

TRANSPORT FOR NSW

ROSEVILLE STATION UPGRADE BIODIVERSITY ASSESSMENT REPORT

MAY 2020



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Roseville Station Upgrade Biodiversity Assessment Report

Transport for NSW

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REV	DATE	DETAILS
A	26/03/2020	First draft
B	17/04/2020	Final_response to TfNSW comments
C	26/05/2020	Final

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GLOSSARY

*	Denotes exotic species
BAM	Biodiversity Assessment Methodology 2017 that supports the <i>Biodiversity Conservation Act 2016</i> (BC Act).
Biodiversity	The biological diversity of life is commonly regarded as being made up of the following three components: <ul style="list-style-type: none">— Genetic diversity — the variety of genes (or units of heredity) in any population.— Species diversity — the variety of species.— Ecosystem diversity — the variety of communities or ecosystems.
Bioregion (region)	A bioregion defined in a national system of bioregionalisation. The site is in the Sydney Basin Bioregion as defined in the Interim Biogeographic Regionalisation for Australia (Thackway and Cresswell 1995).
Candidate species	Species assessed as having a moderate to high likelihood of occurrence within the study area.
Cryptic species	An inconspicuous species which can be difficult to identify.
Department of Environment and Energy	The department develops and implements national policy, programs and legislation to protect and conserve Australia’s natural environment and cultural heritage and administers the EPBC Act. The Commonwealth Department of the Environment was previously known as: <ul style="list-style-type: none">— Department of Sustainability, Environment, Water, Population and Communities (SEWPAC)— Department of the Environment, Water, Heritage and the Arts (DEWHA)— Department of Environment and Heritage (DEH)— Department of the Environment and Water Resources (DEWR).
Ecological community	An assemblage of species occupying a particular area.
Environment, Energy and Science Group	Formerly known as NSW Office of Environment and Heritage. A section of the NSW Department of Planning, Industry and Environment.
Environmental weed	Any plant that is not native to a local area that has invaded native vegetation.
Exotic	Introduced from outside the area (Stralberg, Jongsomjit et al. 2009). Used in the context of this report to refer to species introduced from overseas.
GPS	Global Positioning System – a navigational tool which uses radio receivers to pick up signals from four or more special satellites to provide precise determination of location.
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic components.
High Threat Weed	Vascular plants not native to Australia that if not controlled will invade and outcompete native species. A list of high threat weeds is available as part of the BAM Calculator (https://www.lmbc.nsw.gov.au/bamcalc).
Impact area	Is the land to which is likely to be directly impacted upon by the Proposal.
Indigenous	Native to the area: not introduced (Stralberg, Jongsomjit et al. 2009).

Introduced	Not native to the area: not indigenous (Stralberg, Jongsomjit et al. 2009). Refers to both exotic and non-indigenous Australian native species of plants and animals.
Key threatening processes	A process that threatens, or could threaten, the survival, abundance or evolutionary development of native species, populations or ecological communities (Department of Environment and Conservation 2004). Key threatening processes are listed under the <i>Biodiversity Conservation Act 2016</i> (BC Act), the <i>Fisheries Management Act 1994</i> (FM Act) and the EPBC Act. Capitalisation of the term ‘Key Threatening Processes’ in this report refers to those processes listed specifically under the relevant state and Commonwealth legislation.
Likely	Taken to be a real chance or possibility (Department of Environment and Conservation 2004).
Local population	The population that occurs in the study area. In cases where multiple populations occur in the study area or a population occupies part of the study area, impacts on each subpopulation must be assessed separately (Office of Environment and Heritage, 2017).
Locality	The area within a 10 kilometre radius of the study area.
Migratory species	Species listed as Migratory under the EPBC Act relating to international agreements to which Australia is a signatory. These include Japan-Australia Migratory Bird Agreement, China-Australia Migratory Bird Agreement, Republic of Korea-Australia Migratory Bird Agreement and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Capitalisation of the term ‘Migratory’ in this report refers to those species listed as Migratory under the EPBC Act.
NSW	New South Wales
Plant community type (PCT)	A NSW plant community type identified using the PCT classification system.
Priorities action statements (PAS)	Priorities action statements outline the broad strategies and detailed priority actions to be undertaken in NSW to promote the recovery of Threatened species, population and ecological communities and manage key threatening processes (Department of Environment and Climate Change 2007a).
Priority Weeds	An introduced species listed under the <i>Biosecurity Act 2015</i> . Under the Act, priority weeds have specific control measures for each region.
Proposal	The proposed works as described in detail in Section 1.3.
Protected species	Those species defined as protected under the <i>National Parks and Wildlife Act 1974</i> . Includes all native animals, as well as all native plants listed on Schedule 13 of the <i>National Parks and Wildlife Act 1974</i> (repealed).
Region	A bioregion defined in a national system of bioregionalisation. The Proposal is located within the Sydney Basin Bioregion as defined in the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell 1995).
Significant	Important, weighty or more than ordinary.
Study area	Defined as the area subject to this assessment in which the Proposal is to occur.
Threatened biodiversity	Threatened species, populations or ecological communities as listed under the BC Act, FM Act or the EPBC Act.

Threatened species, populations and ecological communities	Species, populations and ecological communities listed as Vulnerable, Endangered or Critically Endangered (collectively referred to as threatened) under the TSC Act, FM Act or the EPBC Act. Capitalisation of the terms ‘Vulnerable’, ‘Endangered’ or ‘Critically Endangered’ in this report refers to listing under the relevant state and/or Commonwealth legislation.
Viable local population	A population that has the capacity to live, develop and reproduce under normal conditions, unless the contrary can be conclusively demonstrated through analysis of records and references (Department of Environment and Climate Change 2007b).
Weed	A plant growing out of place or where it is not wanted: often characterised by high seed production and the ability to colonise disturbed ground quickly (Stralberg, Jongsomjit et al. 2009). Weeds include both exotic and Australian native species of plant naturalised outside of their natural range.

ABBREVIATIONS

BAM	Biodiversity Assessment Methodology (2017)
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
CAMBA	China Australia Migratory Bird Agreement
EEC	Endangered Ecological Community
EES Group	NSW Environment, Energy and Science Group
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
FM Act	NSW <i>Fisheries Management Act 1994</i>
HA	Hectares
ISCA	Infrastructure Sustainability Council of Australia
JAMBA	Japan Australia Migratory Bird Agreement
LEP	Local Environmental Plan
LGA	Local Government Area
MNES	Matters of National Environmental Significance
NSW	New South Wales
OEH	Office of Environment and Heritage (now known as NSW Environment, Energy and Science Group)
PCT	Plant Community Type
REF	Review of Environmental Factors
RoKAMBA	Republic of Korea Australia Migratory Bird Agreement
TAP	Transport Access Program
TfNSW	Transport for NSW
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i> .

1 PROPOSAL BACKGROUND

1.1 THE PROPOSAL

The NSW Government is committed to facilitating and encouraging use of public transport, such as trains, by upgrading stations to make them more accessible, and improving interchanges around stations with other modes of transport such as buses, bicycles and cars. The Transport Access Program (TAP) is a NSW Government initiative to provide a better experience for public transport customers by delivering accessible, modern, secure and integrated transport infrastructure.

Roseville Station has been identified for an accessibility upgrade as it does not currently meet key requirements of the Commonwealth *Disability Discrimination Act 1992* (DDA) and associated requirements of the *Disability Standards for Accessible Public Transport 2002* (DSAPT). The Proposal would provide safe and equitable access to the platforms and to the pedestrian network surrounding the station. Customer facilities and amenities would also be improved. The upgrades would provide an improved customer experience for existing and future users of the station.

The Proposal involves an accessibility upgrade of Roseville Station as part of TAP which would improve accessibility and amenity for customers. The Proposal would include the following key elements:

- two new lifts connecting the existing footbridge to the Hill Street station entrance and the station platforms
- a new canopy on Hill Street station entrance
- a regraded entry footpath and ramp between the existing bus stop, Pacific Highway, and the station entry
- regrading of the existing pedestrian footpaths along Pacific Highway and Hill Street
- upgrade works to the existing footbridge and stairs including anti-throw screens, hand rails and balustrades
- a new platform canopy at the boarding assistance zone
- modification of the station building to include:
 - one new family accessible toilet and upgrade to the existing toilets to provide one female ambulant toilet and one male ambulant toilet
 - upgrade of existing store room to a station services equipment room (SSER)
- the provision of additional accessibility features including:
 - two accessible parking spaces and an accessible kiss and ride bay
 - new covered bus shelter with seating
 - five bicycle racks (undercover).

1.2 LOCATION OF THE PROPOSAL

The Proposal is located in the suburb of Roseville in the Ku-Ring-Gai Council local government area (LGA) located approximately 13 kilometres north from Central Station.

The Proposal is generally within a low density residential neighbourhood and bounded by local roads, including Hill Street on the north east and Pacific Highway (A1) on the south west side. Roseville Station operates with two rail lines which service intercity and regional connections including North Shore and Western Line (T1) and Northern Line (T9). The Proposal is generally located within the boundaries of the existing station and includes the existing path between the bus stop on Pacific Highway to the western footbridge and along Hill Street to the proposed bus stop. This area will henceforth be referred to as the “study area” and is shown in Figure 1.1.



Legend

- Railway Station
- Railway
- Watercourse
- Local Government Area boundary
- Study Area

Map: PS118200_GIS_013_A1
 Author: Trent.Bowman
 Date: 16/03/2020
 Approved by: Julia.Emerson




1:10,000



TAP REF - Roseville Station

Figure 1.1
 Location of Proposal

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community © Department Finance, Services and Innovation 2019

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1.3 PURPOSE OF THIS REPORT

This Biodiversity Assessment Report has been prepared as part of the Review of Environmental Factors (REF) for the proposal, to determine the impact of the proposal, test if it is likely to significantly affect threatened species in accordance with Section 7.3 of the *Biodiversity Conservation Act 2016* (BC Act) and recommend mitigation measures to avoid and/or minimise impact to biodiversity.

This report will also determine if a Species Impact Statement or Biodiversity Development Assessment Report (refer Section 7.8 (3) of the BC Act) must accompany the environmental assessment (the REF) under Part 5 Division 5.1 of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

The key aims of this Biodiversity Assessment Report are to:

- present the results of desk-based and field-based investigations on biodiversity values within the study area
- provide a description of the biodiversity values and conservation significance within the study area
- undertake an evaluation of any impacts associated with the proposal (in the study area) including associated works implementing vegetation management actions
- undertake assessments of significance within the study area (five-part tests) as prescribed under Section 7.3 of the BC Act
- determine if a Species Impact Statement or Biodiversity Development Assessment must accompany the environmental assessment under Section 7.8 of the BC Act
- recommend relevant mitigation and management measures to minimise any impacts on biodiversity values within the study area
- identify trees for removal and tree replacement requirements in accordance with TfNSW's '*Vegetation Offset Guide*' (2019c).

This report also addresses biodiversity entities listed as Matters of National Environmental Significance (MNES) under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

2 LEGISLATIVE CONTEXT

Commonwealth, State and local government legislation and planning controls relevant to the protection of biodiversity and this Proposal are outlined briefly in this section. These statutory instruments provide conditions, matters for consideration and requirements to seek authorisation (licenses and approvals) to undertake various actions and activities.

2.1 STATE LEGISLATION

2.1.1 *BIODIVERSITY CONSERVATION ACT 2016*

The BC Act outlines the framework for addressing impacts on biodiversity from development and clearing. It establishes a framework to avoid, minimise and offset impacts on biodiversity from development through the Biodiversity Offsets Scheme. The Biodiversity Offsets Scheme creates a transparent, consistent and scientifically based approach to biodiversity assessment and offsetting for all types of development that are likely to have a significant impact on biodiversity (Office of Environment and Heritage 2017).

The Biodiversity Offsets Scheme is not mandatory for activities approved under Part 5 of the EP&A Act although the determining authority must be satisfied that a proposed activity is unlikely to significantly affect threatened species in accordance with Section 7.3 of the BC Act.

If a proposed activity is determined likely to significantly affect threatened species, a Species Impact Statement or Biodiversity Development Assessment Report (refer Section 7.8 (3) of the BC Act) must accompany the environmental assessment (the REF) under Part 5 Division 5.1 of the EP&A Act.

2.1.2 *BIOSECURITY ACT 2015*

The *Biosecurity Act 2015* provides for risk-based management of biosecurity in NSW. It provides a statutory framework to protect the NSW economy, environment and community from the negative impact of pests, diseases and weeds.

The primary object of the Act is to provide a framework for the prevention, elimination and minimisation of biosecurity risks posed by biosecurity matter, dealing with biosecurity matter, carriers and potential carriers, and other activities that involve biosecurity matter, carriers or potential carriers.

In NSW, 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.

2.2 COMMONWEALTH LEGISLATION

2.2.1 *ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999*

Under the Commonwealth EPBC Act, any action that has, would have, or is likely to have a significant impact on a MNES or on Commonwealth land, triggers the Act and may require assessment and approval from the Commonwealth Minister for the Environment.

The nine matters of national environmental significance protected under the EPBC Act are:

- listed threatened species and ecological communities
- listed migratory species
- wetlands of international importance (listed under the Ramsar Convention)
- commonwealth marine areas
- world heritage properties
- national heritage places
- the Great Barrier Reef Marine Park
- nuclear actions (including uranium mines)
- a water resource, in relation to coal seam gas development and large coal mining development.

3 METHODS

3.1 DEFINITIONS

For this report the following definitions apply:

- Study area: defined as the area subject to this assessment in which the Proposal is to occur.
- Proposal area: is the land to which is likely to be directly impacted upon by the Proposal.
- Locality: is a 10-kilometre radius from the study area.
- Bioregion: for this study, the bioregion is the Sydney Basin as defined in the Interim Biogeographic Regionalisation for Australia (IBRA) (Thackway and Cresswell 1995).

All other definitions are provided in the glossary at the start of this document. The Proposal's study area is shown in Figure 1.1.

3.2 PERSONNEL

The contributors to the preparation of this report, their qualifications and roles are listed in Table 3.1.

Table 3.1 Contributors and their roles

NAME	QUALIFICATION	ROLE
Julia Emerson	Bachelor of Environmental; Cert 3 Conservation and Land Management & BAM accredited assessor	Ecologist – Field survey and reporting
Toby Lambert	Bachelor of Environmental Science & BAM accredited assessor	Principal Ecologist – Technical review

All work was carried out under the appropriate licences, including a scientific licence as required under Part 2 of the NSW BC Act (License Number: SL100630), and an Animal Research Authority issued by the Department of Primary Industries (Agriculture).

3.3 NOMENCLATURE

Names of vegetation communities used in this report are based on the Plant Community Types (PCTs) used in the BioNet Vegetation Classification (Environment, Energy & Science Group 2020).

These names are cross-referenced with those used for threatened ecological communities listed under the BC Act and/or the EPBC Act. They are also cross-referenced with existing vegetation mapping using dominant species and structure of the communities in *'The Native Vegetation of the Sydney Metropolitan Area – Version 3.1'* (Office of Environment and Heritage 2016).

Names of plants used in this document follow PlantNet Royal Botanic Gardens (Royal Botanic Gardens 2020) for recent taxonomic changes. Scientific names are used in this report for species of plant. Scientific and common names (where available) are provided in plant lists in appendices. The names of introduced species are denoted with an asterisk (*).

For threatened species of plants, the names used in the EES Threatened Species Website (Environment, Energy & Science Group 2020) are also provided in the tabulated data in appendices where these differ from the names used by PlantNet database.

Names of vertebrate fauna follow the Australian Faunal Directory maintained by the Department of the Environment (2020). Common names are used in the report for species of animal. Scientific names are included in species lists found in appendices.

3.4 DESKTOP ASSESSMENT

A desktop study was conducted to identify:

- the likely distribution of vegetation communities, based on previous mapping and aerial photograph interpretation, for targeted field verification
- a list of threatened species and populations of plants to consider during vegetation surveys and habitat assessment
- a list of threatened species and populations of animals and migratory animals to consider during field-based habitat assessment
- local landscape-scale features of potential significance to biodiversity; e.g. riparian zones and potential wildlife movement corridors
- evaluate baseline information and determine whether additional surveys, mapping and reporting is required to progress the Proposal.

The desktop study included analysis of the following information sources:

- topographic map and aerial photographs
- priority weeds in the Greater Sydney region (Department of Primary Industries 2020b)
- *The Native Vegetation of the Sydney Metropolitan Area – Version 3.1 VIS_ID 4489* (Office of Environment and Heritage 2016).

In addition to the literature listed above database searches of threatened species, populations and communities were conducted in the locality and are summarised below in Table 3.2.

Table 3.2 Database searches

DATABASE	SEARCH DATE	AREA SEARCHES	REFERENCE
PlantNet Database	3 March 2020	Ku-ring-gai LGA	(Royal Botanic Gardens 2020)
EES BioNet Atlas of NSW Wildlife	3 March 2020	10 kilometre x 10 kilometre centred on the study area	(Environment, Energy & Science Group 2020)
EPBC Protected Matters Search Tool	3 March 2020	10 kilometre x 10 kilometre centred on the study area	(Department of the Environment and Energy 2020)
NSW Department of Primary Industries (Fishing and Aquaculture) threatened Aquatic Fauna Database	3 March 2020	Relevant catchment (Sydney Metro)	(Department of Primary Industries 2020a)

3.4.1 DESKTOP ANALYSIS OF VEGETATION

Preliminary mapping of vegetation community boundaries was undertaken through analysis of existing vegetation mapping and aerial photograph interpretation. Analysis of the aerial photographs was used to identify areas of disturbance (e.g. buildings, vehicle tracks, dams and power lines), vegetation structure and likely native versus exotic species composition throughout the study area. This provided an initial definition of vegetation communities into simple structural and disturbance classifications for verification during field surveys.

3.5 FIELD SURVEY

A field survey of the study area was undertaken on the 6 March 2020 by WSP ecologist Julia Emerson. This survey sought primarily to assess the extent and condition of vegetation and fauna habitat, especially for threatened species and ecological communities. The vegetation inspection was used to identify variations in vegetation condition that were not apparent in existing vegetation mapping and refine vegetation community boundaries.

Further detail on the methodology for the field survey is provided in the following sections.

3.5.1 FLORA SURVEY

The floristic diversity and possible presence of threatened species was assessed using the methodologies described below in Section 3.5.1.1 to Section 3.5.1.3.

3.5.1.1 FIELD VERIFICATION OF EXISTING VEGETATION

Vegetation within the study area and locality has been mapped at the regional scale in '*The Native Vegetation of the Sydney Metropolitan Area – Version 3.1 VIS_ID 4489*' (Office of Environment and Heritage 2016).

Data on geology, dominant canopy species, native diversity, vegetation structure and condition was collected across the study area to validate and refine this existing vegetation classification to determine their associated PCT in accordance with the BioNet Vegetation Information System (Environment, Energy & Science Group 2020b).

3.5.1.2 MAPPING OF VEGETATION ZONES

Field validation (ground-truthing) of the existing vegetation classifications undertaken by regional vegetation mapping of the study area was completed to confirm the vegetation structure, dominant canopy species, native diversity, condition and presence of threatened ecological communities. This was based on floristic sampling as described below.

Vegetation zones and conditions were identified and mapped following the Biodiversity Assessment Method (BAM) (Office of Environment & Heritage 2017). This was based on field verification of the PCT, class and formation as outlined in BioNet Vegetation Classification (Office of Environment, Energy & Science 2020b).

3.5.1.3 RANDOM MEANDER SURVEYS

Random meander surveys are a variation of the transect type survey and were completed in accordance with the technique described by Cropper (1993), whereby the recorder walks in a random meander throughout the study area recording dominant and key plant species (e.g. threatened species, priority weeds), boundaries between various vegetation communities and condition of vegetation. The time spent in each vegetation community was generally proportional to the size of the community and its species richness.

3.5.2 FAUNA SURVEY

3.5.2.1 FAUNA HABITAT ASSESSMENT

Fauna habitat assessments were undertaken to assess the likelihood of threatened species of fauna (those species known or predicted to occur within the locality from the literature and database review) occurring within the study area. Fauna habitat assessments were the primary assessment tool in assessing whether a threatened species is likely to occur within the study area.

Fauna habitat characteristics assessed included:

- structure and floristics of the canopy, understorey and ground vegetation, including the presence of flowering and fruiting trees providing potential foraging resources
- presence of hollow-bearing trees providing roosting and breeding habitat for arboreal mammals, birds and reptiles
- presence of the ground cover vegetation, leaf litter, rock outcrops and fallen timber and potential to provide protection for ground-dwelling mammals, reptiles and amphibians
- presence of waterways (ephemeral or permanent) and water bodies.

The following criteria were used to evaluate the condition of habitat values:

- **Good:** A full range of fauna habitat components are usually present (for example, old growth trees, fallen timber, feeding and roosting resources) and habitat linkages to other remnant ecosystems in the landscape are intact.
- **Moderate:** Some fauna habitat components are missing or greatly reduced (for example, old-growth trees and fallen timber), although linkages with other remnant habitats in the landscape are usually intact, but sometimes degraded.
- **Poor:** Many fauna habitat elements in low quality remnants have been lost, including old growth trees (for example, due to past timber harvesting or land clearing) and fallen timber, and tree canopies are often highly fragmented. Habitat linkages with other remnant ecosystems in the landscape have usually been severely compromised by extensive clearing in the past.

3.5.2.2 OPPORTUNISTIC RECORDING

Opportunistic sightings of animals were recorded including diurnal birds and reptiles. Evidence of animal activity, such as scats, diggings, scratch marks, nests/dreys, burrows etc., was also noted. This provided indirect information on animal presence and activity.

During these surveys, a hand-held GPS was used to record the locations of:

- hollow-bearing trees
- aquatic habitat
- rock outcrops.

3.6 LIKELIHOOD OF OCCURRENCE ASSESSMENT

The likelihood of threatened and migratory and threatened species populations identified during desktop assessments were assessed against the criteria outlined in Table 3.3.

Table 3.3 Likelihood of occurrence

LIKELIHOOD OF OCCURRENCE	CRITERIA
Known	The species was observed in the subject site either during the current survey or during another recent survey.
High	A species has a high likelihood of occurrence if: <ul style="list-style-type: none"> — the subject site contains or forms part of a large area of high-quality suitable habitat — important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are abundant within the subject site — the species has been recorded recently in similar habitat in the locality — the subject site is likely to support a resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration.
Moderate	A species has a moderate likelihood of occurrence if: <ul style="list-style-type: none"> — the subject site contains or forms part of a small area of high quality suitable habitat — the subject site contains or forms part of a large area of marginal habitat — important habitat elements (i.e. for breeding or important life cycle periods such as winter foraging periods) are sparse or absent within the subject site — the subject site is unlikely to support a resident populations or to contain habitat that is visited by the species during regular seasonal movements or migration but is likely to be used occasionally during seasonal movements and/or dispersal.
Low	A species has a low likelihood of occurrence if: <ul style="list-style-type: none"> — potentially suitable habitat exists but the species has not been recorded recently (previous 10 years) in the locality despite intensive survey (i.e. the species is considered to be locally extinct) — the species is considered to be a rare vagrant, likely only to visit the subject site very rarely; e.g. during juvenile dispersal or exceptional climatic conditions (e.g. extreme drought conditions in typical habitat of inland birds).
None	Potentially suitable habitat is absent from the subject site.

3.7 LIMITATIONS

Even where field surveys are undertaken, no sampling technique can totally eliminate the possibility that a species is present on a site. For example, some species of plant may be present in the soil seed bank and some fauna species use habitats on a sporadic or seasonal basis and may not be present on site during surveys. Where surveys were conducted outside the optimal time for detecting a particular species, or field surveys were of limited scope, a precautionary approach was taken and it was assumed that the species was present if suitable habitat was observed. Similarly, for areas of vegetation that were not accessible for field verification, vegetation was presumed to be of the community shown in what was considered to be the most accurate available pre-existing vegetation mapping.

The conclusions in this report are based upon the limited data acquired from the site during environmental field surveys and desktop assessment and are, therefore, merely indicative of the environmental condition of the site at the time of preparing the report, including the presence or otherwise of species and the distribution of vegetation types. Also, it should be recognised that site conditions, including the presence of threatened species, can change with time.

4 EXISTING ENVIRONMENT

4.1 LANDSCAPE CONTEXT

Roseville Station is located within the suburb of Roseville which is characterised by scattered exotic and native horticultural plantings. The rail corridor traverses through this largely disturbed landscape which has been subject to a long history of vegetation clearing and urban development. Land uses in the locality include residential and commercial developments and its associated infrastructure (such as road, rail and service line easements).

These land uses, including the establishment and maintenance of the rail corridor, have resulted in the disturbance of the soils, geology and vegetation within the study area. As such, the vegetation within the study area is mostly non-native and highly modified. Larger bushland areas within locality of the study area include Lane Cove National Park to the south-west and Garigal National Park to the north-east. There is no connectivity between the study area and these larger bushland areas and the Proposal will have negligible impact to connectivity. A summary of the study area in relation to administrative, resource management and biogeographical regions is provided in Table 4.1.

Table 4.1 Study area landscape and context summary

LANDSCAPE FEATURE	STUDY AREA
LGA	Ku-ring-gai Council Local Government Area
IBRA Bioregion, IBRA Subregion	Sydney Basin Bioregion, Cumberland Subregion
Local Land Service Region	Greater Sydney
Botanical Subdivision	Central Coast
Mitchell Landscape	Pennant Hills Ridges

4.2 PLANT COMMUNITY TYPES

4.2.1 HIGHLY DISTURBED AREAS WITH NO OR LIMITED NATIVE VEGETATION

This non-native vegetation community occurs over all vegetated areas within the study area with all associated works being located within this vegetation type. This community includes the 'Urban exotic/native' miscellaneous ecosystem which was comprised of ornamental landscape plantings, exotic lawn and environmental weeds. Figure 4.1 shows the location of the mapped vegetation.

Table 4.2 Summary of miscellaneous ecosystems (highly disturbed areas with no or limited native vegetation) dominant species and extent

MISCELLANEOUS ECOSYSTEMS (HIGHLY DISTURBED AREAS WITH NO OR LIMITED NATIVE VEGETATION)	
Dominant canopy species	<i>Acer negundo</i> * (English Oak), <i>Callistemon sp.</i> (Cultivar), <i>Cinnamomum camphora</i> * (Camphor Laurel), <i>Ficus eastica</i> * (Rubber Tree), <i>Ficus microcarpa var. hillii</i> (Small-fruited Fig), <i>Fraxinus griffithii</i> * (Evergreen Ash), <i>Grevillea robusta</i> (Silky Oak), <i>Jacaranda mimosifolia</i> * (Jacaranda), <i>Liquidambar orientalis</i> * (Oriental Sweetgum), <i>Lophostemon confertus</i> (Brush Box), <i>Magnolia grandiflora</i> * (Bull Bay), <i>Phoenix canariensis</i> * (Canary Island Date Palm), <i>Quercus robur</i> * (Box Elder), planted <i>Melaleuca quinquenervia</i> (Broad-leaved Paperbark)
Dominant ground strata species	<i>Agapanthus praecox subsp. orientalis</i> * (Agapanthus), <i>Ageratina riparia</i> * (Mistflower), <i>Araujia sericifera</i> * (Moth Vine), <i>Asparagus aethiopicus</i> * (Asparagus Fern), <i>Cardiospermum grandiflorum</i> * (Balloon Vine), <i>Digitaria ciliaris</i> * (Summer Grass), <i>Ehrharta erecta</i> * (Panic Veldtgrass), <i>Hedera helix</i> * (Ivy), <i>Ipomoea indica</i> * (Blue Morning Glory), <i>Lantana camara</i> * (Lantana), <i>Lantana montevidensis</i> *, <i>Lomandra longifolia</i> (Spiny-headed Mat-rush), <i>Paspalum dilatatum</i> * (Paspalum), <i>Portulaca oleracea</i> (Pigweed), <i>Solanum nigrum</i> * (Black-berry Nightshade)
Area within study area (Ha)	0.38
Impact area (Ha)	0.05



Photo 4.1 Compound to the north-west of Roseville Station with exotic grasslands dominated by *Ehrharta erecta** (Panic Veldtgrass) in the foreground and exotic planted canopy species in the background



Photo 4.2 Temporary lay-down area to the south-west of Roseville station showing an exotic understorey dominated by *Hedera helix** (Ivy) and planted *Melaleuca quinquenervia* (Broad-leaved Paperbark)



Photo 4.3 Planted exotic canopy species (*Fraxinus griffithii**) within the rail corridor of North Shore Line (looking North towards Lindfield)



Photo 4.4 Planted and non-planted exotic canopy species within the rail corridor adjacent to Roseville Station



Legend

- Railway Station
- Railway
- Local Government Area boundary
- Study Area
- Construction compound
- Temporary laydown area
- Trimming

Vegetation Survey (WSP Verified)

- Highly disturbed areas with no or limited native vegetation

Map: PS118200_GIS_014_A2	Author: Trent.Bowman
Date: 17/04/2020	Approved by: Julia.Emerson




1:1,100

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community © Department Finance, Services and Innovation 2019

Coordinate system: GDA 1994 MGA Zone 56
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TAP REF - Roseville Station

Figure 4.1
Plant Community Types

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4.3 FAUNA HABITATS

The fauna habitat within the study area is limited, with majority of vegetation occurring within the Proposal area consisting of planted ornamental native and exotic/native trees and shrubs.

Much of the vegetation within the study area has been previously cleared for rail infrastructure and urban development and what remains provides highly modified habitat. The habitat and vegetation within the study area provides limited resources and generally lacks important features such as hollow bearing trees, rocky outcrops or fallen woody debris.

The study area does not provide any significant habitat for fauna and species likely to utilise resources are those that are well adapted to urban environments or those species that are highly mobile (i.e. birds and bats). The surrounding trees (both native and introduced) provide some foraging habitat (i.e. fruits and blossom) for mobile species (i.e. birds and bats) including foraging habitat for the Powerful Owl and Grey-headed Flying-fox. It is unlikely that these resources are heavily utilise or relied upon by majority of fauna but instead are intermittently used whilst foraging within the greater locality.

4.3.1 CONNECTIVITY

Within the study area there is limited connectivity due to the existing railway line and density of urban development. Remnant vegetation within the locality is highly fragmented and connectivity between patches is predominately disconnected. Due to the highly fragmented remnant vegetation within the Proposal area, species likely to utilise resources being habitat patches are those that are well adapted to urban environments or those species that are highly mobile (i.e. birds and bats). Given the Proposal involves upgrades to either side of the railway line, habitat connectivity is unlikely to be impacted by the Proposal.

4.4 WEEDS

Four Priority Weeds listed under the *Biosecurity Act 2015* for the Greater Sydney Region were identified in the study area. Three of these tree Priority Weeds are also listed as Weeds of National Significance (WONS). A summary of these weeds and their associated duties are detailed below in Table 4.3.

Table 4.3 Weeds of concern within the study area (Department of Primary Industries 2020b)

SCIENTIFIC NAME	COMMON NAME	BIOSECURITY ACT DUTY	WONS
<i>Asparagus aethiopicus</i> *	Asparagus Fern	Prohibition on dealings – Must not be imported into the State or sold.	Yes
<i>Genista monspessulana</i> *	Cape Broom	Prohibition on dealings – Must not be imported into the State or sold.	Yes
<i>Lantana camara</i> *	Lantana	Prohibition on dealings – Must not be imported into the State or sold.	Yes
<i>Olea europea</i> var. <i>cuspidata</i> *	African Olive	Regional Recommended Measure (Proposal within core infestation area) – The plant or parts of the plant are not traded, carried, grown or released into the environment. Land managers prevent spread from their land where feasible. Land managers reduce impacts from the plant on priority assets.	No

5 THREATENED BIODIVERSITY

5.1 THREATENED ECOLOGICAL COMMUNITIES

No threatened ecological communities were identified within the study area and no native vegetation required analysis in this regard.

5.2 THREATENED FLORA

No threatened flora species were identified during site inspections.

Background investigations identified 37 threatened flora species listed under the BC Act and/or EPBC Act that were considered to have the potential to occur within the locality of the study area. The study area is considered unlikely to provide habitat for any threatened flora species based on the availability of habitats present and results of the site inspection. Threatened flora likelihood of occurrence assessments are provided in Appendix A.

No assessments of significance for any threatened flora species listed under either the BC Act or EPBC Act are considered warranted to assess the impacts of the Proposal.

5.3 THREATENED FAUNA

No threatened fauna species were identified during site inspections.

Background investigations identified 71 threatened fauna species listed under the BC Act and/or EPBC Act that have been previously recorded or have the potential to occur within the locality (Appendix B). The likelihood of these species occurring within the study area was determined based on field investigations and fauna habitat available.

Table 5.1 outlines each species considered to have a moderate to high likelihood to occur within the study area and be potentially impacted of the Proposal.

Table 5.1 Threatened fauna species considered likely to occur within the study area

COMMON NAME	SCIENTIFIC NAME	BC ACT ¹	EPBC ACT ²	LIKELIHOOD OF OCCURRENCE	IMPACT TO SPECIES OR HABITAT
Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>	V	V	High. Non-native vegetation recorded is likely to support this species and provide foraging habitat as part of a large home range. No breeding camps were recorded or are known within close-proximity to the study area.	The habitat within the study area is foraging habitat only and represents a small proportion of available habitat within locality.
Powerful Owl	<i>Ninox strenua</i>	V	–	Moderate. This species has been widely recorded within locality of the study area. Though vegetation within the study area is unlikely to provide breeding/roosting habitat, it may form part of the species foraging habitat.	Other habitats within the locality are of higher quality. It is considered unlikely that this species relies on habitat within the study area.

(1) V = Vulnerable under the BC Act

(2) V = Vulnerable under the EPBC Act

Based on available habitat and the potential impacts of the Proposal, it is considered two threatened fauna species, Grey-headed Flying-fox (*Pteropus poliocephalus*) and Powerful Owl (*Ninox strenua*), have a moderate to high likelihood of occurrence or have the potential to utilise the available habitat within the Proposal area.

Specific assessments of significance for any moderate to high likelihood threatened fauna species listed under either the BC Act or EPBC Act are considered warranted to assess the impacts of the Proposal. Assessments of significance have been undertaken for both identified species and are provided in Appendix D.

5.4 MIGRATORY SPECIES

Migratory species are protected under international agreements, to which Australia is a signatory, including JAMBA, CAMBA, RoKAMBA and the Bonn Convention on the Conservation of Migratory Species of Wild Animals. Migratory species are considered MNES and are protected under the EPBC Act.

A total of thirty-seven species listed as migratory under the EPBC Act were identified during background investigations (excluding marine species) that have been previously recorded or have the potential to occur within the locality (Appendix B). Of these, two species are considered likely to utilise the habitat present within the study area.

Table 5.2 Migratory species considered likely to occur within the study area

SCIENTIFIC NAME	COMMON NAME	EPBC ACT STATUS	LIKELIHOOD OF OCCURRENCE
<i>Apus pacificus</i>	Fork-tailed Swift	M	Moderate. This species is generally aerial and may occur in airspace over site during migration.
<i>Hirundapus caudacutus</i>	White-throated Needletail	M	Moderate. This species is generally aerial and may occur in airspace over site during migration.

The species identified above in Table 5.2 have the potential to utilise a wide variety of habitats and are only likely to utilise the air space over the study area intermittently.

The habitat present is unlikely to support these migratory species nor are the habitats critical to any life stage. Due to their mobile nature, the mentioned species is likely to utilise higher quality habitat within the greater locality and where more extensive tracts of native vegetation occur. Because of this, the mentioned species is not considered to be significantly impacted by the action proposed for the construction and operation of the Proposal and is not considered further in this report.

6 POTENTIAL IMPACTS

Potential impacts to biodiversity resulting from the construction and operation phases of the Proposal have been considered below.

6.1 IMPACTS DURING CONSTRUCTION

6.1.1 DIRECT IMPACTS

6.1.1.1 REMOVAL OF VEGETATION

Figure 6.1 shows the location of trees and vegetation to be impacted. Direct impacts to biodiversity because of the Proposal are considered negligible due to the existing disturbed nature of the available habitat and the nature of the construction works to be undertaken. Vegetation clearing would be minimal and limited to approximately 0.05 hectares of Highly Disturbed Areas with No or Limited Native Vegetation including native/exotic ornamental plantings, environmental weeds and exotic lawn.

No impacts to patches of remnant native vegetation or high-quality fauna habitat are predicted to result from the Proposal. Direct mortality or trauma to fauna is also expected to be minimal as habitat to be removed is of low quality (i.e. planted native trees and landscape gardens).

6.1.1.2 IMPACTS TO THREATENED FAUNA

Two threatened fauna (Grey-headed Flying-fox (*Pteropus poliocephalus*) and Powerful Owl (*Ninox strenua*)) are considered to have a moderate to high likelihood to occur within the Proposal area and as a result be potentially impacted by the Proposal. Assessments of Significance for both species have been undertaken (refer to Appendix D) and concluded that these species are not considered likely to be significantly impacted by the proposal. The mitigation measures outlined below in Section 7 would ensure that any possible indirect impacts would be minimised.

6.1.2 INDIRECT IMPACTS

6.1.2.1 POTENTIAL ENVIRONMENTAL IMPACT OF NOISE, LIGHT AND VIBRATIONS ON WILDLIFE

Many animals detect and depend on sound to communicate, navigate, evade danger and find food, but human-made noise can alter the behaviour of animals or interfere with their normal functioning. In some cases it can harm their health, reproduction, survivorship, habitat use, distribution, abundance, or genetic composition (Forman *et al.* 2000). However, variation in ambient noise, such as from wind or other animals, is part of the natural environment and many animals display behavioural adaptations to this variation. For example, certain species of frogs avoid vocalising during loud calling by cicadas or other frogs and some species will time their calls during brief periods of silence (Schwartz & Henderson 1991).

It is likely that noise from the existing rail corridor and arterial roads would already impact background levels of noise in the study area. However, construction and operation phases of the Proposal (along with its ancillary activities) may cause additional disturbance to animals. The impacts from noise emissions are likely to be localised close to the project and are not likely to have a significant long-term impact on wildlife populations, given that populations are already exposed to noise associated with the existing rail corridor. Furthermore, it is likely that most animal species would habituate to periodic noise disturbance from regular maintenance activities (Forman *et al.* 2000).

Artificial light that alters the natural patterns of light and dark in ecosystems is referred to as 'ecological light pollution' (Longcore and Rich 2004). Types of ecological light pollution include chronic or periodically increased illumination, unexpected changes in illumination, and direct glare (Longcore and Rich 2004).

Under present conditions there is moderate light pollution within the study area associated with the existing train station and carpark. The increase of lighting during the construction and operation of the proposal is likely to be inconsequential and significant ecological light pollution impact to wildlife is unlikely.

6.1.2.2 WEEDS

The Proposal is unlikely to impact any Priority Weeds listed under the *Biosecurity Act 2015* for the Greater Sydney Region such that they would pose a risk to any areas of native vegetation.

6.2 IMPACTS DURING OPERATION

The operation of the Proposal is not anticipated to result in any further impacts to biodiversity. Following construction, no further clearing will be required by the Proposal.



Legend

- Railway Station
- Railway
- Local Government Area boundary
- Study Area
- Construction compound
- Temporary laydown area
- Trimming

Vegetation Survey (WSP Verified)

- Highly disturbed areas with no or limited native vegetation

Map: PS118200_GIS_015_A4	Author: Victor Lau
Date: 17/04/2020	Approved by: Julia.Emerson




1:1,100

Coordinate system: GDA 1994 MGA Zone 56
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TAP REF - Roseville Station

Figure 6.1
Vegetation Removal associated with the Proposal

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7 MITIGATION

Construction and operation of the Proposal must be undertaken in accordance with TfNSW's *Vegetation Management (Protection and Removal) Guideline*, TfNSW's *Fauna Management Guideline*, TfNSW's *Vegetation Offset Guide* and TfNSW's *Biodiversity Offsets Calculator*. Specifically, the following measures would be undertaken to avoid and minimise impacts on biodiversity:

- All workers would be provided with an environmental induction prior to commencing work onsite. This induction would include information on the protection measures to be implemented to protect vegetation, penalties for breaches and locations of areas of sensitivity.
- Trees/vegetation nominated to be removed in the Proposal plans would be clearly demarcated onsite prior to construction, to avoid unnecessary vegetation removal. Trees to be retained would be protected through temporary protection measures discussed below.
- Tree protection measures recommended by Earthscape Horticultural Services (2020) to ensure the protection of retained trees are to be adopted during work onsite.
- Site environmental representative should conduct a pre-clearance inspection to identify the presence of any active bird nests which may be erected prior to tree clearing. If identified, clearing of these trees should be postponed until the nestlings have fledged. Alternatively, a suitably qualified and licensed ecologist or spotter catcher should be engaged to relocate the nest to an appropriate location.
- Stockpiles, plant, equipment and materials storage would be located in existing cleared areas away from areas of native vegetation.
- Where the loss of trees is unable to be mitigated, Transport for NSW would replace trees removed because of the Proposal in accordance with the TfNSW's *Vegetation Offset Guide* (TfNSW, 2019c). In accordance with Section 5 of the guideline it is expected that 40 trees would be required to meet this offset requirement.
- Canopy pruning of Trees should be carried out in accordance with the mitigation measures proposed by Earthscape Horticultural Services (2020) whereby the Australia Standard (4373-2007) is adopted and works are carried out by a qualified and experienced arborist or tree surgeon.
- Construction of the Proposal must be undertaken in accordance with TfNSW's *Vegetation Management (Protection and Removal) Guideline SD-111* (2019b) and TfNSW's *Fauna Management Guideline SD-113* (2019a).
- In the event of any tree to be retained becoming damaged during construction, the Contractor would immediately notify the TfNSW Project Manager and TfNSW Environment and Planning Manager to coordinate the response which may include contacting an arborist to inspect and provide advice on remedial action, where possible.
- If a threatened and/or protected flora or fauna species is identified during works associated with the Proposal, works near the species would stop immediately. An ecologist would be engaged to survey the area, in conjunction with TfNSW's Environmental Representative, to advise on management of the species on site.
- Should the detailed design or onsite works determine the need to remove or trim any additional trees, which have not been identified in the REF, the Contractor would be required to complete TfNSW's Tree Removal Application Form and submit it to TfNSW for approval.
- For new landscaping works, mulching and watering would be undertaken until plants are established.
- Weed control measures, consistent with TfNSW's *Weed Management and Disposal Guideline*, would be developed and implemented as part of the CEMP to manage the potential dispersal and establishment of weeds during the construction and operational phase of the Proposal. This would include the management and disposal of weeds in accordance with the *Biosecurity Act 2015*.

8 OFFSETTING

In accordance with the Transport for NSW Vegetation Offset Guide (2019c) individual trees should be offset in areas where individual trees will be impacted. Table 8.1 outlines the offsetting requirements for impacts associated with Proposals on trees which are determined based on the size (Diameter at Breast Height (DBH)) and number of trees to be removed.

Table 8.1 Offsetting for individual trees

TREE TYPE	OFFSET
Large tree (DBH greater than 60 cm)	Plant minimum 8 trees
Medium tree (DBH greater than 15 cm, but less than 60 cm)	Plant minimum 4 trees
Small young tree (DBH less than 15 cm DBH)	Plant minimum 2 trees

The offset requirement to compensate for impacts associated with the Proposal is outlined below in Table 8.2. Individual trees are previously shown in Figure 6.1.

Table 8.2 Offsets required for the Proposal

TREE IDENTIFICATION NO.	SPECIES	TREE TYPE	OFFSET REQUIRED
T1	<i>Lophostemon confertus</i> (Brush Box)	Medium tree	4 trees
T2	<i>Alectryon tomentosus</i> (Hairy Bird's Eye)	Small young tree	Plant minimum 2 trees
T3	<i>Ligustrum lucidum</i> * (Large-leaved Privet)	Small young tree	No offset required – tree is an invasive species which provides no heritage, streetscape, community/ public amenity or intrinsic value.
T4	<i>Ailanthus altissima</i> * (tree-of-heaven)	Medium tree	4 trees
T5	<i>Olea europaea</i> * (Common Olive)	Small young tree	No offset required – tree is an invasive species which provides no heritage, streetscape, community/ public amenity or intrinsic value.
T6	<i>Ailanthus altissima</i> * (tree-of-heaven)	Medium tree	4 trees
T7	<i>Ailanthus altissima</i> * (tree-of-heaven)	Medium tree	4 trees
T8	<i>Angophora floribunda</i> (Rough-barked Apple)	Medium tree	4 trees
T9	<i>Callistemon sp.</i> (Cultivar)	Small young tree	2 trees
T10	<i>Ailanthus altissima</i> * (tree-of-heaven)	Medium tree	4 trees
T11	<i>Callistemon sp.</i> (Cultivar)	Small young tree	2 trees

TREE IDENTIFICATION NO.	SPECIES	TREE TYPE	OFFSET REQUIRED
T12	<i>Angophora floribunda</i> (Rough-barked Apple)	Small young tree	2 trees
T13	<i>Syzygium luehmannii</i> (Riberry)	Small young tree	2 trees
T14	<i>Syzygium luehmannii</i> (Riberry)	Small young tree	2 trees
T15	<i>Magnolia grandiflora</i> * (Bull Bay)	Small young tree	2 trees
T16	<i>Jacaranda mimosifolia</i> * (Jacaranda)	Small young tree	2 trees
Total			40 trees

9 CONCLUSION

This Biodiversity Assessment Report has been prepared to inform a Review of Environmental Factors (REF) for the Roseville Station Upgrade. The findings from the desktop assessment and field investigations have identified no impact to native vegetation and minimal impact to threatened fauna potential habitat. The proposed activity occurs within an existing inner-city urban precinct and the biodiversity value of the existing environment is comparatively low.

A majority of vegetation observed within the Proposal area is comprised of horticultural exotic and native tree specimens that do not form part of any recognised native NSW Plant Community Type. The proposed works will not impact on any area of native vegetation.

The Proposal will result in the loss of 14 exotic ornamental and native trees excluding two are invasive species trees and not exotic ornamental. The impact of this vegetation loss is unlikely to constitute an impact to any important biodiversity value.

Threatened fauna species identified within the locality would likely intermittently utilise the planted vegetation as foraging habitat, however, the habitat is considered low in quality and unlikely to play an important role in the lifecycle of these species. Two threatened fauna species Grey-headed Flying-fox (*Pteropus poliocephalus*) and Powerful Owl (*Ninox strenua*) were considered to have a moderate likelihood to utilise the vegetation within the Proposal area. Assessments of Significance were undertaken for both species and they were not considered likely to be significantly impacted due to the Proposal.

The Proposal does not involve any likely significant impact to native plant community types, threatened terrestrial or aquatic species, threatened ecological communities or their habitat. The proposed activity is deemed unlikely to significantly affect threatened species in accordance with Section 7.3 of the BC Act. Given this, a Species Impact Statement or Biodiversity Development Assessment Report (refer Section 7.8 (3) of the BC Act) is not required to accompany the REF. The proposed activity is also unlikely to significant affect Matters of National Environmental Significance and as such a referral of this activity is not deemed required under the EPBC Act.

The impacts to native biodiversity are predicted to be negligible and any residual or indirect impacts will be mitigated by undertaking works in accordance with TfNSW's *Vegetation Management (Protection and Removal) Guideline*, TfNSW's *Vegetation Offset Guide* and TfNSW's *Fauna Management Guideline*.

The mitigation measures outlined in Section 7 would ensure any potential impact to native biodiversity would be negligible.

10 LIMITATIONS

SCOPE OF SERVICES

This report has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and WSP (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

RELIANCE ON DATA

In preparing the report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

ENVIRONMENTAL CONCLUSIONS

In accordance with the scope of services, WSP has relied upon the data provided for the preparation of the report. Within the limitations imposed by the scope of services, the surveys and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, expressed or implied, is made.

REPORT FOR BENEFIT OF CLIENT

The report has been prepared for the benefit of the client (and no other party). WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Except as provided below parties other than the client should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

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APPENDIX A

THREATENED FLORA LIKELIHOOD OF OCCURRENCE ASSESSMENT



Table A.1 Threatened flora likelihood of occurrence assessment

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Acacia bynoeana</i>	Bynoe's Wattle	E	V	This species occurs in heath or dry sclerophyll forest on sandy soils and is generally associated with overstorey species such as Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksias and Narrow-leaved Apple.	BioNet, PlantNet, PMST	8	Low. Suitable habitat was not recorded.
<i>Acacia pubsecens</i>	Downy Wattle	E	V	Restricted to the Sydney Region from Bilpin to the Georges River and also at Woodford where it usually grows in open sclerophyll forest and woodland on clay soils. Typically it occurs at the intergrade between shales and sandstones in gravelly soils often with ironstones.	PMST	0	Low. Suitable habitat was not recorded.
<i>Acacia terminalis subsp. terminalis</i>	Sunshine Wattle	E	E	This species is associated with coastal scrub and dry sclerophyll woodland on sandy soils.	BioNet, PMST	3	Low. Suitable habitat was not recorded.
<i>Allocaruarina glareicola</i>	-	E	E	Primarily restricted to the Richmond (NW Cumberland Plain) district, but with an outlier population found at Voyager Point, Liverpool. Grows on lateritic soil in open forest.	PMST	0	Low. Suitable habitat was not recorded.
<i>Asterolasia elegans</i>	-	E	E	Occurs on Hawkesbury sandstone where it is found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. Occurs north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby local government areas. Also likely to occur in the western part of Gosford local government area. Known from only seven populations, only one of which is wholly within a conservation reserve.	PMST	0	Low. Suitable habitat was not recorded.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Caladenia tessellata</i>	Thick Lip Spider Orchid	E	V	Occurs south of Swansea where it grows on clay loam or sandy soils. Prefers low open forest with a heathy or sometimes grassy understorey. Within NSW, currently known from two disjunct areas; one population near Braidwood on the Southern Tablelands and three populations in the Wyong area on the Central Coast. Previously known also from Sydney and South Coast areas.	BioNet, PMST	5	Low. Suitable habitat was not recorded.
<i>Callistemon linearifolius</i>	Netted Bottle Brush	V	-	This species is associated with dry sclerophyll forest on the coast and adjacent ranges.	BioNet	8	Low. Suitable habitat was not recorded.
<i>Cryptostylis hunteriana</i>	Leafless Tounge Orchid	V	V	Occurs south from the Gibraltar Range, chiefly in coastal districts but also extends on to tablelands. Grows in swamp-heath and drier forest on sandy soils on granite & sandstone. Occurs in small, localised colonies most often on the flat plains close to the coast but also known from some mountainous areas growing in moist depressions and swampy habitats.	PlantNet, PMST	0	Low. Suitable habitat was not recorded.
<i>Cynanchum elegans</i>	White-flowered Wax Plant	E	E	Occurs from the Gloucester district to the Wollongong area and inland to Mt Dangar where it grows in rainforest gullies, scrub and scree slopes. This species typically occurs at the ecotone between dry subtropical forest/woodland communities.	PMST	0	Low. Suitable habitat was not recorded.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Darwinia biflora</i>	–	V	V	Occurs from Cheltenham to Hawkesbury River where it grows in heath on sandstone or in the understorey of woodland on shale-capped ridges. Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Associated overstorey species include <i>Eucalyptus haemastoma</i> , <i>Corymbia gummifera</i> and/or <i>E. squamosa</i> . The vegetation structure is usually woodland, open forest or scrub.	BioNet, PlantNet, PMST	182	Low. Suitable habitat was not recorded.
<i>Deyeuxia appressa</i>	–	E	E	A highly restricted NSW endemic known only from two pre-1942 records in the Sydney area. Was first collected in 1930 at Herne Bay, Saltpan Creek, off the Georges River, south of Bankstown. Was then collected in 1941 from Killara, near Hornsby. Has not been collected since and may now be extinct in the wild due to the level of habitat loss and development that has occurred within these areas.	BioNet, PlantNet, PMST	3	Low. Suitable habitat was not recorded.
<i>Epacris purpurascens</i> var. <i>purpurascens</i>	–	V	–	Occurs in Gosford and Sydney districts where it grows in sclerophyll forest, scrub and swamps. Usually found in sites with a strong shale influence.	BioNet, PlantNet	15	Low. Suitable habitat was not recorded.
<i>Eucalyptus camfieldii</i>	Camfield's Stringybark	V	V	Occurs in scattered locations within a restricted distribution in a narrow band with the most northerly records in the Raymond Terrace area south to Waterfall. Grows in poor coastal country in shallow sandy soils overlying Hawkesbury sandstone, in coastal heath mostly on exposed sandy ridges. Occurs mostly in small scattered stands near the boundary of tall coastal heaths and low open woodland of the slightly more fertile inland areas.	BioNet, PlantNet, PMST	24	Low. Suitable habitat was not recorded.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	This species is sparsely distributed but widespread on the New England Tablelands from Nundle to north of Tenterfield, being most common in central portions of its range. Found largely on private property and roadsides, and occasionally in conservation reserves. Planted as urban trees, windbreaks and corridors. Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on infertile soils derived from granite or metasedimentary rock.	BioNet	3	Low. The study area is outside of this species known distribution. Historical records of this species within locality are likely to be planted individuals. No individuals recorded within the study area.
<i>Genoplesium baueri</i>	Bauer's Midge Orchid	E	E	Grows in dry sclerophyll forest and moss gardens over sandstone. The species has been recorded from locations between Ulladulla and Port Stephens (OEH 2018).	BioNet, PlantNet, PMST	3	Low. Suitable habitat was not recorded.
<i>Grevillea caleyi</i>	Caley's Grevillea	CE	CE	Restricted to an 8 km square area around Terrey Hills, approximately 20 km north of Sydney. Occurs in three major areas of suitable habitat, namely Belrose, Ingleside and Terrey Hills/Duffys Forest within the Ku-ring-gai, Pittwater and Warringah Local Government Areas. All natural remnant sites occur within a habitat that is both characteristic and consistent between sites. All sites occur on the ridgetop between elevations of 170 to 240 m asl, in association with laterite soils and a vegetation community of open forest, generally dominated by <i>Eucalyptus sieberi</i> and <i>E. gummifera</i> .	BioNet, PlantNet	20	Low. Suitable habitat was not recorded.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea	V	-	Endemic to Western Sydney, centred on an area bounded by Blacktown, Erskine Park, Londonderry and Windsor with outlier populations at Kemps Creek and Pitt Town. Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels. Recorded from Cumberland Plain Woodland, Castlereagh Ironbark Woodland, Castlereagh Scribbly Gum Woodland and Shale/Gravel Transition Forest.	BioNet	1	Low. Suitable habitat was not recorded.
<i>Haloragodendron lucasii</i>	-	E	E	The known locations of this species are confined to a very narrow distribution on the north shore of Sydney. Confined to the Sydney area where it grows in dry sclerophyll open forest on sheltered slopes near creeks on sandstone. Reported to grow in moist sandy loam soils in sheltered aspects, and on gentle slopes below cliff-lines near creeks in low open woodland. Associated with high soil moisture and relatively high soil-phosphorus levels.	BioNet, PlantNet, PMST	18	Low. Suitable habitat was not recorded.
<i>Hibbertia puberula</i>	-	E	-	This species is known to be widespread, but never common. It extends from Wollemi National Park south to Morton National Park and the south coast near Nowra. Early records of this species are from the Hawkesbury River area and Frenchs Forest in northern Sydney, South Coogee in eastern Sydney, the Hacking River area in southern Sydney, and the Blue Mountains. It favours low heath on sandy soils or rarely in clay, with or without rocks underneath. Occurs on sandy soil often associated with sandstone, or on clay.	BioNet	1	Low. Suitable habitat was not recorded.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Hibbertia spanantha</i>	Julian's Hibbertia	CE	CE	Grows in forest with canopy species including <i>Eucalyptus pilularis</i> , <i>E. resinifera</i> , <i>Corymbia gummifera</i> and <i>Angophora costata</i> . The understorey is open with species of Poaceae, Orchidaceae, Fabaceae and Liliaceae. Flowering in October and November, but with an odd flower throughout the year. The soil is identified as a light clay occurring on a shale sandstone soil transition.	BioNet, PlantNet, PMST	2	Low. Suitable habitat was not recorded.
<i>Isotoma fluviatilis</i> subsp. <i>fluviatilis</i>	-	-	X	Currently known from only two adjacent sites on a single private property at Erskine Park in the Penrith LGA. Previous sightings are all from western Sydney, at Homebush and at Agnes Banks. Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone.	BioNet	1	Low. Presumed extinct in NSW.
<i>Lasiopetalum joyceae</i>	-	V	V	Has a restricted range occurring on lateritic to shaley ridgetops on the Hornsby Plateau south of the Hawkesbury River. It is currently known from 34 sites between Berrilee and Duffys Forest. It grows in heath and open woodland in sandy soils on sandstone.	BioNet, PlantNet, PMST	1	Low. Suitable habitat was not recorded.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Leptospermum deanei</i>	–	V	V	Occurs in Hornsby, Warringah, Ku-ring-gai and Ryde LGAs in woodland on lower hills and slopes or near creeks, sandy alluvial soil or sand over sandstone. Occurs in Riparian Scrub- e.g. <i>Tristaniopsis laurina</i> , <i>Baeckea myrtifolia</i> , Woodland (e.g. <i>Eucalyptus haemastoma</i>) and Open Forest (e.g. <i>Angophora costata</i> , <i>Leptospermum trinervium</i> and <i>Banksia ericifolia</i>). Only occurs near the watershed of Lane Cove River where it grows on forested slopes.	BioNet, PlantNet, PMST	1	Low. Suitable habitat was not recorded.
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	V	V	Occurs as disjunct populations in coastal New South Wales from Jervis Bay to Port Macquarie, with the main concentration of records is in the Gosford/Wyong area. Grows in damp places, often near streams, or low-lying areas on alluvial soils of low slopes or sheltered aspects.	PMST	0	Low. Suitable habitat was not recorded.
<i>Melaleuca deanei</i>	Deane's Paperbark	V	V	Occurs in two distinct areas, in the Ku-ring-gai/Berowra and Holsworthy/Wedderburn areas respectively. There are also more isolated occurrences at Springwood (in the Blue Mountains), Wollemi National Park, Yalwal (west of Nowra) and Central Coast (Hawkesbury River) areas. The species occurs mostly in ridgetop woodland, with only 5% of sites in heath on sandstone.	BioNet, PlantNet, PMST	17	Low. Suitable habitat was not recorded.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Microtis angusii</i>	Angus's Onion Orchid	E	E	Currently known from only one site at Ingleside, north of Sydney. A collection previously thought to be this species was made from Sunny Corner 100 km west of Sydney, but has since been confirmed as being genetically distinct and may possibly be a subspecies. The Ingleside population occurs on soils that have been modified but were originally those of the restricted ridgetop lateritic soils in the Duffys Forest – Terrey Hills – Ingleside and Belrose areas. These soils support a specific and distinct vegetation type, the Duffys Forest Vegetation Community which is listed as an endangered ecological community and ranges from open forest to low open forest and rarely woodland.	BioNet, PMST	1	Low. Suitable habitat was not recorded.
<i>Persicaria elaitor</i>	Tall Knotweed	V	V	This species normally grows in damp places, especially beside streams and lakes. Occasionally in swamp forest or associated with disturbance.	PMST	0	Low. Suitable habitat was not recorded.
<i>Persoonia hirsuta</i>	Hairy Geebung	E	E	The species is distributed from Singleton in the north, along the east coast to Bargo in the south and the Blue Mountains to the west. It has a large area of occurrence, but occurs in small populations. Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone or very rarely on shale. Often occurs in areas with clay influence, in the ecotone between shale and sandstone.	BioNet, PlantNet, PMST	2	Low. Suitable habitat was not recorded.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Persoonia mollis</i> <i>subsp. maxima</i>	-	E	E	Restricted to the Hornsby Heights, Mt Colah area north of Sydney. It occurs on sheltered upper hillsides of narrow gullies of Hawkesbury sandstone characterised his by steep sideslopes, rocky benches and broken scarps, with creeks fed by small streams and intermittent drainage depressions. It grows in moist, tall forest (<i>Angophora costata</i> , <i>Eucalyptus piperita</i> , <i>Corymbia gummifera</i>), often with warm temperate rainforest influences (<i>Syncarpia glomulifera</i> , <i>Ceratopetalum apetalum</i> , <i>Callicoma serratifolia</i>). Sometimes recorded in low densities on the dry upper-hillsides of gullies and in more exposed aspects in association with <i>E. haemastoma</i> and <i>E. punctata</i> .	PlantNet, PMST	0	Low. Suitable habitat was not recorded.
<i>Pimelea curviflora</i> var. <i>curviflora</i>	-	V	V	Confined to coastal areas around Sydney where it grows on sandstone and laterite soils. It is found between South Maroota, Cowan, Narrabeen, Allambie Heights, Northmead and Kellyville, but its former range extended south to the Parramatta River and Port Jackson region including Five Dock, Bellevue Hill and Manly. Usually occurs in woodland in the transition between shale and sandstone, often on Lucas Heights soil landscape.	BioNet, PMST	2	Low. Suitable habitat was not recorded.
<i>Pimelea spicata</i>	Spiked Rice-flower	E	E	This species occurs in two disjunct areas: in coastal districts from Lansdowne to Shellharbour, and in Cumberland Plain Woodland inland to Penrith. In western Sydney it grows on Wianamatta Shales in Greybox – Ironbark Woodland with <i>Bursaria spinosa</i> and <i>Themeda australis</i> . In the Illawarra, it occurs on well structured clay soils in grassland or open woodland.	PMST	0	Low. Suitable habitat was not recorded.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Prostanthera marifolia</i>	Seaforth Mintbush	CE	CE	This species is currently only known from the northern Sydney suburb of Seaforth and is very highly restricted in distribution. Known records of this species occur near the endangered Duffys Forest ecological community. Habitat for this species has been recorded as deeply weathered clay-loam soils associated with ironstone and scattered shale lenses on ridgetops.	BioNet, PMST	2	Low. Suitable habitat was not recorded.
<i>Rhodamnia rubescens</i>	Scrub Turpentine	CE	–	Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of <i>R. rubescens</i> typically occur in coastal regions and occasionally extend inland onto escarpments up to 600 m a.s.l. in areas with rainfall of 1,000–1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	BioNet	2	Low. Suitable habitat was not recorded.
<i>Sarcophilus hartmannii</i>	Hartman's Sarcophilus	V	V	From the Richmond River in northern NSW to Gympie in south-east Queensland. Favours cliff faces on steep narrow ridges supporting eucalypt forest and clefts in volcanic rock from 500 to 1,000 m in altitude. Also found occasionally at the bases of fibrous trunks of trees, including cycads and grass-trees.	BioNet	1	Low. Suitable habitat was not recorded.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E	V	Occurs between Bulahdelah and St Georges Basin where it grows in subtropical and littoral rainforest on sandy soils or stabilized dunes near the sea. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. On the central Coast, Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	BioNet, PMST	24	Low. Suitable habitat was not recorded within the study area. This species can occur as planted individuals. No specimens recorded within the study area.
<i>Tetratheca glandulosa</i>	–	V	–	Occurs from Mangrove Mountain to the Blue Mountains where it grows in sandy or rocky heath or scrub. Associated with shale-sandstone transition habitat where shale-cappings occur over sandstone, with associated soil landscapes such as Lucas Heights, Gynea, Lambert and Faulconbridge. Topographically, the plant occupies ridgetops, upper-slopes and to a lesser extent mid-slope sandstone benches. Soils are generally shallow, consisting of a yellow, clayey/sandy loam. Stony lateritic fragments are also common in the soil profile on many of these ridgetops. Vegetation structure varies from heaths and scrub to woodlands/open woodlands, and open forest. Vegetation communities correspond broadly to Benson & Howell's Sydney Sandstone Ridgetop Woodland (Map Unit 10ar). Common woodland tree species include: <i>Corymbia gummifera</i> , <i>C. eximia</i> , <i>Eucalyptus haemastoma</i> , <i>E. punctata</i> , <i>E. racemosa</i> , and/or <i>E. sparsifolia</i> , with an understorey dominated by species from the families Proteaceae, Fabaceae, and Epacridaceae.	BioNet, PlantNet	22	Low. Suitable habitat was not recorded.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Thesium australe</i>	Austral Toadflax	V	V	Austral Toad-flax is found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (<i>Themeda australis</i>).	PMST	0	Low. Suitable habitat was not recorded.

- (1) Listed as Vulnerable (V), Endangered (E), Endangered populations (EP) or Critically Endangered (CE) under the NSW Biodiversity Conservation Act 2016 (BC Act).
- (2) Listed as Vulnerable (V), Endangered (E) or Critically Endangered (CE) under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).
- (3) Habitat data derived from BioNet (Environment, Energy and Science Group, 2020).
- (4) PMST = Commonwealth Protected Matters Search Tool, BioNet = NSW threatened species spatial search tool

APPENDIX B

THREATENED FAUNA LIKELIHOOD OF OCCURRENCE ASSESSMENT



Table B.1 Threatened fauna likelihood of occurrence assessment

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
Amphibians							
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. Spends more than 95% of its time in non-breeding habitat in areas up to 300 m from breeding sites. Whilst in non-breeding habitat it burrows below the soil surface or in the leaf litter. Breeding habitat of this species is generally soaks or pools within first or second order streams. Species is dependent on hanging swamps on the top of sandstone plateaus and deeply dissected gullies that occur as erosion features in the Sydney Basin.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, coastal, or near coastal populations. These locations occur over the species' former range, however they are widely separated and isolated. Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast (one an island population). There is only one known population on the NSW Southern Tablelands. Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (<i>Typha spp.</i>) or spikerushes (<i>Eleocharis spp.</i>). Optimum habitat includes water-bodies that are unshaded, free of predatory fish such as Plague Minnow (<i>Gambusia holbrooki</i>), have a grassy area nearby and diurnal sheltering sites available.	BioNet	1	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Litoria littlejohni</i>	Littlejohn's Tree Frog	V	V	Littlejohn's Tree Frog has a distribution that includes the plateaus and eastern slopes of the Great Dividing Range from Watagan State Forest (90 km north of Sydney) south to Buchan in Victoria. The majority of records are from within the Sydney Basin Bioregion. Records are isolated and tend to be at high altitude.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Mixophyes balbus</i>	Stuttering Frog	E	V	Occur along the east coast of Australia from southern Queensland to north-eastern Victoria. Considered to have disappeared from Victoria and to have undergone considerable range contraction in NSW, particularly in south-east NSW. It is the only Mixophyes species that occurs in south-east NSW and in recent surveys it has only been recorded at three locations south of Sydney. The Dorrigo region, in north-east NSW, appears to be a stronghold for this species. Found in rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range. Outside the breeding season adults live in deep leaf litter and thick understorey vegetation on the forest floor.	PMST	0	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Pseudophryne australis</i>	Red-crowned Toadlet	V	–	The Red-crowned Toadlet has a restricted distribution. It is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. Occurs in open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Red-crowned Toadlets have not been recorded breeding in waters that are even mildly polluted or with a pH outside the range 5.5 to 6.5. Red-crowned Toadlets are quite a localised species that appear to be largely restricted to the immediate vicinity of suitable breeding habitat. Red-crowned Toadlets are usually found as small colonies scattered along ridges coinciding with the positions of suitable refuges near breeding sites.	BioNet	82	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
Birds							
<i>Anthochaera phrygia</i>	Regent Honeyeater	CE	EM	Inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. Birds are also found in drier coastal woodlands and forests in some years. There are only three known key breeding regions remaining: north-east Victoria (Chiltern-Albury), and in NSW at Capertee Valley and the Bundarra-Barraba region. In NSW the distribution is very patchy and mainly confined to the two main breeding areas and surrounding fragmented woodlands. It inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. It feeds mainly on the nectar from a relatively small number of eucalypts that produce high volumes of nectar. Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany.	BioNet, PMST	6	Low. No suitable habitat recorded within the study area.
<i>Apus pacificus</i>	Fork-tailed Swift	–	M	Breeds in the northern hemisphere, wintering south to Australia. It is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground. It mostly occurs over inland plains but sometimes above foothills or in coastal areas over cliffs, beaches, islands and well out to sea. It also occurs over towns and cities. It mostly occurs over dry and/or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh, grassland, spinifex sandplains, farmland and sand-dunes. It sometimes occurs above forests. It probably roosts aerially, but has occasionally been observed to land.	BioNet	3	Moderate. This species is generally aerial and may occur in airspace over site during migration.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Ardenna tenuirostris</i>	Short-tailed Shearwater	–	M	In summer months, the Short-tailed Shearwater is the most common shearwater along the south and south-east coasts of Australia. Enormous flocks of birds head south to breeding grounds off these coasts as they return from wintering grounds in the North Pacific. The Short-tailed Shearwater establishes massive breeding colonies off the southern and south-eastern coasts of Australia each year. Off the coast of Tasmania, colonies can contain over 16 million adults and other colonies in Victoria and New South Wales hold a further two million or more.	BioNet	2	Low. No suitable habitat recorded within the study area.
<i>Artamus cyanopterus cyanopterus</i>	Dusky Woodswallow	V	–	Dusky woodswallows are widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range. 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. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.	BioNet	12	Low. No suitable habitat recorded within the study area, limited habitat connectivity to larger bushland areas support species.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Botaurus poiciloptilus</i>	Australasian Bittern	E	E	Australasian Bitterns are widespread but uncommon over south-eastern Australia. In NSW they may be found over most of the state except for the far north-west. Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (<i>Typha spp.</i>) and spikerushes (<i>Eleocharis spp.</i>). Feeding platforms may be constructed over deeper water from reeds trampled by the bird; platforms are often littered with prey remains. Breeding occurs in summer from October to January; nests are built in secluded places in densely-vegetated wetlands on a platform of reeds.	BioNet, PMST	2	Low. No suitable habitat recorded within the study area.
<i>Calidris canutus</i>	Red Knot	–	EM	In Australasia the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Calidris ferruginea</i>	Curlew Sandpiper	E	M	Occurs in inter-tidal mudflats of estuaries, lagoons, mangrove channels and also around lakes, dams, floodwaters and flooded saltbush surrounding inland lakes.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Calidris tenuirostris</i>	Great Knot	V	CEM	Generally a coastal species found on tidal mudflats and sandy ocean shores. A migratory species visiting Australian waters between September and March.	PMST	0	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo	V / EP	–	The Gang-gang Cockatoo is distributed from southern Victoria through south- and central-eastern New South Wales. In New South Wales, the Gang-gang Cockatoo is distributed from the south-east coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. It occurs regularly in the Australian Capital Territory. It is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee. In spring and summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In autumn and winter, the species often moves to lower altitudes in drier more open eucalypt forests and woodlands, particularly box-gum and box-ironbark assemblages, or in dry forest in coastal areas and often found in urban areas. May also occur in sub-alpine Snow Gum (<i>Eucalyptus pauciflora</i>) woodland and occasionally in temperate rainforests. Favours old growth forest and woodland attributes for nesting and roosting. Nests are located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts.	BioNet	2	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo	V	–	The species is uncommon although widespread throughout suitable forest and woodland habitats, from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak (<i>Allocasuarina littoralis</i>) and Forest Sheoak (<i>A. torulosa</i>) are important foods. Inland populations feed on a wide range of sheoaks, including Drooping Sheoak, <i>Allocasuarina diminuta</i> , and <i>A. gymnathera</i> . Belah is also utilised and may be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak, but also recorded in open woodlands dominated by Belah (<i>Casuarina cristata</i>). Feeds almost exclusively on the seeds of several species of she-oak (<i>Casuarina</i> and <i>Allocasuarina</i> species), shredding the cones with the massive bill. Dependent on large hollow-bearing eucalypts for nest sites.	BioNet	10	Low. No suitable habitat recorded within the study area.
<i>Charadrius leschenaultii</i>	Greater Sand Plover	V	VM	Entirely coastal in NSW foraging on intertidal sand and mudflats in estuaries, and roosting during high tide on sand beaches or rocky shores. A migratory species it is found in New South Wales generally during the summer months.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Charadrius mongolus</i>	Lesser Sand Plover	V	EM	Migratory bird that migrates from the northern hemisphere to coastal areas of northern and east coast of Australia. The species is almost strictly coastal during the non-breeding season, preferring sandy beaches, mudflats of coastal bays and estuaries, sand-flats and dunes near the coast, occasionally frequenting mangrove mudflats.	PMST	0	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Cuculus optatus</i>	Oriental Cuckoo	–	M	A non-breeding migrant to Australia, it often inhabits rainforest, vine thickets, wet sclerophyll forest and open woodland and sometimes occurs in mangroves, wooded swamps and as vagrants in gardens. The population trend appears to be stable.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V	–	The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decortivating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy.	BioNet	2	Low. No suitable habitat recorded within the study area.
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E1	E	The distribution of the Eastern Bristlebird has contracted to three disjunct areas of south-eastern Australia. There are three main populations: Northern - southern Queensland/northern NSW, Central – Barren Ground NR, Budderoo NR, Woronora Plateau, Jervis Bay NP, Booderee NP and Beecroft Peninsula and Southern – Nadgee NR and Croajingalong NP in the vicinity of the NSW/Victorian border. Habitat for central and southern populations is characterised by dense, low vegetation including heath and open woodland with a heathy understorey. In northern NSW the habitat occurs in open forest with dense tussocky grass understorey and sparse mid-storey near rainforest ecotone; all of these vegetation types are fire prone. Age of habitat since fires (fire-age) is of paramount importance to this species.	PMST	0	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Egretta sacra</i>	Eastern Reef Egret	–	M	The Eastern Reef Egret is found on the coast and islands of most of Australia, but is more common on the Queensland coast and Great Barrier Reef than elsewhere. It is now rare on Victorian and Tasmanian coasts. The Eastern Reef Egret lives on beaches, rocky shores, tidal rivers and inlets, mangroves, and exposed coral reefs.	BioNet	1	Low. No suitable habitat recorded within the study area.
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E	–	The Black-necked Stork is restricted mainly to coastal and near-coastal areas of northern and eastern Australia. Throughout the monsoonal areas of northern Australia, the Black-necked Stork is still widespread, but fewer numbers appear southwards to eastern Australia.	BioNet	1	Low. No suitable habitat recorded within the study area.
<i>Glossopsitta pusilla</i>	Little Lorikeet	V	–	The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. NSW provides a large portion of the species' core habitat, with lorikeets found westward as far as Dubbo and Albury. Nomadic movements are common, influenced by season and food availability, although some areas retain residents for much of the year and 'locally nomadic' movements are suspected of breeding pairs. Forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence greater productivity.	BioNet	6	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Grantiella picta</i>	Painted Honeyeater	V	V	The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of the bird and almost all breeding occurs on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree/Weeping Myall (<i>Acacia pendula</i>), Brigalow (<i>A. harpophylla</i>) 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 <i>Amyema</i> .	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	V	M	The White-bellied Sea-eagle is distributed around the Australian coastline, including Tasmania, and well inland along rivers and wetlands of the Murray Darling Basin. In New South Wales it is widespread along the east coast, and along all major inland rivers and waterways. Habitats are characterised by the presence of large areas of open water including larger rivers, swamps, lakes, and the sea. Occurs at sites near the sea or sea-shore, such as around bays and inlets, beaches, reefs, lagoons, estuaries and mangroves; and at, or in the vicinity of freshwater swamps, lakes, reservoirs, billabongs and saltmarsh. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, and forest (including rainforest). Breeding habitat consists of mature tall open forest, open forest, tall woodland, and swamp sclerophyll forest close to foraging habitat. Nest trees are typically large emergent eucalypts and often have emergent dead branches or large dead trees nearby which are used as 'guard roosts'. Feed mainly on fish and freshwater turtles, but also waterbirds, reptiles, mammals and carrion.	BioNet	50	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Hieraetus morphnoides</i>	Little Eagle	V	–	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. Nests in tall living trees within a remnant patch, where pairs build a large stick nest in winter. Preys on birds, reptiles and mammals, occasionally adding large insects and carrion.	BioNet	2	Low. No suitable habitat recorded within the study area.
<i>Hirundapus caudacutus</i>	White-throated Needletail	–	M	Widespread in eastern and south-eastern Australia. In eastern Australia, it is recorded in all coastal regions of Queensland and NSW, extending inland to the western slopes of the Great Divide and occasionally onto the adjacent inland plains. It is almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. Because they are aerial, it has been stated that conventional habitat descriptions are inapplicable, but there are, nevertheless, certain preferences exhibited by the species. Although they occur over most types of habitat, they are probably recorded most often above wooded areas, including open forest and rainforest, and may also fly between trees or in clearings, below the canopy, but they are less commonly recorded flying above woodland. They also commonly occur over heathland, but less often over treeless areas, such as grassland or swamps. When flying above farmland, they are more often recorded above partly cleared pasture, plantations or remnant vegetation at the edge of paddocks. In coastal areas, they are sometimes seen flying over sandy beaches or mudflats and often around coastal cliffs and other areas with prominent updraughts, such as ridges and sand-dunes.	BioNet, PMST	34	Moderate. This species is generally aerial and may occur in airspace over site during migration.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Ixobrychus flavicollis</i>	Black Bittern	V		The Black Bittern has a wide distribution, from southern NSW north to Cape York and along the north coast to the Kimberley region. The species also occurs in the south-west of Western Australia. In NSW, records of the species are scattered along the east coast, with individuals rarely being recorded south of Sydney or inland. Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves. Feeds on frogs, reptiles, fish and invertebrates, including snails, dragonflies, shrimps and crayfish, with most feeding done at dusk and at night. During the day, roosts in trees or on the ground amongst dense reeds.	BioNet	6	Low. No suitable habitat recorded within the study area.
<i>Lathamus discolor</i>	Swift Parrot	E	CE	Breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany <i>Eucalyptus robusta</i> , Spotted Gum <i>Corymbia maculata</i> , Red Bloodwood <i>C. gummifera</i> , Mugga Ironbark <i>E. sideroxylon</i> , and White Box <i>E. albens</i> . Commonly used lerp infested trees include Inland Grey Box <i>E. microcarpa</i> , Grey Box <i>E. moluccana</i> and Blackbutt <i>E. pilularis</i> .	BioNet, PMST	12	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Limosa lapponica baueri</i>	Bar-tailed Godwit	–	M	The Bar-tailed Godwit has been recorded in the coastal areas of all Australian states. It is widespread in the Torres Strait and along the east and south-east coasts of Queensland, NSW and Victoria, including the offshore islands. Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh. It has been sighted in coastal sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. It is rarely found on inland wetlands or in areas of short grass, such as farmland, paddocks and airstrips, although it is commonly recorded in paddocks at some locations overseas.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Lophoictinia isura</i>	Square-tailed Kite	V	–	The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	BioNet	6	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Merops ornatus</i>	Rainbow Bee-eater	–	M	The Rainbow Bee-eater is found throughout mainland Australia. The Rainbow Bee-eater is most often found in open forests, woodlands and shrublands, and cleared areas, usually near water. It will be found on farmland with remnant vegetation and in orchards and vineyards. It will use disturbed sites such as quarries, cuttings and mines to build its nesting tunnels.	BioNet	1	Low. No suitable habitat recorded within the study area.
<i>Monarcha melanopsis</i>	Black-faced Monarch	–	M	Occurs in rainforests, eucalypt woodlands, coastal scrubs, damp gullies in rainforest, eucalypt forest and in more open woodland when migrating.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Monarcha trivirgatus</i>	Spectacled Monarch	–	M	Occurs in the understorey of mountain/lowland rainforests, thickly wooded gullies and waterside vegetation. Migrates to NE NSW in summer to breed.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Motacilla flava</i>	Yellow Wagtail	–	M	This species occurs in a range of habitats including estuarine habitats such as sand dunes, mangrove forests and coastal saltmarshes. This species also occurs in open grassy areas including disturbed sites such as sports grounds and has been recorded on the edges of wetlands, swamps, lakes and farm dams. This species migrates from Asia to Australia in spring-summer. It has been recorded in the estuarine areas of the Hunter River in Newcastle NSW and in QLD and the north of NT and WA.	PMST	0	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	E	E	The Southern Brown Bandicoot has a patchy distribution. It is found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River, southern coastal Victoria and the Grampian Ranges, south-eastern South Australia, south-west Western Australia and the northern tip of Queensland. They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils. They feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogeous (underground-fruiting) fungi. Their searches for food often create distinctive conical holes in the soil. Males have a home range of approximately 5–20 hectares whilst females forage over smaller areas of about 2–3 hectares.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Nettapus coromandelianus</i>	Cotton Pygmy-Goose	E	–	Although once found from north Queensland to the Hunter River in NSW, the Cotton Pygmy-Goose is now only a rare visitor to NSW. Uncommon in Queensland. Freshwater lakes, lagoons, swamps and dams, particularly those vegetated with waterlilies and other floating and submerged aquatic vegetation.	BioNet	4	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Ninox connivens</i>	Barking Owl	V	–	The Barking Owl is found throughout continental Australia except for the central arid regions. Although common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey on these fertile riparian soils. Preferentially hunts small arboreal mammals such as Squirrel Gliders and Common Ringtail Possums, but when loss of tree hollows decreases these prey populations the owl becomes more reliant on birds, invertebrates and terrestrial mammals such as rodents and rabbits. Requires very large permanent territories in most habitats due to sparse prey densities. Monogamous pairs hunt over as much as 6000 hectares, with 2000 hectares being more typical in NSW habitats.	BioNet	10	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Ninox strenua</i>	Powerful Owl	V	–	The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to south-western Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations. It inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. It requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine <i>Syncarpia glomulifera</i> , Black She-oak <i>Allocasuarina littoralis</i> , Blackwood <i>Acacia melanoxylon</i> , Rough-barked Apple <i>Angophora floribunda</i> , Cherry Ballart <i>Exocarpus cupressiformis</i> and a number of eucalypt species. The main prey items are medium-sized arboreal marsupials, particularly the Greater Glider, Common Ringtail Possum and Sugar Glider.	BioNet	507	Moderate. This species has been widely recorded within locality of the study area. Though vegetation within the study area is unlikely to provide breeding/roosting habitat, it may form part of the species foraging habitat.
<i>Numenius madagascariensis</i>	Eastern Curlew	–	CEM	Inhabits coastal estuaries, mangroves, mud flats and sand pits. It is a migratory shorebird which generally inhabits sea and lake shore mud flats, deltas and similar areas, where it forages for crabs and other crustaceans, clam worms and other annelids, molluscs, insects and other invertebrates. Its migration route ranges from its wintering grounds in Australia to its breeding grounds in northern China, Korea and Russia.	PMST	0	Low. No suitable habitat recorded within the study area.

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<i>Numenius minutus</i>	Little Curlew	–	M	On passage the species shows a preference for foraging and resting in swampy meadows near lakes and along river valleys. It overwinters on dry inland grassland, bare cultivation, dry mudflats and coastal plains of black soil with scattered shallow pools of freshwater, swamps, lakes or flooded ground. It shows a preference for short grass swards of less than 20 cm tall, and occasionally occurs in dry saltmarshes, coastal swamps, mudflats or sandflats in estuaries, or on the beaches of sheltered coasts.	BioNet	3	Low. No suitable habitat recorded within the study area.
<i>Pandion cristatus</i>	Eastern Osprey	V	M	Eastern Ospreys are found right around the Australian coast line, except for Victoria and Tasmania. They are common around the northern coast, especially on rocky shorelines, islands and reefs. The species is uncommon to rare or absent from closely settled parts of south-eastern Australia. There are a handful of records from inland areas. Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water.	BioNet	8	Low. No suitable habitat recorded within the study area.
<i>Pluvialis squatarola</i>	Grey Plover	–	M	The Grey Plover breeds around the Arctic regions and migrates to the southern hemisphere, being a regular summer migrant to Australia, mostly to the west and south coasts. The Grey Plover is almost entirely coastal, being found mainly on marine shores, inlets, estuaries and lagoons with large tidal mudflats or sandflats for feeding, sandy beaches for roosting, and also on rocky coasts.	BioNet	2	Low. No suitable habitat recorded within the study area.
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	The Superb Parrot is found throughout eastern inland NSW. Inhabit Box-Gum, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest.	BioNet	1	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Ptilinopus regina</i>	Rose-crowned Fruit-Dove	V	–	Coast and ranges of eastern NSW and Queensland, from Newcastle to Cape York. Vagrants are occasionally found further south to Victoria. Rose-crowned Fruit-doves occur mainly in sub-tropical and dry rainforest and occasionally in moist eucalypt forest and swamp forest, where fruit is plentiful.	BioNet	1	Low. No suitable habitat recorded within the study area.
<i>Ptilinopus superbus</i>	Superb Fruit-Dove	V	–	The Superb Fruit-dove occurs principally from north-eastern in Queensland to north-eastern NSW. It is much less common further south, where it is largely confined to pockets of suitable habitat as far south as Moruya. There are records of vagrants as far south as eastern Victoria and Tasmania. Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees. Part of the population is migratory or nomadic.	BioNet	13	Low. No suitable habitat recorded within the study area.
<i>Rhipidura rufifrons</i>	Rufous Fantail	–	M	Occurs in a range of habitats including the undergrowth of rainforests/wetter eucalypt forests/gullies, monsoon forests paperbarks, sub-inland and coastal scrubs, mangroves, watercourses, parks and gardens. When migrating they may also be recorded on farms, streets and buildings. Migrates to SE Australia in October-April to breed, mostly in or on the coastal side of the Great Dividing Range.	PMST	0	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Rostratula australis</i>	Australian Painted Snipe	E	VM	The Australian Painted Snipe is restricted to Australia. Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. In NSW many records are from the Murray-Darling Basin including the Paroo wetlands, Lake Cowal, Macquarie Marshes, Fivebough Swamp and more recently, swamps near Balldale and Wanganella. Other important locations with recent records include wetlands on the Hawkesbury River and the Clarence and lower Hunter Valleys. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Tyto novaehollandiae</i>	Masked Owl	V	–	Extends from the coast where it is most abundant to the western plains. Overall records for this species fall within approximately 90% of NSW, excluding the most arid north-western corner. Lives in dry eucalypt forests and woodlands from sea level to 1100 m, this species is a forest owl, but often hunts along the edges of forests. Roosts and breeds in moist eucalypt forested gullies, using large tree hollows or sometimes caves for nesting.	BioNet	1	Low. No suitable habitat recorded within the study area.
<i>Tyto tenebricosa</i>	Sooty Owl	V	–	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the Common Ringtail Possum or Sugar Glider.	BioNet	2	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
Insects							
<i>Pommerhelix duralensis</i>	Dural Land Snail	E	E	The species is a shale-influenced-habitat specialist, which occurs in low densities along the western and northwest fringes of the Cumberland IBRA subregion on shale-sandstone transitional landscapes. The species is definitely found within the Local Government Areas of The Hills Shire, Hawkesbury Shire and Hornsby Shire. Records from the Blue Mountains City, Penrith City and Parramatta City may represent this species. 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. It does not burrow nor climb. The species has also been observed resting in exposed areas, such as on exposed rock or leaf litter, however it will also shelter beneath leaves, rocks and light woody debris. Migration and dispersal is limited, with overnight straight-line distances of under 1 metre identified in the literature and studies. The main food sources are hyphae and fruiting bodies of native fungi. It is possible other detritus may be consumed.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Synemon plana</i>	Golden Sun Moth	E	CE	The Golden Sun Moth's NSW populations are found in the area between Queanbeyan, Gunning, Young and Tumut. The species' historical distribution extended from Bathurst (central NSW) through the NSW Southern Tablelands, through to central and western Victoria, to Bordertown in eastern South Australia.	PMST	0	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
Mammals							
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V	–	The Eastern Pygmy-possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW it extends from the coast inland as far as the Pilliga, Dubbo, Parkes and Wagga Wagga on the western slopes. Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable.	BioNet	20	Low. No suitable habitat recorded within the study area.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Found mainly in areas with extensive cliffs and caves, from Rockhampton in Queensland south to Bungonia in the NSW Southern Highlands. It is generally rare with a very patchy distribution in NSW. Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (<i>Petrochelidon ariel</i>), frequenting low to mid-elevation dry open forest and woodland close to these features.	PMST	0	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	Found in eastern NSW, eastern Victoria, south-east and north-eastern Queensland, and Tasmania. 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. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den sites. Females occupy home ranges up to about 750 hectares and males up to 3500 hectares. Are known to traverse their home ranges along densely vegetated creeklines.	BioNet, PMST	8	Low. No suitable habitat recorded within the study area.
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	–	The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. Prefers moist habitats, with trees taller than 20 m. Generally roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	BioNet	7	Low. No suitable habitat recorded within the study area.
<i>Isoodon obesulus obesulus</i>	Southern Brown Bandicoot (eastern)	E	E	The Southern Brown Bandicoot has a patchy distribution. It is found in south-eastern NSW, east of the Great Dividing Range south from the Hawkesbury River, southern coastal Victoria and the Grampian Ranges, south-eastern South Australia, south-west Western Australia and the northern tip of Queensland. They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils. They feed on a variety of ground-dwelling invertebrates and the fruit-bodies of hypogeous (underground-fruited) fungi. Their searches for food often create distinctive conical holes in the soil. Males have a home range of approximately 5–20 hectares whilst females forage over smaller areas of about 2–3 hectares.	BioNet, PMST	90	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Micronomus norfolkensis</i>	Eastern Coastal Free-tailed Bat	V	–	The Eastern Freetail-bat is found along the east coast from south Queensland to southern NSW. 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.	BioNet	12	Low. No suitable habitat recorded within the study area.
<i>Miniopterus australis</i>	Little Bent-winged Bat	V	–	Found along east coast and ranges of Australia from Cape York in Queensland to Wollongong in NSW. Moist eucalypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. Generally found in well-timbered areas. Little Bentwing-bats roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day, and at night forage for small insects beneath the canopy of densely vegetated habitats. Only five nursery sites /maternity colonies are known in Australia.	BioNet	23	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Miniopterus orianae oceanensis</i>	Large Bent-winged Bat	V	–	Eastern Bentwing-bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Populations disperse within about 300 km range of maternity caves. Hunt in forested areas, catching moths and other flying insects above the tree tops.	BioNet	85	Low. No suitable habitat recorded within the study area. Any man-made structures associated with Roseville Station which may be suitable for this species would be subject to a high level of disturbance (noise, vibrations, light) and unlikely to support species.
<i>Myotis macropus</i>	Southern Myotis	V	–	The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. Generally roost in groups of 10–15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	BioNet	27	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Petauroides volans</i>	Greater Glider	–	V	The Greater Glider has a restricted distribution in eastern Australia, from the Windsor Tableland in north Queensland to central Victoria, with an elevated range from sea level to 1200 m above sea level. The species is largely restricted to eucalypt forests and woodlands, feeds exclusively on eucalypt leaves, buds, flowers and mistletoe. It is found in abundance in montane eucalypt forest with relatively old trees and an abundance of hollows. It also favours forests with a diversity of eucalypts to cater for seasonal variation in food abundance.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Petaurus australis</i>	Yellow-bellied Glider	V	–	Restricted to tall, mature eucalypt forest in high rainfall areas of temperate to sub-tropical eastern Australia. Feeds on nectar, pollen, the sap of eucalypts and sometimes insects. Preferred habitats are productive, tall open sclerophyll forests where mature trees provide shelter and nesting hollows and year round food resources are available from a mixture of eucalypt species.	BioNet	1	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Petrogale penicillata</i>	Brush-tailed Rock Wallaby	E	V	The range of the Brush-tailed Rock-wallaby extends from south-east Queensland to the Grampians in western Victoria, roughly following the line of the Great Dividing Range. However the distribution of the species across its original range has declined significantly in the west and south and has become more fragmented. In NSW they occur from the Queensland border in the north to the Shoalhaven in the south, with the population in the Warrumbungle Ranges being the western limit. Occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges, often facing north. Browse on vegetation in and adjacent to rocky areas eating grasses and forbs as well as the foliage and fruits of shrubs and trees. Shelter or bask during the day in rock crevices, caves and overhangs and are most active at night. Highly territorial and have strong site fidelity with an average home range size of about 15 ha.	PMST	0	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Phascolarctos cinereus</i>	Koala	V	V	The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. It was briefly historically abundant in the 1890s in the Bega District on the south coast of NSW, although not elsewhere, but it now occurs in sparse and possibly disjunct populations. Koalas are also known from several sites on the southern tablelands. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. Some preferred species include Forest Red Gum, Grey Gum. In coastal areas, Tallowwood and Swamp Mahogany are important food species, while in inland areas White Box, Bimble Box and River Red Gum are favoured. Home range size varies with quality of habitat, ranging from less than two ha to several hundred hectares in size.	BioNet, PMST	3	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	–	V	The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Genetic evidence indicates that the New Holland Mouse once formed a single continuous population on mainland Australia and the distribution of recent subfossils further suggest that the species has undergone a large range contraction since European settlement. Total population size of mature individuals is now estimated to be less than 10,000 individuals although, given the number of sites from which the species is known to have disappeared between 1999 and 2009, it is likely that the species' distribution is actually smaller than current estimates. Known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes.	BioNet, PMST	3	Low. No suitable habitat recorded within the study area.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Grey-headed Flying-foxes are generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Can travel up to 50 km from the camp to forage; commuting distances are more often <20 km. Feed on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.	BioNet, PMST	1401	High. Non-native vegetation recorded is likely to support this species and provide foraging habitat as part of a large home range. No breeding camps were recorded or are known within close-proximity to the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail-bat	V	–	The Yellow-bellied Sheathtail-bat is a wide-ranging species found across northern and eastern Australia. In the most southerly part of its range – most of Victoria, south-western NSW and adjacent South Australia – It is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North-West Slopes. Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	BioNet	6	Low. No suitable habitat recorded within the study area.
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	–	The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Dividing Range, from north-eastern Victoria to the Atherton Tableland. It extends to the coast over much of its range. In NSW it is widespread on the New England Tablelands, however does not occur at altitudes above 500 m. Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings. Forages after sunset, flying slowly and directly along creek and river corridors at an altitude of 3–6 m.	BioNet	2	Low. No suitable habitat recorded within the study area.

SCIENTIFIC NAME	COMMON NAME	BC ACT ¹	EPBC ACT ²	HABITAT ³	SOURCE ⁴	BIONET RECORDS	LIKELIHOOD OF OCCURRENCE
Reptiles							
<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E	V	The Broad-headed Snake is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250 km of Sydney. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in cervices or hollows in large trees within 500 m of escarpments in summer.	PMST	0	Low. No suitable habitat recorded within the study area.
<i>Varanus rosenbergi</i>	Rosenberg's Goanna	V	–	Rosenberg's Goanna occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. There are records from the South West Slopes near Khancoban and Tooma River. Found in heath, open forest and woodland and associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens.	BioNet	17	Low. No suitable habitat recorded within the study area.

- (1) Listed as Vulnerable (V), Endangered (E1), Endangered populations (E2) or Critically Endangered (CE) under the NSW Biodiversity Conservation Act 2016 (BC Act).
- (2) Listed as Vulnerable (V), Endangered (E) or Critically Endangered (CE) under the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).
- (3) Habitat data derived from BioNet (Environment, Energy and Science Group, 2020).
- (4) PMST = Commonwealth Protected Matters Search Tool, BioNet = NSW threatened species spatial search tool

Note: due to no marine habitat present within or adjacent to the study area, marine species were not included within the likelihood of occurrence assessment.

APPENDIX C

FLORA SPECIES RECORDED



C1 FLORA SPECIES RECORDED

Table C.1 Flora species recorded

FAMILY	SCIENTIFIC NAME	COMMON NAME
Aceraceae	<i>Acer negundo</i> *	Box Elder
Alliaceae	<i>Agapanthus praecox subsp. orientalis</i> *	Agapanthus
Altingiaceae	<i>Liquidambar orientalis</i> *	Oriental Sweetgum
Apocynaceae	<i>Araujia sericifera</i> *	Moth Vine
Apocynaceae	<i>Nerium oleander</i> *	Oleander
Araceae	<i>Monstera deliciosa</i> *	Fruit Salad Plant
Araliaceae	<i>Hedera helix</i> *	Ivy
Arecaceae	<i>Phoenix canariensis</i> *	Canary Island Date Palm
Arecaceae	<i>Washingtonia robusta</i> *	Mexican Washingtonia
Asparagaceae	<i>Asparagus aethiopicus</i> *	Asparagus Fern, Sprengeri Fern
Asteraceae	<i>Ageratina riparia</i> *	Mistflower
Bignoniaceae	<i>Jacaranda mimosifolia</i> *	Jacaranda
Caprifoliaceae	<i>Viburnum tinus</i> *	Laurestinus
Convolvulaceae	<i>Ipomoea indica</i> *	Blue Morning Glory
Cupressaceae	<i>Chamaecyparis lawsoniana</i> *	Lawson's Cypress
Fabaceae (Caesalpinioideae)	<i>Senna pendula</i> *	Easter Cassia
Fabaceae (Faboideae)	<i>Genista monspessulana</i> *	Montpellier Broom

FAMILY	SCIENTIFIC NAME	COMMON NAME
Fabaceae (Mimosoideae)	<i>Acacia baileyana</i>	Cootamundra Wattle
Fagaceae	<i>Quercus robur</i> *	English Oak
Lauraceae	<i>Cinnamomum camphora</i> *	Camphor Laurel
Lomandraceae	<i>Lomandra longifolia</i>	Spiny-headed Mat-rush
Magnoliaceae	<i>Magnolia grandiflora</i> *	Bull Bay
Moraceae	<i>Ficus eastica</i> *	Rubber Tree
Moraceae	<i>Ficus microcarpa</i> var. <i>hillii</i>	Small-fruited Fig
Myrtaceae	<i>Angophora floribunda</i>	Rough-barked Apple
Myrtaceae	<i>Callistemon</i> sp. (Cultivar)	–
Myrtaceae	<i>Lophostemon confertus</i>	Brush Box
Myrtaceae	<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark
Myrtaceae	<i>Melaleuca styphelioides</i>	Prickly-leaved Tea Tree
Myrtaceae	<i>Syzygium luehmannii</i>	Riberry
Ochnaceae	<i>Ochna serrulata</i> *	Mickey Mouse Plant
Oleaceae	<i>Fraxinus griffithii</i> *	Evergreen Ash
Oleaceae	<i>Ligustrum lucidum</i> *	Large-leaved Privet
Oleaceae	<i>Olea europaea</i> *	Common Olive
Poaceae	<i>Digitaria ciliaris</i> *	Summer Grass
Poaceae	<i>Ehrharta erecta</i> *	Panic Veldtgrass
Poaceae	<i>Paspalum dilatatum</i> *	Paspalum
Portulacaceae	<i>Portulaca oleracea</i>	Pigweed

FAMILY	SCIENTIFIC NAME	COMMON NAME
Proteaceae	<i>Banksia spinulosa</i>	Hairpin Banksia
Proteaceae	<i>Grevillea robusta</i>	Silky Oak
Sapindaceae	<i>Alectryon tomentosus</i>	Hairy Bird's Eye
Sapindaceae	<i>Cardiospermum grandiflorum</i> *	Balloon Vine
Simaroubaceae	<i>Ailanthus altissima</i> *	Tree-of-heaven
Solanaceae	<i>Physalis alkekengi</i> *	Chinese Lantern
Solanaceae	<i>Solanum nigrum</i> *	Black-berry Nightshade
Sterculiaceae	<i>Brachychiton acerifolius</i> *	Illawarra Flame Tree
Strelitziaceae	<i>Strelitzia nicolai</i> *	Travellers Palm
Ulmaceae	<i>Celtis sinensis</i> *	Chinese Nettle Tree
Ulmaceae	<i>Ulmus parvifolia</i> *	Chinese Elm
Verbenaceae	<i>Lantana camara</i> *	Lantana
Verbenaceae	<i>Lantana montevidensis</i> *	–

* denotes exotic species

APPENDIX D

SIGNIFICANT IMPACT ASSESSMENTS



D1 GREY-HEADED FLYING-FOX

STATUS

The Grey-headed Flying-fox is listed as Vulnerable under the BC Act and EPBC Act.

DESCRIPTION

The Grey-headed Flying-fox is generally found within 200 km of the eastern coast of Australia, from Rockhampton to Adelaide. The species may be found in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps, while additional foraging is provided by urban gardens and cultivated fruit crops. The Grey-headed Flying-fox is a highly mobile species with a nightly feeding range of 20 to 50 km from a roosting camp. Diet typically comprises of a wide variety of flowering and fruiting plants (Tidemann 1995, Churchill 1998) with non-indigenous and exotic tree species introduced to the urban landscape providing additional foraging habitat for this species. Grey-headed Flying-foxes roost in large numbers, with up to tens of thousands of flying foxes using individual camps for mating, birth and rearing of young.

THREATS

Recognised threats to this community include:

- loss of roosting and foraging sites
- electrocution on powerlines, entanglement in netting and on barbed-wire
- heat stress
- conflict with humans
- incomplete knowledge of abundance and distribution across the species' range.

SPECIFIC IMPACTS

The Proposal area provides suitable foraging habitat in the form of native and exotic horticultural plantings. Approximately 0.05 ha, representing potential foraging habitat will be removed as part of the Proposal, however this represents only a small component of locally occurring resources that are accessible to this species in the locality.

D1.1 BC ACT SIGNIFICANCE ASSESSMENT

In the case of a threatened species, whether the action proposed 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 majority of the proposal area contains planted horticultural native and exotic vegetation with the majority of native tree species being of a semi-mature age class. Due to the relatively small amount of Grey-headed Flying-fox foraging habitat to be removed (0.05 ha) from within the proposal area and the abundance of similar and greater quality habitat elsewhere in the locality, the action proposed is unlikely 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. No roosting camps were identified within or near the Proposal area (Department of the Environment, 2020).

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- *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*

Not applicable

- *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

In relation to the habitat of a threatened species, population or ecological community:

- *the extent to which habitat is likely to be removed or modified as a result of the action proposed*

A relatively small patch of horticultural native and exotic plantings representing a small amount of foraging habitat would be affected by the Proposal. However, the Grey-headed Flying-fox would not be restricted to habitat resources within the study site as this species is likely to use similar habitat resources within the wider locality

- *whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and*

Habitat connectivity is not likely to be affected by the Proposal. The majority of the Proposal area occurs on previously disturbed land and is dominated by horticultural native and exotic plantings. Given that the Grey-headed Flying-fox is highly mobile, regularly foraging up to 50 km from camp sites, and that similar or greater quality foraging resources occur widely in the locality, it is considered unlikely that habitat would become further isolated or fragmented significantly beyond that currently existing within the subject site.

- *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.*

While potential foraging habitat was observed in the Proposal area, no camps were recorded within or near the Proposal area. Grey-headed Flying-foxes regularly forage up to 50 km from roost sites (NSW National Parks and Wildlife Service 2001b). An abundance of similar or greater quality habitat is available in the wider locality. Therefore, the removal of a relatively small amount of suitable foraging habitat (0.05 ha) is not considered likely to significantly affect the availability of quality habitat for this species.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Areas of declared critical habitat under the *Threatened Species Conservation Act 1995*, are now labelled as ‘Areas of Outstanding Biodiversity Values’ (AOBVs) in NSW with the commencement of the BC Act. The *Biodiversity Conservation Regulation 2017* establishes the criteria for declaring AOBVs. The criteria have been designed to identify the most valuable sites for biodiversity conservation in NSW. The Proposal area will not impact any declared AOBVs nor are there any AOBVs identified for this species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A Draft National Recovery Plan for the Grey-headed Flying-fox was published in 2009 (Department of Environment Climate Change and Water NSW 2009), which detailed 12 objectives to help recover this species (Table D.1). In addition, the Office of Environment and Heritage has assigned the species to the landscape species management stream under the Saving our Species program (Office of Environment and Heritage 2017). No priority sites have been identified within the study area or within the locality for the species.

Table D.1 Recovery actions for Grey-headed Flying-fox

ACTION TOOLBOX	LIKELY TO BE AFFECTED BY THE PROPOSAL AREA?
Identify and protect foraging habitat critical to the survival of Grey-headed Flying-foxes throughout their range.	Not applicable
Protect and increase the extent of key winter and spring foraging habitat of Grey-headed Flying-foxes.	Inconsistent – Proposal area will remove a small patch of foraging habitat (0.05 ha)
Identify roosting habitat critical to the survival of Grey-headed Flying-foxes.	Not applicable
Protect and enhance roosting habitat critical to the survival of Grey-headed Flying-foxes.	Not applicable
Substantially reduce deliberate destruction of Grey-headed Flying-foxes in fruit crops.	Not applicable
Reduce negative public attitudes toward Grey-headed Flying-foxes and reduce conflict with humans.	Not applicable
Increase public awareness and understanding of Grey-headed Flying-foxes and the recovery program, and to involve the community in recovery actions.	Not applicable
Monitor population trends in Grey-headed Flying-foxes so as to monitor the species' national distribution and status.	Not applicable
Assess and reduce the impact on Grey-headed Flying-foxes of electrocution on powerlines and entanglement in netting and on barbed-wire.	Not applicable
Improve knowledge of the demographics and population structure of Grey-headed Flying-foxes in order to increase understanding of the ecological requirements of the species.	Not applicable
Increase the effectiveness and efficiency of recovery initiatives for Grey-headed Flying-foxes by working cooperatively with conservation and management programs.	Not applicable
Maintain an effective Grey-headed Flying-fox National Recovery Team to oversee the implementation of the Grey-headed Flying-fox National Recovery Plan.	Not applicable

The Proposal area is inconsistent with one recovery objective, due to the removal of a small patch of foraging habitat. The impact of a relatively small amount of suitable foraging habitat (0.05 ha), is not considered likely to significantly affect the recovery of the species.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to Grey-headed Flying-fox, the Proposal is consistent with one Key Threatening Processes under the BC Act:

- clearing of native vegetation.

Approximately 0.05 ha of habitat would be impacted by the Proposal. The extent of vegetation clearing and habitat removal associated with the Proposal area is considered relatively small in terms of the available habitat for these species within the surrounding landscape, although it is considered to be an incremental loss of suitable habitat locally.

Conclusion

The Proposal will remove a negligible area of horticultural native and exotic plantings. As an abundance of similar and higher quality habitat occurs nearby and in the wider locality, and no breeding habitat is to be disturbed, the action proposed is unlikely to lead to a significant impact on the Grey-headed Flying-fox or its habitat.

D1.2 EPBC ACT SIGNIFICANCE ASSESSMENT FOR GREY-HEADED FLYING-FOX

Is this an important population?

Grey-headed Flying-foxes occur across a range of wooded habitats where their favoured food, eucalypt blossom occurs. They set up roosting camps in association with blossom and fruiting availability, which are usually situated in dense vegetation and associated with water. Grey-headed Flying-foxes can migrate up to 75 km north during the winter and during this time young flying-foxes establish camps.

The Proposal area does not contain suitable habitat for roosting camps and such habitat does not occur within its close vicinity. Therefore, a population of Grey-headed Flying-fox in the Proposal area is not considered to be important, as no roost sites would be affected by the Proposal.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following:

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will result in one or more of the following.

Lead to a long-term decrease in the size of an important population of a species

Not applicable. Grey-headed Flying-fox in the subject site is not part of an important population (refer to above) and onsite habitats are not considered important for the maintenance of local flying-foxes.

Reduce the area of occupancy of an important population

Not applicable. Grey-headed Flying-fox in the subject site is not part of an important population (refer to above) and onsite habitats are not considered important for the maintenance of local flying-foxes.

Fragment an existing important population into two or more populations

Not applicable. Grey-headed Flying-fox in the subject site is not part of an important population (refer to above) and onsite habitats are not considered important for the maintenance of local flying-foxes.

Adversely affect habitat critical to the survival of a species

No critical habitat is listed for the Grey-headed Flying-fox under the EPBC Act.

Habitat critical to the survival of a species may also include areas that are not listed on the Register of Critical Habitat if they are necessary:

- for activities such as foraging, breeding, roosting, or dispersal
- for the long-term maintenance of the species or ecological community (including the maintenance of species essential to the survival of the species or ecological community, such as pollinators)
- to maintain genetic diversity and long-term evolutionary development
- for the reintroduction of populations or recovery of the species or ecological community.

The Proposal will not adversely affect habitat considered critical to this species.

Disrupt the breeding cycle of an important population

Not applicable. Grey-headed Flying-fox in the study area is not part of an important population (refer to above) and onsite habitats are not considered important for the breeding cycle of local flying-foxes.

Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline

No. The Proposal would only affect a small area of suitable foraging habitat for this species (0.05 ha). As this species is known to forage up to 50 km from roost sites, the project is not likely to significantly affect the availability of quality habitat for this species to the extent that the species is likely to decline.

Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat

It is not likely that invasive species (such as introduced predators) that are potentially harmful to the Grey-headed Flying-fox would become further established as a result of the Proposal.

Introduce disease that may cause the species to decline

No. It is not likely that disease would be increased by the Proposal.

Interfere substantially with the recovery of the species.

Due to the limited foraging habitat likely to be affected by the Proposal and as no roost camps are located in the close vicinity of the Proposal area, the proposed action is not likely to interfere with the recovery of this species.

Conclusion

While the proposed action will removal of a small area of potential foraging habitat, it's loss is considered unlikely to have a significant impact on the Grey-headed Flying-fox, due to the abundance of similar and higher quality habitat locally and the small extent of marginal habitat.

D2 POWERFUL OWL

STATUS

The Powerful Owl (*Ninox strenua*) is listed as Vulnerable under to BC Act.

HABITAT AND ECOLOGY

The Powerful Owl is the largest owl in Australasia. It is a typical hawk-owl, with staring yellow eyes and no facial-disc (Garnett and Crowley 2000). It is a sedentary species with a home range of approximately 1000 hectares and occurs within open eucalypt, *Casuarina* or *Callitris* pine forest and woodland. It often roosts in denser vegetation including rainforest or exotic pine plantations. It generally feeds on medium-sized mammals such as possums and gliders but will also eat birds, flying-foxes, rats and insects. Prey are generally hollow dwelling or arboreal dwelling which often require a shrub layer, these are important habitat components for owls. Often Powerful Owls are found in areas with more old trees and hollows than average stands (Garnett and Crowley 2000).

THREATS

The ESS Threatened species profile lists the following threats to the species:

- fragmentation and loss of suitable woodland habitat
- loss of hollow-bearing trees and changes in forest structure
- disturbance during the breeding period
- high fire frequency
- road kills
- secondary poisoning
- predation of fledglings by foxes, dogs and cats.

SPECIFIC IMPACTS

The Powerful Owl was not recorded in the proposal area during field surveys informing this report. The Powerful Owl is however known to occur within the locality. Minor potential foraging habitat was identified in the proposal area, comprising of horticultural native and exotic plantings. The proposal will necessitate the removal of 0.05 ha of potential foraging habitat for the species, which generally has low comparative ecological value.

D2.1 BC ACT SIGNIFICANCE ASSESSMENT

In the case of a threatened species, whether the action proposed 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

Powerful Owl was not recorded in the proposal area during field surveys informing this report. A small amount of potentially suitable foraging habitat (0.05 ha) is likely to be affected by the proposal.

Due to their mobility, large home range and the small extent of habitat in the proposal area, potential habitat occurring within the proposal area would likely provide marginal habitat opportunities within the home range for individuals. Furthermore, essential microhabitat elements, such as diversity of hollow-bearing trees and complex ground layer, necessary for their prey was generally not abundant in the proposal area. Locally occurring Powerful Owls are unlikely to be restricted to habitat within the proposal area, as similar and higher quality habitat occurs widely in the locality. Potential foraging habitat within the proposal area is considered of marginal quality and such habitat would at best represent a small component of locally occurring resources accessible to this species. Therefore, it is not likely to constitute important habitat for local Powerful Owls. The action proposed is unlikely lead to 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.

In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction

Not applicable

In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:

- ***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***

Not applicable

- ***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

In relation to the habitat of a threatened species, population or ecological community:

- ***the extent to which habitat is likely to be removed or modified as a result of the action proposed***

The Proposal area is likely to affect approximately 0.14 ha of potential foraging habitat for the species.

- ***whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and***

Habitat connectivity is not likely to be affected by the Proposal. The Proposal encompasses horticultural native and exotic plantings. It is unlikely that the removal of 0.05 ha would significantly further fragment or isolate any previously undisturbed patches of habitat than what already exists. Furthermore, given these species' high mobility (some using home ranges up to 1500 ha) and that similar and likely more significant habitat occurs widely in the locality, it is not considered likely that habitat would become further isolated or fragmented significantly beyond that currently existing in the study area and wider locality.

- ***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.***

A small (0.05 ha) disturbed area of potential habitat is likely to be affected by the Proposal. Foraging opportunities will continue to exist and an abundance of similar and better quality foraging opportunities are found within the wider locality. Owing to the small extent of potential habitat to be affected and the high mobility of these species, the Proposal is not likely to significantly affect their long-term survival. However, the loss of such habitat must be considered an incremental loss of local habitat.

Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly)

Areas of declared critical habitat under the *Threatened Species Conservation Act 1995*, are now labelled as 'Areas of Outstanding Biodiversity Values' (AOBVs) in NSW with the commencement of the BC Act. The *Biodiversity Conservation Regulation 2017* establishes the criteria for declaring AOBVs. The criteria have been designed to identify the most valuable sites for biodiversity conservation in NSW. The Proposal area is will not impact any declared AOBVs nor are there any AOBVs identified for these species.

Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan

A recovery plan listing a number of recovery actions has been prepared for Large Forest Owls (Department of Environment and Conservation 2006). The overall objective of the NSW Large Forest Owl Recovery Plan is to ensure that the large forest owl species persist in the wild in NSW in each region where they presently occur. No threat abatement plans have been prepared for these threatened species. The Office of Environment and Heritage has assigned these species as landscape management species under the Saving our Species program with a number of recovery actions

for the species. The Proposal area will not interfere significantly with any of the management actions within the Large Forest Owl Recovery Plan and is consistent with the recovery actions under Saving our Species program.

Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process

With respect to the Powerful Owl, the Proposal is consistent with one Key Threatening Process:

- clearing of native vegetation.

The extent of native vegetation clearing and habitat removal associated with the Proposal is considered relatively small and will not represent a significant loss in terms of the available habitat for these species within the surrounding landscape.

Conclusion

The Powerful Owl is a threatened forest owl species with a moderate likelihood of occurrence. Whilst potential habitat exists within the study area, impact to the very small, disturbed patch of habitat is considered unlikely to impact the life-cycle of the species. The Proposal area would likely only be visited irregularly as part of a larger home range. An abundance of similar and potentially more significant habitat occurs in the wider locality that is suitable for habitation by this species. Therefore, the Proposal is considered to represent an incremental loss of available local habitat and is not likely to have a significant impact upon the Powerful Owl.

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