalia	Mammalia	Muridae	1412	*Mus musculus* *	House Mouse			23
Animalia	Mammalia	Muridae	1395	*Rattus fuscipes*	Bush Rat	P		1

Animalia	Mammalia	Muridae	1408	*Rattus rattus*	*	Black Rat		16
Animalia	Mammalia	Muridae	T094	*Rattus sp.*		rat	P	2
Animalia	Mammalia	Canidae	1531	*Canis lupus*	*	Dingo, domestic dog		5
Animalia	Mammalia	Canidae	1904	*Canis lupus dingo*	*	Dingo		4
Animalia	Mammalia	Canidae	1905	*Canis lupus familiaris*	*	Dog		27
Animalia	Mammalia	Canidae	1532	*Vulpes vulpes*	*	Fox		74
Animalia	Mammalia	Felidae	1536	*Felis catus*	*	Cat		30
Animalia	Mammalia	Leporidae	1511	*Lepus capensis*	*	Brown Hare		8
Animalia	Mammalia	Leporidae	1510	*Oryctolagus cuniculus*	*	Rabbit		71
Animalia	Mammalia	Equidae	1513	*Equus asinus*	*	Donkey		1
Animalia	Mammalia	Equidae	1512	*Equus caballus*	*	Horse		12
Animalia	Mammalia	Suidae	1514	*Sus scrofa*	*	Pig		1
Animalia	Mammalia	Bovidae	1518	*Bos taurus*	*	European cattle		16
Animalia	Mammalia	Bovidae	1521	*Capra hircus*	*	Goat		7
Animalia	Mammalia	Bovidae	1522	*Ovis aries*	*	Sheep (feral)		7
Animalia	Mammalia	Cervidae	1526	*Cervus elaphus*	*	Red Deer		5
Animalia	Mammalia	Cervidae	9112	*Cervus sp.*	*	Unidentified Deer		4
Animalia	Mammalia	Cervidae	1523	*Dama dama*	*	Fallow Deer		7
Animalia	Arachnida	Araneidae	T948	*Eriophora transmarina*		Garden orb-weaver, wheelweaving orbweaving spider		1
Animalia	Arachnida	Theridiidae	I069	*Latrodectus hasseltii*		redback spider		2
Animalia	Insecta	Hesperiidae	I402	*Ocybadistes walkeri*		Green Grass-dart		1
Animalia	Insecta	Pieridae	I063	*Delias harpalyce*		imperial white butterfly		1
Animalia	Insecta	Libellulidae	I079	*Orthetrum caledonicum*		blue skimmer		1
Animalia	Gastropoda	Bradybaenidae	I022	*Bradybaena similaris*	*	Asian trampsnail		3
Animalia	Gastropoda	Camaenidae	I006	*Meridolum corneovirens*		Cumberland Plain Land Snail	E1	132
Animalia	Gastropoda	Helicidae	I442	*Cantareus aspersa*	*			2

Animalia	Gastropoda	Limacidae	I099	*Lehmannia nyctelia*			1
Animalia	Gastropoda	Rhytididae	I025	*Austrorhytida capillacea*			2
Animalia	Unknown	Unknown Fauna	9113	*Bird sp.*	Feathers (unknown species)		2
Animalia	Unknown	Unknown Fauna	T350	*Fauna sp.*	Unidentified Fauna		34
Animalia	Unknown	Unknown Fauna	9114	*Insect sp.*	Insect Remains		3
Animalia	Unknown	Unknown Fauna	T202	*Microchiroptera suborder*	Unidentified Microbat		29
Animalia	Unknown	Unknown Fauna	9117	*Reptile sp.*	Unidentified Reptile		4
Animalia	Insecta	Coenagrionidae	I147	*Ischnura heterosticta*	common bluetail		1
Animalia	Insecta	Coenagrionidae	I149	*Xanthagrion erythroneurum*	Red and Blue Damsel		1
Animalia	Mammalia	Miniopteridae	1346	*Miniopterus australis*	Little Bent-winged Bat	V,P	6
Animalia	Mammalia	Miniopteridae	3330	*Miniopterus orianae oceanensis*	Large Bent-winged Bat	V,P	32