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Nuwi Wetland Shadowing Assessment

Bay Park, 23 Bennelong Parkway

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Executive Summary

SMEC Australia Pty Ltd (SMEC) has been commissioned by Piety THP to revise a 2015 assessment of partial shadowing of the Nuwi Wetland Site opposite the proposed development of 'Bay Park', at 23 Bennelong Parkway, Wentworth Point (the proposal). This technical note assesses the potential impacts of the proposal on biodiversity values within the wetland arising from shadows that would cover the site for varying periods throughout the year.

The key findings of the revised assessment are as follows:

- Mapping and surveys of the site indicate that the Nuwi Wetland comprises three Plant community types: Estuarine Saltmarsh, Estuarine Swamp Oak Forest, and Estuarine Mangrove Forest. Estuarine Saltmarsh, and Estuarine Swamp Oak Forest are listed as Endangered Ecological Communities under the Biodiversity Conservation 2016 Act (BC Act).
- A review of the literature suggests that Estuarine Swamp Oak Forest, and Estuarine Mangrove Forest should be tolerant to the shading impacts of the proposed development.
- A review of the literature suggests that Estuarine Saltmarsh is sensitive to the effects of shading. However, Estuarine Saltmarsh is excluded as an Endangered Ecological Community if patches of saltmarsh within a mosaic (i.e. patches within 30 metres of each other) collectively are less than 0.1 hectares in size or if isolated patches are less than 0.1 ha in size. Estuarine Saltmarsh within the Nuwi Wetland form a mosaic of individual patches which collectively cover an area of 0.09 hectares and an isolated patch that covers an area of 0.03 hectares, and therefore is not considered to constitute an Endangered Ecological Community in this instance.
- The Nuwi Wetland site occurs in close proximity (<100 metres) to breeding habitat for the "important" Sydney Olympic Park Green and Golden Bell Frog population. The Nuwi Wetland site may provide habitat connectivity between breeding populations at Narawang Wetland and to the south-east of the site at Sydney Olympic Park.
- Assessments of significance on threatened flora and fauna under the Biodiversity Conservation 2016 Act (BC Act) and the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) showed there to be no significant impact upon threatened species with the potential to occur at the site as a result of shadowing by the Bay Park development.

1 Introduction

1.1 Overview

In 2014, SMEC Australia Pty Ltd (SMEC) was commissioned by Payce Communities Wentworth Point Pty Limited and SH FWT Development Pty Limited to undertake an assessment of the potential impacts to threatened biodiversity using the Nuwi Wetlands that could arise from shadows associated with the proposed 'Bay Park' residential high rise development on Bennelong Parkway, Wentworth Point. The Nuwi wetland is located to the south-west of the proposed development, on the opposite side of Bennelong Parkway to the proposal. This assessment was completed and a final report provided on the 8th of January 2015, with the report determining that it was unlikely that there would be any significant impacts on threatened biodiversity as a result of the proposed development.

On the 19th of March 2018, Alain Assoum, Development Manager with PIETY THP, the new owners of the site, contacted SMEC to undertake a revision of this assessment due to a redesign of the buildings. The changed design reduced the building considerations from three buildings to two, but increased building heights from the previous plans, resulting in an overall changed shading pattern for the Nuwi Wetlands.

This technical note details of the revision of the assessment that the revised proposed development may have on threatened biodiversity using the Nuwi Wetlands.

1.2 Assessment Aims

This report is an update of the Wetland Shadowing Assessment, Bay Park - 23 Bennelong Parkway, Homebush Bay (hereby referred to as the original report) provided to Payce Communities on the 8th of January 2015. This report is based on a site visit to the proposal area by a SMEC ecologist in 10th April 2014. This visit gathered in-depth site information, with particular attention to potential impacts upon threatened biodiversity.

The aims of this revised assessment are to:

- Undertake an updated desktop search for Endangered Ecological Communities (EECs), and all threatened flora and fauna relevant to the impacted area, Nuwi Wetland.
- Provide an updated review of the published literature.
- Identify and assess likely impacts to any EECs and threatened biodiversity within the wetland arising from the proposal's new shadow.
- An assessment of the likelihood of those threatened species, populations or ecological communities identified in the locality of with an assessed high or known likelihood of occurring within the study area.
- Assessment of whether the proposal will have or is likely to have a significant impact on threatened biodiversity as determined by state and national legislation – If threatened items are predicted to have a high likelihood of occurring or are known to occur within the study area.
- Consideration of the nature of the proposal and actual (direct and indirect) and cumulative impacts of the new proposal shadow on habitat requirements of the threatened species, populations or ecological communities within the study area.

1.3 The Site

Nuwi Wetland is located at the intersection of Bennelong Parkway and Hill Road, Wentworth Point. The wetland is roughly rectangular in shape, with the long edges oriented in an approximately north-east/south-west direction. The wetland is tidal and is fed through an inlet in the southern corner which connects with the Parramatta River.

The Nuwi Wetland is adjacent to the Sydney Olympic Park Archery Centre and an electrical substation. The wetland is bounded on two sides by roads and along the south-western edge by a grassed area and car park. A large telecommunications antenna is present within the centre of the wetland. A small brick hut, presumably associated with the antenna, is present in the eastern part of the wetland. There is an access road between the antenna and the hut which is likely to be reclaimed land. There also appears to be the remnants of an access road leading to the northern corner of the site. This is presumed to have been the access road used for construction of the antenna, as it appears from aerial photography to be unmaintained and no longer fully connects the antenna to the shoreline. Two concrete pads are present within the wetland for the purpose of anchoring the antenna's guy lines. These are also constructed upon reclaimed land.

1.4 Surrounding Land-use

The area surrounding the proposal is largely current or former industrial development, with large portions now converted into medium-high density residential. The wetland itself is bounded by Bennelong Parkway and industrial development on one side, with the remaining sides made up by Hill Road, the archery centre and other urban parklands (including the Millennium Parklands to the north and west). As part of the Wentworth Point Urban Activation Precinct proposal much of the land to the north-east has already been rezoned and developed for residential purposes.

Road reserves and other nearby urban spaces between industrial and residential development are generally landscaped and/or maintained as gardens or managed grass. Traffic volumes around the site appear moderate, with significant private vehicle use and regular bus services.

1.5 Landscape Context

The proposal area is located in the Sydney Basin Bioregion, Cumberland subregion. The proposal area is within the Auburn local government area and the Sydney Metropolitan Catchment. The topography of the proposal area is generally level coastal flats with elevation between zero and six metres AHD. The underlying geology of the site is Hawkesbury sandstone overlain by Quaternary sediments.

The Nuwi Wetland site may have formed part of larger wetland complex prior to land reclamation and urban development. The wetland maintains connectivity with the Millennium Parklands swamps through the watercourse in the western corner of the site (under Hill Rd).

Extensive wetlands, within Sydney Olympic Park, exist to the south-east, south and west of the site. Further, remnant native vegetation is present within the nearby Millennium Parklands. These wetlands may provide habitat and refuge sites for fauna that use the proposal area, such as migratory and resident shorebirds.

1.6 Legislative Context

Full detail of the legislative context of the proposal is provided in the EIS for the ‘Bay Park’ development.

2 Methods

2.1 Desktop Assessment

The likelihood of occurrence for threatened fauna and flora species, populations and ecological communities was determined for the Nuwi Wetland site (Attachment A). The ecological records were obtained from the:

- NSW Office of Environment and Heritage (OEH) Atlas of NSW Wildlife Database within a 10 kilometres of the proposal area.
- Commonwealth Department of the Environment and Energy (DotEE) Protected Matters Search Tool. The Protected Matters Search Tool documents all Matters of National Significance (MNES) within 10 km of site. MNES include threatened species, communities and migratory species which are listed under the Commonwealth EPBC Act.
- Sharing and Enabling Environmental Data (SEED) Database State Vegetation Type Map (OEH, 2018).
- NSW Department of Primary Industries Noxious Weeds List (DPI, 2013).

These records and an assessment of the habitat within the Nuwi Wetland site were used to determine the likelihood of a threatened biodiversity occurring in the study area.

The conservation significance of flora and fauna species and populations, and threatened ecological communities was determined according to both the BC Act and EPBC Act.

2.2 Site Visit

The site visit results presented in this report are based on the original survey undertaken on the 10th April 2014 by Jamie McMahon, a qualified ecologist at SMEC Australia. This site visit was undertaken to confirm on-site vegetation mapping where possible, and to obtain extra site details regarding the Nuwi Wetland site.

This site visit consisted of a general search for threatened flora species, non-threatened native and exotic flora species from the accessible perimeter of the Nuwi Wetland site. Access to parts of the Nuwi Wetland site was restricted. This prevented the areas near the antenna access roads and guy line pads from being inspected.

An additional site visit was undertaken on the 24th of August 2018 to determine if any significant changes had occurred in the study area since the initial site inspection. No significant changes were evident.

2.3 Flora and Fauna

The suitability of habitat within the Nuwi Wetland site for a range of threatened species was surveyed and assessed. Habitat characteristics considered that were included the presence of hollow bearing trees, fallen logs, leaf litter and other ground debris, drainage lines, the structure of vegetation communities and the presence of fruiting/flowering plant species.

While walking the perimeter of the site searches were carried out for opportunistic sightings of fauna and signs of fauna activity, such as tracks, scats, scratches and notches on trees, in order to identify the presence of common and threatened fauna species. All flora and fauna species, and signs indicating the presence of fauna were recorded (Appendices 1 and 2).

2.4 Limitations

Limitations to the flora and fauna surveys include:

- Access to the site was restricted by security perimeter fencing.
- While a fauna habitat assessment was undertaken along the perimeter of the site, full fauna surveys (i.e. trapping, spotlighting, call point counts and call playback etc.) were not undertaken.
- The likelihood of occurrence of flora and fauna at the site was informed by a desktop assessment supported by the noted habitat characteristics.

3 Results

3.1 Endangered Ecological Communities

3.1.1 Surrounding Landscape

Native vegetation in the vicinity of the wetland site is comprised of a mosaic of remnant estuarine saltmarsh and mangrove swamp interspersed between large areas of landscaping on naturally occurring and imported soil. Ten EECs were identified as occurring within 10 kilometres of the proposed development. A full list and description of the vegetation characteristics of the EECs derived from the database search is provided in Attachment A.

3.1.2 Within the Nuwi Wetland Site

Three Plant Community Type's (PCT's) are mapped as occurring within the Nuwi Wetland Site according to The Native Vegetation of the Sydney Metropolitan Area digital map (Version 3.0) (OEH, 2016):

- Estuarine Saltmarsh
- Estuarine Swamp Oak Forest
- Estuarine Mangrove Forest

Estuarine Swamp Oak Forest, a component of Swamp Oak Floodplain Forest of the NSW North Coast, Sydney Basin and South East Corner Bioregions, is listed as an EEC under the BC Act and vulnerable under the EPBC Act. Estuarine Saltmarsh conforms to Coastal Saltmarsh in the NSW North Coast, Sydney Basin and South East Corner Bioregions. If particular conditions are met, this PCT is considered to be an EEC under the BC Act (NSW conservation status) and under the EPBC Act (Commonwealth conservation status). In the case of Nuwi Wetland the Costal Saltmarsh is not considered to be an EEC as the isolated patches of saltmarsh cover less than 0.4ha (See Table 1).

Estuarine Mangrove Forest community is floristically and spatially closely related to other estuarine vegetation communities, particularly Estuarine Saltmarsh and Estuarine Swamp Oak Forest. Estuarine Mangrove Forest is protected under the Fisheries Management Act 1994 (FM Act). The PCT's, PCT code, a description of each PCT and the area covered by each PCT within the Nuwi Wetland Site are described in Table 1. The location of each PCT is mapped in Figure 1.

The presence of mapped Estuarine Swamp Oak Forest and Coastal Saltmarsh within the Nuwi Wetland site was not able to be confirmed by completing plots during a physical site inspection. However, the presence of both these EEC's is considered to be likely based upon the regional distribution, habitat requirements and ecology of these plant communities, as well as confidently identified using aerial photography of the site. The condition of these two communities is unknown.

Table 3-1: Plant Community Type, description, area covered and the conservation status of mapped vegetation communities within the Nuwi Wetland Site (EEC = Endangered ecological community; V=Vulnerable; E= Endangered).

PCT CODE	PLANT COMMUNITY TYPE	DESCRIPTION OF PLANT COMMUNITY TYPE	CONSERVATION STATUS		AREA COVERED (HECTARES)
	Conservation naming under the BC Act and the EPBC Act.		BC Act	EPBC Act	
1126	Estuarine Saltmarsh Coastal Saltmarsh in the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – BC Act Subtropical and Temperate Coastal Saltmarsh – EPBC Act	Saltmarshes consist of low succulent herbs and rushes on tidally inundated land. These marshes form plains that adjoin open water and mangroves. Throughout the marsh salinity varies greatly according to tidal influence, evaporation and fresh water accumulation. Some of the areas are flooded regularly, while at slightly higher elevations flooding is rare. After rain, fresh water accumulates and adds extra water to the marsh, leaving pools of standing water when the tide recedes. Chenopod species dominate areas more frequently inundated by the tides, while sea rush (*Juncus kraussii*) occupies the more elevated terrestrial margin. Local scalds occur in small depressions where intensely saline deposits accumulate from the evaporation of tidal waters preventing the growth of any plants at all (Keith 2004). The following are excluded from the Endangered Coastal Saltmarsh ecological community: • saltmarsh occurring in seepage zones on seacliffs and elevated rock platforms above the tidal limit and on elevated headlands subject to aerosolic salt, • saltmarsh occurring on inland saline soils with no tidal connection, • isolated patches of saltmarsh < 0.1 ha, • patches or areas of saltmarsh that contain > 50% weeds (i.e. patches must be dominated by native saltmarsh plant species to be the ecological community), • patches of saltmarsh (possibly senescent) within the coastal margin that are disconnected	N/A	N/A	Nuwi wetland contains an isolated patch and a mosaic of patches of Estuarine Saltmarsh. Mosaic of patches (within 30m of each other) – 0.09 ha Isolated patch (>30m from the mosaic) – 0.03 ha (Total - 0.12 ha)

PCT CODE	PLANT COMMUNITY TYPE	DESCRIPTION OF PLANT COMMUNITY TYPE	CONSERVATION STATUS		AREA COVERED (HECTARES)
		(either naturally or artificially) from a tidal regime but were once connected. However, should the patch be reconnected to the tidal regime (e.g. via removal of an artificial barrier, or constructing a pipeline under a roadway), then the patch becomes part of the ecological community, and existing infrastructure, land already permanently replaced with crops/pasture/ plantations, and human settlements.			
1234	Estuarine Swamp Oak Forest Swamp Oak Floodplain Forest of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions – BC Act Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community – EPBC Act	In the zonation from mangroves to terrestrial sclerophyll and mesophyll forests and woodlands, Estuarine Swamp Oak Forest occurs immediately above tidal influence. It fringes the margins of saline waterbodies that include rivers, lagoons and tidal lakes. Swamp Oak (*Casuarina glauca*) forms dense monospecific stands above a thick ground cover of salt tolerant herbs, rushes and sedges. The shrub layer is low-growing and sparse, comprising a mix of terrestrial species while others typical of wetlands. It is a community of relatively low species diversity. Estuarine Swamp Oak Forest is widespread along the coast of the Sydney basin where it is rarely found at more than two meters above sea level.	EEC	E	0.31 ha
920	Estuarine Mangrove Forest	Stands of mangroves form a low closed to open forest on mudflats in Sydney's harbour, river coves and estuaries. There are two mangrove species found in Sydney. Grey Mangrove (*Avicennia marina*) is the taller and more common, often seen in pure stands. Stands of Grey Mangrove comprise very few species other than the canopy, with the understorey mostly an open mudflat sometimes with scattered saltmarsh herbs. The second mangrove species is River Mangrove (*Aegiceras corniculatum*). It is more often a small tree or shrub found scattered amongst swathes of	N/A	N/A	2.17 ha

PCT CODE	PLANT COMMUNITY TYPE	DESCRIPTION OF PLANT COMMUNITY TYPE	CONSERVATION STATUS		AREA COVERED (HECTARES)
		Grey Mangrove or along upper reaches of coastal riverbanks. It occurs where freshwater influences from runoff or rivers cause lower salinity levels.			

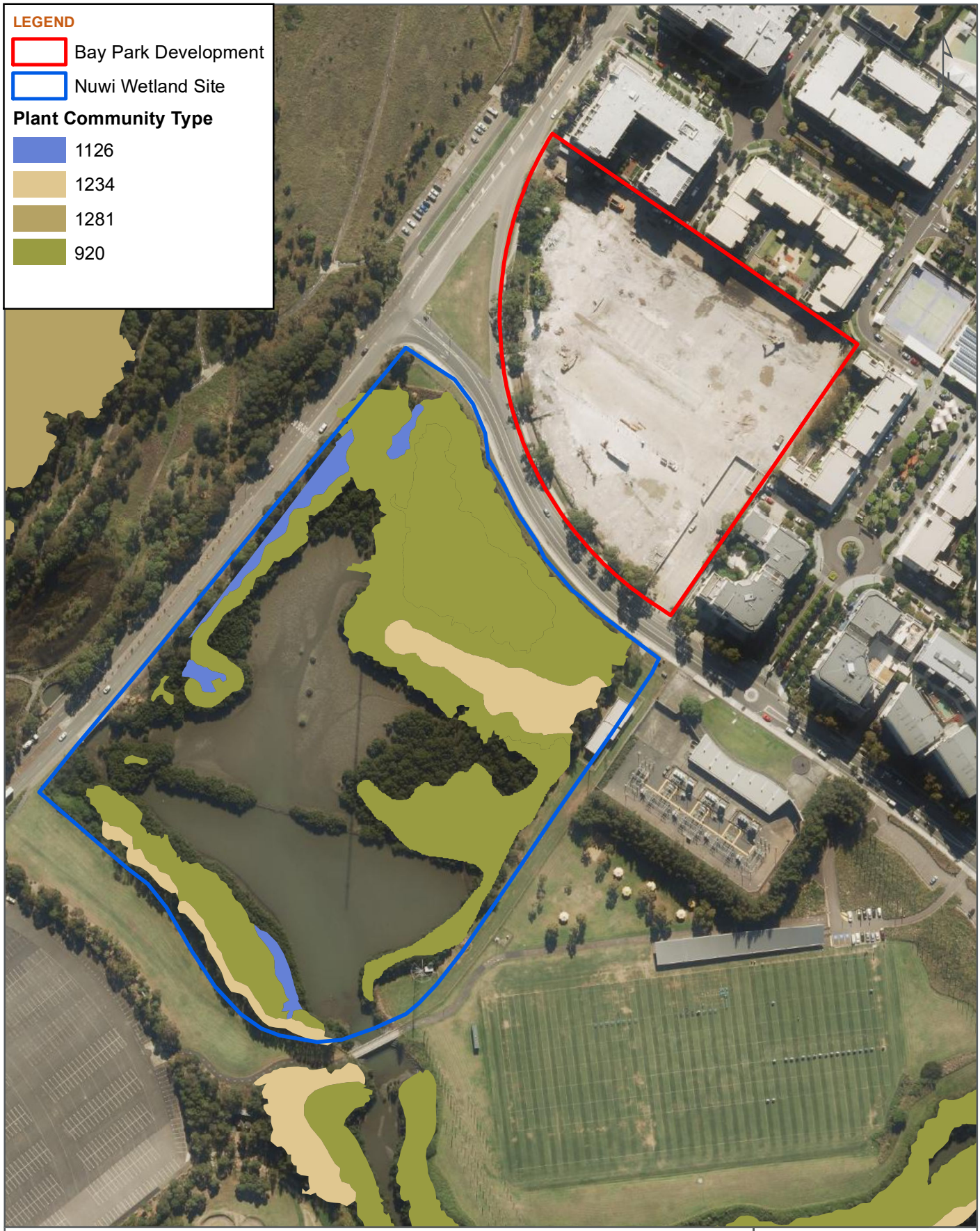

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FIG NO. 1

FIGURE TITLE Vegetation Community Type

PROJECT NO. 30012616

PROJECT TITLE Plant Community Types within the Nuwi Wetland Site.

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3.2 Flora

3.2.1 Threatened Flora

The database searches identified 28 flora species as having been recorded within 10 kilometres of the site, which are listed under the BC Act and/or the EPBC Act. One of these, the Narrow-leaved Wilsonia (*Wilsonia backhousei*), was deemed to have a moderate or higher likelihood of occurrence at Nuwi Wetland and was as such, subject to an assessment of significance (see Attachment A).

3.2.2 Exotic and weed species

Based on the original report and survey, several weed species are present within the Nuwi Wetland Site. Incursion by weeds was noted to be moderate to high. This was particularly the case at the junction between the mangrove forest and other adjacent managed lands and unmanaged lands i.e. adjacent to the wetland site perimeter fencing.

Exotic and weed species observed during the site visits included:

- Cobbler's Pegs (*Bidens pilosa*).
- Blackberry Nightshade (*Solanum nigrum*).
- Flaxleaf Fleabane (*Conyza bonariensis*).
- White Moth Vine (*Araujia sericifera*).
- Common Sowthistle (*Sonchus oleraceus*).
- Madeira vine (*Anredera cordifolia*)
- Morning Glory (*Ipomoea indica*)
- Firethorn *(Pyracantha sp*.)
- Asparagus Fern (*Asparagus aethiopicus*)
- Crofton weed (*Ageratina adenophora*)
- Scotch Thistle (*Onopordum acanthium*)
- Kikuyu (*Pennisetum clandestinum*)
- Purple top (*Verbena bonariensis*)
- Fennel (*Foeniculum vulgare*)
- Ruby dock (*Acetosa vesicaria*)
- Various seeded exotic grasses.

It was noted that some weed management is currently being undertaken at the site.

3.3 Fauna Habitat

The original report and site visit found the structural form of the estuarine mangrove forest around the perimeter of the open water to be largely intact and in good condition. This habitat would provide foraging and sheltering habitat for a range of birds (resident and migratory), mammals (including bats), and reptiles.

Several bird species commonly associated with urban wetland environments were observed during the original site visit. These included: Royal spoonbill (*Plataea regia*), White-faced Heron (*Egretta novaehollandiae*) and Purple swamphen (*Porphyrio porphyrio*) (Appendix B). The Eastern Bent-wing Bat (*Miniopterus schreibersii oceanensis*) and Southern Myotis (*Myotis macropus*) are insectivorous bats that may forage at the site occasionally. Grey-headed Flying-fox may also use the site as they are known to feed on mangrove leaves.

3.3.1 Threatened Fauna

The database searches identified 75 fauna species listed under the BC Act and/or the EPBC Act that have been recorded within 10 kilometres of the site (see t Appendix C). This included 3 species of amphibian, 71 birds, 12 mammals, 6 reptiles and two invertebrates of which one amphibian, 21 birds and four mammals were deemed to have a moderate or higher likelihood of occurrence at Nuwi Wetland and as such, were subject to assessments of significance (see Appendix D).

3.3.2 Green and Golden Bell Frog Habitat

The proposed area is within the historic range of the Green and Golden Bell Frog. The 'important' Sydney Olympic Park population of Green and Golden Bell Frog occurs within the same catchment as the Nuwi Wetland. Further,

Green and Golden Bell Frogs are known to breed 100 metres away in Narawang Wetland. The presence of the species in neighbouring water bodies provides an indicator of the likely use of the Nuwi Wetland by the Green and Golden Bell Frog. This site also provided connectivity between the neighbouring pond and Haslam's creek.

The Commonwealth Significant Impact Guidelines states that a habitat assessment should be the first step in assessing Green and Golden Bell Frog habitat and/or presence (Table 3-2).

Table 3-2: Habitat assessment for the Green and Gold Bell Frog following the Commonwealth Significant Impact Guidelines

CRITERION	RESPONSE
Is the site within the expected range of the species?	Yes
Are there records of the species within the local area/catchment?	Yes, Green and Golden Bell Frog are known to breed 100m away in the Narawang Wetland. The Sydney Olympic Park population of Green and Golden Bell Frog occurs in the neighbouring water bodies.
Does the site support potentially suitable habitat for the species?	Yes, but only in the form of foraging habitat around the permanent tidal wetland located within the proposal area.
Are there other frog species on site? If so, what species?	Frog surveys were not carried out on site, but none would be anticipated given the saline conditions.
What vegetation occurs on and around the site?	Vegetation at the site is comprised primarily of Estuarine Saltmarsh, Estuarine Swamp Oak Forest and Estuarine Mangrove Forest. The Estuarine Mangrove Forest contains Grey Mangrove (*Avicennia marina*). The site is surrounded by roads, urban development and mowed grass.
How close is the nearest water body?	The site itself is a waterbody. The next nearest freshwater body is approximately 100m away. Outflow from the neighbouring pond flows out through the Nuwi wetland into Haslams Creek
How many water bodies occur within 10 kilometres?	More than 15 waterbodies occur within a 10km radius.
Is there habitat connectivity (terrestrial or aquatic) between water bodies on site, and between on-site water bodies and those on neighbouring sites?	Stormwater outflow from the neighbouring pond flow out through the Nuwi wetland into Haslams Creek. This indicates the potential habitat connectivity importance of the Nuwi Wetland at local and regional scales, albeit in a partly saline environment.
Is there any evidence of disturbance on site? Has this habitat been modified as a result of previous development actions?	Previous development actions on-site include the construction of a telecommunications antenna and access road.
Are water bodies infested with mosquito fish or other predatory species that prey on green and golden bell frogs?	The present of Mosquito fish (Gambusia) was not confirmed during the survey. However, Gambusia exist in the nearby Narawang wetland. They are unlikely to be present given the tidal environment present.
Are there other threats to green and golden bell frogs occurring on site?	Not known to be any.

3.4 On-site disturbance/developments

Antenna access road

Inspection of this area was not fully possible due to access restrictions. The nearest point for viewing was about 15 metres away at the rear of the electrical substation, and as such a positive identification could not be confirmed.

Surrounding fringe of wetland

Due to its proximity to the perimeter fence it was possible to inspect this area during the visit. The inspection confirmed that it is unlikely that this area constitutes Estuarine Swamp Oak Forest, as it is generally comprised of only single row of planted *Casuarina glauca* for its entire length. Aside from the presence of adjacent grey mangroves in the main body of the wetland this fringe also lacked other diagnostic species typical of this ecological community.

The presence of mapped Estuarine Swamp Oak (equivalent to Swamp Oak Floodplain Forest EEC) in the centre of the shadowed site was not able to be confirmed during our site inspection. However, the presence of Estuarine Swamp Oak within the Nuwi Wetland site is considered unlikely based upon absence of the same community mapped along the fringes of the site.

4 Potential Impact of Shadows on the Nuwi Wetland Site

4.1 Area of Wetland Affected

Based upon shadow diagrams supplied by the proponent, the Nuwi Wetland site is partially covered by shade from the proposed development for varying portions of the day, depending on the time of the year. Table 4-1 provides details on the area and percentage of the site likely to be affected at different times throughout the year.

Table 4-1: Amount of Nuwi Wetland affected by shadow throughout the day at different times throughout the year.

TIME OF DAY	TOTAL AREA OF WETLAND AFFECTED BY SHADOW (M^2)	TOTAL PERCENTAGE OF WETLAND AFFECTED BY SHADOW
Total area of Nuwi Wetland: 66,700 m^2		
Summer solstice (21 December)		
9:00 am	1,959	2.94%
10:00 am	808	1.21%
11:00 am		0.00%
12:00 pm		0.00%
1:00 pm		0.00%
2:00 pm		0.00%
3:00 pm		0.00%
Equinox (21 March and 22 September)		
9:00 am	5,547	8.32%
10:00 am	4,920	7.38%
11:00 am	2,342	3.51%
12:00 pm	836	1.25%
1:00 pm	100	0.15%
2:00 pm		0.00%
3:00 pm		0.00%
Winter solstice (21 June)		
9:00 am	21,704	32.54%
10:00 am	16,827	25.22%
11:00 am	8,833	13.24%
12:00 pm	4,721	7.08%
1:00 pm	1,110	1.66%
2:00 pm		0.00%
3:00 pm		0.00%

Source: Turnerstudio

The amount of time and extent of shading caused by the proposed development increases towards the winter solstice. This would be the maximum point for shadow effects throughout the year, with just over 32 percent of the wetland site shaded by the proposed development at 9:00 am. The area affected declines throughout the day in winter, with only about seven per cent affected at midday. By 2:00pm in winter no part of the wetland would be affected by shadow. During the summer solstice the amount affected is less, with about three per cent affected at 9:00 am (Table 4-1).

4.2 Impacts of Shading on Vegetation Communities

Changes in the distribution of estuarine vegetation in NSW has been attributed to natural phenomena, such as storms, and human activities such as dredging, reclamation, shoaling and shading from structures and increase in stormwater discharge (West *et al*. 2000). Little research has been conducted to quantify the effects of shading by buildings on Estuarine vegetation, particularly in Australia. However, the shading from structures can potentially degrade habitat function and result in physical alterations to community structure, vegetation cover and biomass (Clark & Robinson, 2006). Impacts of shading are likely to be driven by: availability of photosynthetically available light, and the climatic and microclimatic requirements of the plant species being impacted.

4.2.1 Estuarine Mangrove Forest

The original report and site visit found the Estuarine Mangrove Forest to be dominated by Grey Mangrove (*Avicennia marina*). Grey Mangrove fringes the north-western border of the Nuwi Wetland site, along Bennelong Parkway. This stand of Grey Mangrove is comprised of very few species. This section of vegetation within the Nuwi Wetland site will experience shading by the proposed development for the longest period of time. To our knowledge, little research has been conducted to quantify the effects of shading by physical structures, such as buildings, on Grey Mangrove in Australia. However, research in Australia indicates that Grey Mangrove exhibit photosynthetic responses to changes in irradiance (light), with leaves being able to adapt to partial shade conditions (Ball and Critchely 1982). A study by Clark and Allaway (1993) on Grey Mangrove indicates that seedling densities and survival under canopies (i.e. in full shade) or in canopy gaps (i.e. in sun) are not significantly different. However, seedling growth and density of saplings were greater in canopy gaps. Given that mangroves will only be partially shaded for a proportion of the day by the proposed development, even during the winter solstice, the overall impact upon survival, growth rates and photosynthetic responses of Grey Mangrove within Nuwi Wetland is not expected to be significant.

4.2.2 Estuarine Swamp Oak Forest

The section of Estuarine Swamp Oak Forest within the Nuwi Wetland site would be shaded during the months approaching the winter solstice (June 21) approximately from dawn to 11am. The Estuarine Swamp Oak Forest is likely to be dominated by *Casuarina glauca*. *C. glauca* is known to be tolerant to partial shade. As such it is not expected that *C. glauca* individuals present at the site will significantly affected.

4.2.3 Estuarine Saltmarsh

Estuarine saltmarshes consist of low succulent herbs, rushes and salt-tolerant grasses on tidally inundated land. Estuarine saltmarsh occurs in intertidal zones that are permanently or intermittently open to inundation by marine tides. Saltmarsh ecosystems provide a wide array of benefits to coastal populations, including shoreline protection, fishery support, water quality improvement, wildlife habitat provision, and carbon sequestration. Historically, the major threat globally to salt marshes was filling for agricultural fields or urban construction, which continues as coastlines develop today (Hansen and Reiss 2015). Many examples of Estuarine Saltmarsh that remain in Sydney are small in size, highly fragmented and patchy in distribution.

To our knowledge, little research has been conducted to quantify the effects of shading by physical structures, such as buildings, on Estuarine saltmarsh in Australia. However, shading by buildings is believed to contribute to the degradation and loss of saltmarsh habitat in Australia. Previous studies in salt marsh habitat dominated by *Spartina alterniflora* in the USA have demonstrated how the shading produced by physical structures (e.g. docks) cause physical and biological alteration to saltmarsh habitat through the thinning of the vegetated canopy (see Merkey et al., 2005 and references therein, Clark & Robinson, 2006). This thinning increases predation risk to juvenile inhabitants sheltering and feeding in the marsh, causes habitat fragmentation and decreases food availability in the form of detritus and algae (Clark & Robinson, 2006). *Spartina alterniflora*, the dominant salt marsh plant in the study by Clark & Robinson (2006) is particularly sensitive to shading impacts and shading from docks would occur over a longer period then the proposed development. The estuarine saltmarsh in Australia is similarly likely to be sensitive to

shading impacts considering that the community tends to be distributed in open habitat in areas where little shading occurs.

The review of the literature (above) suggests that Estuarine Saltmarsh may be sensitive to the effects of shading. However, Estuarine Saltmarsh is excluded as an EEC if patches of saltmarsh within a mosaic (i.e. patches within 30 m of each other) collectively are less than 0.1 ha in size or if isolated patches are less than 0.1 ha in size. Estuarine Saltmarsh within the Nuwi Wetland form a mosaic of individual patches which collectively cover an area of 0.09 ha and an isolated patch that covers an area of 0.03 ha, and therefore is not considered to constitute an EEC in this instance.

4.2.4 Impacts of Shading on Threatened Flora

Based upon the results of the desktop searches undertaken prior to the site inspection several threatened flora species were identified as having the potential to be present within the affected portion of the Nuwi Wetland site (Appendix C). Assessments of significance under both the NSW BC Act and the Commonwealth EPBC Act have been carried out (Appendix D). These assessments show that there is not likely to be a significant impact upon any threatened flora species as a result of the partial shadowing of the wetland site by the proposal.

4.3 Impacts of Shading on Fauna

4.3.1 Threatened fauna

Based upon the results of the desktop searches undertaken prior to the site inspection several threatened species were identified as having the potential to be present within the affected portion of the Nuwi Wetland site. Assessments of significance under both the NSW BC Act and the Commonwealth EPBC Act have been carried out (Appendix D). These assessments show that there is unlikely to be a significant impact upon any threatened species or community as a result of the partial shadowing of the wetland site by the proposal.

4.4 Cumulative Impacts

A high existing level of anthropogenic activity occurring in and around the proposal area may alter or change the biophysical and ecological processes supporting biodiversity within the Nuwi Wetland site. While these other anthropogenic activities are not a direct or indirect result of the proposed development, the cumulative effects of these activities may impact the Nuwi Wetland site in the future.

Cumulative impacts at the Nuwi Wetland site that may arise from the proposed development and other anthropogenic impacts include:

- A decline in biodiversity habitat values and condition of vegetation in the wetland through the introduced weeds that are more shade tolerant.
- Changes in vegetation community assemblages and spatial arrangements due to the increased shading.
- An increases in local noise, vibration, light and other human activity, particularly from increased traffic adjacent to the Nuwi Wetland site.
- Decline in air and/or water quality arising from construction activities associated with this and other nearby urban development activities.

The severity of potential cumulative impacts in the area are likely to be contingent upon the timing and scale of other developments. From the concept level information available in the Wentworth Point Master Plan and the Sydney Olympic Park Master Plan, the scale of nearby development seems to be of a medium to high density nature

5 Conclusion and Recommendations

The key findings of this technical note are as follows.

- Mapping and surveys of the site indicate that the Nuwi Wetland comprises three Plant community types: Estuarine Saltmarsh, Estuarine Swamp Oak Forest, and Estuarine Mangrove Forest. Estuarine Saltmarsh, and Estuarine Swamp Oak Forest are listed as EECs under the *Biodiversity Conservation 2016 Act* (BC Act).
- A review of the literature suggests that Estuarine Swamp Oak Forest, and Estuarine Mangrove Forest should be tolerant to the shading impacts of the proposed development.
- A review of the literature suggests that Estuarine Saltmarsh may be sensitive to the effects of shading. However, Estuarine Saltmarsh is excluded as an EEC if patches of saltmarsh within a mosaic (i.e. patches within 30 m of each other) collectively are less than 0.1 ha in size or if isolated patches are less than 0.1 ha in size. Estuarine Saltmarsh within the Nuwi Wetland form a mosaic of individual patches which collectively cover an area of 0.09 ha and an isolated patch that covers an area of 0.03 ha, and therefore is not considered to constitute an EEC in this instance.
- The Nuwi Wetland site occurs in close proximity (<100 metres) to breeding habitat for the “important’ Sydney Olympic Park Green and Golden Bell Frog population. The site may provide habitat connectivity between breeding populations at Narawang Wetland and to the south-east of the site at Sydney Olympic Park.

Assessments of significance on threatened flora and fauna under the BC Act and the EPBC Act showed there to be no significant impact upon threatened species with the potential to occur at the site arising from shadowing from the Bay Park development

6 References

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Appendix A Recorded fauna during the site visit

LATIN NAME	COMMON NAME
Egretta novaehollandiae	White-faced Heron
Corvus coronoides	Australian Raven
Cracticus tibicen	Australian Magpie
Manorina melanocephala	Noisy Miner
Grallina cyanoleuca	Magpie Lark
Pelecanus conspicillatus	Australian Pelican
Rhipidura leucophrys	Willie Wagtail
Acridotheres tristis	Indian Myna
Platalea regia	Royal Spoonbill
Threskiornis moluccus	Australian White Ibis

Appendix B Recorded flora during the site visit

* denotes exotic species

LATIN NAME	COMMON NAME
Avicennia marina	Grey Mangrove
Foeniculum vulgare	Fennel
*Araujia sericifera**	White Moth Vine
Asparagus aethiopicus	Asparagus Fern
Lomandra longifolia	Spiny-head Mat-rush
Ageratina adenophora	Crofton Weed
*Conyza bonariensis**	Fleabane
*Bidens pilosa**	Cobbler's Pegs
*Sonchus oleraceus**	Common Sowthistle
*Anredera cordifolia**	Madeira Vine
Jacaranda mimosifolia	Jacaranda
Casuarina glauca	
Casuarina cunninghamiana	
Einadia hastata	
*Ipomoea indica**	Morning Glory
Acacia decurrens	Green Wattle
Acacia floribunda	
Acacia implexa	
Juncus sp.	
Passiflora herbertiana	Native Passionfruit
Pittosporum undulatum	
*Pennisetum clandestin um**	Kikuyu
Paspalum sp.	
*Acetosa vesicaria**	Ruby Dock
*Pyracantha sp.**	Firethorn
*Solanum nigru m**	Blackberry Nightshade
*Verbena bonariensis**	Purple Top
*Lantana camara**	
*Lantana camara**	Water Vine
Cayratia clematidea	Native Grape

LATIN NAME	COMMON NAME
Dianella caerulea	Blue Flax-lily

Appendix C Likelihood of Occurrence

Table A presents a description of the likelihood of occurrence table. Table B presents the likelihood of occurrence assessment of threatened flora and fauna species, threatened communities and migratory species listed under either the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) or the *Biodiversity Conservation Act 2016* (BC Act). A Protected Matters Search (PMST 488QKE) and a BioNet Search (10X10 km) were conducted to assess which species may occur at the site.

Table A. Description of likelihood of occurrence table

Likelihood rating	Threatened flora and fauna criteria
Known	The species was observed within the study area.
High	It is likely that a species inhabits or utilises habitat within the study area.
Moderate	Potential habitat for a species occurs on the site. Adequate field survey would determine if there is a 'high' or 'low' likelihood of occurrence for the species within the study area.
Low	It is unlikely that the species inhabits the study area.
None	The species has not been recorded within the study area and habitat within the study area is unsuitable for the species.

Table B. Likelihood of occurrence of matters listed under the EPBC Act 1999 or the BC Act 2016 at Nuwi Wetland

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
Listed Threatened Ecological Communities							
Blue Gum High Forest in the Sydney Basin Bioregion		E4B	CE		Blue Gum High Forest is restricted to areas with deep clay soils that are derived from shale and predominantly associated with Wianamatta Shale, although the parent geology may also be Hawkesbury Sandstone or the Mittagong Formation	Low	This community is unlikely to be present at Nuwi Wetland as it is unlikely to occur in intertidal, highly saline environments.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion		V2			Occurs almost exclusively on soils derived from Tertiary alluvium, or on sites located on adjoining shale or Holocene alluvium.	Low	This community is unlikely to be present at Nuwi Wetland as it is unlikely to occur in intertidal, highly saline environments.
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community			E		Occurs on coastal flats, floodplains, drainage lines, lake margins, wetlands and estuarine fringes where soils are at least occasionally saturated, water-logged or inundated.	High	This community is likely to be present at Nuwi Wetland.
Coastal Upland Swamp in the Sydney Basin Bioregion		E3			Occurs 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.	Low	This community is unlikely to be present at Nuwi Wetland as it is unlikely to occur in intertidal, highly saline environments.
Cooks River/Castlereagh Ironbark Forest in the Sydney Basin Bioregion		E3			Has a very restricted natural distribution and mainly occurs on clay soils derived from the deposits of ancient river systems (alluvium), or on shale soils of the Wianamatta Shales.	Low	This community is unlikely to be present at Nuwi Wetland as it is unlikely to occur in intertidal, highly saline environments.
Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest		E4B	CE		The Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest typically occurs on flat to undulating or hilly terrain, at elevations up to approximately 350 metres above sea level.	Low	This community is unlikely to be present at Nuwi Wetland as it is unlikely to occur in intertidal, highly saline environments.
Shale gravel Transition Forest in the Sydney Basin Bioregion		E3	CE		Occurs primarily where shallow deposits from ancient river systems overlay shale soils, but also associated with localised concentrations of iron-hardened gravel.	Low	This community is unlikely to be present at Nuwi Wetland as it is unlikely to occur in intertidal, highly saline environments.
Subtropical and Temperate Coastal Saltmarsh			V		Occurs in coastal areas under regular or intermittent tidal influence	High	This community may be present at Nuwi Wetland, however, patch size at the site is unlikely to meet the minimum patch

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
							size thresholds for classification of ecological community.
Turpentine-Ironbark Forest in the Sydney Basin Bioregion		E3	CE		Occurs in moderately wet areas, with annual rainfall of 800-1100 mm/year, on clay soils derived from Wianamatta Shale. Occurs on relatively high fertility soils.	Low	This community is unlikely to be present at Nuwi Wetland as it is unlikely to occur in intertidal, highly saline environments.
Western Sydney Dry Rainforest in the Sydney Basin Bioregion/Western Sydney Dry Rainforest and Moist Woodland on Shale		E3	CE		It is generally found on shale soil in the Cumberland Plain, generally on gullies, sheltered slopes and rugged terrain in isolated patches	Low	This community is unlikely to be present at Nuwi Wetland as it is unlikely to occur in intertidal, highly saline environments.
Flora							
Acacia bynoeana	Bynoe's Wattle	E1	V	1	Occurs in heath or dry sclerophyll forest on sandy soils. Seems to prefer open, sometimes slightly disturbed sites such as trail margins, edges of roadside spoil mounds and in recently burnt patches. Associated overstorey species include Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat. It is not known to occur in intertidal, highly saline environments.
Acacia clunies-rossiae	Kanangra Wattle	V		1	Grows in dry sclerophyll forest on skeletal soils on rocky slopes, or on alluvium along creeks.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat and is located outside of its known distribution. It is not known to occur in intertidal, highly saline environments.
Acacia pubescens	Downy Wattle	V	V	78	Occurs on alluviums, shales and at the intergrade between shales and sandstones. The soils are characteristically gravely soils, often with	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
					ironstone. Occurs in open woodland and forest, in a variety of plant communities, including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.		suitable habitat. It is not known to occur in intertidal, highly saline environments.
Acacia terminalis subsp. *terminalis MS*	Sunshine Wattle	E	E	5	Sunshine Wattle is found in open coastal eucalypt woodland or forest, usually in sandy soil on creek banks, hill-slopes or in shallow soil in rock crevices and sandstone platforms on cliffs.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat and is located outside of its known distribution. It is not known to occur in intertidal, highly saline environments.
Allocasuarina glareicola		E	E	0 (PMST)	This species grows on tertiary alluvial gravels, with yellow clayey subsoil and lateritic soil. These soils are low in fertility and are strongly to very strongly acidic. Rainfall in the area is lower than surrounding regions.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat and is located outside of its known distribution. It is not known to occur in intertidal, highly saline environments.
Asterolasia elegans		E	E	0 (PMST)	Occurs on Hawkesbury sandstone. Found in sheltered forests on mid- to lower slopes and valleys, e.g. in or adjacent to gullies which support sheltered forest. The canopy at known sites includes Turpentine, Smooth-barked Apple, Sydney Peppermint, Forest Oak and Christmas Bush.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat and is located outside of its known distribution. It is not known to occur in intertidal, highly saline environments.
Caladenia tessellata	Thick-lipped Spider-orchid, Daddy Long-legs	E	V	1	Requires low, dry sclerophyll woodland with a heathy or sometimes grassy understorey on clay loams or sandy soils, specifically in dry, low Brittle Gum (Eucalyptus mannifera), Inland Scribbly Gum (E. rossii) and Allocasuarina spp. woodland with a sparse understorey and stony soil.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat and is located outside of its known distribution. It is not known to occur in intertidal, highly saline environments.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	0 (PMST)	The Leafless Tongue-orchid has been reported to occur in a wide variety of habitats including heathlands, heathy woodlands, sedgelands, Xanthorrheoa spp. plains, dry sclerophyll forests (shrub/grass sub-formation and shrubby sub-formation), forested wetlands, freshwater wetlands, grasslands, grassy woodlands, rainforests and wet sclerophyll forests (grassy sub-formation). Soils are generally considered to be moist and sandy, however, this species is also known to grow in dry or peaty soils.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat and is located outside of its known distribution. It is not known to occur in intertidal, highly saline environments.
Darwinia biflora		V	V	3	Occurs on the edges of weathered shale-capped ridges, where these intergrade with Hawkesbury Sandstone. Associated overstorey species include *Eucalyptus haemastoma*, *Corymbia gummifera* and/or *E. squamosa*. The vegetation structure is usually woodland, open forest or scrub-heath.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat and is located just to the south of its known distribution. It is not known to occur in intertidal, highly saline environments.
Deyeuxia appressa		E	E	0 (PMST)	Given that *D. appressa* hasn't been seen in over 60 years, almost nothing is known of the species' habitat and ecology.	Low	This species is unlikely to be present at Nuwi Wetland as the site is unlikely to support suitable habitat. It is not known to occur in intertidal, highly saline environments.
Eucalyptus camfieldii	Camfield's Stringybark	V	V	1	Occurs mostly in small scattered stands in exposed situations on sandstone plateaus, ridges and slopes near the coast, often on the boundary of tall coastal heaths or low open woodland. Requires shallow sandy soils.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat. It is not known to occur in intertidal, highly saline environments.
Eucalyptus nicholii	Narrow-leaved Black Peppermint	V	V	1	Typically grows in dry grassy woodland, on shallow soils of slopes and ridges. Found primarily on	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
					infertile soils derived from granite or metasedimentary rock.		suitable habitat. It is not known to occur in intertidal, highly saline environments.
Eucalyptus scoparia	Wallangarra White Gum	E1	V	1	Found in open eucalypt forest and woodland on well-drained granite hilltops, slopes and rocky outcrops, typically at high altitudes. Only known from 3 locations near Tenterfield.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat and is located outside of its known distribution. It is not known to occur in intertidal, highly saline environments.
Genoplesium baueri	Bauer's Midge Orchid	E1	E	5	Grows in dry sclerophyll forest and moss gardens over sandstone.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat. It is not known to occur in intertidal, highly saline environments.
Hibbertia spanantha			CE	0 (PMST)	Grows in forest with canopy species including *Eucalyptus pilularis, E. resinifera*, *Corymbia gummifera* and *Angophora costata*. The understorey is open with species of Poaceae, Orchidaceae, Fabaceae and Liliaceae.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat. It is not known to occur in intertidal, highly saline environments.
Hypsela sessiliflora			Extinct	2	Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone.	Low	This species is unlikely to be present at Nuwi Wetland as the site is likely to be to saline for this species. It is not known to occur in intertidal, highly saline environments.
Leptospermum deanei	Deane's Tea-tree	V	V	1	Woodland on lower hill slopes or near creeks. Sandy alluvial soil or sand over sandstone.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat and is located outside of its known distribution. It is not known to occur in intertidal, highly saline environments.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
Melaleuca biconvexa	Binconvex Paperbark	V		1	Biconvex Paperbark generally grows in damp places, often near streams or low-lying areas on alluvial soils of low slopes or sheltered aspects.	Low	Nuwi Wetland is located outside of this species' known distribution.
Melaleuca deanei	Deane's Paperbark	V	V	2	The species grows in heath on sandstone.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat. It is not known to occur in intertidal, highly saline environments.
Pelargonium sp. Striatellum	Omeo Stork's-bill	E	E	0 (PMST)	This species occurs in Victoria and New South Wales. Normally located in habitat just above high water mark of ephemeral lakes and can colonise exposed lake beds.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat and is located outside of its known distribution. It is not known to occur in intertidal, highly saline environments.
Persoonia hirsuta	Hairy Geebung	E1	E	2	*Persoonia hirsuta* occurs in dry sclerophyll forest and woodland with a shrubby understorey. It also favours disturbed heath, shrubby thickets and sandstone scrubs.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat. It is not known to occur in intertidal, highly saline environments.
Persoonia nutans	Nodding Geebung	E	E	0 (PMST)	The Nodding Geebung has a disjunct distribution that is presumably influenced by soil type. The species is confined to aeolian and alluvial sediments, below 60 m above sea level.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat and is located outside of its known distribution.
Pimelea curviflora var. curviflora		V	V	5	Occurs on shaley/lateritic soils over sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands. Also recorded in Illawarra Lowalnd Grassy Woodland habitat at Albion Park on the Illawaraa coastal plain.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat. It is not known to occur in intertidal, highly saline environments.
Pimelea spicata	Spiked Rice-flower	E	E	0 (PMST)	In both the Cumberland Plain and Illawarra environments this species is found on well-	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
					structured clay soils. On the Cumberland Plain sites it is associated with Grey Box communities (particularly Cumberland Plain Woodland variants and Moist Shale Woodland) and in areas of ironbark.		suitable habitat. It is not known to occur in intertidal, highly saline environments.
Prostanthera marifolia	Seaforth Mintbush	E4A	CE	2	Occurs in localised patches in or in close proximity to the endangered Duffys Forest ecological community. Located on deeply weathered clay-loam soils associated with ironstone and scattered shale lenses, a soil type which only occurs on ridge tops and has been extensively urbanised.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat. It is not known to occur in intertidal, highly saline environments.
Pterostylis saxicola	Sydney Plains Greenhood	E	E	1	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat. It is not known to occur in intertidal, highly saline environments.
Syzygium paniculatum	Magenta Lilly Pilly	E1	V	3	On the central coast Magenta Lilly Pilly occurs on gravels, sands, silts and clays in riverside gallery rainforests and remnant littoral rainforest communities.	Low-Moderate	This species may be present at Nuwi Wetland as the site supports potential habitat.
Tetratheca juncea	Black-eyed Susan	V	V	1	It is usually found in low open forest/woodland with a mixed shrub understorey and grassy groundcover. However, it has also been recorded in heathland and moist forest.	Low	This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat. It is not known to occur in intertidal, highly saline environments.
Thesium australe	Austral Toadflax		V	0 (PMST)	Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast.		This species is unlikely to be present at Nuwi Wetland as the site supports no suitable habitat. It is not known to occur in intertidal, highly saline environments.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
Wilsonia backhousei	Narrow-leafed Wilsonia	V		98	Wilsonia backhousei is salt tolerant and is found in intertidal saltmarshes and, more rarely, on seacliffs.	High	This species is likely to be present at Nuwi Wetland as the site supports suitable habitat. This species is known to occur along Haslam's Creek and at the Waterbird Refuge wetland in Sydney Olympic/Bicentennial Park.
Invertebrates							
Meridolum corneovirens	Cumberland Plain Land Snail	E			Primarily inhabits Cumberland Plain Woodland (a critically endangered ecological community). This community is a grassy, open woodland with occasional dense patches of shrubs. It is also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest, which are also listed communities.	Low	No suitable habitat at Nuwi Wetland. The site is located east of its known distribution.
Pommerhelix duralensis	Dural Woodland Snail	E	E		This species has a strong affinity for communities in the interface region between shale-derived and sandstone-derived soils, with forested habitats that have good native cover and woody debris.	Low	No suitable habitat at Nuwi Wetland. The site is located south and east of its known distribution.
Amphibians							
Heleioporus australiacus	Giant Burrowing Frog	V	V	2	Found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based.	Low	No suitable habitat at Nuwi Wetland. Very rare in the central Sydney Basin.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
Litoria aurea	Green and Golden Bell Frog	E1	V	12957	Large populations in NSW are located around the metropolitan areas of Sydney, Shoalhaven and mid north coast. It Inhabits marshes, dams and stream-sides, particularly those containing bullrushes (Typha spp.) or spikerushes (Eleocharis spp.)	High	Nuwi Wetland may support suitable foraging habitat. The wetlands adjacent to Nuwi Wetland support the largest extant population of Green and Golden Bell Frog in Sydney. Individuals which breed adjacent to Nuwi Wetland at Narrawang Wetland are likely to also occasionally occur at Nuwi Wetland.
Pseudophryne australis	Red-crowned Toadlet	V		32	Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings in open forests mostly on Hawkesbury and Narrabeen Sandstones.		No suitable habitat at Nuwi Wetland. Very rare in this part of the central Sydney Basin.
Birds							
Actitis hypoleucos	Common Sandpiper		Mi	80	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.	Moderate	Potential roosting and/or foraging habitat in the form of mudflats adjacent to mangroves is present at Nuwi Wetland. There are 20 + Common Sandpiper records from Sydney Olympic/Bicentennial Park. Most records from Shipwreck Point (700 m east of Nuwi Wetland).
Anthochaera phrygia	Regent Honeyeater	CE	E	10	Inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. NSW the distribution is very patchy and mainly confined to the two main breeding areas at Capertee Valley and the Bundarra-Barraba region and surrounding fragmented woodlands. Birds are also found in drier coastal woodlands and forests. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian	None	No suitable habitat located at Nuwi Wetland. The most recent record from the region (1987) is of five individuals at Rookwood General Cemeteries Reserve Trust approximately 4 km south of Nuwi Wetland. There are several historic records (pre-1950) in inner west Sydney.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
					forests of River She-oak. These habitats have significantly large numbers of mature trees, high canopy cover and abundance of mistletoes. Key eucalypt species include Mugga Ironbark, Yellow Box, Blakely's Red Gum, White Box and Swamp Mahogany. Nectar and fruit from the mistletoes are also eaten during the breeding season.		
Apus pacificus	Pacific Swift		Mi	2	The Pacific Swift leaves its breeding grounds in Siberia from August–September. They usually arrive in Australia around October. In NSW, the Fork-tailed Swift is recorded in all regions.They mostly occur over inland plains but sometimes above foothills or in coastal areas. They prefer dry, open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. They sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines (Higgins 1999). The Fork-tailed Swift is an aerial eater, flying anywhere from 1 m to 300 m above the ground to forage (Higgins 1999).	High	Likely to occur in airspace above Nuwi Wetland. Recorded in 2013, 2015 and 2016 at Sydney Olympic/Bicentennial Park.
Arenaria interpres	Ruddy Turnstone		Mi	8	In Australasia, the Ruddy Turnstone is mainly found on coastal regions with exposed rock coast lines or coral reefs. It also lives near platforms and shelves, often with shallow tidal pools and rocky, shingle or gravel beaches.	Low	Marginal resting habitat present at Nuwi Wetland. Rare visitor in the Sydney Olympic/Bicentennial Park area. Recorded at Bicentennial Park in 2013.
Artamus cyanopterus	Dusky Woodswallow	V		39	Primarily occurs in dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings,	Low	No suitable habitat present at Nuwi Wetland however the Dusky Woodswallow may occasionally forage above the site. Rare visitor in the Sydney

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
					acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.		Olympic/Bicentennial Park area. Recorded at Sydney Olympic/Bicentennial Park in 2012 and 2014.
Botaurus poiciloptilus	Australasian Bittern	E1	E	11	Inhabits temperate freshwater wetlands and occasionally estuarine reedbeds, with a preference for permanent waterbodies with tall dense vegetation. The species prefers wetlands with dense vegetation, including sedges, rushes and reeds. Freshwater is generally preferred, although dense saltmarsh vegetation in estuaries and flooded grasslands are also used by the species.	Low	No suitable habitat present at Nuwi Wetland. Recorded at Sydney Olympic Park in 2006, 2007 and 2013. Individuals occasionally recorded at Narawang Wetland during multiple years between 2005-2010.
Calidris acuminata	Sharp-tailed Sandpiper		Mi	646	In Australasia, the Sharp-tailed Sandpiper prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation.	High	Suitable roosting and/or foraging habitat in the form of mudflats adjacent to mangroves present at Nuwi Wetland. Regularly recorded at Sydney Olympic/Bicentennial Park.
Calidris canutus	Red Knot		Mi	15	In Australasia the Red Knot mainly inhabit intertidal mudflats, sandflats and sandy beaches of sheltered coasts, in estuaries, bays, inlets, lagoons and harbours; sometimes on sandy ocean beaches or shallow pools on exposed wave-cut rock platforms or coral reefs.	Low	Suitable roosting and/or foraging habitat in the form of mudflats adjacent to mangroves present at Nuwi Wetland. Rare/uncommon visitor in the Sydney Olympic/Bicentennial Park area.
Calidris ferruginea	Curlew Sandpiper	E1	Mi	358	Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near	Moderate	Suitable roosting and/or foraging habitat in the form of mudflats adjacent to mangroves present at Nuwi Wetland. Uncommon visitor in the Sydney

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
					the coast, and ponds in saltworks and sewage farms.		Olympic/Bicentennial Park area which is recorded approximately every second year. For example, observed in 2003, 2005, 2006, 2012, 2013 and 2014.
Calidris melanotos	Pectoral Sandpiper		Mi	40	In Australasia, the Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands.	Moderate	Suitable roosting and/or foraging habitat in the form of mudflats adjacent to mangroves present at Nuwi Wetland. Rare visitor in the Sydney Olympic/Bicentennial Park area having been recorded in 2006 and 2007. Observed most recently in 2008 at Mason Park, Homebush.
Calidris ruficollis	Red-necked Stint		Mi	46	In Australasia, the Red-necked Stint is mostly found in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks and, sometimes, on protected sandy or coralline shores.	Moderate	Suitable roosting and/or foraging habitat in the form of mudflats adjacent to mangroves present at Nuwi Wetland. Uncommon visitor in the Sydney Olympic/Bicentennial Park area. Recorded occasionally during the past decade (i.e. in 2009, 2012-2015 and 2017).
Calidris tenuirostris	Great Knot	V	Mi	2	In Australasia, the species typically prefers sheltered coastal habitats, with large intertidal mudflats or sandflats. This includes inlets, bays, harbours, estuaries and lagoons.	Low	Potential roosting and/or foraging habitat present at Nuwi Wetland. Vagrant in the Sydney Olympic/Bicentennial Park area.
Callocephalon fimbriatum	Gang-gang Cockatoo population in the Hornsby and Ku-ring-gai Local Government Areas	E2, V		107	In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas.	Low	No suitable habitat present at Nuwi Wetland. Very few records in the greater region.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
Calyptorhynchus lathami	Glossy Black-Cockatoo	V		4	Inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of sheoak occur. Black Sheoak and Forest Sheoak are important foods. Feeds almost exclusively on the seeds of several species of she-oak (Casuarina and Allocasuarina species). Dependent on large hollow-bearing eucalypts for nest sites.	Low	No suitable habitat present at Nuwi Wetland. Very few records in the greater region.
Charadrius bicinctus	Double-banded Plover		Mi	0 (PMST)	The Double-banded Plover is found on littoral, estuarine and fresh or saline terrestrial wetlands and also saltmarsh, grasslands and pasture. It occurs on muddy, sandy, shingled or sometimes rocky beaches, bays and inlets, harbours and margins of fresh or saline terrestrial wetlands such as lakes, lagoons and swamps, shallow estuaries and rivers. The species is sometimes associated with coastal lagoons, inland saltlakes and saltworks.	Low	Potential roosting and/or foraging habitat present at Nuwi Wetland. Rare visitor at Sydney Olympic/Bicentennial Park. Most recently recorded in 2007 and 2010.
Charadrius leschenaultii	Greater Sand-plover	V	Mi	1	In the non-breeding grounds in Australasia, the species is almost entirely coastal, inhabiting littoral and estuarine habitats. They mainly occur on sheltered sandy, shelly or muddy beaches with large intertidal mudflats or sandbanks, as well as sandy estuarine lagoons, and inshore reefs, rock platforms, small rocky islands or sand cays on coral reefs. They are occasionally recorded on near-coastal saltworks and saltlakes, including marginal saltmarsh, and on brackish swamps. They seldom occur at shallow freshwater wetlands	Low	Potential roosting and/or foraging habitat present at Nuwi Wetland. Vagrant. Recorded at Mason Park, Homebush in 1991.
Charadrius mongolus	Lesser Sand Plover		Mi	0 (PMST)	Almost entirely coastal in NSW, favouring the beaches of sheltered bays, harbours and estuaries	Low	Potential roosting and/or foraging habitat present at Nuwi Wetland. Vagrant.

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					with large intertidal sandflats or mudflats; occasionally occurs on sandy beaches, coral reefs and rock platforms.		
Chlidonias leucopterus	White-winged Black Tern		Mi	1	In Australia, and elsewhere in their non-breeding range, the species mostly inhabits fresh, brackish or saline, and coastal or subcoastal wetlands. White-winged Black Terns frequent tidal wetlands, such as harbours, bays, estuaries and lagoons, and their associated tidal sandflats and mudflats.	Low	Potential foraging habitat present at Nuwi Wetland. Vagrant. Recorded at Sydney Olympic Park in 1969 and 1990.
Circus assimilis	Spotted Harrier	V		3	Occurs in grassy open woodland including Acacia and mallee remnants, inland riparian woodland, grassland and shrub steppe. It is found most commonly in native grassland, but also occurs in agricultural land, foraging over open habitats including edges of inland wetlands.	Low	No suitable habitat present at Nuwi Wetland. Recorded at Sydney Olympic Park in 2007, 2012, 2013 and 2018. Latest record approximately 800 m south of Nuwi Wetland.
Cuculus optatus	Oriental Cuckoo		Mi	0 (PMST)	Occurs in monsoon rainforest, wet sclerophyll forest, open woodlands and appears quite often along edges of forests, or ecotones between forest types.	Low	Potential habitat present at Nuwi Wetland. Possible very rare visitor. Nearest record from East Ryde in 2014 approximately 6 km north-east of Nuwi Wetland.
Daphoenositta chrysoptera	Varied Sittella	V		2	Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and *Acacia* woodland.	Low	No suitable habitat present at Nuwi Wetland. Very rare visitor in this part of the Sydney Basin.
Ephippiorhynchus asiaticus	Black-necked Stork	V		1	Floodplain wetlands (swamps, billabongs, watercourses and dams) of the major coastal rivers are the key habitat in NSW for the Black-necked Stork. Secondary habitat includes minor	Low	No suitable habitat present at Nuwi Wetland. Very rare visitor in the Sydney Basin.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
					floodplains, coastal sandplain wetlands and estuaries.		
Epthianura albifrons	White-fronted Chat population in the Sydney Metropolitan Catchment Management Area	E2,V		476	Gregarious species, usually found foraging on bare or grassy ground in wetland areas, singly or in pairs. They are insectivorous, feeding mainly on flies and beetles caught from or close to the ground.	Low	No suitable habitat present at Nuwi Wetland. Formerly common species in the Sydney Olympic/Bicentennial Park area but has undergone a major decline. Recent records include flocks of up to nine individuals at Newington Nature Reserve in 2009, 2011, 2013 and 2014 down from maximum flock size of 22 birds in 2000 (Jenner *et al*. 2011). Recorded at Sydney Olympic Park in 2005, 2007-2009, 2013-2015 and 2017.
Falco subniger	Black Falcon	V		1	The Black Falcon inhabits woodland, shrubland and grassland in the arid and semi-arid zones, especially wooded watercourses and agricultural land with scattered remnant trees.	Low	No suitable habitat present at Nuwi Wetland. Vagrant. Recorded at Sydney Olmpic Park in 2012 and Masons Park, Homebush in 1990.
Gallinago hardwickii	Latham's Snipe		Mi	646	In Australia, Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They usually inhabit open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies)	Moderate	Potential roosting and/or foraging habitat present at Nuwi Wetland. Likely to fly over the site whilst moving between suitable habitat at Narawang Wetland and Wentworth Common. Uncommon visitor in Sydney Olympic/Bicentennial Park recorded in low numbers most years.
Gelochelidon nilotica	Gull-billed Tern			15	Inhabits freshwater swamps, brackish and salt lakes, beaches and estuarine mudflats, floodwaters, sewage farms, irrigated croplands and grasslands throughout much of Australia excluding the western interior.	Low	No suitable habitat present at Nuwi Wetland. Rare visitor in the Sydney Olympic/Bicentennial Park area. Last recorded in the region in 2000.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
Glossopsitta pusilla	Little Lorikeet	V		11	Mostly occur in dry, open eucalypt forests and woodlands. They have been recorded from both old-growth and logged forests in the eastern part of their range, and in remnant woodland patches and roadside vegetation on the western slopes. Nest in small hollows (entrance approx. 3 cm) of Eucalyptus spp.	Low	No suitable habitat present in the Nuwi Wetland. Rare visitor at Sydney Olympic/Bicentennial Park region. A flock of 15 was recorded at Sydney Olympic Park in 2014.
Haematopus longirostris	Pied Oystercatcher	E		1	Occurs on intertidal flats of inlets and bays, open beaches and sandbanks.	Low	No suitable habitat present at Nuwi Wetland. Very rare visitor in region.
Haliaeetus leucogaster	White-bellied Sea-Eagle		Ma	262	This species inhabits coastal and inland riverine areas with large areas of open water. Breeding habitat is located near water and predominantly within tall open forest and woodland. The nest is a large structure made of sticks. Foraging habitat is large areas of open water as well as open terrestrial habitats such as grasslands. They forage either from a perch or whilst in flight.	High	Suitable foraging habitat present at Nuwi Wetland. Common breeding resident in the Sydney Olympic/Bicentennial Park area.
Heteroscelus brevipes	Grey-tailed Tattler		Mi	3	The Grey-tailed Tattler is often found on sheltered coasts with reefs and rock platforms or with intertidal mudflats. It can also be found at intertidal rocky, coral or stony reefs as well as platforms and islets that are exposed at low tide.	Low	Marginal habitat present at Nuwi Wetland. Very rare visitor in the region. Recorded at Sydney Olympic Park in 2014.
Hieraaetus morphnoides	Little Eagle	V		6	Distributed throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. Occupies habitats rich in prey within open eucalypt forest, woodland or open woodland. Requires tall living trees for		No suitable habitat present at Nuwi Wetland. Uncommon/rare visitor in the Sydney Olympic/Bicentennial Park area. Recorded in 2006, 2013 and 2015 at Sydney Olympic Park.

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					building a large stick nest and preys on birds, reptiles and mammals and occasionally carrion.		
Hirundapus caudacutus	White-throated Needletail		Mi	7	This species is predominantly aerial within Australia, however they have been recorded roosting in trees in both forests and woodlands within dense foliage either in the canopy or within hollows. This species breeds in northern Asia. And migrates south between September-October.	High	Common visitor recorded each year overhead at Sydney Olympic/Bicentennial Park in small to large flocks. Very likely to occur in airspace above Nuwi Wetland.
Hydroprogne caspia	Caspian Tern		Mi	22	The Caspian Tern is mostly found in sheltered coastal embayments (harbours, lagoons, inlets, bays, estuaries and river deltas) and those with sandy or muddy margins are preferred. They also occur on near-coastal or inland terrestrial wetlands that are either fresh or saline, especially lakes (including ephemeral lakes), waterholes, reservoirs, rivers and creeks. They also use artificial wetlands, including reservoirs, sewage ponds and saltworks.	High	Suitable foraging habitat present at Nuwi Wetland. Common visitor regularly recorded at Sydney Olympic/Bicentennial Park.
Ixobrychus flavicollis	Black Bittern	V		5	Inhabits both terrestrial and estuarine wetlands, generally in areas of permanent water and dense vegetation. Where permanent water is present, the species may occur in flooded grassland, forest, woodland, rainforest and mangroves.	Moderate	Suitable habitat present at Nuwi Wetland. Very rare visitor in the Sydney Olympic/Bicentennial Park area. Recorded in 2005 at Narawang Wetland.
Lathamus discolor	Swift Parrot	E1	CE	11	In NSW mostly occurs on the coast and south west slopes, occurring in areas where eucalypts are flowering profusely or where there are abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark and White Box.	Low	No suitable habitat present at Nuwi Wetland. Rare visitor in the Sydney Olympic/Bicentennial Park area. Recorded at Sydney Olympic Park in 1991. Only recent records from the region are from West Ryde and Meadowbank in 2010-2012

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
							approximately 3 km north of Nuwi Wetland.
Limicola falcinellus	Broad-billed Sandpiper	V	Mi	2	The Broad-billed Sandpiper occurs in sheltered parts of the coast, favouring estuarine mudflats but also occasionally occur on saltmarshes, shallow freshwater lagoons, saltworks and sewage farms, and in areas with large soft intertidal mudflats, which may have shell or sandbanks nearby. Occasionally they occur on reefs or rocky platforms.	Low	Potential roosting and/or foraging habitat present at Nuwi Wetland. Rare vagrant. Recorded at Sydney Olympic/Bicentennial Park in 1978.
Limosa lapponica	Bar-tailed Godwit		Mi	824	The Bar-tailed Godwit is found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays.	Moderate	Suitable roosting and/or foraging habitat in the form of mudflats adjacent to mangroves present at Nuwi Wetland. Recorded fairly regularly at Sydney Olympic/Bicentennial Park.
Limosa limosa	Black-tailed Godwit	V	Mi	14	In Australia the Black-tailed Godwit has a primarily coastal habitat environment. The species is commonly found in sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit; occasionally recorded on rocky coasts or coral islets.	Low	Potential roosting and/or foraging habitat present at Nuwi Wetland. Rare vagrant. Recorded in 1982, 1984, 1992 and 1997 at Sydney Olympic/Centennial Park.
Lophoictinia isura	Square-tailed Kite	V		1	Occurs in a variety of timbered habitats including dry woodlands and open forests. Shows a particular preference for timbered watercourses.	Low	No suitable habitat at Nuwi Wetland. Rare in the region. One record from Sydney Olympic Park in 2017.
Monarcha melanopsis	Black-faced Monarch		Mi	17	The Black-faced Monarch mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical	Moderate	Potential habitat present at Nuwi Wetland. Uncommon visitor at Sydney Olympic/Centennial Park.

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					(notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest. Other areas in which the Black-faced Monarch may be found include: gullies in mountain areas or coastal foothills, softwood scrub dominated by Brigalow (*Acacia harpophylla*), coastal scrub dominated by Coast Banksia (*Banksia integrifolia*) and Southern Mahogany (*Eucalyptus botryiodes*), occasionally among mangroves and sometimes in suburban parks and gardens.		
Monarcha melanopsis	Spectacled Monarch		Mi	0 (PMST)	Occurs in dense vegetation, mainly in rainforest but also in moist or wet sclerophyll forest and occasionally in other densely vegetated habitats such as mangroves, drier forest, woodlands, parks and gardens.	Low	No suitable habitat present at Nuwi Wetland. Rare vagrant. No records of this species in the Sydney Olympic /Centennial Park area.
Motacilla flava	Eastern Yellow Wagtail		Mi	0 (PMST)	Occurs in grasslands, airstrips, damp open area and sports fields.	Low	No suitable habitat present at Nuwi Wetland. Rare vagrant. One record of this species in the Sydney Olympic /Centennial Park area from 2013.
Myiagra cyanoleuca	Satin Flycatcher		Mi	5	Summer breeding range from Qld to Tas, winter migration to NE Qld. Satin Flycatchers inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands often near wetlands or watercourses, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests.	Moderate	Suitable habitat present at Nuwi Wetland. Uncommon visitor at Sydney Olympic /Centennial Park.
Neophema pulchella	Turquoise Parrot	V		1	Occurs in eucalypt woodland particularly adjoining clearings, timbered ridges and creeks in farmland.	Low	No suitable habitat present at Nuwi Wetland. Very rare visitor in region.

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Nettapus coromandelianus	Cotton Pygmy Goose	V		4	Freshwater lakes, lagoons, swamps and dams, particularly those vegetated with waterlilies and other floating and submerged aquatic vegetation.	Low	No suitable habitat present at Nuwi Wetland. Very rare visitor in the Sydney Basin.
Ninox connivens	Barking Owl	V		8	Occurs throughout NSW, where it inhabits dry open sclerophyll forests and woodlands, favouring dense riparian stands of eucalypts or casuarinas along watercourses or around wetlands, where there are many large trees suitable for roosting or breeding.	None	No suitable habitat present at Nuwi Wetland. Very rare visitor to inner western Sydney. Not recorded in the Sydney Olympic /Centennial Park area. The nearest record is of an individual in East Ryde in 2000 (approximately 6 km north-east Nuwi Wetland).
Ninox strenua	Powerful Owl	V		377	Is endemic to eastern and south-eastern Australia, being widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered, mostly historical records on the western slopes and plains in NSW. Inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. They require large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. Powerful Owls nest in large tree hollows (at least 0.5m deep), in large eucalypts (diameter at breast height of 80-240 cm) that are at least 150 years old.	None	No suitable habitat present at Nuwi Wetland. Rare visitor south of the Parramatta River. Has not been recorded in the Sydney Olympic /Centennial Park area.
Numenius madagascariensis	Eastern Curlew		Mi	29	The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sandflats, often with beds of seagrass.	Moderate	Suitable roosting and/or foraging habitat in the form of mudflats adjacent to mangroves present at Nuwi Wetland. Uncommon visitor in the Sydney Olympic /Centennial Park area. Recorded at Sydney Olympic /Centennial Park in 1997, 2007-2009.

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Numenius minutus	Little Curlew		Mi	0 (PMST)	The Little Curlew is most often found feeding in short, dry grassland and sedgeland, including dry floodplains and blacksoil plains, which have scattered, shallow freshwater pools or areas seasonally inundated. Open woodlands with a grassy or burnt understorey, dry saltmarshes, coastal swamps, mudflats or sandflats of estuaries or beaches on sheltered coasts, mown lawns, gardens, recreational areas, ovals, racecourses and verges of roads and airstrips are also used.	None	No suitable habitat present at Nuwi Wetland. Rare vagrant in the Sydney Basin. Has not been recorded in the Sydney Olympic /Centennial Park area.
Numenius phaeopus	Whimbrel		Mi	2	The Whimbrel is often found on the intertidal mudflats of sheltered coasts. It is also found in harbours, lagoons, estuaries and river deltas, often those with mangroves, but also open, unvegetated mudflats. It is occasionally found on sandy or rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms.	Low	Marginal roosting and/or foraging habitat present at Nuwi Wetland. Rare visitor in the Sydney Olympic /Centennial Park area. Recorded at Sydney Olympic /Centennial Park in 1984.
Pandion cristatus	Eastern Osprey	V		5	Favour coastal areas, especially the mouths of large rivers, lagoons and lakes. Feed on fish over clear, open water. Nests are made high up in dead trees or in dead crowns of live trees, usually within one kilometre of the sea.	Moderate	Potential foraging habitat present at Nuwi Wetland. Rare visitor in the Sydney Olympic /Centennial Park area. Recorded at Sydney Olympic /Centennial Park in 2007 and 2016.
Petroica boodang	Scarlet Robin	V		5	Occurs in dry eucalypt forests and woodlands with a typically grassy understorey.	Low	No suitable habitat present at Nuwi Wetland. Rare visitor in the Sydney Basin.
Petroica phoenicea	Flame Robin	V		3	Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The ground layer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. In winter, birds migrate to	Low	No suitable habitat present at Nuwi Wetland. Rare visitor in the Sydney Basin. No records in the Sydney Olympic /Centennial Park area.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
					drier more open habitats in the lowlands (i.e. valleys below the ranges, and to the western slopes and plains).		
Philomachus pugnax	Ruff		Mi	3	In Australia the Ruff is found on generally fresh, brackish of saline wetlands with exposed mudflats at the edges. It is found in terrestrial wetlands including lakes, swamps, pools, lagoons, tidal rivers, swampy fields and floodlands.	Low	No suitable habitat present at Nuwi Wetland. Recorded at Bicentennial Park in 1990 and 2009.
Plegadis falcinellus	Glossy Ibis		Mi	60	The Glossy Ibis inhabits fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation throughout much of Australia excluding the western interior.	Moderate	Suitable foraging and/or roosting habitat present at Nuwi Wetland. Uncommon visitor in the Sydney Olympic/Bicentennial Park area. Recorded most years in low numbers. Closest record to Nuwi Wetland is from the Wentworth Common in 2013 (500 m south-east of Nuwi Wetland).
Pluvialis fulva	Pacific Golden Plover		Mi	305	In non-breeding grounds in Australia this species usually inhabits coastal habitats, though it occasionally occurs around inland wetlands. Pacific Golden Plovers usually occur on beaches, mudflats and sandflats (sometimes in vegetation such as mangroves, low saltmarsh such as Sarcocornia, or beds of seagrass) in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks.	Moderate	Suitable roosting and/or foraging habitat in the form of mudflats adjacent to mangroves present at Nuwi Wetland. Regular though uncommon visitor in the Sydney Olympic/Bicentennial Park area.
Pluvialis squatarola	Grey Plover		Mi	2	In non-breeding grounds in Australia, Grey Plovers occur almost entirely in coastal areas, where they usually inhabit sheltered embayments, estuaries and lagoons with mudflats and sandflats, and occasionally on rocky coasts with wave-cut	Low	Suitable roosting and/or foraging habitat present at Nuwi Wetland. Vagrant in study region.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
					platforms or reef-flats, or on reefs within muddy lagoons. They also occur around terrestrial wetlands such as near-coastal lakes and swamps, or salt-lakes.		
Ptilinopus superbus	Superb Fruit-Dove	V		4	Inhabits rainforest and similar closed forests where it forages high in the canopy, eating the fruits of many tree species such as figs and palms. It may also forage in eucalypt or acacia woodland where there are fruit-bearing trees.	Low	No suitable habitat present at Nuwi Wetland. Rare visitor in the Sydney Olympic/Bicentennial Park area.
Rhipidura rufifrons	Rufous Fantail		Mi	43	This species is a summer breeding migrant to SE Australia. They occur in the undergrowth of rainforests/wetter Eucalypt forests/gullies. Preference for deep shade, and is often seen close to the ground. The Rufous Fantail feeds on insects, in the middle and lower levels of the canopy. Constructs a small compact cup nest, suspended from a tree fork about 5 m from the ground.	High	Suitable habitat present at Nuwi Wetland. Occasional visitor at Sydney Olympic/Centennial Park. Most recently recorded at Shipwreck Point in 2017 approximately 400 m east of Nuwi Wetland.
Rostratula australis	Australian Painted Snipe		E, Mi	3	Inhabits shallow inland wetlands, either freshwater or brackish water bodies. nests on the ground amongst tall reed-like vegetation near water, and feeds near the water's edge and on mudflats.	Low	No suitable habitat present at Nuwi Wetland. Rare visitor at Sydney Olympic/Bicentennial Park recorded in 2011 and 2012.
Sterna hirundo	Common Tern		Mi	30	Common Terns are marine, pelagic and coastal. In Australia, they are recorded in all marine zones, but are commonly observed in near-coastal waters, both on ocean beaches, platforms and headlands and in sheltered waters, such as bays, harbours and estuaries with muddy, sandy or rocky shores.	Moderate	Suitable foraging habitat located at Nuwi Wetland. Rare/uncommon visitor in the Sydney Olympic/Bicentennial Park area. Recorded at Sydney Olympic/Bicentennial Park in 1992, 1995-1997, 1999, 2000, 2004, 2006 and 2013.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
Sternula albifrons	Little Tern	E1	Mi	7	Almost exclusively coastal, preferring sheltered environments; however, may occur several kilometres from the sea in harbours, inlets and rivers (with occasional offshore islands or coral cay records). Nests in small, scattered colonies in low dunes or on sandy beaches just above high tide mark near estuary mouths or adjacent to coastal lakes and islands.	None	No suitable habitat present at Nuwi Wetland. Vagrant. Formerly an uncommon summer migrant that previously nested up until 1964/65 on a sandspit in Homebush Bay.
Stictonetta naevosa	Freckled Duck	V		1	Prefer permanent freshwater swamps and creeks with heavy growth of Cumbungi, Lignum or Tea-tree. During drier times they move from ephemeral breeding swamps to more permanent waters such as lakes, reservoirs, farm dams and sewage ponds.	Low	No suitable habitat present at Nuwi Wetland. Vagrant. Recorded at Sydney Olympic/Bicentennial Park in 1985.
Tringa glareola	Wood Sandpiper		Mi	4	The Wood Sandpiper uses well-vegetated, shallow, freshwater wetlands, such as swamps, billabongs, lakes, pools and waterholes. They are typically associated with emergent, aquatic plants or grass, and dominated by taller fringing vegetation, such as dense stands of rushes or reeds, shrubs, or dead or live trees, especially Melaleuca and River Red Gums *Eucalyptus camaldulensis* and often with fallen timber.	Low	Marginal roosting and/or foraging habitat present at Nuwi Wetland. Very rare visitor at Sydney Olympic/Centennial Park. Recorded at Sydney Olympic/Bicentennial Park in 1966 and 1982 and Mason Park, Homebush in 2007.
Tringa nebularia	Common Greenshank		Mi	171	The Common Greenshank is found in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. It occurs in sheltered coastal habitats, typically with large mudflats and saltmarsh, mangroves or seagrass. Habitats include embayments, harbours, river estuaries, deltas and lagoons and are recorded less often in round tidal pools, rock-flats and rock platforms.	High	Suitable roosting and/or foraging habitat in the form of mudflats adjacent to mangroves present at Nuwi Wetland. Occasional visitor in the Sydney Olympic/Bcientennial Park area. Recorded here roughly once every three years.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
					The species uses both permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes and inundated floodplains, claypans and saltflats. It will also use artificial wetlands, including sewage farms and saltworks dams, inundated rice crops and bores.		
Tringa stagnatilis	Marsh Sandpiper		Mi	40	The Marsh Sandpiper lives in permanent or ephemeral wetlands of varying salinity, including swamps, lagoons, billabongs, saltpans, saltmarshes, estuaries, pools on inundated floodplains, and intertidal mudflats and also regularly at sewage farms and saltworks.	High	Suitable roosting and/or foraging habitat in the form of mudflats adjacent to mangroves present at Nuwi Wetland. Occasional visitor in the Sydney Olympic/Bicentennial Park area. Recently recorded at Sydney Olympic/Bientennial Park in 2005-2008, 2013-2015
Tyto longimembris	Eastern Grass Owl	V		2	Eastern Grass Owls are found in areas of tall grass, including grass tussocks, in swampy areas, grassy plains, swampy heath, and in cane grass or sedges on flood plains.	None	No suitable habitat present at Nuwi Wetland. Rare vagrant in the Sydney Basin. Recorded once at Sydney Olympic/Bicentennial Park in 1982.
Tyto novaehollandiae	Masked Owl	V		2	Occurs in dry eucalypt forests and woodlands from sea level to 1100 m.	Low	No suitable habitat present at Nuwi Wetland. Rare visitor in the central Sydney Basin.
Tyto tenebricosa	Sooty Owl	V		1	Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	Low	No suitable habitat present at Nuwi Wetland. Rare visitor in the central Sydney Basin.
Xenus cinereus	Terek Sandpiper	V	M	1	The Terek Sandpiper mostly forages in the open, on soft wet intertidal mudflats or in sheltered estuaries, embayments, harbours or lagoons.	Low	Suitable roosting and/or foraging habitat present at Nuwi Wetland. Rare visitor in the Sydney Olympic/Bicentennial Park

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
					Preferring to roost in or among mangroves, birds may perch in branches or roots up to 2 m from the ground, or beneath them in the shade on hot days.		area. Recorded at Sydney Olympic/Bicentennial Park in 2010.
Mammals							
Cercartetus nanus	Eastern Pygmy Possum	V		1	Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest.	Low	No suitable habitat present at Nuwi Wetland. Very rare in the central Sydney Basin.
Dasyurus maculatus	Spotted-tailed Quoll	E		2	Recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline.	Low	No suitable habitat present at Nuwi Wetland. Very rare in the central Sydney Basin.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		7	Prefers moist habitats, with trees taller than 20 m. Generally, roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings.	Low	Unlikely to forage above mangroves/swamp oak forest present at Nuwi Wetland.
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		131	Eastern Bent-wing Bats occur along the east and north-west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other man-made structures. Hunt in forested areas, catching moths and other flying insects above the tree tops. Cumberland dry sclerophyll forests are identified as a potential vegetation type used by this species.	Moderate	Potential foraging habitat present at Nuwi Wetland. Recorded at Sydney Olympic/Centennial Park.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
Mormopterus norfolkensis	Eastern Freetail-bat	V		11	Inhabits dry eucalypt forest and coastal woodlands, along with riparian zones in rainforest and wet sclerophyll forest. Forages above the forest canopy or at forest edges. Known to roost in tree hollows but occasionally found in buildings.	Moderate	Suitable foraging habitat present at Nuwi Wetland. Recorded breeding at Sydney Olympic/Centennial Park.
Myotis macropus	Southern Myotis	V		31	Generally, roost in groups of 10 - 15 close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. Forage over streams and pools.	High	Suitable foraging habitat present at Nuwi Wetland. Recorded at Sydney Olympic/Centennial Park.
Perameles nasuta	Long-nosed Bandicoot	V	E Pop	18	Long-nosed Bandicoots are found in rainforest, moist gullies, woodlands, and heath. Long-nosed bandicoots benefit from a mosaic of mixed habitats, including open grassy areas (such as lawns in urban areas) that they forage in at night-time and sheltered areas with undergrowth that they retreat to and nest in.	Low	Suitable habitat unlikely to be present at Nuwi Wetland. Very few records in this region south of the Parramatta River and west of Petersham.
Petaurus australis	Yellow-bellied Glider	V		1	Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils.	Low	No suitable habitat present at Nuwi Wetland. Very few records in the region.
Phascolarctos cinereus	Koala	V	V	1	Inhabits eucalypt woodlands and forests.	Low	No suitable habitat present at Nuwi Wetland. Very few records in the region
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	259	Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are commonly found in gullies, close to water, in vegetation with a dense canopy. They travel up to 50 km to forage, on the nectar and pollen of native trees, in particular	Moderate	Suitable foraging habitat is present at Nuwi Wetland. Recorded at Sydney Olympic/Centennial Park. Recently recorded in 2010, 2015 and 2016.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
					Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines.		
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V		19	Inhabits eucalypt rainforest, sclerophyll forest and open woodland vegetation. Availability of tree hollows is important for access to roosting sites.	Low	The Nuwi Wetland is unlikely to support suitable roosting and/or foraging habitat. Very few records within 5 km of the study site however there is one record from < 1km north-west of the Nuwi Wetland in 2008.
Scoteanax rueppellii	Greater Broad-nosed Bat	V		6	Utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although this species usually roosts in tree hollows, it has also been found in buildings.	Low	The Nuwi Wetland is unlikely to support suitable roosting and/or foraging habitat. Very few records within 5 km of the study site.
Reptiles							
Caretta caretta	Loggerhead Turtle	E	E, Ma, Mi	0	Marine species; coming on land only to nest on beaches	None	No suitable habitat present at Nuwi Wetland.
Chelonia mydas	Green Turtle	V	V, Ma, Mi	0	Marine species; coming on land only to nest on beaches	None	No suitable habitat present at Nuwi Wetland.
Dermochelys coriacea	Leatherback Turtle, Leathery Turtle	E	E, Ma, Mi	0	Marine species; coming on land only to nest on beaches	None	No suitable habitat present at Nuwi Wetland.
Eretmochelys imbricata	Hawksbill Turtle		V, Ma, Mi	0	Marine species; coming on land only to nest on beaches	None	No suitable habitat present at Nuwi Wetland.
Hoplocephalus bungaroides	Broad-headed Snake	E	V	0	Confined to the Sydney basin within a radius of approximately 200 km of Sydney. Preferred habitat of sandstone outcrops with woodland,	None	No suitable habitat present at Nuwi Wetland. No records in the Sydney Olympic/Bicentennial Park area.

Species Name	Common Name	Status (BC Act)	Status (EPBC Act)	Number of records (<10 km of site) (BioNet database)	Habitat requirements	Likelihood of occurrence	Comment
					open woodland and/or heath vegetation. Shelters in rock crevices and under flat sandstone rocks on exposed cliff edges and tree hollows.		
Natator depressus	Flatback Turtle		V, Ma, Mi	0	Marine species; coming on land only to nest on beaches	None	No suitable habitat present at Nuwi Wetland.

Appendix D Assessments of Significance

Assessments of Significance

Tables A-Q present assessments of significance of two threatened ecological communities, 21 species listed under the EPBC Act 1999 and 10 species listed under the BC Act 2016.

Consideration of impacts on the following ecological communities is warranted, as the assessed likelihood of occurrence is moderate or greater:

- Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community
- Subtropical and Temperate Coastal Saltmarsh.

Consideration of impacts on the following species listed under the EPBC Act 1999 is warranted, as the assessed likelihood of occurrence is moderate or greater:

- Green and Golden Bell Frog (*Litoria aurea*) *Vulnerable*
- Grey-headed Flying-fox (*Pteropus poliocephalus*) *Vulnerable*
- Glossy Ibis (*Plegadis falcinellus*) *Migratory*
- Curlew Sandpiper (*Calidris ferruginea*) *Critically Endangered*, *Migratory*
- Bar-tailed Godwit (*Limosa lapponica baueri*) *Vulnerable*, *Migratory*
- Common Greenshank (*Tringa nebularia*) *Migratory*
- Common Sandpiper (*Actitis hypoleucos*) *Migratory*
- Sharp-tailed Sandpiper (*Calidris melanotos*) *Migratory*
- Pectoral Sandpiper (*Calidris melanotos*) *Migratory*
- Red-necked Stint (*Calidris ruficollis*) *Migratory*
- Pacific Golden Plover (*Pluvialis fulva*) *Migratory*
- Marsh Sandpiper (*Tringa stagnatilis*) *Migratory*
- Eastern Curlew (*Numenius madagascariensis*) *Critically Endangered*, *Migratory*
- Latham's Snipe (*Gallinago hardwickii*) *Migratory*
- Caspian Tern (*Hydroprogne caspia)* *Migratory*
- Eastern Osprey (*Pandion cristatus*) *Migratory*
- Pacific Swift (*Apus pacificus*) *Migratory*
- White-throated Needletail (*Hirundapus caudacutus*) *Migratory*
- Black-faced Monarch (*Monarcha melanopsis*) *Migratory*
- Satin Flycatcher (*Myiagra cyanoleuca*) *Migratory*
- Rufous Fantail (*Rhipidura rufifrons*) *Migratory*

Consideration of impacts on the following species listed under the BC Act 2016 is warranted, as the assessed likelihood of occurrence is moderate or greater:

- Green and Golden Bell Frog (*Litoria aurea*) *Vulnerable*
- Grey-headed Flying-fox (*Pteropus poliocephalus*) *Vulnerable*
- Curlew Sandpiper (*Calidris ferruginea*) *Endangered*
- Eastern Osprey (*Pandion cristatus*) *Vulnerable*
- White-bellied Sea-Eagle (*Haliaeetus leucogaster*) *Vulnerable*
- Black Bittern (*Ixobrychus flavicollis*) *Vulnerable*
- Eastern Bentwing-bat (*Miniopterus schreibersii oceanensis*) *Vulnerable*
- Eastern Freetail-bat (*Mormopterus norfolkensis*) *Vulnerable*
- Southern Myotis (*Myotis macropus*) *Vulnerable*
- Narrow-leaved Wilsonia (*Wilsonia backhousei*) *Vulnerable*

Green and Golden Bell Frog (*Litoria aurea*)

The Green and Golden Bell Frog is listed as vulnerable under the EPBC Act 1999 and endangered under the BC Act 2016.

The Green and Golden Bell Frog inhabits marshes, dams and stream-sides, particularly those containing bullrushes (*Typha spp*.) or spikerushes (*Eleocharis spp*.). The Green and Golden Bell Frog formerly had a distribution that extended from Brunswick Heads south to Gippsland in Victoria. This distribution extended as far west as Tumut, the ACT and even to Bathurst. Approximately 50 populations remain in coastal and near coastal areas along the length of its former distribution. The wetlands adjacent to Nuwi Wetland support the largest extant population of Green and Golden Bell Frog in Sydney. Nuwi Wetland is unlikely to support breeding habitat but may support foraging or dispersal habitat. A waterway between Nuwi Wetland and known breeding habitat located at Narawang Wetland immediately west of the site may provide important connectivity between Narawang Wetland and Sydney Olympic Park.

It is likely that the wetlands immediately west and south-east of Nuwi Wetland support an important population of Green and Golden Bell Frog necessary for this species' long-term survival and recovery because three of the four criteria outlined in Commonwealth of Australia (2013) are likely to be met:

- • Key source populations either for breeding or dispersal
- • Populations that are necessary for maintaining genetic diversity, and/or
- • Populations that are near the limit of a species range
- • Important population identified as such in a recovery plan

Table A. Assessment of significance: Green and Golden Bell Frog (*Litoria aurea*)

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A VULNERABLE SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Criteria	**lead to a long-term decrease in the size of an important population of a species**
Response	The proposed development is unlikely to lead to a long-term decrease in the size of an important population given: Shading of Nuwi Wetland is unlikely to increase mortality, reduce the extent or adversely modify potential habitat or breeding habitat. Shading of Nuwi Wetland is unlikely to impact individuals known to breed at Narawang Wetland and which may utilise the Nuwi Wetland periodically to the point that this will cause the population to undergo a long-term decline.
Criteria	**reduce the area of occupancy of an important population**
Response	The proposed development is unlikely to reduce the area of occupancy of an important population of the Green and Golden Bell Frog given that the area to be affected by shading is unlikely to contain breeding habitat. Shading is unlikely to lead to habitat at Nuwi Wetland becoming unsuitable for dispersing individuals and is hence unlikely to reduce the area of occupancy.
Criteria	**fragment an existing important population into two or more populations**
Response	Shading of a portion of Nuwi Wetland is unlikely to fragment an existing important population into two or more populations given that the nature of this impact is unlikely to create a barrier to dispersal
Criteria	**adversely affect habitat critical to the survival of a species**
Response	No habitat critical to the survival of the Green and Golden Bell Frog is likely to be present at Nuwi Wetland.
Criteria	**disrupt the breeding cycle of an important population**

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A VULNERABLE SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Response	The proposed development is unlikely to disrupt the breeding cycle of an important population given that no suitable breeding habitat is likely to be present in the impact area. Increased shading at Nuwi Wetland is unlikely to impact breeding individuals known to occur at Narawang Wetland.
Criteria	**modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**
Response	Shading of Nuwi Wetland may have a minor impact on the floristics of the habitat present but is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the Green and Golden Bell Frog is likely to decline.
Criteria	**result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**
Response	The proposed development is unlikely to introduce invasive species that are harmful to the Green and Golden Bell Frog becoming established in Green and Golden Bell Frog habitat.
Criteria	**introduce disease that may cause the species to decline**
Response	The proposed development is unlikely to introduce disease that may cause the Green and Golden Bell Frog to decline. It is noted that the first published observation of a mortality event directly attributed to the Chytrid fungus for a wild population of Green and Golden Bell Frog was documented at a site in Sydney Olympic Park 500 m south of the survey area in 1999 (Penman et al. 2008).
Criteria	**interfere substantially with the recovery of the species**
Response	Shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to interfere substantially with the recovery of the Green and Golden Bell Frog.

Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox is listed as vulnerable under the BC Act 2016 and the EPBC Act 1999. It occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are commonly found in gullies, close to water, in vegetation with a dense canopy. Travel up to 50 km to forage on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. The Grey-headed Flying-fox has been recorded adjacent to Nuwi Wetland at Sydney Olympic/Bicentennial Park and may occasionally forage in the mangroves at Nuwi Wetland. The nearest known camp is located 5 km west of Nuwi Wetland at Clyde, NSW.

Table B. Assessment of significance: Grey-headed Flying-fox (*Pteropus poliocephalus*)

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A VULNERABLE SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Criteria	**lead to a long-term decrease in the size of an important population of a species**
Response	The proposed development is unlikely to lead to a long-term decrease in the size of an important population given that shading of parts of Nuwi Wetland is unlikely to reduce the extent of the foraging habitat present at Nuwi Wetland.
Criteria	**reduce the area of occupancy of an important population**
Response	The proposed development is unlikely to reduce the area of occupancy of an important population of the Grey-headed Flying-fox given that shading of parts of Nuwi Wetland is unlikely to reduce the extent of the foraging habitat present at Nuwi Wetland.
Criteria	**fragment an existing important population into two or more populations**

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A VULNERABLE SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Response	Shading of a portion of Nuwi Wetland is unlikely to fragment an existing important population into two or more populations.
Criteria	**adversely affect habitat critical to the survival of a species**
Response	No habitat critical to the survival of the Grey-headed Flying-fox is likely to be present at Nuwi Wetland.
Criteria	**disrupt the breeding cycle of an important population**
Response	The proposed development is unlikely to disrupt the breeding cycle of an important population of Grey-headed Flying-fox. The nearest known camp is located 5 km west of Nuwi Wetland at Clyde, NSW.
Criteria	**modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**
Response	Increased shading of Nuwi Wetland resulting from the development of Bay Park, 23 Bennelong Parkway may have a minor impact on certain floristic or structural attributes of species within the Estuarine Mangrove Forest but is unlikely to modify, destroy, remove or isolate or decrease the availability or quality of foraging habitat to the extent that the Grey-headed Flying-fox is likely to decline.
Criteria	**result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**
Response	The proposed development is unlikely to introduce invasive species that are harmful to the Grey-headed Flying-fox becoming established in Grey-headed Flying-fox habitat.
Criteria	**introduce disease that may cause the species to decline**
Response	The proposed development is unlikely to introduce disease that may cause the Grey-headed Flying-fox to decline.
Criteria	**interfere substantially with the recovery of the species**
Response	Increased shading of Nuwi Wetland resulting from the development of Bay Park, 23 Bennelong Parkway is unlikely to interfere substantially with the recovery of the Grey-headed Flying-fox.

Glossy Ibis (*Plegadis falcinellus*)

The Glossy Ibis is listed as migratory under the EPBC Act 1999. It inhabits fresh water marshes at the edges of lakes and rivers, lagoons, flood-plains, wet meadows, swamps, reservoirs, sewage ponds, rice-fields and cultivated areas under irrigation throughout much of Australia excluding the western interior (Marchant and Higgins 1990). Their main threat is the loss and degradation of wetlands which they depend on for foraging and breeding. The Glossy Ibis has a very large global population (200, 000 +), of which approximately 12% is estimated to occur in Australia (Marchant and Higgins 1990).

The Glossy Ibis is an uncommon, non-breeding visitor at wetlands in Sydney Olympic/Bicentennial Park which is recorded most years in low numbers. The closest record to Nuwi Wetland is from the Wentworth Common in 2013 (500 m south-east Nuwi Wetland). The mangroves and mudflats at Nuwi Wetland provide suitable foraging and roosting habitat.

Nuwi Wetland is unlikely to support important Glossy Ibis habitat given that only the fourth of the following important habitat requirements are likely to be met.

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of a species, and/or

Nuwi Wetland is unlikely to occasionally support an ecologically significant proportion of the population of Glossy Ibis given a), the maximum size of flocks recorded in nearby wetland at Sydney Olympic/Bicentennial Park and b), the species' total population size.

- habitat that is of critical importance to the species at particular life-cycle stages, and/or

The mangroves and mudflats at Nuwi Wetland are not of critical importance at a particular life-cycle stage for the Glossy Ibis.

- habitat utilised by a migratory species which is at the limit of the species' range, and/or

Nuwi Wetland is not at the geographic limit of the distribution of any of the 14 migratory shorebirds assessed below.

- habitat within an area where the species is declining.

Glossy Ibis populations have declined over much of their global range over the past 30 years and in Australia numbers declined by 38% between 1977-1981 and 1998-2002 (Barrett et al. 2003). Hence, the habitat is located in an area where the Glossy Ibis is likely to be declining.

Table C. Assessment of significance: Glossy Ibis (*Plegadis falcinellus*)

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A MIGRATORY SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Criteria	**substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species**
Response	Nuwi Wetland is unlikely to represent important habitat for the Glossy Ibis given that an ecologically significant proportion of its population is unlikely to utilise the site. Regardless of the importance of the Nuwi Wetland for this species, increased shading of Nuwi Wetland is unlikely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate any Glossy Ibis habitat.
Criteria	**result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or**
Response	The proposed development is unlikely to result in an invasive species that is harmful to Glossy Ibis becoming established in an area of important Glossy Ibis habitat.
Criteria	**seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the Glossy Ibis' population given the nature of the likely impacts of the proposed development and the number of Glossy Ibis that are likely to occur at Nuwi Wetland.
Conclusion	**The proposed development is unlikely to have an adverse impact on Glossy Ibis.**

Shorebirds: Common Greenshank (*Tringa nebularia*), Common Sandpiper (*Actitis hypoleucos*), Curlew Sandpiper (*Calidris ferruginea*), Sharp-tailed Sandpiper (*Calidris melanotos*), Pectoral Sandpiper (*Calidris melanotos*), Bar-tailed Godwit (*Limosa lapponica*), Red-necked Stint (*Calidris ruficollis*), Pacific Golden Plover (*Pluvialis fulva*), Marsh Sandpiper (*Tringa stagnatilis*), Eastern Curlew (*Numenius madagascariensis*), Latham's Snipe (*Gallinago hardwickii*)

Each of the shorebird species assessed below are listed as migratory under the EPBC Act 1999 and have large non-breeding area distributions which encompass large parts of coastal, near-coastal and/or inland Australia. The Curlew Sandpiper and Eastern Curlew are also listed as critically endangered under the EPBC Act 1999 and the former is listed as endangered under the BC Act 2016. These shorebirds face threats in their breeding range in the Northern Hemisphere, along their migration pathway, the East Asian-Australasian Flyway (EAAF), which spans 23 countries, and in their foraging habitat and roosting sites in Australia. Threats to these shorebirds include habitat loss and degradation at staging areas in East Asia through land reclamation and other factors (Murray *et al*. 2014, Piersma *et al*. 2016), hunting in East Asia, disturbance and habitat degradation in their non-breeding habitat (i.e. from recreational activities such as fishing, boating, walking dogs, night lighting) (Priest *et al.* 2002, Glover *et al.* 2011), and global warming (Wauchope *et al*. 2016).

Common Greenshank, Marsh Sandpiper

The Common Greenshank and Marsh Sandpiper occur in a wide variety of inland wetlands and sheltered coastal habitats of varying salinity. In sheltered coastal habitats, they typically forage at sites containing mudflats, saltmarsh, mangroves or seagrass (Higgins and Davies 1996). Inland habitat types utilised include permanent and ephemeral terrestrial wetlands, including swamps, lakes, dams, rivers, creeks, billabongs, waterholes, inundated floodplains and claypans. The Common Greenshank's EAAF population is estimated to comprise 110,000 individuals whilst the Marsh Sandpiper's EAAF population is estimated to comprise 130,000 individuals (Hansen et al. 2016). Both species are occasional visitors in the Sydney Olympic/Bicentennial Park area. Suitable roosting and/or foraging habitat in the form of mudflats adjacent to mangroves is present at Nuwi Wetland. The Common Greenshank is recorded in low numbers at Sydney Olympic/Bicentennial Park roughly once every three years. The Marsh Sandpiper has been recently recorded at Sydney Olympic/Bicentennial Park in 2005-2008, 2013-2015.

Common Sandpiper

The Common Sandpiper occurs across a wide range of coastal wetlands and some inland wetlands but typically inhabits muddy margins or rocky shores in estuaries to quite far upstream and around lakes, billabongs, dams and occasionally piers and jetties (Higgins and Davies 1996). The Common Sandpiper's EAAF population is estimated to consist of 190,000 individuals (Hansen et al. 2016). The Common Sandpiper is an occasional visitor in the areas of habitat <1 km south-east of Nuwi Wetland. There are 20 + Common Sandpiper records from Sydney Olympic/Bicentennial Park. Most records from Shipwreck Point (700 m east of Nuwi Wetland).

Curlew Sandpiper

The Curlew Sandpiper occurs at a range of inland wetlands and sheltered coastal habitat types. It typically occurs on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms (Higgins and Davies 1996). The Curlew Sandpiper's EAAF population is estimated to comprise 90,000 individuals and is in steep decline (Department of Environment 2015, Hansen et al. 2016). This species also occasionally utilises inland ephemeral and permanent lakes, dams and bore drains. The Curlew Sandpiper is an occasional visitor in the Sydney Olympic/Bicentennial Park area which is recorded approximately every second year. For example, observed in 2003, 2005, 2006, 2012, 2013 and 2014.

Sharp-tailed Sandpiper

The Sharp-tailed Sandpiper primarily utilises shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation (Higgins and Davies 1996). This includes intertidal mudflats, lagoons, swamps, lakes and pools near the coast, and dams, waterholes, soaks, bore drains and bore swamps, saltpans and sewage farms. The Sharp-tailed Sandpiper's EAAF population is estimated to comprise 85,000 individuals (Hansen et al. 2016). This species is regularly recorded at Sydney Olympic/Bicentennial Park in small to large flocks of up to 200 individuals. Suitable roosting and/or foraging habitat in the form of mudflats adjacent to mangroves is present at Nuwi Wetland however due to its size and habitat type this location likely supports far lower numbers of Sharp-tailed Sandpiper in comparison with the Waterbird Refuge at Sydney Olympic Park and Mason Park in Homebush.

Pectoral Sandpiper

The Pectoral Sandpiper occurs at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands (Higgins and Davies 1996). The Pectoral Sandpiper prefers water bodies that have open fringing mudflats and low, emergent or fringing vegetation, such as grass or samphire. It is

usually found in coastal or near coastal habitat but is occasionally found further inland. The Pectoral Sandpiper's EAAF population is estimated to comprise 1,220,000 – 1,930,000 individuals (Hansen *et al*. 2016). It is a rare visitor in the Sydney Olympic/Bicentennial Park area having been recorded in 2006 and 2007. It was recorded most recently in the area in 2008 at Mason Park, Homebush. The mudflats at Nuwi Wetland likely constitute suitable roosting and/or foraging habitat.

Bar-tailed Godwit

The Bar-tailed Godwit primarily inhabits coastal habitats such as sheltered bays, estuaries and lagoons with large intertidal mudflats or sandflats, or spits and banks of mud, sand or shell-grit and are only occasionally found on inland freshwater or saline lakes, swamps or bore-overflows (Higgins and Davies 1996). The Bar-tailed Godwit's EAAF population of 325,000 individuals comprises two subspecies, namely *Limosa lapponica bauera* and *Limosa lapponica menzbieri*.

Red-necked Stint

The Red-necked Stint primarily occurs in coastal areas, including in sheltered inlets, bays, lagoons and estuaries with intertidal mudflats (Higgins and Davies 1996). They occasionally occur on exposed or ocean beaches, and sometimes on stony or rocky shores, reefs or shoals. They also occur at near-coastal or inland saltworks, sewage farms, saltmarshes and ephemeral or permanent shallow wetlands. The Red-necked Stint's EAAF population is estimated to comprise 475,000 individuals (Hansen *et al*. 2016). This species is an uncommon visitor in the Sydney Olympic/Bicentennial Park area which has been recorded occasionally during the past decade (i.e. in 2009, 2012-2015 and 2017). The Nuwi Wetland contains suitable roosting and/or foraging habitat.

Pacific Golden Plover

The Pacific Golden Plover occurs on beaches, mudflats and sandflats in sheltered areas including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks (Marchant and Higgins 1993). This species is less often recorded in terrestrial habitats, usually wetlands such as fresh, brackish or saline lakes, billabongs, pools, swamps and wet claypans, especially those with muddy margins and often with submerged vegetation or short emergent grass. The Pacific Golden Plover's EAAF population is estimated to comprise 120,000 individuals (Hansen *et al.* 2016). This species is a regular though uncommon visitor in the Sydney Olympic/Bicentennial Park area. The Nuwi Wetland supports suitable roosting and/or foraging habitat in the form of mudflats adjacent to mangroves.

Eastern Curlew

The Eastern Curlew primarily occurs at coastal lakes, inlets, bays and estuarine habitats and occasionally inhabits ocean beaches and rock platforms throughout its almost exclusively coastal distribution in NSW. It roosts on spits and inlets near the high-tide mark. The Eastern Curlew's EAAF population is estimated to comprise 35,000 individuals (Hansen *et al*. 2016). The Eastern Curlew is an uncommon visitor in the Sydney Olympic /Centennial Park area which has been recorded in low numbers in 1997, 2006, 2007, 2008 and 2009.

Latham's Snipe

The Latham's Snipe occurs in permanent and ephemeral wetlands up to 2000 m above sea-level. They prefer open, freshwater wetlands with low, dense vegetation (e.g. swamps, flooded grasslands or heathlands, around bogs and other water bodies) but also occasionally inhabit saline or brackish water, in modified or artificial habitats (Higgins and Davies 1996). The Latham's Snipe's EAAF population is estimated to comprise 30,000 individuals (Hansen *et al.* 2016). There is potential roosting and/or foraging habitat present at Nuwi Wetland. This species is likely to fly over the site whilst moving between suitable habitat at Narawang Wetland and Wentworth Common. It is an uncommon visitor at Sydney Olympic/Bicentennial Park which is recorded in low numbers most years.

Important shorebird habitat and ecologically significant proportions of shorebird populations

Shorebird habitat for migratory shorebirds listed under the EPBC Act 1999 is considered internationally important according to the EPBC Act Policy Statement 3.21 (Commonwealth of Australia 2017) if it regularly supports:

- 1 per cent of the individuals in a population of one species or subspecies of waterbird or
- a total abundance of at least 20 000 waterbirds.

Shorebird habitat for migratory shorebirds listed under the EPBC Act 1999 is considered nationally important according to the EPBC Act Policy Statement 3.21 (Commonwealth of Australia 2017) if it regularly supports:

- 0.1 per cent of the flyway population of a single species of migratory shorebird, barring Latham's Snipe, for which it is 0.05% or
- 2000 migratory shorebirds or
- 15 migratory shorebird species

The number of individual birds that corresponds to 0.1% of the total population of each of the 14 shorebirds included in this assessment in accordance with the latest population estimates (Hansen *et al*. 2016) is as follows:

Common Greenshank (110); Common Sandpiper (190); Curlew Sandpiper (90); Sharp-tailed Sandpiper (85); Pectoral Sandpiper (1220); Red-necked Stint (475); Pacific Golden Plover (120); Marsh Sandpiper (130); Eastern Curlew (35), Latham's Snipe (18) (Hansen *et al.* 2016).

Nuwi Wetland is unlikely to meet the following important habitat requirements (Commonwealth of Australia 2013):

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of a species, and/or

Given the small size of the mudflat exposed during low tide at Nuwi Wetland and the maximum flock sizes recorded at larger areas of higher quality habitat adjacent to the site at Sydney Olympuic/Bicentennial Park it is unlikely that this site supports an ecologically significant proportion of the population of any of these species as per the important habitat criteria outlined in the Matters of National Environmental Significance – Significant impact guidelines (Commonwealth of Australia 2013).

- habitat that is of critical importance to the species at particular life-cycle stages, and/or

Habitat at Nuwi Wetland is not of critical importance at a particular life-cycle stage for any of these shorebird species.

- habitat utilised by a migratory species which is at the limit of the species' range, and/or

Nuwi Wetland is not at the geographic limit of the distribution of any of the 14 migratory shorebirds assessed below.

- habitat within an area where the species is declining.

Recent analyses of longitudinal data collected in Australia have highlighted significant declines in the EAAF populations of Curlew Sandpiper, Bar-tailed Godwit, Red-necked Stint, Common Greenshank, Pacific Golden Plover and Latham's Snipe (Clemens et al. 2016, Studds et al. 2017). A proportion of these species' populations occur in NSW during the non-breeding season, hence, the habitat present at Nuwi Wetland is located in a region where these six species are declining.

Table D. Assessment of significance: Common Greenshank Tringa nebularia, Common Sandpiper Actitis hypoleucos, Curlew Sandpiper Calidris ferruginea, Sharp-tailed Sandpiper Calidris melanotos, Pectoral Sandpiper Calidris melanotos, Red-necked Stint Calidris ruficollis, Pacific Golden Plover Pluvialis fulva, Marsh Sandpiper Tringa stagnatilis, Eastern Curlew (Numenius madagascariensis), Latham's Snipe Gallinago hardwickii

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A MIGRATORY SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Criteria	**substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to substantially modify, destroy or isolate an area of important Common Greenshank, Common Sandpiper, Curlew Sandpiper, Sharp-tailed Sandpiper, Pectoral Sandpiper, Bar-tailed Godwit, Red-necked Stint, Pacific Golden Plover, Marsh Sandpiper, Eastern Curlew or Latham's Snipe habitat. Nuwi Wetland is unlikely to support important habitat for any of these shorebird species.
Criteria	**result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or**
Response	The proposed development is unlikely to result in an invasive species that is harmful to Common Greenshank, Common Sandpiper, Curlew Sandpiper, Sharp-tailed Sandpiper,

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A MIGRATORY SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
	Pectoral Sandpiper, Bar-tailed Godwit, Red-necked Stint, Pacific Golden Plover, Marsh Sandpiper, Eastern Curlew or Latham's Snipe becoming established in an area of important Common Greenshank, Common Sandpiper, Curlew Sandpiper, Sharp-tailed Sandpiper, Pectoral Sandpiper, Bar-tailed Godwit, Red-necked Stint, Pacific Golden Plover, Marsh Sandpiper, Eastern Curlew or Latham's Snipe habitat.
Criteria	**seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of Common Greenshank, Common Sandpiper, Curlew Sandpiper, Sharp-tailed Sandpiper, Pectoral Sandpiper, Bar-tailed Godwit, Red-necked Stint, Pacific Golden Plover, Marsh Sandpiper, Eastern Curlew or Latham's Snipe because Nuwi Wetland given Nuwi Wetland is unlikely to regularly support an ecologically significant proportion of any of these species. The effects of increased shading may have minor impacts on factors such as habitat quality and prey availability however it is unlikely that this will seriously disrupt the lifecycle of shorebird species using Nuwi Wetland.
Conclusion	**The proposed development is unlikely to have a significant adverse impact on the Common Greenshank, Common Sandpiper, Curlew Sandpiper, Sharp-tailed Sandpiper, Pectoral Sandpiper, Bar-tailed Godwit, Red-necked Stint, Pacific Golden Plover, Marsh Sandpiper, Eastern Curlew or Latham's Snipe.**

Caspian Tern (*Hydroprogne caspia*), Common Tern (*Sterna hirundo*)

The Caspian Tern is generally restricted to coastal areas or large water bodies such as rivers, wetlands or lakes throughout its widespread Australian range (Higgins and Davies 1996). The Caspian Tern is a relatively common visitor which is regularly recorded at Sydney Olympic/Bicentennial Park. Suitable foraging habitat is present at Nuwi Wetland.

The Common Tern occurs in all marine zones, but is most regularly observed in near-coastal waters, both on ocean beaches, platforms and headlands and in sheltered waters, such as bays, harbours and estuaries with muddy, sandy or rocky shores within its mostly coastal Australian distribution (Higgins and Davies 1996). The Common Tern is a rare/uncommon visitor in the Sydney Olympic/Bicentennial Park area which has been recorded in 1992, 1995-1997, 1999, 2000, 2004, 2006 and 2013. Suitable foraging habitat located at Nuwi Wetland.

Nuwi Wetland is unlikely to support important Caspian Tern or Common Tern habitat given that none of the following important habitat requirements are likely to be met:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of a species, and/or
- habitat that is of critical importance to the species at particular life-cycle stages, and/or
- habitat utilised by a migratory species which is at the limit of the species' range, and/or
- habitat within an area where the species is declining.

Table E. Assessment of significance: Caspian Tern (*Hydroprogne caspia*), Common Tern (*Sterna hirundo*)

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A MIGRATORY SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Criteria	**substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species**

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A MIGRATORY SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important Caspian Tern or Common Tern habitat. Nuwi Wetland is unlikely to support important habitat for these two tern species.
Criteria	**result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or**
Response	The proposed development is unlikely to result in an invasive species that is harmful to the Caspian Tern or Common Tern becoming established in an area of important Caspian Tern or Common Tern habitat.
Criteria	**seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the Caspian Tern or Common Tern population given that these species are non-breeding visitors which are likely to only occur in low numbers at Nuwi Wetland.
Conclusion	**The proposed development is unlikely to have a significant adverse impact on the Caspian Tern or Common Tern.**

Eastern Osprey (*Pandion cristatus*)

The Eastern Osprey is listed as migratory under the EPBC Act 1999 and vulnerable under the BC Act 2016/ TSC Act 1995. The Eastern Osprey's Australian distribution encompasses much of the mainland's coast excluding the Nullarbor Plain. It primarily occurs in coastal areas (but occasionally travels inland along major rivers) where it inhabits inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes (Marchant and Higgins 1993). The main threat to Eastern Osprey in Australia is loss, degradation or alteration of habitat for urban or tourism development (Clancy 1989, 1991, Dennis 2007, Olsen 1998). Other threats include ingestion of prey items containing pollutants such as pesticides, heavy metals or fishing tackle and competition for food with commercial and recreational fisheries. The Eastern Osprey is uncommon in NSW where it's population was estimated to comprise roughly 100 pairs in 1996 (Clancy 2006). It is a rare visitor in the Sydney Olympic /Centennial Park area which has been recorded in 2007 and 2016. Nuwi Wetland supports potential foraging habitat.

Nuwi Wetland is unlikely to support important Eastern Osprey habitat given that none of the following important habitat requirements are likely to be met:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of a species, and/or
- habitat that is of critical importance to the species at particular life-cycle stages, and/or
- habitat utilised by a migratory species which is at the limit of the species' range, and/or
- habitat within an area where the species is declining.

Table F. Assessment of significance: Eastern Osprey (*Pandion cristatus*)

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A MIGRATORY SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Criteria	**substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to substantially modify (including by fragmenting, altering fire regimes, altering

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A MIGRATORY SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
	nutrient cycles or altering hydrological cycles), destroy or isolate an area of important Eastern Osprey habitat. Nuwi Wetland is unlikely to support important Eastern Osprey habitat.
Criteria	**result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or**
Response	The proposed development is unlikely to result in an invasive species that is harmful to Eastern Osprey becoming established in an area of important Eastern Osprey habitat.
Criteria	**seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the Eastern Osprey's population (i.e. 24 individuals) given that this species is a rare visitor at Nuwi Wetland and the nature of the likely impact is not disruptive to this species.
Conclusion	**The proposed development is unlikely to have a significant adverse impact on the Eastern Osprey.**

Pacific Swift (*Apus pacificus*), White-throated Needletail (*Hirundapus caudacutus*)

The Pacific Swift and White-throated Needletail are listed as migratory under the EPBC Act 1999.

The Pacific Swift is a widespread, almost exclusively aerial migratory species which is distributed throughout much of north-east, east and south-east Asia and Australia (Higgins 1999). The nominate race migrates to Australia during the non-breeding season (October-April) over a broad range of different habitat types. Pacific Swift mostly occur over dry or open habitats on inland plains but are known to occur over ocean, beaches, islands, and mountainous and/or heavily forested areas. A total of 100 individuals corresponds to an ecologically significant proportion of their population at the national scale, whilst a total of 1000 individuals corresponds to an internationally significant proportion of their population (Commonwealth of Australia 2015). The Pacific Swift is an uncommon visitor which has been recorded in 2013, 2015 and 2016 at Sydney Olympic/Bicentennial Park. It is likely to occur in the airspace above Nuwi Wetland.

The White-throated Needletail is a migratory swift which breeds in north-east Asia and spends the non-breeding season (October - April) in eastern and south-eastern Australia (Higgins 1999). Whilst in Australia, the White-throated Needletail occurs most frequently in forested areas located along and east of the Great Dividing Range, where it is almost exclusively aerial (Commonwealth of Australia 2015). Large tracts of native vegetation, particularly forest, is considered a key habitat requirement (Commonwealth of Australia 2015). The White-throated Needletail also occurs over beaches, mudflats, open woodland and urban areas. A total of 10 individuals is an ecologically significant proportion of their population at the national scale, whilst a total of 100 individuals represents an internationally significant proportion of their population (Commonwealth of Australia 2015). The White-throated Needletail is a common visitor recorded each year overhead at Sydney Olympic/Bicentennial Park. It is very likely to occur in airspace above Nuwi Wetland.

Nuwi Wetland is unlikely to support important Pacific Swift or White-throated Needletail habitat, as none of the following four important habitat requirements are likely to be met:

- habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of a species, and/or
- habitat that is of critical importance to the species at particular life-cycle stages, and/or
- habitat utilised by a migratory species which is at the limit of the species' range, and/or
- habitat within an area where the species is declining.

Table G. Assessment of significance: Pacific Swift (Apus pacificus), White-throated Needletail (Hirundapus caudacutus)

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A MIGRATORY SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Criteria	**substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway will not substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important Pacific Swift or White-throated Needletail habitat. Nuwi Wetland is unlikely to support important Pacific Swift or White-throated Needletail habitat.
Criteria	**result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or**
Response	The proposed development will not result in an invasive species that is harmful to Pacific Swift or White-throated Needletail becoming established in an area of important Pacific Swift or White-throated Needletail habitat. No invasive species are known to affect the Pacific Swift or White-throated Needletail in Australia.
Criteria	**seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to disrupt the lifecycle of either the Pacific Swift or White-throated Needletail.
Conclusion	**The proposed development is unlikely to have a significant adverse impact on the Pacific Swift or White-throated Needletail.**

Black-faced Monarch (*Monarcha melanopsis*), Satin Flycatcher (*Myiagra cyanoleuca*), Rufous Fantail (*Rhipidura rufifrons*)

The Black-faced Monarch, Satin Flycatcher and Rufous Fantail are listed as migratory under the EPBC Act. Habitat loss and degradation in eastern Australia poses a threat to these migratory passerines though each has a large population and extensive suitable habitat is located in protected areas across their respective ranges.

The Black-faced Monarch primarily occurs tropical, sub-tropical and temperate rainforest in eastern Australia (Higgins *et al*. 2006). It is an uncommon visitor at Sydney Olympic/Centennial Park. Nuwi Wetland supports potential habitat that is most likely to be utilise during migration. The Satin Flycatcher inhabits wet and dry sclerophyll forests and tall woodlands in eastern Australia, particularly heavily vegetated gullies (Higgins *et al*. 2006). During migration, the Satin Flycatcher occurs in coastal forests, woodlands and mangroves. It is an uncommon visitor at Sydney Olympic /Centennial Park and is likely to occur at Nuwi Wetland as the site contains suitable habitat. The Rufous Fantail occurs in wet sclerophyll forests with a dense shrubby understory in eastern Australia (Higgins *et al*. 2006). Rufous Fantail often inhabit often gullies dominated by eucalypts such as Tallow-wood (*Eucalyptus microcorys*), Mountain Grey Gum (*E*. *cypellocarpa*), Narrow-leaved Peppermint (*E*. *radiata*), Mountain Ash (*E. regnans*), Alpine Ash (*E*. *delegatensis*), Blackbutt (*E*. *pilularis*) or Red Mahogany (*E*. *resinifera*). They also occur in subtropical and temperate rainforests. The Rufous Fantail is an occasional visitor at Sydney Olympic/Centennial Park. It was most recently recorded at Shipwreck Point in 2017 approximately 400 m east of Nuwi Wetland. The mangroves and swamp oak forest at Nuwi Wetland comprise suitable habitat.

The site is unlikely to support important Black-faced Monarch, Satin Flycatcher or Rufous Fantail habitat as none of the following four important habitat requirements are likely to be met:

a) habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of a species, and/or

b) habitat that is of critical importance to the species at particular life-cycle stages, and/or

c) habitat utilised by a migratory species which is at the limit of the species' range, and/or

habitat within an area where the species is declining.

Table G. Assessment *of significance:* Black-faced Monarch (*Monarcha melanopsis),* Satin Flycatcher (*Myiagra cyanoleuca),* Rufous Fantail (*Rhipidura rufifrons)*

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A MIGRATORY SPECIES IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Criteria	**substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species**
Response	Shading of approximately 1.8 ha of Estuarine Mangrove Forest and 0.1 ha of Swamp Oak Forest at Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway may have a minor impact on certain attributes of these habitat types however such impacts are unlikely to cause substantial modification to or result in the loss of such habitat. The habitat at Nuwi Wetland is unlikely to comprise important habitat for these three migratory passerines.
Criteria	**result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species, or**
Response	The proposed development is unlikely to introduce an invasive species that is harmful to Black-faced Monarch, Satin Flycatcher or Rufous Fantail (i.e. Black rat (*Rattus rattus*) and invasive vines (Commonwealth of Australia 2015)) becoming established in an area of important Black-faced Monarch, Satin Flycatcher or Rufous Fantail habitat.
Criteria	**seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of either the Black-faced Monarch, Satin Flycatcher or Rufous Fantail.
Conclusion	**The proposed development is unlikely to have a significant adverse impact on Black-faced Monarch, Satin Flycatcher or Rufous Fantail.**

Coastal Swamp Oak (*Casuarina glauca*) Forest of New South Wales and South East Queensland ecological community

Table H. Assessment of significance: Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A CRITICALLY ENDANGERED OR ENDANGERED ECOLOGICAL COMMUNITY IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Criteria	**reduce the extent of an ecological community**
Response	Increased shading associated with the proposed development may have a negative impact on Coastal Swamp Oak (*Casuarina glauca*) Forest though is unlikely to reduce the extent of this community at Nuwi Wetland.

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A CRITICALLY ENDANGERED OR ENDANGERED ECOLOGICAL COMMUNITY IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Criteria	**fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines**
Response	Due to the nature of the proposed development it is unlikely that the proposed action will fragment or increase fragmentation of Coastal Swamp Oak (*Casuarina glauca*) Forest.
Criteria	**adversely affect habitat critical to the survival of an ecological community**
Response	No critical habitat has been declared for this ecological community.
Criteria	**modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns**
Response	The proposed development is unlikely to modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the survival of Coastal Swamp Oak (*Casuarina glauca*) Forest, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.
Criteria	**cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting**
Response	The proposed development is unlikely to cause a substantial change in the species composition of an occurrence of Coastal Swamp Oak (*Casuarina glauca*) Forest, including causing a decline or loss of functionally important species, for example, through regular burning or flora or fauna harvesting due to the nature of the impact of the proposed development on the Nuwi Wetland.
Criteria	**cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:** **-- assisting invasive species, that are harmful to the listed ecological community, to become established, or** **-- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or**
Response	The proposed development is unlikely to cause a substantial reduction in the quality or integrity of Coastal Swamp Oak (*Casuarina glauca*) Forest given that increased shading is unlikely have a considerable effect on the floristics or structure of this community.
Criteria	**interfere with the recovery of an ecological community.**
Response	The proposed development is unlikely to interfere with the recovery of Coastal Swamp Oak (*Casuarina glauca*) Forest as a restricted area of this community is present in the impact area, and no significant impact on such habitat is expected.
Conclusion	**The proposed development is unlikely to have an adverse impact Coastal Swamp Oak (*Casuarina glauca*) Forest.**

Subtropical and Temperate Coastal Saltmarsh

Table I. Assessment of significance: Subtropical and Temperate Coastal Saltmarsh

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A CRITICALLY ENDANGERED OR ENDANGERED ECOLOGICAL COMMUNITY IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Criteria	**reduce the extent of an ecological community**
Response	Increased shading associated with the proposed development may have a negative impact on Subtropical and Temperate Coastal Saltmarsh though is unlikely to reduce the extent of this community at Nuwi Wetland.
Criteria	**fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines**
Response	Increased shading is unlikely to fragment or increase fragmentation of Subtropical and Temperate Coastal Saltmarsh at Nuwi Wetland.
Criteria	**adversely affect habitat critical to the survival of an ecological community**
Response	No critical habitat has been declared for this ecological community.
Criteria	**modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns**
Response	The proposed development is unlikely to modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for the survival of Subtropical and Temperate Coastal Saltmarsh, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.
Criteria	**cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting**
Response	The proposed development is unlikely to cause a substantial change in the species composition of an occurrence of Subtropical and Temperate Coastal Saltmarsh, including causing a decline or loss of functionally important species, for example, through regular burning or flora or fauna harvesting due to the nature of the impact of the proposed development on the Nuwi Wetland.
Criteria	**cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:** **-- assisting invasive species, that are harmful to the listed ecological community, to become established, or** **-- causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community, or**
Response	The proposed development is unlikely to cause a substantial reduction in the quality or integrity of Subtropical and Temperate Coastal Saltmarsh. Increased shading is unlikely have a considerable effect on the floristics or structure of this community.
Criteria	**interfere with the recovery of an ecological community.**
Response	The proposed development is unlikely to interfere with the recovery of Subtropical and Temperate Coastal Saltmarsh as a restricted area of this community is present in the impact area, and no significant impact on such habitat is expected.

TEST	AN ACTION IS LIKELY TO HAVE A SIGNIFICANT IMPACT ON A CRITICALLY ENDANGERED OR ENDANGERED ECOLOGICAL COMMUNITY IF THERE IS A REAL CHANCE OR POSSIBILITY THAT IT WILL:
Conclusion	**The proposed development is unlikely to have an adverse impact Subtropical and Temperate Coastal Saltmarsh.**

Assessments of Significance - BC Act 2016

Green and Golden Bell Frog (*Litoria aurea*)

Table J. Assessment of significance: Green and Golden Bell Frog (Litoria aurea)

TEST	
Criteria	**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**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to have an adverse effect on the life cycle of the Green and Golden Bell Frog such that a viable local population of the species is likely to be place at risk of extinction given: • Shading of a portion of Nuwi Wetland is unlikely to increase mortality, reduce the extent or adversely modify potential habitat or breeding habitat. • Shading of a portion of Nuwi Wetland is unlikely to impact breeding individuals known to occur at the adjacent Narawang Wetland.
Criteria	**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** • **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**
Response	NA
Criteria	**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, and:** • **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, and** • **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality**
Response	• Approximately 1.8 ha of Estuarine Mangrove Forest and 0.1 ha of Estuarine Swamp Oak Forest will be affected by shading as a result of the development of Bay Park, 23 Bennelong Parkway. • No habitat is likely to become fragmented or isolated as shading is unlikely to create a barrier to dispersal. • Though unlikely, the habitat to be affected by shading may be important to the long-term survival of the Green and Golden Bell Frog at this locality. However, the impact

TEST	
	of the shading of such habitat is unlikely to adversely impact this population of Green and Golden Bell Frog such that its long-term persistence will be threatened.
Criteria	**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)**
Response	The proposed development is unlikely to have an adverse direct or indirect effect on a declared area of outstanding biodiversity value given that no such areas are present at Nuwi Wetland.
Criteria	**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 development does not constitute any key threatening process.

Grey-headed Flying-fox (*Pteropus poliocephalus*)

The Grey-headed Flying-fox is listed as vulnerable under the BC Act 2016 and the EPBC Act 1999. It occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are commonly found in gullies, close to water, in vegetation with a dense canopy. Travel up to 50 km to forage on the nectar and pollen of native trees, in particular Eucalyptus, Melaleuca and Banksia, and fruits of rainforest trees and vines. The Grey-headed Flying-fox has been recorded adjacent to Nuwi Wetland at Sydney Olympic/Bicentennial Park and may occasionally forage in the mangroves at Nuwi Wetland. The nearest known camp is located 5 km west of Nuwi Wetland at Clyde, NSW.

Table K. Assessment of significance: Grey-headed Flying-fox (Pteropus poliocephalus)

TEST	
Criteria	**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**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to have an adverse effect on the life cycle of Grey-headed Flying-fox such that a viable local population is likely to be placed at risk of extinction given that: • No Grey-headed Flying-fox camp is located at or near Nuwi Wetland. The nearest camp is located 5 km west of Nuwi Wetland. • Any impact on the fruiting of mangrove species located in the shading zone is unlikely to reduce the quality of this foraging habitat to the point that the local population of Grey-headed Flying-fox is likely to be place at the risk of extinction. It is unlikely that the habitat to be impacted is important to the long-term persistence of the local Grey-headed Flying fox population.
Criteria	**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** • **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**

TEST	
Response	NA
Criteria	**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, and:** • **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, and** • **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality**
Response	• Approximately 1.8 ha of Estuarine Mangrove Forest and 0.1 ha of Estuarine Swamp Oak Forest will be affected by shading as a result of the development of Bay Park, 23 Bennelong Parkway. • No habitat is likely to become fragmented or isolated as a result of the proposed development. • The habitat to be affected by shading is unlikely to be important to the long-term survival of the Grey-headed Flying-fox as it neither comprises important breeding habitat nor does it support an ecologically significant proportion of this species' population.
Criteria	**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)**
Response	The proposed development is unlikely to have an adverse direct or indirect effect on a declared area of outstanding biodiversity value given that no such areas are present at Nuwi Wetland.
Criteria	**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 development does not constitute any key threatening process.

Microbats – Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), Eastern Free-tail Bat (*Morphomopterus norfolkensis*), Southern Myotis (*Myotis macropus*)

The Eastern Bentwing Bat (*Miniopterus schreibersii oceanensis*), Eastern Free-tail Bat (*Morphomopterus norfolkensis*) and Southern Myotis (*Myotis macropus*) are listed as vulnerable under the BC Act 2016.

Eastern Bentwing Bat

The Eastern Bentwing Bat occurs in eastern and south-eastern Australia between Cape York, QLD and Naracoorte, SA where it occurs across a range of habitats but tends to forage over forested landscapes. The Eastern Bentwing Bat primarily roosts in caves but also uses derelict mines, storm-water tunnels, buildings and other man-made structures. It forms discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. It has been recorded nearby at Sydney Olympic/Bicentennial Park. Nuwi Wetland likely supports suitable foraging habitat.

Eastern Free-tail Bat

The Eastern Free-tail Bat occurs in wet and dry sclerophyll forest, coastal woodlands, mangroves and in riparian zones in rainforest along the eastern seaboard and adjacent ranges between the Sunshine Coast, QLD and Eden, NSW and inland to approximately Warwick, QLD and Muswellbrook, NSW. It generally forages above forest canopy or forest

edge and requires roosts including tree hollows. It has been recorded nearby at Sydney Olympic/Bicentennial Park. Nuwi Wetland likely supports suitable foraging habitat.

Southern Myotis

The Southern Myotis occurs in northern, eastern and south-eastern Australia over creeks, pools and lakes where it preys on insects and small fish. The Southern Myotis generally roosts in groups of 10-15 individuals close to water in caves, mine shafts, hollow-bearing trees, storm water channels, buildings, under bridges and in dense foliage. It has been recorded nearby at Sydney Olympic/Bicentennial Park. Nuwi Wetland supports suitable foraging habitat.

Table L. Assessment of significance: Eastern Bentwing Bat (Miniopterus schreibersii oceanensis), Eastern Free-tail Bat (Morphomopterus norfolkensis), Southern Myotis (Myotis macropus)

TEST	
Criteria	**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**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to have an adverse effect on the life cycle of the Eastern Bentwing Bat, Eastern Free-tail Bat or Southern Myotis such that a viable local population of any of these species is likely to be placed at risk of extinction given:
Criteria	**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 • 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
Response	NA
Criteria	**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, and:** • **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, and** • **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality**
Response	• Approximately 1.8 ha of Estuarine Mangrove Forest and 0.1 ha of Estuarine Swamp Oak Forest will be affected by shading as a result of the development of Bay Park, 23 Bennelong Parkway. • No habitat is likely to become fragmented or isolated as a result of the proposed development. • The habitat to be affected by shading is unlikely to be important to the long-term survival of the Eastern Bentwing Bat, Eastern Free-tail Bat or Southern Myotis as it neither comprises important breeding habitat nor does it support an ecologically significant proportion of this species' population.

TEST	
Criteria	• **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)**
Response	The proposed development is unlikely to have an adverse direct or indirect effect on a declared area of outstanding biodiversity value given that no such areas are present at Nuwi Wetland.
Criteria	• **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**
Response	The proposed development does not constitute any key threatening process.
Conclusion	The proposed development is unlikely to have a significant adverse impact on these species.

Curlew Sandpiper (*Calidris ferrunginea*)

The Curlew Sandpiper occurs at a range of inland wetlands and sheltered coastal habitat types. It typically occurs on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms (Higgins and Davies 1996). The Curlew Sandpiper's EAAF population is estimated to comprise 90,000 individuals and is in steep decline (Department of Environment 2015, Hansen *et al*. 2016). This species also occasionally utilises inland ephemeral and permanent lakes, dams and bore drains. The Curlew Sandpiper is an occasional visitor in the Sydney Olympic/Bicentennial Park. It is recorded in low numbers at wetlands in this area approximately every second year. During the past two decades it was recorded at Sydney Olympic/Bicentennial Park 2003, 2005, 2006, 2012, 2013 and 2014. SMEC

Table M. Assessment of significance: Curlew Sandpiper (Calidris ferrunginea)

TEST	
Criteria	**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**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to have an adverse effect on the life cycle of the Curlew Sandpiper such that a viable local population is likely to be placed at risk of extinction given: a) The Curlew Sandpiper likely only occurs at Nuwi Wetland occasionally and in low numbers. b) The habitat to be affected by shading is unlikely to be important to the long-term survival of this species.
Criteria	**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** • **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**
Response	NA
Criteria	**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, and:** • **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, and**

TEST	
	• **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality**
Response	• Approximately 0.5 ha of mudflats exposed during low tide will be affected by shading as a result of the development of Bay Park, 23 Bennelong Parkway. • No habitat is likely to become fragmented or isolated as a result of the proposed development. • The habitat to be affected by shading is unlikely to be important to the long-term survival of the Curlew Sandpiper as it neither comprises important breeding habitat nor does it support an ecologically significant proportion of this species' population.
Criteria	**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)**
Response	The proposed development is unlikely to have an adverse direct or indirect effect on a declared area of outstanding biodiversity value given that no such areas are present at Nuwi Wetland.
Criteria	**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**
Response	The proposed development does not constitute any key threatening process.
Conclusion	The proposed development is unlikely to have a significant adverse impact on this species.

Black Bittern (*Ixobrychus flavicollis)*

The Black Bittern occurs in coastal and near-coastal areas of northern and eastern Australia where it primarily inhabits dense vegetation associated with terrestrial and estuarine wetlands and occasionally inhabits flooded grassland, forest, woodland, rainforest and mangroves (Marchant and Higgins 1990). The Black Bittern is a very rare visitor in the Sydney Olympic/Bicentennial Park area. It was recorded in 2005 adjacent to Nuwi Wetland at Narawang Wetland. Nuwi Wetland contains suitable foraging and roosting habitat.

Table N. Assessment of significance: Black Bittern (*Ixobrychus flavicollis)*

TEST	
Criteria	**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**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to have an adverse effect on the life cycle of the Black Bittern such that a viable local population is likely to be placed at risk of extinction given: a) The Black Bittern likely only occurs at Nuwi Wetland on rare occasions. b) Shading of suitable habitat is unlikely to cause this species to decline in this locality and the habitat to be affected by shading is unlikely to be important to the long-term survival of a viable local population.
Criteria	**in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**

TEST	
	• **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** • **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**
Response	NA
Criteria	**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, and:** • **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, and** • **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality**
Response	• Approximately 1.8 ha of Estuarine Mangrove Forest and 0.1 ha of Estuarine Swamp Oak Forest will be affected by shading as a result of the development of Bay Park, 23 Bennelong Parkway. • No habitat is likely to become fragmented or isolated as a result of the proposed development. • The habitat to be affected by shading is unlikely to be important to the long-term survival of the Black Bittern as it doesn't comprise important breeding habitat and this species is likely to only very rarely utilise this habitat.
Criteria	**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)**
Response	The proposed development is unlikely to have an adverse direct or indirect effect on a declared area of outstanding biodiversity value given that no such areas are present at Nuwi Wetland.
Criteria	**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**
Response	The proposed development does not constitute any key threatening process.
Conclusion	The proposed development is unlikely to have a significant adverse impact on this species.

Eastern Osprey (*Pandion haliaetus*)

The Eastern Osprey is listed as migratory under the EPBC Act 1999 and vulnerable under the BC Act 2016/ TSC Act 1995. The Eastern Osprey's Australian distribution encompasses much of the mainland's coast excluding the Nullarbor Plain. It primarily occurs in coastal areas (but occasionally travels inland along major rivers) where it inhabits inshore waters, reefs, bays, coastal cliffs, beaches, estuaries, mangrove swamps, broad rivers, reservoirs and large lakes (Marchant and Higgins 1993). The main threat to Eastern Osprey in Australia is loss, degradation or alteration of habitat for urban or tourism development (Clancy 1989, 1991, Dennis 2007, Olsen 1998). Other threats include ingestion of prey items containing pollutants such as pesticides, heavy metals or fishing tackle and competition for food with commercial and recreational fisheries. The Eastern Osprey is uncommon in NSW where it's population was estimated to comprise roughly 100 pairs in 1996 (Clancy 2006). It is a rare visitor in the Sydney Olympic /Centennial Park area which has been recorded in 2007 and 2016. Nuwi Wetland supports potential foraging habitat.

Nuwi Wetland is unlikely to support important Eastern Osprey habitat given that none of the following important habitat requirements are likely to be met:

a) habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of a species, and/or

b) habitat that is of critical importance to the species at particular life-cycle stages, and/or

c) habitat utilised by a migratory species which is at the limit of the species' range, and/or

d) habitat within an area where the species is declining.

Table O. Assessment of significance: Eastern Osprey (Pandion haliaetus)

TEST	
Criteria	**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**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to have an adverse effect on the life cycle of the Eastern Osprey such that a viable local population is likely to be placed at risk of extinction given:
Criteria	**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** • **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**
Response	NA
Criteria	**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, and:** • **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, and** • **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality**
Response	• Approximately 0.5 ha of suitable foraging habitat will be affected by shading as a result of the development of Bay Park, 23 Bennelong Parkway. • No habitat is likely to become fragmented or isolated as a result of the proposed development. • The habitat to be affected by shading is unlikely to be important to the long-term survival of the Eastern Osprey as it doesn't comprise important breeding habitat and this species is likely to only very rarely utilise this habitat.
Criteria	**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)**
Response	The proposed development is unlikely to have an adverse direct or indirect effect on a declared area of outstanding biodiversity value given that no such areas are present at Nuwi Wetland.
Criteria	**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**
Response	The proposed development does not constitute any key threatening process.
Conclusion	The proposed development is unlikely to have a significant adverse impact on this species.

White-bellied Sea-eagle (*Haliaeetus leucogaster*)

The White-bellied Sea-eagle is listed as vulnerable under the BC Act 2016/ TSC Act 1995. The White-bellied Sea-Eagle occurs in coastal habitats and terrestrial wetlands which contain large bodies of water such as lakes, rivers and the sea throughout Australia excluding the interior (Marchant and Higgins 1993). It is a common breeding resident in the Sydney Olympic/Bicentennial Park area. Nuwi Wetland likely supports suitable foraging habitat however it doesn't contain any suitable nest trees.

Table P. Assessment of significance: White-bellied Sea-eagle (Haliaeetus leucogaster)

TEST	
Criteria	**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**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway is unlikely to have an adverse effect on the life cycle of the White-bellied Sea-Eagle such that a viable local population is likely to be placed at risk of extinction given:
Criteria	**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** • **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**
Response	NA
Criteria	**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, and:** • **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, and** • **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality**
Response	• Approximately 0.5 ha of suitable habitat will be affected by shading as a result of the development of Bay Park, 23 Bennelong Parkway. • No habitat is likely to become fragmented or isolated as a result of the proposed development. • The habitat to be affected by shading is unlikely to be important to the long-term survival of the White-bellied Sea-eagle as it doesn't comprise important breeding habitat and this species is likely to only very rarely utilise this habitat.
Criteria	**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)**
Response	The proposed development is unlikely to have an adverse direct or indirect effect on a declared area of outstanding biodiversity value given that no such areas are present at Nuwi Wetland.
Criteria	**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**

TEST	
Response	The proposed development does not constitute any key threatening process.
Conclusion	The proposed development is unlikely to have a significant adverse impact on this species.

Narrow-leaved Wilsonia (*Wilsonia backhousei*)

The Narrow-leaved Wilsonia is listed as vulnerable under the BC Act 2016. It occurs primarily in saltmarshes and on seacliffs along Australia's southern coast between Geraldton, WA and Sydney, NSW.

One of the largest populations of Narrow-leaved Wilsonia in NSW is present in the area surrounding Nuwi Wetland. Individuals are present at Newington Nature Reserve, along Haslams Creek and Duck River and adjacent to the Waterbird Refuge at Sydney Olympic Park. Nuwi Wetland likely supports suitable habitat for this species however due to a lack of survey effort its status on the site is unknown.

Table Q. Assessment of significance: Narrow-leaved Wilsonia (Wilsonia backhousei)

TEST	
Criteria	**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**
Response	Increased shading of Nuwi Wetland as a result of the development of Bay Park, 23 Bennelong Parkway may have an adverse effect on the life cycle of the Narrow-leaved Wilsonia such that a viable local population of Narrow-leaved Wilsonia is likely to be placed at risk of extinction given: • periodic shading may have significant impacts on aspects of this species' lifecycle processes such as flowering, recruitment, fruiting, germination and competition.
Criteria	**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** • **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**
Response	NA
Criteria	**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, and:** • **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, and** • **the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species or ecological community in the locality**
Response	• approximately 1.9 ha of suitable habitat will be affected by periodic shading which may have significant impacts on aspects of this species' lifecycle processes such as flowering, recruitment, fruiting, germination and competition. • an area of habitat may become fragmented or isolated if the species is indeed present at Nuwi Wetland and periodic shading significantly impacts individuals present at the site. • the habitat to be affected by shading may be, though is unlikely to be important to the long-term survival of this species in the locality.
Criteria	**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)**

TEST	
Response	The proposed development is unlikely to have an adverse direct or indirect effect on a declared area of outstanding biodiversity value given that no such areas are present in the Nuwi Wetland.
Criteria	**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**
Response	The proposed development may constitute clearing of native vegetation, a key threatening process, given that periodic shading may correspond to long-term modification of habitat.
Conclusion	The proposed development is unlikely to, though may have a significant adverse impact on this species.

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