Charles Street Square Biodiversity Impact Statement

City of Parramatta

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Template 2.8.1

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Abbreviations

Abbreviation	Description
BC Act	NSW *Biodiversity Conservation Act 2016*
BIA	Biodiversity Impact Assessment
BIS	Biodiversity Impact Statement
BDAR	Biodiversity Development Assessment Report
CEEC	Critically Endangered Ecological Community
DCP	Development Control Plan
DECC	Department of Environment and Climate Change
DEEC	Department of Energy, Environment, and Conservation
DotEE	Department of the Environment and Energy
EEC	Endangered Ecological Community
ELA	Eco Logical Australia Pty Ltd.
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
FM Act	*Fisheries Management Act 1994*
KTP	Key Threatening Processes
LEP	Local Environmental Plan
LGA	Local Government Area
MNES	Matters of National Environmental Significance
PW	Priority Weed listed under the *Biosecurity Act 2015*
OEH	Office of Environment and Heritage
REF	Review of Environmental Factors

Abbreviation	Description
PCT	Plant Community Type
TEC	Threatened Ecological Community
WM Act	*Water Management Act 2000*
WoNS	Weeds of National Significance

Executive Summary

Eco Logical Australia Pty Ltd (ELA) was engaged by City of Parramatta to prepare a Biodiversity Impact Statement (BIS) to accompany a Review of Environmental Factors (REF) for an assessment under Part 5 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). The proposal is for the redevelopment of Charles Street Square, Parramatta (i.e. the 'study area'). The works include construction of a new public space on the southern bank of the Parramatta River adjacent to the new ferry terminal, including a projected artwork which will be displayed at night time on the rock face and vegetation on the northern bank.

Information used to undertake this assessment was based on several existing reports and datasets of the study area and proposed developments in the locality. Due to the available data from previous assessments, and the relatively minor impacts of the proposed works, further field assessment was not considered necessary.

Two threatened ecological communities (TECs) have been previously identified within the study area:

- *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* – listed as an Endangered Ecological Community (EEC) under the NSW *Biodiversity Conservation Act 2016* (BC Act).
- *Shale Sandstone Transition Forest in the Sydney Basin Bioregion* – listed as a Critically Endangered Ecological Community (CEEC) under the BC Act and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC) Act.

These communities are located on the northern bank and will not be directly impacted by the proposed works. Vegetation within the proposed impact area includes a mixture of native and exotic landscape plantings.

Suitable habitat was not identified within the study area for any threatened flora species due to the high level of modification of the southern bank and high level of weed incursion and disturbance on the northern bank. Potential habitat was identified for the following threatened fauna species:

- *Artamus cyanopterus cyanopterus* (Dusky Woodswallow)
- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus australis* (Little Bent-wing Bat)
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat)
- *Mormopterus norfolkensis* (Eastern Coastal Free-tailed Bat)
- *Myotis macropus* (Southern Myotis)
- *Pteropus poliocephalus* (Grey-headed Flying-Fox)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)

The proposal will result in the removal of 0.02 ha of planted native/exotic vegetation representing marginal foraging habitat for Grey-headed Flying-fox. The proposed projected artwork will also result in indirect impacts on nocturnal fauna including Grey-headed Flying-fox and those microchiropteran bats listed above. Tests of significance (5-part tests) in accordance with Section 7.3 of the BC Act were undertaken for Grey-headed Flying-fox and microchiropteran bats. It was determined that the proposal is unlikely to have a significant impact on any threatened species or ecological community listed under the BC Act. Therefore, a Species Impact Statement (SIS) or Biodiversity Development Assessment Report (BDAR) is not required.

A significance assessment in accordance with the EPBC Act was undertaken for Grey-headed flying Fox. It was determined that the proposal is unlikely to have a significant impact on this species or any other 'Matters of National Environmental Significance' (MNES) in accordance with the EPBC Act.

A number of mitigation measures have been recommended within this report to ameliorate potential direct and indirect impacts on native vegetation within and adjacent to the development.

1. Introduction

1.1 Background

Eco Logical Australia (ELA) was commissioned by the City of Parramatta to undertake a Biodiversity Impact Assessment (BIA) to be included in a Review of Environmental Factors (REF) for the proposed redevelopment of Charles Street Square.

1.2 Description of the study area

The study area (Figure 1) is located at the corner of Charles Street and Phillip St, Parramatta. The study area encompasses Lot 2 DP 869820, Lot 2 DP 869816, Lot 1 DP 506760, Lot 21, 22 and 23 DP 1346, and part of the Parramatta River. The southern bank of the river contains existing buildings, pathways, ferry terminal and planted vegetation. The northern bank consists of a mixture of remnant and revegetation native vegetation as well as weeds and degraded vegetation.

1.3 Project description

Charles Street Square, adjacent to the new Parramatta Ferry Wharf and the Escarpment Boardwalk currently under construction has been proposed for redevelopment as an entry point from the Parramatta River to the Parramatta Central Business District (CBD). The concept design for Charles Street Square was approved in December 2019 for exhibition in late February 2020 (Figure 2). The scope of works for the upgrade of Charles Street Square includes:

- New ramps and stairs to improve universal access and better connect the wharf to the street.
- Removal of the existing steel shelter and construction of a new shelter.
- New paving and establishment of cohesive levels to create:
  - A clear 6 m wide shared pathway at the river edge;
  - A mid-level terrace addressing the Port Bar café and connecting pedestrian access from George Street and the new residential development to the south; and
  - A broader square at street level including a significant new tree.
- An amphitheatre addressing the river, providing a place for the public to enjoy the river environment and seating for waiting ferry passengers.
- A new storage room for City of Parramatta visitor services mobile kiosks.
- Relocated 24-7 accessible toilet module.
- A new site office for ferry operator staff respite and public interface.
- New public artwork including a sculpture of Arthur Phillip and a facility housing projectors which will project storytelling elements to the embankment opposite (over the Escarpment Boardwalk currently under construction).
- Bike hire and bike parking facilities.
- New lighting and public domain elements such as bubblers and bins.
- New electronic and static signage for the ferry service and general wayfinding.

Figure 1: Location of the study area

Figure 2: Concept Plan

2. Legislative context

Commonwealth and State legislation and policies as well as local policies apply to the assessment, planning and management of ecological issues within the study area. A brief outline of the relevant Commonwealth and State Acts and Policies, and local policies, are provided below in Table 1**.**

Table 1: Legislative context

Name	Relevance to the project	Section in this report
Commonwealth		
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Matters of National Environmental Significance (MNES) have been identified as having a potential to occur within the locality. This report assesses the likelihood of occurrence of MNES within the site and concludes that the development is not likely to have a significant impact on MNES.	Section 5.3 and Appendix C
State		
Environmental Planning and Assessment Act 1979 (EP&A Act)	The EP&A Act is the principal planning legislation for NSW, providing a framework for the overall environmental planning and assessment of development proposals. The EP&A Act places a duty on the determining authority to adequately address a range of environmental matters including maintenance of biodiversity and the likely impact to threatened species, populations or ecological communities (under the BC Act– refer below). The proposed upgrade works are to be assessed under Part 5 of the EP& Act 1979.	Section 5
Biodiversity Conservation Act 2016 (BC Act)	An assessment of the proposed development in accordance with the BC Act is provided in Section 5 of this report. Impacts to threatened species and threatened ecological communities listed under the BC Act are required to be assessed in accordance with Section 7.3 of the BC Act, known as 'tests of significance' which is available in Appendix B. For works assessed under Part 5 of the EP&A Act, if the proposal is likely to have a significant impact on a threatened species or ecological community, the proponent may choose to undertake a Species Impact Statement (SIS) or a Biodiversity Development Assessment Report (BDAR).	Section 5.2 and Appendix B
Fisheries Management Act 1994 (FM Act)	The FM Act is the principal piece of legislation protecting aquatic habitat in NSW. The act aims to conserve fish stocks, key fish habitat, aquatic vegetation, and threatened species, populations and communities. Threatened aquatic species, populations and communities are listed under Schedules 4, 4A and 5 of the FM Act, while key threatening processes are listed under Schedule 6. As a public authority, Roads and Maritime must give the Minister written notice of the proposed work under Section 199 if they occur in areas mapped as key fish habitat (KFH) and have: • direct or indirect impact to marine vegetation; • require dredging or excavation of the bed or bank; • block fish passage; or • involve land reclamation. The area around Parramatta Wharf is mapped as Key Fish Habitat (KFH). There would be no impact to marine vegetation, so a permit to *Harm Marine Vegetation* under Part 7 of the FM Act is not required. No excavation of the bed or bank is proposed, so a permit for *Dredging &/or Reclamation* is not required.	N/A

Name	Relevance to the project	Section in this report
Coastal Management Act 2016 (CM Act) and State Environmental Planning Policy (SEPP) (Coastal Management) 2018 (Coastal Management SEPP)	The objects of this Act are to manage the coastal environment of NSW in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State. Part 2 of the CM Act identifies objectives related to four coastal management areas of the 'coastal zone': • Coastal wetlands and littoral rainforests area • Coastal vulnerability area • Coastal environment area • Coastal use area. The study area falls under the 'coastal environment area' and 'coastal use area'. However, under clause 13 (3) and 14 (2) of the Coastal Management SEPP, the development objectives for the 'coastal environment area' and 'coastal use area' do not apply to land within the Foreshores and Waterways Area within the meaning of Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005. Therefore, the Coastal Management SEPP is not applicable to this project.	N/A
Water Management Act 2000 (WM Act)	The proposed works are to be assessed under Part 5 of the EP& Act 1979, therefore a Controlled Activity Approval under s91 of the WM Act is not required. Best practice mitigation measures are discussed in this report.	Section 5.4
Planning Instruments		
Sydney Regional Environmental Plan (SREP, Sydney Harbour Catchment) 2005	The proposal is located within the Sydney Harbour Catchment and is subject to the SREP (Sydney Harbour Catchment) 2005. The SREP lists matters that City of Parramatta is to consider before carrying out any activity determined under Part 5 of the EP&A Act. The relevant clause to this aquatic ecology assessment is Clause 21: biodiversity, ecology and environment protection.	Section 5.5
Parramatta Local Environmental Plan (LEP) 2011	The study area does not contain any areas mapped as Terrestrial Biodiversity on the Natural Resources - Biodiversity Map under the Parramatta LEP, nor does it contain any areas mapped on the Natural Resources - Riparian Land and Waterways Map under the Parramatta LEP.	N/A

3. Methodology

3.1 Literature review and database search

A review of readily available databases pertaining to the ecology and environmental features of the study area, surrounding area and existing vegetation mapping was conducted to identify records of threatened species, populations, communities and their potential habitat. Databases, reports and previous vegetation mapping datasets that were reviewed included:

- Arboricultural Impact Assessment Report & Tree Protection Plan and Specification – Charles Street Square (Moore Trees Arboricultural Services 2019)
- Parramatta Escarpment EEC (ELA 2014)
- Parramatta Wharf Upgrade - Aquatic Ecology Assessment (ELA 2018)
- Review of Environmental Factors for Parramatta City Council - Charles Street Weir and Rangihou Reserve (Kerry Gordon Planning Services Pty Ltd 2019)
- BioNet / Atlas of NSW Wildlife 5 km database search (Department of Planning, Industry and the Environment (DPIE) 2020) accessed 5 May 2020
- EPBC Act Protected Matters Search Tool 5 km database search (Department of Agriculture, Water and the Environment (DAWE) 2020a) accessed 5 May 2020.
- NSW Threatened Species Profiles (DPIE 2020b)
- Vegetation mapping of the study area (Office of Environment and Heritage (OEH) 2016).

Aerial photography (Bing Maps and Google Earth) of the study area and surrounds was also used to investigate the extent of vegetation cover and landscape features. In addition, relevant Geographic Information Systems (GIS) datasets (soil, geology, drainage) were reviewed to guide the site inspection. Published literature and threatened species profiles were also used during the review. A full list of information sources is provided in Section 7.

A field survey was not undertaken as part of this assessment. Previous survey data collected from the study area (as outlined above) was relied upon for this assessment.

3.2 Likelihood of occurrence

Species from both the BioNet Wildlife Atlas and DAWE online search were undertaken to produce a list of threatened species, populations and communities that may occur within the subject site. The likelihood of occurrence for threatened species, populations and communities on the site was determined based on location of database records, the likely presence or absence of suitable habitat in the subject site, and knowledge of the species' ecology (Appendix A). Five terms for the likelihood of occurrence of species are used in this report:

- "yes" = the species was or has been observed in the study area
- "likely" = a medium to high probability that a species uses the study area
- "potential" = suitable habitat for a species occurs in the study area, 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 study area, and
- "no" = habitat in the study area and in its vicinity is unsuitable for the species.

4. Results

4.1.1 Literature and database review

A summary of information gathered from previous studies of the study area is outlined in Table 2.

Table 2: Summary of literature review

Study Name	Area Covered	Results
Parramatta Escarpment EEC (ELA 2014)	Northern bank of Parramatta River including vegetation on top of the escarpment.	Identification of threatened ecological communities (TECs) within vegetation on northern bank including: • River Flat Eucalypt Forest; and • Shale Sandstone Transition Forest.
The Native Vegetation of the Sydney Metropolitan Area (OEH 2016)	Entire study area.	Modelling of vegetation communities within the study area. Communities identified include: • Weeds and Exotics; and • Mangroves
Parramatta Wharf Upgrade - Aquatic Ecology Assessment (ELA 2018)	Aquatic habitat and vegetation within Parramatta River in the study area.	The following habitat features and vegetation types were identified in the study area: • Mangroves; • Subtidal un-vegetated compacted sediment; • Intertidal stabilised rock shelf; and • Intertidal rock platform.
Arboricultural Impact Assessment Report & Tree Protection Plan and Specification – Charles Street Square (Moore Trees Arboricultural Services 2019)	Arboricultural assessment of trees on the southern side of Parramatta River within the study area.	Several planted native and exotic trees have been mapped on the southern side of the river which have been included in this assessment.
Review of Environmental Factors for Parramatta City Council - Charles Street Weir and Rangihou Reserve (Kerry Gordon Planning Services Pty Ltd 2019)	Northern side of Parramatta River.	Impact assessment associated with construction of boardwalk and facilities between Charles Street Weir and Ranihou Reserve.
Vegetation Management Plan (VMP) Stewart St Reserve/Dixon Park – Escarpment Boardwalk Link and 5 Part Test of Significance. (Applied Ecology 2019)	Proposed boardwalk and adjacent vegetation on northern side of Parramatta River.	Vegetation description, habitat assessment and weeds list on northern bank.

4.1.2 Vegetation communities

The Native Vegetation of the Sydney Metropolitan Area (OEH 2016) identified the vegetation along the northern bank as consisting of Weeds and Exotics and Estuarine Mangrove Forest (Figure 3), no vegetation was mapped on the southern bank. In 2014, ELA undertook an assessment of the vegetation

along and atop the escarpment. While the majority of vegetation present was dominated by weeds and exotics and did not conform to a native vegetation community, small patches of vegetation conformed to native vegetation communities outlined below (Figure 3):

- *River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions* – listed as an Endangered Ecological Community (EEC) under the BC Act.
- *Shale Sandstone Transition Forest in the Sydney Basin Bioregion* – listed as a Critically Endangered Ecological Community (CEEC) under the BC Act and EPBC Act.

Areas mapped as native vegetation were highly degraded by weed infestation and were in poor condition. It must be noted that these communities are located outside of the footprint of any direct impact works associated with this proposal.

Vegetation on the southern river bank within the proposed redevelopment area consisted of a mixture of native and exotic plantings. A brief description of vegetation within the study area is provided in Table 3.

Table 3: Description of vegetation within the development site from ELA 2014, Moore Trees Arboricultural Services (2019) and Applied Ecology 2019.

Vegetation Community	Plant Community Type (PCT)	Dominant species	Threatened status
River-Flat Eucalypt Forest	*PCT 835: Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion*	Dominant species included; *Backhousia myrtifolia* (Grey Myrtle), *Angophora floribunda* (Rough-barked Apple), *Casuarina glauca* (Swamp Oak), *Casuarina cunninghamiana* (River Oak) and *Notelaea longifolia* (Large Mock-olive).	BC Act: EEC EPBC Act: Not Listed
Shale Sandstone Transition Forest	*PCT 1395: Narrow-leaved Ironbark - Broad-leaved Ironbark - Grey Gum open forest of the edges of the Cumberland Plain, Sydney Basin Bioregion*	Native canopy species include *Syncarpia glomulifera* (Turpentine), *Corymbia gummifera* (Red Bloodwood), *Eucalyptus tereticornis* (Forest Red Gum), *Pteridium esculentum* (Bracken) and *Imperata cylindrica* (Blady Grass).	BC Act: CEEC EPBC Act: CEEC
Estuarine Mangrove Forest	*PCT 920: Mangrove Forests in estuaries of the Sydney Basin Bioregion and South East Corner Bioregion*	Scattered *Avicenna marina* (Grey Mangroves) are located along the Parramatta River, including within the south of the study area.	PCT 920 is 'partially subset of' Coastal Saltmarsh TEC listed as an EEC under the BC Act and Vulnerable Ecological Community (VEC) under the EPBC Act. No saltmarsh was present in this community and therefore the

Vegetation Community	Plant Community Type (PCT)	Dominant species	Threatened status
			mangroves are not associated with the TEC.
Mixed Plantings	N/A	This PCT was represented by the following planted native species; *Angophora costata* (Smooth-barked Apple), *Corymbia maculata* (Spotted Gum), *Lophostemon confertus* (Brush Box), *Elaeocarpus reticulatus* (Blueberry Ash), and exotic planted species; *Jacaranda mimosifolia* (Jacaranda), *Schinus molle* (Pepper Tree).	N/A
Weeds and Exotics	N/A	Weeds are not listed as part of a PCT. Weeds recorded within the study area include; *Cardiospermum grandiflorum* (Balloon Vine), *Lantana camara* (Lantana), *Anredera cordifolia* (Madeira Vine), *Ligustrum lucidum* (Broad-leaf Privet), *Olea europaea* subsp. *cuspidata* (African Olive) and *Cestrum parqui* (Green Cestrum).	N/A

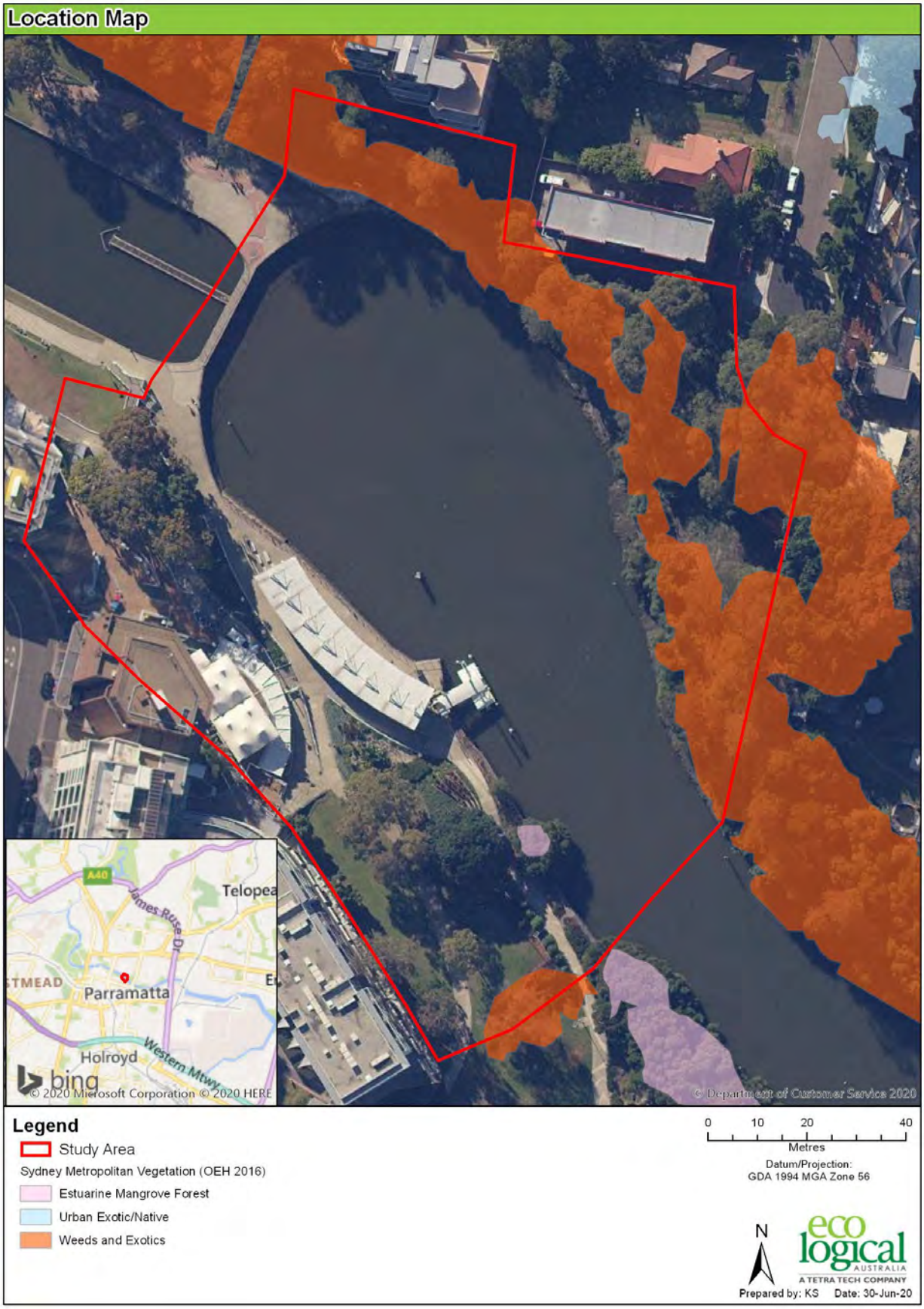

Figure 3: OEH Vegetation Mapping (2016)

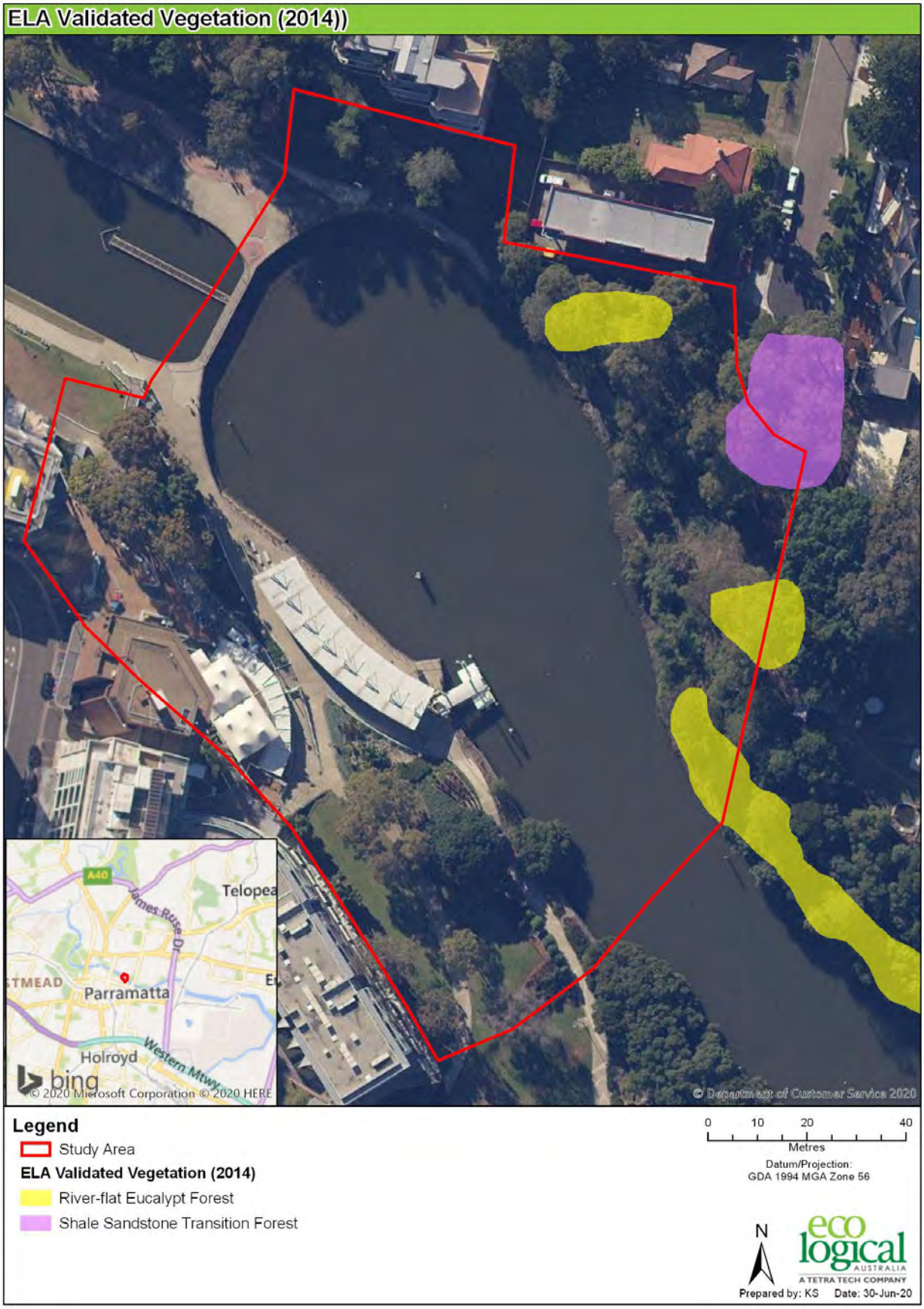

Figure 4: ELA Validated Vegetation Mapping (2014)

4.1.3 Threatened flora species

The desktop review identified a total of 33 threatened flora species listed under the BC or EPBC Acts, which may have the potential to occur within a 5 km radius of the study area. An assessment of the likelihood of occurrence of threatened flora species within the study area is available in Appendix A**.** No threatened flora species are likely to occur within the proposed direct impact area. Due to the high level of weed disturbance on the northern bank it is also unlikely that any threatened flora species are present in the indirect impact area.

4.1.4 Threatened fauna species

The desktop literature review identified a total of 115 threatened and migratory fauna species listed under the BC or EPBC Acts, which may have the potential to occur within a 5 km radius of the study area. An assessment of the likelihood of occurrence of threatened fauna species within the impact assessment area is available in Appendix A.

Potential habitat within the study area is available for the following species:

- *Artamus cyanopterus cyanopterus* (Dusky Woodswallow)
- *Ninox connivens* (Barking Owl)
- *Ninox strenua* (Powerful Owl)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus australis* (Little Bent-wing Bat)
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat)
- *Mormopterus norfolkensis* (Eastern Coastal Free-tailed Bat)
- *Myotis macropus* (Southern Myotis)
- *Pteropus poliocephalus* (Grey-headed Flying-Fox)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat).

5. Impact Assessment

5.1 Terrestrial Biodiversity

5.1.1 Direct Impacts

The proposed works will have no direct impacts on native vegetation communities, including the two TECs identified in the study area and mangrove areas. Existing native vegetation (excluding native plantings) are located on the northern bank, where there will be no direct impacts associated with this proposal.

Four planted native trees located on the southern side of the river will require removal for construction works. The location of these trees requiring removal is shown in Figure 5 and Figure 6. A total of 0.02 ha of planted vegetation will be removed for the proposed works (Figure 6). They include:

- Two x *Angophora costata* (Smooth-barked Apple)
- One x *Corymbia maculata* (Spotted Gum)
- One x *Lophostemon confertus* (Brush Box)

These native trees proposed for removal are plantings located in landscaped areas and garden beds and concreted area. While *A. costata* and *C. maculata* occur naturally within the Sydney region, these trees have been planted and are located within landscaped garden beds and are therefore not considered representative of any native Plant Community Type (PCT) or TEC. However, for the purposes of habitat considerations they have been assessed as native vegetation.

These trees represent marginal foraging habitat for Grey-headed Flying-fox. Furthermore, these trees are semi mature and are unlikely to provide roosting or breeding habitat such as hollows. Considering the isolated nature and urbanised context of the vegetation, no other threatened species are likely to frequently utilise these resources for foraging.

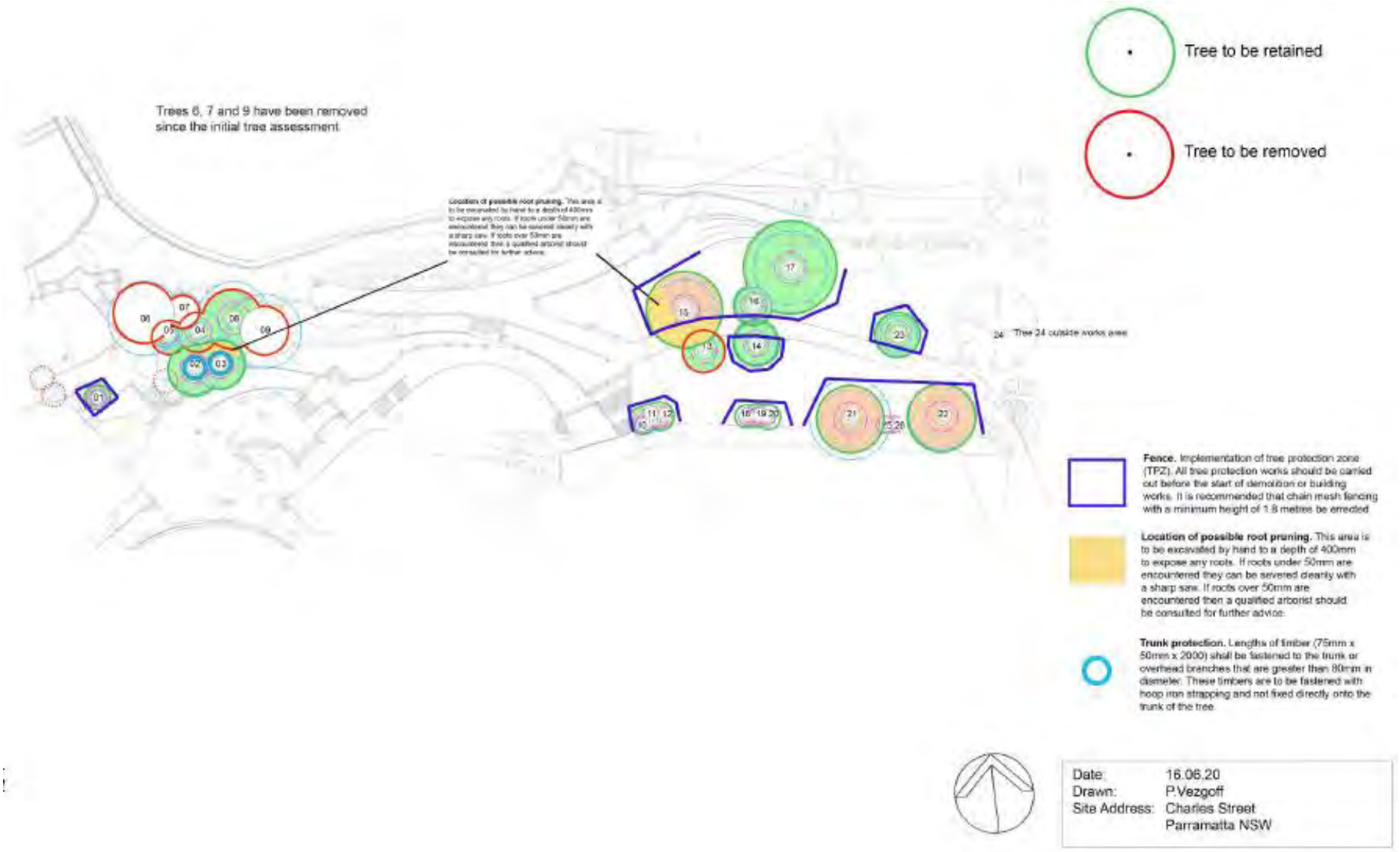

Figure 5: Tree removal plan (Moore Trees Arboricultural Services 2020)

Figure 6: Impacts to planted vegetation (based on Moore Trees Arboricultural Services 2019)

5.1.2 Indirect Impacts

5.1.2.1 Artificial lighting

The proposal includes a projected artwork that would be displayed on the northern bank of the river on the rock face and to a lesser extent the vegetation at the top of the rock face. The artwork would be displayed for a 3 hour period on a nightly basis and cover an area of up to 30 m wide by 10 m high. The proposed lighting type is Laser Diode, with a maximum intensity of 254 lux (for a proposed image of 20 m x 7.2 m) or an intensity of 130 lux (for a proposed image of 30 m x 10 m). A range of colours would be used for the projection.

The proposed projected artwork has the potential to indirectly impact nocturnal fauna which are likely to utilise the study area. A range of studies have been published on the impacts of artificial lighting on microbats. Some studies have found activity of certain species may increase around artificial lighting due to increased insect activity (Scanlon & Petit, 2008;). However, overall studies indicate that locations containing artificial lighting contain a lower level of species richness and activity of microbats (Scanlon & Petit, 2008; Stone, Harris & Jones, 2015; Linley, 2017; Newport, Shorthouse & Manning, 2014). Microbat activity may be reduced in lit areas with light levels as low as 3.7 lux for *Myotis* spp. (Stone, Harris & Jones, 2015). Considering the light levels of the proposed projected artwork may be as high as 254 lux, the foraging activity of bats is likely to be substantially reduced during operating hours and the flight path may be altered to avoid the illuminated area. It is noted that diurnal fauna such as birds may roost in the vegetation on the northern bank during the night. The artificial lighting may deter roosting of diurnal fauna within the projection area. Additional roosting habitat is available along the escarpment vegetation and no threatened fauna species reliant on night time roosting would be impacted by the proposed projected artwork.

Bats have been observed using waterways as a directional guide and clear flightpath when leaving and returning to their roost. High-flying species such as Grey-headed Flying-fox would not be impacted by the light beams crossing the river. Low-flying species such as Myotis would likely fly beneath the light beam, as they forage from the water surface. Other species navigating the air space above the river may fly directly through the light beams, but this would typically be perpendicular to the source and unlikely to cause interference to navigation. Therefore, the light beam is a low indirect impact to navigation.

The artwork will be projected onto the shale escarpment which is currently being impacted by construction for the boardwalk on the northern side of the river. Considering the level of disturbance currently occurring as a result of the boardwalk works, and noting that no likely microbat roosts were identified during the assessment of the escarpment excavation works, there are unlikely to be any significant microbat roost sites within the escarpment that would be impacted by the proposed projection. The vegetation located along or above the escarpment has been identified as dominated by shrubs, weeds and a mixture of mature, planted and regenerating trees. No significant hollows or potential microbat roosts were identified along the escarpment for the VMP and 5-part-tests (Applied Ecology) associated with the boardwalk, however, it is noted that detailed fauna surveys were not undertaken. It is unlikely that any significant threatened microbat roosts would be impacted by the proposed projected artwork. A 3D view of the proposed projection path is show in Figure 7.

Figure 7: 3D view of proposed projection path

5.2 Biodiversity Conservation Act 2016

Impacts to threatened species and threatened ecological communities listed under the BC Act are required to be assessed in accordance with Section 7.3 of the BC Act, known as 'test (s) of significance'.

For assessments under Part 5 of the EP&A Act the biodiversity offsets scheme threshold does not apply, as specified in section 7.2 (2). For a Part 5 assessment if the conclusion of the tests of significance state there is potential for a significant impact on a threatened species or ecological community, then the proponent has the option of preparing a SIS or BDAR.

A test of significance was undertaken for the following species:

- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus australis* (Little Bent-wing Bat)
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat)
- *Mormopterus norfolkensis* (Eastern Coastal Free-tailed Bat)
- *Myotis macropus* (Southern Myotis)
- *Pteropus poliocephalus* (Grey-headed Flying-Fox)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat).

Pteropus poliocephalus (Grey-headed Flying-fox) is likely to utilise foraging resources within the study area and there is a known maternity camp approximately 1.3 km north-west of the study area. A Test of Significance was undertaken for this species and it was determined that the proposed planted vegetation removal and artwork projection are unlikely to have a significant impact on the Grey-headed Flying-fox in accordance with Section 7.3 of the BC Act. It is considered that the proposed projected artwork would disrupt the foraging activity and flight path of the above listed species during the duration

of the light show (approximately 3 hours after dusk). However, considering that the artwork project will only be displayed for a small proportion of the night, and that no breeding sites are likely to be impacted, it is unlikely to result in a significant impact on any threatened microbats. Therefore, a SIS or BDAR is not required for the proposal.

A small number of bird species (listed in Section 4.1.4) have marginal habitat available within the study area, including nocturnal species *Ninox strenua* (Powerful Owl) and *Ninox connivens* (Barking Owl) the indirect impacts associated with the proposed artwork projection would have negligible impacts on these species. Powerful Owl and Barking Owl are highly mobile species and forage nocturnally within native vegetation and sometimes more open areas. The indirect impacts resulting from the projected artwork may result in deterrence of these owls and their prey (predominantly mammals) for the duration of the projection. However, considering the highly mobile nature of these species and the minor indirect impacts that would occur, the impacts are considered negligible and therefore a test of significance was not undertaken. The planted native vegetation proposed for removal is unlikely to provided suitable habitat for threated bird species considering its location in a highly urbanised setting within landscaped garden beds.

No aquatic species would be impacted by the development or light display as the light passes over and not into the water. Should the light display be altered to strike the water, red lighting is preferred as it has limited penetration through the water column compared to blue and green light (Becker et al 2013).

5.3 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act establishes a process for assessing the environmental impact of activities and developments where "Matters of National Environmental Significance" (MNES) may be affected. Under the Act, any action which "has, will have, or is likely to have a significant impact on a MNES" is defined as a "controlled action", and requires approval from the Commonwealth DAWE which is responsible for administering the EPBC Act. One nationally threatened fauna species, *Pteropus poliocephalus* (Grey-headed Flying-fox), is likely to utilise foraging resources within the study area and there is a known maternity camp within 1.3 km of the proposed works. A Significance Assessment was undertaken for the Grey-headed Flying Fox and it was determined that the proposed works are unlikely to have a significant impact on this species.

5.4 Water Management Act 2000

The proposed works are within the 40 m corridor for waterfront land for the Parramatta River, however, as the proponent is a Public Authority (defined in the WM Act), a controlled activity approval is not required. Mitigation measures relating to the control of sediment and runoff have been provided in Section 6. The development requires the removal of a small number of planted landscaping trees and earthworks associated with the proposal are within developed areas. No large trees will be removed which would severely destabilise soil and lead to erosion within the riparian corridor.

5.5 Sydney Regional Environmental Plan (SREP, Sydney Harbour Catchment) 2005

Clause 21 of the SREP provides nine matters to be taken into consideration in relation to biodiversity, ecology and environment protection, as assessed in Table 4.

Table 4: SREP, Sydney Harbour Catchment assessment

SREP, Sydney Harbour Catchment	Assessment
21 Biodiversity, ecology and environment protection *The matters to be taken into consideration in relation to biodiversity, ecology and environment protection are as follows—*	
(a) development should have a neutral or beneficial effect on the quality of water entering the waterways,	During construction, potential impact to water quality would be controlled by implementation of a Construction Environmental Management Plan (CEMP). During operation, the proposed redevelopment area would not alter the water quality of Parramatta River.
(b) development should protect and enhance terrestrial and aquatic species, populations and ecological communities and, in particular, should avoid physical damage and shading of aquatic vegetation (such as seagrass, saltmarsh and algal and mangrove communities),	No seagrass, saltmarsh or macroalgae communities occur on site. Mangroves occur near the site, but if no-go zones are established and sedimentation barriers are effectively implemented during construction there would be no impact to these plants or the wider community. A small area of planted native vegetation (0.02 ha) will be removed, however, will be replaced with similar landscape plantings.
(c) development should promote ecological connectivity between neighbouring areas of aquatic vegetation (such as seagrass, saltmarsh and algal and mangrove communities	No seagrass, saltmarsh or macroalgae communities occur on site, or are likely to establish here. Harm to mangroves will be avoided through establishing no-go zones during construction. The redevelopment would not affect future connectivity of marine vegetation because it is located at the tidal extent of the river.
(d) development should avoid indirect impacts on aquatic vegetation (such as changes to flow, current and wave action and changes to water quality) as a result of increased access,	The proposed works occur on existing developed areas on land and will not result in indirect impacts on aquatic vegetation, provided effective mitigation measures are included in the CEMP.
(e) development should protect and reinstate natural intertidal foreshore areas, natural landforms and native vegetation,	An existing seawall prevents establishment of any natural intertidal foreshore, landforms or vegetation beyond the existing mangroves. The proposal would not alter this situation due to onshore land use.
(f) development should retain, rehabilitate and restore riparian land,	Riparian land is heavily modified by concrete open space and landscaping. While planted native trees in landscaped areas will be removed this will not substantially alter the quality f the riparian land. It is understood that additional trees will be planted within landscaped areas.
(g) development on land adjoining wetlands should maintain and enhance the ecological integrity of the wetlands and, where possible, should provide a vegetative buffer to protect the wetlands	The proposal is not within a designated wetland identified on the Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 – Wetlands Protection Map. The proposal does not alter the net amount of habitat in the nearest wetland downstream. There would be no impact to marine vegetation.
(h) the cumulative environmental impact of development,	The foreshore and aquatic habitat is highly modified due to a seawall and commuter wharf. The proposal includes redevelopment of areas already highly modified and consisting predominantly of hard surfaces. The cumulative environmental impact is low given the existing conditions and small area of additional impact on modified vegetation. The projected artwork will have indirect impacts on

SREP, Sydney Harbour Catchment	Assessment
	terrestrial species, however, is unlikely to contribute significantly to cumulative impacts on the waterway.
(i) whether sediments in the waterway adjacent to the development are contaminated, and what means will minimise their disturbance.	Sediment contamination occurs on site, typical of the highly disturbed catchment and land use of the Parramatta River. A Stage 2 Contamination Assessment of the top 20 cm of sediment was previously undertaken within the site by Coffey Geotechnics (18 May 2016) for the purpose of the Ferry Wharf construction. Based on the analytical results, the sediments reported elevated contamination, with three chemicals of potential concern above low trigger values. Potential acid sulfate soils (ASS) were also detected in the shallow sediment samples. Coffey concluded that contamination risk arising from proposed ferry wharf construction works is considered to be low and sediment appears to have sufficient acid neutralising capacity. Coffey recommend that the disturbance of sediment and/or the underlying soils should be kept to a minimum to lower the risk of exposing these sediments to oxygen. The proposed Charles Street Square redevelopment works occur in highly modified areas and are unlikely to affect sediments within the river.

6. Recommendations

A number of general mitigation measures will be implemented which will reduce the potential impact on threatened species listed under the BC Act and EPBC Act.

The following mitigation measures will be implemented to reduce the ecological impacts associated with the proposed works within the study area:

- Tree protection fencing as outlined in the Arborist Assessment (Moore Trees Arboricultural Services 2020) should be installed around trees to be retained in the vicinity of the works to prevent inadvertent impacts on vegetation proposed for retention.
- Appropriate sediment control fencing or bags to be installed at the bounds of the construction area to prevent impacts to the adjacent Parramatta River, as detailed in stormwater and civil plans prepared by Northrop (2020).
- Storage areas should be located away from the drainage lines and Parramatta River to minimise risk of pollution and adverse impact to aquatic ecosystems.
- Landscape plantings will utilise locally occurring species to enhance habitat for native fauna, as detailed in the landscape plans for the proposed works.
- The artwork project should adhere to the proposed timeframes to limit the disturbance to foraging habitat for threatened microbats, nocturnal birds and diurnal species.
- The projected artwork should incorporate lower lighting within the sequence so as to not illuminate the native vegetation at maximum brightness for the duration of the projection.

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Appendix A Likelihood of Occurrence

An assessment of likelihood of occurrence was made for threatened and migratory species 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 site inspection and professional judgement. Some Migratory or Marine species identified from the Commonwealth database search have been excluded from the assessment, due to lack of habitat. 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.

The records column refers to the number of records occurring within 5 km of the study area, as provided by the NSW Wildlife Atlas (BioNet) database search.

Information provided in the habitat associations' column has primarily been extracted (and modified) from the Commonwealth Species Profile and Threats Database and the NSW Threatened Species Profiles.

Table 5: Threatened ecological communities (TECs) likelihood table

Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Assessment of Significance required
Castlereagh Scribbly Gum and Agnes Banks Woodland	V	EEC	Occurs almost exclusively on soils derived from Tertiary alluvium, or on sites located on adjoining shale or Holocene alluvium. Often adjacent to and on slightly higher ground than Castlereagh Ironbark Forest or Shale Gravel Transition Forest in the Sydney Basin Bioregion. Dominated by *Eucalyptus parramattensis* subsp. *parramattensis*, *Angophora bakeri* and *E. sclerophylla.* A small tree stratum of *Melaleuca decora* is sometimes present, generally in areas with poorer drainage. It has a well-developed shrub stratum consisting of sclerophyllous species such as *Banksia spinulosa* var. *spinulosa, Melaleuca nodosa, Hakea sericea* and *H. dactyloides* (multi-stemmed form). The ground stratum consists of a diverse range of forbs including *Themeda australis, Entolasia stricta*, *Cyathochaeta diandra, Dianella revoluta* subsp. *revoluta, Stylidium graminifolium*, *Platysace ericoides*, *Laxmannia gracilis* and *Aristida warburgii.*	No. Not present.	No
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	EEC	EEC	The structure of the community may vary from open forests to low woodlands, scrubs or reedlands with scattered trees. It has a dense to sparse tree layer in which *Casuarina glauca* (swamp oak) is the dominant species northwards from Bermagui. Other trees including *Acmena smithii* (lilly pilly), *Glochidion* spp. (cheese trees) and *Melaleuca* spp. (paperbarks) may be present as subordinate species, and are found most frequently in stands of the community northwards from Gosford. *Melaleuca ericifolia* is the only abundant tree in this community south of Bermagui. The understorey is characterised by frequent occurrences of vines, *Parsonsia straminea*, *Geitonoplesium cymosum* and *Stephania japonica* var. *discolor*, a sparse cover of shrubs, and a continuous groundcover of forbs, sedges, grasses and leaf litter. The composition of the ground stratum varies depending on levels of salinity in the groundwater. Associated with grey-black clay-loams and sandy loams, where the groundwater is saline or sub-saline, on waterlogged or periodically inundated flats, drainage lines, lake margins and estuarine fringes associated with coastal floodplains. Generally occurs below 20 m elevation.	No. Not present.	No

Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Assessment of Significance required
Coastal Upland Swamps in the Sydney Basin Bioregion	EEC	EEC	Occur primarily on impermeable sandstone plateaux with shallow groundwater aquifers in the headwaters and impeded drainage lines of streams, and on sandstone benches with abundant seepage moisture. Generally associated with acidic soils.	No. Not present.	No
Cooks River / Castlereagh Ironbark Forest	EEC	CEEC	Associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. The structure of the community may vary from tall open forests (>40m) to woodlands. The most widespread and abundant dominant trees include *Eucalyptus tereticornis* (forest red gum), *E. amplifolia* (cabbage gum), *Angophora floribunda* (rough-barked apple) and *A. subvelutina* (broad-leaved apple). *Eucalyptus baueriana* (blue box), *E. botryoides* (bangalay) and *E. elata* (river peppermint) may be common south from Sydney. *E. ovata* (swamp gum) occurs on the far south coast, *E. saligna* (Sydney blue gum) and *E. grandis* (flooded gum) may occur north of Sydney, while *E. benthamii* is restricted to the Hawkesbury floodplain. A layer of small trees may be present, including *Melaleuca decora, M. styphelioides* (prickly-leaved teatree), *Backhousia myrtifolia* (grey myrtle), *Melia azadarach* (white cedar), *Casuarina cunninghamiana* (river oak) and *C. glauca* (swamp oak). Scattered shrubs include *Bursaria spinosa, Solanum prinophyllum, Rubus parvifolius, Breynia oblongifolia, Ozothamnus diosmifolius, Hymenanthera dentata, Acacia floribunda* and *Phyllanthus gunnii.* The groundcover is composed of abundant forbs, scramblers and grasses.	No. Not present.	No
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest	CEEC	CEEC	Has an open forest structure and occurs primarily where shallow deposits from ancient river systems overlay shale soils, but also associated with localised concentrations of iron-hardened gravel. A transition plant community which grades into Cumberland Plain Woodland where the influence of gravel soil declines, and grades into Cooks River/Castlereagh Ironbark Forest or Castlereagh Scribbly Gum Woodland where gravel deposits are thick. Was not recorded during the site inspection s.	No. Not present.	No

Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Assessment of Significance required
River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions	**EEC**	**-**	**Found on the river flats of the coastal floodplains. Known from parts of the Local Government Areas of Port Stephens, Maitland, Singleton, Cessnock, Lake Macquarie, Wyong, Gosford, Hawkesbury, Baulkham Hills, Blacktown, Parramatta, Penrith, Blue Mountains, Fairfield, Holroyd, Liverpool, Bankstown, Wollondilly, Camden, Campbelltown, Sutherland, Wollongong, Shellharbour, Kiama, Shoalhaven, Palerang, Eurobodalla and Bega Valley.**	**Yes. Occurs in the study area on northern side of river.**	**No. Not impacted by proposed works.**
Shale/Sandstone Transition Forest	**CEEC**	**CEEC**	**Occurs at the edges of the Cumberland Plain, where clay soils from the shale rock intergrade with earthy and sandy soils from sandstone, or where shale caps overlay sandstone. The boundaries are indistinct, and the species composition varies depending on the soil influences. It typically occurs in moderately wet sites, with an annual rainfall of 800-1100mm per year, and on clay soils derived from Wianamatta shale. The tree canopy is dominated by Turpentine and a variety of eucalypt species. Its distribution is mainly on the Cumberland Plain of the Sydney region.**	**Yes. Occurs in the study area on northern side of river.**	**No. Not impacted by proposed works.**
Subtropical and Temperate Coastal Saltmarsh	-	V	Within a relatively narrow margin of the Australian coastline, within the subtropical and temperate climatic zones south of the South- east Queensland IBRA bioregion.	No. Not present.	No
Turpentine-Ironbark Forest of the Sydney Basin Bioregion	EEC	CEEC	Remnants mostly occur in the Baulkham Hills, Hornsby, Ku-ring-gai, Parramatta, Ryde, Sutherland and Hurstville local government areas of Sydney.	No. Not present.	No

Name	BC Act	EPBC Act	Habitat Associations	Likelihood of Occurrence	Assessment of Significance required
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	-	EEC	Found on igneous rock (predominately Tertiary basalt and microsyenite). Typically occurs at elevations between 650 and 1050 m above sea level.	No. Not present.	No
Western Sydney Dry Rainforest and Moist Woodland on Shale	EEC	CEEC	A dry vine scrub community of the Cumberland Plain, western Sydney. Canopy trees include Prickly Paperbark (*Melaleuca styphelioides*), Hickory Wattle (*Acacia implexa*) and Native Quince (*Alectryon subcinereus*). Many rainforest species occur in the shrub layer, such as Mock Olive (*Notelaea longifolia*), Hairy Clerodendrum (*Clerodendrum tomentosum*) and Yellow Pittosporum *(Pittosporum revolutum*). The shrub layer combines with vines, such as Gum Vine (*Aphanopetalum resinosum*), Wonga Vine (*Pandorea pandorana*) and Slender Grape (*Cayratia clematidea*) to form dense thickets in sheltered locations	No. Not present.	No

E= Endangered Ecological Community, CEEC = Critically Endangered Ecological Community.

Table 6: Threatened flora species likelihood table

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of Occurrence	Assessment of Significance required
Acacia bynoeana	Bynoe's Wattle	E	V	*Acacia bynoeana* 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.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Acacia pubescens	Downy Wattle	V	V	*Acacia pubescens* 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.	15	Unlikely. Suitable habitat not present.	No.
Allocasuarina glareicola	-	-	E	*Allocasuarina glareicola* 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.	0	Unlikely. Not known from locality. Suitable habitat not present.	No
Asterolasia elegans	-	E	E	Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys.	0	Unlikely. Not known from locality. Suitable habitat not present.	No
Caladenia tessellata	Thick-lipped Spider-orchid	E	V	Currently known from two disjunct areas; one population near Braidwood on the Southern Tablelands and three populations in the Wyong area on the Central Coast. Grassy sclerophyll woodland on clay loam or sandy soils, or low woodland with stony soil.	0	Unlikely. Not known from locality. Suitable habitat not present.	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of Occurrence	Assessment of Significance required
Callistemon linearifolius	Netted Bottle Brush	V		Georges River to Hawkesbury River in the Sydney area (limited to the Hornsby Plateau area), and north to the Nelson Bay area of NSW. Also Coalcliff in the northern Illawarra. Dry sclerophyll forest. Flowers spring – summer.	3	Unlikely. Suitable habitat not present.	No
Cryptostylis hunteriana	Leafless Tongue-orchid	-	V	Coastal heathlands, margins of coastal swamps and sedgelands, coastal forest, dry woodland, and lowland forest.	0	Unlikely. Not known from locality. Suitable habitat not present.	No
Darwinia biflora	-	V	V	Woodland, open forest or scrub-heath on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone.	0	Unlikely. Not known from locality. Suitable habitat not present.	No
Dillwynia tenuifolia	-	V	-	Scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest, transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland, and disturbed escarpment woodland on Narrabeen sandstone.	2	Unlikely. Suitable habitat not present.	No
Dillwynia tenuifolia	*Dillwynia tenuifolia* in the Baulkham Hills local government area	E1	E	Vegetation similar to Cumberland Plain Woodland, on Wianamatta Shale soils.	1	Unlikely. Suitable habitat not present.	No
Epacris purpurascens var. *purpurascens*	-	V	-	Sclerophyll forest, scrubs and swamps. Most habitats have a strong shale soil influence. Lifespan is recorded to be 5-20 years, requiring 2-4 years before seed is produced in the wild. Killed by fire and re-establishes from soil-stored seed.	63	Unlikely. Suitable habitat not present.	No
Eucalyptus camfieldii	Camfield's Stringybark	V	V	Woodland, open forest or scrub-heath on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone.	0	Unlikely.	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of Occurrence	Assessment of Significance required
						Not known from locality. Suitable habitat not present.	
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	New England Tablelands from Nundle to north of Tenterfield. Dry grassy woodland, on shallow soils of slopes and ridges.	1	Unlikely. Site not within natural range of species. Suitable habitat not present.	No
Genoplesium baueri	Yellow Gnat-orchid	V	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 and flowers from December to March.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Grammitis stenophylla	Narrow-leaf Finger Fern	E		In NSW it has been found on the south, central and north coasts and as far west as Mount Kaputar National Park near Narrabri. Rainforest and moist eucalypt forest, usually near streams, on rocks or in trees.	1	Unlikely. Suitable habitat not present.	No
Hibbertia superans	-	E1	-	Open woodland and heathland it appears to prefer open disturbed areas.	43	Unlikely. Suitable habitat not present.	No
Isotoma fluviatilis subsp. *fluviatilis*	-	-	X	Damp places on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland, and alluvial woodland/shale plains woodland.	1	Unlikely. Suitable habitat not present.	No
Marsdenia viridiflora subsp. *viridiflora*	*Marsdenia viridiflora* subsp. *viridiflora* population in the Bankstown,	E2	-	Vine thickets and open shale woodland.	1	Unlikely. Suitable habitat not present.	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of Occurrence	Assessment of Significance required
	Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas						
Persicaria elatior	Knotweed	V	V	Beside streams and lakes, swamp forest or disturbed areas	0	Unlikely. Not known from locality. Suitable habitat not present.	No
Persoonia hirsuta	Hairy Geebung	E	E	Sandy soils in dry sclerophyll open forest, woodland and heath on sandstone.	0	Unlikely. Not known from locality. Suitable habitat not present.	No
Persoonia nutans	Nodding Geebung	E	E	Northern populations: sclerophyll forest and woodland (Agnes Banks Woodland, Castlereagh Scribbly Gum Woodland and Cooks River / Castlereagh Ironbark Forest) on aeolian and alluvial sediments. Southern populations: tertiary alluvium, shale sandstone transition communities and Cooks River / Castlereagh Ironbark Forest. Peak flowering is from November to March with sporadic flowering all year round. An obligate seed regenerator. Seed germination is promoted by fire and also by physical disturbance. Although listed as a short-lived species much of the ecology is poorly known. Maturity is expected in about 10 years.	0	Unlikely. Suitable habitat not present.	No
Pimelea curviflora var. *curviflora*	-	V	V	*Pimelea curviflora* var. *curviflora* 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	6	Unlikely. Suitable habitat not present.	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of Occurrence	Assessment of Significance required
				shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Flowers October to May.			
Pimelea spicata	Spiked Rice-flower	E	E	In western Sydney, *Pimelea spicata* occurs on an undulating topography of well-structured clay soils, derived from Wianamatta shale. It is associated with Cumberland Plains Woodland, in open woodland and grassland often in moist depressions or near creek lines. Has been located in disturbed areas that would have previously supported	2	Unlikely. Suitable habitat not present.	No
Pomaderris prunifolia	*P. prunifolia* in the Parramatta, Auburn, Strathfield and Bankstown Local Government Areas	E2		Population is known from only three sites: at Rydalmere, within Rookwood Cemetery and at The Crest of Bankstown. At Rydalmere it occurs among grass species on sandstone near a creek. At Rookwood Cemetery it occurs in a small gully of degraded Cooks River / Castlereagh Ironbark Forest on shale soils. Does not appear to spread vegetatively. The longevity is thought to be 10-25 years. Buds are present for many months before flowers open. Probably killed by fire.	8	Unlikely. Suitable habitat not present.	No
Pterostylis saxicola	Sydney Plains Greenhood	E	E	Small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines, adjacent to sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	2	Unlikely. Suitable habitat not present.	No
Rhodamnia rubescens	Scrub Turpentine	CE	-	Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils. This species is characterised as highly to extremely susceptible to infection by Myrtle Rust. Myrtle Rust affects all plant parts.	3	Unlikely. Suitable habitat not present.	No
Syzygium paniculatum	Magenta Lillypilly	V	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. In the Ourimbah Creek valley, *S. paniculatum* occurs within gallery	7	Unlikely. Suitable habitat not present.	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of Occurrence	Assessment of Significance required
				rainforest with *Alphitonia excelsa*, *Acmena smithii*, *Cryptocarya glaucescens*, *Toona ciliata*, *Syzygium oleosum* with emergent *Eucalyptus saligna*. At Wyrrabalong NP, *S. paniculatum* occurs in littoral rainforest as a co-dominant with *Ficus fraseri*, *Syzygium oleosum*, *Acmena smithii*, *Cassine australe*, and *Endiandra sieberi*.			
Tetratheca glandulosa	Glandular Pink Bell	V	-	Heath, scrub, woodlands and open forest on upper-slopes and mid-slope sandstone benches. Soils generally shallow, consisting of a yellow, clayey/sandy loam. Flowers July-November however residual flowers may persist until late December. Flowering influenced by seasonal weather conditions and/or microclimate. Resprouts from a woody root following fire, however the role fire plays in seed germination and persistence of the species is unclear.	1	Unlikely. Suitable habitat not present.	No
Thesium australe	Austral Toadflax	V	V	Widespread throughout the eastern third of NSW but most common on the North Western Slopes, Northern Tablelands and North Coast. Occurs in grassland or grassy woodland. Often found in damp sites in association with Kangaroo Grass (*Themeda australis*) (DECC 2007). The preferred soil type is a fertile loam derived from basalt although it occasionally occurs on metasediments and granite.	0	Unlikely. Not known from locality. Suitable habitat not present.	No
Triplarina imbricata	Creek Triplarina	E	E	A few locations in the ranges south-west of Glenreagh and near Tabulam in north-east NSW. Along watercourses in low open forest with Tristaniopsis laurina (Water Gum).	4	Unlikely. Suitable habitat not present.	No
Wahlenbergia multicaulis	Tadgell's Bluebell in the local government areas of Auburn, Bankstown, Baulkham Hills, Canterbury,	E2	-	Unlikely. Not known from locality. Suitable habitat not present.	1	Unlikely. Suitable habitat not present.	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of Occurrence	Assessment of Significance required
	Hornsby, Parramatta and Strathfield						
Wilsonia backhousei	Narrow-leafed Wilsonia	V	-	In NSW, found on the coast between Mimosa Rocks 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). Margins of salt marshes and lakes. Flowering occurs in spring and summer.	100	Unlikely. Suitable habitat not present.	No
Zannichellia palustris	-	E1	-	Fresh or slightly saline stationary or slowly flowing water.	5	Unlikely. Suitable habitat not present.	No

V= Vulnerable; E= Endangered; E2= Endangered population; E= Endangered, CE= Critically Endangered, X = Presumed extinct.

Table 7: Fisheries Management Act species likelihood table

Scientific Name	Common Name	FM Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Epinephelus daemelii	Black Rockcod	V	V	Along the entire NSW coast including Lord Howe Island. Caves, gutters and beneath bomboras on rocky reefs. Small juveniles are often found in coastal rock pools, and larger juveniles around rocky shores in estuaries.	0	Unlikely. Suitable habitat not present.	No
Macquarie australasica	Macquarie Perch	E	E	Habitat for this species 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.	0	Unlikely. Not known from locality.	No

V= Vulnerable; E= Endangered, PE= Presumed extinct.

Table 8: Threatened fauna species likelihood table

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
				Amphibia			
Heleioporus australiacus	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, where the soil is soft and sandy so that burrows can be constructed.	0	Unlikely. Not known from locality. Suitable habitat not present.	No
Litoria aurea	Green and Golden Bell Frog	E	V	It can utilise a variety of natural and man-made waterbodies such as coastal swamps, marshes, lakes, other estuary wetlands, riverine floodplain wetlands, stormwater detention basins, farm dams, bunded areas, drains, ditches and other structures capable of storing water. Permanent swamps and ponds with established fringing vegetation (e.g. *Typha* sp. and spikerushes–*Eleocharis* sp.) adjacent to open grassland areas for foraging and free from predatory fish such as Mosquito Fish (*Gambusia holbrooki*) are also.	15989	Unlikely. Suitable habitat not present. High number of records due to the close proximity of the study area to Sydney Olympic Park; where there is a known population of Green and Golden Bell Frog. Dispersal habitat available within river, however, suitable wetland habitat to available in study area.	No
Litoria raniformis	Growling Grass Frog	E	V	In NSW, only known to exist in isolated populations in the Coleambally Irrigation Area, the Lowbidgee floodplain and around Lake Victoria. A few recent unconfirmed records have also been made in the Murray Irrigation Area.	0	Unlikely. Not known from locality. Suitable habitat not present.	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Mixophyes balbus	Stuttering Frog	E	V	Along the east coast of Australia from southern Qld to north-eastern Victoria. Rainforest and wet, tall open forest in the foothills and escarpment on the eastern side of the Great Dividing Range.	0	Unlikely Not known from locality. Suitable habitat not present.	No
Pseudophryne australis	Red-crowned Toadlet	V	-	Open forests, mostly on Hawkesbury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings.	3	Unlikely. Suitable habitat not present.	No
Reptilia							
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Dry and wet sclerophyll forests, riverine forests, coastal heath swamps, rocky outcrops, heaths, grassy woodlands.	0	Unlikely. Not known from locality. Suitable habitat not present.	No
Insecta							
Synemon plana	Golden Sun Moth	E1	CE	Natural Temperate Grasslands and grassy Box-Gum Woodlands in which groundlayer is dominated by *Austrodanthonia* spp. (wallaby grasses).	0	Unlikely. Not known from locality. Suitable habitat not present.	No
Gastropoda							
Meridolum corneovirens	Cumberland Land Snail	E	-	Associated with open eucalypt forests, particularly Cumberland Plain Woodland (CPW). Found under fallen logs, debris and in bark and leaf litter around the trunk of gum trees or burrowing in loose soil around clumps of grass. Urban waste may also form suitable habitat.	2	Unlikely. Degraded habitat and maintained understorey within subject site.	No. Habitat not available within in impact area.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Pommerhelix duralensis	Dural Woodland Snail	E	E	Shale-sandstone transitional landscapes. Found in Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest; Turpentine-Ironbark Forest; Shale/Sandstone Transition Forest; Turpentine Ironbark Margin Forest; Hinterland Sandstone Gully Forest; and Sydney Hinterland Transition Woodland. Feeds on the fruits and hyphae of a range of native fungi species and possibly on other detritus. Has been observed resting in exposed areas, such as on exposed rock or leaf litter, however it will also shelter beneath leaves, rocks and light woody debris.	31	Unlikely. Degraded habitat and maintained understorey within impact area. No local records.	No. Habitat not available within in impact area.
				Diurnal aves			
Anthochaera Phrygia	Regent Honeyeater	E	CE	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 (*C. cunninghamiana*). It primarily feeds on nectar from box and ironbark eucalypts and occasionally from Banksia's and mistletoes. It is reliant on locally abundant nectar sources with different flowering times to provide reliable supply of nectar. Suitable habitat likely to be present within the Precinct.	3	Unlikely. Suitable habitat not present.	No.
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Woodlands and dry open sclerophyll forest, usually eucalypts and mallee associations. Also have recordings in shrub and heathlands and various modified habitats, including regenerating forests. In western NSW, this species is primarily associated with River Red Gum/Black Box/Coolabah open forest/woodland and associated with larger river/creek systems.	18	Potential Habitat available in vegetation on north side of river.	No.
Botaurus poiciloptilus	Australasian Bittern	V	E	Occurs in terrestrial wetlands with tall dense vegetation, occasionally estuarine habitats, reedbeds, swamps, streams, and estuaries.	9	No. Suitable habitat not present.	No.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Burhinus grallarius	Bush Stone-curlew	E1	-	In NSW, it occurs in lowland grassy woodland and open forest.	1	No. Suitable habitat not present.	No.
Callocephalon fimbriatum	Gang-gang Cockatoo	V	-	Tall mountain forests and woodlands in summer; in winter, may occur at lower altitudes in open eucalypt forests and woodlands, and urban areas.	1	No. Suitable habitat not available within subject site.	No
Calyptorhynchus lathami	Glossy Black-Cockatoo	V	-	Open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur.	1	No. Suitable habitat not available within subject site.	No
Circus assimilis	Spotted Harrier	V	-	Grassy open woodland, inland riparian woodland, grassland, shrub steppe, agricultural land and edges of inland wetlands.	4	No. Suitable habitat not available within subject site.	No
Daphoenositta chrysoptera	Varied Sittella	V	-	Distribution includes most of mainland Australia except deserts and open grasslands. Prefers eucalypt forests and woodlands with rough-barked species, or mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods from bark, dead branches, or small branches and twigs.	2	Unlikely. Preferred habitat not available.	No.
Dasyomis brachypterus	Eastern Bristlebird	E	E	Habitat is characterised by dense, low vegetation and includes sedgeland, heathland, swampland, shrubland, sclerophyll forest and woodland, and rainforest, as well as open woodland with a heathy understorey. In northern NSW occurs in open forest with tussocky grass understorey.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Epthianura albifrons	White-fronted Chat	V	-	Saltmarsh vegetation, open grasslands and sometimes low shrubs bordering wetland areas.	502	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Epthianura albifrons	White-fronted Chat population in the Sydney Metropolitan Catchment Management Area	E2	-	Saltmarsh of Newington Nature Reserve and in grassland on the northern bank of the Parramatta River. Saltmarsh and on the sandy shoreline of a small island of Towra Point Nature Reserve.	250	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Glossopsitta pusilla	Little Lorikeet	V	-	Dry, open eucalypt forests and woodlands, including remnant woodland patches and roadside vegetation.	2	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Grantiella picta	Painted Honeyeater	-	V	A nomadic species that typically inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests with abundant mistletoe (DECC 2007). It is a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias, preferring *Amyema* sp mistletoe (DECC 2007).	0	Unlikely. Not known from locality. Preferred foraging habitat not recorded within subject site	No. considered negligible.
Haliaeetus leucogaster	White-bellied Sea-Eagle	V	-	Freshwater swamps, rivers, lakes, reservoirs, billabongs, saltmarsh and sewage ponds and coastal waters. Terrestrial habitats include coastal dunes, tidal flats, grassland, heathland, woodland, forest and urban areas.	327	No. Suitable habitat not available within the subject site.	No
Hieraaetus morphnoides	Little Eagle	V	-	Open eucalypt forest, woodland or open woodland, including sheoak or *Acacia* woodlands and riparian woodlands of interior NSW.	6	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Ixobrychus flavicollis	Black Bittern	V	-	Terrestrial and estuarine wetlands. Also flooded grassland, forest, woodland, rainforest and mangroves where permanent water is present.	3	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Lathamus discolor	Swift Parrot	E	CE	Breeds in Tasmania between September and January. Migrates to mainland in autumn, where it forages on profuse flowering Eucalypts. 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 (*Eucalyptus robusta*), Spotted Gum (*Corymbia maculata*), Red Bloodwood (*C. gummifera*), Mugga Ironbark (*E. sideroxylon*), and White Box (*E. albens*).	8	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Petroica boodang	Scarlet Robin	V	-	Dry eucalypt forests and woodlands, and occasionally in mallee, wet forest, wetlands and tea-tree swamps.	2	Unlikely. Preferred habitat not available.	No. Highly mobile species. Impact considered negligible.
Petroica phoenicea	Flame Robin	V	-	Breeds in upland tall moist eucalypt forests and woodlands. In winter uses dry forests, open woodlands, heathlands, pastures and native grasslands. Occasionally occurs in temperate rainforest, herbfields, heathlands, shrublands and sedgelands at high altitudes.	1	No. Suitable habitat not available within subject site.	No
Polytelis swainsonii	Superb Parrot	V	-	In NSW, occurs on inland slopes of the Great Divide and on adjacent plains, especially along the major river-systems. Box-gum woodland, Box-Cypress-pine and Boree Woodlands and River Red Gum Forest.	1	Unlikely. Suitable habitat not present.	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Rostratula australis	Australian Painted Snipe	E1	E	Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds (ibid.). Breeding is often in response to local conditions; generally occurs from September to December. Roosts during the day in dense vegetation. Forages nocturnally on mud-flats and in shallow water. Feeds on worms, molluscs, insects and some plant-matter (ibid.).	3	Unlikely. Suitable habitat not available within subject site.	No
Stictonetta naevosa	Freckled Duck	V	-	Freshwater swamps and creeks, lakes, reservoirs, farm dams and sewage ponds.	1	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
				Nocturnal aves			
Ninox connivens	Barking Owl	V	-	Wide but sparse distribution in NSW, avoiding the most central arid regions. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Woodland and open forest, including fragmented remnants and partly cleared farmland, wetland and riverine forest. It roosts in dense shaded foliage in large trees. Nesting occurs in hollows in large, old eucalypts, either living or dead. The nesting season is during mid-winter and spring, but may vary between pairs and from year to year. The Barking Owl preferentially hunts small arboreal mammals such as Squirrel Gliders and Ringtail Possums, but also takes birds, invertebrates and terrestrial mammals.	7	Potential. Marginal foraging habitat available on northern bank.	No. Negligible indirect impact on foraging habitat for highly mobile species.
Ninox strenua	Powerful Owl	V	-	Woodland, open sclerophyll forest, tall open wet forest and rainforest.	98	Potential. Marginal foraging habitat available on northern bank.	No. Negligible indirect impact on foraging habitat for

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
							highly mobile species.
Tyto longimembris	Eastern Grass Owl	V	-	Areas of tall grass, including grass tussocks, swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains.	2	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Tyto novaehollandiae	Masked Owl	V	-	Dry eucalypt forests and woodlands from sea level to 1100 m.	3	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Tyto tenebricosa	Sooty Owl	V	-	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. Roosts by day in the hollow of a tall forest tree or in heavy vegetation; hunts by night for small ground mammals or tree-dwelling mammals such as the *Pseudocheirus peregrinus* (Common Ringtail Possum) or *Petaurus breviceps* (Sugar Glider). Nests in very large tree-hollows.	1	Unlikely. Suitable habitat not present.	No
				Mammalia			
Dasyurus maculatus	Spotted-tailed Quoll	V	E	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 and in NSW within 200km of the coast. Preferred habitat is mature wet forest (Belcher 2000b; Green & Scarborough 1990; Watt 1993), especially in areas with rainfall 600 mm/year (Edgar & Belcher 2008; Mansergh 1984). Unlogged forest or forest that has been less disturbed by timber harvesting is also preferable (Catling et	5	Unlikely. Suitable habitat not present.	No.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
				al. 1998, 2000). 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).			
Isoodon obesulus obesulus	Southern Brown Bandicoot (eastern)	E	E	Heath or open forest with a heathy understorey on sandy or friable soils.	0	Unlikely. Not know from locality. Suitable habitat not present.	No.
Petauroides volans	Greater Glider	-	V	The greater glider is an arboreal nocturnal marsupial, largely restricted to eucalypt forests and woodlands. It is typically found in highest abundance in taller, montane, moist eucalypt forests with relatively old trees and abundant hollows. The greater glider favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species.	0	Unlikely. Not know from locality. Suitable habitat not present.	No.
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges.	0	Unlikely. Not know from locality. Suitable habitat not present.	No.
Phascolarctos cinereus	Koala	V	V	Associated with both wet and dry Eucalypt forest and woodland that contains a canopy cover of approximately 10 to 70%, with acceptable Eucalypt food trees. Some preferred Eucalyptus species are: *Eucalyptus tereticornis, E. punctata, E. cypellocarpa, E. viminalis.*	4	Unlikely. Not know from locality. Suitable habitat not present.	No.
Pseudomys novaehollandiae	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 understorey and vegetated sand dunes. A social animal, living	0	Unlikely. Not know from locality. Suitable habitat not present.	No.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
				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.			
				Mammalia (bats)			
Chalinolobus dwyeri	**Large-eared Pied Bat**	**V**	**V**	**Wet and dry sclerophyll forests, Cyprus Pine dominated forest, woodland, sub-alpine woodland, edges of rainforests and sandstone outcrop country. Roots in caves, rock overhangs and disused mine shafts.**	**1**	**Potential. Foraging habitat available within study area.**	**Yes - indirect impacts**
Falsistrellus tasmaniensis	**Eastern False Pipistrelle**	**V**	**-**	**Prefers moist habitats with trees taller than 20 m. Roosts in tree hollows but has also been found roosting in buildings or under loose bark.**	**6**	**Potential. Foraging and roosting habitat within study area.**	**Yes – indirect impacts**
Miniopterus australis	**Little Bent-wing Bat**	**V**	**-**	**Prefers well-timbered areas including rainforest, wet and dry sclerophyll forests, Melaleuca swamps and coastal forests. This species shelter in a range of structures including culverts, drains, mines and caves. Relatively large areas of dense vegetation of either wet sclerophyll forest, rainforest or dense coastal banksia scrub are usually found adjacent to caves in which this species is found. Breeding occurs in caves, usually in association with *M. schreibersii*.**	**1**	**Potential. Foraging habitat within subject site only.**	**Yes – indirect impacts**
Miniopterus orianae oceanensis	**Large Bent-winged 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. It forages above and below the tree canopy on small insects. Will utilise caves, old mines, and stormwater channels, under bridges and occasionally buildings for shelter.**	**90**	**Potential. Foraging habitat within subject site only.**	**Yes – indirect impacts**

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Mormopterus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	Most records of this species are from dry eucalypt forest and woodland east of the Great Dividing Range. Individuals have, however, been recorded flying low over a rocky river in rainforest and wet sclerophyll forest and foraging in clearings at forest edges. Primarily roosts in hollows or behind loose bark in mature eucalypts, but have been observed roosting in the roof of a hut.	12	Potential. Foraging habitat available within study area.	Yes – indirect impacts
Myotis macropus	Southern Myotis	V	-	Southern Myotis found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. 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. While roosting (in groups of 10-15) it 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. It forages over streams, dams and pools catching insects and small fish by raking their feet across the water surface.	35	Potential. Foraging habitat available within study area.	Yes – indirect impacts
Pteropus poliocephalus	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. Camps are often located in gullies, typically close to water, in vegetation with a dense canopy.	962	Likely. Foraging habitat within subject site.	Yes – indirect impacts
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Almost all habitats, including wet and dry sclerophyll forest, open woodland, open country, mallee, rainforests, heathland and waterbodies.	14	Potential. Foraging habitat available within study area.	Yes – indirect impacts

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Scoteanax rueppellii	**Greater Broad-nosed Bat**	**V**	**-**	**Associated with moist gullies in mature coastal forest, or rainforest, east of the Great Dividing Range, tending to be more frequently located in more productive forests. 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.**	**7**	**Potential. Foraging habitat available within study area.**	**Yes – indirect impacts**
				Listed marine and migratory species			
Actitis hypoleucos	Common Sandpiper	-	Mi	The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats.	79	No. Suitable habitat not available within subject site.	No
Apus pacificus	Fork-tailed Swift	-	Mi; Ma	Sometimes travels with Needletails. Varied habitat with a possible tendency to more arid areas but also over coasts and urban areas.	3	No. Suitable habitat not available within subject site.	No
Ardea ibis	Cattle Egret	-	Mi	Grasslands, wooded lands and terrestrial wetlands.	137	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Ardenna grisea	Sooty Shearwater	-	Ma	Islands, offshore.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Arenaria interpres	Ruddy Turnstone	-	Mi	Tidal reefs and pools; pebbly, shelly and sandy shores; mudflats; inland shallow waters; sewage ponds, saltfields; ploughed ground.	4	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Calidris acuminata	Sharp-tailed Sandpiper	-	Ma; Mi	Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	691	No. Suitable habitat not available within subject site.	No
Calidris canutus	Red Knot	-	E; Mi	Intertidal mudflats, sandflats sheltered sandy beaches, estuaries, bays, inlets, lagoons, harbours, sandy ocean beaches, rock platforms, coral reefs, terrestrial saline wetlands near the coast, sewage ponds and saltworks. Rarely inland lakes or swamps.	14	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Calidris ferruginea	Curlew Sandpiper	E	CE; Mi	Littoral and estuarine habitats, including intertidal mudflats, non-tidal swamps, lakes and lagoons on the coast and sometimes inland.	332	No. Suitable habitat not available within subject site.	No
Calidris mauri	Western Sandpiper	-	M	Tidal mudflats and sandflats in sheltered lagoons, river deltas and estuaries; salt-evaporation ponds; terrestrial wetlands, such as the margins of lakes and ponds.	1	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Calidris melanotos	Pectoral Sandpiper	-	Ma; Mi	Shallow fresh to saline wetlands, including coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	33	No. Suitable habitat not available within the subject site.	No
Calidris ruficollis	Red-necked Stint	-	Mi	Tidal mudflats, saltmarshes, sandy and shelly beaches, saline and freshwater wetlands, saltfields, sewage ponds.	38	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Calidris tenuirostris	Great Knot	V	CE; Mi	Intertidal mudflats or sandflats, including inlets, bays, harbours, estuaries and lagoons.	2	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Calonectris leucomelas	Streaked Shearwater	-	Ma	Marine species.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Charadrius bicinctus	Double-banded Plover	-	Mi	Beaches, bays and inlets, exposed reefs and rock platforms, harbours, margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps; shallow estuaries, rivers, saltmarsh, grasslands, pasture. Sometimes associated with coastal lagoons, inland saltlakes, saltworks, seagrass beds, kelp beds.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Charadrius leschenaultii	Greater Sand Plover	V	V; Mi	Almost entirely restricted to coastal areas in NSW, mainly on sheltered sandy, shelly or muddy beaches or estuaries with large intertidal mudflats or sandbanks.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Charadrius mongolus	Lesser Sand Plover	V	E; Mi	Almost entirely coastal in NSW, using sheltered bays, harbours and estuaries with large intertidal sandflats or mudflats, sandy beaches, coral reefs and rock platforms.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Chlidonias leucopterus	White-winged Black Tern	-	M	Large coastal and inland wetlands, saltfields, tidal estuaries, lagoons, grassy swamps, and sewage ponds.	1	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Cuculus optatus	Oriental Cuckoo	-	Mi	Non breeding habitat: monsoonal rainforest, vine thickets, wet sclerophyll forest or open Casuarina, Acacia or Eucalyptus woodland.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Diomedea antipodensis	Antipodean Albatross	V	V; Ma	Marine species.	0	Unlikely.	No.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
						Not known from locality. Suitable habitat not present.	
Diomedea antipodensis gibsoni	Gibson's Albatross	V	V; Ma	Marine species.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Diomedea epomophora	Southern Royal Albatross	-	V; Ma	Marine and pelagic.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Diomedea exulans	Wandering Albatross	E1	V; Ma	Marine species.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Diomedea sanfordi	Northern Royal Albatross	-	E; Mi; Ma	Marine, pelagic and aerial.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Gallinago hardwickii	Latham's Snipe	-	Mi	A variety of permanent and ephemeral wetlands, preferring open fresh water wetlands with nearby cover. Occupies a variety of vegetation around wetlands including wetland grasses and open wooded swamps. Can occur in habitats that have saline or brackish water, such as saltmarsh, mangrove creeks, around bays and beaches, and at tidal rivers. They are regularly recorded in or around modified or artificial habitats including pasture, ploughed paddocks, irrigation channels and drainage ditches and sewage and dairy farms. They can also	763	No. Suitable habitat not available within the subject site.	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
				occur in various sites close to humans or human activity (e.g. near roads, railways, airfields, commercial or industrial complexes).			
Gelochelidon nilotica	Gull-billed Tern	-	Mi	Freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grasslands.	15	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Hirundapus caudacutus	White-throated Needletail	-	V; Mi	Forages aerially over a variety of habitats usually over coastal and mountain areas, most likely with a preference for wooded areas. Has been observed roosting in dense foliage of canopy trees, and may seek refuge in tree hollows in inclement weather.	21	No. Suitable habitat not available within subject site. Not known from locality	No
Hydroprogne caspia	Caspian Tern	-	Mi	Coastal offshore waters, beaches, mudflats, estuaries, rivers, lakes.	32	Potential. Foraging habitat available within study area.	No. Negligible impact on foraging habitat for highly mobile species.
Limicola falcinellus	Broad-billed Sandpiper	V	Mi	Sheltered parts of the coast such as estuarine sandflats and mudflats, harbours, embayments, lagoons, saltmarshes and reefs.	2	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Limosa lapponica	Bar-tailed Godwit	-	Mi	Summer migrant to Australia. Widespread along the coast of NSW, including the offshore islands. Also numerous scattered inland records. Intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons, bays, seagrass beds, saltmarsh, sewage farms and saltworks, saltlakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms, and coral reef-flats. Rarely inland wetlands, paddocks and airstrips.	838	Potential. Foraging habitat available within study area.	No. Negligible impact on foraging habitat for highly mobile species.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Limosa lapponica menzbieri	Northern Siberian Bar-tailed Godwit,	-	CE	Occurs mainly in coastal habitats such as intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays as well as coastal sewage farms and saltworks, salt lakes and brackish wetlands near coasts, sandy ocean beaches, rock platforms and coral reef flats.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Limosa limosa	Black-tailed Godwit	V	Mi	Usually sheltered bays, estuaries and lagoons with large intertidal mudflats and/or sandflats. Further inland, it can also be found around muddy lakes and swamps.	11	Unlikely. Limited foraging habitat in subject site.	No. Highly mobile species. Impact considered negligible.
Macronectes giganteus	Southern Giant-Petrel	E1	E; Ma	Marine species.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Macronectes halli	Northern Giant Petrel	V	V; Ma	Marine species.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Merops ornatus	Rainbow Bee-eater	-	Mi	Open forests and woodlands, shrublands, farmland, areas of human habitation, inland and coastal sand dune systems, heathland, sedgeland, vine forest and vine thicket.	2	Unlikely.. Suitable habitat not present.	No.
Monarcha melanopsis	Black-faced Monarch	-	Mi	Habitat typically includes rainforest and eucalypt forests, with feeding occurring in tangled understorey.	0	Unlikely. Not known from locality. Suitable habitat not present.	No
Monarcha trivirgatus	Spectacled Monarch		Mi	Mountain/lowland rainforest, wooded gullies, riparian vegetation including mangroves.	0	Unlikely.	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
						Not known from locality. Suitable habitat not present.	
Motacilla flava	Yellow Wagtail	-	Mi	An insectivorous bird, inhabiting open country near water, such as wet meadows. It nests in tussocks.	0	No. Suitable habitat not available within subject site. Not known from locality	No
Myiagra cyanoleuca	Satin Flycatcher	-	Mi	Habitat typically includes wetter, denser forest, often at high elevations.	0	Unlikely. Not known from locality. Suitable habitat not present.	No
Numenius madagascariensis	Eastern Curlew	-	CE; Mi	Estuaries, bays, harbours, inlets and coastal lagoons, intertidal mudflats or sandflats, ocean beaches, coral reefs, rock platforms, saltmarsh, mangroves, freshwater/brackish lakes, saltworks and sewage farms.	28	No. Suitable habitat not available within subject site.	No
Numenius phaeopus	Whimbrel	-	Mi	Estuaries, mangroves, tidal flats, coral cays, exposed reefs, flooded paddocks, sewage ponds, grasslands, sports fields, lawns.	1	Unlikely.. Suitable habitat not present.	No.
Pachyptila turtur subantarctica	Fairy Prion (southern)	-	V	Marine bird, found in temperate and subantarctic seas. The Fairy Prion sometimes forages over continental shelves and the continental slope, but it can come close inshore in rough weather. It may also feed in deep coastal waters.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Pandion cristatus	Osprey	V	Mi	Rocky shorelines, islands, reefs, mouths of large rivers, lagoons and lakes.	4	No. Suitable habitat not available within subject site	No
Philomachus pugnax	Ruff (Reeve)	-	Mi	Terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and floodlands. Occasionally harbours, estuaries, seashores, sewage farms and saltworks.	0	Unlikely.	No

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
						Not known from locality. Suitable habitat not present.	
Plegadis falcinellus	Glossy Ibis	-	Mi	Edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation. Occasionally estuaries, deltas, saltmarshes and coastal lagoons.	79	Potential. Foraging habitat available within study area.	No. Negligible impact on foraging habitat for highly mobile species.
Pluvialis fulva	Pacific Golden Plover	-	Mi	Tidal reefs and pools; pebbly, shelly and sandy shores; mudflats; inland shallow waters; sewage ponds, saltfields; ploughed ground.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Pluvialis squatarola	Grey Plover	-	Mi	Mudflats, saltmarsh, tidal reefs and estuaries.	1	Potential. Foraging habitat available within study area.	No. Negligible impact on foraging habitat for highly mobile species.
Pluviatalis fulva	Pacific Golden Plover	-	Mi	Estuaries, mudflats, saltmarshes, mangroves, rocky reefs, inland swamps, ocean shores, paddocks, sewage ponds, ploughed land, airfields, playing fields.	291	Potential. Foraging habitat available within study area.	No. Negligible impact on foraging habitat for highly mobile species.
Rhipidura rufifrons	Rufous Fantail	-	Mi	It is a summer breeding migrant to southeastern Australia. It is found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation. Open country may be used by the Rufous Fantail during migration.	0	Unlikely. Not known from locality. Suitable habitat not present.	No
Sterna hirundo	Common Tern	-	Mi	Offshore waters, ocean beaches, estuaries, large lakes. Less commonly freshwater swamps, floodwaters, sewage farms and brackish and saline lakes.	24	Unlikely.. Suitable habitat not present.	No.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Sternula albifrons	Little Tern	E1	Mi	Sheltered coastal environments, harbours, inlets and rivers.	6	Unlikely.. Suitable habitat not present.	No.
Sternula nereis nereis	Australian Fairy Tern	-	V	Embayments of a variety of habitats including offshore, estuarine or lake islands, wetlands and mainland coastline. Nests on sheltered sandy beaches, spits and banks above the high tide line and below vegetation.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Thalassarche bulleri	Buller's Albatross	-	V; Ma	Inshore, offshore and pelagic waters.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Thalassarche cauta cauta	Shy Albatross	V	V; Ma	Marine species.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Thalassarche cauta steadi	White-capped Albatross	-	V; Ma	It occurs both inshore and offshore, and enters harbours and bays.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Thalassarche eremita	Chatham Albatross	V	E; Ma	Subantarctic and subtropical waters. It occurs both onshore and offshore, and enters harbours and bays.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Thalassarche impavida	Campbell Albatross	-	V; Ma	Subantarctic and subtropical waters from pelagic to shelf-break water habitats.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Thalassarche melanophris	Black-browed Albatross	V	V; Ma	Marine species.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Thalassarche salvini	Salvin's Albatross	-	V; Ma	Subantarctic and subtropical waters. It occurs both onshore and offshore, and enters harbours and bays.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Thinornis rubricollis rubricollis	Hooded Plover (eastern)	CE	V	Sandy ocean beaches, tidal bays and estuaries, rock platforms, rocky or sand-covered reefs, and small beaches in lines of cliffs. Also use near-coastal saline and freshwater lakes and lagoons.	0	Unlikely. Not known from locality. Suitable habitat not present.	No.
Tringa brevipes	Grey-tailed Tattler	-	Mi	Sheltered coasts with reefs and rock platforms or intertidal mudflats; intertidal rocky, coral or stony reefs; shores of rock, shingle, gravel or shells; embayments, estuaries and coastal lagoons; lagoons and lakes; and ponds in sewage farms and saltworks.	1	Unlikely.. Suitable habitat not present.	No.
Tringa glareola	Wood Sandpiper	-	Mi	Well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes; inundated grasslands; floodplains; irrigated crops; sewage ponds; reservoirs; large farm dams; bore drains; rarely brackish wetlands and saltmarsh.	3	Unlikely.. Suitable habitat not present.	No.
Tringa nebularia	Common Greenshank	-	Ma; Mi	Terrestrial wetlands (swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans, saltflats, sewage farms and saltworks dams, inundated rice crops and bores) and sheltered coastal habitats (mudflats, saltmarsh, mangroves, embayments, harbours, river estuaries, deltas, lagoons, tidal pools, rock-flats and rock platforms).	170	Potential. Foraging habitat available within study area.	No. Negligible impact on foraging habitat for highly mobile species.

Scientific Name	Common Name	BC Act	EPBC Act	Habitat Associations	Records	Likelihood of occurrence	Assessment of Significance required
Tringa stagnatilis	Marsh Sandpiper	-	Mi	Swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, intertidal mudflats, sewage farms and saltworks, reservoirs, waterholes, soaks, bore-drain swamps and flooded inland lakes.	41	Unlikely.. Suitable habitat not present.	No.
Xenus cinereus	Terek Sandpiper	V	Mi	Mudbanks and sandbanks near mangroves, rocky pools and reefs, and occasionally up to 10 km inland around brackish pools.	1	Unlikely. Suitable habitat not present.	No

CE = Critically Endangered, E = Endangered;, V = Vulnerable, Mi= Migratory, Ma = Marine

Appendix B Tests of Significance (BC Act)

Tests of significance in accordance with section 7.3 of the BC Act were undertaken for the following species which were determined to be potentially impacted by the proposed works (Appendix A):

- *Pteropus poliocephalus* (Grey-headed Flying-fox)
- *Falsistrellus tasmaniensis* (Eastern False Pipistrelle)
- *Miniopterus australis* (Little Bent-wing Bat)
- *Miniopterus orianae oceanensis* (Large Bent-winged Bat)
- *Mormopterus norfolkensis* (Eastern Coastal Free-tailed Bat)
- *Myotis macropus* (Southern Myotis)
- *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat)
- *Scoteanax rueppellii* (Greater Broad-nosed Bat)

A combined Test of Significance was undertaken for microchiropteran bats which have similar habitat requirements.

Table 9: Test of significance on *Pteropus poliocephalus* (Grey-headed Flying-fox)

BC Act	Question	Response
7.3.1 a)	In the case of a threatened species: whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	Factors likely to have an adverse effect on the life cycle of the Grey-headed Flying-fox would include a substantial loss and/or fragmentation of foraging habitat and loss of suitable roosting or breeding habitat. Given the proximity to a significant camp approximately 1.3 km to the north-west, it is likely that Grey-headed Flying-fox would utilize foraging resources within the study area. The breeding camp will not be directly impacted by the proposal and indirect impacts such as increased noise or disturbance during construction would be negligible considering that: the subject site is located 1.3 km from the camp; the study area is significantly developed and the camp is already located in an urbanized area. 0.02 ha of marginal foraging habitat in the form of planted native vegetation will be removed, which is considered negligible relative to similar urban vegetation available in the locality. The proposed projected artwork will have minor indirect impacts on potential foraging habitat within the native vegetation on the northern bank for three hours on a nightly basis. The works may deter some individuals from foraging during the project hours, however, considering the small time frame over which it will occur, the availability of similar habitat in the locality, and that the local camp would be accustomed to urban lighting, the works will not impact the long-term survival of this species in the locality.
7.3.1 b) i	In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: 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	N/A
7.3.1 b) ii	In the case of an endangered ecological community or critically endangered ecological community: Whether the proposed development or activity 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.	N/A
7.3.1 c) i	In relation to the habitat of a threatened species or ecological community: The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity	The proposed works remove 0.02 ha of marginal foraging habitat for the Grey-headed Flying-fox. Only minor indirect impacts will occur on habitat with the projected artwork.

BC Act	Question	Response
7.3.1 c) ii	In relation to the habitat of a threatened species or ecological community: Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity	No habitat for the Grey-headed Flying-fox will be fragmented or isolated as a result of the proposed works.
7.3.1 c) iii	In relation to the habitat of a threatened species or ecological community: 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 0.02 ha of marginal foraging habitat to be removed is considered negligible on a local scale relative to the similar urban native vegetation available within the locality. The proposed projected artwork will have minor indirect impacts on potential habitat for three hours on a nightly basis. The works may deter some individuals from foraging during the project hours, however, considering the small time frame over which it will occur, the availability of similar habitat in the locality, and that the local camp would be accustomed to urban lighting, the works will not impact the long-term survival of this species in the locality.
7.3.1 d)	Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).	The proposed development will not have an adverse effect on any declared area of outstanding biodiversity value.
7.3.1 e)	Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	One key threatening process was identified for the proposed works, *"Clearing of native vegetation"*. The proposed works will remove 0.02 ha of planted native vegetation. This will not contribute significantly to the key threatening processes that will not result in a decline of Grey-headed Flying-fox in the locality.
Conclusion	**Is there likely to be a significant impact?**	The proposed works are unlikely to have a significant impact on the Grey-headed Flying-fox.

Table 10: Test of significance on microchiropteran bats

BC Act	Question	Response
7.3.1 a)	In the case of a threatened species: whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction	*Falsistrellus tasmaniensis* (Eastern False Pipistrelle), *Miniopterus australis* (Little Bent-wing Bat), *Miniopterus orianae oceanensis* (Large Bent-winged Bat), *Mormopterus norfolkensis* (Eastern Coastal Free-tailed Bat), *Myotis macropus* (Southern Myotis), *Saccolaimus flaviventris* (Yellow-bellied Sheathtail-bat), and *Scoteanax rueppellii* (Greater Broad-nosed Bat) are considered to have potential foraging habitat within the native vegetation on the northern bank. Southern Myotis is likely to forage over the water within the Parramatta River, likely below the height of the light beam. Factors likely to have an adverse effect on the life cycle of the above listed microbats would include a substantial loss and/or fragmentation of foraging habitat and loss of suitable roosting or breeding habitat. The area of native vegetation to be indirectly affected by the projected artwork provides potential foraging habitat for those microbats listed above. The proposed projected artwork will have indirect impacts on potential foraging habitat within the native vegetation on the northern bank for three hours on a nightly basis. It is anticipated that the lights will deter microbats from foraging or flying through the project light area during the duration of the light show, however, considering the small time frame over which it will occur, the availability of similar habitat in the locality, and that the local camp would be accustomed to urban lighting, the works will not impact the long-term survival of these species in the locality. The works are unlikely to impact any maternity roosts for microbats.
7.3.1 b) i	In the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity: 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	N/A
7.3.1 b) ii	In the case of an endangered ecological community or critically endangered ecological community: Whether the proposed development or activity 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.	N/A
7.3.1 c) i	In relation to the habitat of a threatened species or ecological community:	The proposed works will not remove or permanently modify any habitat for and threatened microbats. Indirect impacts will occur on potential foraging habitat

BC Act	Question	Response
	The extent to which habitat is likely to be removed or modified as a result of the proposed development or activity	within the projected artwork area and flight paths may be affected during the duration of the light show.
7.3.1 c) ii	In relation to the habitat of a threatened species or ecological community: Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity	No habitat for threatened microbats will be fragmented or isolated as a result of the proposed works.
7.3.1 c) iii	In relation to the habitat of a threatened species or ecological community: 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 proposed projected artwork will have minor indirect impacts on potential habitat for three hours on a nightly basis. The works may deter some individuals from foraging during the project hours, however, considering the small time frame over which it will occur, the availability of similar habitat in the locality, and that the local populations of microbat would be accustomed to urban lighting, the works will not impact the long-term survival of this species in the locality.
7.3.1 d)	Whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly).	The proposed development will not have an adverse effect on any declared areas of outstanding biodiversity value.
7.3.1 e)	Whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.	The proposed works will not contribute to any key threatening processes that would impact the threatened microbats listed above.
Conclusion	Is there likely to be a significant impact?	The proposed works are unlikely to have a significant impact Eastern False Pipistrelle, Little Bent-wing Bat, Large Bent-winged Bat, Eastern Coastal Free-tailed Bat, Southern Myotis, Yellow-bellied Sheathtail-bat, and Greater Broad-nosed Bat.

Appendix C Significance Assessment (EPBC Act)

Table 11: Significance assessment on Grey-headed Flying-fox

Criterion	Question	Response
An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:		
1)	lead to a long-term decrease in the size of an important population of a species	The proposed will have minor indirect impacts to foraging habitat as a result of artificial lighting associated with the projected artwork. A known maternity camp is located in Parramatta Park approximately 1.3 km to the north-west. Foraging habitat is available within the study area within native vegetation on the northern bank. The proposed artificial lighting associated with the project artwork may act as a minor deterrent to foraging habitat for up to three hours on a nightly basis for this species. Additionally, the project will result in the removal of 0.02 ha of foraging habitat for the Grey-headed Flying-fox. However, the proposed works are unlikely to lead to a long term decrease in the size of an important population of Grey-headed Flying-fox.
2)	reduce the area of occupancy of an important population	Temporary indirect impacts to foraging habitat as a result of artificial lighting are unlikely to reduce the area of occupancy of an important population. Approximately 0.02 ha of marginal foraging habitat will be removed as a result of the proposed works is considered minor relative to available habitat along the Parramatta River in the locality.
3)	fragment an existing important population into two or more populations	The proposed action will not fragment the local population into two or more populations.
4)	adversely affect habitat critical to the survival of a species	The draft National Recovery Plan for the Grey-headed Flying-fox (DoEE 2017) defines habitat critical to the survival of the species as natural habitat that is: • productive foraging habitats linked by migration corridors or stopover habitats and camps within a nightly commuting distance of the foraging resources. • during winter and spring when food bottlenecks have been identified. The native vegetation on the northern bank is limited due to the surrounding residential land use and would provide only a small amount of potential foraging habitat. Vegetation within the study area is not considered to be critical to the survival of the species.
5)	disrupt the breeding cycle of an important population	A known breeding camp is located approximately 1.3 km to the north-west of the study area. The breeding cycle of this population will not be impacted by the proposed works.
6)	modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline	The loss of 0.02 ha of foraging habitat in the form of planted native trees is considered negligible, relative to available habitat within the locality. Indirect impacts of the proposal associated with artificial lighting will not modify, remove,

Criterion	Question	Response
		isolate or decrease the availability or quality of habitat to the extent that would cause the species to decline.
7)	result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat	The proposed works will not result in the establishment of an invasive species within the available habitat for the Grey-headed Flying-fox. A Vegetation Management Plan has been prepared for the vegetation on the northern bank which will manage weeds within Grey-headed Flying-fox habitat.
8)	introduce disease that may cause the species to decline, or	Grey-headed Flying-foxes are reservoirs for the Australian bat lyssavirus and can cause clinical disease and mortality in the species. The proposed action is unlikely to present a significant ecological stress on any camps or on individuals that may utilise the subject site and therefore the works are unlikely to introduce or exacerbate this virus or any other disease that may cause this species to decline.
9)	interfere substantially with the recovery of the species.	The proposed action will have only minor indirect impacts on the Grey-headed Flying-fox and is unlikely to interfere with the recovery of the species.
Conclusion	**Is there likely to be a significant impact?**	The proposed action is unlikely to have a significant impact on the Grey-headed Flying-fox.

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