Sports-ground lighting installation at Passmore Reserve Manley Vale, NSW: Flora and fauna assessment

FINAL REPORT

Prepared for BBF Planners on behalf of Northern Beaches Council

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- NSW Environment, Energy and Science for access to the BioNet Atlas of NSW Wildlife.

Biosis staff involved in this project were:

- Matthew Hyde and Kayla Asplet
- Anne Murray (mapping)

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1 Introduction

1.1 Project background

Biosis Pty Ltd was commissioned by BBF Planners on behalf of the Northern Beaches Council (Council) to complete a flora and fauna assessment to describe the ecological values and constraints associated with the proposed installation of sportsground lighting at Passmore Reserve, Manley Vale NSW (the study area).

Biosis understands that Council is proposing to install eight lighting poles around the perimeter of Passmore Reserve, four of which are 25 metres in height and four 30 metres in height (Figure 1). A lighting concept plan and luminosity report has been developed for the proposed lighting installation by APEX Lighting (2018). This plan details 29 Philips OptiVision LED gen 2 BVP525 lighting modules, with a total luminous flux of 183,011 lumens per module, to be fitted out across the eight lighting poles.

The Council's asset management group is developing a Development Application (DA) to support the installation of this lighting in accordance with Part 4 of the *Environmental Planning and Assessment Act 1979* (EP&A Act). Pre-lodgement advice (PLM2018/0253) provided by Council has indicated the requirement for a flora and fauna assessment to accompany the DA submission to assess potential impacts to light sensitive nocturnal fauna. Mitigation measures to reduce potential impacts are also requested.

Additional requirements to be addressed within the assessment include:

- Relevant clauses included in Part E (The Natural Environment) of the Warringah Development Control Plan 2011 (Warringah DCP) relating to the removal/modification of any native vegetation as well as activities that may impact the Wildlife Corridor mapped along the Manly Creek riparian corridor.

The study area provides habitat to threatened fauna species, listed under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and NSW *Biodiversity Conservation Act 2016* (BC Act). Assessments of the potential impacts to these species resulting from the proposed lighting installation needs to be undertaken in accordance with the *Matters for National Environmental Significance Significant Impact Guidelines* (Commonwealth of Australia 2009) for EPBC Act listed species (SIC assessment), and the Test of Significance (ToS) as defined under Part 7 of the BC Act for species listed under the BC Act.

Therefore, the objective of this flora and fauna assessment is to address the requirements outlined by Council and assess the impacts of the proposed lighting installation on any threatened species, populations or ecological communities (biota), or their habitat, listed under the EPBC Act and BC Act.

1.2 The study area

The study area is approximately 4.5 hectares and consists of Passmore Reserve and the adjacent bushland fringing Manly Lagoon and Manly Creek (Figure 1). The study area is located within the Northern Beaches Local Government Area (LGA), and is zoned as RE1 – Public Recreation under the Warringah LEP. Several large recreational areas occur within the vicinity of Passmore Reserve including Warringah Golf Course to the north west, David Thomas Reserve to the west and Nolan Reserve to the east. Residential properties occupy land south of the study area.

1.3 Potential impacts of artificial lighting on nocturnal fauna

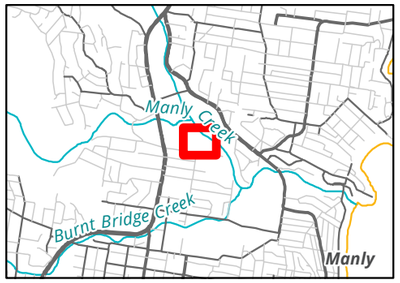
Light is a natural stimulus, which impacts on the physiology, behaviour and movement of all organisms. Artificial lighting alters the length of the natural photoperiod, disrupting the natural circadian rhythm and sensory ecology of organisms. This change in photoperiod can affect the foraging, breeding and dispersal behaviours of fauna. In addition, fauna also use lighting cues as a means for predator detection and habitat selection, both of which are impacted by the introduction of artificial light (Blackwell, DeVault, & Seamans 2015, Roberts et al. 2015).

Based on available research, other impacts resulting from increased lighting pollution include:

- Potential decrease in species abundance and diversity
- Resource partitioning and shifts in foraging niches
- Increased predation
- Alterations to trophic interactions
- Physiological influences on species (particularly mammals)
- Potential behavioural adaptions

The Sydney Basin has an extensive history (over 200 years) of disturbance and modification from foreshore development, industry and increased residential development (Birch and Taylor 1999, 2000; McCready et al. 2000, 2006b). This latter point highlights that in the context of the proposed works, that nocturnal biota within this locality may already be under pressure due to urban encroachment. It has been acknowledged by Council that this reserve and the adjoining vegetated riparian corridor are already subject to varying degrees of lighting, e.g. Nolans Reserve to the east has night lighting.

Artificial lighting at night is one of the most common fastest growing types of environmental pollution, increasing at 6% per year globally and identified as a key threat to biodiversity (Robert et al. 2015). Artificial lighting appears to have some level of influence on all tropic levels within urban terrestrial ecosystems, which in turn may result in both positive and negative feedback effects and impact overall ecosystem health. The mitigation options in Table 2 have been developed to address these potential impacts.



Legend

Study area

Light pole (height)
n - Number of modules

25m

30m

Plant community type

PCT1234 - Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion

Urban native/exotic

Acknowledgements: Basemap © Land and Property Information 2016, Imagery © NearMap

Figure 1 Proposed lighting plan at Nolan Passmore Reserve

0 10 20 30 40 50

Metres
Scale: 1:1,000 @ A3
Coordinate System: GDA 1994 MGA Zone 56

N

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30670_F1_ProposedLightingPlan

2 Methods

2.1 Literature and database review

Prior to completing the field investigation, information provided by Northern Beaches Council as well as other key information was reviewed, including:

- Review of current scientific literature on the ecological impacts of light pollution.
- Commonwealth Department of the Environment and Energy (DEE) Protected Matters Search Tool for matters protected by the EPBC Act.
- NSW Environment, Energy and Science (EES) BioNet Atlas of NSW Wildlife, for items listed under the BC Act.
- EES Vegetation Information System (VIS) mapping, including:
  - *The Native Vegetation of the Sydney Metropolitan Area* (OEH 2016)

The implications for the project were assessed in relation to key biodiversity legislation and policy including:

- *Environment Protection and Biodiversity Conservation Act 1999*
- *Environmental Planning and Assessment Act 1979*
- *Biodiversity Conservation Act 2016*
- *State Environmental Planning Policy (Coastal Management) 2018* (Coastal Management SEPP)
- *Warringah Development Control Plan 2011*

2.2 Field investigation

A field investigation of the study area was undertaken on 9 September 2019 by Matthew Hyde (Project Zoologist) of Biosis. The locations of the proposed lighting towers were inspected and potential reflective areas contributing to light spill were assessed.

A habitat-based assessment was completed to determine the presence of suitable habitat for threatened species previously recorded (EES 2019) or predicted to occur (Commonwealth of Australia 2019) within 5 kilometres. This list was filtered according to species descriptions, life history, habitat preference and soil preference to determine those species most likely to be present within the study area.

3 Results

Passmore Reserve consists of a large maintained grass sports-field with associated public amenities including change rooms and toilets in the south east corner and a playground in the north western corner of the Reserve. It is accessed by road via Campbell Parade to the south of the Reserve. A bitumen path encircles the extent of the Reserve. The study area occurs at sea level elevation, with the sports fields located on flat ground. Light is likely to travel further distances across the flat landscape relative to sites with hillier terrain.

The proposed lighting works will illuminate the sports-field area of Passmore Reserve and associated amenities. Light spill is likely to occur into the surrounding biodiversity corridor provided by the riparian area of Brookvale Creek and Manly Lagoon to the north of the Reserve without careful consideration of light pole location and orientation.

3.1.1 Vegetation communities

The majority of the vegetation within the study area consisted of mown sports playing fields, not supporting native vegetation. Surrounding the sports fields, the vegetation consisted predominantly of one native vegetation community, PCT 1234 *Swamp Oak swamp forest fringing estuaries, Sydney Basin Bioregion and South East Corner Bioregion* (Swamp Oak Swamp Forest). This community was located around the western and northern edges of the Reserve adjacent to riparian areas. This matches the vegetation community type mapped in *The Native Vegetation of the Sydney Metropolitan Area* (OEH 2016) (Figure 1*)*. The vegetation community was confirmed based on the presence of dominant canopy species Swamp Oak *Casuarina glauca*, with scattered occurrences of Swamp Mahogany *Eucalyptus robusta*, supporting a midstorey layer of Broad-leaved Paperbark *Melaleuca quinquenervia* and Prickly-leaved Tea-tree *M. styphelioides*. The ground stratum included common species such as Spiny-headed Mat-rush *Lomandra longifolia* and Weeping Grass *Microlaena stipoides*. Coast Banksia *Banksia integrifolia* was also present along the eastern boundary of the sports fields.

A planted row of Port Jackson Fig *Ficus rubiginosa* was present along the southern edge of the sports fields adjacent to the car park area.

3.1.2 Threatened species

Background searches identified records of threatened flora and fauna species recorded (EES 2019) or predicted to occur (Commonwealth of Australia 2019) within 5 kilometres of the study area. We understand that no removal of vegetation is required for the installation of the proposed lighting towers and as such further consideration of impacts to threatened flora species is not required.

Threatened fauna species considered most likely to have habitat within the study area, and likely to be subject to adverse impacts from lighting, based on the background research are as follows:

- Eastern Pygmy-possum *Cercartetus nanus* (Vulnerable, BC Act)
- Large Bent-winged Bat *Miniopterus orianae oceanensis* (Vulnerable, BC Act)
- Large-eared Pied Bat *Chalinolobus dwyeri* (Vulnerable, EPBC Act and BC Act)
- Little Bent-winged Bat *Miniopterus australis* (Vulnerable, BC Act)
- Greater Broad-nosed Bat *Scoteanax rueppellii* (Vulnerable BC Act)
- Grey-headed Flying-fox *Pteropus poliocephalus* (Vulnerable, EPBC Act and BC Act)
- Southern Brown Bandicoot (eastern) *Isoodon obesulus obesulus* (Endangered, EPBC and BC Act)

- Southern Myotis *Myotis macropus* (Vulnerable, BC Act)
- Spotted-tailed Quoll *Dasyurus maculatus* (Endangered, EPBC Act; Vulnerable, BC Act)
- Eastern Osprey *Pandion cristatus* (Vulnerable, BC Act)

An assessment of the habitat values within the study area for each of these threatened fauna species, as well as an assessment of the likelihood of occurrence or impact from the proposed works, is provided in Table 1. Based on the size of the study area, the survey effort is considered comprehensive to assess the presence of potential habitat for the species.

Table 1 Assessment of habitat for threatened fauna species

Species	Habitat association	Likelihood of occurrence or impact
Eastern Pygmy-possum	Eastern Pygmy Possum inhabits heathland, Banksia scrub and eucalypt forests along the south-east coast of Australia. The species is nocturnal, emerging at night to feed on nectar and pollen from flowering plants such as banksias and eucalypts, as well as some arthropods. They construct small spherical nests out of bark, often in tree hollows or beneath a loose layer of bark, where they shelter during the day. The study area contains a very small area of banksia scrub in the eastern portion of the study area, which is an important foraging resource for the species. Garrigal National Park, approximately 3 km west of the study area and the bushland west of Manly Vale supports majority of the records for this species (EES 2019).	The study area and surrounding locality represent potential foraging habitat for Eastern Pygmy-possum. No hollow bearing trees were detected within the study area and immediate surrounds, it is likely the native vegetation areas along the riparian corridor to the north provide this resource. Given the limited amount of foraging resources, and no nearby hollows, the likelihood of occurrence for this species is low. Therefore, it is unlikely the proposed lighting of Passmore Reserve would result in negative impacts to Eastern Pygmy-possum. Therefore, a Test of Significance (ToS) under the BC Act is not required.

Species	Habitat association	Likelihood of occurrence or impact
Grey-headed Flying-fox	Coast Banksia and flowering Eucalyptus trees including Swamp Mahogany, are part of the documented blossom diet for Grey-headed Flying Fox (Eby & Law 2008). Given the presence of feed trees in the vegetation surrounding Passmore Reserve, the study area and surrounding locality is considered potential foraging habitat for Grey-headed Flying-fox. The closest Grey-headed Flying-Fox camp is located approximately 2.1 km to the south of Passmore Reserve along Burnt Bridge Creek in Balgowlah (Department of the Environment 2015). As such the study area and immediately locality is not considered as roosting habitat for the Grey-headed Flying-fox.	Given the proximity of the Balgowlah flying-fox camp to Passmore Reserve, and the availability of foraging resources within the locality, there is a high likelihood Grey-headed Flying-fox occurs within the locality. Impacts from the proposed lighting works are the potential for light spill to act as a deterrent to foraging Grey-headed Flying-fox within the locality. However, trials of bright lighting as a deterrent to foraging flying-foxes in fruit orchards have been found to be ineffective (Hall & Richards 2000). Whilst lights may initially act as a deterrent, individuals become accustomed to light and will feed in a fully illuminated orchard (Department of Primary Industries and Fisheries n.d.). Therefore, it is unlikely the proposed lighting of Passmore Reserve would result in a negative impacts to Grey-headed Flying-fox. Therefore, a ToS under the BC Act and SIC assessment under the EPBC Act is not required.
Southern Brown Bandicoot (eastern)	Southern Brown Bandicoot is known to inhabit shrub and heath vegetation communities, particularly those with sandy soils and dense heathy vegetation in the lower stratum (Van Dyck & Strahan 2008). Garrigal National Park, approximately 3 km west of the study area supports the majority of the records for this species (EES 2019).	Given the lack of available habitat for this species and the degree of isolation of from Garrigal National Park, the likelihood of occurrence for this species is low. Therefore, it is unlikely the proposed lighting of Passmore Reserve would result in a negative impacts to Southern Brown Bandicoot. Therefore, a ToS under the BC Act is not required.

Species	Habitat association	Likelihood of occurrence or impact
Foraging microbats	Threatened microbat records in the locality (5 kilometres radius) include: **Edge-space foragers (slow flyers that utilise gleaning and interception techniques)** • Southern Myotis • Large-eared Pied Bat • Greater Broad-nosed Bat Global studies, on edge-space foragers (i.e. Southern Myotis, Large-eared Pied Bat and Greater Broad-nosed Bat) have shown that they exhibit light avoidance behaviour in response to increased light (Black et al. 1994, McGuire & Fenton 2010, Patriarca & Debernardi 2010, Rowse, Harris, & Jones 2016) **Open-space foragers (fast-flyers)** • Little Bentwing-bat • Large Bentwing-bat Based on the morphological and behavioural characteristics of Large Bentwing-bat and Little Bentwing-Bat it is assumed that these species are likely to utilise artificial lighting for foraging purposes (Haddock et al. 2019).	Given the availability of potential foraging habitat within the riparian corridor to the north of the study area, and the proximity of the recent records within the locality, there is potential for microbat species to be utilising the study area for foraging purposes. As referred to in the pre-lodgement advice (PLM2018/0253) provided by Council, it is known that the stormwater infrastructure in the nearby golf course and under Warringah Mall are primary roost sites for microbats occurring in the areas. Given that urban vegetation remnants are important for providing important foraging habitat for microbat species that require a vegetated edges for intercepting prey (Gonsalves 2012, Clarke-Wood et al. 2016), the species that exhibit edge-space or trawling foraging characteristics are stipulated to be most susceptible to impacts resulting from anthropogenic lighting. Therefore, a ToS under the BC Act has been prepared (Appendix 1).
Spotted-tail Quoll	Spotted-tail Quoll are recorded in a wide range of habitats such as the riparian forest and stream beds present within the locality of the study area (Department of the Environment 2019b). Spotted-tail Quolls are solitary animals requiring very large home ranges. Whilst some overlap in ranges can occur, females typically have a home range of between 180 and 1000 ha and males have a range of between 2000 and 5000 ha (Van Dyck & Strahan 2008).	As Spotted-tail Quolls require extensive home ranges, very large areas of habitat are likely to be required in order to support a viable population of the species (Glen & Dickman 2006). The native vegetation connected with the vegetation within Passmore Reserve covers an area of less than 5 ha and is effectively isolated from any other vegetation patches by residential development and roads. As such the study area and surrounding locality is not considered capable of sustaining a viable population of Spotted Tail Quoll and likelihood of occurrence and impacts are low. Therefore, a ToS under the BC Act and SIC assessment under the EPBC Act is not required.

Species	Habitat association	Likelihood of occurrence or impact
Eastern Osprey	This species is likely to forage offshore and/or in nearby watercourses including Manly Creek. Sportsground lighting in the adjacent Nolan Reserve is currently utilised as a nesting site for Eastern Osprey.	Lighting poles similar to that proposed at Passmore Reserve is currently utilised by Eastern Osprey in Nolan Reserve as a nesting site (outside of the study area). This nesting site is likely to be utilised primarily throughout the breeding season (between July and September). However, some individuals use nests as feeding platforms during the non-breeding season, while others appear to forage over wide areas adjacent to their breeding territories (Clancy 2005). The Eastern Osprey within the locality is nesting on an existing lighting pole (Plate 1 and Plate 2) in a sports field surrounded by lighting modules. As such the species must be accustomed to artificial lighting to some degree. Therefore, a ToS under the BC Act is not required. It is understood that Northern Beaches Council would like to provide additional habitat for the nesting individuals in Nolan Reserve. A potential option has been provided in Appendix 4.

3.1.3 Migratory species

The impacts of artificial lighting at night (ALAN) on migratory bird species are well documented with birds being attracted to, and subsequently disorientated by, high intensity glare from communication towers, offshore oil platforms and other structures. Birds migrating at night can become 'trapped by the beam' of such lighting structures and subsequently die from direct collisions with structures, collisions with other birds, or through the excessive depletion of energy stores due to the disorientating effects of ALAN (Blackwell, DeVault, & Seamans 2015).

Migratory species are protected under the EPBC Act as one of the Matters of National Environmental Significance. Records for 43 migratory bird species included on the EPBC Migratory Species Lists exist within the vicinity of the proposed lighting works (Department of the Environment 2019c, Commonwealth of Australia 2019). It is likely that the proposed lighting installation will contribute to the cumulative light pollution escaping skywards from the surrounding recreational and residential areas including Nolan Park and Manly Vale town centre. However, the cumulative level of ALAN from these factors are already high and the addition of the proposed sports-field lighting is unlikely to result in a significant increase of these lighting impacts on migratory birds. Mitigation measures recommended within this report will also help in reducing these potential impacts. As such further assessment of impacts to migratory bird species is not required.

4 Impact assessment and mitigation measures

4.1 Impact assessment

The proposed sportsground lighting works has the potential to have the following impacts on the surrounding environment if not appropriately addressed:

- Light spill into the 'dark' vegetated areas surrounding Manly Creek.
- Contributing to the cumulative artificial light pollution across the Manly Vale residential area.
- Potential decrease in the abundance and diversity of bat species.
- Potential impacts to foraging habitat for Southern Myotis, which may lead to behavioural adaptions.
- Resource partitioning and shifts in foraging niches.
- Alterations to predator-prey species interactions.

BC Act ToS (Appendix 1) and EPBC Act SIC (Appendix 2) assessments have been undertaken to determine the significance of potential impacts to threatened fauna within the study area and surrounding locality. These assessments found no significant impacts are likely to occur for the threatened species with the potential to occur within the vicinity of the proposed works, provided the recommendations included in this assessment report are adopted to minimise light spill into the ecologically sensitive areas. These mitigation measures will also be of benefit to non-threatened fauna species that are also likely to be present within the locality, ensuring that any potential impacts on non-threatened fauna species in the area are also minimised.

4.1.1 Water Management Act 2000

The WM Act provides for the sustainable and integrated management of the state's water for the benefit of both present and future generations based on the concept of ecologically sustainable development. Under the WM Act an approval is required to undertake controlled activities on waterfront land, unless that activity is otherwise exempt under Section 91E. Waterfront land is defined within the Act as the bed of any river, lake or estuary and any land within 40 metres of the river banks, lake shore or estuary mean high water mark.

A public authority does not need to obtain a controlled activity approval for any controlled activities that it carries out in, on or under waterfront land.

The WM Act is supported by a series of interpretation guidelines including *Controlled activities on waterfront land - guidelines for riparian corridors on waterfront land* (NSW Office of Water 2012). This guideline defines a riparian management envelope referred to as the vegetated riparian zone (VRZ). The width of the VRZ within a riparian corridor has been pre-determined and standardised for first, second, third and fourth order and greater watercourses according to the Strahler System of ordering watercourses and is measured from the top of the highest bank on both sides of the watercourse. This guideline also presents the riparian corridor matrix that assists applicants for controlled activity approvals to identify certain works and activities that can occur on waterfront land and in riparian corridors. The guideline also includes overarching management measures for works on waterfront land.

Works are proposed within 40 metres of the top of the bank along a 4th Strahler order watercourse, Manly Creek, thus, a controlled activity permit from the NSW DPI is required.

4.1.2 Warringah Development Control Plan 2011 – Part E

Part E of the Warringah DCP relates to protection of The Natural Environment. Specifically, an objective of section E2 Prescribed Vegetation is *to retain and enhance native vegetation communities and the ecological functions of wildlife corridors.* It is noted that the northern half of Passmore Reserve is mapped as part of a wildlife corridor.

The proposed installation of lighting in the vicinity of the mapped wildlife corridor does not align with the objectives of the Warringah DCP as there is a likelihood of disrupting the cycle of nocturnal fauna activity within the corridor, however assuming that mitigation measures provided in this report are implemented, it is unlikely that the project will significantly negate this objective.

4.1.3 Coastal Management SEPP

Coastal Management SEPP aims to promote a co-ordinated approach to land use planning in the coastal zone of NSW in a manner consistent with the objects of the *Coastal Management Act 2016* (CM Act). The SEPP has replaced the now repealed:

- SEPP No. 14 Coastal Wetlands
- SEPP No. 26 Littoral Rainforests
- SEPP No. 71 Coastal Protection

The site is within the coastal use area as mapped on the Coastal Environment Area Map. Clause 13 (and subclauses) of the SEPP relevant to the project include:

> *(1) Development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following:*
>
> *(a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,*
>
> *(b) coastal environmental values and natural coastal processes,*
>
> *(d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,*

In accordance with Clause 13.2, development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

> *(a) the development is designed, sited and will be managed to avoid an adverse impact referred to in subclause (1), or*
>
> *(b) if that impact cannot be reasonably avoided—the development is designed, sited and will be managed to minimise that impact, or*
>
> *(c) if that impact cannot be minimised—the development will be managed to mitigate that impact.*

The proposed installation of eight light poles will result in minimal ground and sediment disturbance, therefore is unlikely to adversely impact biophysical, hydrological and ecological aspects of the environment within the mapped Coastal Environment Area. Recommendations to minimise soil and sediment transportation during works is provided in Section 5.

4.2 Mitigation measures for artificial lighting

Potential mitigation measure for minimising the impacts of the proposed lighting installation are provided in Table 2. These measures have been largely adapted from Part 4 (good lighting design principles) of the NSW Department of Planning and Environment's *Dark Sky Planning Guideline* (2016).

Table 2 Mitigation measure for lighting impacts for the proposed Passmore Reserve sportsfield lighting project

Mitigation measure	
Eliminate upward light spill through directing lights downwards and installing shields	Light spill that occurs above the horizontal plane of lighting fixtures contributes directly to artificial sky-glow. The upwards spilling of light can be minimised by: • Installing light fitting shields with an opaque cover, mounted horizontally across the top of the lighting module. These shielding attachments allow only the downward projection of light. • Direct lights downwards and avoid shining directly onto the public amenities and nearby residences which have the potential to reflect light skywards. • Utilise low beam angles that are close to vertical where possible to minimise light glare. When light shines below the horizontal plan of a lighting fitting there is a dramatic reduction in the level of artificial sky-glow produced (Department of Planning and Environment 2016).
Avoid over lighting	• Lighting levels should be appropriate for the activity and adjusted depending on the type of sport and level of competition in accordance with the minimum lighting requirements of the AS2560 Sports lighting series and AS 4282: 2019 Control of the obtrusive effects of outdoor lighting. • Lights should be switched off when not required. • The curfew stipulated by Council of lights out at 9.30pm should be enforced.
Consider use of asymmetric beams	• Consider use of asymmetric beams that permit horizontal glazing. These can be kept at or near parallel to the playing surface, minimising light spill. • Asymmetric beam also allows the light modules to the mounted on the edge of the park, avoiding the need for fittings to be tilted upwards.
Supplementary landscaping with native species along the western edge of Passmore Reserve, closest to residential buildings	• Council deemed the tree canopy surrounding the reserve as adequate, screening some parts of these structures from the both the public domain and private properties. If there is scope to do so, further supplementary planting of native species will enhance the screening of light from residential buildings, thereby minimising the amount of light reflecting from high-glare surfaces.

5 Recommendations

Given there are potential impacts to native fauna, particularly resulting from light spill to the nearby bushland adjacent to Manly Creek, recommendations to minimise disturbance have been provided. Recommendations are also provided for implementation during the installation of the proposed lighting towers to minimise impacts to surrounding vegetation and habitats. These include:

- Lighting modules are to be fitted with shields to minimise light spill and pointed downwards to minimise contribution to sky-glow. It is acknowledged that some lighting may need to remain uncovered/angled skywards to allow for illumination during ball sports in accordance with AS 2560.2.3-2007 Sports lighting specific applications – Lighting for football (all codes). Use of these unshielded lights is to be minimised as much as possible.
- Lighting levels are to be adjusted to match minimum level of illuminance required for the sport and level of competition in play. Lighting should be programmed to meet these various requirements and switched off when not required.
- Consider implementing the other mitigation measures included in Table 2 to further reduce the impacts of light spill including:
  - Use of asymmetric beaming to minimise light spill.
  - Preferentially lighting with modules located along southern edge of Passmore Reserve facing away from main areas of Manly Creek riparian corridor.
  - Enhancing the native vegetation buffer that exists on the western edge of Passmore Reserve between the sports fields and the residential properties by planting a native shrub strip to further block light spill into areas below.
- During the installation of the lighting towers to the fullest extent practicable, minimise disturbance to any native vegetation surrounding the study area.
- Trees to be retained should be protected in accordance with Australian Standard AS4970 – 2009 Protection of trees on development sites, during construction, operation and decommissioning of the site compound as required.
- Soil transportation should be minimised within, into or out of the study area to reduce the spread of weeds.
- Appropriate erosion and sediment control measures should be installed to avoid indirect impacts to the surrounding biodiversity values of the Manly Creek riparian corridor.
- A luminosity assessment should be undertaken following installation of the proposed lighting works to ensure consistency with the modelled lighting output and compliance with AS 4282 *Control of the Obtrusive Effects of Outdoor Lighting*. Assessment should include measures of luminous flux and illuminance under the different lighting setups required for the various types of sports and competition levels to ensure lighting levels do not exceed the minimum requirements.
- Consider the inclusion of a built basket like structure atop a light pole, if feasible with the design, to provide nesting habitat for Eastern Osprey (Appendix 4).

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Appendices

Appendix 1 BC Act Tests of Significance

Microbat species

Threatened microbat records (OEH BioNet 2019) in the locality (5-kilometre radius) include:

Edge-space foragers (slow flyers that utilise gleaning and interception techniques)

- Southern Myotis (Vulnerable, BC Act).
- Large-eared Pied Bat *Chalinolobus dwyerii* (Vulnerable, BC Act and EPBC Act).
- Greater Broad-nosed Bat *Scoteanax rueppellii* (Vulnerable, BC Act).

Open-space foragers (fast-flyers)

- Yellow-bellied Sheathtail-Bat *Saccolaimus flaviventris* (Vulnerable, BC Act).
- Little Bentwing-bat *Miniopterus australis* (Vulnerable, BC Act).
- Large Bentwing-bat *Miniopterus orianae oceanensis* (Vulnerable, BC Act).

Based on the morphological and behavioural characteristics of Large Bentwing-bat, Little Bentwing-bat and Yellow-bellied Sheathtail Bat it is assumed that these species are likely to utilise artificial lighting for foraging purposes. The species are fast flyers that can be observed foraging above the canopy or low through grassy fields. Due to its agile and fast flight, it can intersect positive phototaxis (move towards the light) prey in open areas (i.e. beetles and flies) (Churchill 2008). The research undertaken by Haddock et al. (2019), further endorsed this positive response of Large Bentwing-bat to LED streetlights as the results showed a decrease to Gould's Wattled Bat *Chalinolobus gouldii* but not Large Bentwing-bat. The data suggests that the species is more influenced by seasonal and environmental variations.

Recent global studies have reported a negative association between bat activity and increased light pollution, specifically relating to the genus of Myotis. International research relevant to the Myotis genus have shown that this taxon have developed a behavioural adaption to avoid anthropogenic light (Black et al. 1994, McGuire and Fenton 2010, Patriarca and Debernardi 2010, Rowse et al. 2016). This behavioural adaption has been inherited to reduce the risk of predation and avoid potential adverse impacts on sensorial capabilities (Patriarca and Debernardi 2010). In America, *Myotis lucifugus* showed a drastic worsening in its ability to avoid large obstacles under artificial lighting conditions (McGuire and Fenton 2010). Furthermore, impaired flight response under artificial lighting conditions theoretically, would make the species more susceptible to predation and less effective during foraging efforts.

In broader terms, the research suggest that the impacts of artificial lighting on bats is highly dependent on taxonomical and morphological traits (i.e. physical characteristics and foraging guilds). Faster flying bats with longer wingspans (i.e. Freetail bats and Bentwing bats) would potentially utilise artificial lighting for foraging, whereas slower flyers with short-broader wings (i.e. Southern Myotis, Greater Broad-nosed Bat and Large-eared Pied Bat) that utilise cluttered and edge environments, tend to avoid artificial lighting (Rowse et al. 2016, Haddock et al. 2019). The potential impacts resulting from anthropogenic light pollution include:

- Increased resource partitioning (creating new foraging niches) (Rowse et al. 2016, Haddock et al. 2019).
- Behavioural adaptions (Black et al. 1994, McGuire and Fenton 2010, Patriarca and Debernardi 2010, Rowse et al. 2016).

- Reduced sensorial capabilities (McGuire and Fenton 2010).
- Long-term impacts to physiology (Patriarca and Debernardi 2010).
- Shifts in prey composition and an increase in phototaxis positive prey (Longcore and Rich 2004).
- Shifts in microbat species composition (Linley 2015, Rowse et al. 2016).
- Potential reduction in nightly foraging activity (Patriarca and Debernardi 2010, Haddock et al. 2019).
- Reduced predator avoidance (McGuire and Fenton 2010).
- Modification of regular flightpath (Patriarca and Debernardi 2010).
- Increased stress, which may lead to reduce population size or mortality (Rowse et al. 2016).
- Changes in trophic interactions (Longcore and Rich 2004).

Given that urban vegetation remnants are important for providing important foraging habitat for microbat species that require a vegetated edges for intercepting prey (Gonsalves 2012, Clarke-Wood et al. 2016), the species that exhibit edge-space or trawling foraging characteristics are stipulated to be most susceptible to impacts resulting from anthropogenic lighting. Therefore, a Test of Significance (ToS) under the BC Act has been prepared.

In light of the assessment (questions a - e), the proposed lighting plan will not significantly impact potential habitat for the microbats, provided the mitigation actions in Table 2 are implemented.

The following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats.

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

Impacts likely to have an adverse effect on the life cycle of Southern Myotis, Greater Broad-nosed Bat, Large-eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat include direct mortality, loss or disturbance of roosting sites, clearing adjacent to foraging areas (i.e. decreased numbers of insects), application of pesticides in or adjacent to foraging areas, reduction in stream quality affecting food resources (specifically Southern Myotis) and predation by feral animals.

No roosting habitat, in the form of caves, culverts or hollow bearing trees has been recorded in the study area, and will not be impacted by the proposed works.

The proposed lighting plan surrounding Passmore Reserve, without mitigation measures may affect potential foraging habitat for Southern Myotis, Greater Broad-nosed Bat and Large-eared Pied Bat. Impacts resulting from uncontrolled light spill may provoke avoidance behaviour in these species and/or disorientation during flight. However, adjacent foraging habitats are available in areas along Manly Creek, Manly Lagoon and Garrigal National Park.

Open-space foragers such as Little Bentwing-bat and Large Bentwing-bat have morphological traits which may provide the opportunity to benefit from increased artificial lighting. These faster-flying species (long wingspans) would potentially utilise artificial lighting for foraging in open spaces, targeting positive phototaxis prey (attracted to light). The research undertaken by Haddock et al. 2019, further endorsed this positive response of Bentwing-bats to LED streetlights.

Taking these factors into consideration it is unlikely that the installation of the proposed lighting, appropriately mitigated, would have an adverse effect on Southern Myotis, Greater Broad-nosed Bat, Large-

eared Pied Bat, Little Bentwing-bat, Large Bentwing-bat and Yellow-bellied Sheathtail-Bat such that viable local populations would be placed at risk of extinction.

(b) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:

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

(ii) is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,

Not applicable, not an ecological community.

(c) in relation to the habitat of a threatened species or ecological community:

(i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and

The proposed works will not result in the direct removal of habitat for Southern Myotis, Greater Broad-nosed Bat, Large-eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat. In addition, no roosting habitat for microbats in the form of hollow bearing trees, culverts or caves have been recorded within the study area.

The proposed lighting plan, without mitigation, would potentially result in modification of foraging habitat for Southern Myotis, Greater Broad-nosed Bat, Large-eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat. With the adoption of the mitigation measures, including eliminating upward light spill, aiming lights below the horizontal plane to avoid extended light attenuation and aiming lights away from the remnants in the north-east and north-west of the study area (particularly the riparian corridor of Manly Creek), the modification of habitat within the vicinity of Passmore Reserve would not be significant.

Therefore, with mitigation measures foraging habitat for Southern Myotis, Greater Broad-nosed Bat, Large-eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat will not be significantly modified by the lighting plan.

(ii) 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 current foraging habitat within the study area is comprised of Swamp Oak Swamp Plain Forest along the northern edge of the study area. Additional habitat that is suitable for foraging are found in adjacent habitats along Manly Creek, Manly Lagoon and Garrigal National Park. Therefore, primary foraging habitat used by Southern Myotis, Greater Broad-nosed Bat, Large-eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat is unlikely to become fragmented as a result of the proposal.

(iii) 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,

Edge-space foraging habitat will be indirectly affected because of the proposed lighting installation (uncontrolled light spill), if not managed.

Open-space foraging habitat will be directly impacted (Passmore Reserve), however, open-space foragers do not exhibit light avoidance behaviour and therefore, will not be negatively impacted by increased lighting (provided the mitigation measures are implemented).

The habitat within the study area is not considered important to the long-term survival of any of these species (no confirmed roosting, breeding or maternal sites within the study area) and foraging habitat of similar quality is found along the Manly Creek, Manly Lagoon and Garrigal National Park.

(d) whether the proposed development or activity is likely to have an adverse effect on any declared area of outstanding biodiversity value (either directly or indirectly),

There are no declared areas of outstanding biodiversity value within the study area or locality. The proposed action will not affect declared areas of outstanding biodiversity value.

(e) whether the proposed development or activity is or is part of a key threatening process or is likely to increase the impact of a key threatening process.

The following Key Threatening Processes listed by the BC Act are relevant to the proposed light installation:

- Loss or disturbance of highly productive foraging sites.

The habitat features within the study area are not considered highly productive foraging habitat (some degree of urban encroachment). The vegetation bordering the study area provides connection to higher quality habitat surrounding the study area for edge-space and clutter foragers. Therefore, the works will not result in the increase of a KPI for these threatened bat species, through the loss or direct disturbance of highly productive foraging sites.

Conclusion

In light of the consideration of the above five factors (a-e), the proposed activity is not likely to significantly impact Southern Myotis, Greater Broad-nosed Bat, Large-eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat within the study area or wider locality, as:

- No roosting or breeding habitat will be impacted as a result of the proposed activity.
- The proposed lighting plan with mitigation measures in place (Table 2), will not significantly impact potential foraging habitat for threatened microbat species. Other habitat features within the adjacent surrounds, provides foraging habitat for Southern Myotis, Greater Broad-nosed Bat, Large-eared Pied Bat, Little Bentwing-bat and Large Bentwing-bat.
- The proposed activity does not significantly contribute to the KTPs for these species.
- The proposed activity is not considered to adversely affect the lifecycle of these species.

Application of the Biodiversity Offset Scheme (BOS) or preparation of a Species Impact Statement (SIS) is therefore not required.

Appendix 2 EPBC Act Significant Impact Criteria assessments

Large-eared Pied Bat *Chalinolobus dwyerii*

Based on the proposed installation of lights at the Passmore Reserve, the following SIC assessment outlines the potential impacts on Large-eared Pied Bat, in accordance with the EPBC Act.

Populations of Large-eared Pied Bat that may occur within the study area are not considered important populations due to the lack of suitable habitat for maternal roosts within the study area or in the nearby surrounds. Known breeding habitat occurs in the sandstone escarpments of the Sydney Basin and northwest slopes of New South Wales. According to the National Recovery Plan for Large-eared Pied Bat *Chalinolobus dwyeri* (DERM 2011), the species distribution and population sizes are still widely unknown.

The site contains foraging habitat within the vegetation corridor of Manly Creek. The study area does not support roosting habitat for this species, however, the landscape features within Garrigal National Park provide suitable roosting habitat in the form of sandstone cliff-overhangs and karsts. There are nearby records of the species (within 1.5 kilometres; EES 2019), therefore a SIC assessment is required.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

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

The *Important populations* of Large-eared Pied Bat are mainly restricted to sandstone escarpment areas of the Sydney Basin and northwest slopes of NSW and Moreton Bay National Park, however the species distribution and population sizes are still widely unknown. The study area is not located in an area currently classified as primary habitat for this species (DERM 2011). However, Garrigal National Park (west of the study area) would be mapped as important habitat due to recent species records (EES 2019) and suitable landscape features in the form of sandstone cliffs and outcrops.

No roosting habitat, in the form of caves, culverts or hollow bearing trees have been recorded in the study area, and will not be directly impacted by the proposed works. The proposed light installation will not result in the direct or indirect disturbance to potential habitat with the implementation of mitigation measures to shield the light from 'dark' areas in the northern portion of the study area. Habitat will remain available for movement of the species through the study area and the lighting plan is unlikely to lead to direct mortality.

Provided the recommended mitigation measures are followed, it is unlikely that the proposed action will lead to a long-term decrease in the size of an important population of Large-eared Pied Bat.

- **reduce the area of occupancy of an important population**

Large-eared Pied Bat distribution and population sizes are still largely unknown, further survey is required throughout its known range to determine the size and distribution of existing populations (DERM 2011).

The study area is underlain by sandstone; however the topographic relief is low and lacks elevated terrain for landscape features that are suitable for cave-dwelling bat species. The distribution and primary habitat of the species within the Sydney Basin is primarily confined to the network of sandstone cliffs (DERM 2011).

No roosting habitat, in the form of caves, culverts or hollow bearing trees have been recorded in the study area, and will not be directly impacted by the proposed works. The species may use the vegetation corridors on the northern-eastern edge of the study area on occasion, however, better quality habitat is found to the west in Garrigal National Park. The light attenuation will be controlled by implementing the mitigation

measures in the report and therefore the proposed activity will not reduce an area of occupancy of an important population.

- **fragment an existing important population into two or more populations**

As stated above, the proposed lighting installation is unlikely to directly affect habitat for the species (foraging habitat) provided the Manly Creek riparian corridor is shielded from increased light pollution. Therefore, the indirect disturbance associated with the light installation will not fragment an existing important population of Large-eared Pied Bat.

- **adversely affect habitat critical to the survival of a species**

The species is dependent on the presence of diurnal roosts for shelter. The roosts are utilised during torpor, raising young and for sheltering purposes when they are not foraging. The study area does not contain any habitat features suitable for roosting. No roosting habitat, in the form of caves, culverts or hollow bearing trees has been recorded in the study area, and will not be directly impacted by the proposed works.

The number of known breeding sites is limited. A maternity roost has been observed in a sandstone cave near Coonabarabran, and another nearby in the Pilliga sandstone (Pennay 2010). Any maternity roosts must be considered habitat critical to the survival of the species. The structure of maternity roosts for the species is very specific (high arched caves with a dome-shaped roof), this is so juvenile bats can learn to fly safely and for thermoregulation.

The study area provides marginal foraging habitat in the form of a vegetated riparian corridor. Provided the appropriate measures are followed (aiming light below the horizontal plane and away from the riparian corridor), there will be no impact to foraging habitat for Large-eared Pied Bat within the study area.

- **disrupt the breeding cycle of an important population**

The proposed activity will not affect an important population, the study area is not considered critical to the breeding cycles of an Important Population.

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

No roosting habitat, in the form of caves, culverts or hollow bearing trees has been recorded in the study area, and will not be directly impacted by the proposed works. The indirect disturbance of potential habitat in the study area is not considered likely to modify, destroy, remove, isolate or decrease the availability of habitat to the extent that the species is likely to decline.

- **result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

The proposed activity will not result in other invasive species that are harmful to a Large-eared Pied Bat becoming established at the study area.

- **introduce disease that may cause the species to decline, or**

The proposed activity will not introduce disease that may cause the species to decline.

- **interfere substantially with the recovery of the species.**

The proposed activity will not interfere substantially with the recovery of the species.

Conclusion

Provided the recommended avoidance measures are implemented as part of the proposed activity, it is unlikely that the proposal will significantly impact an important population of Large-eared Pied Bat.

The risks to Large-eared Pied Bat can be managed by implementing the mitigation measures in the report to avoid light spill into foraging and roosting areas. The above identified that the lifecycle and the long-term viability of Large-eared Pied Bat populations within the study area will not significantly impacted as a result of the proposed activity.

In light of the assessment, the impacts associated with the proposed light installation will be mitigated and consequently will not result in a significant impact to Large-eared Pied Bat, and therefore referral to the minister is not required.

Appendix 3 Plates

Plate 1 Eastern Osprey nesting site on an existing lighting pole in Nolan Reserve

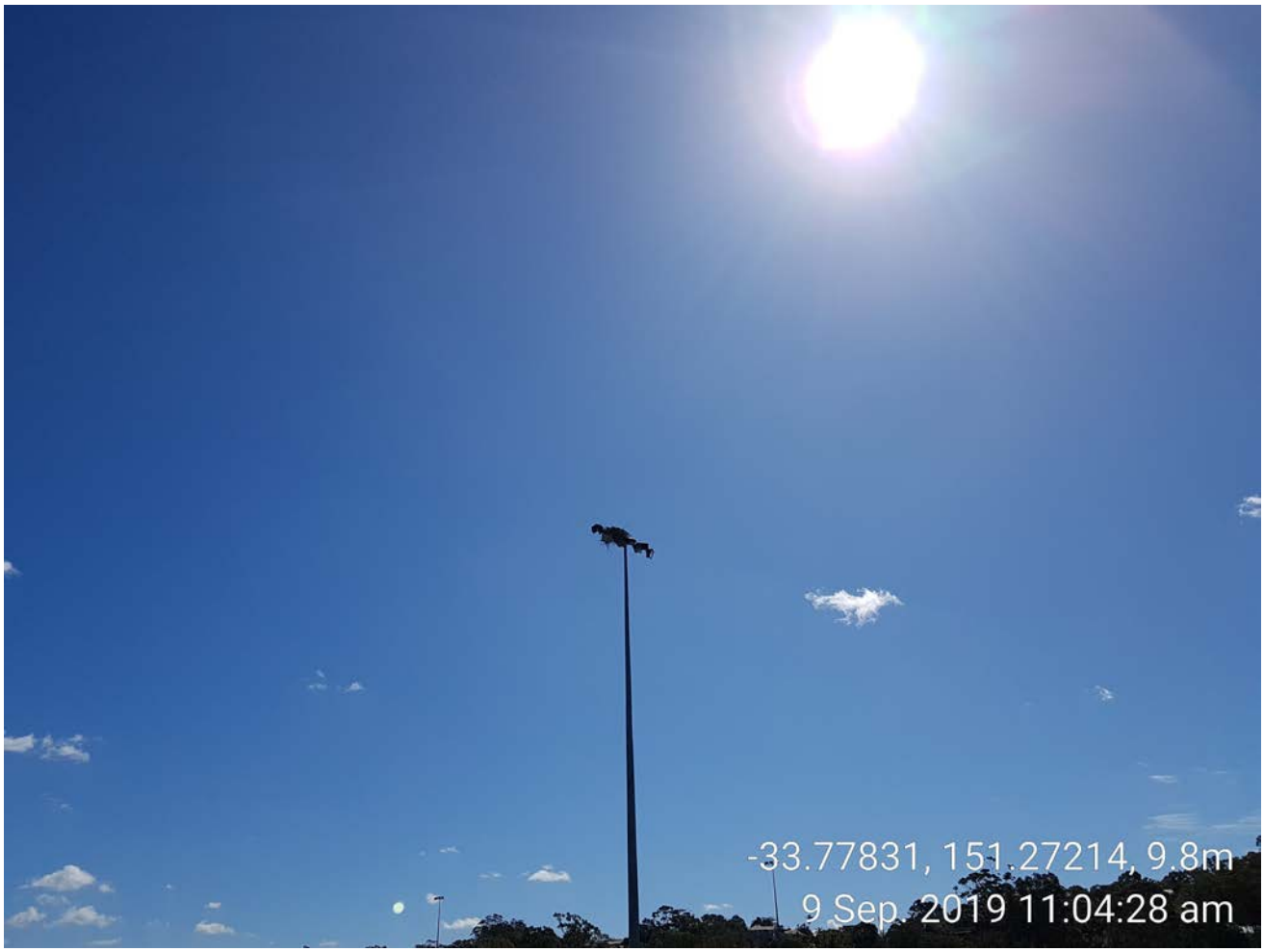


Plate 2 Height of nest site is approximately 25 metres

Appendix 4 Osprey Nest Platform Manual

Information sheet

Wildlife Management

Osprey nest platform manual

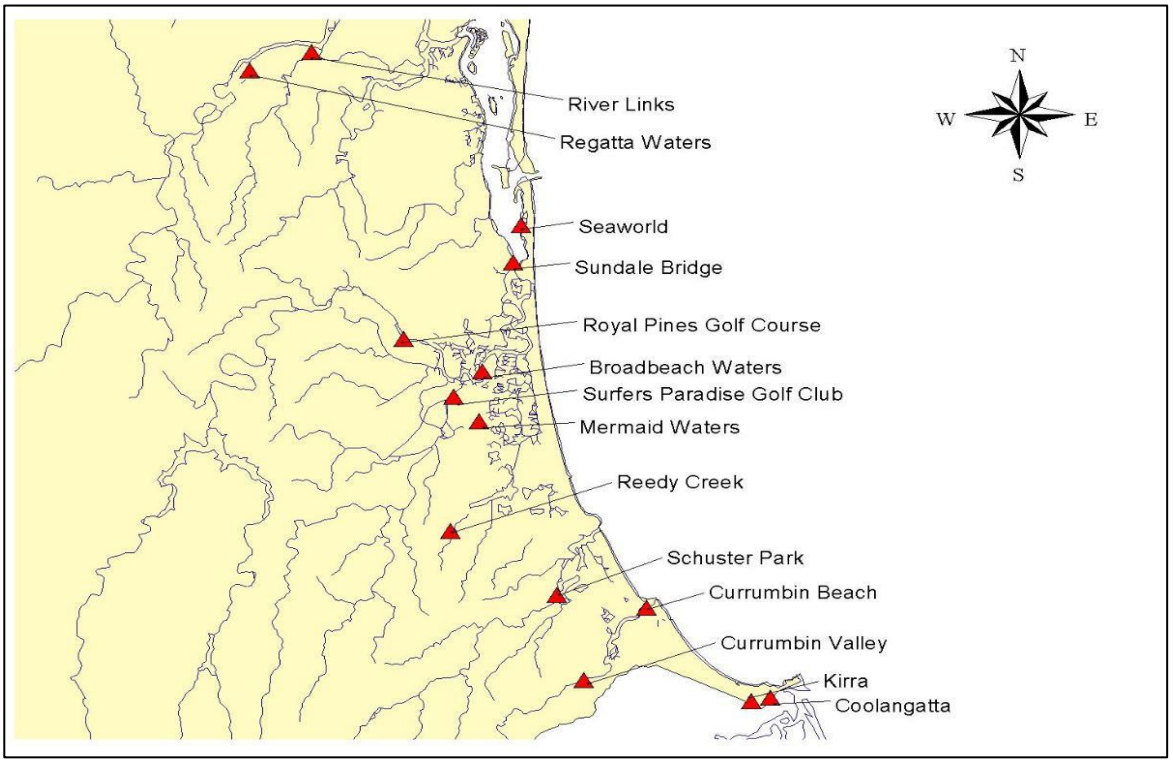
The purpose of this document is to provide information to proponents undertaking nest relocation or surrogate nest construction for Osprey species under an DES permit or authority.

Artificial nesting platforms for Eastern Ospreys

Few birds can compete with the osprey when it comes to attracting attention and affection from the general public. This is largely due to their habit of using the same (often massive) nest year after year, their striking appearance and their hunting prowess – using their talons to snatch fish from the water in spectacular fashion.

Due the osprey's widespread distribution along the Queensland coastal strip, this information sheet will be applicable to other regions even though it is largely based on information from south-east Queensland.

Around the Gold Coast region, there are 14 historic osprey nests sites (refer to map 1). They often use trees for nesting platforms as well as man-made structures, such as power poles. Due to public safety issues and the safety of the bird and its chicks, the choice of nesting sites is not always appropriate. Old trees with large branches may pose a danger to the public and, in some cases, may need to be removed. Nests built on power poles may be flimsy and not sturdy enough to support the eggs and chicks. These birds also run the risk of being electrocuted and nesting material can even cause power failures.



Map 1: Historical known osprey nest sites in the Gold Coast area.

ABN 46 640 294 485

In these situations, there is the option of constructing an artificial alternative nesting platform for the birds. Due to their preference for nesting in exposed situations, ospreys provide a unique opportunity to relocate the nest to elevated platforms where they can successfully breed and raise their young.

This information sheet contains general information on ospreys, as well as specific information on the requirements for building an artificial platform to ensure that the ospreys have a suitable nesting site. Construction diagrams and the materials required are also included.

Identification

Ospreys are raptors (birds of prey) with a body length of 50–63 cm and a wingspan of up to 170 cm. They have dark brown upperparts, with a white head and underparts. They also have a brown streak through the eye, down the sides of the neck and a brown "necklace" across its chest. This "necklace" is darker and more pronounced in the female. Juveniles have a darker face and heavier bands across the chest than adults, and a more mottled appearance. Adult females are slightly larger than the males [3]. In flight, ospreys soar on long, arched wings which have a characteristic bend at the "wrist" joint [1]. The tail is short and square with a white edge on the tip [3].

Habitat

Eastern ospreys are commonly found in estuarine and marine areas, keeping to the coast and large river inlets. They have been recorded in habitats ranging from mangroves, inshore seas, coastal islands, estuaries and rivers [5].

Diet

Ospreys feed almost exclusively on fish of up to 2 kg in size. They are also known to occasionally take sea snakes. The birds usually feed singly or in dispersed pairs within their breeding and feeding territory, which generally consists of 5–20 km of coastline [4]. The osprey hovers above the water, then dives from a height of 10–40 m and plunges feet first into the water [1]. Gripping fish with their talons, the catch is then carried headfirst to reduce wind resistance, back to a roost or perch before being ripped apart and eaten. To assist in holding on to the slippery fish, the feet have spiny footpads called spicules. Osprey are very effective and efficient hunters, with approximately 90% of their dives successfully resulting in a catch [4].

Osprey (*Pandion* spp.*) feeding, Moreton Bay, EPA 2000.*

Breeding

Breeding occurs from June to September. Nesting pairs of osprey perform courtship aerial dives and swoops at a height of 100–300m above the nest site. Copulation usually occurs on the nest or close to it. Calls are made during displays but are infrequent at other times [4]. Ospreys typically mate for life, returning to the same nest over and over again.

Nesting

In south-east Queensland, ospreys start nesting around April. Large nests are built from sticks and lined with seaweed and grass. The nests may be constructed on cliff faces, headlands, rocky foreshores and islands and in the forks of large trees up to 30 m above the ground [4]. The nests are generally located within 3 km of a water body and frequently within sight of water [1]. Ospreys are also known to nest on man-made structures, such as communication towers, power poles, channel markers and artificial nest platforms. Studies indicate that ospreys are successful in raising young on such structures[1].

Nests may be used for consecutive years, with the pair adding material to the nest year after year. Both the female and male help to build and repair the nest, with the male collecting most of the material and the female working it into the nest structure. Usually 2–3 matt white to buff-brown speckled eggs are laid once a year. Generally the female incubates the eggs for about 5 weeks while the male brings her fish. The young develop feathers at about 30 days of age. The male collects fish for the brood with the female tearing up the fish into small pieces to feed to the young. The young are fed until they leave the nest, approximately 8 weeks after hatching [4].

The young continue to use the nest for roosting for about a week after fledging. Within this time they are taught or learn how to fish. For several weeks after this time, the young birds continue to use the nest as a feeding platform [4]. The young are sexually mature at approximately 3 years. The chance of survival between each year does vary, however, juvenile ospreys have an average survival rate of approximately 60% and adult ospreys 80 to 90%. The oldest known osprey in the wild was 25 years old, however, very few individuals reach this age [1].

Osprey (*Pandion* spp.*) nest, in fork of tree, Coomera, Gold Coast, EPA 2000.*

Nesting platforms

Construction

When creating an artificial nesting platform, special consideration must be given to the suitability of the location. As the main dietary component of the osprey is fish, platforms must be located close to water. Ideally the site should be 50 m from the water body with a maximum distance of 3 km [2]. As predation is a concern for the ospreys, the platform should also be erected in an open area to allow for an unobstructed view of the sky. The height of the platform should also be greater than any nearby trees. If several nesting platforms are to be built in the one location, they should be placed at no less than 300 m apart [2].

To build a nesting platform the materials listed on page 5 are required. Plans for the construction of the platform are also attached. Please note that all timber must be treated and all the fixings must be galvanised.

These plans are for the construction of a timber platform, however there is the option of creating a steel platform instead.

Osprey *nesting platform – This design has since been revised to remove the vertical perch as crows were found to use the roost to harass the osprey for food, EPA 2000.*

Osprey *nesting platform – Nesting platform at Currumbin Creek, EPA 2000.*

Maintenance

The nesting platforms require an inspection at least once a year [2]. During this inspection, any foreign, potentially harmful material – such as fishing line, plastic bags and fishing hooks – should be removed. A layer of sticks can also be removed if the material in the nest is greater than half a metre deep. As the ospreys continually add material to their nest each year, nests that become too large may be blown off the platform by strong winds [2].

Osprey nest platform material requirements

Hardwood treated timber requirements
All timber to be treated

Item	Size (mm)	Quantity
Main Pole Floor	75 x 75 x 1400	2
Main Floor Supports	75 x 75 x 1800	2
Floor End Supports	75 x 75 x 1000	2
Flooring	100 x 50 x 1000	7
Horizontal Perch	65 x 100 x 1800	2
Angle Brace	100 x 50 x 670	1

Metal work requirements
All metal work to be hot dip galvanised

Item	Size	Quantity
Galv Ring Shanked Nails	75 mm	As required
Galv Ring Shanked Nails	25 mm	As required
Triple Grip Timber Braces	As required	40
Bracing Strap	25 mm x 0.5 x 1400	2
Cup Head Bolts, Washers & Nuts	M10 x 235	4
Cup Head Bolts, Washers & Nuts	M10 x 160	8
Cup Head Bolts, Washers & Nuts	M10 x 125	2
Cup Head Bolts, Washers & Nuts	M10 x 110	4
Cup Head Bolts, Washers & Nuts	M10 x 130	4
Main Support King Bolt	M20 x 430 Check Pole Head on Site	1

Pole requirements

- 20/8KN CCA Treated Hardwood Timber Pole
- Sink Pole 3.0 m
- Install Maximum Depth Concrete Foundation
- Require 20 Bags of Premix, Easymix 20 Kg Bag
- Pole Steps Galv Steel 16 mm Dia Require 18
- Aluminium Pole Cap Approx. 355 x 0.4 mm

Please Note: The vertical perch was removed from the materials list as crows were found to be using this upper roost.

Osprey camera information

The installation of osprey cams allow for the remote monitoring of nest sites and chick development. A camera that has motion sensors, is waterproof and has infrared capabilities for night-time observations is ideal. A variety of cameras exist that are suitable for observing the ospreys. At the higher end of the market is the camera such as that which was used for the “Frodocam”, which monitors Peregrine Falcons in Brisbane. This site creates worldwide interest, and provides an excellent educational opportunity regarding the conservation of raptors.

The costs of setting up an osprey webcam vary greatly, depending on the features of the camera.

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