

# FLORA AND FAUNA

## Biodiversity assessment

NSW Rewilding Program, Shanes Park, NSW

OCTOBER 2021



# Appendix D: Flora and Fauna Biodiversity assessment

## Disclaimer

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Cover photographs:

Left: Character of a section of one of the unnamed drainage lines within the subject site.  
Right: Character of the eucalypt woodland that is present within Shanes Park.

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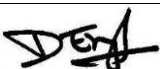
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### **Disclaimer**

This document has been prepared in accordance with information provided by NSW National Parks and Wildlife Service ('the client'). This investigation has relied upon information collected during the course of a field investigation, and as available in current known literature and data sources. All findings, conclusions or recommendations contained within this document are based upon the abovementioned circumstances. The study has been prepared for use by NSW Public Works Advisory and the client, and no responsibility for its use by other parties is accepted by Lesryk Environmental Pty Ltd.

Given the dynamic nature of the relevant pieces of environmental legislation considered in this report, the authors consider that this report only has a 'shelf life' of six months. If a development application, Review of Environmental Factors or Statement of Environmental Effect is not submitted to a determining authority for consideration within this time frame, it is recommended that this report be reviewed and revised where required in light of any relevant legislative listings or changes.

This report is prepared in accordance with the 6<sup>th</sup> Edition of the Commonwealth of Australia (2002) Style Manual.

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## **Acronyms & Abbreviations**

<b>Abbreviation</b>	<b>Definition</b>
°C	Degrees Celsius
AOBV	Areas of Outstanding Biodiversity Value
BC Act	NSW <i>Biodiversity Conservation Act 2016</i>
BDAR	Biodiversity Development Assessment Report
CEEC	Critically Endangered Ecological Community
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DE	Commonwealth Department of the Environment (now known as the Commonwealth Department of Agriculture, Water and the Environment)
DEC	NSW Department of Environment and Conservation (now known as the NSW Department of Planning, Industry and Environment)
DECC	NSW Department of Environment and Climate Change (now known as the NSW Department of Planning, Industry and Environment)
DECCW	NSW Department of Environment, Climate Change and Water (now known as the NSW Department of Planning, Industry and Environment)
DEE	Commonwealth Department of the Environment and Energy (now known as Commonwealth Department of Agriculture, Water and the Environment)
DPI	NSW Department of Primary Industries
DPIE	NSW Department of Planning, Industry and Environment
EEC	Endangered Ecological Community
EPA 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	Hectare
HBT	Hollow-bearing tree
KFH	Key Fish Habitat
KTP	Key Threatening Process
Lesryk	Lesryk Environmental Pty Ltd
LEP	Local Environmental Plan
LGA	Local Government Area
mm/cm/m/m <sup>2</sup> /km	Millimetres, centimetres, metres, square metres, kilometres
MNES	Matters of National Environmental Significance
NSW	New South Wales
NPW Act	NSW <i>National Parks and Wildlife Act 1974</i>
NPWS	NSW National Parks and Wildlife Service
OEH	NSW Office of Environment and Heritage
PCT	Plant Community Type
PMST	Protected Matters Search Tool
RoTAP	Rare of Threatened Australian Plant
SEPP	State Environmental Planning Policy
SIS	Species Impact Statement
TEC	Threatened Ecological Community
VEC	Vulnerable Ecological Community
WoNS	Weeds of National Significance

## **Glossary:**

Proposal	Is considered to include ‘all activities likely to be undertaken within the subject site to achieve the objective of the proposed development’ (DECC 2007).
Subject site	Means the area directly affected by the proposal. The subject site includes the footprint of the proposal and any ancillary works, facilities, accesses or hazard reduction zones that support the construction or operation of the development or activity (OEH 2018).
Study area	Means the subject site and any additional areas which are likely to be affected by the proposal, either directly or indirectly (OEH 2018).
Study region	Is considered to ‘include the lands that surround the subject site for a distance of 10 km’ (DECC 2007).
Areas of outstanding biodiversity	An area of outstanding biodiversity value is: <ul style="list-style-type: none"> <li>○ an area important at a State, national or global scale, and</li> <li>○ an area that makes a significant contribution to the persistence of at least one of the following: <ul style="list-style-type: none"> <li>i. multiple species or at least one threatened species or ecological community</li> <li>ii. irreplaceable biological distinctiveness</li> <li>iii. ecological processes or ecological integrity</li> <li>iv. outstanding ecological value for education or scientific research.</li> </ul> </li> <li>○ The declaration of an area may relate, but is not limited, to protecting threatened species or ecological communities, connectivity, climate refuges and migratory species (BC Act 2016).</li> </ul>
Important population	Is a population that is necessary for a species’ long-term survival and recovery; this may include populations identified as such in recovery plans, and/or that are: <ul style="list-style-type: none"> <li>○ key source populations either for breeding or dispersal</li> <li>○ populations that are necessary for maintaining genetic diversity, and/or</li> <li>○ populations that are near the limit of the species range (DE 2013).</li> </ul>
Local population (in regards to a threatened species)	Comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area (DECC 2007).
Invasive species	Is an introduced species, including an introduced (translocated) native species, which out-competes native species for space and resources, or which is a predator of native species. Introducing an invasive species into an area may result in that species becoming established. An invasive species may harm listed threatened species or ecological communities by direct competition, modification of habitat or predation.
Direct impacts	Are those that directly affect the habitat of species and ecological communities and of individuals using the study area. They include, but are not limited to, death through predation, trampling, poisoning of the animal/plant itself and the removal of suitable habitat (OEH 2018).
Indirect impacts	Occur when project-related activities affect species or ecological communities in a manner other than direct loss within the subject site. Indirect impacts may sterilise or reduce the habitability of adjacent or connected habitats. Indirect impacts can include loss of individuals through starvation, exposure, predation by domestic and/or feral animals, loss of breeding opportunities, loss of shade/shelter, reduction in viability of adjacent habitat due to edge effects, deleterious hydrological changes, increased soil salinity, erosion, inhibition of nitrogen fixation, weed invasion, noise, light spill, fertiliser drift, or increased human activity within or directly adjacent to sensitive habitat areas (OEH 2018).

## 1. Introduction

At the request of NSW National Parks and Wildlife Service (NPWS), a Biodiversity survey has been conducted in relation to the proposed establishment of fencing around the perimeter of the former Air Services Australia site, known as Shanes Park (hereafter referred to as the 'subject site'), Shanes Park, NSW; as part of the NSW Rewilding Program (Figure 1a).

The NSW Rewilding Program is a ten-year project to reintroduce native fauna and restore ecosystems in NSW. It involves the establishment of four large feral predator (cats and foxes) free areas [of which Shanes Park is one] which will enable the reintroduction of locally extinct species, provide conservation benefits to other threatened species and restore the functioning of essential ecosystem processes.

The purpose of the fencing is to permit the management and exclusion of feral species (including predators such as cats and foxes) to:

- permit the reintroduction of species currently listed as extinct in NSW
- permit the establishment of new populations of animals that are currently locally extinct
- reduce the extinction risk of a number of native species, including those impacted by bushfire.

The proposal involves the construction of 10.08 km of fencing enclosing an area of 550 ha. In addition to the fencing, the proposal involves the establishment of 17 passing bays and 19 turnarounds within the site. The passing bays are to be 6 m in width, while the turnarounds would be 22 m in diameter (Figure 1b).

To permit the proposal, the extent of total disturbance and/or vegetation removal required would be 5.31 ha; this comprised of:

- a cleared corridor width of 7.5 m (4.5 m and 3 m on either side of the fence) ('impact footprint') along the proposed fencing alignment, resulting in the removal of 4.79 ha
- 0.52 ha vegetation clearance to permit the establishment of passing bays and turnarounds.

A 'berm and moat' is present within the boundary of the subject site. Along stretches where there is a 7.5 m or greater gap between the pegged boundary and the berm/moat, the impact footprint will be between the boundary and this feature. At stretches where the gap between the boundary and berm/moat is less than 7.5 m, the impact footprint will be just inside the berm/moat.

The former Air Services Australia land transferred to NPWS in December 2020, and currently sits as Part 11 lands under the NPW Act, awaiting gazettal.

The Biodiversity survey has been prepared by Lesryk Environmental Pty Ltd ('Lesryk') to contribute to the proposal's Review of Environmental Factors prepared by NPWS.

It is acknowledged that, at the request of NPWS, Lesryk prepared a Technical Site Assessment report of both Castlereagh Nature Reserve and Shanes Park (Lesryk 2021). Aspects that pertain to Shanes Park, and are applicable to the current investigation, have been drawn upon and included in this report.

Those flora and fauna investigations conducted as part of the Technical Site Assessment were conducted prior to the accurate surveying of the fencing alignment. Where this is different from the assumed fencing alignment investigated during the course of the Technical Site Assessment, additional surveys, particularly targeting threatened plants, the Cumberland Plain Land Snail (*Meridolum corneovirens*) and hollow-bearing trees, have been conducted.

In preparing this report, no assessments that draw on the criteria provided under the EPBC Act's Significant Impact Guidelines and/or Section 7.3 of the BC Act, have been conducted, NPWS advising that they would be producing these in-house.



Figure 1a. Proposal area

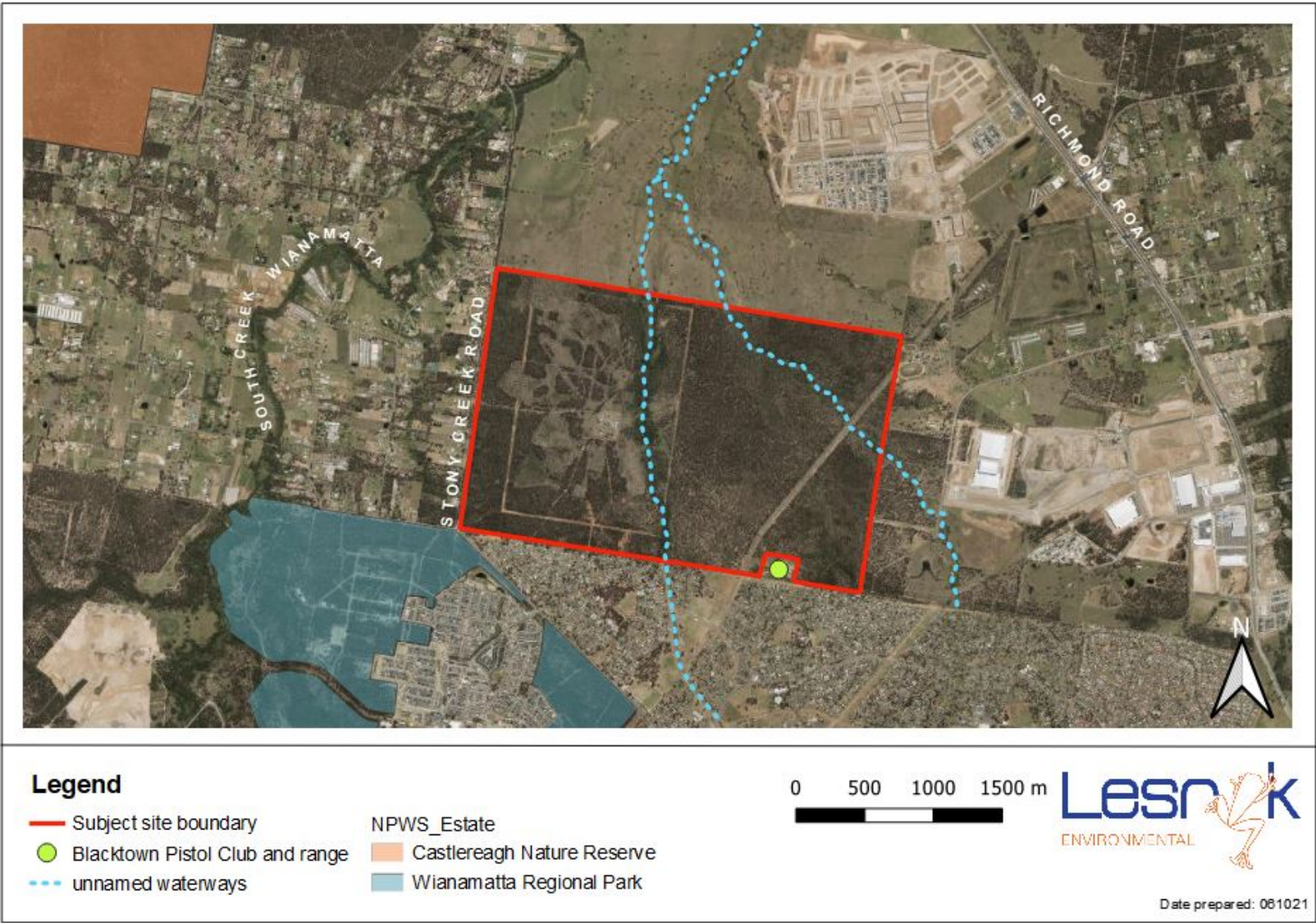
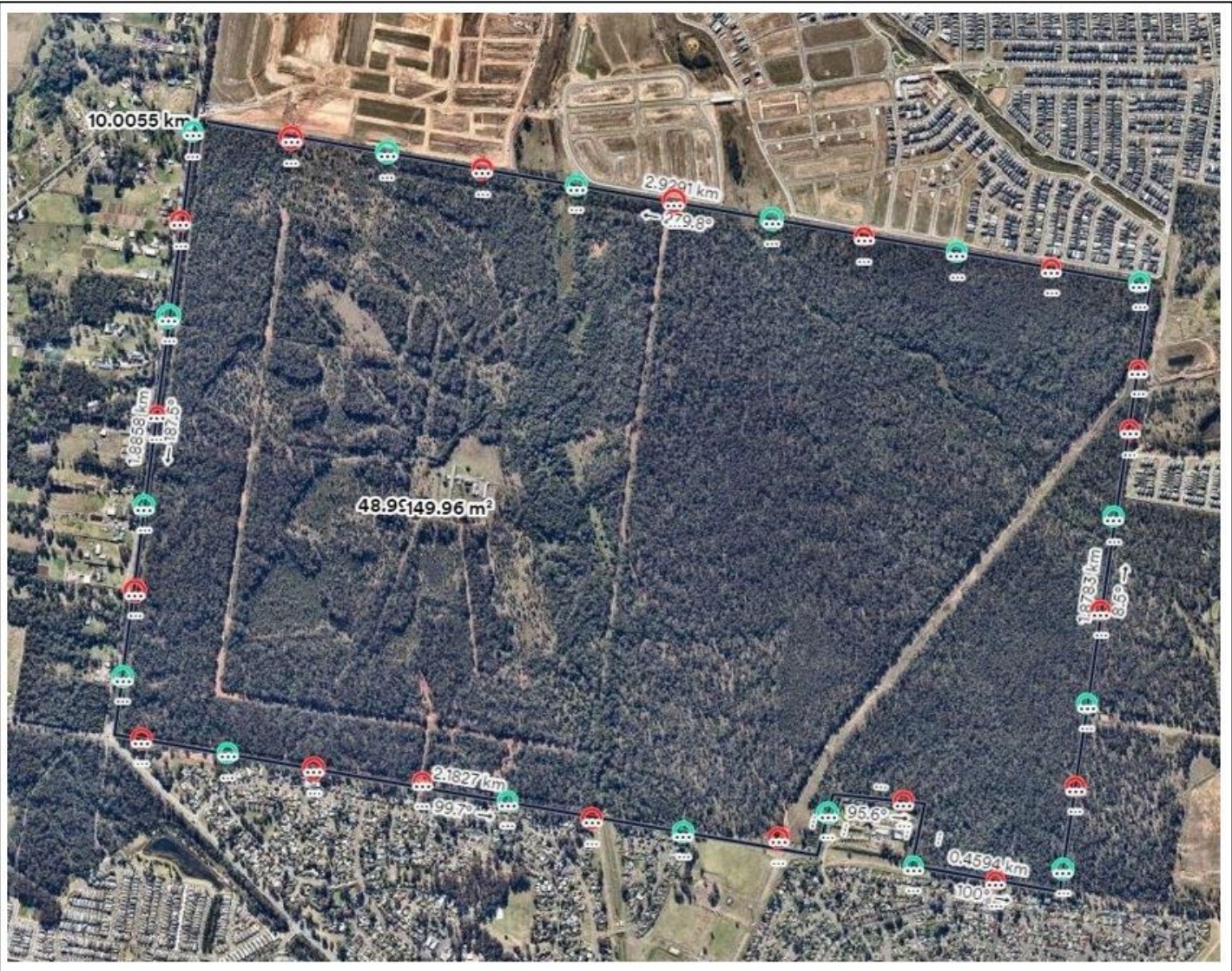


Figure 1b. Location of proposed passing bays (green) and turnaround areas (red) (Source: NPWS)



This report therefore identifies:

- the species and communities present within the proposed fencing alignment
- the State and Federal conservation status of these
- the extent of disturbance likely to result due to the conducting of the fencing proposed (this including the establishment of passing bays and turnaround areas)
- the extent of those fauna habitat types, vegetation communities and species recorded along the fencing alignment within other portions of Shanes Park.

The assessment of possible impact associated with the proposal is based on a field investigation of the study area, a literature review of previous studies conducted in both the region and this portion of the Blacktown City Council LGA, the consultation of standard databases and a consideration of the objectives of the EPBC Act, EPA Act, BC Act, NPW Act, FM Act and any relevant SEPP.

As the project is being assessed under Part 5 of the EPA Act, in line with Section 7.8(2) of the BC Act, the project does not need to be assessed under Part 6 (the Biodiversity Offsets Scheme) of the BC Act. Hence, the application of the Biodiversity Assessment Method (Division 2, Part 6 of the BC Act) is not required.

## 2. Legislative requirements

A number of Commonwealth, State and local Acts, policies and documents are relevant to the proposal and its possible impact on the ecology of both the subject site and locality. The most relevant items of these are listed in Table 1.

**Table 1.** Summary of legislative and policy requirements

Level	Relevant Legislation/Policy	Relevance to study area
Commonwealth	<i>Environment Protection and Biodiversity Conservation Act 1999</i>	Under this Act an action will require approval from the Minister if the action has, will have, or is likely to have, a significant impact on a Matters of National Environmental Significance (MNES). MNES include listed threatened species and ecological communities, migratory species and wetlands of international importance protected under international agreements. Where applicable, the assessment criteria relevant to this Act must be drawn upon to determine whether there would be a significant effect on these species and hence whether referral to the Federal Environment Minister is required.  Several ecological communities and one plant listed under the Act was recorded during the field survey.
State	<i>NSW Environmental Planning and Assessment Act 1979</i>	Part 5 of this Act requires that a determination be made as to whether a proposed action is likely to significantly affect threatened species or ecological communities, or their habitats listed on Schedules 1 and 2 of the BC Act. Where found, the assessment criteria under Part 7 Section 7.3 of the BC Act (the 'Assessment of Significance') will be drawn upon to determine whether there is likely to significantly affect threatened species or ecological communities, or their habitats, and hence whether a SIS is required.

Level	Relevant Legislation/Policy	Relevance to study area
	NSW <i>Biodiversity Conservation Act 2016</i>	<p>The purpose of this Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development.</p> <p>Several ecological communities, four threatened plants and two threatened fauna species listed under the Act were recorded during the field survey.</p>
	NSW <i>Biosecurity Act 2015</i>	<p>Part 3, Clause 22 of this Act states 'any person who deals with biosecurity matter or a carrier and who knows, or ought reasonably to know, the biosecurity risk posed or likely to be posed by the biosecurity matter, carrier or dealing has a biosecurity duty to ensure that, so far as is reasonably practicable, the biosecurity risk is prevented, eliminated or minimised'.</p> <p>This includes pest animal and plants species as defined under Clause 15 of the Act and anything declared by the regulations to be a pest for the purposes of this Act.</p>
	NSW <i>Fisheries Management Act 1994</i>	<p>The object of this Act is to conserve, develop and share the fishery resources of the state for the benefit of present and future generations. In particular, the Act aims to:</p> <ul style="list-style-type: none"> <li>a) conserve fish stocks and key fish habitats</li> <li>b) conserve threatened species, populations and ecological communities of fish and marine vegetation</li> <li>c) promote ecologically sustainable development, including the conservation of biological diversity.</li> </ul> <p>Under Section 199 of the Act, a public authority (other than a local government authority) must, before it carries out or authorises the carrying out of dredging or reclamation work:</p> <ul style="list-style-type: none"> <li>• give the Minister written notice of the proposed work, and</li> <li>• consider any matters concerning the proposed work that are raised by the Minister within 28 days after the giving of the notice (or such other period as is agreed between the Minister and the public authority).</li> </ul>

Level	Relevant Legislation/Policy	Relevance to study area
	SEPP (Sydney Region Growth Centres) 2006	<p>With reference to the North West Growth Centre Land Zoning Map - Sheet LZN_002, the subject site is zoned as Environmental Conservation.</p> <p>Cl.10 'Objectives for development in land use reservation zones' of the SEPP, with respect to the Environment Conservation Zone, are:</p> <ul style="list-style-type: none"> <li>(a) to protect and restore areas of special ecological, scientific or aesthetic values,</li> <li>(b) to conserve biological diversity, native vegetation corridors, aboriginal heritage or cultural values of the land, and its scenic qualities.</li> </ul> <p>Cl.12(2) [with reference to the Environmental Conservation Zone], development is permitted without consent by or under the <i>National Parks and Wildlife Act 1974</i> (but only if the land is reserved under that Act).</p> <p>The former Air Services Australia land transferred to NPWS in December 2020, and currently sits as Part 11 lands under the NPW Act, awaiting gazettal.</p>
Local	Blacktown Local Environmental Plan 2015	<p>This plan aims to make local environmental planning provisions for land in Blacktown in accordance with the relevant standard environmental planning instrument under section 3.20 of the EPA Act.</p> <p>Land zone mapping under the LEP identifies the subject site within SEPP (Sydney Region Growth Centres) 2006.</p> <p>The aims of the LEP relevant to the proposed work are:</p> <ul style="list-style-type: none"> <li>h) to conserve, restore and enhance biological diversity and ecosystem health, particularly threatened species, populations and communities.</li> </ul>

### 3. Environmental setting

The 'subject site' is the former Air Services Australia site (a Federal Government entity) located at Shanes Park in Western Sydney, about 9.2 km north-east of Penrith; within the Blacktown LGA.

The reserve (559 ha in size) is currently accessed off Stoney Creek Road, and is north-east of Wianamatta Regional Park (Figure 1a).

A number of management trails are present within the rewilding site; these maintained to Rural Fire Service (RFS) standard. In addition to the existing trail network, new passing bays (involving a widened trafficable surface of 6 m in width) and turnaround areas are necessary to permit the proposal.

This portion of the LGA is situated within an urban to semi-rural landscape characterised by residential dwellings, small agricultural lots, commercial businesses, Council parklands and some open areas that support bushland. North adjacent to the site is a new housing estate development.

Within the reserve, two unnamed creeks [branches of South Creek/Wianamatta Creek] are present; one traversing south-north through the centre of the reserve, with the second traversing the north-eastern corner.

Neither of the drainage lines present within the subject site are mapped as Key Fish Habitat (DPI – Fisheries 2021).

For reference, a photographic record of the subject site has been provided (Appendix 1).

Blacktown Pistol Club and range is present within a fenced off portion of land within the south-eastern corner of the reserve, off Hammerli Way. Additional land uses in the surrounding region include recreational and sporting amenities (i.e. oval); a number of schools; retirement villages; and a shopping precinct to the east. The new Marsden Park residential release area is present along the northern boundary of the subject site.

According to monthly rainfall figures from the Penrith Lakes AWS<sup>1</sup> the annual average rainfall in the region is approximately 721.6 mm, with the greatest falls being experienced during February (Bureau of Meteorology 2021). Average temperatures ranged from a July minimum of 5.3 °C to a January high of 31.2 °C (Bureau of Meteorology 2021).

The Penrith 1:100,000 Soil Landscape map sheet (Bannerman *et al.* 2010) identifies that the subject site is located within three landscapes, being (Figure 2):

- Berkshire Park Alluvial Landscape
- Blacktown Residual Landscape
- South Creek Alluvial Landscape.

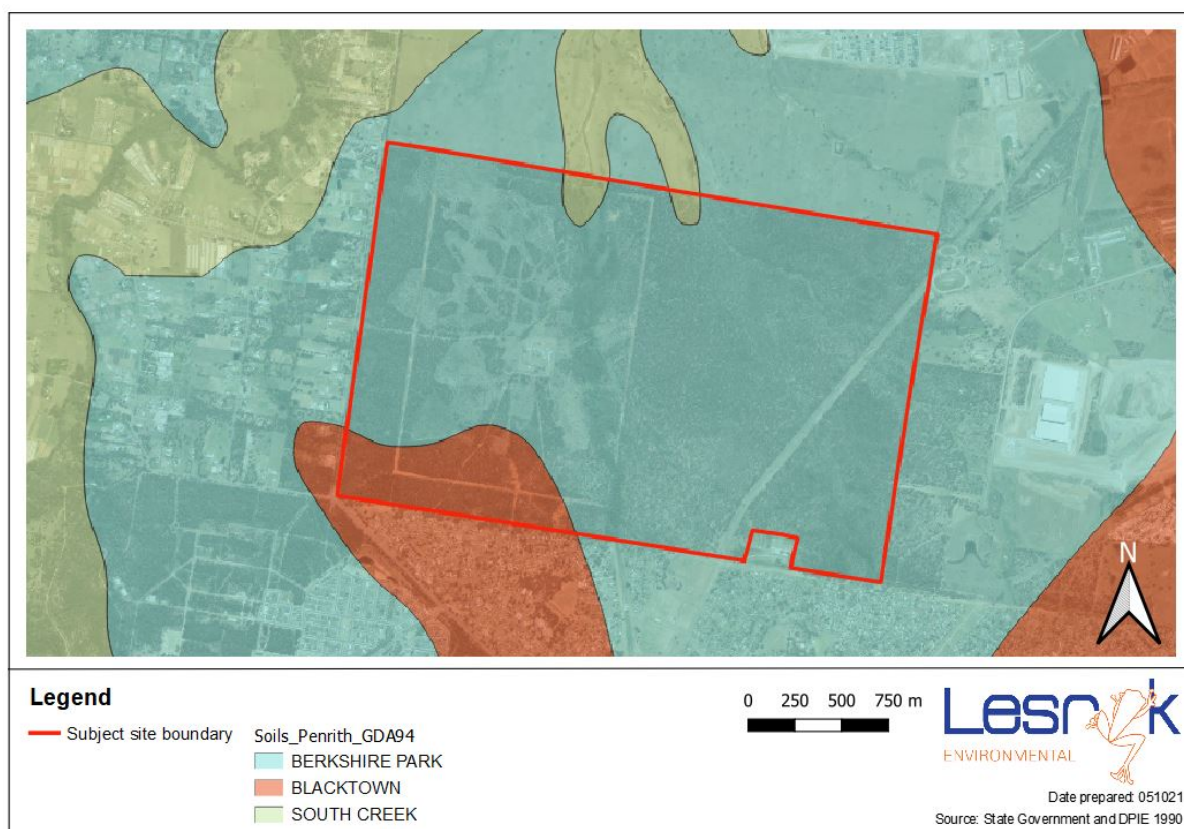
The Berkshire Park Landscape soils are weakly pedal orange heavy clays and clayey sands, often mottled; ironstone nodules are common; large silcrete boulders occur in sand/clay matrix; with solods, yellow podzolic soils, red podzolic soils, chocolate soils, structured plastic clays and structured clays (Bannerman and Hazelton 2011). Limitations are very high wind erosion hazard if cleared; gully, sheet and rill erosion on dissected areas; localised seasonal waterlogging; localised flood hazard; impermeable soils and low soil fertility (Bannerman and Hazelton 2011).

The Blacktown Landscape is shallow to moderately deep hard-setting mottled texture contrast soils; red and brown podzolic soils on crests grading to yellow podzolic soils on lower slopes and in drainage lines (Bannerman and Hazelton 2011). Limitations are localised seasonal waterlogging, localised water erosion hazard; moderately reactive highly plastic subsoil and localised surface movement potential (Bannerman and Hazelton 2011).

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<sup>1</sup> nearest operating weather station

**Figure 2.** Soil landscapes



The South Creek Landscape is often very deep layered sediments over bedrock or relict soils; structured plastic clays or structured loams in and immediately adjacent to drainage lines, where pedogenesis has occurred; red and yellow podzolic soils are most common on terraces with small areas of structure grey clays, leached clay and yellow solodic soils (Bannerman and Hazelton 2011). Limitations are flood hazard, seasonal water-logging; localised permanently high watertables; localised water erosion hazard, and localised surface movement potential (Bannerman and Hazelton 2011).

Natural elevations within the subject site range from 15 m to 50 m ASL. Topography within the study area is characterised by flat terrace tops dissected by present day small drainage channels and narrow drainage lines, with small remnant surfaces occurring to the east and south are at a slightly higher elevation (approximately 20 m); gently undulating rises with local relief 10–30 m and slopes generally >5% but occasionally up to 10%; broad crests and ridges (200–600 m) and rounded with convex upper slopes grading into concave lower slopes; flat to gently sloping alluvial plain with occasional terraces or levees providing low relief. Slopes <5% (Bannerman and Hazelton 2011).

Through reference to the listings provided under the EPBC and FM Acts, it is noted that no gazetted areas of critical habitat for any flora or fauna species, populations or communities occur within, or in the vicinity of, the study area. Similarly, none of the AOBVs listed under Part 3 of the Biodiversity Conservation Regulation 2017 occur within, or in the vicinity of, the study area (DPIE 2021a).

#### **4. Literature review and field guides**

Prior to carrying out any fieldwork, previous studies conducted in the surrounding region and known databases were consulted to identify the diversity of ecological communities, flora and fauna species known for, or potentially occurring in, the subject site. The identification of those known or potentially occurring native species and communities within this portion of the Blacktown Council LGA, particularly those listed under the Schedules to the EPBC and BC Acts, thereby permits the tailoring of the field survey strategies to the detection of these plants and animals, their vegetation associations and

necessary habitat requirements. By identifying likely species, particularly any threatened plants and animals, the most appropriate species-specific survey techniques may be selected should their associated vegetation communities/habitat requirements be present. The carrying out of a literature search also ensures that the results from surveys conducted during different climatic, seasonal and date periods are considered and drawn upon as required. This approach therefore increases the probability of considering the presence of, and possible impacts on, all known and likely native species, particularly any plants and animals that are of regional, State and/or national conservation concern. This approach also avoids issues inherent with a one-off 'snap-shot' study.

The databases referred to include:

- the DAWE Protected Matters Search Tool (DAWE 2021a)
- the DPIE BioNet database [Atlas of NSW Wildlife] (DPIE 2021a)
- the OEH Threatened Species website (OEH 2021b)
- DPI WeedWise Database (DPI 2021a)
- eBird (The Cornell Lab 2021)
- the DPIE Bionet Vegetation Classification database (DPIE 2021c)

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

When accessing the DAWE and DPIE databases, the search area specified was a 10 km buffer around the study area. The data searches were carried out on 17/09/2021.

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

Field guides and standard texts used include:

- Royal Botanic Gardens and Domain Trust (undated), Richardson *et al.* (2010) (used for the identification of plants)
- Cogger (2014) (reptiles and frogs)
- Simpson and Day (2010) (birds)
- Van Dyck and Strahan (2008) (non-flying mammals)
- Churchill (2008) (flying mammals)
- Triggs (1996) (identification of scats, tracks and markings).

The naming of those species recorded or known for the region follows the nomenclature presented in these texts, or within the EPBC, BC and FM Acts.

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

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

- the EPBC, BC and FM Acts
- the Bionet Vegetation Classification database (DPIE 2021c)



## 5. Results of the literature review

### 5.1. Threatened species

A review of the DAWE, DPIE, eBird and Atlas of Living Australia databases (Atlas of Living Australia 2021, DAWE 2021, DPIE 2021a, The Cornell Lab 2021) identified 19 threatened plants and 64 threatened animals listed under the EPBC Act and/or the Schedules of the BC Act that have been previously recorded in the study region (Appendix 2). Due to a lack of their necessary habitats, oceanic or estuarine species were not considered to occur as resident species within the study area.

Based on a consideration of the habitat needs of those threatened species previously recorded in the study region (as provided in standard texts – refer to the bibliography section for those used), combined with the identification of those habitats present within the subject site, there is the potential for some of the species listed in Appendix 2 to occur within, or in the vicinity of, the reserve. Therefore, during the course of the field investigation, targeted surveys for these species, or their necessary habitats, were conducted.

It is acknowledged that some of the threatened fauna species listed in Appendix 2 may fly over (e.g. Grey-headed Flying-fox [*Pteropus poliocephalus*], raptors) and potentially forage within the subject site on occasion; however, none of these animals are likely to be reliant on those habitats affected by the proposal for their lifecycle requirements. While the proposed perimeter fencing will create a permanent barrier to the movement of some ground traversing fauna (a proposal objective being to exclude feral species), the rewilding program will restore conservation benefits to extant species and reintroduce and maintain viable populations of extinct species.

### 5.2. Vegetation mapping

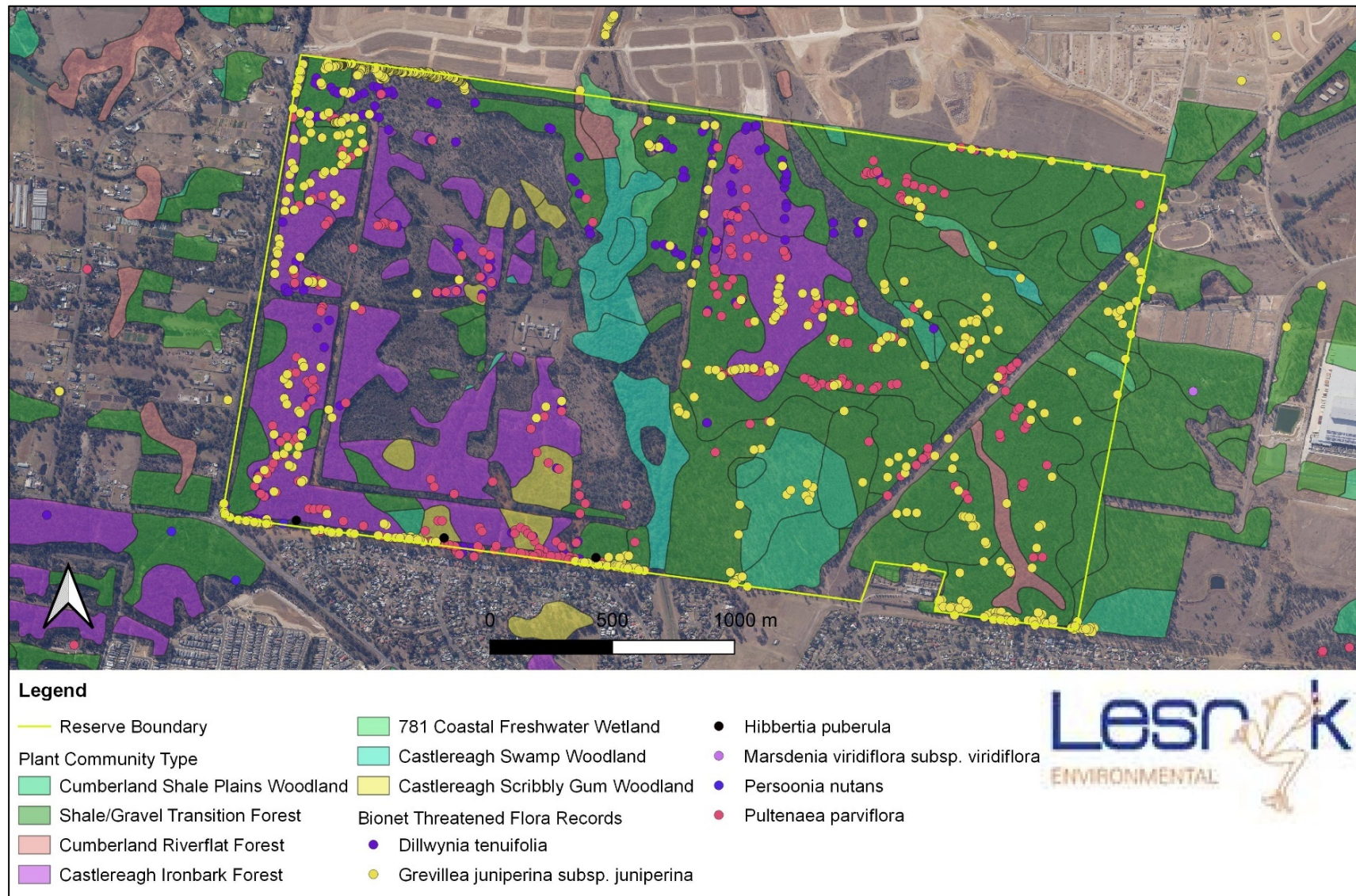
With reference to mapping conducted by OEH (2011) (Figure 3) and the Bionet Vegetation Classification database (DPIE 2021c), Table 2 summarises the plant community types (PCTs) that are mapped as occurring within the subject site and their conservation status.

**Table 2.** Mapped vegetation, classification and conservation status

Mapped Community (OEH 2011)	PCT	BC Act status (shortened name)	EPBC Act Status
Shale Plains Woodland	849 – Cumberland Shale Plains Woodland	CEEC Cumberland Plain Woodland	CEEC Cumberland Shale Plains Woodland and Shale-Gravel Transition Forest
Shale-Gravel Transition Forest	724 - Castlereagh shale - gravel transition forest	EEC Shale-Gravel Transition Forest	EEC River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria
Alluvial Woodland <sup>2</sup>	835- Cumberland riverflat forest	EEC River-flat Eucalypt Forest on Coastal Floodplains	EEC Agnes Banks and Castlereagh Scribbly Gum Woodlands
Castlereagh Ironbark Forest	725 - Castlereagh Ironbark forest	CEEC Cooks River-Castlereagh Ironbark Forest	Not listed
Castlereagh Scribbly Gum Woodland	883 - Castlereagh Scribbly Gum Woodland	VEC Castlereagh Scribbly Gum Woodland	
Freshwater Wetland	1071 - <i>Phragmites australis</i> and <i>Typha orientalis</i> coastal freshwater wetlands of the Sydney Basin Bioregion	EEC Freshwater Wetlands on Coastal Floodplains	

<sup>2</sup> Areas mapped by OEH (2011) as Castlereagh Swamp Woodland in Figure 3 overleaf were found to be to be Alluvial Woodland during field surveys.

Figure 3. Vegetation mapping (OEH 2011) and threatened flora species records (DPIE 2021a) in the study area<sup>3</sup>



<sup>3</sup> n.b. there are numerous threatened flora records that overlap one another.

## 6. Field survey methods

Investigations of the subject site were carried out by Deryk Engel (B.Env.Sc.Hons) [Senior ecologist], Paul Burcher (B.App.Sc.) [Botanist], Joseph Morton (B.Env.Bio) [Ecologist], Chelsea Tiller (B.Soc.Sc) [Ecologist] and Harry Engel [Ecologist] on 30 September 2021. The weather conditions experienced during the site investigation were mild temperatures (20 °C), cloudy skies (50%) and still conditions. Paul Burcher also conducted surveys on 16 October 2021 when temperatures reached 24 °C with light cloud (10%) and moderate to gusty winds (20-40 kmh.).

As part of the Technical Site Assessment, Shanes Park was visited and inspections conducted on, 21 April 2021. This investigation was conducted by Deryk Engel, Paul Burcher, Ben Ford (Botanist), Joseph Morton, Sarah Marshall and Harry Engel.

The purpose of the field investigations was to identify the presence of any plants, animals, fauna habitats or vegetation communities that are of State and/or national conservation significance as listed under the Schedules to the EPBC, BC and/or FM Acts, that are present within, or close to, the impact footprint associated with the proposal.

Whilst the field investigations primarily concentrated on the assumed/surveyed fencing alignment, to put the extent of vegetation removal required to permit the fencing proposal to proceed in context with the remainder that would be retained within the remainder of the reserve, targeted investigations were conducted for hollow-bearing trees, birds, the Cumberland Plain Land Snail (*Meridolum corneovirens*) and *Hibbertia puberula*.

The methods employed during the course of those investigations conducted within the subject site were:

- the identification of dominant plant species within the areas of likely disturbance, including both direct and indirect impacts
- transects through potential habitat of *Hibbertia puberula* in the vicinity of previous records
- transects through the likely impact area for species as yet unrecorded but considered to have a moderate to high likelihood of occurring in the reserve.
- the identification of the structure of those vegetation communities and terrestrial/aquatic fauna habitats present
- direct observation of fauna species within, adjacent to, or flying over the subject site (all diurnal calls being identified in the field)
- dedicated 20-minute-long bird surveys, these being undertaken by one researcher employing the point-count method (DEC 2004)
- dedicated 20-minute-long surveys targeting the BC Act listed Cumberland Plain Land Snail<sup>4</sup>
- targeted searches for other species of State and national conservation concern or their likely habitat areas, identified during the literature review stage
- leaf litter, ground debris and tree bark search for reptiles and frogs
- the identification of any indirect evidence such as tracks, scats, diggings and scratchings that would suggest the presence of any fauna species
- mapping of hollow-bearing trees.

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

The survey methods employed, were generally based on the descriptions provided in:

- the survey guidelines for threatened plants (OEH 2016)
- the DEC's 2004 publication.

While not considered to compromise the scientific rigour of the field investigations, no specific surveys (i.e. trapping, nocturnal work) were carried out. These studies were not conducted as they were beyond the scope of work required. In order to overcome this limitation:

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<sup>4</sup> This being the only invertebrate targeted due to its listing as Vulnerable under the BC Act.

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

By the completion of those investigations conducted with the subject site, a total of about:

- 20 person hours were accumulated conducting botanical surveys
- 60 minutes was accumulated conducting dedicated bird surveys
- 120 minutes was accumulated conducting dedicated ground debris searches
- 32 hours was accumulated mapping those hollow-bearing trees present within the impact footprint
- 60 person minutes was accumulated conducting hollow-bearing tree transects at six locations within the reserve.

In addition to the above, about 18 hours of non-dedicated surveys were accumulated. These are surveys associated with the identification of those species heard, observed or indicated (e.g. diggings or carcasses found) whilst traversing the subject site or when involved in conducting the other survey methods employed.

As noted, a number of the surveys carried out within the 'central' portions of the reserve were conducted to put the extent of impact(s) associated with the fencing proposal in context with the habitat resources present within the remainder of the study area. For example, the fencing proposal will result in habitat for the Cumberland Plain Land Snail being cleared. Whilst this is the case, targeted surveys, conducted at random locations with the reserve, identified viable populations of this species beyond the limits of the fencing alignment.

### 6.1. Botanical survey

Plant samples were collected (as per approval granted in accordance with OEH Scientific Licence SL10642) for later identification using standard texts.

Based on the results of the literature review and the habitat requirements of those threatened flora species identified as potentially occurring (see Appendix 2), surveys were conducted by walking transects through known and likely habitat. Large populations of *Pultenaea parviflora*, *Dillwynia tenuifolia* and *Grevillea juniperina subsp juniperina* occur within the reserve.

Given that these are numerous, reasonably accurately mapped within the reserve and that they are adequately represented outside the likely impact area, surveys concentrated on establishing the presence and distribution of (if present) *Hibbertia puberula*, *Acacia pubescens*, *Marsdenia viridiflora* var. *viridiflora*, *Micromyrtus minutiflora*, *Pimelea spicata* and *Persoonia nutans*.

### 6.2. Dedicated diurnal bird survey

Dedicated bird surveys were conducted during the fauna survey at the following locations, these lasting for approximately 20 minutes/session:

- Easting (E) 295969; Northing (N) 6266776
- E294887; N6267588
- E294876; N6267331.

The bird surveys were carried out during the early to mid-morning period, the researcher remaining in a static location and documenting all of the species that were observed or heard calling (Figure 4).

In addition to the dedicated bird surveys conducted, any incidental observations or records made whilst traversing the subject site or conducting additional surveys (e.g. habitat assessments) were recorded.

Figure 4. Fauna survey locations



### **6.3. Cumberland Plain Land Snail ground debris searches**

Dedicated ground debris searches targeting the Cumberland Plain Land Snail were conducted at the following locations, these lasting for a minimum period of 20 person minutes per site (Figure 4):

- Site 1 – E294532; N6266730
- Site 2 – E294528; N6266908
- Site 3 – E294607; N6267593
- Site 4 – E295409; N6268432
- Site 5 – E295718; N6267517
- Site 6 – E297009; N6267086.

The dedicated searches involved lifting and looking underneath fallen timber, logs and natural and artificial ground debris (e.g. urban refuse). Leaf litter accumulations at the base of trees were also raked and searched.

The targeted Cumberland Plain Land Snail searches were conducted until:

- A Land Snail was identified (either a living individual or discarded shell)
- An interval of 20 person minutes had passed.

Any reptiles or frogs observed during the ground debris searches were also identified.

It is noted that, whilst traversing the entire fencing alignment, any suitable natural or artificial ground debris was also searched.

### **6.4. Hollow-bearing tree surveys**

Along the surveyed boundary fencing alignment, the position of those mature trees that were, or were considered to be, hollow-bearing, were recorded through use of a Garmen™ hand-held Global Positioning Unit (GPS). In addition to recording the GPS location of each tree, other features such as the plant's height, number of hollows present, orientation (i.e. vertical or horizontal hollows), and so forth were recorded (Appendix 4).

The determination of whether a tree was hollow-bearing or not was made from the ground; while binoculars were used to assist with this determination, the orientation of some of the limbs inspected was vertical (Appendix 4). If a vertical dead limb/branch was noted, or a possible cavity/hollow seen, a precautionary approach was adopted. As all observations were made from the ground it was not possible to determine if these features were actually hollow-bearing or not.

To put the number of hollow-bearing trees present within the impact footprint in context with those present within other portions of the reserve, six random sites were selected (Figure 4). At each of these locations, two researchers traversed two 50 m long linear transects, these being 10 m apart. Whilst traversing these transects, the number of hollow-bearing trees present was recorded. Whilst the number of hollow-bearing trees per survey site was obtained, the trees themselves were not GPS'ed.

For reference, the hollow-bearing tree surveys conducted within the reserve were conducted at the following locations:

- E295409; N6268432
- E295255; N6268370
- E295718; N6267517
- E296618; N6267433
- E296864; N6267379
- E297009; N6267086.

## 6.5. Fauna habitat assessment

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

Two unnamed creeks are present within the reserve; one traversing south-north through the centre of the site, with the second traversing the north-east corner. In proximity to the proposal area, a brief investigation of these waterways was conducted, this involving (where possible) traversing a distance of up to 10 m upstream/downstream respectively, with notes taken on the habitat present, the structure of the drainage line's banks, riparian communities, course and the presence of any snags or other features important to the lifecycle requirements of those aquatic species present or considered likely to occur.

It is acknowledged that the proposed fencing will not erect any barriers to fish movement nor would it cause the isolation or fragmentation of any aquatic environments.

No rock outcrops, caves, suitable cave-substitutes or other unique habitat features are present within either the proposal area, or reserve.

## 6.6. Study limitations

Access to almost all parts of the impact footprint was possible, thereby ensuring that all portions of the proposal area were sampled. Ground searches for threatened plant species were hampered in some area by dense Blackthorn (*Bursaria spinosa*) thickets, particularly in the south-west portion of the reserve. However, given the overshadowing cover of this species, it is considered that in such situations there is a low likelihood that the threatened plant species being targeted would occur.

No adverse weather conditions or relevant seasonal variables were encountered during the course of any of the site inspections.

Detailed targeted survey using equipment such as echolocation detectors was not conducted as it was beyond the scope of work requested of Lesryk.

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

In order to overcome any limitations:

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

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

## 7. Results

### 7.1. Flora species recorded

Four threatened plant species have been recorded in the reserve, namely:

- *Hibbertia puberula* - listed as endangered on the BC Act
- *Pultenaea parviflora* - listed as endangered on the BC Act and vulnerable on the EPBC Act
- *Grevillea juniperina* subsp. *juniperina* - listed as vulnerable on the BC Act
- *Dillwynia tenuifolia* - listed as vulnerable on the BC Act.

In relation to *Hibbertia puberula*, confirmation the species' occurrence in the reserve has not yet been determined, as flowering required to ascertain diagnostic features had not commenced during the survey period. Accordingly, a precautionary approach has been taken and those *Hibbertia* plants found that had a vegetative character consistent with descriptions of the species are assumed to be *Hibbertia puberula*. A total of 30 individuals have been recorded to date, with more likely to be detected when the plant becomes more obvious during its flowering period. Two individuals are likely to be removed for construction of the fence and associated access to it (Table 3).

**Table 3.** Estimates of numbers of threatened plants to be cleared to permit establishment of the fencing.

#### Key

E – Endangered                      V – Vulnerable

Species	Status		Shanes Park	
	BC Act	EPBC Act	Estimated Population	Number individuals likely to be removed (% of site population)
<i>Dillwynia tenuifolia</i>	V		10,000	100 (1%)
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	V		5,000	50 (1%)
<i>Hibbertia puberula</i>	E		30+	2 (<6.7%)
<i>Pultenaea parviflora</i>	E	V	1000	50 (5%)

*Pultenaea parviflora*, *Grevillea juniperina* subsp. *juniperina* and *Dillwynia tenuifolia* are common in suitable habitat (Castlereagh Ironbark Forest and Shale/Gravel Transition Forest) through the reserve, particularly at disturbance margins. A small proportion of each species' population in the reserve would be affected by construction of the fence and the associated accesses to it (Table 3). Proliferation of each of the species at the new disturbance margins is likely.

While targeted searches for the remaining threatened plants with a moderate to high likelihood of occurrence (refer to Appendix 4) were conducted, none were recorded.

Assessments drawing on the criteria provided under the EPBC Act's Significant Impact Guidelines and Part 7, Section 7.3 of the BC Act will be required for those threatened plants recorded within, or close to, the proposal area.

#### 7.1.1. Weeds

Under the NSW *Biosecurity Act 2015*, '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.'



During the course of the botanical survey, several exotic plants were observed, six of which are listed under Schedule 3 of the NSW *Biosecurity Regulation 2017*. With reference to DPI (2021a) each of these species is also listed as a 'priority weed' in the Greater Sydney region. For reference, these species and their relevant legal requirement are provided in Table 4.

**Table 4.** Weeds of significance recorded on site

Species	Listed	Measure	Legal Requirements
Bridal Creeper <i>Asparagus asparagoides</i>	NSW <i>Biosecurity Regulation 2017</i> / DPI (2021a) / WoNS	Prohibition on dealings	Must not be imported into the state, sold, bartered, exchanged or offered for sale.
Ground Asparagus <i>Asparagus aethiopicus</i>	NSW <i>Biosecurity Regulation 2017</i> / DPI (2021a) / WoNS	Prohibition on dealings	Must not be imported into the state, sold, bartered, exchanged or offered for sale.
African Olive <i>Olea europaea subsp. cuspidata</i>	NSW <i>Biosecurity Regulation 2017</i> / DPI (2021a)	Regional Recommended Measure	The plant or parts of the plant are not traded, carried, grown or released into the environment
Blackberry <i>Rubus fruticosus</i> agg. spp.	NSW <i>Biosecurity Regulation 2017</i> / DPI (2021a) / WoNS	Prohibition on dealings	Must not be imported into the State or sold.
Fireweed <i>Senecio madagascariensis</i>	NSW <i>Biosecurity Regulation 2017</i> / DPI (2021a)	Regional Recommended Measure	Land managers reduce impacts from the plant on priority assets
Lantana <i>Lantana camara</i>	NSW <i>Biosecurity Regulation 2017</i> / DPI (2021a) / WoNS	Prohibition on dealings	Must not be imported into the state, sold, bartered, exchanged or offered for sale.

In addition to these species, African Lovegrass (*Eragrostis curvula*) was recorded within the reserve. This introduced grass is a Weed of National Significance (WoNS<sup>5</sup>) and is probably the greatest threat to those Threatened Ecological Communities and threatened plant species recorded in the reserve.

## 7.2. Vegetation communities

The following Plant Community Types (PCTs) currently listed in the Bionet Vegetation Classification Database (DPIE 2021c) occur within the footprint of the proposal:

- 725 – Castlereagh Ironbark Forest.  
This community is widespread in the west of the reserve and is characterised by a canopy of Broad-leaved Ironbark (*Eucalyptus fibrosa*) to 20 m above a dense understorey of 10 m high *Melaleuca decora* and Ball Honeymyrtle (*M.nodosa*) to 3 m. Shrub cover is sparse to moderately dense and includes *Grevillea juniperina subsp juniperina*, *Daviesia ulicifolia* and *Dillwynia tenuifolia*. Common ground cover species are Sword Sedge (*Lepidosperma laterale*), *Dianella revoluta*, Mulga Fern (*Cheilanthes sieberi*), Mat-rushes (*Lomandra filiformis* and *L.multiflora*), Three-awn Spear Grass (*Aristida vagans*) and, at and near disturbance margins, the introduced plant African Lovegrass (*Eragrostis curvula*).
- 724 – Castlereagh Shale - Gravel Transition Forest.  
This is the most widespread PCT in the reserve. It has a canopy to 25 m of Broad-leaved Ironbark, Forest Red Gum (*Eucalyptus tereticornis*) and Grey Box (*E.moluccana*) with an understorey that often includes Black She-oak (*Allocasuarina littoralis*) and Sickle Wattle (*Acacia falcata*). *Melaleucas* are less common and the shrub layer includes Blackthorn,

<sup>5</sup> The list of WoNS is part of a combined State and Commonwealth initiative to combat invasive species.

*Dillwynia sieberi*, *D.tenuifolia* and *Grevillea juniperina subsp juniperina*. African Lovegrass is common near the reserve's boundaries and Rhodes Grass (*Chloris gayana*) is common in the south. The native groundcover component is similar to the Castlereagh Ironbark Forest though species such as Kangaroo Grass (*Themeda triandra*) can be more common.

- 835 – Cumberland Riverflat Forest.  
This community occurs along and beside drainage lines and includes areas mapped as Castlereagh Swamp Woodland by OEH (OEH 2011). The canopy is composed of Rough-barked Apple (*Angophora floribunda*), Forest Red Gum and Cabbage Gum (*E.amplifolia*). Intact areas have an understorey of *Melaleuca styphelioides* and/or Swamp Oak (*Casuarina glauca*) and a groundcover of both Weeping Meadow Grass (*Microlaena stipoides*) and Kangaroo Grass. However, those part of the community impacted by the fence alignment tend to be weed-infested with an understorey of Privet (*Ligustrum spp*) and introduced herbs and grasses forming a dense groundcover where there is sufficient light.
- 883 – Castlereagh Scribbly Gum Woodland.  
A small area of this community is traversed by the proposed fence alignment in the south of the reserve. It has a canopy of Scribbly Gum (*Eucalyptus racemosa*) and Narrow-leaved Apple (*Angophora bakeri*) and a variety of shrub and groundcover species.
- 1071 – *Phragmites australis* and *Typha orientalis* coastal freshwater wetlands of the Sydney Basin Bioregion.  
This community occurs along the two drainage lines in the north of the reserve where impeded drainage has resulted in pondages allowing colonisation by the native species Cumbungi (*Typha orientalis*), Common Rush (*Juncus usitatus*), *Bolboschoenus caldwellii*, Knotweed (*Persicaria* sp) and *Schoenoplectus validus*. Weeds are interspersed amongst stands of these species and are dominant in much of the larger western wetland. Common species are the herbs Buttercup (*Ranunculus spp*), Curled Dock (*Rumex crispus*), Plantain (*Plantago lanceolata*) and the shrub Peruvian Primrose (*Ludwigia peruviana*). It is unclear whether these wetlands were formed by artificial means, which would disqualify them as the BC Act Endangered Ecological Community (EEC) known as Freshwater Wetlands on Coastal Floodplains. Till this matter is resolved, a precautionary approach is taken and they are assumed to be part of this EEC.
- 849 – Cumberland Shale Plains Woodland.  
A small area of this community occurs in the south of the reserve east of the main creek. It is characterised by a canopy of Forest Red Gum and Grey Box with a moderate to dense shrub layer of Blackthorn. The groundcover is composed of the native species Kangaroo Grass, *Paspalidium distans*, Weeping Meadow Grass and Hedgehog Grass (*Echinopogon caespitosus*) with the introduced African Lovegrass often dominating near the boundary.

Table 5 summarises the conservation status of the vegetation and estimates of clearing required to permit the conducting of the proposal.

**Table 5.** Extent of vegetation predicted to be cleared to achieve the objectives of the proposal.

**Key**

EEC – Endangered Ecological Community

VEC – Vulnerable Ecological Community

CEEC – Critically Endangered ecological community

Mapped Community (OEH 2011) <sup>6</sup>	PCT	BC Act status	EPBC Act Status	Current Extent (ha)	Total area in reserve (ha)	Area affected (ha)	Area affected as % of current extent	Area affected as % of reserve total
Shale Plains Woodland	849 - Cumberland Shale Plains Woodland	CEEC Cumberland Plain Woodland	CEEC Cumberland Shale Plains Woodland and Shale-Gravel Transition Forest	6800	25.38	0.22	0.003	0.87
Shale-Gravel Transition Forest	724 - Shale-Gravel Transition Forest	EEC Shale-Gravel Transition Forest	CEEC River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	1700	251.38	3.87	0.23	1.54
Alluvial Woodland <sup>7</sup>	835 - Cumberland riverflat forest	EEC River-flat Eucalypt Forest on Coastal Floodplains	-	4729	39.19	0.17	0.004	0.43
Freshwater Wetlands	1071 - <i>Phragmites australis</i> and <i>Typha orientalis</i> coastal freshwater wetlands of the Sydney Basin Bioregion	EEC - Freshwater Wetlands on Coastal Floodplains	-	unknown	2.85	0.08	unknown	2.81
Castlereagh Ironbark Forest	725 - Castlereagh Ironbark Forest	CEEC Cooks River-Castlereagh Ironbark Forest	CEEC Cooks River-Castlereagh Ironbark Forest	1100	120.91	0.42	0.04	0.35
Castlereagh Scribbly Gum Woodland	883 - Castlereagh Scribbly Gum Woodland	VEC Castlereagh Scribbly Gum Woodland	EEC Castlereagh Scribbly Gum and Agnes Banks Woodlands	3100	12.49	0.03	0.001	0.24
<b>Totals</b>					<b>452.21</b>	<b>4.79</b>		<b>1.06</b>

<sup>6</sup> During calculations, some corrections to the OEH (2011) mapping were done based on ground truthing of community boundaries in or near proposed clearing limits. However, this was not done comprehensively for the entire Nature Reserve.

<sup>7</sup> Areas mapped by OEH (OEH 2011) as Castlereagh Swamp Woodland within the reserve were interpreted to be Alluvial Woodland and added to the totals for that community.

### 7.3. Fauna species recorded during the field investigation

By the completion of the field investigations conducted within, adjacent to and in the vicinity of the proposal area, one native mammal, 39 native birds, three amphibians, eight reptiles and the State listed Cumberland Plain Land Snail had been recorded (Appendix 3). In addition, several introduced animals were also detected.

In regards to the detection of those native species observed:

- A number of Eastern Grey Kangaroos (*Macropus giganteus*) were seen within the reserve
- All birds were observed or identified based on their characteristic calls
- All reptiles were observed either during the dedicated ground debris searches or incidentally whilst traversing the proposal area
- All frog were heard calling or recorded during the dedicated ground debris searches
- The Cumberland Plain Land Snail was recorded during the dedicated ground debris searches.

Of those native species detected, two are listed under the schedules to the BC Act; these being the:

- Little Lorikeet (*Glossopsitta pusilla*) – listed as vulnerable under the Act
- Cumberland Plain Land Snail – listed as endangered.

For reference, habitat descriptions for these two threatened species are provided below.

No threatened animals listed under the EPBC Act were detected during the investigation.

During the course of the site inspections:

- a herd of Fallow Deer (*Dama dama*) numbering about 10 individuals was observed within the reserve.
  - *Herbivory and environmental degradation caused by feral deer* is listed as a Key Threatening Process under Schedule 4 of the BC Act
- a Fox (*Vulpes vulpes*) was seen.
  - *Predation by the European Red Fox Vulpes vulpes* is listed as a Key Threatening Process under Schedule 4 of the BC Act
- Mosquito Fish (*Gambusia holbrooki*) were observed in each of the drainage lines inspected.
  - *Predation by Gambusia holbrooki* (Plague Minnow or Mosquito Fish) is listed as a Key Threatening Process under Schedule 4 of the BC Act.

It is expected that, as part of the feral pest management component of the proposal, the removal of the deer herd, fox and other introduced mammals would be conducted ethically.

Given their proliferation in the drainage lines of the Greater Sydney region, and the likely dispersal of individuals during flood periods, it is not considered economically viable to address the presence of the Mosquito Fish. Whilst this species would be affecting the viability of some amphibian populations, this fish does provide foraging opportunities for species such as the State listed Southern Myotis (*Myotis macropus*).

In regards to those protected native species recorded, as defined by the BC Act, the proposal is expected to have an adverse effect on medium to large ground traversing mammals, such as the Eastern Grey Kangaroo. The erection of the security fencing would negate the movement of these individuals into and out of the reserve, this presenting management issues (such as inbreeding) of those animals that are retained within the fencing.

During the site inspections, no large stick nests that would suggest the breeding presence of a raptor were observed.

Based on a review of those databases consulted, other medium to large ground traversing mammal native species that have been recorded in the study region and which are expected to be affected by the proposal are the Short-beaked Echidna (*Tachyglossus aculeatus*), Common Ringtail Possum (*Pseudocheirus peregrinus*) and Common Brushtail Possum (*Trichosurus vulpecula*).

A Management Plan should be developed to ensure that the proposal does not affect the viability of local populations of these species. To determine those medium to large ground traversing mammals that are present within the reserve, targeted surveys should be conducted.

The movement and interbreeding patterns of arboreal traversing (i.e. gliders) and flying animals would not be affected by the proposal. The proposal would also not affect the behaviour of species with limited home range areas (such as those reptiles, frogs and invertebrates recorded). The mesh size proposed to be used along the base of the fencing (this being in the order of 30 mm) would permit herpetofauna to enter and exit the reserve.

### **7.3.1. Little Lorikeet**

The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia (OEH 2021a). Little Lorikeets forage primarily in the canopy of open Eucalypt forest and woodland, particularly along watercourses (OEH 2021a, Frith 2007). They feed mostly on pollen, nectar, blossoms, native and cultivated fruits and seeds (Frith 2007), feeding in small flocks (<10), though often with other lorikeets (OEH 2021a, Frith 2007). This species roosts in treetops, often distant from feeding areas (OEH 2021a). Nests in a hollow, usually 3 cm at the entrance and usually high above the ground (2 m to 15 m), typically in the limb or trunk of smooth-barked Eucalypts (OEH 2021a). These nest sites are often used repeatedly for decades, suggesting that preferred sites are limited (OEH 2021a). Nesting season extends from May to September (OEH 2021a).

While conducting one of the dedicated bird surveys, this carried out adjacent to one of the unnamed drainage lines in the southern portion of the reserve, a number of Little Lorikeet were heard flying over the reserve (researcher standing at E295969; N6266776) (Figure 5). During the field surveys, whilst flowering eucalypts were present and species such as the Rainbow Lorikeet (*Trichoglossus haematodus*) were feeding in these, no Little Lorikeets were recorded foraging within the reserve itself.

Within the area investigated, suitable foraging (i.e. nectar producing plants) and breeding (i.e. hollow-bearing trees) resources are present. While some habitat available for use by this species will be cleared to permit the proposal, given the amount of similar resources being retained within the reserve, resources that meet the lifecycle requirements of the Little Lorikeet will be maintained.

As a species listed as vulnerable under the BC Act, the Little Lorikeet will require an assessment of significance drawing on the criteria provided under Section 7.3 of the BC Act (commonly referred to 'the five-part test'). Should the assessment determine that the project would have a significant impact on this species, NPWS must prepare a SIS (per Section 7.8(3) of the BC Act).

### **7.3.2. Cumberland Plain Land Snail**

This species lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains (OEH 2021a). Primarily inhabits Cumberland Plain Woodland; being a grassy, open woodland with occasional dense patches of shrubs (OEH 2021a). It is also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest (OEH 2021a). Lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish, and can dig several centimetres into soil to escape drought (OEH 2021a).

Individuals of the Cumberland Plain Land Snail, both live and discarded shells, were identified at each of the sites where ground debris searches were conducted (Figure 5). During these searches, 5 to 10 individuals were recorded per site.

With reference to Figures 4 and 5, the individuals recorded were detected both within, adjacent to and beyond the limits of, the proposal area.

**Figure 5.** Locations of threatened fauna species recorded



As a species listed as endangered under the BC Act, the Cumberland Plain Land Snail will require an assessment of significance, drawing on the criteria provided under Section 7.3 of the BC Act. Should the assessment determine that the project would have a significant impact on this species, NPWS must prepare a SIS or a BDAR (per Section 7.8(3) of the BC Act).

#### 7.4. Fauna species previously recorded within, or in proximity to, the reserve

Based on a consideration of those databases consulted, a large number of native species have been previously recorded in, adjacent to and in the vicinity of the reserve (Appendix 3). Considering the documented lifecycle requirements and habitat needs of these species, a number would occur as resident animals within the reserve.

Of those species previously recorded, a number are listed under the Schedules to the EPBC and BC Acts (Appendix 3).

With reference to the 'Likelihood of Occurrence' table (Appendix 2) and based on the adoption of a precautionary approach, as they have been previously recorded within the surrounding region<sup>8</sup> and/or suitable foraging and roosting habitat is present within the reserve, and as targeted surveys were not conducted (i.e. echolocation, call playback), it is assumed that the threatened fauna species provided in Table 6 could potentially occur within and/or adjacent to the subject site.

**Table 6.** Species considered highly likely to occur within/adjacent to the reserve.

Species	EPBC Act	BC Act	Habitat within reserve
Squirrel Glider <i>Petaurus norfolcensis</i>	–	Vulnerable	Hollow-bearing trees, flowering plants
Yellow-bellied Sheath-tail-bat <i>Saccolaimus flaviventris</i>	–	Vulnerable	Hollow-bearing trees, insect-attracting plants
Eastern False Pipistrelle <i>Falsistrellus tasmaniensis</i>	–	Vulnerable	Hollow-bearing trees, insect-attracting plants
Southern Myotis <i>Myotis macropus</i>	–	Vulnerable	Hollow-bearing trees, drainage lines in which exotic fish were observed
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i>	–	Vulnerable	Hollow-bearing trees, insect-attracting plants
Eastern Coastal Free-tailed Bat <i>Micronomus norfolkensis</i>	–	Vulnerable	Hollow-bearing trees, insect-attracting plants
Australian Painted Snipe <i>Rostratula australis</i>	Endangered	Endangered	Suitable water bodies present
Curlew Sandpiper <i>Calidris ferruginea</i>	Critically Endangered, Migratory	Endangered	Suitable water bodies present
Latham's Snipe <i>Gallinago hardwickii</i>	Migratory	–	Suitable water bodies present
Speckled Warbler <i>Chthonicola sagittata</i>	–	Vulnerable	Suitable woodlands present
Varied Sittella <i>Daphoenositta chrysoptera</i>	–	Vulnerable	Suitable woodlands present
Dusky Woodswallow <i>Artamus cyanopterus cyanopterus</i>	–	Vulnerable	Suitable woodlands present

These 12 potentially occurring threatened species will require assessments of significance, drawing on the criteria provided under the EPBC Act's Significant Impact Guidelines and/or Section 7.3 of the BC Act.

<sup>8</sup> Via a BioNet database search of a 10 km radius of the study area.

## **7.5. Habitat types available for native fauna species**

Two habitat types available to native fauna were recorded within the study area, these being:

- Eucalypt woodland (corresponds to PCT's 725, 724, 835, 883 and 849 described in Section 7.2)
- Aquatic environment (corresponds to PCT 1071 described in Section 7.2).

For reference, a description of these is provided below. It is recommended these descriptions be read in conjunction with reference to the photographic record provided (Appendix 1).

### **7.5.1. Eucalypt woodland**

This habitat supports trees that are between 10 m and 25 m in height, a relatively continuous canopy being present throughout the reserve. Due to urban development, including the proximate Marsden Park land release, connectivity beyond the limits of the reserve is limited, particularly for arboreal gliding animals and sensitive ground traversing species. Urban tolerant animals, such as the Eastern Grey Kangaroo and Common Brushtail Possum, would currently be able to negotiate those urban developments and infrastructures that occur in proximity to the reserve.

The middle-storey within the eucalypt woodland is of a medium density and about 10 m in height, with a medium to high density understorey of 2-3 m. The groundcover is composed of grasses and forbs; leaf litter and natural ground debris is common, as are weeds on the urban fringe along the southern and western boundaries.

Sections of the eucalypt woodland have been disturbed and affected by past land use practices such as the establishment of the former Air Services Australia site and a transmission line. The woodland has also been disturbed by unrestricted off-road vehicle access, the establishment of an internal road network and the illegal dumping of urban refuse.

By the completion of the investigation, 52 hollow-bearing trees that may be used by those hollow-dependent species (e.g. Yangochiroptera) previously recorded in the study region, particularly those that are of conservation significance, were recorded within, or close to, the proposal area (Figure 6). For reference, details on these plants have been proposed (refer to Appendix 4). The hollow-diameters observed (refer to Appendix 4) within these trees would be suitable for occupation by small to medium sized species such as birds and bats, and larger species such as owls.

It is expected that the proposal will require the removal of a number of those hollow-bearing trees recorded. Those trees cleared that have a Diameter Breast Height of 200 mm or greater will be retained within the subject site and repurposed as coarse woody debris.

Whilst surveying six randomly selected sites, hollow-bearing trees were recorded within three of these (Figure 6). Within these three sites, on average, about three hollow-bearing trees per 1000 square metres were recorded.

Whilst hollow-bearing trees would be removed to permit the conducting of the proposal, within the remainder of the reserve, similar resources would be retained. The presence of these hollow-bearing trees would provide local resources that would ensure the long-term viability of those species that occupy them.



**Figure 6.** Hollow-bearing trees recorded within both the proposal area and reserve



### 7.5.2. Aquatic environment

Two unnamed creeks are present within the Shanes Park rewilding site; one traversing south-north through the centre of the site, with the second traversing the north-east corner (Figure 1). These waterways feed into South Creek/Wianamatta Creek about 3 km to the north of the subject site.

Both channels are generally 2 m to 3 m wide, and each has earthen banks and beds. Due to overbank flows during flood periods, a number of side channels are present, as are 'wetlands'. The creeks supported open expanses of water, with emergent and floating aquatic vegetation present. Exotic weeds occur on the banks, while the riparian vegetation is primarily per the descriptions provided for the adjacent eucalypt woodland. Significant amounts of flood borne debris was present along sections of the waterways, including large accumulations of urban refuse.

One exotic species, the Mosquito Fish (*Gambusia holbrooki*), was identified within each drainage line during the investigation. This was the only fish recorded, though it is expected that species such as Eels (*Anguilla* sp.) and the introduced Common Carp (*Cyprinus carpio*) would also occur (it is noted that each of these species was recorded during the course of a dam dewatering project that the authors were involved with as part of the proximate Marsden Park residential release. The dam that was dewatered was present on the eastern boundary of the reserve).

The volume of urban refuse present in association with the two drainage lines, is expected to be having an adverse effect on those native fish (as defined by the FM Act) present. Inclusion of gross pollutant traps that are regularly maintained into the fencing design, particularly along the southern section of the reserve, should be considered.

Neither of the drainage lines within the reserve are mapped as Key Fish Habitat (KFH) (DPI-Fisheries) (Figure 7).

**Figure 7.** Key Fish Habitat (blue lines) (reserve boundary denoted by red line)



With reference to the NSW Department of Industries' Fisheries Spatial Data Portal [search Hawkesbury-Nepean], South Creek/Wianamatta Creek is identified as KFH (Figure 7); however, as the proposed activities are terrestrial in nature, beyond existing levels of disturbance, the proposed work would not have a significant impact on these waterways. No major areas of aquatic habitat are to be removed, fragmented, isolated, significantly modified or disturbed.

No threatened fish species listed under the EPBC or FM Acts are considered to occur within 10 km of the reserve (Appendix 3). Given the extent of work proposed and the habitats to be affected, it is considered unnecessary that any assessments (i.e. reference to the EPBC Act's Significant Impact Guidelines or Section 221ZV (Part 7A) of the FM Act) in regards to State or Federally listed threatened fish be conducted.

The proposed work is not considered to result in any fish species, aquatic-associated animals or their populations becoming extinct in the locality. The work will not establish any barriers to fish movements, or isolate any of their habitat areas. Post-work, those fish that may traverse the drainage lines present would still be able to do so post-development.

Part 7 Division 3, 'Dredging and reclamation' of the FM Act is applicable to the proposal; dredging and reclamation defined as:

Dredging work —

- a) any work that involves excavating water land
- b) any work that involves moving material on water land or removing material from water land.

Reclamation work —

- a) using any material (such as sand, soil, silt, gravel, concrete, oyster shells, tyres, timber or rocks) to fill in or reclaim water land, or
- a) depositing any such material on water land for the purpose of constructing anything over water land (such as a bridge), or
- b) draining water from water land for the purpose of its reclamation.

Water land is land submerged by water —

- b) whether permanently or intermittently
- c) whether forming an artificial or natural body of water.

and includes wetlands<sup>9</sup> and any other land prescribed by the regulations as water land to which this Division applies.

Section 199 of the FM Act requires that the proponent must, before it carries out or authorises the carrying out of dredging work:

- (a) give the Minister written notice of the proposed work, and
- (b) consider any matters concerning the proposed work that are raised by the Minister within 28 days after the giving of the notice (or such other period as is agreed between the Minister and the public authority).

In accordance with Section 199 of the FM Act, as the proposal would have an effect on each drainage line present, it is recommended that NPWS consult with DPI Fisheries prior to construction commencing.

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<sup>9</sup> wetlands include marshes, mangroves, swamps, or other areas that form a shallow body of water when inundated intermittently or permanently with fresh, brackish or salt water, and where the inundation determines the type and productivity of the soils and the plant and animal communities.

## 8. Legislative considerations

### 8.1. Commonwealth - *Environment Protection and Biodiversity Conservation Act 1999*

By the completion of the field investigation five MNES listed under this Act was recorded within, or in the vicinity of the proposal area, being:

- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest - CEEC
- River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria - CEEC
- Cooks River - Castlereagh Ironbark Forest – CEEC
- Castlereagh Scribbly Gum and Agnes Banks Woodlands – EEC
- *Pultenaea parviflora* - vulnerable

Based on a precautionary approach, a further three fauna species listed under this Act are considered likely to occur as they have been previously recorded in the study region and habitat suitable for their occurrence is present:

- Australian Painted Snipe (*Rostratula australis*) – listed as endangered
- Curlew Sandpiper (*Calidris ferruginea*) – critically endangered, migratory
- Latham's Snipe (*Gallinago hardwickii*) – migratory.

Each of these MNES will require assessments of significance, drawing on the criteria provided under the EPBC Act's Significant Impact Guidelines.

### 8.2. State – *Biodiversity Conservation Act 2016*

By the completion of the field investigation, seven TECs, four threatened flora species and two threatened fauna species, listed under this Act had been recorded:

- Cumberland Plain Woodland - CEEC
- Shale-Gravel Transition Forest – EEC
- River-flat Eucalypt Forest on coastal floodplains -EEC
- Cooks River - Castlereagh Ironbark Forest – CEEC
- Freshwater Wetlands on Coastal Floodplains – EEC
- Castlereagh Scribbly Gum Woodland<sup>10</sup> – VEC
- Sydney Freshwater Wetlands – EEC
- *Hibbertia puberula* – endangered
- *Pultenaea parviflora* – endangered
- *Dillwynia tenuifolia* – vulnerable
- *Grevillea juniperina subsp. juniperina* – vulnerable
- Little Lorikeet (*Glossopsitta pusilla*) – vulnerable
- Cumberland Plain Land Snail (*Meridolum corneovirens*) – endangered.

Based on a precautionary approach, a further 11 fauna species listed under this Act are considered likely to occur:

- Squirrel Glider (*Petaurus norfolcensis*) – listed as vulnerable
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*) – vulnerable
- Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) – vulnerable
- Southern Myotis (*Myotis macropus*) – vulnerable
- Greater Broad-nosed Bat (*Scoteanax rueppellii*) – vulnerable
- Eastern Coastal Free-tailed Bat (*Micronomus norfolkensis*) – vulnerable
- Australian Painted Snipe (*Rostratula australis*) – endangered
- Curlew Sandpiper (*Calidris ferruginea*) – endangered

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<sup>10</sup> VECs do not require assessment under section 7.3 of the BC Act

- Speckled Warbler (*Chthonicola Sagittata*) – vulnerable
- Varied Sittella (*Daphoenositta chrysoptera*) – vulnerable
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*) – vulnerable.

These entities, apart from Castlereagh Scribbly Gum Woodland, will require assessments of significance, drawing on the criteria provided under Part 7, Section 7.3 of the BC Act.

### 8.3. State – Fisheries Management Act 1994

No threatened fish species listed under the EPBC or FM Acts are considered to be directly or indirectly affected by the proposal. Given the extent of work proposed and the habitats to be affected, it is considered unnecessary that any assessments (i.e. reference to the EPBC Act's Significant Impact Guidelines or Section 221ZV (Part 7A) of the FM Act) in regards to State or federally listed threatened fish be conducted.

As the work proposed would have a direct impact on those drainage lines present, in accordance with Section 199 of the FM Act, NPWS must consult with DPI Fisheries prior to construction commencing.

## 9. Conclusion

As part of the proposed establishment of fencing around the perimeter of Shanes Park reserve, this being conducted as part of the NSW Rewilding Program, a Biodiversity Assessment has been conducted.

By the completion of this investigation, the following matters of conservation significance had been recorded:

- Cumberland Plain Woodland – listed as a CEEC on the BC Act
- Shale-Gravel Transition Forest – listed as an EEC on the BC Act
- Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest – listed as a CEEC on the EPBC Act
- River-flat Eucalypt Forest on coastal floodplains – listed as an EEC on the BC Act and a CEEC on the EPBC Act
- Cooks River - Castlereagh Ironbark Forest – listed as a CEEC on the BC Act and the EPBC Act
- Castlereagh Scribbly Gum Woodland – listed as a VEC on the BC Act
- Freshwater Wetlands on Coastal Floodplains – listed as an EEC on the BC Act
- Castlereagh Scribbly Gum and Agnes Banks Woodlands – listed as an EEC on the EPBC Act
- *Hibbertia puberula* – listed as endangered on the BC Act
- *Pultenaea parviflora* – listed as endangered on the BC Act and vulnerable on the EPBC Act
- *Dillwynia tenuifolia* – listed as vulnerable on the BC Act
- *Grevillea juniperina* subsp. *juniperina* – listed as vulnerable on the BC Act
- Little Lorikeet – listed as vulnerable under the BC Act
- Cumberland Plain Land Snail – listed as endangered under the BC Act.

Based on a precautionary approach, a further 12 fauna species listed under the EPBC and/or BC Acts were considered likely to occur:

- Squirrel Glider – listed as vulnerable under the BC Act
- Yellow-bellied Sheath-tail-bat – listed as vulnerable under the BC Act
- Eastern False Pipistrelle – listed as vulnerable under the BC Act
- Southern Myotis – listed as vulnerable under the BC Act
- Greater Broad-nosed Bat – listed as vulnerable under the BC Act
- Eastern Coastal Free-tailed Bat – listed as vulnerable under the BC Act
- Australian Painted Snipe – listed as endangered under the EPBC and BC Acts
- Curlew Sandpiper – listed as critically endangered and migratory under the EPBC Act, and endangered under the BC Act

- Latham's Snipe – listed as migratory under the EPBC Act
- Speckled Warbler – listed as vulnerable under the BC Act
- Varied Sittella – listed as vulnerable under the BC Act
- Dusky Woodswallow – listed as vulnerable under the BC Act.

Assessments using the EPBC Act's Significant Impact Guidelines and the criteria provided under Section 7.3 of the BC Act are required to be conducted on the CEECs, EECs and threatened species recorded and those threatened species potentially occurring.

It is not expected that any threatened fish species (as defined by the FM Act) would utilise or occupy the waterways present within the study area; as such, an assessment referencing the EPBC Act's Significant Impact Guidelines or Section 221ZV (Part 7A) of the FM Act is not required.

## **10. Recommendations**

Following an investigation of both the proposal area and remainder of Shanes Park, the following recommendations are provided:

- 1) A Management Plan should be developed that ensures the proposal does not affect the viability of those resident fauna populations that occupy Shanes Park, particularly medium to large ground traversing animals.
  - a. To assist development of the Management Plan, targeted surveys should be undertaken to determine the diversity of medium to large ground traversing resident species
- 2) Those trees cleared to achieve the objectives of the proposal that have a Diameter Breast Height of 200 mm or greater should be retained within the subject site and repurposed as coarse woody debris.
- 3) As part of the overall management of the site, measures should be implemented to remove the 6 weeds of significance and occurrences of African Lovegrass.
- 4) In accordance with Section 199 of the FM Act, as the proposal would have an effect on each drainage line present, it is recommended that NPWS consult with DPI Fisheries prior to construction commencing.
- 5) Inclusion of gross pollutant traps where the proposal intersects the unnamed drainage lines within the southern portion of Shanes Park should be considered.

## 11. Bibliography

Anstis, M 2017, *Tadpoles and frogs of Australia*, New Holland Publishers, Sydney, NSW

Atlas of Living Australia 2021, *Explore your area: Shanes Park – 5 km radius*, viewed September, <[https://biocache.ala.org.au/explore/your-area#-33.7112|150.7722|12|ALL\\_SPECIES](https://biocache.ala.org.au/explore/your-area#-33.7112|150.7722|12|ALL_SPECIES)>

Bannerman S.M., Hazelton P.A. and Tille P.J., 2010, *Soil Landscapes of the Penrith 1:100,000 Sheet map*, reprint, Department of Environment, Climate Change and Water, Sydney.

Bannerman S.M. and Hazelton P.A., 2011, *Soil Landscapes of the Penrith 1:100,000 Sheet report*, digital reprint, Office of Environment and Heritage, Sydney.

Briggs, J and Leigh, J 1996, *Rare or Threatened Australian Plants*, CSIRO Publishing, Collingwood, Victoria

Bureau of Meteorology 2021, *Bureau of Meteorology Climate Averages*, viewed September 2021, <<http://www.bom.gov.au/climate/averages>>

Churchill, S 2008, *Australian bats - 2nd Edition*, Allen and Unwin, Crows Nest, NSW

Cogger, H 2014, *Reptiles and amphibians of Australia*. CSIRO Publishing, Collingwood, Victoria

Commonwealth of Australia 2002, *Style Manual 6<sup>th</sup> Edition*, John Wiley and Sons Australia Ltd, Richmond, Victoria

Cropper, S 1993, *Management of Endangered Plants*, CSIRO, Melbourne, Victoria

Department of Agriculture, Water and the Environment 2021a, *Protected Matters Search Tool*, viewed September 2021, <<http://www.environment.gov.au/epbc/pmst/index.html>>

– 2021b, *Register of Critical Habitat*, viewed September 2021, <<https://www.environment.gov.au/cgi-bin/sprat/public/publicregisterofcriticalhabitat.pl>>

– 2021c, *Species profile and threats database*, viewed September 2021, <<https://www.environment.gov.au/cgi-bin/sprat/public/sprat.pl>>

Department of the Environment 2013, *Matters of National Environmental Significance: Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999*, viewed September 2021 <[http://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines\\_1.pdf](http://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf)>

Department of Environment and Climate Change 2007, *Threatened species assessment guidelines: The assessment of significance*, Department of Environment and Climate Change, Hurstville, NSW

– 2009 *Threatened species survey and assessment guidelines: field survey methods for fauna: Amphibians*. Office of Environment and Heritage, Sydney, NSW

Department of Environment and Conservation 2004 [Working draft], *Threatened Species Survey and Assessment: Guidelines for developments and activities*, New South Wales Department of Environment and Conservation, Hurstville, NSW.

Department of the Environment, Water, Heritage and the Arts 2010a, *Survey guidelines for Australia's threatened bats: Guidelines for detecting bats listed as threatened under the EPBC Act*. Commonwealth of Australia Barton, ACT

– 2010b, *Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the EPBC Act*. Commonwealth of Australia Barton, ACT

– 2010c, *Survey guidelines for Australia's threatened frogs: Guidelines for detecting frogs listed as threatened under the EPBC Act*. Commonwealth of Australia Barton, ACT

Department of Planning, Industry and Environment 2021a, *Area of Outstanding Biodiversity Value register*, viewed September 2021, <https://www.environment.nsw.gov.au/topics/animals-and-plants/biodiversity/areas-of-outstanding-biodiversity-value/area-of-outstanding-biodiversity-value-register>

- 2021b, *BioNet (Atlas of NSW Wildlife) Database*, data downloaded September 2021, [http://www.environment.nsw.gov.au/atlaspublicapp/UI\\_Modules/ATLAS\\_/AtlasSearch.aspx](http://www.environment.nsw.gov.au/atlaspublicapp/UI_Modules/ATLAS_/AtlasSearch.aspx)

– 2021c, *BioNet Vegetation Classification*, viewed October 2021, <https://www.environment.nsw.gov.au/NSWVCA20PRapp/LoginPR.aspx?ReturnUrl=%2fNSWVCA20PRapp%2fdefault.aspx>

Department of Primary Industries 2021a, *NSW Weedwise, Priority weeds for the Greater Sydney - Blacktown*, viewed September 2021, <https://weeds.dpi.nsw.gov.au/WeedBiosecurities?AreaId=21>

– 2021b, *Threatened species lists*, viewed September 2021, <https://www.dpi.nsw.gov.au/fishing/species-protection/what-current>

– 2021c, *Fisheries NSW Spatial Data Portal, Key Fish Habitat – Hawkesbury-Nepean*, viewed September 2021, <https://www.dpi.nsw.gov.au/about-us/research-development/spatial-data-portal>

– 2009, *Appendix F: Stream Order and Waterway Classification System*, viewed September 2021 [https://www.dpi.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0004/634621/9.-Appendices-F-to-J.pdf](https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/634621/9.-Appendices-F-to-J.pdf)

Department of Sustainability, Environment, Water, Population and Communities 2011a, *Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act*. Commonwealth of Australia Barton, ACT

– 2011b, *Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act*. Commonwealth of Australia Barton, ACT

eBird 2009-2020, *Shanes Park*, viewed September, <https://ebird.org/hotspot/L2557630>

– 2011/2014, *South Creek, Shanes Park, Willmot*, viewed September 2021, <https://ebird.org/hotspot/L2557615>

Frith, HJ (Ed) 2007, *Complete book of Australian birds*, Readers Digest, Surry Hills, NSW

Harden, G (Ed) 1992-2002, *Flora of New South Wales Vol 1,2,3 and 4*, NSW University Press, Kensington, NSW

Keith, D 2004, *Ocean Shores to Desert Dunes; the native vegetation of New South Wales and the ACT*, NSW National Parks & Wildlife Service, Sydney, NSW

Lincoln-Smith, M. 2003, *Aquatic Ecology in Environmental Impact Assessment, EIA Guideline Series*. Prepared on behalf of Department of Planning, viewed September 2021, [https://www.hornsby.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0008/125378/NSW-Aquatic-Ecology-in-EIA-Guide.pdf](https://www.hornsby.nsw.gov.au/__data/assets/pdf_file/0008/125378/NSW-Aquatic-Ecology-in-EIA-Guide.pdf)

NSW Government 2017, *Blacktown Local Environmental Plan 2015*, viewed September 2021, <https://legislation.nsw.gov.au/view/html/inforce/current/epi-2015-0239#>

Office of Environment and Heritage (2011a) *Remnant Vegetation Mapping of the Cumberland Plain (crown cover greater than 10%)*. VIS\_ID 2221. Viewed online October 2021 [https://datasets.seed.nsw.gov.au/dataset/remnant-vegetation-mapping-of-the-cumberland-plain-crown-cover-greater-than-10-vis\\_id-2221e0dca](https://datasets.seed.nsw.gov.au/dataset/remnant-vegetation-mapping-of-the-cumberland-plain-crown-cover-greater-than-10-vis_id-2221e0dca)



- 2016, *NSW Guide to Surveying Threatened Plants*, Office of Environment and Heritage, Sydney South, NSW, viewed September 2021, <<http://www.environment.nsw.gov.au/resources/threatenedspecies/160129-threatened-plants-survey-guide.pdf>>

– 2018, *Threatened Species Test of Significance Guidelines*, Office of Environment and Heritage, Sydney NSW, viewed September 2021, <<https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Threatened-species/threatened-species-test-significance-guidelines-170634.pdf>>

– 2021a, *Threatened biodiversity profile search*, viewed September 2021, <<https://www.environment.nsw.gov.au/threatenedspeciesapp/>>

Richardson, FJ, Richardson, RG and Shepherd RCH 2007 *Weeds of the south-east: an identification guide*. RG & FJ Richardson, Meredith, Victoria.

Royal Botanic Gardens and Domain Trust undated *PlantNET (The NSW Plant Information Network System)*, Sydney, viewed September 2021, <<https://plantnet.rbgsyd.nsw.gov.au>>

Roads and Traffic Authority 2011, Biodiversity guidelines: Protecting and managing biodiversity on RTA projects, NSW Roads and Traffic Authority (now Roads and Maritime Services), Sydney, NSW, viewed October 2021 <[https://www.rms.nsw.gov.au/business-industry/partners-suppliers/documents/guides-manuals/biodiversity\\_guidelines.pdf](https://www.rms.nsw.gov.au/business-industry/partners-suppliers/documents/guides-manuals/biodiversity_guidelines.pdf)>

Simpson, K and Day, N 2010, *Field guide to the birds of Australia*, 8th Edition, Penguin Books Australia, Victoria

State Government of NSW and Department of Planning, Industry and Environment 2000, *Soil Landscapes of the Penrith 1:100,000 Sheet – SEED dataset*, viewed October 2021, <<https://datasets.seed.nsw.gov.au/dataset/soil-landscapes-of-the-penrith-1-100000-sheet0cca7>>

Triggs, B 1996, *Tracks, scats and other traces: a field guide to Australian mammals*, Oxford University Press, Melbourne, Victoria

Van Dyck, S and Strahan, R 2008, *The mammals of Australia* (3rd edition), Reed New Holland, Sydney, NSW

weedsAustralia 2021, *Weeds of national significance*, viewed September 2021, <<http://www.environment.gov.au/biodiversity/invasive/weeds/weeds/lists/wons.html>>

**Appendix 1. Photographic record of the area investigated**

	<p>Character of the woodlands present within the reserve.</p>
	<p>Character of the woodlands present within the reserve.</p>
	<p>Nature of one of the unnamed drainage lines present within the reserve.</p>



Nature of one of the unnamed drainage lines present within the reserve.



Extent of urban flood borne debris present within reserve.



Nature of an impounded section of the drainage lines present. Photograph taken at proposed fence crossing location.



Character of the woodlands present within the reserve near the proposed fencing alignment.



Character of the woodlands present within the reserve near the proposed fencing alignment.

## Appendix 2. Threatened species previously recorded in the study region their 'likelihood of occurrence'

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### Key

V - vulnerable    E - endangered    CE - critically endangered    M - migratory    EP – endangered population    X - extinct

A State or nationally listed threatened species is considered to have a:

- **High** likelihood of occurrence if it has been recorded within 10 km of the study area and there is either suitable habitat present or the potential for the species to fly over the site (while species may fly over, it is acknowledged that for some species no suitable habitat will be present within the study area).
- **Moderate** likelihood of occurrence if they have a predicted occurrence (via the EPBC Act Protected Matters Search Tool or BioNet geographic search) and there is either suitable habitat present or the potential for the species to fly over the site (while species may fly over, it is acknowledged that for some species no suitable habitat will be present within the study area).
- **Low** likelihood of occurrence if suitable habitat for an animal is not present regardless of whether they have been recorded within 10 km, or have a predicted occurrence.

Note: The number of records is from BioNet (within a 10 km radius of the study area) unless otherwise stated.

Note: As these habitats are not present, no pelagic or estuarine species have been considered in the following table. Given that the proposed work is not located within the Commonwealth marine area, this being from 3 to 200 nautical miles from the coast, no species listed as marine under the EPBC Act have been considered; nor has the marine status of any species been acknowledged.

\* - habitat requirements were generally extracted from DAWE (2021a), OEH (2021a), Harden (1992-2002), Frith (2007), Churchill (2008), Anstis (2017), Cogger (2014), Van Dyck and Strahan (2008), with other references used being identified in the bibliography.

Species	Status		Primary habitat requirements	Number of records	Likelihood of Occurrence <sup>11</sup>
	EPBC Act	BC Act			
<b>PLANTS</b>					
Bynoe's Wattle <i>Acacia bynoeana</i>	V	E	Occurs in heath or dry sclerophyll forest on sandy soils.	87	Low. Habitat absent.
Downy Wattle <i>Acacia pubescens</i>	V	V	Occurs in open woodland and forest, in a variety of plant communities including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.	23	Moderate. Few nearby records. Suitable habitat represented by Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland. No records in reserve despite numerous surveys and obvious diagnostic features.
<i>Allocasuarina glareicola</i>	E	E	Primarily restricted to the Richmond district, with an outlier population found at Voyager Point, Liverpool. Grows in Castlereagh woodland on lateritic soil.	96	Moderate. Suitable habitat represented by Castlereagh Scribbly Gum woodland, Castlereagh Ironbark Forest, Shale/Gravel Transition Forest. No records in reserve despite numerous surveys and reasonably obvious diagnostic features.
<i>Dillwynia tenuifolia</i>		V	In western Sydney, may be locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	2780	Recorded in study area. Common in Castlereagh Ironbark Forest, Shale Gravel Transition Forest and Castlereagh Scribbly Gum woodland.
Juniper-leaved Grevillea <i>Grevillea juniperina</i> subsp. <i>juniperina</i>		V	Grows on reddish clay to sandy soils derived from Wianamatta Shale and Tertiary alluvium (often with shale influence), typically containing lateritic gravels.	3534	Recorded in study area. Common in Castlereagh Ironbark Forest, Cumberland Plain Woodland and Shale Gravel Transition Forest.
Small-flower Grevillea <i>Grevillea parviflora</i> subsp. <i>parviflora</i>	V	V	In Sydney it is restricted to Appin, Picton Bargo area. Grows in sandy or light clay soils usually over thin shales, often with lateritic ironstone gravels and nodules. Unusual local record from Ropes Creek.	2	Low. Habitat absent.
<i>Hibbertia puberula</i>		E	Occurs on sandy soil often associated with sandstone, or on clay. Habitats are typically dry sclerophyll woodland communities, although heaths are also occupied.	3	Recorded in Castlereagh Ironbark Forest in the south-west of the reserve.

<sup>11</sup> For the site to support, and be important for the lifecycle requirements of, a locally viable population of this species.

Species	Status		Primary habitat requirements	Number of records	Likelihood of Occurrence <sup>11</sup>
	EPBC Act	BC Act			
<i>Isotoma fluviatilis</i> subsp. <i>fluviatilis</i>		X		3	Extinct.
Macadamia Nut <i>Macadamia integrifolia</i>	V		Grows in remnant rainforest, preferring partially open areas such as rainforest edge in NE NSW and SE Queensland.	2	Low. Local records are planted specimens.
<i>Marsdenia viridiflora</i> R. Br. subsp. <i>viridiflora</i> population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas		EP	Grows in vine thickets and open shale woodland. Recorded nearby in Wianamatta Regional Park. Record 300 m east of reserve is only accurate to 5km and is from 1914.	983	High. Habitat represented by Castlereagh Ironbark Forest, Shale/Gravel Transition Forest, Castlereagh Scribbly Gum Woodland, Castlereagh Shrubby Swamp Woodland, Not recorded in reserve but not an obvious species.
<i>Micromyrtus minutiflora</i>	V	E	Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments.	360	Moderate. Habitat represented by Castlereagh Scribbly Gum Woodland, Castlereagh Ironbark Forest, Shale/Gravel Transition Forest. Recorded nearby in Wianamatta Regional Park but no records in reserve despite numerous surveys and reasonably obvious diagnostic features.
Hairy Geebung <i>Persoonia hirsuta</i>	E	E	Found in sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	7	Low. Habitat absent.
Nodding Geebung <i>Persoonia nutans</i>	E	E	Restricted to the Cumberland Plain in western Sydney, between Richmond in the north and Macquarie Fields in the south. Southern populations occupy tertiary alluvium, but extend onto shale sandstone transition communities and into Cooks River/Castlereagh Ironbark Forest.	894	Moderate. Habitat represented by Castlereagh Scribbly Gum Woodland and to a lesser extent Castlereagh Ironbark Forest and Shale/Gravel Transition Forest. Recorded nearby in Wianamatta Regional Park but no records in reserve despite numerous surveys and reasonably obvious diagnostic features.
Austral Pillwort <i>Pilularia novae-hollandiae</i>		E	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	1	Low. Potential habitat present but extremely rare.

Species	Status		Primary habitat requirements	Number of records	Likelihood of Occurrence <sup>11</sup>
	EPBC Act	BC Act			
			woodland/shale plains woodland (Cumberland Plain Woodland) ecotone		
<i>Pimelea curviflora</i> var. <i>curviflora</i>	V	V	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	18	Low. Habitat absent.
Spiked Rice-flower <i>Pimelea spicata</i>	E	E	Found on well-structured clay soils On the Cumberland Plain sites it is associated with Grey Box communities (particularly Cumberland Plain Woodland variants and Moist Shale Woodland) and in areas of ironbark. Co-occurring are Grey Box ( <i>Eucalyptus moluccana</i> ), Forest Red Gum ( <i>E. tereticornis</i> ) and Narrow-leaved Ironbark ( <i>E. crebra</i> ). Blackthorn ( <i>Bursaria spinosa</i> ) is often present at sites (and may be important in protection from grazing) and Kangaroo Grass ( <i>Themeda australis</i> ) is usually present in the groundcover (also indicative of a less intense grazing history).	509	High. Habitat represented by Cumberland Shale Plains Woodland. Recorded nearby in Wianamatta Regional Park and sometimes not apparent above ground and often overlooked when not in flower.
Sydney Plains Greenhood <i>Pterostylis saxicola</i>	E	E	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines.	1	Low. Habitat absent.
<i>Pultenaea parviflora</i>	V	E	May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland.	1068	Recorded in study area. Common in Castlereagh Ironbark Forest and Shale/Gravel Transition Forest.
Magenta Lilly Pilly <i>Syzygium paniculatum</i>	V	E	Found only in NSW, in a narrow, linear coastal strip from Upper Lansdowne to Conjola State Forest. On the south coast the Magenta Lilly Pilly occurs on grey soils over sandstone, restricted mainly to remnant stands of littoral (coastal) rainforest. Commonly planted in gardens and parks.	3	Low. Habitat absent.



Species	Status		Primary habitat requirements	Number of records	Likelihood of Occurrence <sup>11</sup>
	EPBC Act	BC Act			
<b>MAMMALS</b>					
Spotted-tailed Quoll <i>Dasyurus maculatus</i>	E	V	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	11	Low. Not considered to be present within or in proximity to Shanes Park.
Koala <i>Phascolarctos cinereus</i>	V	V	Open eucalypt forest and woodland, containing a variety of 'preferred' food tree species.	8	Low. Not considered to be present within or in proximity to Shanes Park.
Yellow-bellied Glider <i>Petaurus australis</i>		V	Occurs in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	3	Low. Considered to be locally extinct.
Squirrel Glider <i>Petaurus norfolcensis</i>		V	Inhabits woodland and dry sclerophyll forest areas below 300 m in elevation, though in the northern parts of its distribution it will also occur in coastal forest and some of the wet forest areas bordering on rainforests. Habitat ideally consists of a stand of diverse shrub and tree cover and numerous nesting hollows used as dens for shelter and raising young.	6	High. Suitable foraging and sheltering habitat present. Unlikely to have been surveyed for within this parcel of land. Assumed present based on precautionary approach.
Grey-headed Flying-fox <i>Pteropus poliocephalus</i>	V	V	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops.	429	Low. No flying-fox camps present. May forage within Shanes Park but would not occur as <i>resident population</i> .
Yellow-bellied Sheathtail-bat <i>Saccolaimus flaviventris</i>		V	Roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows. Forages in most habitats across its very wide range, with and without trees; appears to defend an aerial territory.	14	High. Suitable foraging, breeding and roosting habitat present.
Eastern False Pipistrelle <i>Falsistrellus tasmaniensis</i>		V	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in hollow-bearing trees (eucalypts), but has also been found under loose bark on trees or in buildings.	27	High. Suitable foraging, breeding and roosting habitat present.
Southern Myotis <i>Myotis macropus</i>		V	Generally, roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools catching insects and small fish by raking their feet across the water surface.	70	High. Suitable foraging, breeding and roosting habitat present.
Greater Broad-nosed Bat <i>Scoteanax rueppellii</i>		V	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is	40	High. Suitable foraging, breeding and roosting habitat present.

Species	Status		Primary habitat requirements	Number of records	Likelihood of Occurrence <sup>11</sup>
	EPBC Act	BC Act			
			most commonly found in tall wet forest. Usually roosts in tree hollows but also in buildings.		
Little Bent-winged Bat <i>Miniopterus australis</i>		V	Generally found in well-timbered areas. Roost in caves, tunnels, tree hollows, abandoned mines, stormwater drains, culverts, bridges and sometimes buildings during the day.	13	Low. No suitable roosting or breeding habitat present. May forage within Shanes Park on occasion.
Large Bent-winged Bat <i>Miniopterus orianae oceanensis</i>		V	Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures.	103	Low. No suitable roosting or breeding habitat present. May forage within Shanes Park on occasion.
Eastern Coastal Free-tailed Bat <i>Micronomus norfolkensis</i>		V	Occur in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. Roost mainly in tree hollows but will also roost under bark or in man-made structures.	76	High. Suitable foraging, breeding and roosting habitat present.
<b>BIRDS</b>					
Freckled Duck <i>Stictonetta naevosa</i>		V	Prefers permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times moves from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	2	Low. No suitable habitat present.
Blue-billed Duck <i>Oxyura australis</i>		V	Prefers deep water in large permanent wetlands and swamps with dense aquatic vegetation.	2	Low. No suitable habitat present.
Superb Fruit-Dove <i>Ptilinopus superbus</i>		V	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.	1 (Atlas of Living Australia)	Low. No suitable habitat present.
White-throated Needletail <i>Hirundapus caudacutus</i>	V, M		Almost exclusively aerial. Takes insects on wing over a range of habitat types. Recorded most often above wooded areas, including open forest and rainforest.	6	Low. No suitable habitat present.
Fork-tailed Swift <i>Apus pacificus</i>	M		Almost exclusively aerial. Takes insects on wing over a range of habitat types, but also less than 1 m above open areas or over water. Mostly occur over inland plains but sometimes above foothills or in coastal areas.	6	Low. No suitable habitat present.
Black-necked Stork <i>Ephippiorhynchus asiaticus</i>		E	Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat	2	Low. No suitable habitat present.

Species	Status		Primary habitat requirements	Number of records	Likelihood of Occurrence <sup>11</sup>
	EPBC Act	BC Act			
			in NSW for the Black-necked Stork. Secondary habitat includes minor floodplains, coastal sandplain wetlands and estuaries.		
Black Bittern <i>Ixobrychus flavicollis</i>		V	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.	2	Low. May utilise site on occasion but unlikely to be a resident species.
Australasian Bittern <i>Botaurus poiciloptilus</i>	E	E	Occupies shallow, vegetated freshwater or brackish swamps, usually dominated by tall, dense reed beds of <i>Typha</i> sp., <i>Juncus</i> sp. and <i>Phragmites</i> sp. Nests on platforms of reeds and rushes, usually built over water in dense cover.	1	Low. May utilise site on occasion but unlikely to be a resident species.
Glossy Ibis <i>Plegadis falcinellus</i>	M		This Ibis inhabits shallow freshwater swamps and mudflats particularly where trees and bushes provide shelter. They nest within branches of trees growing within water in secluded locations.	1	Low. May occasionally utilise Shanes Park on occasion during periods of drought but would not be a resident species.
Square-tailed Kite <i>Lophoictinia isura</i>		V	Found in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	8 1 (eBird 2010)	Low. May occasionally utilise Shanes Park on occasion during its foraging intervals but unlikely to be a resident species.
White-bellied Sea-eagle <i>Haliaeetus leucogaster</i>		V	Found in coastal habitats (especially those close to the sea-shore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia.	9 1 eBird (2010)	Low. May occasionally utilise Shanes Park on occasion during its foraging intervals but unlikely to be a resident species.
Little Eagle <i>Hieraaetus morphnoides</i>		V	Occupies open eucalypt forest, woodland or open woodland. Sheoak or <i>Acacia</i> woodlands and riparian woodlands of interior NSW are also used.	25 2 records (eBird 2010)	Low. May occasionally utilise Shanes Park on occasion during its foraging intervals but unlikely to be a resident species.
Spotted Harrier <i>Circus assimilis</i>		V	Occurs in grassy open woodland including <i>Acacia</i> and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	4	Low. May occasionally utilise Shanes Park on occasion during its foraging intervals but unlikely to be a resident species.

Species	Status		Primary habitat requirements	Number of records	Likelihood of Occurrence <sup>11</sup>
	EPBC Act	BC Act			
Black Falcon <i>Falco subniger</i>		V	Found along tree-lined watercourses and in isolated stands of trees, mainly in arid and semi-arid areas.	4	Low. Not considered to be present.
Pacific Golden Plover <i>Pluvialis fulva</i>	M		Non-breeding summer migrant that prefers coastal habitats, though it occasionally occurs around inland wetlands. Pacific Golden Plovers usually occur on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as <i>Sarcocornia</i> , or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks.	8	Low. No suitable habitat present.
Double-banded Plover <i>Charadrius bicinctus</i>	M		Found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. Occurs within muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers. Is sometimes associated with coastal lagoons, inland saltlakes and saltworks.	2	Low. No suitable habitat present.
Australian Painted Snipe <i>Rostratula australis</i>	E	E	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber.	5	High, suitable habitat present. May occupy site during summer period.
Wood Sandpiper <i>Tringa glareola</i>	M		Non-breeding summer migrant. Prefers well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially <i>Melaleuca</i> and River Red Gums <i>Eucalyptus camaldulensis</i> and often with fallen timber.	8	Low. No suitable habitat present.
Common Sandpiper <i>Actitis hypoleucos</i>	M		Non-breeding summer migrant that is widespread in small numbers in a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats.	2	Low. No suitable habitat present.

Species	Status		Primary habitat requirements	Number of records	Likelihood of Occurrence <sup>11</sup>
	EPBC Act	BC Act			
Common Greenshank <i>Tringa nebularia</i>	M		Non-breeding summer migrant. Inhabits a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass.	1	Low. No suitable habitat present.
Marsh Sandpiper <i>Tringa stagnatilis</i>	M		Non-breeding summer migrant. Inhabits permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, salt pans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks	3	Low. No suitable habitat present.
Latham's Snipe <i>Gallinago hardwickii</i>	M		Non-breeding summer migrant to south-eastern Australia usually inhabiting open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies)	17	High, suitable habitat present. May occupy site during summer period.
Sharp-tailed Sandpiper <i>Calidris acuminata</i>	M		Arrives from breeding grounds between July and September. When present in Australia, occurs within most wader habitats including both saltwater and freshwater environments. Feeds on aquatic insects. Shelter within low herbage at the edge of waterbodies.	2	Low. No suitable habitat present.
Pectoral Sandpiper <i>Calidris melanotos</i>	M		Non-breeding summer migrant that in Australasia prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	10	Low. No suitable habitat present.
Red-necked Stint <i>Calidris ruficollis</i>	M		Non-breeding summer migrant. Mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores.	11	Low. No suitable habitat present.
Curlew Sandpiper <i>Calidris ferruginea</i>	CE, M	E	Non-breeding summer migrant. Generally, occupies littoral and estuarine habitats, and in New South Wales is mainly found in intertidal mudflats of sheltered coasts.	4	High, suitable habitat present. May occupy site during summer period.
Glossy Black-Cockatoo <i>Calyptorhynchus lathami</i>		V	Inhabits eucalypt woodland and feeds almost exclusively on Casuarina fruits.	4	Low. May utilise Shanes Park on occasion during its foraging intervals but unlikely to be a resident species.

Species	Status		Primary habitat requirements	Number of records	Likelihood of Occurrence <sup>11</sup>
	EPBC Act	BC Act			
Gang-gang Cockatoo <i>Callocephalon fimbriatum</i>		V	Prefers tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests during summer, these being at higher altitudes. In winter, occurs at lower altitudes in drier, more open eucalypt forests and woodlands, or in dry forest in coastal areas.	1	Low. May occasionally utilise Shanes Park on occasion during its foraging intervals but unlikely to be a resident species.
Little Lorikeet <i>Glossopsitta pusilla</i>		V	Forages primarily in open eucalypt forest and woodland canopies, particularly along water courses; occasionally in Angophoras, Melaleucas and other tree species, also riparian habitats are used.	24	High. Recorded by authors in Shanes Park.
Swift Parrot <i>Lathamus discolor</i>	CE	E	Eucalypt forests. When over-wintering on the mainland, this species is dependent on winter-flowering eucalypt species.	66	Low. May utilised Shanes Park during over-wintering foraging intervals.
Powerful Owl <i>Ninox strenua</i>		V	Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. Requires large tree hollows for nesting.	15	Low. May utilised Shanes Park on occasion during foraging intervals but unlikely to be resident species.
Barking Owl <i>Ninox connivens</i>		V	Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. Requires tree hollows for nesting.	2 records (Atlas of Living Australia)	Low. May utilised Shanes Park on occasion during foraging intervals but unlikely to be resident species.
Sooty Owl <i>Tyto tenebricosa</i>		V	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	1	Low. May use Shanes Park on occasions during foraging intervals but unlikely to be resident species.
Brown Treecreeper <i>Climacteris picumnus victoriae</i>		V	Occupies eucalypt woodlands, mallee and dry open forests. Open forests are preferred, particularly those that contain open ground and fallen timber. A family group occupies a home range of 5 to 10 ha. Most of the day is spent foraging in the open ground and amongst leaf litter and timber debris for beetles, bugs, larvae and ants. Nests are built in a hollow limb or trunk. Breeding occurs between June and December.	1 record (Atlas of Living Australia)	Low. May use Shanes Park on occasions during foraging intervals but unlikely to be resident species.
Speckled Warbler <i>Chthonicola Sagittata</i>		V	Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy.	21 unrecorded no. (eBird 2015)	High. Recorded previously within Shanes Park and in similar habitat in the proximate Castlereagh Nature Reserve.
Regent Honeyeater <i>Anthochaera phrygia</i>	CE	CE	Inhabits dry open forest and woodland. These woodlands have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes.	30	Low. May utilised Shanes Park on occasion during foraging intervals but unlikely to be resident species.

Species	Status		Primary habitat requirements	Number of records	Likelihood of Occurrence <sup>11</sup>
	EPBC Act	BC Act			
Black-chinned Honeyeater <i>Melithreptus gularis gularis</i>		V	Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark ( <i>Eucalyptus sideroxylon</i> ), White Box ( <i>E. albens</i> ), Inland Grey Box ( <i>E. microcarpa</i> ), Yellow Box ( <i>E. melliodora</i> ), Blakely's Red Gum ( <i>E. blakelyi</i> ) and Forest Red Gum ( <i>E. tereticornis</i> ).	8	Low. May utilised Shanes Park on occasion during foraging intervals but unlikely to be resident species.
Painted Honeyeater <i>Grantiella picta</i>	V	V	Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus <i>Amyema</i> .	2	Low. May utilised Shanes Park on occasion during foraging intervals but unlikely to be resident species.
Varied Sittella <i>Daphoenositta chrysoptera</i>		V	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and <i>Acacia</i> woodland.	90 unrecorded no. (eBird 2014) 5 records (eBird 2020)	High. Recorded previously within Shanes Park. Suitable foraging, roosting and breeding habitat present.
Dusky Woodswallow <i>Artamus cyanopterus cyanopterus</i>		V	Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris.	72 1 record (eBird 2014)	High. Recorded previously within Shanes Park. Suitable foraging, roosting and breeding habitat present.
Rufous Fantail <i>Rhipidura rufifrons</i>	M		Occurs within mangroves, fringing vine scrubs, rainforests and wet sclerophyll forests. The species forages within scrubby understorey and take insects and spiders. Migrates in March/April to northern Queensland and New Guinea and returns September/October.		Moderate. Some suitable habitat present.
Black-faced Monarch <i>Monarcha melanopsis</i>	M		Prefers wet eucalypt forest and rainforest. Nests in sheeted gullies or within rainforest foraging within the middle storey layers. This species migrates in March/April as far as New Guinea and returns September.		Moderate. Some suitable habitat present.
Flame Robin <i>Petroica phoenicea</i>		V	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys.	5	Moderate. Recorded in similar habitat in the proximate Castlereagh Nature Reserve.
Scarlet Robin <i>Petroica boodang</i>		V	Lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs.	17 2 records (eBird 2014)	Moderate. Recorded in similar habitat in the proximate Castlereagh Nature Reserve.

Species	Status		Primary habitat requirements	Number of records	Likelihood of Occurrence <sup>11</sup>
	EPBC Act	BC Act			
				1 record (eBird 2015)	
Diamond Firetail <i>Stagonopleura guttata</i>		V	Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum <i>Eucalyptus pauciflora</i> Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland.	1	Low. No suitable habitat present.
<b>AMPHIBIANS</b>					
Green and Golden Bell Frog <i>Litoria aurea</i>	V	E	Inhabits a variety of environments, including disturbed sites, ephemeral ponds, wetlands, marshes, dams and stream-sides, particularly those that contain one or more of the following aquatic plants: bullrush ( <i>Typha</i> spp.), spikerush ( <i>Eleocharis</i> spp.), <i>Juncus kraussii</i> , <i>Schoenoplectus littoralis</i> and <i>Sporobolus virginicus</i> .	21	Low. Habitat absent.
<b>INVERTEBRATES</b>					
Cumberland Land Snail <i>Meridolum corneovirens</i>		E	Lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. Primarily inhabits Cumberland Plain Woodland; lives under litter of bark, leaves and logs, or shelters in loose soil around grass clumps. Occasionally shelters under rubbish.	431	High. Recorded by authors in Shanes Park.
Dural Land Snail <i>Pommerhelix duralensis</i>	E	E	The species has a strong affinity for communities in the interface region between shale-derived and sandstone-derived soils, with forested habitats that have good native cover and woody debris. It favours sheltering under rocks or inside curled-up bark.	1	Low. Habitat absent.



### Appendix 3: Fauna species recorded or known to occur in the vicinity of the reserve.

#### Source of Records

- 1 = Species recorded during present study  
 2 = OEH (2021)  
 3 = eBird (2021)  
 4 = Atlas of Living Australia (2021)

#### Key

- A – species listed under the EPBC Act  
 V – species is Vulnerable  
 CE – species is Critically Endangered  
 M – species listed as migratory listed under the EPBC Act  
 \* – indicates introduced species
- B – species listed under the BC Act or FM ACT (fish)  
 E – species is Endangered  
 Ma – species listed as marine under the EPBC Act

A	B	Common Name	Family and Scientific Name	1	2	3	4
		<b>MAMMALS</b>					
			<b>Tachyglossidae</b>				
		Short-beaked Echidna	<i>Tachyglossus aculeatus</i>		x		x
			<b>Dasyuridae</b>				
E	V	Spotted-tailed Quoll	<i>Dasyurus maculatus</i>		x		x
			<b>Peramelidae</b>				
		Long-nosed Bandicoot	<i>Perameles nasuta</i>		x		
			<b>Phascolarctidae</b>				
V	V	Koala	<i>Phascolarctos cinereus</i>		x		x
			<b>Vombatidae</b>				
		Common Wombat	<i>Vombatus ursinus</i>		x		x
			<b>Petauridae</b>				
	V	Yellow-bellied Glider	<i>Petaurus australis</i>		x		
		Sugar Glider	<i>Petaurus breviceps</i>		x		x
	V	Squirrel Glider	<i>Petaurus norfolcensis</i>		x		
			<b>Pseudocheiridae</b>				
		Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>		x		x
			<b>Phalangeridae</b>				
		Common Brushtail Possum	<i>Trichosurus vulpecula</i>		x		x
			<b>Macropodidae</b>				
		Eastern Grey Kangaroo	<i>Macropus giganteus</i>	x	x		x
		Common Wallaroo	<i>Macropus robustus</i>		x		
		Swamp Wallaby	<i>Wallabia bicolor</i>		x		x
			<b>Pteropodidae</b>				
V	V	Grey-headed Flying-fox	<i>Pteropus poliocephalus</i>		x		x
		Little Red Flying-fox	<i>Pteropus scapulatus</i>		x		x
			<b>Emballonuridae</b>				
	V	Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>		x		
			<b>Vespertilioidae</b>				
		Gould's Wattlebat	<i>Chalinolobus gouldii</i>		x		x
		Chocolate Wattlebat	<i>Chalinolobus morio</i>		x		x
	V	Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>		x		
	V	Southern Myotis	<i>Myotis macropus</i>		x		x
		Lesser Long-eared Bat	<i>Nyctophilus geoffroyi</i>		x		x
		Gould's Long-eared Bat	<i>Nyctophilus gouldi</i>		x		x
	V	Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>		x		x
		Eastern Broad-nosed Bat	<i>Scotorepens orion</i>		x		
		Large Forest Bat	<i>Vespadelus darlingtoni</i>		x		
		Eastern Forest Bat	<i>Vespadelus pumilus</i>		x		
		Southern Forest Bat	<i>Vespadelus regulus</i>		x		x
		Little Forest Bat	<i>Vespadelus vulturnus</i>		x		x
			<b>Miniopteridae</b>				
	V	Little Bent-winged Bat	<i>Miniopterus australis</i>		x		x
	V	Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>		x		x

A	B	Common Name	Family and Scientific Name	1	2	3	4
			<b>Molossidae</b>				
		White-striped Freetail Bat	<i>Austronomus australis</i>		x		x
	V	Eastern Coastal Free-tailed Bat	<i>Micronomus norfolkensis</i>		x		x
		Eastern Freetail Bat	<i>Mormopterus ridei</i>		x		x
			<b>Muridae</b>				
		* House Mouse	<i>Mus musculus</i>		x		x
		Bush Rat	<i>Rattus fuscipes</i>		x		
		* Brown Rat	<i>Rattus norvegicus</i>		x		x
		* Black Rat	<i>Rattus rattus</i>		x		x
			<b>Canidae</b>				
		Dingo	<i>Canis lupus dingo</i>		x		x
		* Fox	<i>Vulpes vulpes</i>	x	x		x
		* Dog	<i>Canis familiaris</i>		x		
			<b>Felidae</b>				
		* Feral Cat	<i>Felis catus</i>				x
			<b>Leporidae</b>				
		* Rabbit	<i>Oryctolagus cuniculus</i>		x		x
		* Brown Hare	<i>Lepus capensis</i>				x
			<b>Equidae</b>				
		* Horse	<i>Equus caballus</i>		x		
			<b>Suidae</b>				
		* Pig	<i>Sus scrofa</i>		x		
			<b>Bovidae</b>				
		* European Cattle	<i>Bos taurus</i>		x		
		* Goat	<i>Capra hircus</i>		x		x
		* Domesticated Sheep	<i>Ovis aries</i>		x		
			<b>Cervidae</b>				
		* Fallow Deer	<i>Dama dama</i>	x	x		x
		* Rusa Deer	<i>Cervus timorensis</i>		x		x
		<b>BIRDS</b>					
			<b>Dromaiidae</b>				
		Emu	<i>Dromaius novaehollandiae</i>		x		
			<b>Megapodiidae</b>				
		Australian Brush Turkey	<i>Alectura lathami</i>		x		x
			<b>Phasianidae</b>				
		Stubble Quail	<i>Coturnix pectoralis</i>		x		x
		Brown Quail	<i>Coturnix ypsilophora</i>		x	x	x
		King Quail	<i>Coturnix chinensis</i>		x		
			<b>Anatidae</b>				
		Black Swan	<i>Cygnus atratus</i>		x		x
		Plumed Whistling-Duck	<i>Dendrocygna eytoni</i>		x		
		Pacific Black Duck	<i>Anas superciliosa</i>	x	x	x	
		Grey Teal	<i>Anas gracilis</i>		x	x	x
		Chestnut Teal	<i>Anas castanea</i>		x	x	x
		Australasian Shoveler	<i>Anas rhynchotis</i>		x		x
		Pink-eared Duck	<i>Malacorhynchus membranaceus</i>		x		x
		Hardhead	<i>Aythya australis</i>		x		x
		Australian Wood Duck	<i>Chenonetta jubata</i>		x	x	
	V	Freckled Duck	<i>Stictonetta naevosa</i>		x		
	V	Blue-billed Duck	<i>Oxyura australis</i>		x		
			<b>Podicipedidae</b>				
		Hoary-headed Grebe	<i>Poliocephalus poliocephalus</i>		x		x
		Australasian Grebe	<i>Tachybaptus novaehollandiae</i>		x		x
			<b>Columbidae</b>				
	V	Superb Fruit-Dove	<i>Ptilinopus superbus</i>				x
		Topknot Pigeon	<i>Lopholaimus antarcticus</i>		x		x

A	B	Common Name	Family and Scientific Name	1	2	3	4
		* Rock Dove	<i>Columba livia</i>	x	x	x	
		* Spotted Dove	<i>Streptopelia chinensis</i>	x	x	x	
		Peaceful Dove	<i>Geopelia striata</i>		x	x	
		Bar-shouldered Dove	<i>Geopelia humeralis</i>		x		x
		Common Bronzewing	<i>Phaps chalcoptera</i>		x	x	x
		Brush Bronzewing	<i>Phaps elegans</i>		x		x
		Crested Pigeon	<i>Ocyphaps lophotes</i>	x	x	x	
		Wonga Pigeon	<i>Leucosarcia picata</i>		x		x
			<b>Podargidae</b>				
		Tawny Frogmouth	<i>Podargus strigoides</i>		x	x	x
			<b>Aegothelidae</b>				
		Australian Owlet-nightjar	<i>Aegotheles cristatus</i>		x	x	x
			<b>Apodidae</b>				
V, M,M a		White-throated Needletail	<i>Hirundapus caudacutus</i>		x	x	x
M,M a		Fork-tailed Swift	<i>Apus pacificus</i>		x		x
			<b>Anhingaidae</b>				
		Darter	<i>Anhinga novaehollandiae</i>		x		x
			<b>Phalacrocoracidae</b>				
		Pied Cormorant	<i>Phalacrocorax varius</i>		x		x
		Little Pied Cormorant	<i>Phalacrocorax melanoleucos</i>		x	x	x
		Great Cormorant	<i>Phalacrocorax carbo</i>		x		
		Little Black Cormorant	<i>Phalacrocorax sulcirostris</i>		x		x
			<b>Pelecanidae</b>				
		Australian Pelican	<i>Pelecanus conspicillatus</i>		x	x	x
			<b>Ciconiidae</b>				
	E	Black-necked Stork	<i>Ephippiorhynchus asiaticus</i>		x		
			<b>Ardeidae</b>				
		White-necked Heron	<i>Ardea pacifica</i>		x	x	
		White-faced Heron	<i>Egretta novaehollandiae</i>		x	x	
Ma		Cattle Egret	<i>Ardea ibis</i>	x	x		x
Ma		Great Egret	<i>Ardea alba</i>		x	x	
		Intermediate Egret	<i>Ardea intermedia</i>		x	x	x
Ma		Eastern Reef Egret	<i>Egretta sacra</i>		x		
		Nankeen Night-Heron	<i>Nycticorax caledonicus</i>		x	x	x
	V	Black Bittern	<i>Ixobrychus flavicollis</i>		x		x
E	E	Australasian Bittern	<i>Botaurus poiciloptilus</i>		x		
			<b>Threskiornidae</b>				
M,M a		Glossy Ibis	<i>Plegadis falcinellus</i>		x		
		Australian White Ibis	<i>Threskiornis molucca</i>	x	x	x	
		Straw-necked Ibis	<i>Threskiornis spinicollis</i>		x		x
		Royal Spoonbill	<i>Platalea regia</i>		x		x
		Yellow-billed Spoonbill	<i>Platalea flavipes</i>		x		x
			<b>Accipitridae</b>				
		Pacific Baza	<i>Aviceda subcristata</i>		x	x	
		Black-shouldered Kite	<i>Elanus axillaris</i>		x	x	x
	V	Square-tailed Kite	<i>Lophoictinia isura</i>		x	x	
		Whistling Kite	<i>Haliastur sphenurus</i>		x	x	x
Ma	V	White-bellied Sea-eagle	<i>Haliaeetus leucogaster</i>		x	x	x
		Wedge-tailed Eagle	<i>Aquila audax</i>		x	x	x
	V	Little Eagle	<i>Hieraaetus morphnoides</i>		x	x	x
		Brown Goshawk	<i>Accipiter fasciatus</i>	x	x	x	
		Collared Sparrowhawk	<i>Accipiter cirrocephalus</i>		x	x	
		Grey Goshawk	<i>Accipiter novaehollandiae</i>		x	x	
	V	Spotted Harrier	<i>Circus assimilis</i>		x		x

A	B	Common Name	Family and Scientific Name	1	2	3	4
		Swamp Harrier	<i>Circus approximans</i>		x		x
			<b>Falconidae</b>				
	V	Black Falcon	<i>Falco subniger</i>		x		x
		Peregrine Falcon	<i>Falco peregrinus</i>		x	x	x
		Australian Hobby	<i>Falco longipennis</i>		x		x
		Brown Falcon	<i>Falco berigora</i>		x		
		Nankeen Kestrel	<i>Falco cenchroides</i>		x	x	x
			<b>Rallidae</b>				
		Buff-banded Rail	<i>Gallirallus phillippensis</i>		x		x
		Lewin's Rail	<i>Lewinia pectoralis</i>			x	x
		Baillon's Crake	<i>Porzana pusilla</i>		x		
		Australian Spotted Crake	<i>Porzana fluminea</i>		x	x	x
		Spotless Crake	<i>Porzana tabuensis</i>		x	x	x
		Dusky Moorhen	<i>Gallinula tenebrosa</i>		x	x	x
		Purple Swamphen	<i>Porphyrio porphyrio</i>		x		x
		Eurasian Coot	<i>Fulica atra</i>		x		x
			<b>Recurvirostridae</b>				
		Black-winged Stilt	<i>Himantopus himantopus</i>		x		x
		Red-necked Avocet	<i>Recurvirostra novaehollandiae</i>		x		
			<b>Charadriidae</b>				
		Masked Lapwing	<i>Vanellus miles</i>	x	x	x	
		Banded Lapwing	<i>Vanellus tricolor</i>		x		
M,M a		Pacific Golden Plover	<i>Pluvialis fulva</i>		x		
		Red-kneed Dotterel	<i>Erythronyx cinctus</i>		x		x
M,M a		Double-banded Plover	<i>Charadrius bicinctus</i>		x		
		Red-capped Plover	<i>Charadrius ruficapillus</i>		x		
		Black-fronted Dotterel	<i>Euseyonis melanops</i>		x	x	x
			<b>Rostratulidae</b>				
E,M a	E	Australian Painted Snipe	<i>Rostratula australis</i>		x		
			<b>Scolopacidae</b>				
M,M a		Wood Sandpiper	<i>Tringa glareola</i>		x		
M,M a		Common Sandpiper	<i>Actitis hypoleucos</i>		x		
M,M a		Common Greenshank	<i>Tringa nebularia</i>		x		
M,M a		Marsh Sandpiper	<i>Tringa stagnatilis</i>		x		
M,M a		Latham's Snipe	<i>Gallinago hardwickii</i>		x		x
M,M a		Sharp-tailed Sandpiper	<i>Calidris acuminata</i>		x		
M,M a		Pectoral Sandpiper	<i>Calidris melanotos</i>		x		
M,M a		Red-necked Stint	<i>Calidris ruficollis</i>		x		
CE, M,M a		Curlew Sandpiper	<i>Calidris ferruginea</i>		x		
			<b>Turnicidae</b>				
		Painted Button-quail	<i>Turnix varius</i>		x	x	x
		Red-chested Button-quail	<i>Turnix pyrrhotorax</i>		x		x
			<b>Glareolidae</b>				
		Australian Pratincole	<i>Stiltia isabella</i>		x		
			<b>Cacatuidae</b>				
	V	Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>		x		x
		Yellow-tailed Black Cockatoo	<i>Calyptorhynchus funereus</i>		x	x	x

A	B	Common Name	Family and Scientific Name	1	2	3	4
	V	Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>		x		x
		Galah	<i>Eolophus roseicapillus</i>		x	x	
		Long-billed Corella	<i>Cacatua tenuirostris</i>		x	x	x
		Little Corella	<i>Cacatua sanguinea</i>	x	x	x	
		Sulphur-crested Cockatoo	<i>Cacatua galerita</i>		x	x	
		Cockatiel	<i>Nymphicus hollandicus</i>		x		x
			<b>Psittacidae</b>				
		Rainbow Lorikeet	<i>Trichoglossus haematodus</i>	x	x	x	
		Scaly-breasted Lorikeet	<i>Trichoglossus chlorolepidotus</i>		x		x
		Musk Lorikeet	<i>Glossopsitta concinna</i>		x	x	
	V	Little Lorikeet	<i>Glossopsitta pusilla</i>	x	x	x	x
		Australian King Parrot	<i>Alisterus scapularis</i>		x		x
		Budgerigar	<i>Melopsittacus undulatus</i>		x		x
CE, Ma	E	Swift Parrot	<i>Lathamus discolor</i>		x		
		Crimson Rosella	<i>Platycercus elegans</i>		x		x
		Eastern Rosella	<i>Platycercus eximius</i>	x	x	x	
		Red-rumped Parrot	<i>Psephotus haematonotus</i>		x	x	
			<b>Cuculidae</b>				
		Pallid Cuckoo	<i>Cacomantis pallidus</i>		x	x	
		Brush Cuckoo	<i>Cacomantis variolosus</i>			x	x
		Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>		x	x	
		Horsfield's Bronze-Cuckoo	<i>Chalcites basalus</i>		x	x	x
		Shining Bronze-Cuckoo	<i>Chalcites lucidus</i>		x	x	
		Eastern Koel	<i>Eudynamys orientalis</i>	x	x	x	x
		Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>	x	x	x	x
			<b>Strigidae</b>				
	V	Powerful Owl	<i>Ninox strenua</i>		x		x
		Southern Boobook	<i>Ninox novaeseelandiae</i>		x		x
	V	Barking Owl	<i>Ninox connivens</i>				x
			<b>Tytonidae</b>				
	V	Sooty Owl	<i>Tyto tenebricosa</i>		x		
		Eastern Barn Owl	<i>Tyto javanica</i>		x		x
			<b>Alcedinidae</b>				
		Azure Kingfisher	<i>Ceyx azureus</i>		x	x	x
			<b>Halcyonidae</b>				
		Laughing Kookaburra	<i>Dacelo novaeguineae</i>	x	x	x	x
		Sacred Kingfisher	<i>Todiramphus sanctus</i>		x	x	x
			<b>Meropidae</b>				
Ma		Rainbow Bee-eater	<i>Merops ornatus</i>		x		x
			<b>Coraciidae</b>				
		Dollarbird	<i>Eurystomus orientalis</i>		x		x
			<b>Pittidae</b>				
		Noisy Pitta	<i>Pitta versicolor</i>			x	x
			<b>Climacteridae</b>				
		White-throated Treecreeper	<i>Cormobates leucophaea</i>		x	x	x
	V	Brown Treecreeper	<i>Climacteris picumnus victoriae</i>				x
			<b>Ptilonorhynchidae</b>				
		Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>		x	x	x
			<b>Maluridae</b>				
		Superb Fairy-wren	<i>Malurus cyaneus</i>	x	x	x	x
		Variiegated Fairy-wren	<i>Malurus lamberti</i>		x	x	x
			<b>Acanthizidae</b>				
		White-browed Scrubwren	<i>Sericornis frontalis</i>	x	x	x	x
	V	Speckled Warbler	<i>Chthynicola sagittata</i>		x	x	x
		Weebill	<i>Smicromnis brevirostris</i>		x	x	x
		White-throated Gerygone	<i>Gerygone albogularis</i>	x	x	x	x
		Brown Gerygone	<i>Gerygone mouki</i>		x		x

A	B	Common Name	Family and Scientific Name	1	2	3	4
		Western Gerygone	<i>Gerygone fusca</i>			x	x
		Brown Thornbill	<i>Acanthiza pusilla</i>	x	x	x	x
		Yellow Thornbill	<i>Acanthiza nana</i>		x	x	x
		Striated Thornbill	<i>Acanthiza lineata</i>		x	x	x
		Buff-rumped Thornbill	<i>Acanthiza reguloides</i>		x	x	x
		Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>		x		x
			<b>Pardalotidae</b>				
		Spotted Pardalote	<i>Pardalotus punctatus</i>	x	x	x	x
		Striated Pardalote	<i>Pardalotus striatus</i>		x	x	x
			<b>Meliphagidae</b>				
		Red Wattlebird	<i>Anthochaera carunculata</i>	x	x	x	x
		Little (Brush) Wattlebird	<i>Anthochaera chrysoptera</i>		x		x
		Striped Honeyeater	<i>Plectorhyncha lanceolata</i>		x		x
		Noisy Friarbird	<i>Philemon corniculatus</i>	x	x	x	x
		Little Friarbird	<i>Philemon citreogularis</i>		x		x
CE	C E	Regent Honeyeater	<i>Anthochaera phrygia</i>		x		x
		Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>		x		x
		Bell Miner	<i>Manorina melanophrys</i>		x		x
		Noisy Miner	<i>Manorina melanocephala</i>	x	x	x	x
		Lewin's Honeyeater	<i>Meliphaga lewinii</i>		x	x	x
		Yellow-faced Honeyeater	<i>Lichenostomus chrysops</i>	x	x	x	x
		White-eared Honeyeater	<i>Lichenostomus leucotis</i>		x	x	x
		Fuscous Honeyeater	<i>Lichenostomus fuscus</i>		x	x	x
		White-plumed Honeyeater	<i>Lichenostomus pencillatus</i>		x	x	x
	V	Black-chinned Honeyeater	<i>Melithreptus gularis</i>		x		x
		Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>		x	x	x
		White-naped Honeyeater	<i>Melithreptus lunatus</i>	x	x	x	x
		White-cheeked Honeyeater	<i>Phylidonyris niger</i>		x		x
		New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>		x	x	x
		Brown Honeyeater	<i>Lichmera indistincta</i>		x		x
V	V	Painted Honeyeater	<i>Grantiella picta</i>		x		x
		Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>		x	x	x
		Scarlet Honeyeater	<i>Myzomela sanguinolenta</i>	x	x	x	x
			<b>Psophodidae</b>				
		Eastern Whipbird	<i>Psophodes olivaceus</i>		x		x
			<b>Neosittidae</b>				
	V	Varied Sittella	<i>Daphoenositta chrysoptera</i>		x	x	x
			<b>Campephagidae</b>				
		Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>		x	x	x
		Cicadabird	<i>Coracina tenuirostris</i>		x	x	
		White-winged Triller	<i>Lalage sueurii</i>		x	x	x
			<b>Pachycephalidae</b>				
		Crested Shrike-tit	<i>Falcunculus frontatus</i>		x	x	x
		Grey Shrike-thrush	<i>Colluricincla harmonica</i>	x	x	x	x
		Golden Whistler	<i>Pachycephala pectoralis</i>		x	x	x
		Rufous Whistler	<i>Pachycephala rufiventris</i>		x	x	x
			<b>Oriolidae</b>				
		Olive-backed Oriole	<i>Oriolus sagittatus</i>	x	x	x	
		Australasian Figbird	<i>Sphecotheres vieillotii</i>		x	x	x
			<b>Artamidae</b>				
		Masked Woodswallow	<i>Artamus personatus</i>			x	x
		White-browed Woodswallow	<i>Artamus superciliosus</i>		x	x	x
	V	Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>		x	x	x
		Grey Butcherbird	<i>Cracticus torquatus</i>	x	x	x	
		Pied Butcherbird	<i>Cracticus nigrogularis</i>	x	x		x
		Australian Magpie	<i>Cracticus tibicen</i>	x	x	x	x
		Pied Currawong	<i>Strepera graculina</i>	x	x	x	x

A	B	Common Name	Family and Scientific Name	1	2	3	4
		Grey Currawong	<i>Strepera versicolor</i>		x		x
			<b>Dicruridae</b>				
		Spangled Drongo	<i>Dicrurus bracteatus</i>		x		x
			<b>Rhipiduridae</b>				
		Grey Fantail	<i>Rhipidura albiscapa</i>	x	x	x	x
M,M	a	Rufous Fantail	<i>Rhipidura rufifrons</i>		x	x	x
		Willie Wagtail	<i>Rhipidura leucophrys</i>	x	x	x	x
			<b>Corvidae</b>				
		Australian Raven	<i>Corvus coronoides</i>	x	x	x	x
			<b>Monarchidae</b>				
		Leaden Flycatcher	<i>Myiagra rubecula</i>		x	x	x
		Restless Flycatcher	<i>Myiagra inquieta</i>		x	x	x
M,M	a	Black-faced Monarch	<i>Monarcha melanopsis</i>		x		x
		Magpie-lark	<i>Grallina cyanoleuca</i>	x	x	x	x
			<b>Corcoracidae</b>				
		White-winged Chough	<i>Corcorax melanorhamphos</i>	x	x	x	x
		Apostlebird	<i>Struthidea cinerea</i>		x		x
			<b>Petroicidae</b>				
		Rose Robin	<i>Petroica rosea</i>		x	x	x
	V	Flame Robin	<i>Petroica phoenicea</i>		x		x
	V	Scarlet Robin	<i>Petroica boodang</i>			x	x
		Red-capped Robin	<i>Petroica goodenovii</i>		x	x	x
		Eastern Yellow Robin	<i>Eopsaltria australis</i>		x	x	x
		Jacky Winter	<i>Microeca fascinans</i>		x	x	x
			<b>Alaudidae</b>				
		* Eurasian Skylark	<i>Alauda arvensis</i>		x		
			<b>Cisticolidae</b>				
		Golden-headed Cisticola	<i>Cisticola exilis</i>		x	x	x
			<b>Acrocephalidae</b>				
Ma		Australian Reed-Warbler	<i>Acrocephalus australis</i>		x	x	x
			<b>Megaluridae</b>				
		Rufous Songlark	<i>Cincloramphus mathewsi</i>		x		x
		Brown Songlark	<i>Cincloramphus cruralis</i>		x		
		Tawny Grassbird	<i>Megalurus timoriensis</i>		x	x	x
		Little Grassbird	<i>Megalurus gramineus</i>		x	x	
			<b>Timaliidae</b>				
		Silvereye	<i>Zosterops lateralis</i>	x	x	x	x
			<b>Hirundinidae</b>				
		Welcome Swallow	<i>Hirundo neoxena</i>	x	x	x	x
		Tree Martin	<i>Petrochelidon nigricans</i>		x	x	x
		Fairy Martin	<i>Petrochelidon ariel</i>		x	x	
			<b>Pycnonotidae</b>				
		* Red-whiskered Bulbul	<i>Pycnonotus jocosus</i>	x	x	x	
			<b>Turdidae</b>				
		* Common Blackbird	<i>Turdus merula</i>		x	x	x
			<b>Sturnidae</b>				
		* Common Starling	<i>Sturnus vulgaris</i>		x	x	
		* Common Myna	<i>Sturnus tristis</i>	x	x	x	
			<b>Nectariniidae</b>				
		Mistletoebird	<i>Dicaeum hirundinaceum</i>		x	x	
			<b>Estrildidae</b>				
		Double-barred Finch	<i>Taeniopygia bichenovii</i>		x	x	
		Zebra Finch	<i>Taeniopygia guttata</i>		x		
		Red-browed Finch	<i>Neochmia temporalis</i>	x	x	x	
	V	Diamond Firetail	<i>Stagonopleura guttata</i>		x		
		* Nutmeg Mannikin	<i>Lonchura punctulata</i>		x		x

A	B	Common Name	Family and Scientific Name	1	2	3	4
		Chestnut-breasted Mannikin	<i>Lonchura castaneothorax</i>		x	x	
			<b>Passeridae</b>				
		* House Sparrow	<i>Passer domesticus</i>		x	x	
			<b>Motacillidae</b>				
		Australasian Pipit	<i>Anthus naovaeseelandiae</i>		x		x
			<b>Fringillidae</b>				
		* European Goldfinch	<i>Carduelis carduelis</i>		x		x
		<b>REPTILES</b>					
			<b>Chelidae</b>				
		Eastern Snake-necked Turtle	<i>Chelodina longicollis</i>	x	x		x
		Macquarie Turtle	<i>Emydura macquarii</i>		x		x
			<b>Diplodactylidae</b>				
		Wood Gecko	<i>Diplodactylus vittatus</i>		x		x
			<b>Pygopodidae</b>				
		Common Scaly-foot	<i>Pygopus lepidopodus</i>		x		x
			<b>Scincidae</b>				
		Bar-sided forest-skink	<i>Concinnia tenuis</i>		x		x
		Striped Snake-eyed Skink	<i>Cryptoblepharus virgatus</i>	x	x		x
		Robust Ctenotus	<i>Ctenotus robustus</i>		x		x
		Copper-tailed Skink	<i>Ctenotus taeniolatus</i>		x		x
		Eastern Water Skink	<i>Eulamprus quoyii</i>		x		x
		Dark-flecked Garden Sun-skink	<i>Lampropholis delicata</i>	x	x		x
		Pale-flecked Garden Sun-skink	<i>Lampropholis guichenoti</i>	x	x		x
		White's Skink	<i>Liopholis whitii</i>		x		
		Tree-base litter-skink	<i>Lygisaurus foliorum</i>		x		x
		Weasel Skink	<i>Saproscincus mustelinus</i>		x		x
		Shingle-back	<i>Tiliqua rugosa</i>		x		x
		Eastern Blue-tongued Lizard	<i>Tiliqua scincoides</i>		x		x
			<b>Agamidae</b>				
		Jacky Lizard	<i>Amphibolurus muricatus</i>	x	x		x
		Eastern Water Dragon	<i>Intellagama lesueurii</i>	x	x		x
		Bearded dragon	<i>Pogona barbata</i>		x		x
			<b>Varanidae</b>				
		Lace Monitor	<i>Varanus varius</i>		x		x
			<b>Typhlopidae</b>				
		Blackish blind snake	<i>Ramphotyphlops nigrescens</i>		x		x
			<b>Colubridae</b>				
		Green Tree Snake	<i>Dendrelaphis punctulatus</i>		x		x
			<b>Elapidae</b>				
		Yellow-faced whipsnake	<i>Demansia psammophis</i>		x		x
		Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>	x	x		x
		Eastern Brown Snake	<i>Pseudonaja textilis</i>	x	x		x
		<b>AMPHIBIANS</b>					
			<b>Limnodynastidae</b>				
		Eastern Banjo Frog	<i>Limnodynastes dumerilii</i>		x		x
		Brown-striped Frog	<i>Limnodynastes peronii</i>	x	x		x
		Spotted Grass Frog	<i>Limnodynastes tasmaniensis</i>		x		x
		Ornate Burrowing Frog	<i>Platyplectrum ornatum</i>		x		
			<b>Myobatrachidae</b>				
		Common Eastern Froglet	<i>Crinia signifera</i>	x	x		x
		Brown Toadlet	<i>Pseudophryne bibronii</i>		x		
		Smooth Toadlet	<i>Uperoleia laevigata</i>		x		x
		Tyler's Toadlet	<i>Uperoleia tyleri</i>		x		x
			<b>Hylidae</b>				
V	E	Green and Golden Bell Frog	<i>Litoria aurea</i>		x		x



A	B	Common Name	Family and Scientific Name	1	2	3	4
		Green Tree Frog	<i>Litoria caerulea</i>		x		x
		Bleating Tree Frog	<i>Litoria dentata</i>		x		x
		Brown Tree Frog	<i>Litoria ewingii</i>		x		
		Eastern Dwarf Tree Frog	<i>Litoria fallax</i>		x		x
		Broad-palmed Frog	<i>Litoria latopalmata</i>		x		x
		Peron's Tree Frog	<i>Litoria peronii</i>		x		x
		Leaf Green Tree Frog	<i>Litoria phyllochroa</i>	x			
		Tyler's Tree Frog	<i>Litoria tyleri</i>		x		x
		Verreaux's Tree Frog	<i>Litoria verreauxii</i>		x		x
<b>INVERTEBRATES</b>							
			<b>Helicidae</b>				
		* Common Garden Snail	<i>Helix aspersa</i>	x			x
			<b>Camaenidae</b>				
	E	Cumberland Plain Land Snail	<i>Meridolum corneovirens</i>	x	x		x
	E	Dural Land Snail	<i>Pommerhelix duralensis</i>		x		
<b>FISH</b>							
		* Carp, Common (European)	<i>Cyprinus carpio</i>		x		x
		Eel, Long-finned	<i>Anguilla reinhardtii</i>		x		x
		Eel, Short-finned	<i>Anguilla australis</i>		x		x
		* Mosquitofish	<i>Gambusia holbrooki</i>	x	x		
		Gudgeon, Empire	<i>Hypseleotris compressus</i>				x
		Smelt, Australian	<i>Retropinna semoni</i>				x

**Appendix 4.** Details of hollow-bearing trees recorded

HBT	Easting	Northing	Obvious hollows	Orientation: Horizontal (H) Vertical (V)	No. of hollows	Size class (mm)	Tree height (m)	Dead stag	Suitability for fauna
1	295723	6266567	Yes	H	2	0-5	15	No	Microbats
2	295174	6266640	Yes	H	2	0-5	10	No	As above
3	295160	6266637	Yes	H + V	3	6-19	10	Yes	Small to medium birds + arboreal possums
4	295089	6266647	Yes	H	6	0-5	10	No	Microbats
5	294699	6266702	No	V	2	6-19	10	No	Small to medium birds + arboreal possums
6	294525	6266742	Yes	H + V	6	6-19	10	Yes	As above
7	294505	6266760	Yes	V	2	6-19	15	No	As above
8	294596	6267609	No	H	3	0-5	5	Yes	Microbats
9	294593	6267562	Yes	H + V	4	> 20	10	No	Owls + arboreal possums
10	294569	6267465	Yes	H + V	3	6-19	15	No	Small to medium birds + arboreal possums
11	294561	6267340	Yes	H	1	0-5	10	No	Microbats
12	294534	6267141	Yes	H	5	6-19	10	Yes	Small to medium birds + arboreal possums
13	294510	6266973	No	V	4	0-5	10	No	Microbats
14	294502	6266801	Yes	H	2	> 20	10	No	Owls + arboreal possums
15	296140	6266495	Yes	H	1	0-5	10	No	Microbats
16	296130	6266495	No	V	2	0-5	10	Yes	As above
17	296123	6266497	Yes	H	2	0-5	10	Yes	As above
18	296083	6266516	No	V	1	0-5	10	No	As above
19	296020	6266514	No	V	5	0-5	10	Yes	As above
20	295917	6266535	Yes	V	1	0-5	10	No	As above
21	295786	6266556	No	H + V	5	0-5	10	Yes	As above
22	295771	6266559	Yes	H + V	3	0-5	8	No	As above
23	295499	6268467	No	V	2	6-19	6	No	Small to medium birds + arboreal possums
24	295500	6268466	No	H	2	0-5	8	No	Microbats
25	295593	6268448	Yes	H + V	8	6-19	5	Yes	Small to medium birds + arboreal possums
26	295605	6268448	Yes	H	2	0-5	8	Yes	Microbats
27	295673	6268442	No	V	2	0-5	10	No	As above
28	295755	6268433	Yes	H	1	0-5	10	No	As above
29	295801	6268458	Yes	V	1	> 20	10	No	Owls + arboreal possums

HBT	Easting	Northing	Obvious hollows	Orientation: Horizontal (H) Vertical (V)	No. of hollows	Size class (mm)	Tree height (m)	Dead stag	Suitability for fauna
30	295830	6268417	No	V	2	0-5	8	Yes	Microbats
31	295834	6268414	No	V	1	0-5	6	Yes	As above
32	295853	6268414	No	V	1	0-5	4	Yes	As above
33	295912	6268407	No	H + V	3	0-5	15	No	As above
34	295955	6268401	Yes	H	1	6-19	10	Yes	Small to medium birds + arboreal possums
35	296566	6268323	No	V	2	0-5	15	No	Microbats
36	297036	6268254	No	V	2	0-5	10	Yes	As above
37	297559	6267602	No	V	1	0-5	15	No	As above
38	297537	6267336	No	V	2	0-5	8	Yes	As above
39	297529	6267286	Yes	H	1	6-19	10	No	Small to medium birds + arboreal possums
40	294619	6267561		V	6	6-19	10	Yes	As above
41	294598	6267472		V	1	> 20	5	Yes	Owls + arboreal possums
42	294553	6267175		H	1	6-19	20	No	Small to medium birds + arboreal possums
43	294524	6266930		H + V	2	0-5	15	Yes	Microbats
44	294699	6266705		V	1	6-19	12	No	Small to medium birds + arboreal possums
45	294530	6266728		H	1	> 20	15	No	Owls + arboreal possums
46	294525	6266742		H	6	6-19	12	Yes	Small to medium birds + arboreal possums
47	294894	6266670		V	4	6-19	13	Yes	As above
48	294861	6268563		V	1	6-19	15	No	As above
49	295425	6268450		V	1	0-5	10	Yes	Microbats
50	295408	6268475		H	6	6-19	10	No	Small to medium birds + arboreal possums
51	295345	6268463		V	6	6-19	12	No	As above
52	295339	6268462		H	4	6-19	15	Yes	As above