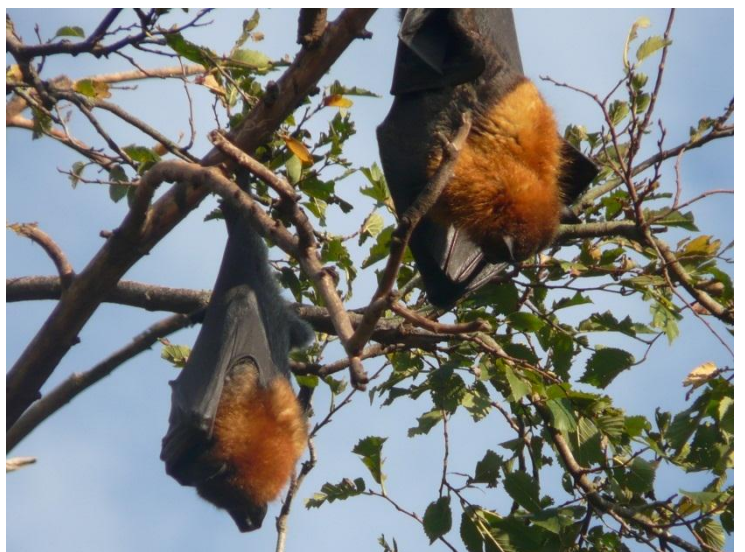




Parramatta North Urban Renewal (PNUR) Proposed Rezoning Ecological Assessment

Prepared for
UrbanGrowth NSW

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Terms and Abbreviations

Abbreviation	Description
CBD	Central Business District
CP	Cumberland Precinct
DotE	Commonwealth Department of the Environment
EIA	Environmental Impact Assessment
EEC	Endangered Ecological Community
EP&A Act	NSW <i>Environmental Planning and Assessment Act 1979</i>
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ELA	Eco Logical Australia
GHFF	Grey-headed Flying-fox
ILP	Indicative Layout Plan
KTP	Key Threatening Process
LEP	Local Environment Plan
LGA	Local Government Area
PNUR	Parramatta North Urban Renewal
RFEF	River-flat Eucalypt Forest
SEPP	State Environmental Planning Policy
SLP	Sports and Leisure Precinct
SSD	State Significant Development
SSI	State Significant Infrastructure
TSC Act	NSW <i>Threatened Species Conservation Act 1995</i>

Executive summary

Eco Logical Australia has assessed potential ecological impacts of the proposed Parramatta North Urban Renewal area (PNUR). The assessment was conducted in accordance with relevant NSW and Commonwealth legislation and guidelines. It included field validation of vegetation communities, and targeted survey of Grey-headed Flying-fox and microchiropteran bats.

The key ecological values that the proposal addresses in order to minimise impact are:

- Grey-headed Flying-fox (GHFF) – the camp, individuals, and foraging resources. This species is vulnerable under the NSW *Threatened Species Conservation Act 1995* (TSC Act) and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- East-coast Freetail Bat and Eastern Bentwing Bat – both vulnerable under the TSC Act.
- River-flat Eucalypt Forest – an endangered ecological community under the TSC Act.
- Hollow bearing trees – an important resource for fauna, including threatened species.

The proposed PNUR development will not require remnant vegetation to be cleared. The GHFF camp will be managed in situ, and the development will be designed and constructed to minimise potential impacts (e.g. from noise and light) to the camp. Management measures (e.g. weed control, regeneration and replanting) will enhance areas of native vegetation along the riparian corridor to improve ecological connectivity and provide additional habitat, as well as improve amenity. Further detail about the proposed management measures is provided in the Ecological Management Plan by ELA.

The impact assessment concluded that the proposal was unlikely to result in a significant impact to any threatened ecological community or threatened species following the application of appropriate mitigation and management measures. The proposal does not require the preparation of a Species Impact Statement under the TSC Act.

While the proposed action is considered unlikely to result in a direct impact to the GHFF or its habitat, the proposed action will result in indirect impacts to the GHFF associated with construction in adjacent areas. Legal certainty regarding the significance of an impact under EPBC Act can only be obtained through referral to the Commonwealth. On this basis, given the likelihood of indirect impacts to the species, referral to the Commonwealth is recommended.

1 Introduction

Parramatta North Urban Renewal area (PNUR) is located to the west and north-west of the Parramatta CBD, Sydney's second CBD (**Figure 2**). Parramatta is located in the geographical heart of Sydney and plays a significant role in the Greater Metropolitan area as the most important centre in Western Sydney. The PNUR is located to the east of the Westmead Health campus, separated by the Parramatta River. The PNUR is also in proximity to the Rydalmere Education Precinct and transport links.

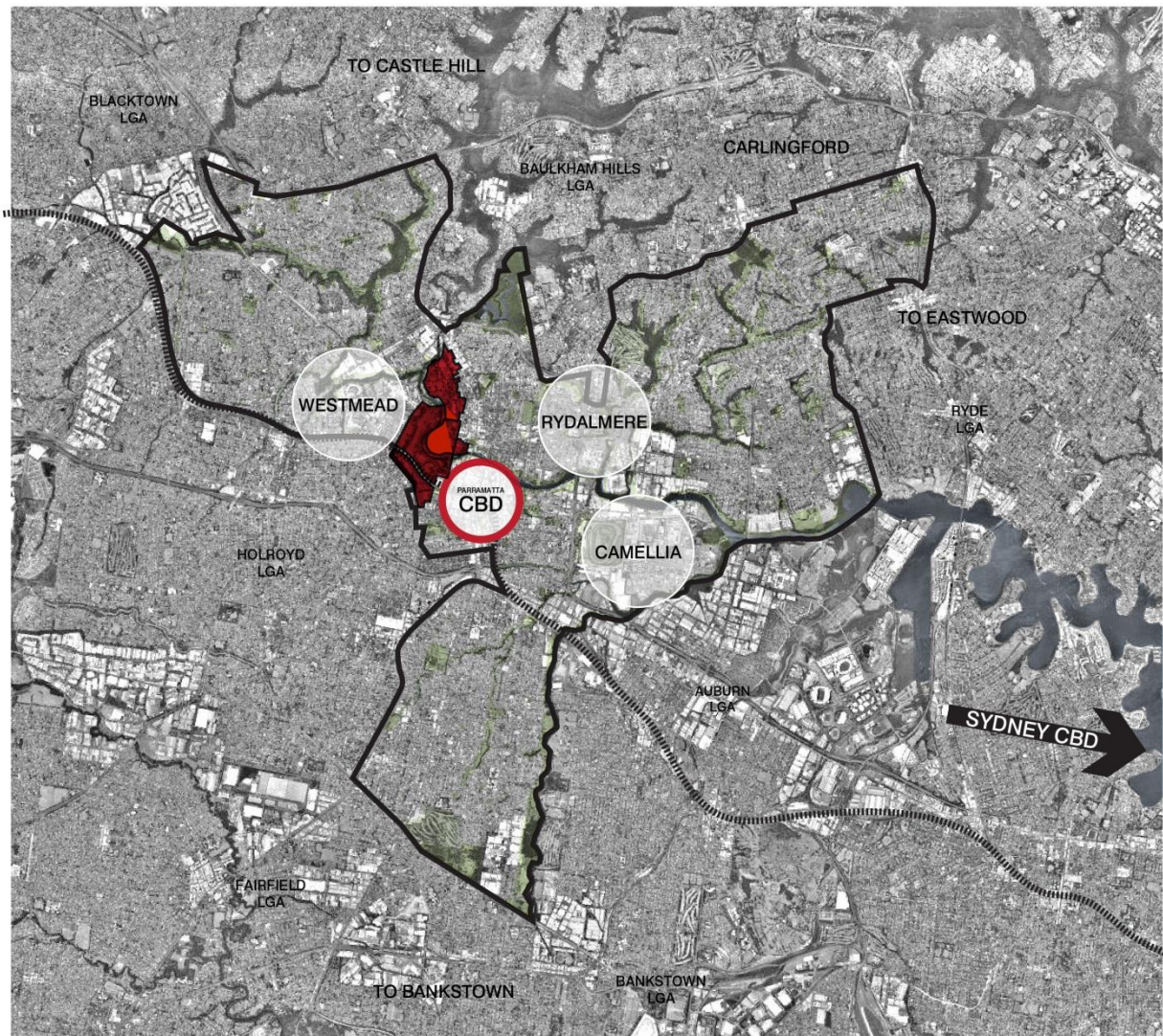


Figure 1: Location plan (AJ+C)

Eco Logical Australia Pty Ltd (ELA) has been engaged by UrbanGrowth NSW to assess the ecological impacts/issues relating to the proposed amendment to the planning framework applying to the study area. The investigations relate only to the Cumberland and Sports and Leisure Precincts within the PNUR. The assessment has been undertaken to inform a State Significant Site study (the Study) which is investigating potential amendments of the statutory planning controls applying to the Cumberland and Sports and Leisure Precincts of the PNUR.

PNUR includes many locational and site specific attributes, including frontage to the Parramatta River and a rich history of Aboriginal, early colonial, nineteenth and twentieth century uses. The potential exists to deliver housing and employment opportunities in a precinct that will embrace and interpret these heritage attributes to make them a focus of the urban environment that will emerge through future development and facilitate their retention and re-use.

The amendment to the statutory planning provisions is anticipated to be undertaken via a State Environmental Planning Policy (SEPP) to amend the provisions of Parramatta City Centre LEP 2007 and Parramatta LEP 2011. Site specific Development Control Plan (DCP) provisions are also proposed to be prepared to guide future development. Amendment of the planning framework will facilitate the lodgement of future Development Applications with Parramatta City Council to be assessed and determined under the provisions of Part 4 of the *Environmental Planning and Assessment Act 1979*.

1.1 Background

The PNUR is located to the west and north-west of the Parramatta CBD, Sydney's second CBD. Parramatta is located in the geographical heart of Sydney and plays a significant role as the most important centre in Western Sydney. The PNUR is located to the immediate east of the Westmead Health campus, separated by the Parramatta River.

The PNUR is a 146 ha area and has been divided into four distinct Precincts comprising:

- The Cumberland Precinct (40 ha)
- Sport and Leisure Precinct (21 ha)
- Old Kings School Precinct (4 ha)
- Parramatta Park Precinct (81 ha).

Locations of The Cumberland Precinct and Sport and Leisure Precinct are shown in **Figure 2**.

This Study has been prepared in order to identify how best to plan for the urban renewal of the Cumberland Precinct and the Sports and Leisure Precinct only. The recommended planning controls have been prepared recognising the locational advantages of the PNUR to the Parramatta CBD, the Westmead Health Precinct, the Rydalmere Education Precinct, and transport options.

The renewal of the area provides exceptional opportunities for the delivery of housing cultural and community uses, and the capacity to protect, enhance and re-use significant heritage buildings and structures.

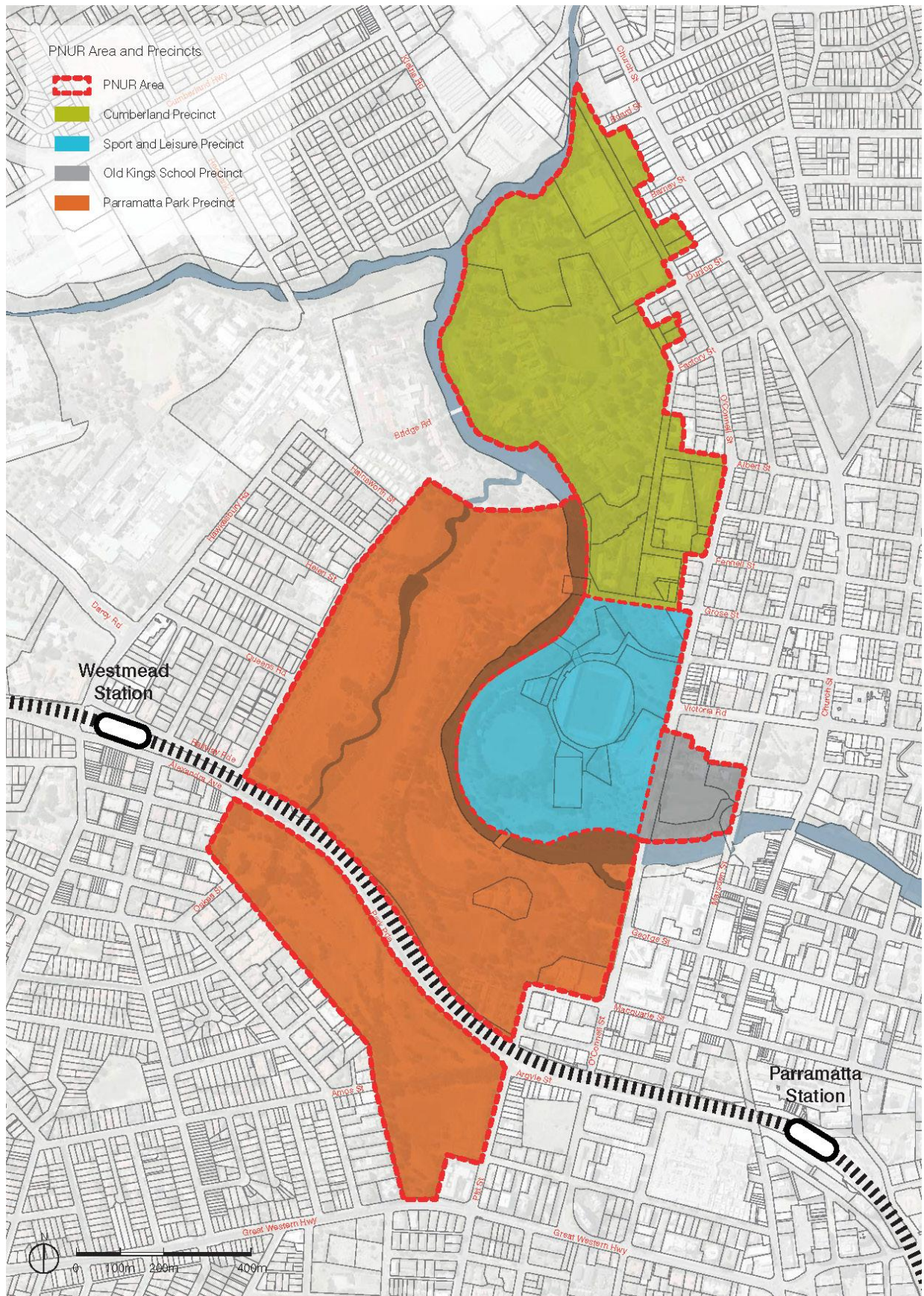


Figure 2: Precinct plan (AJ+C)

1.2 Location

The PNUR is located to the west and north-west of the Parramatta CBD, Sydney's second CBD. Parramatta is located in the geographical heart of Sydney and plays a significant role in the Greater Metropolitan area as the most important centre in Western Sydney. The PNUR is located to the east of the Westmead Health campus, separated by the Parramatta River. The PNUR is also within close proximity to the Rydalmere Education Precinct and transport links.

The Study relates only to the Cumberland and Sports and Leisure precincts within the PNUR.

The Sports and Leisure Precinct (SLP) is located centrally within the PNUR. The SLP is delineated to the west and south by the meander of the Parramatta River, O'Connell Street to the east and Grose Street to the north.

The Cumberland Precinct (CP) is the northern most part of the PNUR and is broadly delineated by the meander of the Parramatta River to the west and north, O'Connell Street to the east and Grose Street to the south.

Combined, the two precincts comprise the areas of the PNUR to the east of the Parramatta River and west of O'Connell Street. The lands to the west of the Parramatta River contain Parramatta Park, including Old Government House and Domain.

1.3 Existing land uses

Land uses and facilities currently located within the SLP include Parramatta Stadium and associated facilities, Parramatta public pool, Parramatta Leagues Club, open space parkland and venue car parking. These built facilities and associated structures occupy predominantly the north eastern two thirds of the precinct. The balance of the precinct, nestled inside the meander of the Parramatta River, is predominantly landscaped open space with some incursion of at grade car parking.

Land uses within the Cumberland Precinct include the Cumberland Hospital, the NSW Linen Service, allied health related uses and NGOs and the former Parramatta Gaol. The precinct contains buildings of State and local heritage significance as well as potential Aboriginal archaeological sites. Buildings are dispersed throughout the precinct serviced by an irregular access network and broadly surrounding a central oval. These clusters of buildings are interspersed with vegetation and are framed by an almost continuous band of vegetation framing the eastern bank of the Parramatta River.

1.4 Surrounding areas

The PNUR study area is located to the immediate west and north-west of the Parramatta CBD. The north-eastern area of the CBD is emerging as a mixed use residential precinct with residential tower forms.

To the east of the study area, uses range from educational uses, residential accommodation in forms ranging from single dwellings to three storey residential flat buildings, interspersed with non-residential uses of former dwellings. Further east a spine of retail and commercial uses are located along Church Street and Victoria Road.

To the north east of the site, generally along O'Connell Street building forms are typically three storey residential flat buildings and commercial and retail land uses in the areas to the east of the former Parramatta Gaol.

To the north of the Cumberland Precinct on the opposite bank of the Parramatta River is the Northmead industrial area including large format industrial buildings.

To the north west of the Cumberland Precinct is a small pocket of single storey cottages bound by further industrial development to the west and three storey residential flat buildings fronting Briens Road, Northmead

To the west of the Cumberland Precinct beyond Parramatta Park is the Westmead medical precinct which is adjoined by a residential area bound generally by Hawkesbury Road, Hainsworth Street, Park Avenue and Railway Parade. Development in this area is predominantly three storey residential flat building forms interspersed with taller higher density residential flat buildings. This residential pocket of land is separated from the lands the subject of this Study by Parramatta Park.

1.5 The proposal

The PNUR area provides opportunities to protect and enhance heritage significant sites, and deliver housing, cultural uses and employment on the edge of the Parramatta CBD. The area is also exceptionally well located in proximity to the Westmead Health and Rydalmere Education specialised precincts, as well as existing and planned transport.

The location at the edge of the Parramatta CBD also places the area at the western extent of the Global Economic Corridor and Parramatta Road Corridor. These locational advantages, in concert with the proximity to the Western Sydney Employment Area, underline the strategic merits of the urban renewal of the area. PNUR includes many locational and site specific attributes, including frontage to the Parramatta River and a rich history of Aboriginal, early colonial, nineteenth and twentieth century uses. The potential exists to deliver housing and employment opportunities in a precinct that will embrace and interpret these heritage attributes to make them a focus of the urban environment that will emerge through future development.

The Study has been undertaken to prepare an appropriate suite of planning controls to guide the urban renewal of the area and future development. This has led to an Indicative Layout Plan (ILP) guiding future open space, transport links and building footprints, as well as zoning and height of building controls, which are to be implemented in conjunction with site specific Development Control Plan provisions to guide the fine grain development of the area.

This suite of controls has had regard to the site's heritage, environmental values and physical constraints.

The ILP envisages the creation of a mixed use area within the Cumberland Precinct that accommodates new development for housing, employment, cultural and community uses in new buildings and through the adaptation of existing heritage buildings. For the Sports and Leisure Precinct, the ILP envisages the strengthening of the current role of the area as a major sports venue and the introduction of allied retail and commercial uses to support the role of Parramatta Stadium as a major sport and entertainment venue for Parramatta and greater western Sydney. The Sports and Leisure Precinct may also accommodate ancillary retail to support the resident and employee population to be accommodated in the PNUR.

The study proposes amendments to the planning framework, including revisions to the development controls that will facilitate a mixed use residential redevelopment of the study area. The proposed amended planning framework will facilitate the lodgement of future development applications for the land in the study area which are anticipated to achieve the following development yields:

- Cumberland Precinct
 - Approximately 4,100 dwellings
 - Approximately 28,000 m² GFA of adaptive reuse of retained heritage buildings
 - Up to 4,000 m² GFA of retail space
- Sports and Leisure Precinct
 - Approximately 34,000 m² GFA of mixed-use (likely to be predominantly commercial)

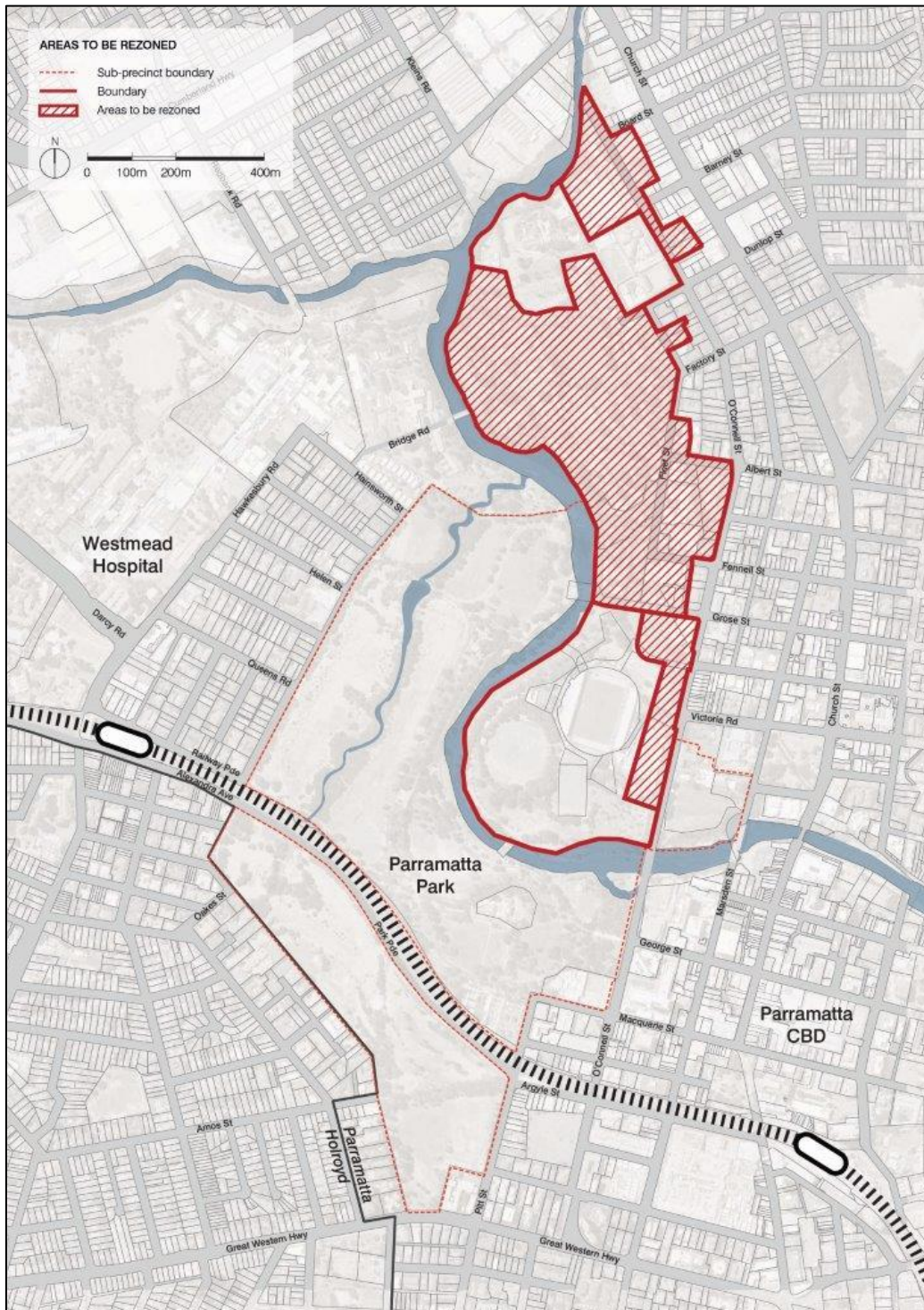


Figure 3: Rezoning boundary (AJ+C)

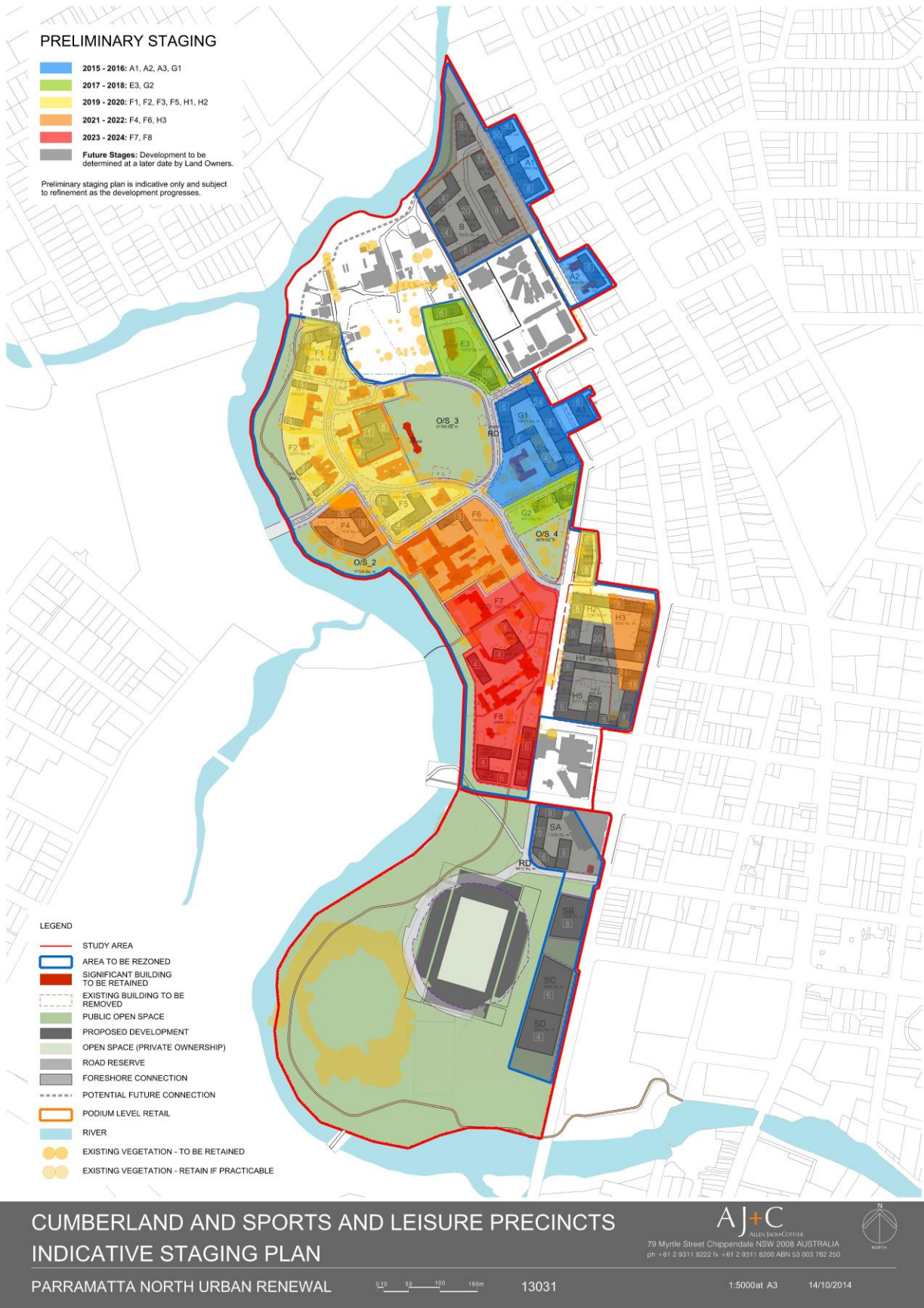


Figure 4: Indicative layout and staging plan (AJ+C)

2 Legislation

Legislation and planning policies relevant to the proposal and this ecological assessment are tabled below.

Table 1: Relevant legislation

Name	Relevance to the project	Section in this report
Commonwealth		
<i>Environment Protection and Biodiversity Conservation Act 1999</i>	Matters of National Environmental Significance (MNES) have been identified on or near the site and have been considered in this report. Referral to the Commonwealth Department of Environment is recommended and has been prepared.	Section 5.5 and Appendix D
State		
<i>Environmental Planning and Assessment Act 1979 (EP&A Act)</i>	Future development facilitated by the proposed rezoning would be assessed under Part 4 of the EP&A Act. Assessments of significance for impacts to threatened species have been prepared in accordance with s5A of the Act.	Section 5.5 and Appendix C
<i>Noxious Weeds Act 1993 (NW Act)</i>	The site contains weeds listed under the NW Act which requires particular controls and responses.	Section 4.2.2
<i>Threatened Species Conservation Act 1995 (TSC Act)</i>	The TSC Act establishes those species and ecological communities considered to be threatened in NSW. The EP&A Act provides for the assessment of impacts to species listed as threatened under the TSC Act. The land proposed for rezoning is not biodiversity certified under s126 of the TSC Act and, therefore, construction impacts to threatened species and endangered ecological communities listed under the TSC Act are required in accordance with s5A of the EP&A Act.	Sections 4 and 5 and Appendix C
<i>Water Management Act 2000 (WM Act)</i>	The proposal may involve works on waterfront land. If so, it requires a Controlled Activity Approval under s91 of the WM Act. As the works also require consent under Part 4 of the EP&A Act it is considered Integrated Development under that Act. At this stage of the planning process, these impacts are unknown.	Not considered in this report
Planning Instruments		
Parramatta LEP 2011	The study area comprises various zones; B4 mixed use, R2 Low Density Residential, R4 High Density Residential and RE2 Private Recreation. An amendment to the statutory planning provisions is anticipated to be undertaken via a State Environmental Planning Policy (SEPP) to amend the provisions of Parramatta City Centre LEP 2007 and Parramatta LEP 2011. Site specific Development Control Plan (DCP) provisions are also proposed to be prepared to guide future development.	Not considered further in this report

3 Methods

3.1 Literature and database review

Searches of BioNet / Atlas of NSW Wildlife and the EPBC Protected Matters Search Tool for threatened flora and fauna which have either been previously recorded within the region or are likely to occur due to the presence of suitable habitat were undertaken on 8 September 2014. A search of a 5 km radius around the study site was undertaken. Species from these searches were combined to produce a list of threatened fauna and flora species that may occur within the study site.

A review of literature relating to this study site was undertaken prior to field survey. The distribution of vegetation communities was considered with review of both NSW Office of Environment and Heritage (OEH) vegetation maps of the Cumberland Plain (NSW NPWS 2002) and Sydney Metro CMA vegetation maps (OEH 2013a and b).

3.2 Field survey

A field survey was conducted on the 27 August, and 7 and 8 September 2014 by Bruce Mullins and Dr Rodney Armistead encompassing all of the PNUR. The objectives of the field survey were to:

- validate vegetation mapping for the PNUR
- identify vegetation management zones in the PNUR
- identify fauna habitat features in PNUR
- confirm the extent of the Grey-headed Flying-fox camp along the Parramatta River (noting that this had also been done in a specialist study by ELA earlier in 2014)
- identify the presence and diversity of microchiropteran bats (microbats).

3.2.1 Vegetation mapping validation

Sydney Metro CMA vegetation mapping (OEH 2013a and b) for the site was validated in the field. A meander through areas mapped as native vegetation communities, and other wooded areas was undertaken to confirm vegetation community type. Notes on the dominant canopy, shrub and ground cover were recorded to help classify vegetation community type. Field maps and live aerial imagery (on a smart device) were used to pin point community boundaries, with changes to community boundaries hand drawn onto field maps.

3.2.2 Fauna habitat

During the field survey, the location of fauna habitat features was recorded using a hand held GPS and marked onto field maps in combination with a live aerial image (on a smart device) of the site.

3.2.3 Fauna survey

The field survey focused on collecting fauna habitat data at this stage of the planning process, plus some targeted survey for microbats. Other records of fauna were reviewed from previous surveys in the area by ELA, including fly-out counts of Grey-headed Flying-fox.

Two Anabat detectors (Titley Electronics – one SD1 and the other ZCAIM) were placed in disturbed urban parkland near the river and Cumberland Riverflat Forest on the 7 and 8 September 2014. Each Anabat device was programmed to record from 5 pm to 6 am over two nights. Whilst the survey effort complies with the requirements of DEC (2004), timing is outside of the optimal season (October to March).

Anabat calls were analysed by Alicia Lyon. The confidence of call identification is ranked as definite, probable, possible and unidentifiable (in decreasing order of confidence).

3.3 Impact assessment

The EP&A Act states that if a species, population or ecological community listed in Schedules 1, 1A and 2 of the TSC Act is present or potentially present, a review of the factors set out to establish if there is likely to be a significant impact on that species, population, ecological community or habitat, must be undertaken. Section 5A of the EP&A Act sets out seven factors that must be addressed as part of an Assessment of Significance (7 part test). This enables a decision to be made as to whether a proposed action is likely to significantly affect a threatened species, population or ecological community and, hence, if a Species Impact Statement (SIS) is required.

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where 'Matters of National Environmental Significance' (NES) may be affected. The Significant Impact Criteria is an assessment process to determine whether an activity is likely to significantly affect matters of NES, and whether a referral to the Minister is required. An EPBC Act referral has been prepared for this project and is available as a separate document.

Appendix B lists all threatened biota identified in the database searches and ranks their likely occurrence on the study site. **Section 5** contains a summary of the potential impacts of the proposal and the outcomes of the Assessment of Significance and Significant Impact Criteria. **Appendices C** and **D** contain the complete Assessment of Significance and Significant Impact Criteria, respectively.

4 Results

4.1 Literature and database review

A review of vegetation mapping for the site identified different vegetation communities. NPWS (2002) vegetation mapping of the study area included Alluvial Woodland and Shale Sandstone Transition Forest (high sandstone influence). Vegetation mapping by Sydney Metro CMA (OEH 2013a and b) identified only one native vegetation community in the study area; Cumberland Riverflat Forest. Alluvial Woodland (NPWS 2002) and Cumberland Riverflat Forest (OEH 2013a and b) are, for the most part, equivalent vegetation types.

The Atlas of NSW Wildlife and EPBC Protected Matters Search Tool combined identified 15 threatened ecological communities, 30 threatened flora, two endangered populations, 35 threatened fauna (comprising three fish, six frogs, 1 reptile, 1 invertebrate, 12 birds, 12 mammals), and 30 migratory species (excluding marine and pelagic species). These threatened ecological communities, populations, species and migratory species are listed in **Appendix B**.

4.2 Field survey

A field survey was conducted on the 27 August 2014 by Bruce Mullins and Dr Rodney Armistead encompassing all of the PNUR over 10 person hours. Targeted survey for microchiropteran bats was conducted from the 7-9 September 2014.

Weather conditions during the survey are in **Table 2**.

Table 2: Weather conditions during the survey recorded in Parramatta (Masons Drive)

Date	Min Temp (°C)	Max Temp (°C)	Rainfall (mm)
27 August 2014	10.8	17.2	22.8
7 September 2014	9.9	17.8	13.2
8 September 2014	8.4	20.2	1.0
9 September 2014	8.7	25.0	0

4.2.1 Vegetation communities

A survey was conducted across the whole study area, with particular attention towards previously mapped vegetation communities (see Section 4.1 for details about previous vegetation community mapping). One native vegetation community was identified in the study area; Cumberland Riverflat Forest (in accordance with OEH (2013a and b)) (**Figures 5 and 6**). This community is listed as an endangered ecological community (EEC) under the TSC Act. The community is made up of five patches in the study area, with a total area of 1.88 ha.

There are five main conventions for naming native vegetation communities in the Sydney Basin. These are Sydney Metro CMA vegetation mapping (OEH 2013a and b), NPWS (2002), Biometric Vegetation Types and endangered ecological communities as listed under the TSC Act and EPBC Acts. **Table 3** matches the vegetation type identified in the study area under each convention, noting that there is no EPBC Act EEC equivalent for Cumberland Riverflat Forest.

Table 3: Equivalent vegetation types

OEH (2013a and b)	NPWS (2002)	Biometric Vegetation Type	TSC EEC
Cumberland Riverflat Forest	Alluvial Woodland	Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin	River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregion

Cumberland Riverflat Forest was characterised in the study area by a native canopy of *Eucalyptus tereticornis* (Forest Red Gum), *Angophora floribunda* (Rough-barked Apple), *Casuarina glauca* (Swamp Oak) and *Casuarina cunninghamiana* (River Oak). *E. amplifolia* (Cabbage Gum), *E. robusta* (Swamp Mahogany) and *E. moluccana* (Grey Box) were present in lower numbers. Native shrubs included *Bursaria spinosa* (Blackthorn), *Acacia decurrens* (Sydney Green Wattle), *Pittosporum undulatum* and *Acacia longifolia* (Sydney Golden Wattle), while the ground cover included the natives *Microlaena stipoides* (Weeping Grass), *Commelina cyanea*, *Lomandra longifolia* (Spiny Mat-rush) and *Dichondra repens* (Kidney Weed).

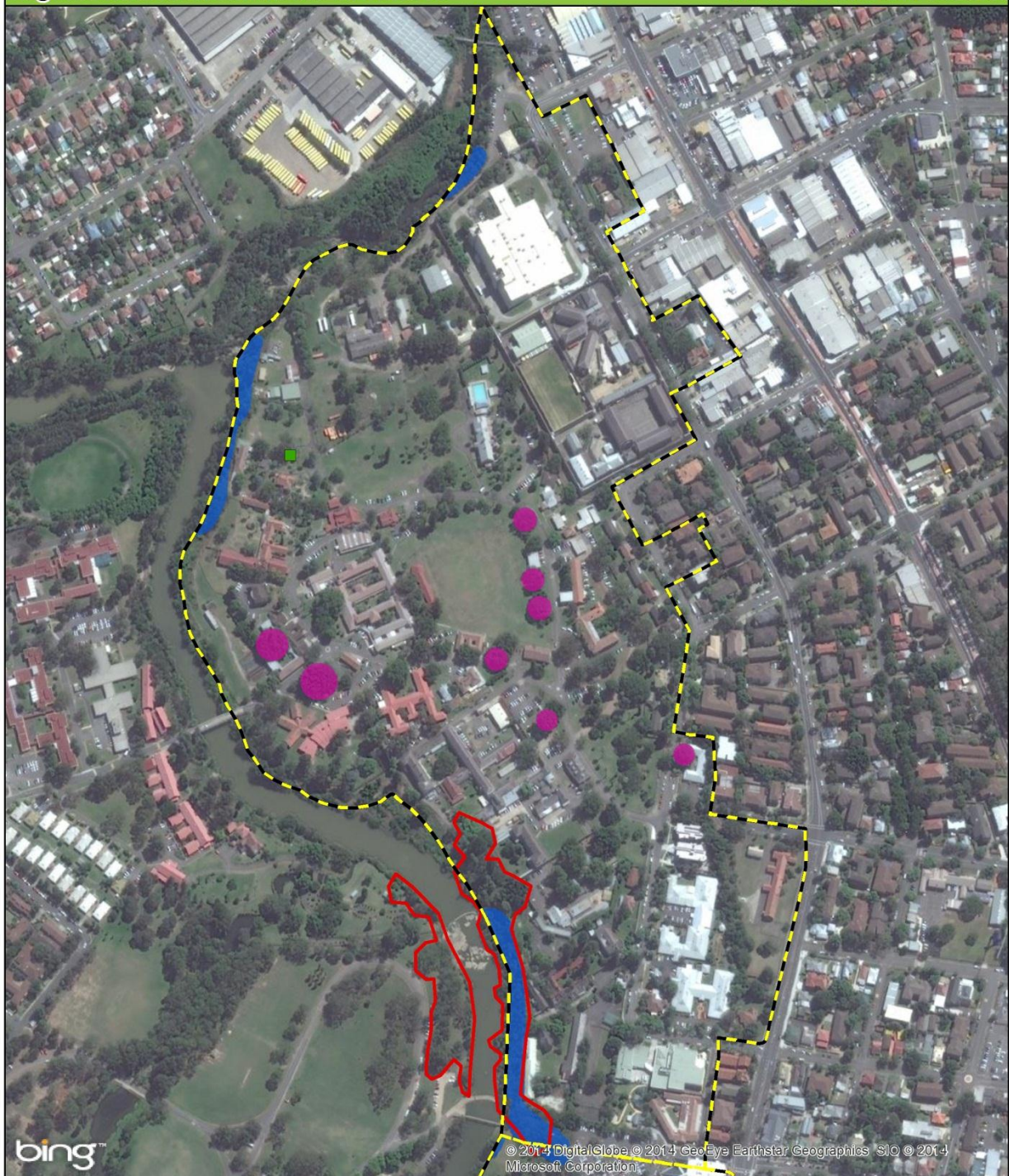
In the study area, Cumberland Riverflat Forest was in varying condition. Most patches of the community were in low to moderate condition. Patches in moderate condition contained a tree canopy, shrub layer and ground layer. Weeds were common and in some parts of the patch dominant. Some patches were subject to regular management (such as weed removal) and had been fenced off to limit public access.

Patches in low condition were virtually cleared and were subject to active vegetation restoration; plantings, and weed management. These patches contained little of the original vegetation, were small in area and lacked diversity.

Some features of Cumberland Riverflat Forest in the study area suggest that they may be in transition towards two EECs: Shale Sandstone Transition Forest (by the presence of *Angophora costata* (Smooth-barked Apple)) in the northern parts just outside the study area, and Swamp Oak Floodplain Forest (by the presence of Swamp Oak) in the southern parts of the site. It was deemed that there wasn't enough floristic evidence to conclude that native vegetation on site was other than Cumberland Riverflat Forest.

It is possible that Swamp Oak Floodplain Forest, an endangered ecological community, occurred in the study area prior to European Settlement immediately adjacent to the Parramatta River on the lower benches where there is a saline influence. *Casuarina glauca* (Swamp Oak) is the dominant tree in this vegetation type, however, it can also occur in Cumberland Riverflat Forest (River-flat Eucalypt Forest). During the survey for this report, the "best fit" for these trees in a modified environment was Cumberland Riverflat Forest.

Vegetation and Fauna Habitat Features **The Cumberland Precinct**



Legend

Study Area	Vegetation (ELA 2014)	Hollow-bearing Tree	0 50 100 200 Metres GDA 1994 MGA Zone 56
Parramatta River	River-flat Eucalypt Forest	Hollow-bearing Tree (Exotic)	
Grey-headed Flying-fox Camp	River-flat Eucalypt Forest (Regen)	Dead Stag	 www.ecoaus.com.au Prepared by: JD Date: 12/09/2014
PNUR Precincts	Fig tree	Fallen Log	

Note: Unmapped vegetation has been assessed in the field as planted.

Figure 5: Vegetation mapping and habitat values in the Cumberland Precinct

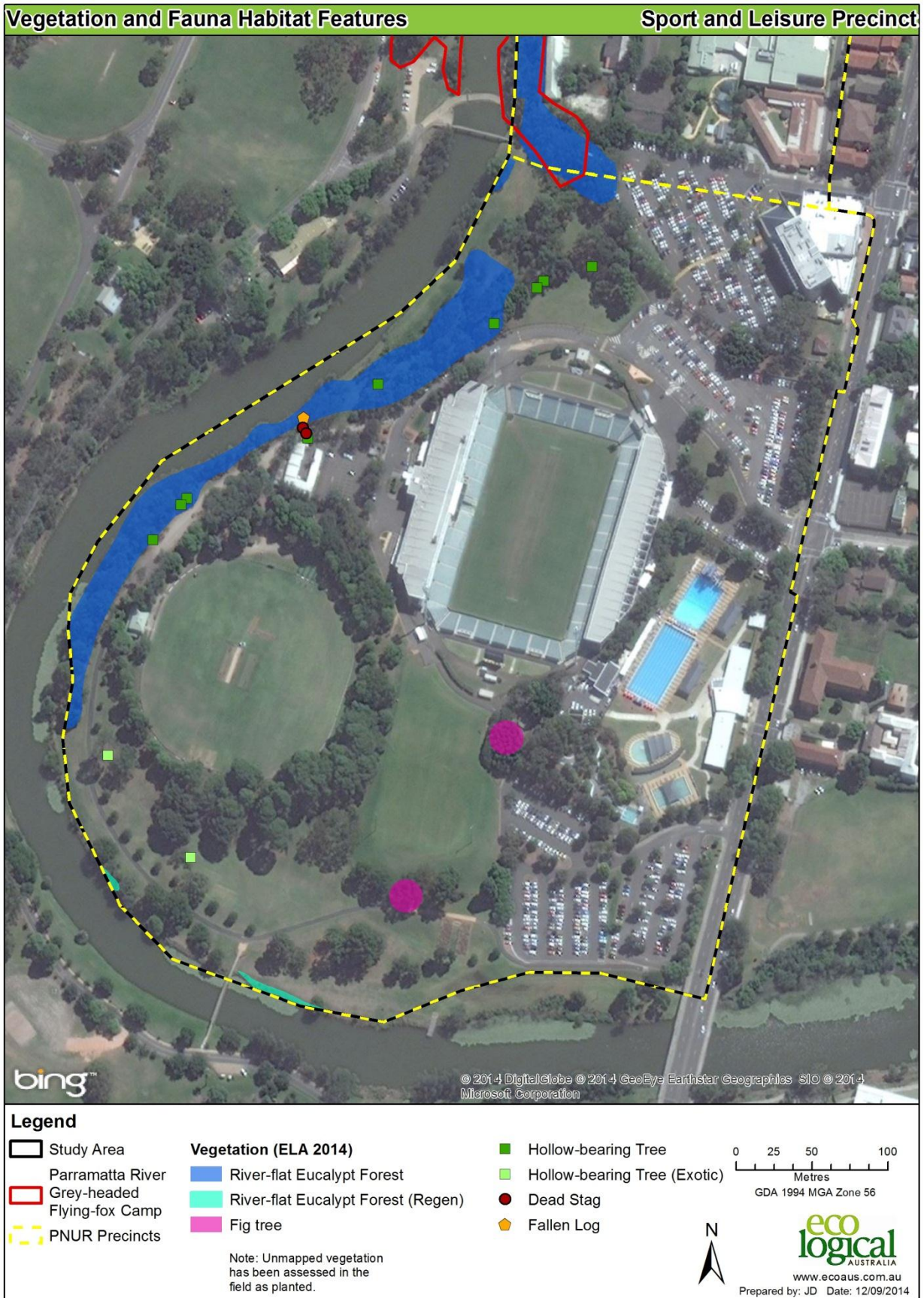


Figure 6: Vegetation mapping and habitat values in the Sport and Leisure Precinct

4.2.2 Flora

A total of 57 flora species were identified during the survey, with the focus of the survey being in and around areas of native vegetation. Of these, only 23 were native or planted natives; the remainder were exotic species. Eight species are declared noxious in Parramatta LGA and one is a Weed of National Significance (WoNS) (**Table 4**).

No threatened flora were recorded and the high degree of disturbance and weed invasion suggests that they are unlikely to occur in the study area.

The majority of vegetation on site comprises amenity planting around the Cumberland Hospital, sporting facilities and residences. They comprise a range of native (but not endemic) and exotic species such as *Corymbia citriodora* (Lemon-scented Gum), *Eucalyptus microcorys* (Tallowwood), *Lophostemon confertus* (Brush Box), *Cinnamomum camphor* (Camphor Laurel), *Ficus* sp. (Fig).

Table 4: Noxious and Weeds of National Significance observed in the study area

Scientific Name	Common Name	Class
<i>Cardiospermum grandiflorum</i>	Balloon Vine	4
<i>Ipomoea indica</i>	Morning Glory	4
<i>Lantana camara</i>	Lantana	4, WoNS
<i>Ligustrum lucidum</i>	Broad-leaved Privet	4
<i>Ligustrum sinense</i>	Narrow-leaved Privet	4
<i>Olea europaea</i> subsp. <i>cuspidata</i>	African Olive	4
<i>Opuntia</i> sp.	Prickly Pear	4
<i>Ricinus communis</i>	Castor Oil Plant	4

Class 4 legal requirements - the growth of the plant must be managed in a manner that continuously inhibits the ability of the plant to spread and the plant must not be sold, propagated or knowingly distributed.

4.2.3 Fauna

With the exception of survey for microbats, target fauna survey was not undertaken as part of this report. However, incidental observations of fauna were noted during the site visit along with records from recent surveys from nearby sites. These species are recorded in **Appendix A**.

The study area includes a known *Pteropus poliocephalus* (Grey-headed Flying-fox) camp in the south-west of the study area along the Parramatta River. Grey-headed Flying-fox is a vulnerable species under the TSC and EPBC Acts. Previous studies of this camp include a management plan prepared by ELA (2008) and a specialist advice report by ELA (2014).

The camp is spread across both banks of the Parramatta River, and is known to be consistently utilised by the species with population estimates fluctuating between 10,000 - 20,000 individuals based on seasonal movements. The camp is a known breeding site for the species and meets the criteria for consideration as roosting habitat which is critical to the survival of the species as identified in the Draft National Recovery Plan for the species (DECCW, 2009).

Anabat detectors recorded the calls of six microbat species. Two species were definitely identified from; *Chalinolobus gouldi* (Gould's Wattled Bat) and *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat). Two species identification were ranked as probable; *Mormopterus* sp.2 (Eastern Freetail Bat) and *Scotorepens orion* (Eastern Broad-nosed Bat), and one species identification was ranked as possible; *Mormopterus norfolkensis* (East-coast Freetail Bat) and *Vespadelus darlingtoni* (Large Forest Bat). Two of these species are vulnerable under the TSC Act; Eastern Bentwing Bat and East-coast Freetail Bat.

Based on the field survey results and available habitat, an additional three threatened species were considered to have potential to occur on site; *Ninox strenua* (Powerful Owl), *Scoteanax rueppellii* (Greater Broad-nosed Bat) and *Myotis macropus* (Southern Myotis).

4.2.4 Fauna habitat

The study area contains a range of habitat that could be used by fauna. **Table 5** lists these habitat types and the broad fauna groups that may use this habitat in the study area.

Table 5: Fauna habitat types in the study area

Fauna habitat type	Native fauna groups that may use this habitat	Potential use
Scattered trees	Birds, mammals, reptiles	Foraging, refuge, breeding
Riparian woodland	Birds, mammals, reptiles, frogs	Foraging, refuge, breeding
Hollow-bearing trees	Birds, mammals, reptiles	Refuge, breeding
Fallen logs	Mammals, reptiles, frogs	Foraging, refuge
Fig trees	Birds and mammals	Foraging refuge, breeding
Stags	Birds, mammals, reptiles	Refuge, breeding
Built environment	Mammals, reptiles	Refuge

5 Impact assessment

A description of the proposal is in **Section 1.5**. In a broad sense, the proposal will establish a range of recreational, residential and employment precincts in the study area. The proposal recognises and will embrace the cultural and natural assets of the study area, and will establish management plans to protect and sustain these values in the long term.

Whilst at the rezoning stage, the precise nature, location and extent of all impacts of the proposal are not defined. The proposed precinct plan and management plan have been used as the basis for the impact assessment. It is recognised that further impact assessment would be required in future to consider environmental conditions in relation to specific development applications.

5.1 Potential impacts

Even though the proposal is only a rezoning at this stage, potential impacts relevant to the ecological assessment include:

- short term (construction) impacts
 - noise
 - dust
 - vibration
 - vegetation clearing – minor and not remnant native vegetation
 - light spill
- longer term impacts e.g. from use of paths, recreational areas, commercial and residential
 - noise
 - light spill
 - maintenance e.g. rubbish, weed control
 - anthropogenic disturbance.

5.2 Key ecological values

The key ecological values that the proposal may impact are:

- Grey-headed Flying-fox – the camp, individuals, and foraging resources. This species is vulnerable under the TSC Act and EPBC Act
- East-coast Freetail Bat and Eastern Bentwing Bat – both vulnerable under the TSC Act
- River-flat Eucalypt Forest – an endangered ecological community under the TSC Act
- Hollow bearing trees – an important resource for fauna, including threatened species.

Wherever possible, impacts to these known ecological values should be avoided. Management plans of the natural environment should specifically consider these values, and include actions to protect, sustain and enhance these values.

5.3 Key threatening processes

The degraded and modified nature of the site means that many of the site's ecological values are at risk from listed Key Threatening Processes (KTP).

Relevant KTPs under the TSC Act are:

- Alteration to natural flow regimes of rivers and streams and their floodplains and wetlands.
- Invasion and establishment of exotic vines and scramblers.
- Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata*.
- Invasion, establishment and spread of *Lantana camara*.
- Invasion of native plant communities by exotic perennial grasses.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Removal of dead wood and dead trees.

Relevant KTPs under the EPBC Act are:

- Aggressive exclusion of birds from potential woodland and forest habitat by over-abundant noisy miners (*Manorina melanocephala*).
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Novel biota and their impact on biodiversity.

If these threats are not appropriately managed during development of the study area, they may continue to threaten native vegetation and native species. However, the KTP that is beyond the control of the proposal is alteration to natural flow regimes of river and streams and their floodplains and wetlands.

5.4 Impact mitigation measures

Measures to mitigate potential impacts are discussed in a separate Ecological Management Plan for PNUR. These measures include:

- Use the existing brick wall as a barrier between the GHFF camp and development and do not construct paths or other infrastructure in the camp.
- Avoid clearing remnant RFEF.
- Avoid noise impacts as follows:
 - Ensure all plant and equipment is maintained to Australian Standards to minimise noise generation.
 - Position plant and equipment as far from the GHFF camp as possible.
 - Shield noise at its source, where possible.
 - Schedule construction of the shared path outside the GHFF breeding season (i.e. when the ratio of lactating or late-pregnancy females and/or dependent young is greater than 5% of the population in the camp).
 - Avoid construction at dawn when the GHFF are returning to the camp to roost.
 - Commission an ecologist with suitable experience to monitor the health of the GHFF during the breeding season when new buildings are being constructed in F7 and F8. If GHFF become too stressed they can abort young. The ecologist would have authority to stop noisy construction work if the GHFF are stressed. The work would be allowed to resume at night when the camp is empty or when the ecologist determines that the GHFF are no longer stressed and at risk.
- Avoid light spill impacts as follows:
 - Do not shine construction lights toward the GHFF habitat or other habitat areas.
 - Install lights along the side of the path on the side furthest from the river.

- Install low bollards (1-2 m height) between the path and the riparian habitat where suitable, with post tops (4-5 m height) installed at key pedestrian junctions if required for public safety.
- Utilise low pressure sodium lamps with UV filters in landscaping near the riparian corridor.
- Minimise the time during which the lighting is used.
- Use lowest possible brightness.
- Direct light below the horizontal plane towards the path and shield riparian vegetation by fitting lights with hoods.
- Retain hollow bearing trees, or compensate for the loss of these trees with artificial structures, such as nest boxes. Nest boxes should be designed for specific fauna, such as microbats, possums, birds. Nest box design will influence the types and species of fauna to use this supplementary habitat.
- Wherever possible, retain fig trees in precinct planning.
- Establish erosion and sediment controls as part of a Construction Environmental Management Plan.

Other measures proposed that will assist with conservation of ecological values on site are discussed in the management plan and include:

- Regenerate, rehabilitate and re-create native vegetation communities along the riparian corridor using best practice bush regeneration techniques and in accordance with a detailed vegetation management plan.
- Manage GHFF heat stress.
- Implement a community environmental education and engagement program.

5.5 Summary of impact assessment

The Assessment of Significance and Significant Impact Criteria were applied to threatened ecological communities and species that were known or had the potential to occur in the study area (refer to **Appendices C** and **D**, respectively).

5.6 Conclusions and recommendations

Considering that the proposal is in the early planning process and intends to avoid remnant native vegetation and the GHFF camp, and enhance and recreate areas of native vegetation, the impact assessment concluded that the proposal was unlikely to result in a significant impact to any threatened ecological community or threatened species following the application of appropriate mitigation and management measures. The proposal does not require the preparation of a Species Impact Statement.

While the proposed action is considered unlikely to result in a direct impact to the GHFF or its habitat, the proposed action will result in indirect impacts to the GHFF associated with construction in adjacent areas. Legal certainty regarding the significance of an impact can only be obtained through referral to the Commonwealth. On this basis, given the likelihood of indirect impacts to the species, referral to the Commonwealth is recommended. A separate EPBC Act referral document has been prepared and submitted to the Department of Environment.

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Appendix A - Species lists

Flora

Common species identified in Cumberland Riverflat Forest

Scientific Name	Common Name
<i>Acacia decurrens</i>	Sydney Green Wattle
<i>Acacia floribunda</i>	White Sallow Wattle (planted)
<i>Acacia longifolia</i>	Sydney Golden Wattle
<i>Ageratina riparia</i> *	Mist Flower
<i>Anagallis arvensis</i> *	Pimpernel
<i>Angophora costata</i>	Smooth-barked Apple
<i>Angophora floribunda</i>	Rough-barked Apple
<i>Araujia sericifera</i> *	Moth Plant
<i>Asparagus aethiopicus</i> *	Asparagus Fern
<i>Banksia serrata</i>	Old Man Banksia (planted)
<i>Bidens pilosa</i> *	Cobbler's Peg
<i>Bursaria spinosa</i>	Blackthorn
<i>Callistemon</i> sp.	Bottlebrush (planted)
<i>Cardiospermum grandiflorum</i> *	Balloon Vine
<i>Casuarina cunninghamiana</i>	River Oak
<i>Chloris gayana</i> *	Rhodes Grass
<i>Cinnamomum camphora</i> *	Camphor Laurel
<i>Cirsium vulgare</i> *	Spear Thistle
<i>Commelina cyanea</i>	Scurvy Weed
<i>Corymbia citriodora</i>	Lemon-scented Gum (planted)
<i>Cynodon dactylon</i> *	Couch
<i>Dichondra repens</i>	Kidney Weed
<i>Ehrharta erecta</i> *	Panic Veldgrass

Scientific Name	Common Name
<i>Ehrharta longifolia</i> *	Annual Veldgrass
<i>Eragrostis curvula</i> *	African Lovegrass
<i>Eucalyptus amplifolia</i>	Cabbage Gum
<i>Eucalyptus moluccana</i>	Grey Box
<i>Eucalyptus tereticornis</i>	Forest Red Gum
<i>Gomphocarpus fruticosus</i> *	Cottony Balloon Bush
<i>Grevillea robusta</i>	Silky Oak (planted)
<i>Hardenbergia violacea</i>	
<i>Ipomoea</i> sp. *	Morning Glory
<i>Lantana camara</i> *	Lantana
<i>Ligustrum lucidum</i> *	Large-leaved Privet
<i>Ligustrum sinense</i> *	Small-leaved Privet
<i>Lomandra longifolia</i>	Spiny Mat-rush
<i>Lophostemon confertus</i>	Brush Box (planted)
<i>Medicago polymorpha</i> *	Burr Medic
<i>Melaleuca quinquenervia</i>	Broad-leaved Paperbark
<i>Microlaena stipoides</i>	Weeping Grass
<i>Modiola caroliniana</i> *	Red-flowered Mallow
<i>Olea europaea</i> subsp. <i>cuspidata</i> *	African Olive
<i>Opuntia</i> sp.	
<i>Paspalum dilatatum</i> *	Paspalum
<i>Pennisetum clandestinum</i> *	Kikuyu
<i>Phoenix</i> sp. *	
<i>Phragmites australis</i>	Common Reed
<i>Pittosporum undulatum</i>	Sweet Pittosporum
<i>Plantago lanceolata</i> *	Plantain
<i>Pyracantha angustifolia</i> *	Firethorn

Scientific Name	Common Name
<i>Ricinus communis</i> *	Castor Oil Plant
<i>Rumex crispus</i> *	Curled Dock
<i>Sida rhombifolia</i> *	Paddy's Lucerne
<i>Solanum nigrum</i> *	Blackberry Nightshade
<i>Sonchus oleraceus</i> *	Sowthistle
<i>Taraxacum officinale</i> *	Dandelion
<i>Verbena bonariensis</i> *	Purple Top
<i>Vicia</i> sp. *	Vetch

Note: * = exotic species

Fauna

Scientific Name	Common Name
BIRDS	
<i>Alisterus scapularis</i>	King Parrot
<i>Anas superciliosa</i>	Pacific Black Duck
<i>Ardea pacifica</i>	White-necked Heron
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo
<i>Cacatua sanguinea</i>	Little Corella
<i>Columba livia</i> *	Feral Pigeon
<i>Corvus coronoides</i>	Australian Raven
<i>Cracticus torquatus</i>	Grey Butcherbird
<i>Dacelo novaeguineae</i>	Laughing Kookaburra
<i>Eolophus roseicapillus</i>	Galah
<i>Fulica atra</i>	Eurasian Coot
<i>Grallina cyanoleuca</i>	Magpie-lark
<i>Gymnorhina tibicen</i>	Australian Magpie
<i>Hirundo neoxena</i>	Welcome Swallow

Scientific Name	Common Name
<i>Manorina melanocephala</i>	Noisy Miner
<i>Ocyphaps lophotes</i>	Crested Pigeon
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant
<i>Porphyrio porphyrio</i>	Purple Swamp Hen
<i>Psephotus haematodus</i>	Red-rumped Parrot
<i>Rhipidura leucophrys</i>	Willie Wagtail
<i>Sphecotheres vieilloti</i>	Australian Figbird
<i>Strepera graculina</i>	Pied Currawong
<i>Sturnus tristis</i> *	Common Myna
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe
<i>Threskiornis molucca</i>	Australian White Ibis
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet
<i>Vanellus miles</i>	Masked Lapwing
MAMMALS	
<i>Chalinolobus gouldi</i>	Gould's Wattled Bat
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing Bat
<i>Mormopterus norfolkensis</i>	East-coast Freetail Bat
<i>Mormopterus</i> sp. 2	Eastern Freetail Bat
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox
<i>Scotorepens orion</i>	Eastern Broad-nosed Bat
<i>Vespadelus darlingtoni</i>	Large Forest Bat
AMPHIBIANS	
<i>Limnodynastes peronii</i>	Striped Marsh Frog

Note: * = introduced species

Appendix B - Threatened species and ecological communities likelihood of occurrence

An assessment of likelihood of occurrence was made for threatened and migratory species, and ecological communities identified from the database search. Five terms for the likelihood of occurrence of species are used in this report. This assessment was based on database or other records, presence or absence of suitable habitat, features of the proposal site, results of the field survey and professional judgement. The terms for likelihood of occurrence are defined below:

- “yes” = the species was or has been observed on the site
- “likely” = a medium to high probability that a species uses the site
- “potential” = suitable habitat for a species occurs on the site, but there is insufficient information to categorise the species as likely to occur, or unlikely to occur
- “unlikely” = a very low to low probability that a species uses the site
- “no” = habitat on site and in the vicinity is unsuitable for the species.

Marine and pelagic species have been excluded from the tables.

Community	TSC Act	EPBC Act	Likelihood of occurrence
ECOLOGICAL COMMUNITIES			
Blue Gum High Forest in the Sydney Basin Bioregion	E	CE	No
Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion	V		No
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion	E		No
Cumberland Plain Woodland in the Sydney Basin Bioregion	E	CE	Unlikely
Freshwater Wetlands on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E		No
Moist Shale Woodland in the Sydney Basin Bioregion	E	CE	No
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E		Yes
Shale gravel Transition Forest in the Sydney Basin Bioregion	E	CE	No
Shale/Sandstone Transition Forest	E	E	Unlikely
Southern Sydney sheltered forest on transitional sandstone soils in the Sydney Basin Bioregion	E		No

Community	TSC Act	EPBC Act	Likelihood of occurrence
Subtropical and Temperate Coastal Saltmarsh	E	V	No
Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E		Unlikely
Swamp Sclerophyll Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	E		No
Sydney Turpentine-Ironbark Forest	E	CE	No
Western Sydney Dry Rainforest in the Sydney Basin Bioregion	E	CE	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
PLANTS					
<i>Acacia bynoeana</i>	Bynoe's Wattle	E	V	<i>Acacia bynoeana</i> is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains, and has recently been found in the Colymea and Parma Creek areas west of Nowra. It is found in heath and dry sclerophyll forest, typically on a sand or sandy clay substrate, often with ironstone gravels (DECC 2007).	No
<i>Acacia gordonii</i>		E	E	<i>Acacia gordonii</i> is restricted to the north-west of Sydney, occurring in the lower Blue Mountains in the west, and in the Maroota/Glenorie area in the east, within the Hawkesbury, Blue Mountains and Baulkham Hills local government areas. Grows in dry sclerophyll forest and heathlands amongst or within rock platforms on sandstone outcrops (DECC 2007).	No
<i>Acacia pubescens</i>	Downy Wattle	V	V	<i>Acacia pubescens</i> occurs on the NSW Central Coast in Western Sydney, mainly in the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and Mountain Lagoon. It is associated with Cumberland Plains Woodlands, Shale / Gravel Forest and Shale / Sandstone Transition Forest growing on clay soils, often with ironstone gravel (NPWS 1997; Benson and McDougall 1996).	No
<i>Allocasuarina glareicola</i>		E	E	<i>Allocasuarina glareicola</i> is primarily restricted to the Richmond district on the north-west Cumberland Plain, with an outlier population found at Voyager Point. It grows in Castlereagh woodland on lateritic soil (DECC 2007).	No
<i>Asterolasia elegans</i>		E	E	<i>Asterolasia elegans</i> is restricted to a few localities on the NSW Central Coast north of Sydney, in the Baulkham Hills, Hawkesbury and Hornsby LGAs. It is found in sheltered forests on mid- to lower slopes and valleys, in or adjacent to gullies (DEC 2005).	No
<i>Caladenia tessellata</i>	Thick Lip Spider Orchid	E	V	<i>Caladenia tessellata</i> occurs in grassy sclerophyll woodland, often growing in well-structured clay loams or sandy soils south from Swansea, usually in sheltered moist places and in areas of increased sunlight (DEC 2005). It flowers from September to November (DEC 2005).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Callistemon linearifolius</i>	Netted Bottlebrush	V	-	<i>Callistemon linearifolius</i> has been recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW, growing in dry sclerophyll forest (DEC 2005). For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River (DEC 2005).	No
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	V	<i>Cryptostylis hunteriana</i> is known from a range of vegetation communities including swamp-heath and woodland (DEC 2005). The larger populations typically occur in woodland dominated by Scribbly Gum (<i>Eucalyptus sclerophylla</i>), Silvertop Ash (<i>E. sieberi</i>), Red Bloodwood (<i>Corymbia gummifera</i>) and Black Sheoak (<i>Allocasuarina littoralis</i>); where it appears to prefer open areas in the understorey of this community and is often found in association with the Large Tongue Orchid (<i>C. subulata</i>) and the Tartan Tongue Orchid (<i>C. erecta</i>) (DEC 2005). Bell (2001) has identified Coastal Plains Scribbly Gum Woodland and Coastal Plains Smoothed-barked Apple Woodland as potential habitat on the Central Coast. Flowers between November and February, although may not flower regularly (DEC 2005; Bell 2001).	No
<i>Darwinia biflora</i>		V	V	<i>Darwinia biflora</i> is an erect or spreading shrub to 80cm high associated with habitats where weathered shale capped ridges intergrade with Hawkesbury Sandstone, where soils have a high clay content (NPWS 1997).	No
<i>Epacris purpurascens</i> var. <i>purpurascens</i>		V		<i>Epacris purpurascens</i> var. <i>purpurascens</i> has been recorded between Gosford in the north to Avon Dam in the south, in a range of habitats, but most have a strong shale soil influence (DEC 2005).	No
<i>Eucalyptus camfieldii</i>	Camfield's Stringybark	V	V	<i>Eucalyptus camfieldii</i> is associated with shallow sandy soils bordering coastal heath with other stunted or mallee eucalypts, often in areas with restricted drainage and in areas with laterite influenced soils, thought to be associated with proximity to shale (DEC 2005).	No
<i>Eucalyptus nicholii</i>	Narrow-leaved Black Peppermint	V	V	<i>Eucalyptus nicholii</i> naturally occurs in the New England Tablelands of NSW, where it occurs from Nundle to north of Tenterfield. Grows in dry grassy woodland, on shallow and infertile soils, mainly on granite (DECC 2007). This species is widely planted as an urban street tree and in gardens but is quite rare in the wild (DECC 2007). Plantings undertaken for horticultural and aesthetic purposes are not considered threatened species under the TSC Act.	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Genoplesium baueri</i>	Yellow Gnat-orchid	E	E	Known from coastal areas from northern Sydney south to the Nowra district. Previous records from the Hunter Valley and Nelson Bay are now thought to be erroneous. Grows in shrubby woodland in open forest on shallow sandy soils.	No
<i>Grammitis stenophylla</i>	Narrow-leaf Finger Fern	E		In NSW, <i>Grammitis stenophylla</i> has been found on the south, central and north coasts, and as far west as Mount Kaputar National Park near Narrabri, in moist places, usually near streams, on rocks or in trees, in rainforest and moist eucalypt forest (DEC 2005).	No
<i>Hibbertia superans</i>		E		<i>Hibbertia superans</i> mainly occurs in the north west Sydney region between Baulkham Hills and Wisemans Ferry, with a disjunct occurrence near Mt Boss (inland from Kempsey) on the Mid North Coast of NSW. In the Sydney region it occurs in dry sclerophyll forest on sandstone ridgetops while the northern occurrence is on granite (DECC 2007).	No
<i>Leptospermum deanei</i>	<i>Leptospermum deanei</i>	V	V	<i>Leptospermum deanei</i> has been recorded in Hornsby, Warringah, Ku-ring-gai and Ryde LGAs, in woodland on lower hill slopes or near creeks, at sites with sandy alluvial soil or sand over sandstone (DEC 2005). It has also been recorded in riparian scrub dominated by <i>Tristaniopsis laurina</i> and <i>Baeckea myrtifolia</i> ; woodland dominated by <i>Eucalyptus haemastoma</i> ; and open forest dominated by <i>Angophora costata</i> , <i>Leptospermum trinervium</i> and <i>Banksia ericifolia</i> (DEC 2005).	No
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas	E2		This Endangered Population of <i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> occurs in the Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys areas of western Sydney. It grows in vine thickets and open shale woodland (DECC 2007).	No
<i>Melaleuca biconvexa</i>	Biconvex Paperbark	V	V	<i>Melaleuca biconvexa</i> occurs in coastal districts and adjacent tablelands from Jervis Bay north to the Port Macquarie district. It grows in damp places often near streams (PlantNet 2011).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Melaleuca deanei</i>	Deane's Paperbark	V	V	Found in heath on sandstone (DEC 2005), and also associated with woodland on broad ridge tops and slopes on sandy loam and lateritic soils (Benson and McDougall 1998).	No
<i>Pelargonium striatellum</i> sp.	Omeo's Stork's Bill	E	E	In NSW, <i>Pelargonium</i> sp. <i>Straitellum</i> (G.W. Carr 10345) is known from the Southern Tablelands (PlantNet 2011). Otherwise, only known from the shores of Lake Omeo near Benambra in Victoria where it grows in cracking clay soil that is probably occasionally flooded (Walsh & Entwisle 1999). The species is known to occur in habitat usually located just above the high water level of irregularly inundated or ephemeral lakes. During dry periods, the species is known to colonise exposed lake beds. It is not known if the species' rhizomes and/or soil seedbank persist through prolonged inundation or drought (DSEWPAC 2012).	No
<i>Persoonia hirsuta</i>	Hairy Persoonia	E	E	<i>Persoonia hirsuta</i> occurs from Singleton in the north, south to Bargo and the Blue Mountains to the west (DECC 2007). It grows in dry sclerophyll eucalypt woodland and forest on sandstone (PlantNet 2011).	No
<i>Persoonia mollis</i> subsp. <i>maxima</i>		E	E	Deep gullies or on the steep upper hillsides of narrow gullies incised from Hawkesbury Sandstone, characterised by steep sideslopes, rocky benches and broken scarps, with creeks fed by small streams and intermittent drainage depressions. Occurrences of this plant have been recorded on the dry upper-hillsides of gullies and in more exposed aspects (Scribbly Gum <i>E. haemastoma</i> , Grey Gum (<i>E. punctata</i>) (NPWS 1999).	No
<i>Persoonia nutans</i>	Nodding Geebung	E	E	Associated with dry woodland, Castlereagh Scribbly Gum Woodland, Agnes Banks Woodland and sandy soils associated with tertiary alluvium, occasionally poorly drained (Benson and McDougall 2000). Endemic to the Western Sydney (Benson and McDougall 2000).	No
<i>Pimelea curviflora</i> var. <i>curviflora</i>		V	V	<i>Pimelea curviflora</i> var. <i>curviflora</i> is confined to the coastal area of Sydney between northern Sydney in the south and Maroota in the north-west. It grows on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridge tops and upper slopes amongst woodlands (DECC 2007). Associated with the Duffys Forest Community, shale lenses on ridges in Hawkesbury sandstone geology (Pittwater Council 2000).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Pimelea spicata</i>	Spiked Rice-flower	E	E	In western Sydney, <i>Pimelea spicata</i> occurs on an undulating topography of well-structured clay soils, derived from Wianamatta shale (DEC 2005). It is associated with Cumberland Plains Woodland (CPW), in open woodland and grassland often in moist depressions or near creek lines (Ibid.). Has been located in disturbed areas that would have previously supported CPW (Ibid.).	No
<i>Pomaderris prunifolia</i>	<i>P. prunifolia</i> in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas	E2	-	This Endangered Population of <i>Pomaderris prunifolia</i> is only known from three sites in the Parramatta, Auburn, Strathfield and Bankstown LGAs (at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown) in Western Sydney. It grows in disturbed areas on sandstone or shale soils (DECC 2007).	No
<i>Pterostylis gibbosa</i>	Illawarra Greenhood	E	E	Known from a small number of populations in the upper Hunter Valley (Milbrodale), the Illawarra region (Albion Park and Yallah) and near Nowra (DEC 2005). Plants grow in a variety of woodland and open forest communities with shallow rocky soils.	No
<i>Pterostylis saxicola</i>	Sydney Plains Greenhood	E	E	Terrestrial orchid predominantly found in Hawkesbury Sandstone Gully Forest growing in small pockets of soil that have formed in depressions in sandstone rock shelves (NPWS 1997). Known from Georges River National Park, Ingleburn, Holsworthy, Peter Meadows Creek, St Marys Tower (NSW Scientific Committee 1999).	No
<i>Streblus pendulinus</i>	<i>Siah's backbone</i>	-	E	On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well developed rainforest, gallery forest and drier, more seasonal rainforest (DSEWPAC 2012).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E	V	This species occupies a narrow coastal area between Bulahdelah and Conjola State Forests in NSW. On the Central Coast, it occurs on Quaternary gravels, sands, silts and clays, in riparian gallery rainforests and remnant littoral rainforest communities (Payne 1997). In the Ourimbah Creek valley, <i>S. paniculatum</i> occurs within gallery rainforest with <i>Alphitonia excelsa</i> , <i>Acmena smithii</i> , <i>Cryptocarya glaucescens</i> , <i>Toona ciliata</i> , <i>Syzygium oleosum</i> with emergent <i>Eucalyptus saligna</i> . At Wyrabalong NP, <i>S. paniculatum</i> occurs in littoral rainforest as a co-dominant with <i>Ficus fraseri</i> , <i>Syzygium oleosum</i> , <i>Acmena smithii</i> , <i>Cassine australe</i> , and <i>Endiandra sieberi</i> . Payne (1991) reports that the species appears absent from Terrigal formation shales, on which the gully rainforests occur. <i>S. paniculatum</i> is summer flowering (November-February), with the fruits maturing in May (DECC 2007).	No
<i>Tetradlea glandulosa</i>		V	V	Associated with ridgetop woodland habits on yellow earths (Travers Morgan 1991) also in sandy or rocky heath and scrub (NPWS 1997). Often associated with sandstone / shale interface where soils have a stronger clay influence (NPWS 1997). Flowers July to November.	No
<i>Triplarina imbricata</i>	Creek Triplarina	E	E	Found only in a few locations in the ranges south-west of Glenreagh and near Tabulam in north-east NSW. Along watercourses in low open forest with Water Gum (<i>Tristaniopsis laurina</i>) (DEC 2005).	No
<i>Wilsonia backhousei</i>	Narrow-leafed Wilsonia	V		In NSW, <i>Wilsonia backhousei</i> is found on the coast between Mimosas National Park and Wamberal north of Sydney (Nelson's Lake, Potato Point, Sussex Inlet, Wowly Gully, Parramatta River at Ermington, Clovelly, Voyager Point, Wollongong and Royal National Park). It grows on the margins of salt marshes and lakes (DEC 2005).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
FISH					
<i>Epinephelus daemeli</i>	Blackcod	-	V	Black cod generally inhabit near-shore rocky and offshore coral reefs at depths down to 50 m, but are occasionally recorded from deeper waters. In coastal waters adult black cod are found in rock caves, rock gutters and on rock reefs (DSEWPAC 2012).	No
<i>Macquarie australasica</i>	Macquarie Perch	E (under FM Act)	E	Habitat for the Macquarie perch is bottom or mid-water in slow-flowing rivers with deep holes, typically in the upper reaches of forested catchments with intact riparian vegetation. Macquarie perch also do well in some upper catchment lakes. In some parts of its range, the species is reduced to taking refuge in small pools which persist in midland–upland areas through the drier summer periods.	No
<i>Prototroctes maraena</i>	Australian Grayling	-	V	Historically, this species occurred in coastal streams from the Grose River southwards through NSW, VIC and TAS. On mainland Australia, this species has been recorded from rivers flowing east and south of the main dividing ranges. This species spends only part of its lifecycle in freshwater, mainly inhabiting clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops but has also been found in muddy-bottomed, heavily silted habitat. Grayling migrate between freshwater streams and the ocean and as such it is generally accepted to be a diadromous (migratory between fresh and salt waters) species.	No
FROGS					
<i>Heleioporus australiacus</i>	Giant Burrowing Frog	V	V	Forages in woodlands, wet heath, dry and wet sclerophyll forest (Ehmann 1997). Associated with semi-permanent to ephemeral sand or rock based streams (Ehmann 1997), where the soil is soft and sandy so that burrows can be constructed (Environment Australia 2000).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Litoria aurea</i>	Green and Golden Bell Frog	E	V	This species has been observed utilising a variety of natural and man-made water bodies (Pyke & White 1996) such as coastal swamps, marshes, dune swales, lagoons, lakes, other estuary wetlands, riverine floodplain wetlands and billabongs, stormwater detention basins, farm dams, bunded areas, drains, ditches and any other structure capable of storing water (DECC 2007). Fast flowing streams are not utilised for breeding purposes by this species (Mahony 1999). Preferable habitat for this species includes attributes such as shallow, still or slow flowing, permanent and/or widely fluctuating water bodies that are unpolluted and without heavy shading (DECC 2007). Large permanent swamps and ponds exhibiting well-established fringing vegetation (especially bulrushes— <i>Typha</i> sp. and spikerushes— <i>Eleocharis</i> sp.) adjacent to open grassland areas for foraging are preferable (Ehmann 1997; Robinson 1993). Ponds that are typically inhabited tend to be free from predatory fish such as Mosquito Fish (<i>Gambusia holbrooki</i>) (DECC 2007).	No
<i>Litoria littlejohni</i>	Heath Frog	V	V	Distribution of this species has significantly reduced due to loss of habitat from forestry and urban development. Current distribution is limited Qld Islands including; Fraser Is, Moreton Is, Bribie Is, North Stradbroke Is and coastal north-east NSW but may extend to Jervis Bay in southern NSW. Habitats include water bodies in sandstone environments such as; sedge swamps, drainage lines and lakes (Meyer et al 2006). Eggs are laid in shallow water following Spring/Summer breeding (Meyer et al. 2006)	No
<i>Litoria raniformis</i>	Southern Bell Frog	E	V	Relatively still or slow-flowing sites such as billabongs, ponds, lakes or farm dams, especially where bulrushes (<i>Typha</i> sp., <i>Eleocharis</i> sp. and <i>Phragmites</i> sp.) are present (DECC 2007; Ehmann 1997). This species is common in lignum shrublands, black box and River Red Gum woodlands, irrigation channels and at the periphery of rivers in the southern parts of NSW (DECC 2007). This species occurs in vegetation types such as open grassland, open forest and ephemeral and permanent non-saline marshes and swamps (DECC 2007). Open grassland and ephemeral permanent non-saline marshes and swamps have also been associated with this species (Ehmann 1997).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Mixophyes balbus</i>	Stuttering Frog	E	V	A variety of forest habitats from rainforest through wet and moist sclerophyll forest to riparian habitat in dry sclerophyll forest (DECC 2007) that are generally characterised by deep leaf litter or thick cover from understory vegetation (Ehmann 1997). Breeding habitats are streams and occasionally springs. Not known from streams disturbed by humans (Ehmann 1997) or still water environments (NSW Scientific Committee 2002).	No
<i>Pseudophryne australis</i>	Red-crowned Toadlet	V	-	Red-crowned Toadlets are found in steep escarpment areas and plateaus, as well as low undulating ranges with benched outcroppings on Triassic sandstones of the Sydney Basin (DECC 2007). Within these geological formations, this species mainly occupies the upper parts of ridges, usually being restricted to within about 100 m of the ridge top. However they may also occur on plateaus or more level rock platforms along the ridge top (DECC 2007). Associated with open forest to coastal heath (Ehmann 1997). Utilises small ephemeral drainage lines which feed water from the top of the ridge to the perennial creeks below for breeding, and are not usually found in the vicinity of permanent water (Ehmann 1997). Breeding sites are often characterised by clay-derived soils and generally found below the first sandstone escarpment in the talus slope (NPWS 1997).	No

REPTILES

<i>Hoplocephalus bungaroides</i>	Broad-headed Snake	E	V	Typical sites consist of exposed sandstone outcrops and benching where the vegetation is predominantly woodland, open woodland and/or heath on Triassic sandstone of the Sydney Basin (DECC 2007). They utilise rock crevices and exfoliating sheets of weathered sandstone during the cooler months and tree hollows during summer (Webb & Shine 1998). Some of the canopy tree species found to regularly co-occur at known sites include <i>Corymbia eximia</i> , <i>C. gummifera</i> , <i>Eucalyptus sieberi</i> , <i>E. punctata</i> and <i>E. piperita</i> (DECC 2007).	No
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INVERTEBRATES

<i>Meridolum corneovirens</i>	Cumberland Plain Land Snail	E		This species occurs on Cumberland Plain where it forages on fungus growing on the roots of eucalypts within Cumberland Plain Woodland, typically <i>Eucalyptus tereticornis</i> (Forest Red Gum).	No
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Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
DIURNAL BIRDS					
<i>Anthochaera phrygia</i> (aka <i>Xanthomyza phrygia</i>)	Regent Honeyeater	E	E & M	Associated with temperate eucalypt woodland and open forest including forest edges, wooded farmland and urban areas with mature eucalypts, and riparian forests of River Oak (<i>Casuarina cunninghamiana</i>) (Garnett 1993). Areas containing Swamp Mahogany (<i>Eucalyptus robusta</i>) in coastal areas have been observed to be utilised (NPWS 1997). The Regent Honeyeater primarily feeds on nectar from box and ironbark eucalypts and occasionally from banksias and mistletoes (NPWS 1995). As such it is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar (Environment Australia 2000).	Unlikely
<i>Botaurus poiciloptilus</i>	Australasian Bittern	V	-	Terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats (Marchant & Higgins 1993). Reedbeds, swamps, streams, estuaries (Simpson & Day 1999).	Unlikely
<i>Dasyornis brachypterus</i>	Eastern Bristlebird	E	E	Habitat is characterised by dense, low vegetation including heath and open woodland with a heathy understorey; in northern NSW occurs in open forest with tussocky grass understorey; all of these vegetation types are fire prone. Age of habitat since fires (fire-age) is of paramount importance to this species; Illawarra and southern populations reach maximum densities in habitat that has not been burnt for at least 15 years; however, in the northern NSW population a lack of fire in grassy forest may be detrimental as grassy tussock nesting habitat becomes unsuitable after long periods without fire; northern NSW birds are usually found in habitats burnt five to 10 years previously.	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Epthianura albifrons</i>	White-fronted Chat	V		Regularly observed in the saltmarsh of Newington Nature Reserve (with occasional sightings from other parts of Sydney Olympic Park and in grassland on the northern bank of the Parramatta River). Current estimates suggest this population consists of 8 individuals. Regularly observed in the saltmarsh and on the sandy shoreline of a small island of Towra Point Nature Reserve. This population is estimated to comprise 19-50 individuals. Have been observed breeding from late July through to early March, with 'open-cup' nests built in low vegetation. Nests in the Sydney region have also been seen in low isolated mangroves. Gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground (DECC 2005).	No
<i>Hieraaetus morphnoides</i>	Little Eagle	V	-	Occupies open eucalypt forest, woodland or open woodland, nests in tall living trees within a remnant patch. Preys mostly on rabbits and medium-sized birds (OEH 2014b).	Unlikely
<i>Lathamus discolor</i>	Swift Parrot	E	E	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts (Blakers et al. 1984; Schodde and Tidemann 1986; Forshaw and Cooper 1981). Hence, in this region, autumn and winter flowering eucalypts are important for this species. Favoured feed trees include winter flowering species such as Swamp Mahogany (<i>Eucalyptus robusta</i>), Spotted Gum (<i>Corymbia maculata</i>), Red Bloodwood (<i>C. gummifera</i>), Mugga Ironbark (<i>E. sideroxylon</i>), and White Box (<i>E. albens</i>) (DECC 2007).	Unlikely
<i>Petroica boodang</i>	Scarlet Robin	V		The Scarlet Robin is found in south-eastern and south-western Australia, as well as on Norfolk Island. In Australia, it is found south of latitude 25°S, from south-eastern Queensland along the coast of New South Wales (and inland to western slopes of Great Dividing Range) to Victoria and Tasmania, and west to Eyre Peninsula, South Australia; it is also found in south-west Western Australia. The Scarlet Robin lives in open forests and woodlands in Australia, while it prefers rainforest habitats on Norfolk Island. During winter, it will visit more open habitats such as grasslands and will be seen in farmland and urban parks and gardens at this time (BIB, 2006).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Polytelis swainsonii</i>	Superb Parrot	V	V	The Superb Parrot is found throughout eastern inland NSW. On the South-western Slopes their core breeding area is roughly bounded by Cowra and Yass in the east, and Grenfell, Cootamundra and Coolac in the west. Birds breeding in this region are mainly absent during winter, when they migrate north to the region of the upper Namoi and Gwydir Rivers. The other main breeding sites are in the Riverina along the corridors of the Murray, Edward and Murrumbidgee Rivers where birds are present all year round. Mainly inhabits forests and woodlands dominated by eucalypts, especially River Red Gums (<i>Eucalyptus camaldulensis</i>) and box eucalypts such as Yellow Box (<i>Eucalyptus melliodora</i>) or Grey Box (<i>E. microcarpa</i>). The species also seasonally occurs in box-pine (<i>Callitris</i> sp.) and Boree (<i>Acacia pendula</i>) woodlands (Webster 1988, 1998). They forage at or near the ground. Nest in hollows.	No
<i>Rostratula australis</i>	Australian Painted Snipe	E	E	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (DECC 2007). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (<i>ibid.</i>). Breeding is often in response to local conditions; generally occurs from September to December (DECC 2007). Roosts during the day in dense vegetation (NSW Scientific Committee 2004). Forages nocturnally on mud-flats and in shallow water (DECC 2007). Feeds on worms, molluscs, insects and some plant-matter (<i>ibid.</i>).	No
<i>Sternula nereis nereis</i>	Fairy Tern	-	V	The Fairy Tern (Australian) nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation. The subspecies has been found in embayments of a variety of habitats including offshore, estuarine or lacustrine (lake) islands, wetlands and mainland coastline (Higgins & Davies 1996). The bird roosts on beaches at night (DSEWPAC 2012).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
NOCTURNAL BIRDS					
<i>Ninox connivens</i>	Barking Owl	V	-	Associated with a variety of habitats such as savanna woodland, open eucalypt forests, wetland and riverine forest. The habitat is typically dominated by Eucalypts (often Redgum species), however often dominated by Melaleuca species in the tropics (DECC 2007). It usually roosts in dense foliage in large trees such as River She-oak (<i>Allocasuarina cunninghamiana</i>), other Casuarina and Allocasuarina, eucalypts, Angophora, Acacia and rainforest species from streamside gallery forests (NPWS 2003). It usually nests near watercourses or wetlands (NPWS 2003) in large tree hollows with entrances averaging 2-29 metres above ground, depending on the forest or woodland structure and the canopy height (Debus 1997).	No
<i>Ninox strenua</i>	Powerful Owl	V	-	Powerful Owls are associated with a wide range of wet and dry forest types with a high density of prey, such as arboreal mammals, large birds and flying foxes (Environment Australia 2000, Debus & Chafer 1994). Large trees with hollows at least 0.5 m deep are required for shelter and breeding (Environment Australia 2000).	Potential
MAMMALS (EXCLUDING BATS)					
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	-	The Spotted-tailed Quoll inhabits a range of forest communities including wet and dry sclerophyll forests, coastal heathlands and rainforests (Mansergh 1984; DECC 2007j), more frequently recorded near the ecotones of closed and open forest. This species requires habitat features such as maternal den sites, an abundance of food (birds and small mammals) and large areas of relatively intact vegetation to forage in (DECC 2007). Maternal den sites are logs with cryptic entrances; rock outcrops; windrows; burrows (Environment Australia 2000).	No
<i>Dasyurus maculatus maculatus</i>	Spotted-tailed Quoll (SE Mainland Population)	-	E		
<i>Isodon obesulus obesulus</i>	Southern Brown Bandicoot	E	E	This species is associated with heath, coastal scrub, heathy forests (Menkhorst & Knight 2004), shrubland and woodland on well drained soils. This species is thought to display a preference for newly regenerating heathland and other areas prone to fire (Menkhorst & Seebeck 1990).	No
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E	V	Rocky areas in a variety of habitats, typically north facing sites with numerous ledges, caves and crevices (Strahan 1995).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Phascolarctos cinereus</i>	Koala	V	V	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70% (Reed et al. 1990), with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis	No
<i>Pseudomys novaehollandiae</i>	New Holland Mouse	-	V	A small burrowing native rodent with a fragmented distribution across Tasmania, Victoria, New South Wales and Queensland. Inhabits open heathlands, open woodlands with a heathland understory and vegetated sand dunes. A social animal, living predominantly in burrows shared with other individuals. The home range of the New Holland Mouse ranges from 0.44 ha to 1.4 ha and the species peaks in abundance during early to mid stages of vegetation succession typically induced by fire (DSEWPC 2010)	No

MAMMALS (BATS)

<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	The Large-eared Pied Bat has been recorded in a variety of habitats, including dry sclerophyll forests, woodland, sub-alpine woodland, edges of rainforests and wet sclerophyll forests (Churchill 1998; DECC 2007). This species roosts in caves, rock overhangs and disused mine shafts and as such is usually associated with rock outcrops and cliff faces (Churchill 1998; DECC 2007).	Unlikely
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V	-	Prefers moist habitats with trees taller than 20m (DECC 2007). Roosts in tree hollows but has also been found roosting in buildings or under loose bark (DECC 2007).	Unlikely
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bent-wing Bat	V	-	Associated with a range of habitats such as rainforest, wet and dry sclerophyll forest, monsoon forest, open woodland, paperbark forests and open grassland (Churchill 1998). It forages above and below the tree canopy on small insects (AMBS 1995, Dwyer 1995, Dwyer 1981). Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter (Environment Australia 2000, Dwyer 1995).	Yes

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Mormopterus norfolkensis</i>	Eastern Freetail Bat	V	-	Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range (Churchill 1998). Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges (Environment Australia 2000; Allison & Hoye 1998). Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut (Environment Australia 2000; Allison & Hoye 1998).	Yes
<i>Myotis macropus</i>	Southern Myotis	V	-	Will occupy most habitat types such as mangroves, paperbark swamps, riverine monsoon forest, rainforest, wet and dry sclerophyll forest, open woodland and River Red Gum woodland, as long as they are close to water (Churchill 1998). While roosting is most commonly associated with caves, this species has been observed to roost in tree hollows, amongst vegetation, in clumps of Pandanus, under bridges, in mines, tunnels and stormwater drains (Churchill 1998). However the species apparently has specific roost requirements, and only a small percentage of available caves, mines, tunnels and culverts are used (Richards 1998).	Potential
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox	V	V	Inhabits a wide range of habitats including rainforest, mangroves, paperbark forests, wet and dry sclerophyll forests and cultivated areas (Churchill 1998, Eby 1998). Camps are often located in gullies, typically close to water, in vegetation with a dense canopy (Churchill 1998).	Yes
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V	-	Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range (Churchill, 1998), tending to be more frequently located in more productive forests (Hoye & Richards 1998). Within denser vegetation types use is made of natural and man made openings such as roads, creeks and small rivers, where it hawks backwards and forwards for prey (Hoye & Richards 1998).	Potential
MIGRATORY MARINE BIRD SPECIES LISTED UNDER EPBC ACT					
<i>Apus pacificus</i>	Fork-tailed Swift	-	M	Sometimes travels with Needletails. Varied habitat with a possible tendency to more arid areas but also over coasts and urban areas (Simpson & Day 1999).	Unlikely
MIGRATORY TERRESTRIAL SPECIES LISTED UNDER EPBC ACT					

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	-	M	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas (Marchant & Higgins 1993, Simpson & Day 1999). Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers. Breeding habitat is usually in or close to water, but may occur up to a kilometer away (Marchant & Higgins 1993).	Unlikely
<i>Hirundapus caudacutus</i>	White-throated Needletail	-	M	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas (Marchant & Higgins 1993; Simpson & Day 1999). Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather (Marchant & Higgins 1993).	Unlikely
<i>Merops ornatus</i>	Rainbow Bee-eater	-	M	Resident in coastal and sub-coastal northern Australia; regular breeding migrant in southern Australia, arriving September to October, departing February to March, some occasionally present April to May. Occurs in open country, chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, road-cuttings, sand-pits, occasionally coastal cliffs (<i>ibid</i>). Nest is a chamber at the end of a burrow, up to 1.6 m long, tunnelled in flat or sloping ground, sandy bank or cutting (<i>ibid</i>).	Unlikely
<i>Monarcha melanopsis</i>	Black-faced Monarch	-	M	Rainforest and eucalypt forests, feeding in tangled understory (Blakers et al. 1984).	Unlikely
<i>Monarcha trivirgatus</i>	Spectacled Monarch	-	M	Wet forests, mangroves (Simpson and Day 1999).	No
<i>Myiagra cyanoleuca</i>	Satin Flycatcher	-	M	Wetter, denser forest, often at high elevations (Simpson & Day 2004).	Unlikely
<i>Rhipidura rufifrons</i>	Rufous Fantail	-	M	The Rufous Fantail is a summer breeding migrant to southeastern Australia (Morcombe, 2004). The Rufous Fantail is found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation (Morcombe, 2004). Open country may be used by the Rufous Fantail during migration (Morcombe, 2004).	Unlikely
<i>Xanthomyza phrygia</i>	Regent Honeyeater	E	E, M	SEE DIURNAL BIRDS ABOVE	Unlikely

MIGRATORY WETLAND SPECIES LISTED UNDER EPBC ACT

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Ardea alba</i>	Great Egret	-	M	The Great Egret is common and widespread in Australia (McKilligan, 2005). The Eastern Great Egret has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). These include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs (Kushlan & Hancock 2005; Marchant & Higgins 1993; Martínez-Vilalta & Motis 1992). The species usually frequents shallow waters. It forages in a wide range of wet and dry habitats including permanent and ephemeral freshwaters, wet pasture and estuarine mangroves and mudflats (McKilligan, 2005).	No
<i>Ardea ibis</i>	Cattle Egret	-	M	Cattle Egrets forage on pasture, marsh, grassy road verges, rain puddles and croplands, but not usually in the open water of streams or lakes and they avoid marine environments (McKilligan, 2005). Some individuals stay close to the natal heronry from one nesting season to the next, but the majority leave the district in autumn and return the next spring. Cattle Egrets are likely to spend the winter dispersed along the coastal plain and only a small number have been recovered west of the Great Dividing Range (McKilligan, 2005).	Unlikely
<i>Arenaria interpres</i>	Ruddy Turnstone	-	M	Frequents beaches along the coast of NSW (DNR 2000). Flies from Siberia or Alaska to Australia in August - September each year (<i>ibid</i>).	No
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	-	M	It prefers the grassy edges of shallow inland freshwater wetlands. It is also found around sewerage treatment ponds, flooded grasslands, mudflats, mangroves, rocky shores and beaches.	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Calidris canutus</i>	Red Knot	-	M	The Red Knot is similar in shape and proportions to Great Knot (<i>Calidris tenuirostris</i>), but smaller and less bulky, with shorter bill, and the breeding plumage differs markedly. The Red Knot is common in all the main suitable habitats around the coast of Australia (Barrett et al. 2002; Watkins 1993), but is less numerous in south-west Australia than elsewhere (Lane 1987). It is not found in significant numbers along much of the NSW coast, where wader habitat is rather scarce (excluding the Hunter Estuary). In Australasia the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs. They are occasionally seen on terrestrial saline wetlands near the coast, such as lakes, lagoons, pools and pans, and recorded on sewage ponds and saltworks, but rarely use freshwater swamps. They rarely use inland lakes or swamps (Higgins & Davies 1996).	No
<i>Calidris ferruginea</i>	Curlew Sandpiper	E	M	Intertidal mudflats of estuaries, lagoons, mangrove channels; around lakes, dams, floodwaters, flooded saltbush surrounds of inland lakes (Morcombe, 2004).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Calidris ruficollis</i>	Red-necked Stint	-	M	The Red-necked Stint is distributed along most of the Australian coastline with large densities on the Victorian and Tasmanian coasts. The Red-necked Stint has been recorded in all coastal regions, and found inland in all states when conditions are suitable. In Australasia, the Red-necked Stint is 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. Occasionally they have been recorded on exposed or ocean beaches, and sometimes on stony or rocky shores, reefs or shoals. They also occur in saltworks and sewage farms; saltmarsh; ephemeral or permanent shallow wetlands near the coast or inland, including lagoons, lakes, swamps, riverbanks, waterholes, bore drains, dams, soaks and pools in saltflats. They sometimes use flooded paddocks or damp grasslands. (Higgins & Davies 1996). The Red-necked Stint mostly forages on bare wet mud on intertidal mudflats or sandflats, or in very shallow water; mostly in areas with a film of surface water and mostly close to edge of water. During high tides they sometimes forage in non-tidal wetlands. Red-necked Stints may also forage in Samphire, generally avoid beds of seagrass, but may feed along edges.	No
<i>Calidris tenuirostris</i>	Great Knot	V	M	Sheltered coastal habitats containing large intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons (DECC 2007). Often recorded on sandy beaches with mudflats nearby, sandy spits and inlets, or exposed reefs or rock platforms (Morris 1989; Higgins & Davies 1996).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Charadrius bicinctus</i>	Double-banded Plover	-	M	The Double-banded Plover can be found in both coastal and inland areas. During the non-breeding season, it is common in eastern and southern Australia, mainly between the Tropic of Capricorn and western Eyre Peninsula, with occasional records in northern Queensland and Western Australia (Marchant & Higgins 1993). The Double-banded Plover is found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on 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. The species is sometimes associated with coastal lagoons, inland saltlakes and saltworks. It is also found on seagrass beds, especially <i>Zostera</i> , which, when exposed at low tide, remain heavily saturated or have numerous water-filled depressions. Usually the Double-banded Plover spends winter on estuaries and other coastal habitats such as lagoons, saltmarsh, beaches and pasture.	No
<i>Charadrius leschenaultii</i>	Greater Sand Plover	V	M	Entirely coastal in NSW, foraging on intertidal sand and mudflats in estuaries, roosting during high tide on sandy beaches or rocky shores (DECC 2007)	No
<i>Charadrius mongolus</i>	Lesser Sand Plover	V	M	Favours coastal areas including beaches, mudflats and mangroves where they forage (DECC 2007). They may be seen roosting during high tide on sandy beaches or rocky shores (DECC 2007). The species feeds mostly on extensive, freshly-exposed areas of intertidal sandflats and mudflats in estuaries or beaches, or in shallow ponds in saltworks (Evans 1975; Hindwood & Hoskin 1954; Johnstone & Storr 1998; McGill & Keast 1945). They also occasionally forage on coral reefs and on sandy or muddy river margins (Booth 1982; Evans 1975; McGill & Keast 1945; Pegler 1983). At inland sites, they have been recorded foraging in muddy areas around lakes, soaks and bores (Badman & May 1983; Henle 1989; McGill & Keast 1945).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Gallinago hardwickii</i>	Latham's Snipe	-	M	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover (Marchant and Higgins 1993). Occupies a variety of vegetation around wetlands (Marchant and Higgins 1993) including wetland grasses and open wooded swamps (Simpson and Day 1999). Latham's Snipe sometimes occur in habitats that have saline or brackish water, such as saltmarsh, mangrove creeks, around bays and beaches, and at tidal rivers (Frith et al. 1977; Naarding 1983; Patterson 1991). These habitats are most commonly used when the birds are on migration (Frith et al. 1977). They are regularly recorded in or around modified or artificial habitats including pasture, ploughed paddocks, irrigation channels and drainage ditches, ricefields, orchards, saltworks, and sewage and dairy farms (Fielding 1979; Frith et al. 1977; Lane & Jessop 1985; Naarding 1982, 1983). They can also occur in various sites close to humans or human activity (e.g. near roads, railways, airfields, commercial or industrial complexes) (Frith et al. 1977; Naarding 1983).	No
<i>Heteroscelus brevipes</i>	Grey-tailed Tattler	-	M	The Grey-tailed Tattler is distributed along most of the coast from the Queensland border, south to Tilba Lake. It is more heavily distributed along coastal regions north of Sydney. The species is rarely recorded in Victoria, however sightings have been reported in Gippsland, and east of McLaughlans Beach. The Grey-tailed Tattler is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide. It has been found around shores of rock, shingle, gravel or shells and also on intertidal mudflats in embayments, estuaries and coastal lagoons, especially fringed with mangroves.	No
<i>Limosa lapponica</i>	Bar-tailed Godwit	-	M	Mainly coastal, usually sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats. Breeds in Northern Russia, Scandinavia, NW Alaska (DEH 2005).	No
<i>Limosa limosa</i>	Black-tailed Godwit	-	M	Mainly coastal, usually sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats (DEH 2005). Often found inland in small numbers (ibid). Breeds in Iceland, Nth Atlantic, Europe, Russian and China (<i>ibid</i>).	No

Scientific Name	Common Name	TSC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence
<i>Numenius madagascariensis</i>	Eastern Curlew	-	M	Intertidal coastal mudflats, coastal lagoons, sandy spits (DEH 2005). Breeds in Russia, NE China (<i>ibid</i>).	No
<i>Numenius minutus</i>	Little Curlew	-	M	The smallest of the curlews, the Little Curlew is known to breed in Siberia, with migrants arriving after early April. Southern migration begins in September following the Chinese coast and, after a staging in Mongolia, continues to Northern Australia and New Guinea. Outside of the breeding season, the species inhabits grasslands, open plains, parklands and mud-flats of Northern Australia (Simpson and Day 1999).	No
<i>Numenius phaeopus</i>	Whimbrel	-	M	Intertidal coastal mudflats, river deltas and mangroves, occasionally sandy beaches (DEH 2005). Breeds Siberia and Alaska (<i>ibid</i>).	No
<i>Pluvialis fulva</i>	Pacific Golden Plover	-	M	Breeds North Siberia, Alaska (DEH 2005). Mainly coastal, beaches, mudflats and sandflats and other open areas such as recreational playing fields in Australia (<i>ibid</i>).	No
<i>Rostratula australis</i> (<i>a.k.a. R. benghalensis</i>)	Painted Snipe (Australian subspecies)	E	V	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber (DECC 2007). Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (<i>ibid</i>). Breeding is often in response to local conditions; generally occurs from September to December (DECC 2007). Roosts during the day in dense vegetation (NSW Scientific Committee 2004). Forages nocturnally on mud-flats and in shallow water (DECC 2007). Feeds on worms, molluscs, insects and some plant-matter (<i>ibid</i>).	No
<i>Tringa stagnatilis</i>	Marsh Sandpiper	-	M	Coastal - Permanent or ephemeral wetlands of varying degrees of salinity, commonly inland (DEH 2005). Breeds Eastern Europe to Eastern Siberia (<i>ibid</i>). The Marsh Sandpiper lives in 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. They are recorded less often at reservoirs, waterholes, soaks, bore-drain swamps and flooded inland lakes. The Marsh Sandpiper usually forages in shallow water at the edge of wetlands. They probe wet mud of mudflats or feed among marshy vegetation (Higgins & Davies 1996).	No

CE = Critically Endangered; E = Endangered; E2 = Endangered Population; V = Vulnerable; M = Migratory.

Appendix C – Assessment of Significance

The Assessment of Significance (7-part test) is applied to species, populations and ecological communities listed on Schedules 1, 1A and 2 of the TSC Act and Schedules 4, 4A and 5 of the Fisheries Management Act. The assessment sets out 7 factors, which when considered, allow proponents to undertake a qualitative analysis of the likely impacts of an action and to determine whether further assessment is required via a Species Impact Statement (SIS). All factors must be considered and an overall conclusion made based on all factors in combination. An SIS is required if, through application of the 7-part test, an action is considered likely to have a significant impact on a threatened species, population or ecological community.

Based on the results of Appendix B, the Assessment of Significance has been applied to:

- River-flat Eucalypt Forest (RFEF)
- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat)
- *Mormopterus norfolkensis* (East-coast Freetail Bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)
- *Myotis macropus* (Southern Myotis)
- *Ninox strenua* (Powerful Owl)

The impact assessment is limited, to some extent, to general broad planning objectives, without some specific details regarding clearing extent and locations. An indicative plan for the study area is presented in **Figure 4**, but more detail regarding impacts will become apparent at the masterplanning stage.

River-flat Eucalypt Forest

- a) **in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Not applicable

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

Not applicable

- c) **in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- i. **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
 - ii. **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

The proposal will create residential, employment and recreational precincts within the study area. As part of the proposal, management plans will be prepared to protect and enhance the site's ecological

values. RFEF occurs as a discontinuous band along the Parramatta River. The proposal should not result in the removal of this vegetation, but rather, create a plan to protect, restore and extend the vegetation community along the Parramatta River.

The proposal presents an opportunity to secure the local population rather than threaten it with extinction.

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

i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and

The proposal would not remove vegetation of this community, but through better management of the site, increase the extent of the community in the study area.

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

The proposal will not further fragment the community.

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

The proposal will not remove habitat.

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

No critical habitat has been identified by the Director-General of the National Parks & Wildlife Service on the Register of Critical Habitat.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

RFEF is considered in the Cumberland Plain Recovery Plan. The site is outside of the priority conservation lands. The proposal is consistent with this plan.

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

Threatening processes active in the study area relevant to the proposal are:

- Invasion and establishment of exotic vines and scramblers.
- Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata*.
- Invasion, establishment and spread of *Lantana camara*.
- Invasion of native plant communities by exotic perennial grasses.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Removal of dead wood and dead trees.

The proposal will not exacerbate any of these KTPs, instead it presents an opportunity to reduce their impact.

Conclusion

The proposal will not result in a significant adverse impact to RFEF. The proposal presents an opportunity to enhance and restore the community in the study area.

Grey-headed Flying-fox

- b) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

GHFF occurs in the study area. A population of GHFF has established a camp within the study area along the Parramatta River comprising between 10-20,000 individuals. The camp will be retained in situ.

The greatest risk to the life cycle of the species will be during the breeding season. As described in the PNUR ecological management plan:

- Construction of the shared path will be scheduled outside the GHFF breeding season (i.e. when the ratio of lactating or late-pregnancy females and/or dependent young is greater than 5% of the population in the camp).
- A suitably experienced ecologist will monitor the health of the GHFF during the breeding season when new buildings are being constructed in F6, F7 and F8 (see **Figure 4**). If GHFF become too stressed they can abort young. The ecologist would have authority to stop noisy construction work if the GHFF are stressed. The work would be allowed to resume at night when the camp is empty or when the ecologist determines that the GHFF are no longer stressed and at risk.

In this way, the viability of the local population will be sustained, and will not threaten the local population with extinction.

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

Not applicable.

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

- i. **is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- ii. **is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**
- iii. Not applicable.

- d) in relation to the habitat of a threatened species, population or ecological community:**

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

The proposal would not remove vegetation that forms part of the GHFF camp. There is potential that foraging habitat (in the form of figs and planted eucalypts) may be lost during construction. At this stage it is not known to what extent this habitat would be removed.

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

The proposal will not further fragment habitat for the species.

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

The proposal will not remove habitat that forms part of the GHFF camp.

- e) **whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),**

No critical habitat for these species has been identified by the Director-General of the National Parks & Wildlife Service on the Register of Critical Habitat under the TSC Act.

- f) **whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,**

A Draft National Recovery Plan (DECCW 2008) for the species has been developed. The proposed action is consistent with the objectives of the plan regarding the protection of key roosting habitat and in-situ management of the species. All reasonable efforts will be taken to minimise the loss of foraging habitat for the species within the local area as a result of the proposed works through the retention of fig trees and flowering eucalypts. The recommended 300 m buffer to the camp is not considered realistic given that the camp is positioned in an existing urban environment near Parramatta CBD.

- g) **whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

Threatening processes active in the study area relevant to the proposal are:

- Invasion and establishment of exotic vines and scramblers.
- Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata*.
- Invasion, establishment and spread of *Lantana camara*.
- Invasion of native plant communities by exotic perennial grasses.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Removal of dead wood and dead trees.

The proposal will not exacerbate any of these KTPs, instead it presents an opportunity to reduce their impact.

Conclusion

The proposal is unlikely to result in a significant adverse impact to GHFF if the development is conducted in accordance with the ecological management plan.

Eastern Bentwing Bat

- c) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Eastern Bentwing Bat was detected on site using Anabat detectors. The species typically roosts in caves, culverts and other man-made structures. The species is highly mobile and moves widely throughout the state. In a 12 month study by ELA in another part of the Sydney Basin, the population peaked in autumn before dispersing to breeding sites outside the Sydney Basin.

The proposal may remove some potential habitat but it is unlikely to place a local population at risk of extinction.

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

Not applicable.

- c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
 - ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

- d) in relation to the habitat of a threatened species, population or ecological community:**
- i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**

The proposal would not remove remnant native vegetation from the site. There is potential that foraging habitat and temporary roosts (culverts) may be removed during construction. At this stage it is not known to what extent this habitat would be removed.

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

The proposal will not further fragment habitat for the species.

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

The proposal will not remove important habitat.

- e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),**

No critical habitat for these species has been identified by the Director-General of the National Parks & Wildlife Service on the Register of Critical Habitat.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan has not been prepared for Eastern Bentwing Bat.

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

Threatening processes active in the study area relevant to the proposal are:

- Invasion and establishment of exotic vines and scramblers.
- Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata*.
- Invasion, establishment and spread of *Lantana camara*.
- Invasion of native plant communities by exotic perennial grasses.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Removal of dead wood and dead trees.

The proposal will not exacerbate any of these KTPs, instead it presents an opportunity to reduce their impact.

Conclusion

The proposal is unlikely to result in a significant adverse impact to Eastern Bentwing Bat.

East-coast Freetail Bat

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

East-coast Freetail Bat was detected on site using Anabat detectors. The species typically roosts in tree hollows and sometimes man-made structures. The majority of hollow bearing trees grow within remnant RFEF. The proposal will retain this vegetation community type, therefore, loss of this habitat is unlikely such that the local population will be placed at risk of extinction.

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

Not applicable.

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

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

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

Not applicable.

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

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

The proposal would not remove remnant native vegetation in the study area. One hollow bearing trees is a non-native tree may be removed as part of the proposal.

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

The proposal will not further fragment habitat for the species.

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

The proposal may remove one non-native hollow bearing tree.

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

No critical habitat for these species has been identified by the Director-General of the National Parks & Wildlife Service on the Register of Critical Habitat.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan has not been prepared for East-coast Freetail Bat.

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

Threatening processes active in the study area relevant to the proposal are:

- Invasion and establishment of exotic vines and scramblers.
- Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata*.
- Invasion, establishment and spread of *Lantana camara*.
- Invasion of native plant communities by exotic perennial grasses.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Removal of dead wood and dead trees.

The proposal will not exacerbate any of these KTPs, instead it presents an opportunity to reduce their impact.

Conclusion

The proposal will not result in a significant adverse impact to East-coast Freetail Bat. The proposal presents an opportunity to enhance and restore habitat for the species in the study area

Southern Myotis

- e) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

The Southern Myotis resides near creeks and streams. It roosts in hollows and man-made structures, such as bridges, often overhanging or near water. The proposal will not remove hollows with remnant native vegetation, but may remove one hollow within a non-native species. The species was not identified on Anabat detectors, but may occur in the area.

The proposal is not likely to place a local viable population at risk of extinction.

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

Not applicable.

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

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

Not applicable.

- d) in relation to the habitat of a threatened species, population or ecological community:**

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

The proposal would not remove remnant native vegetation in the study area. One hollow bearing trees is a non-native tree may be removed as part of the proposal.

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

The proposal will not further fragment habitat for this species.

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

The proposal may remove one non-native hollow bearing tree.

- e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),**

No critical habitat for these species has been identified by the Director-General of the National Parks & Wildlife Service on the Register of Critical Habitat.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan has not been prepared for Southern Myotis.

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

Threatening processes active in the study area relevant to the proposal are:

- Invasion and establishment of exotic vines and scramblers.
- Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata*.
- Invasion, establishment and spread of *Lantana camara*.
- Invasion of native plant communities by exotic perennial grasses.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Removal of dead wood and dead trees.

The proposal will not exacerbate any of these KTPs, instead, it presents an opportunity to reduce their impact.

Conclusion

The proposal will not result in a significant adverse impact to Southern Myotis. The proposal presents an opportunity to enhance and restore habitat for the species in the study area.

Greater Broad-nosed Bat

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

Greater Broad-nosed Bat was not recorded in the study area, however, there is potential that the species occurs. Greater Broad-nosed Bat roost in tree hollows and man-made structures. The proposal will not remove hollows with remnant native vegetation, but may remove one hollow within a non-native species.

The proposal is not likely to place a local viable population at risk of extinction.

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

Not applicable

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

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

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

Not applicable.

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

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

The proposal would not remove remnant native vegetation in the study area. One hollow bearing trees is a non-native tree may be removed as part of the proposal.

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

The proposal will not further fragment habitat for this species.

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

The proposal may remove one non-native hollow bearing tree.

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

No critical habitat for these species has been identified by the Director-General of the National Parks & Wildlife Service on the Register of Critical Habitat.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan has not been prepared for Greater Broad-nosed Bat.

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

Threatening processes active in the study area relevant to the proposal are:

- Invasion and establishment of exotic vines and scramblers.
- Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata*.
- Invasion, establishment and spread of *Lantana camara*.
- Invasion of native plant communities by exotic perennial grasses.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Removal of dead wood and dead trees.

While the proposal will not exacerbate any of these KTPs, it presents an opportunity to reduce their impact.

Conclusion

The proposal will not result in a significant adverse impact to Greater Broad-nosed Bat. The proposal presents an opportunity to enhance and restore habitat for the species in the study area.

Powerful Owl

- g) in the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.**

Powerful Owl is a wide ranging species, relatively common in the Sydney Basin, particularly in the northern and southern suburbs. Powerful Owl will often roost in dense vegetation along creeklines, and have a varied diet comprising possums, large birds and flying-foxes. They nest in very large trees with large hollows; no such trees or hollows were observed on site.

The proposal will not remove potential roost habitat for the species, but rather, is likely to enhance potential habitat for the species and its prey. The proposal is not likely to place a viable population at risk of extinction.

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

Not applicable

- c) in the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:**
- i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
 - ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.**

Not applicable.

- d) in relation to the habitat of a threatened species, population or ecological community:**
- i. the extent to which habitat is likely to be removed or modified as a result of the action proposed, and**

The proposal would not remove habitat for this species, but through better management of the site, increase the extent of potential habitat in the study area for the species and its prey.

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

The proposal will not further fragment habitat for this species.

- i. the importance of the habitat to be removed, modified, fragmented or isolated to the long term survival of the species, population or ecological community in the locality,**

The proposal will not remove important habitat for this species.

- e) whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly),**

No critical habitat for these species has been identified by the Director-General of the National Parks & Wildlife Service on the Register of Critical Habitat.

f) whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan,

A recovery plan for Large Forest Owls (DEC 2006) has been prepared, which includes Powerful Owl. The recovery plan includes an objective to consider the impact of planning proposals on Large Forest Owls, and minimise habitat loss and fragmentation. The intent to manage site ecological values and consider these values in the planning process is consistent with the recovery plan.

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

Threatening processes active in the study area relevant to the proposal are:

- Invasion and establishment of exotic vines and scramblers.
- Invasion of native plant communities by African Olive *Olea europaea* subsp. *cuspidata*.
- Invasion, establishment and spread of *Lantana camara*.
- Invasion of native plant communities by exotic perennial grasses.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Removal of dead wood and dead trees.

While the proposal will not exacerbate any of these KTPs, it presents an opportunity to reduce their impact.

Conclusion

The proposal will not result in a significant adverse impact to Powerful Owl. The proposal presents an opportunity to enhance and restore habitat for the species in the study area.

Appendix D – Significant impact criteria

The EPBC Act Policy Statement 1.1 Significant Impact Guidelines outline '**Significant Impact Criteria**' that are to be used to assist in determining whether a proposed action is likely to have a significant impact on matters of national environmental significance. Matters listed under the EPBC Act as being of national environmental significance include:

- Listed threatened species and ecological communities
- Listed migratory species
- Wetlands of International Importance
- The Commonwealth marine environment
- World Heritage properties
- National Heritage places
- Nuclear actions
- Great Barrier Reef Marine Park
- A water resource in relation to coal seam gas development and large coal mining development

Specific '**Significant Impact Criteria**' are provided for each matter of national environmental significance except for threatened species and ecological communities in which case separate criteria are provided for species listed as endangered and vulnerable under the EPBC Act.

The Significant Impact Criteria has been applied to one species; *Pteropus poliocephalus* (Grey-headed Flying-fox).

The impact assessment is limited, to some extent, to general broad planning objectives, without some specific details regarding clearing extent and locations. More detail regarding impacts will become apparent at the masterplanning stage.

An EPBC Act referral has been prepared for the PNUR rezoning.

Matters to be addressed	Impact (Commonwealth Legislation)
a. any environmental impact on a World Heritage Property;	A world heritage property is present on the western side of Parramatta River outside of the study area.
b. any environmental impact on Wetlands of International Importance;	The proposal will not affect any part of a Wetland of International Importance
c. any impact on Commonwealth Listed Critically Endangered or Endangered Species; d. any impact on Commonwealth Listed threatened Species;	<p>Grey-headed Flying-fox</p> <p>An action is likely to have a significant impact on an endangered species if there is a real chance or possibility that it will:</p> <p>Criterion 1: lead to a long-term decrease in the size of an important population of a species</p> <p>A GHFF camp occurs within the boundary of the study area along the Parramatta River, which is known to contain a breeding population of the species and has been recorded to contain between 10-20,000 individuals. The species is considered to comprise a single interbreeding population of the species across its range (DotE, 2014). The proposal will not directly impact on the camp, but it may have indirect impacts (e.g. associated with construction noise or increased use of the area near the camp).</p> <p>While some disturbance to the camp may occur, it is not considered likely to result in a long term decrease in the size of an important population following the application of appropriate mitigation and management measures. These include an increase in the available habitat area along the riparian corridor.</p> <p>Criterion 2: reduce the area of occupancy of an important population</p> <p>The proposed works will not reduce the area of occupancy of the camp. The proposal includes works to enhance and restore River-flat Eucalypt Forest along the Parramatta River which may increase the area of potential habitat in the long term. Any disturbance to the camp as a result of the construction works is considered likely to be temporary.</p> <p>Criterion 3: fragment an existing important population into two or more populations</p> <p>The proposed works will not fragment an existing important population into two or more populations.</p> <p>Criterion 4: adversely affect habitat critical to the survival of a species</p> <p>The habitat present within the study area is considered to be habitat critical to the survival of the species as it is a camp which has been continuously utilised and is a known breeding camp for the species. The GHFF habitat will not be directly affected by the proposal i.e. no vegetation will be removed.</p>

	<p>Criterion 5: disrupt the breeding cycle of an important population</p> <p>Management measures to prevent disruption of the breeding cycle of the population include:</p> <ul style="list-style-type: none"> • Construction of the shared path will be scheduled outside the GHFF breeding season (i.e. when the ratio of lactating or late-pregnancy females and/or dependent young is greater than 5% of the population in the camp). • A suitably experienced ecologist will monitor the health of the GHFF during the breeding season when new buildings are being constructed in F6, F7 and F8 (see Figure 4). If GHFF become too stressed they can abort young. The ecologist would have authority to stop noisy construction work if the GHFF are stressed. The work would be allowed to resume at night when the camp is empty or when the ecologist determines that the GHFF are no longer stressed and at risk. <p>Criterion 6: modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline</p> <p>The proposed works will not impact the GHFF camp, but it may remove trees in the surrounding area that provide a food resource. At this stage of the planning process, the extent of tree removal is not certain. However, it would seem unlikely that removing some food trees will cause the species to decline.</p> <p>Criterion 7: result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat</p> <p>Section 5.3 list KTPs that are threatening ecological values in the study area. The proposal will increase management efforts on ecological values which should reduce the potential for invasive species to threaten GHFF and the camp.</p> <p>Criterion 8: introduce disease that may cause the species to decline, or interfere substantially with the recovery of the species.</p> <p>The proposed works will not introduce disease that may cause the species to decline, or interfere substantially with the recovery of the species.</p> <p>Criterion 9: interfere with the recovery of the species.</p> <p>The proposed action will not interfere with the recovery of the species.</p>
e. any environmental impact on Commonwealth Listed Migratory Species;	No
f. any critically endangered and endangered ecological communities	No

g. does any part of the Proposal involve a Nuclear Action;	No
h. any environmental impact on a Commonwealth Marine Area;	No
i. In addition, any direct or indirect impact on Commonwealth lands	No

eco
logical
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