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AVIFAUNA MANAGEMENT PLAN

Koombana Precinct

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Dr Janelle Eagle/Jeremy Fitzpatrick		24 January 2024

Prepared by:

RPS

Dr Claire Greenwell
Senior Marine Scientist

Level 3, 500 Hay Street
Subiaco, WA 6008

T +61 8 9211 1111
E claire.greenwell@rpsgroup.com.au

Prepared for:

South West Development Commission

Ashley Clements
Director of Regional Development – Infrastructure and Land

9th Floor, 61 Victoria Street
Bunbury WA 6230

T (08) 9792 2000
E ashley.clements@swdc.wa.gov.au

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OVERVIEW

This management plan, the Koombana Precinct Avifauna Management Plan (KPAMP), was commissioned by the South West Development Commission (SWDC) to address concerns raised by the Environmental Protection Authority and the public in relation to the Strategic Public Environmental Review (SPER) (and Appendices) for the proposed development of the Koombana Bay Marine Structures (KBMS) project. These concerns were in relation to potential effects on the birdlife in and around the Casuarina Boat Harbour area of development.

To ensure that the management plan addressed the concerns raised and that it could be feasibly implemented, on 5 December 2023, RPS and the SWDC hosted a workshop with the key land and sea managers and subject matter experts involved in the management of land and/or birdlife within the Koombana Precinct to provide input to the development of the plan. Key stakeholders included the Department of Transport, Southern Ports Authority, Department of Water and Environmental Regulation, Department of Biodiversity, Conservation and Attractions, City of Bunbury, WA Fairy Tern Network and BirdLife Australia. In-person and written consultation on the draft report from each of the stakeholders has been considered in finalising the KPAMP. The workshop focused on documenting the key avifauna species within the Koombana Precinct, their important breeding, feeding or roosting sites and existing threats including those relating to the proposed development of the KBMS project.

For the purposes of this plan, key avifauna species are defined as species protected under the *Environment and Biodiversity Conservation* (EPBC) *Act 1999*, *Biodiversity Conservation* (BC) *Act 2016* and locally breeding species considered to be of high social value within the local community i.e. above their ecological role or legal status under the EPBC Act or BC Act (identified in Table 4-1 and Table 4-2). A total of 21 species were identified but of those, three (flesh-footed shearwater *Ardenna carneipes*, little shearwater *Puffinus assimilis* and wedge-tailed shearwater *Puffinis pacificus*) were screened out for consideration in the plan on the basis that their breeding habitat is limited to offshore islands (to the north and/or south of Koombana Bay) and their foraging habitat does not include the sheltered inshore waters of the Koombana Precinct.

For the remaining 18 species, habitat use and threats within the Koombana Precinct were reviewed, and seven species were identified as requiring monitoring, management and/or mitigation solutions to ensure their local protection. These species included the little penguin *Eudyptula minor*, Australian fairy tern *Sternula nereis nereis*, Australian pied oystercatcher *Haemotopus longirostris,* red-capped plover *Charadrius ruficapillus*, silver gull *Chroicocephalus novaehollandiae*, banded lapwing *Vanellus tricolor* and bridled tern *Onychoprion anaethetus*.

The KPAMP identifies and details the measures currently being implemented by DoT and SPA to protect the birdlife of the Koombana Precinct and those that will be implemented during construction of the KBMS development. Notably, many of the management measures identified in this plan already occur from year to year, with strong support and interest from a wide range of stakeholders. Therefore, this plan formalises the existing work taking place and affirms the ongoing stakeholder collaboration in support of birdlife protection within the Koombana Precinct and surrounds.

The plan also outlines the legal frameworks that exist for the protection of birdlife, and the management measures required to be implemented to reduce the threats to birdlife. The measures proposed can be used to manage and mitigate potential impacts to birdlife, the habitats that support them on an ongoing basis in Koombana Bay. To support ongoing protection, this management plan should be reviewed annually by relevant government agencies, in conjunction with stakeholders, to assess the success of threat mitigation measures being implemented and to understand any changes required to improve management, review ongoing requirements for monitoring and management, ensure the conservation status of birds is accurately represented, identify and include any new legislative requirements, add any new individual species at risk if required, and incorporate ongoing stakeholder feedback.

In-person and written consultation on the draft KPAMP was provided from each of the respective stakeholders and integrated into the final version. Stakeholders are acknowledged for their valuable time and advice invested in developing this plan.

1 INTRODUCTION

The purpose of this avifauna management plan is to provide a method by which to reduce and manage the potential impacts to birdlife associated with development, construction, and increased recreation within and around Koombana Precinct. The Koombana Precinct Avifauna Management Plan (KPAMP) identifies and details the birdlife and their habitat usage within the Outer Harbour (McKenna Point), Casuarina Boat Harbour and Koombana Bay (collectively identified here as Koombana Precinct) (Figure 1-1) and, to a lesser extent, the adjacent Leschenault Estuary. The plan covers Casuarina Boat Harbour works that form part of the KBMS proposal and adjoining Outer Harbour (McKenna Point) area, but not the Koombana Bay Sailing Club breakwater or Dolphin Discovery Centre jetty development areas.

The mobile nature of birdlife, their variable patterns of habitat use, and the characteristics and locations of human disturbance have the potential to impact birdlife within and around the Koombana Precinct in various ways. The KPAMP identifies and details the measures to be implemented during construction and maintenance works in the Koombana Precinct including the Koombana Bay Marine Structures development, to manage and mitigate any potential impacts to birdlife and the habitats that support them.

For the purposes of this plan, key avifauna species are defined as species protected under the *Environment and Biodiversity Conservation* (EPBC) *Act 1999*, *Biodiversity Conservation* (BC) *Act 2016* and locally breeding species considered to be of high social value within the local community, i.e. above their ecological role or legal status under the EPBC Act or BC Act (identified in Table 4-1 and Table 4-2). Each relevant species is described including details on the legal status, habitat use, timing of occurrence and the behavioural characteristics that are relevant for informing management.

Information on the Leschenault Estuary and the use of this important habitat by birds in the region provides context around the importance of the estuary for birdlife, which is potentially a more important area for some species compared to the urban/industrial Koombana Precinct. While a brief overview of the Leschenault Inlet is described, this area is beyond the scope of this plan as all species of interest and associated management actions are limited to the Casuarina Boat Harbour development area and Outer Harbour (McKenna Point).

The plan also outlines the legal frameworks that exist for the protection of birdlife and the management measures required to be implemented to reduce threats. Notably, many of the management measures identified in this plan already occur from year to year, with strong support and interest from a wide range of stakeholders. Therefore, this plan formalises the existing work taking place and affirms the ongoing stakeholder collaboration in support of birdlife protection within the Koombana Precinct and surrounds.

1.1 Objectives of the plan

1. Identify the habitat use of birdlife within the Koombana Precinct.
2. Provide for the protection and/or monitoring of EPBC Act, BC Act-listed species and those considered to be of high social value within the local community, i.e., above their ecological role or legal status under the EPBC Act or BC Act.
3. Provide for the long-term future of Australian fairy terns (*Sternula nereis nereis*) (an EPBC Act and BC Act-listed species, which is the subject of a national recovery plan) in the Bunbury area through a managed nesting area.
4. Ensure no harm or significant disturbance to other species of nesting birds because of the construction, dredging and sand pumping activities within the Koombana Precinct.
5. Ensure the protection of little penguins utilising Koombana Bay.

Figure 1-1: Outer Harbour, Casuarina Boat Harbour and Koombana Bay (collectively identified here as the Koombana Precinct) and the adjacent Leschenault Inlet and Leschenault Estuary

2 PLAN DEVELOPMENT

Birdlife management in the Koombana Precinct is multi-jurisdictional and will require ongoing collaboration to ensure best practice management. The key partners include the Department of Transport (DoT), responsible for the management of the Casuarina Boat Harbour; the Southern Ports Authority (SPA), responsible for the management of the Outer Harbour (McKenna Point); and DBCA working in collaboration with the DoT and SPA to ensure birdlife, particularly beach-nesting species, are appropriately managed to ensure there are no negative impacts to populations.

The City of Bunbury is responsible for the design, management, planning and delivery of community assets and services. The South West Development Commission (SWDC) has provided support to the community, DoT, and other proponents involved in local infrastructure projects, ensuring a holistic approach to the development of Bunbury's Waterfront, including the development of the Casuarina Boat Harbour. The Western Australian Fairy Tern Network and BirdLife Australia provide feedback and support for the management and monitoring of birdlife in the precinct (Table 2-1).

This management plan was commissioned by the SWDC, to address comments made by the Environmental Protection Authority and the public in relation to the KBMS proposed development. Key concerns raised during the public KBMS consultation period were around ensuring an ongoing protected nesting area for the Australian fairy tern *Sternula nereis nereis*, including consideration of the option of establishing a dedicated breeding area, and potential impacts to little penguins *Eudyptula minor* and migratory birds.

Table 2-1: Key stakeholders and interest groups involved in the development of the Koombana Precinct Avifauna Management Plan

Name	Role	Engagement status
South West Development Commission	Project Lead, community consultation and communications lead	Project team
Department of Transport	Transforming Bunbury's Waterfront (TBW) Stage 3.1 delivery Agency, management of TBW3.1 construction, Casuarina Boat Harbour manager, undertaking Outer Harbour (McKenna Point) planning study	Project team
Southern Ports Authority	Outer Harbour manager - undertakes existing actions to protect the fairy tern nesting site at Outer Harbour (McKenna Point)	Collaborate
Department of Water and Environmental Regulation	Regulator - monitors compliance during and after construction	Collaborate
Department of Biodiversity, Conservation and Attractions	Government agency responsible for wildlife conservation and management	Collaborate
City of Bunbury	Local council interfacing with the community in relation to design, planning and delivery of community assets and services	Collaborate
WA Fairy Tern Network	Subject matter experts. Affiliated with WA Seabird Conservation Network for Fairy Tern protection across WA	Consult
Birdlife Australia	Subject matter experts. Community group	Consult

2.1 Stakeholder consultation process for plan development

On 5 December 2023, RPS and the SWDC hosted a workshop with the key land and sea managers and subject matter experts involved in the management of land and/or birdlife within the Koombana Precinct. The workshop focused on identifying the key species within the Koombana Precinct and their important breeding, feeding or roosting sites. Existing site threats, and those related to the proposed development of the KBMS development, were identified, and the potential monitoring, mitigation and management solutions for each species were discussed.

In-person and written consultation on the draft KPAMP from each of the respective stakeholders was integrated into the final version. Stakeholders are acknowledged for their considerable time and advice invested in developing this plan.

2.2 Potential future jurisdictional changes

During the workshop, it was noted there may be potential jurisdictional changes within the Outer Harbour (McKenna Point), currently managed by SPA, in the future. Asset inventory planning led by the South West Development Commission, is underway to determine the best use of the Outer Harbour, but there is not likely to be any change within the next 12 months. A detailed understanding of the asset components that make up the remaining SPA managed area, beyond the DoT development footprint (and costs to meet required specifications) is required. This includes consideration of:

- Detailed estimate to get wharf back to good condition and/or demolish
- Dredging costs (and sand trap management)
- Inventory of services and civils (conditions and upgrades)
- 'Whole–of–life' maintenance program (e.g. 30–50 years)
- Potential future use/s (to inform asset life).

Until the asset inventory is completed, decisions on longer term management measures, for example, the feasibility of a dedicated breeding site for the Australian fairy tern, cannot be further considered. However, it was noted by the SPA and DoT that the McKenna Point sand traps will continue to accumulate sand into the future and can be managed so that a suitable habitat remains available for nesting fairy terns (for further detail, see Section 5.2.2).

Any changes in land tenure at the Outer Harbour (McKenna Point) that result in public access to this currently secure area would also have important implications for other species of nesting birds besides the Australian fairy tern, such as red-capped plover *Charadrius ruficapillus*, Australian pied oystercatcher *Haematopus longirostris*, and bridled tern *Onychoprion anaethetus*. The plan is written according to the current jurisdictional regime, and annual reviews of this plan would require consideration of jurisdictional changes.

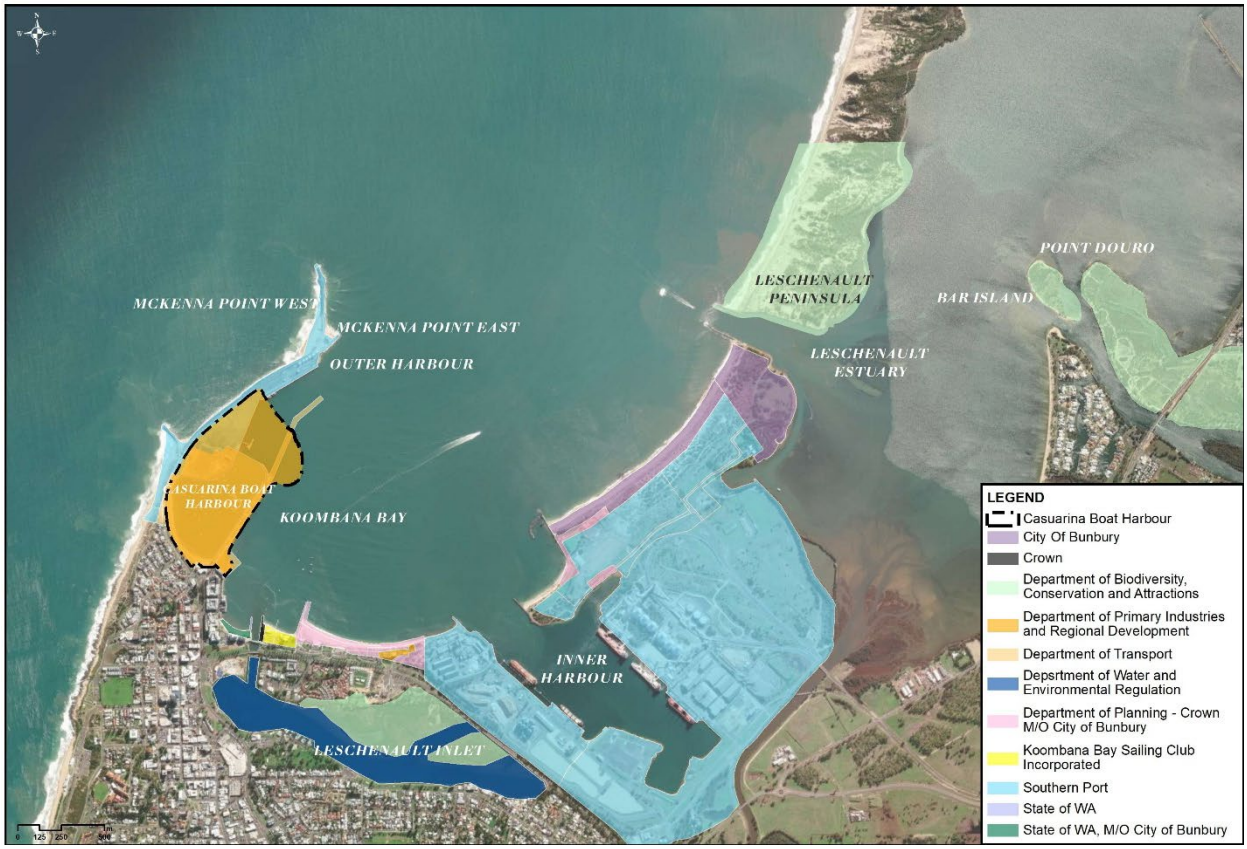


Figure 2-1: Koombana Precinct land management jurisdictions

3 LEGAL FRAMEWORKS FOR SPECIES PROTECTION

3.1 Environment Protection and Biodiversity Conservation Act 1999

The Australian Government uses the EBPC Act 1999 to protect and manage threatened, migratory, and marine species in the marine environment. Under the EPBC Act, actions that have, or are likely to have, a significant impact on nationally protected matters require approval from the Australian Government Minister for the Environment before an action can be undertaken (Commonwealth of Australia 2020a).

3.1.1 Marine species

Under the United Nations Convention on the Law of the Sea, Australia has rights and responsibilities over 16 million square kilometres of ocean – an area more than double that of the Australian continent (Commonwealth of Australia 2020a). Marine-listed species belong to taxa the Australian Government has recognised to ensure their long-term protection, pursuant to s248 of the EPBC Act (Commonwealth of Australia 2012). Once listed as a marine species under the EPBC Act, it becomes an offence to kill, injure, take, trade, keep or move of any listed marine species in or on a Commonwealth area (Commonwealth of Australia 2020a).

3.1.2 Migratory species

Migratory species are protected by the EPBC Act; specifically those migratory species listed under the Convention on the Conservation of Migratory Species of Wild Animals (also known as the CMS or the Bonn Convention; www.cms.int/) and bilateral migratory bird agreements with Japan (JAMBA), China (CAMBA) and the Republic of Korea (ROKAMBA).

Australia's list of migratory species is established under Section 209 of the EPBC Act. Section 211 (A to E) of the EPBC Act prohibits the killing, injuring, taking, trading, keeping or moving of any migratory species in or on a Commonwealth area, although certain exemptions are allowed for in Section 212 (Commonwealth of Australia 2020a). For places outside of Commonwealth areas, the EPBC Act prevents actions (Section 140) or approvals under Strategic Assessments (Section 146L) that are inconsistent with Australia's migratory species' obligations under the CMS, JAMBA, CAMBA or ROKAMBA (Commonwealth of Australia 2020a).

Signatories to JAMBA, CAMBA and ROKAMBA are committed to taking appropriate measures to preserve and enhance the environment of migratory birds by seeking means to prevent damage to such birds and their environment (Commonwealth of Australia 2020a).

3.1.3 Threatened species

Recovery plans

The federal Environment Minister may make or adopt and implement recovery plans for threatened fauna listed under the EPBC Act. Recovery plans set out the research and management actions necessary to stop the decline of, and support the recovery of, listed threatened species or threatened ecological communities. The aim of a recovery plan is to maximise the long-term survival in the wild of a threatened species or ecological community. As such, any adopted Recovery Plans are a statutory instrument under the EPBC Act and decision making cannot be inconsistent with the objectives or actions set out in a Recovery Plan. Of the avifauna being considered for the Koombana Precinct, only the Australian fairy tern, *Sternula nereis nereis* (see Section 4.1.2) is the subject of a recovery plan.

Wildlife conservation plans

Wildlife conservation plans have been developed for seabirds (Commonwealth of Australia 2020a) and migratory shorebirds (Commonwealth of Australia 2015). These plans provide a framework to guide the conservation of these taxa and their habitat in Australia. In recognition of their migratory habits, the Wildlife Conservation Plan for Migratory Shorebirds, outlines national activities to support their appreciation and conservation throughout the East Asian–Australasian Flyway (EAAF).

3.1.4 Biologically important areas

Biologically important areas (BIAs) are of particular importance for the conservation of protected species and are where individuals aggregate and display biologically important behaviours such as breeding, foraging, resting or migration (Commonwealth of Australia 2015a). BIAs are located anywhere within the Australian marine environment including state, Commonwealth, and adjacent waters and can also be designated over terrestrial areas used for biologically important behaviours (e.g. nesting). BIAs are:

- Designed to inform decision making about actions which may impact protected marine species
- Described in conservation plans for protected marine species including statutory recovery plans, wildlife conservation plans, and conservation advice documents.

3.2 Biodiversity Conservation Act 2016

The Western Australian Government uses the BC Act and Biodiversity Conservation Regulations 2018 to conserve and protect biodiversity and biodiversity components in the state; and promote the ecologically sustainable use of biodiversity components in the state. Activities that may result in the taking or disturbance of fauna requires lawful authority under the BC Act (DBCA 2023a).

A Ministerial Authorisation under section 40 of the BC Act is required to take or disturb threatened species (critically endangered, endangered or vulnerable) (DBCA 2023b). Substantial penalties apply for impacts to threatened species and threatened ecological communities without an authorisation (up to $500,000) (DBCA 2023b).

4 KOOMBANA PRECINCT

Koombana Bay is located around 150 km south of Perth in Bunbury, Western Australia. The bay is separated from the adjacent Leschenault Estuary by the Leschenault Peninsula barrier dune system. It represents one of few large estuarine systems on the lower western coast of Western Australia that opens to the Indian Ocean (Raines, Youngson & Unno 2000). The Collie River is the main tributary of the estuary, which discharges into the southernmost region of the basin (Semeniuk, Semeniuk & Unno 2000).

The structure of Koombana Bay has been highly modified from its original configuration (Semeniuk et al. 2000). A deep, narrow entrance channel “the Cut” was excavated in 1966 to allow greater ocean exchange and opens to Koombana Bay at the southern end (Semeniuk et al. 2000). Modifications to Koombana Bay commenced in 1897 with the construction of the Outer Harbour Breakwater (hereafter breakwater), which led to a reduction in wave height, sand movement and shoaling within the harbour (Seashore Engineering Pty Ltd 2013). The breakwater is an extension of the natural Basalt formation that ends in Point Casuarina. The breakwater consists of a stone wall that extends into the Indian Ocean and provides an area of calm water on its eastern side (Heritage Council of Western Australia & City of Bunbury 2017).

Two beaches are located towards the northern end of the breakwater known as McKenna Point. The first is McKenna Point East, a 70 m long north-facing coarse sandy beach, trapped between the main breakwater and an inner 100 m long north trending groyne (SLSA 2023). McKenna Point West is a 275 m long, coarse sandy beach sited on the seaward side of the breakwater. Both the eastern and western beaches form as sand accumulates in engineered sand traps, which are subject to periodic sand removal to prevent overfilling of sand traps and to maintain navigability of the Outer Harbour, with sand being used for the renourishment of Koombana Beach from time-to-time (Seashore Engineering Pty Ltd 2013).

The Leschenault Estuary, together with the shoreline habitats of the Koombana Precinct, including the urbanised harbour rock walls and beaches, comprise a diverse range of habitat types that support a rich array of flora and fauna (Semeniuk et al. 2000). Natural shore seepages from the Leschenault dune barrier and discrete seepage points act as sinks and conduits for groundwater discharge in the estuary (Cresswell 2000). These freshwater seepage sites are important for peripheral estuarine vegetation but also avifauna, particularly during summer as no permanent freshwater sources exist on the peninsula (Cresswell 2000; Semeniuk et al. 2000).

Freshwater flows, generated mainly from winter-spring rainfall in the region are critical to landscape processes and have profound effects on the physical, chemical, and biological properties of the estuarine and coastal system. Freshwater flows mobilise nutrients and generate large stocks of plankton, which have important flow-on effects for invertebrate and fish recruitment e.g. sandy sprat *Hyperlophus vittatus* within the estuarine and coastal system (Gillson 2011; Bice et al. 2015). Seasonal and interannual variation in the volume of freshwater flow, which influence salinity, turbidity, and temperature, can have pronounced impacts on the richness and diversity of invertebrates and fishes through changes in growth, survival, and recruitment (Skreslet 1986; Gillson 2011). Consequently, interannual variability in habitat and resource availability for shorebirds, waterbirds, and coastal seabirds likely explains temporal changes in species distributions, for at least some species, e.g. Australian fairy tern and little penguin *Eudyptula minor* (Phillips et al. 2019; Greenwell, Tweedley, et al. 2021; Phillips et al. 2022).

Adjacent to Koombana Bay and the Leschenault Estuary is the Leschenault Inlet, which is managed in accordance with the *Waterways Conservation Act 1976* (along with the Leschenault Estuary) and falls under the jurisdiction of the Department of Water and Environmental Regulation. At the western end of the Leschenault Inlet is the Bunbury Storm Surge Barrier, managed by the Department of Transport. The barrier was constructed in 1980, following flooding of the Bunbury townsite during Cyclone Alby in 1978 (Department of Transport 2023). The barrier is operated during periods of extreme high ocean water levels, isolating the Leschenault Inlet from the Indian Ocean to prevent ocean flooding of the low-lying areas of Bunbury (Department of Transport 2023).

4.1 Birds of Koombana Bay and KBMS

A search of the Birdata and eBird databases showed, at least, 77 seabirds, shorebirds waterbirds and terrestrial birds have been recorded within or along the shorelines of Koombana Bay (from Leschenault Peninsula to the Koombana Precinct) (BirdLife Australia 2023; Cornell Lab of Ornithology 2023). The most frequently recorded species were the silver gull *Chroicocephalus novaehollandiae* (87%), greater crested tern (62%), pied cormorant *Phalacrocorax varius* (60%) and little pied cormorant *Microcarbo melanoleucos* (53%).

Of all species recorded within the Koombana Precinct, 21 are protected under the EPBC Act and/or BC Act or are locally breeding species considered of high social value within the local community. Six biologically important areas for EPBC listed seabirds overlap the Koombana Precinct, including the little penguin, fairy tern, bridled tern, flesh-footed shearwater Ardenna carneipes, little shearwater *Puffinus assimilis* and wedge-tailed shearwater *Puffinis pacificus*. Despite being protected under the marine provisions of the EPBC Act, the flesh-footed shearwater, little shearwater and wedge-tailed shearwater have been initially screened out from the KPAMP on the basis that their breeding habitat is limited to offshore islands (to the north and/or south of Koombana Bay) and their foraging habitat does not include the sheltered inshore waters of the Koombana Precinct (Marchant & Higgins 1993). Therefore, 18 species are considered as part of the KPAMP and identified in Table 4-1 and Table 4-2).

Two resident beach-nesting shorebirds (Australian pied oystercatcher and red-capped plover) are known to occur locally throughout the year and breed on shoreline/dune habitats. The Australian fairy tern, which is a listed, threatened coastal seabird with a status of 'Vulnerable' under the EPBC Act, is observed during the October to March breeding period (Table 4 2), and intermittently breeds within the Outer Harbour, including at McKenna Point West, which is the most frequently used nesting site for the species, at least in recent history (see Table 4 3) (Greenwell & Dunlop 2023). In early 2023, the terns nested within the Casuarina Boat Harbour laydown area. The choice of this nesting location may have been due to the removal of sand from the western McKenna Point sand trap in the lead up to the breeding season and therefore a lack of suitable nesting habitat there (Greenwell & Dunlop 2023; pers comm. J.N Dunlop). Fairy terns are protected by a recovery plan, which is a legislative instrument for their protection given effect by the EPBC Act.

Three migratory terns (bridled tern *Onychoprion anaethetus*, Caspian tern *Hydroprogne caspia*, crested tern *Thalasseus bergii*) are recorded annually for at least part of the year, in addition to eight trans-equatorial migratory shorebirds which are recorded intermittently and mainly during the Austral summer (Tables 4.1 and 4.2). Other migratory shorebirds have the potential to occur within the Koombana Precinct, but the adjacent Leschenault Estuary is a more important habitat for these birds (Raines et al. 2000).

Table 4-1: EPBC Act- and BC Act-listed and locally breeding seabirds and shorebirds within Koombana Bay

Group	Common name	Scientific name	EPBC Act status	BC Act status	Recovery plans / bilateral agreements
Resident	Little penguin	*Eudyptula minor*	Ma		
	Australian fairy tern	*Sternula nereis nereis*	Ma, Mi, V	V	Recovery Plan for the Australian Fairy Tern
	Australian pied oystercatcher	*Haematopus longirostris*			
	Banded lapwing	*Vanellus tricolor*			
	Red-capped plover	*Charadrius ruficapillus*	Ma		
	Silver gull	*Chroicocephalus novaehollandiae*	Ma		
Migratory	Bridled tern	*Onychoprion anaethetus*	Ma, Mi	Mi	CAMBA, JAMBA
	Caspian tern*	*Hydroprogne caspia*	Ma, Mi	Mi	JAMBA
	Greater crested tern*	*Thalasseus bergii*	Ma, Mi	Mi	JAMBA
	Whimbrel	*Numenius phaeopus*	Ma, Mi	Mi	Bonn, CAMBA, JAMBA, ROKAMBA, WCP for Migratory shorebirds
	Grey plover	*Pluvalis squatarola*	Ma, Mi, V	Mi	Bonn, CAMBA, JAMBA, ROKAMBA, WCP for Migratory shorebirds
	Greater sand plover	*Charadrius leschenaultii*	Ma, Mi, V	Mi, V	Bonn, CAMBA, JAMBA, ROKAMBA, WCP for Migratory shorebirds
	Bar-tailed godwit	*Limosa lapponica baueri*	Ma, Mi, V	Mi, E	Bonn, CAMBA, JAMBA, ROKAMBA, WCP for Migratory shorebirds
	Grey-tailed tattler	*Tringa brivipes*	Ma, Mi	Mi	Bonn, CAMBA, JAMBA, ROKAMBA, WCP for Migratory shorebirds
	Common sandpiper	*Actitis hypoleucos*	Ma, Mi	Mi	Bonn, CAMBA, JAMBA, ROKAMBA, WCP for Migratory shorebirds
	Great knot	*Calidris tenuirostris*	Ma, Mi, V	Mi, CR	Bonn, CAMBA, JAMBA, ROKAMBA, WCP for Migratory shorebirds
	Sanderling	*Calidris alba*	Ma, Mi	Mi	Bonn, CAMBA, JAMBA, ROKAMBA, WCP for Migratory shorebirds
	Red-necked stint	*Calidris ruficollis*	Ma, Mi	Mi	Bonn, CAMBA, JAMBA, ROKAMBA, WCP for Migratory shorebirds

Under EPBC Act and BC Act Status, Ma = Marine, Mi = Migratory, V = Vulnerable, CR = Critically Endangered. WCP – Wildlife Conservation Plan. Bilateral Migratory Bird Agreements = Japan-Australia (JAMBA), China-Australia (CAMBA) and the Republic of Korea-Australia (ROKAMBA), the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention). WCP = Wildlife Conservation

Table 4-2: Occurrence and breeding chronology of EPBC Act-listed, BC Act-listed, and locally breeding seabirds and shorebirds that occur within Koombana Bay

Common name	Presence in SW WA	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Little penguin	Year-round												
Australian fairy tern	Oct–Feb												
Australian pied oystercatcher	Year - round												
Banded lapwing	Year-round												
Red-capped plover	Year-round												
Silver gull	Year-round												
Bridled tern	Sep–April												
Caspian tern	Year-round												
Greater crested tern	Year-round												
Whimbrel	Sep–Apr												
Grey plover	Sep–Apr												
Greater sand plover	Sep–Apr												
Bar-tailed godwit	Sep–Apr												
Grey-tailed tattler	Sep–Apr												
Common sandpiper	Sep–Apr												
Great knot	Sep–Apr												
Sanderling	Sep–Apr												
Red-necked stint	Sep–Apr												

The presence of each species is represented by stippling or solid shading. For migratory shorebirds, which do not breed in Australia, the higher density of stippling represents the main overwintering period before birds migrate to the northern hemisphere to breed. For locally breeding seabirds and shorebirds, the timing of breeding in south-western Australia is denoted by solid shading with black representing the peak breeding period and, to a lesser extent, the area shaded in grey. Species known to breed within the Koombana Precinct are shown in bold font.

4.1.1 Little penguin

The little penguin *Eudyptula minor* is listed as marine species under the EPBC Act. Two small, edge of range colonies occur on Penguin Island and Garden Island (Cannell 2001), while a former colony on Carnac Island (Dunlop & Storr 1981) appears to have been extirpated (pers. comm. E. Clitheroe). The nearshore waters from Perth (including Rottnest Island) to Bunbury have been identified as a biologically important area for the species (DCCEEW 2021).

In 1995, 1,000 little penguins were estimated to occur on Penguin Island (Cannell 2001). However, more recent population estimates in 2019 indicate the population decreased by around 80% since island-wide mark-recapture estimates began in 2007, to around 300 individuals (Cannell et al. 2011; Cannell 2018; Cannell 2020; Greenwell et al. 2022). Various anthropogenic factors are considered to have contributed to the decline of the population (Cannell et al. 2016).

In 1997, 10–40 little penguins were estimated to occur on Garden Island (Cannell 2001). The population has grown steadily since then and in 2019, the population within the main colony was thought to consist of around 400 birds (Cannell unpub. data; RPS 2020). Additional nests are situated outside of the main colony but there are no publicly available estimates on their numbers.

Following completion of the annual moult (December/January), little penguins can remain at sea for up to several weeks but may return to land at any time. Little penguins are visual hunters, relying on their sight and high ambient light levels to be able to capture their prey (Cannell & Cullen 1998). Their diet consists mainly of small bait fishes such as blue sprat *Spratelloides robustus*, sandy sprat and Australian sardine *Sardinops sagax* (Klomp & Wooller 1988). During the breeding season, little penguin foraging is constrained by the need to return to the nest site to brood eggs and feed chicks.

Penguins intermittently return to their breeding colonies from February–March to commence pre-breeding activities, including site prospecting, pair-bonding and nest guarding (Wienecke 1993). The breeding season is relatively protracted, and variable among years and between pairs, but typically extends from April to December (Dunlop, Klomp & Wooller 1988; Wienecke 1993; Nicholson 1994). Clutches usually consist of two eggs, which are incubated by both parents for approximately 45 days (Stahel & Gales 1997). After egg hatching, the small young need to be fed every night and continuously kept warm; thus, the pair switches to a routine alternating between a day at the nest with a day foraging (Collins, Cullen & Dann 1999). Chicks are fed at the nest site for seven to eight weeks before fledging (Wienecke 1993).

Publicly available tracking data from Western Australia is somewhat limited but comprehensive studies from Victoria (n = 161 and 61 transmitters) showed that adults typically remain within close foraging range of their breeding colonies during the incubation (<50.0 km) and chick-rearing periods (<20–36.0 km), compared to the non-breeding period (≤500 km) (Collins, Cullen & Dann 1999; Hoskins et al. 2008). Penguins tracked from Philip Island travelled an average of 4.4 days during incubation compared with 2.1 days during the chick-rearing period and 5.2 days during the non-breeding period (Collins et al. 1999). During a single day of foraging, little penguins can travel up to 8–21 km from the colony (Collins et al. 1999; McCutcheon 2011, Cannell 2017, 2018).

In 2016, 14 incubating adults (n= eight males, six females) and 14 chick-rearing adults (n= six males, eight females) from Penguin Island, Western Australia were fitted with satellite transmitters to understand foraging patterns during the breeding period (Cannell 2017). During incubation, the home range of all penguins extended from Rottnest to Binningup and foraging trips lasted, on average, 5.3 ± 2.5 days (Cannell 2017). The maximum foraging range was between 7–86 km from the colony (Cannell 2017). During the chick-rearing period, penguins foraged much closer to the colony and all foraging trips were limited to a single day return trip. The maximum distance the penguins travelled from the colony ranged from 8–21 km and the core foraging areas included Warnbro Sound, Comet Bay, Singleton to Madora, Sepia Depression and Five Fathom Bank, west of Garden Island (Cannell 2017). These distances are fairly similar to those recorded by Collins et al. (1999).

In 2017, six incubating little penguins from Penguin Island were tracked using satellite transmitters (n= six incubating males, one incubating female). In addition, one male rearing chicks (chicks up to two weeks old) was tracked with GPS (Cannell 2018). Due to the very poor breeding year, likely associated with high sea surface temperatures and purported low prey availability, few penguins were able to be tracked (Cannell 2018). Furthermore, four of the six tags failed before the birds returned to the colony due to equipment failure and two birds remained at sea for longer than the battery duration – likely related to poor food availability (Cannell 2018).

From the data collected, penguin trip duration ranged from one to ten days during the incubation period and one day during the chick rearing period (Cannell 2018). Each penguin typically concentrated foraging effort in one area and remained within their core foraging area, rather than travelling across multiple areas (18–62 km^2) (Cannell 2018). For six of the multi-day foraging trips recorded, the maximum distance penguins travelled from the colony was 22–33 km (Cannell 2018). The penguins foraged in Warnbro Sound, Comet Bay (especially adjacent to Singleton), the west side of Garden Island, and Cockburn Sound. One male travelled for five days before returning to the colony. The next day, he departed the colony and did not return for 11 days. During this period, he travelled at least 145 km south to Geographe Bay. His breeding attempt failed and chicks were found dead in the nest (Cannell 2018).

Given the considerable distance from Koombana Bay to little penguin breeding sites (>130 km from Penguin Island and Garden Island), with evidence that breeding success decreases with increased foraging distance from the colony (Cannell 2001), little penguin foraging activity is likely to be lower in Koombana Bay during the breeding period. Particularly, chick-rearing adults (which remained within 21 km of the Penguin Island colony in the Cannell (2016, 2017) studies). Little penguins are more likely to be present within Koombana Bay over the summer months (December to March), during the post-breeding period, when adults are not constrained by the distance they can travel to find food and may forage further south from the colony and spend more time in Koombana Bay and Geographe Bay. Little penguins have been recorded hauling out for moulting in Koombana Bay with one record of a bird beneath the boardwalk at the Dolphin Discovery Centre, and another at the yacht club in 2016 (pers. comm. C. Taylor/DBCA).

4.1.2 Australian fairy tern

The Australian fairy tern *Sternula nereis nereis* (hereafter fairy tern) is listed as Vulnerable under the EPBC Act and BC Act. A national recovery plan for the species entered into force On 5 May 2022. The long-term vision of the recovery plan is "The Australian Fairy Tern population has increased in size to such an extent that the species no longer qualifies for listing as threatened under any of the *Environment Protection and Biodiversity Conservation Act 1999* listing criteria" (Commonwealth of Australia 2020b). The objective of the recovery plan is "By 2030, sustain a positive population trend (compared to 2020 baseline counts) in the number of mature individuals of the Australian Fairy Tern in both the eastern and western populations" (Commonwealth of Australia 2020b).

The Australian fairy tern population occurs along the coasts of Western Australia, South Australia, Victoria, New South Wales and Tasmania and the population is estimated at 6,300–7,600 mature individuals (Greenwell et al. 2021c). Western Australia has the largest population in the country, estimated at 5,000-6,000 mature individuals (Greenwell et al. 2021c). Of those, around 1,400 mature individuals (700 pairs) regularly breed along the lower west coast between Perth and Bunbury (Dunlop & Greenwell 2021). Similar numbers of fairy tern occur in the Houtman Abrolhos (Dunlop & Greenwell 2021). These areas, which include the Koombana Precinct, have been identified as a biologically important area (BIA) for the species (DCCEEW, 2023).

The fairy tern is highly specialised in its choice of nesting site and usual nesting habitats include wide, coarse-grained, and lightly coloured beaches, spits, sandbars, banks, and ridges within sheltered embayments, near river mouths (when silt-free) or on continental islands (Higgins & Davies 1996). Fairy terns typically return to the same region to breed from year to year, but not necessarily the same site (Greenwell et al. 2021b). Colony site selection is influenced by a range of factors, including local prey distributions and availability (Greenwell et al. 2021b).

A tracking study of fairy terns in the Coorong Estuary, South Australia showed that adults foraged in the adjacent Southern Ocean, 500 m out from shore and within about 2,000 m from the colony (Paton & Rogers 2009). A tracking study of the closely related little tern *Sternula albifrons* in the United Kingdom showed that the average return foraging trip distance for birds at a successful breeding colony was, on average, between 1,441–3,177 m (Perrow et al. 2006).

The timing and location of breeding, including within Koombana Bay, varies from year to year and is likely dependent on prey availability and habitat stability (Greenwell, Dunlop, et al. 2021; Greenwell, Tweedley, et al. 2021). Thus, the number of terns present at a particular site can vary greatly among years (Greenwell & Dunlop 2023).

Past breeding locations within or adjacent to the Koombana Precinct in recent history include McKenna Point West, McKenna Point East, Leschenault Estuary, and the Casuarina Boat Harbour laydown area (Table 4-3, Figure 4-1). Several breeding attempts have also been made at Bar Island and the Leschenault Peninsula (Table 4-3; J.N. Dunlop). Since the 2017–2018 breeding season, fairy terns have attempted to breed in the Koombana Precinct on seven occasions, highlighting the importance of the area for the species.

Table 4-3: Fairy tern breeding and outcomes in Bunbury between 2017–2018 and 2023–2024

Year	Site	Pairs	Outcome	Reasons for failure	Observed threats
2017/18	McKenna Point West	70	High chick production	N/A	Silver gull
2019/20	McKenna Point West	168	Failed	Unknown. Unconfirmed, presumed predator	Cat (tracks), peregrine falcon
2020/21	Leschenault Peninsula	18	Failed	Off-road vehicles	
2020/21	McKenna Point West	1	Failed in the early colony formation stage	Unknown	
2022/23	Casuarina Boat Harbour laydown area	70	High chick production	N/A	Dog inside fenced area
2023/24	McKenna Point East	10	Failed	Failed during early colony formation, presumably due to disturbance from sand trap-clearing machinery	Machinery
2023/24	McKenna Point West	225	High chick production		Red fox (detected on wildlife camera)

Table adapted from Greenwell & Dunlop (2023).

That nesting has occurred on seven occasions in as many years highlights the significance of the area for this Vulnerable species, especially given the often-ephemeral nature of breeding sites and typical low site faithfulness exhibited by fairy terns. Along with the Houtman Abrolhos Islands, the lower west coast region is the most critical management unit in terms of the number of breeding birds, with the former exposed to the most extreme threats (Dunlop & Greenwell 2020). In recent decades, habitat loss arising from expanding coastal development combined with high levels of colony disturbance and rising water levels have rendered many historically important breeding sites, such as the Peel-Harvey Estuary, unusable (Dunlop & Greenwell 2020; Dunlop & Greenwell 2023). Thus, the preservation of a breeding site within the Bunbury Outer Harbour (McKenna Point) is considered of critical importance for the long-term maintenance of the lower west coast fairy tern population (Dunlop & Greenwell 2020).

Fairy tern nests consist of a shallow scrape in the sand, which may be lined with shells or vegetation. A clutch consists of one to two eggs, rarely three. Nesting sites are generally in open areas within sight of the water. Adults often incorporate shell fragments, small stones, or other organic/inorganic materials in and around the nest, which increase the camouflage of eggs and chicks (Greenwell et al. 2021b). Incubation and chick guarding is shared by both parents, and it takes about 21 days for eggs to hatch and 22 days for chicks to fledge (Greenwell et al. 2021b).

Australian fairy terns are piscivorous and feed predominantly on small schooling fishes such as anchovies *Engraulis australis*, sandy sprat and blue sprat, which they catch by hovering and plunge diving up to about 30 cm (Greenwell, Tweedley et al. 2021). Occasionally, small squids are caught at dusk (Greenwell, Tweedley, et al. 2021). Fairy terns forage in sheltered, clear, marine waters, usually close inshore and are considered a 'bluewater' tern due to their occurrence and feeding in very clear water.

At night and when not feeding, fairy terns roost on wide sandy beaches, tombolos, sandbars, and salt lakes. Bar Island and Point Douro are important aggregation and club sites (i.e. areas where terns aggregate for courtship, pair formation and pair bonding) for the terns in the lead up to the breeding season. This area is also likely to support a night roost, evidenced by the presence of fairy terns in the very early morning.

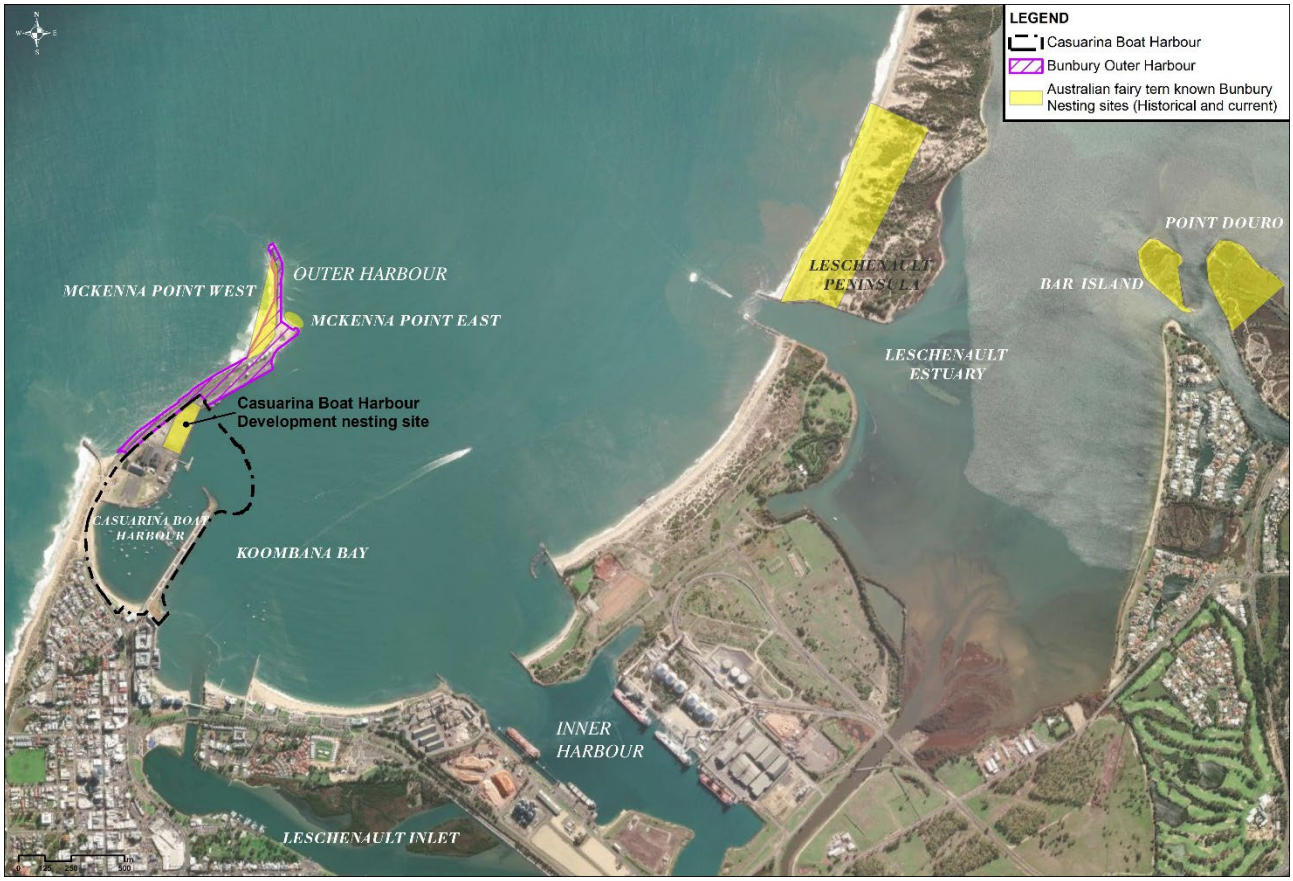


Figure 4-1: Current and historical Australian fairy tern nesting sites in the Bunbury area, including the Koombana Precinct Australian pied oystercatcher

The Australian pied oystercatcher nests and feeds along the shorelines of Koombana Bay and the Leschenault Estuary. Although it has no special legal protections under the EPBC Act or BC Act, it is of high social value for the community as it is a conspicuous, well-known beach-nesting species.

The Australian pied oystercatcher has a continuous Distribution around the Australia coastline and continental islands, where sandy beaches occur, although, in areas of high human occupation, oystercatchers are often notably absent. They prefer intertidal mudflats and sandbanks, undisturbed beaches, sand bars, estuaries, and coastal salt lakes (Maguire 2008).

The breeding season is, broadly, September to January in southern Australia. They nest in open environments in undisturbed sites and are highly site-faithful over time (Maguire 2008). Their nests consist of a shallow scrape in the sand, which may be lined or unlined with some shell fragments, pebbles, vegetation, or other debris (Maguire 2008). The clutch consists of one to three eggs, commonly two, and both parents incubate, feed young, and fiercely defend their nesting territory. Incubation is 26–29 days and chicks fledge after about 50–56 days (Maguire 2008). The diet of the Australian pied oystercatcher consists, mainly, of marine molluscs, gastropods, polychaetes, and crabs, which are caught using a range of foraging techniques including hammering, prising, probing, and stabbing (Cornell University 2023).

In the Bunbury area, Australian pied oystercatchers feed, rest and breed on the beaches of the Koombana Precinct and within the Leschenault Estuary and are present year-round (BirdLife Australia 2023; Cornell Lab of Ornithology 2023). Breeding pairs are observed on nests and/or with chicks in most years at the Outer Harbour (McKenna Point) (pers. obs. C. Taylor/DBCA).

4.1.3 Red-capped plover

The red-capped plover *Charadrius ruficapillus* is listed as a threatened marine species under the EPBC Act. It is found in Australia, Tasmania, Timor and possibly Roti in Indonesia (Cornell University 2023). The red-capped plover most commonly resides in coastal habitats and has a particular penchant for sandy/shelly beaches with mud or sandflats and saline wetlands behind dunes (i.e. saltmarshes and saltpans). They also occur in inland wetlands (largely avoiding the arid interior), saltworks and sewage ponds (Cornell University 2023).

The red-capped plover breeds seasonally between July–January and occasionally into February or March in southern Australia (Maguire 2008; Cornell University 2023). They commonly nest as solitary pairs, but sometimes in loose colonies (Cornell University 2023). Their nest consists of a shallow scrape in the sand, shell-grit or among seaweed wrack, which may be lined or unlined with some shell fragments, pebbles, vegetation, or other debris (Cornell University 2023). In some areas, eggs are laid directly onto limestone platforms (pers obs. C.N. Greenwell). The clutch size usually consists of one to three eggs, commonly two (Maguire 2008). Eggs are incubated for 28–31 days and chicks fledge after about 35 days. Most incubation is completed by the female.

Red-capped plover feed on small crustaceans, molluscs, marine and terrestrial insects, mainly along the shoreline or lower dunes. Their feeding behaviour is characterised by a run-stop-peck motion, which is typical of Charadrius plovers (Maguire 2008).

Red-capped plovers occur on beaches of Koombana Bay and within the Leschenault Estuary throughout the year (BirdLife Australia 2023; Cornell Lab of Ornithology 2023). Breeding pairs are observed on nests and/or with chicks in most years at the Outer Harbour (McKenna Point) and a pair with two chicks was observed within the Casuarina Boat Harbour development area in October 2023 (pers. obs. C. Taylor/DBCA). The actual location of the nest site was unknown (pers. obs. C. Taylor/DBCA).

4.1.4 Banded lapwing

The banded lapwing *Vanellus tricolor* has no elevated legal protections under the EPBC Act or BC Act. However, its presence (including nesting) within the Bunbury area, is of high social value within the local community (raised through the SPER public consultation process).

The banded lapwing is fairly uncommon within metropolitan environments and is, therefore, considered a species of high social value. Larger numbers occur in inland areas, particularly after high rainfall, and small populations persist on Garden Island, Rottnest Island and in less well-developed urban areas such as Forrestdale Lakes, Bennet Springs, Lake Walyungup and Lake McLarty (Cornell Lab of Ornithology 2023). A small number of pairs appear to be persisting within the Bunbury area (Figure 4-2) (Cornell Lab of Ornithology 2023).

The banded lapwing typically prefers open, short, and sparse grasslands, but may also be found on ovals, golf courses, wetlands, and in semi-arid regions (Cornell University 2023). Pairs are generally resident with some erratic or nomadic movements, and the timing of breeding varies depending on rainfall, but frequently between June and November (Cornell University 2023).

Banded lapwing nests consist of a shallow scrape or depression in ground, unlined or lined with grass and other plant materials and debris. Clutches consist of three to five eggs but most commonly four. The eggs are laid 24-hours apart, except the fourth, which can take up to four days. The clutch is incubated by both parents for 26–28 days, but incubation is postponed until after the third egg is laid (Cornell University 2023). Chicks fledge after approximately 55–60 days but are fully feathered within 42 days (Cornell University 2023).

Banded lapwings have a varied diet, feeding on plant material, seeds and a range of terrestrial insects, spiders, works and molluscs (Cornell University 2023). Two or three pairs breed within the Bunbury Outer Harbour and Leschenault Inlet area each year (pers. comm. S. Kalab).

Figure 4-2: Current and historical nesting areas used by banded lapwings (denoted by green dots) and the main silver gull nesting area in Outer Harbour (blue shaded area) within the Koombana Precinct (excluding the Bunbury Inner Harbour)

4.1.5 Silver gull

The silver gull *Chroicocephalus novaehollandiae* is a listed marine species under the EPBC Act. It occurs in both coastal and inland locations, frequenting natural environments as well as parks, rubbish dumps, and livestock pens (Cornell University 2023).

In 1942, few silver gull breeding colonies were present within metropolitan areas of south-western Australia. In the Perth region, small colonies were limited to Bird and Shag islands within Warnbro Sound, but the population was estimated to contain fewer than 200 individuals. By 1988, the population within Shoalwater Bay had grown to at least 4,000 pairs, with an estimated 2,500–3,000 pairs on Penguin Island, alone (Dunlop 1988). Considerable numbers now occur within the Bunbury region. Readily available human organic waste is the principal driver for their population increase in the urban environment (Dunlop 1988).

Large gull populations are often problematic, particularly for other nesting birds as they have the potential to significantly reduce breeding success through the predation of eggs or young, but also and kleptoparasitise (deliberately steal) food from other seabirds (Dunlop 1988). Away from their breeding colonies, gulls can be a public pest, stealing food from people and fouling public places and moored vessels, are carriers of disease and accumulate and transmit antibiotic resistant, human pathogenic bacteria (Dunlop 1988; Mukerji).

The silver gull has a protracted breeding season, from autumn through to late spring (peak in winter), and typically nests amongst rocks, rubble, and low bushes on islands. The nest consists of a shallow nest scrape, lined with vegetation. Both parents share the incubation of 1–3 eggs and in years of high food availability, pairs may raise two broods within a year (Cornell University 2023). The typical foraging niche of the silver gull is a scavenger in the intertidal zone. However, the diet is supplemented by an abundance of human food waste in the urban environment (Dunlop 1988).

Silver gull nests are scattered at the northern extent of the Outer Harbour, particularly around the wharf and around the methanol storage tanks (Figure 4 2). In addition, hundreds of silver gulls occur and breed within the Inner Harbour (on infrastructure and vessels) and are a source population for recruitment to the Casuarina Boat Harbour infrastructure.

4.1.6 Bridled tern

The bridled tern *Onychoprion anaethetus* is listed as marine and migratory under the EPBC Act and BC Act and is protected under the CAMBA and JAMBA and Wildlife Conservation Plan for Seabirds (Commonwealth of Australia 20202). The bridled tern is distributed throughout the western and eastern Indian Ocean, Indo-Pacific region, and the Atlantic and Pacific Ocean sides of central America in to tropical and subtropical environments (Dunlop & Rippey 1998). In Western Australia, the species has been increasing its breeding range into temperate south-western Australia and south of the Houtman Abrolhos Islands since 1843. The bridled tern was established in Shoalwater by 1920 and has now extended its range as far south-east as western South Australia (Dunlop & Jenkins 1994; Dunlop & Rippey 1998; Dunlop & Greenwell 2022). An extensive biologically important area has been identified for this species in Western Australia, including Koombana Bay (DCCEEW 2021).

The bridled tern is a truly migratory, pelagic tern, remaining at sea for the duration of the non-breeding season. From mid-late September, pairs or first-time breeders start to return to colonies in south-western Australia at night. Immature birds, in their third year, arrive in the second half of the breeding season (Dunlop & Rippey 1998). By mid-October terns can be seen during the day, where they begin to occupy their nesting territories (Dunlop & Rippey 1998). Pairs lay a single egg on the ground, either under shrubbery or on limestone ledges and rock stacks and chicks fledge after 58–60 days (Cornell University 2023).

Breeding colonies are typically confined to continental or oceanic islands, or rock stacks disconnected from the mainland. The largest colony on the lower west coast of Australia is on Penguin Island, which in 2006 was estimated to support 3,000–4,000 established pairs (Dunlop & Pedelty 2007). Extremely large colonies also occur at the Houtman Abrolhos. The nest typically consists of a single egg, laid under vegetation or in rocks/rock stacks. Incubation is 28–30 days and the fledging occurs at 58–63 days (Commonwealth of Australia 2020a).

In a typical year, bridled terns in south-western Australia exit the colony en masse, in the second week of April and commence their northward migration to the north-west Sulawesi Sea (Dunlop & Jenkins 1994; Dunlop & Rippey 1998). They remain in their non-breeding foraging grounds throughout the Austral winter.

The preferred foraging habitat of the bridled tern is shelf waters (and within 70 km of breeding colonies) in areas of downwelling (Dunlop 1996). These convergence zones aggregate prey, but also *Sargassum* from coastal reefs and flotsam from terrestrial environments, which provide habitat for neuston, i.e. marine organisms that live close to the ocean surface, and small pelagic fishes on which bridled terns feed (Dunlop 1996; Dunlop & Rippey 1998).

Recent records indicate the bridled tern is now breeding in the seawalls around the Casuarina Boat Harbour in Bunbury (pers. comm. J.N. Dunlop; C. Taylor/DBCA). Increased habitat availability through the creation of additional seawalls may facilitate an increase in the number of nesting pairs over time. The current extent of nesting is unknown, but terns have been seen roosting on the seawall north of the wharf. Any breeding is probably limited to a small number of pairs.

4.1.7 Caspian tern

The Caspian tern *Hydroprogne caspia* is listed as marine and migratory under the EPBC Act and BC Act and is protected under the JAMBA. The Caspian tern occurs in both Australia and Japan, with both countries signatories to the Japan-Australia Migratory Bird Agreement (JAMBA). However, there is no evidence to suggest the species is migratory in south-western Australia (pers. Comm J.N. Dunlop.; Dunlop & McNeill 2017; Stockwell et al. 2022).

Banding records of locally breeding individuals suggest that Caspian tern make local movements and do not leave Western Australia outside of the breeding season. For example, Caspian terns breeding on Penguin Island are known to aggregate on the Peel-Harvey Estuary (Dunlop & McNeill 2017; Stockwell et al. 2022) and Leschenault Estuary during their nonbreeding period (BirdLife Australia 2023; Cornell Lab of Ornithology 2023).

Caspian tern colonies are, predominantly found in coastal waters and the closest colonies to Bunbury are on Penguin Island and Rottnest Island. Breeding occurs, primarily, between June and December (Dunlop & McNeill 2017). Caspian terns feed predominantly on whitings and mullets (Stockwell et al. 2022) and prefer sheltered environments, such as the Leschenault Estuary.

The Caspian tern may occasionally be seen within Koombana Bay and the Leschenault Inlet, but the Leschenault Estuary, particularly Point Douro with its extensive shallow sand flats, is a much more important habitat for this species (BirdLife Australia 2023; Cornell Lab of Ornithology 2023). Given the relatively low importance of the Koombana Precinct for the Caspian tern and the absence of any nesting, this species will not be further considered in this management plan (i.e. for monitoring, management, and mitigation).

4.1.8 Greater crested tern

The crested tern *Thalasseus bergii* is listed as marine and migratory under the EPBC Act and BC Act and is protected under the JAMBA. However, there is no evidence to suggest the species is migratory in southern Australia; it is considered sedentary or resident in WA but may disperse after breeding (see Marchant & Higgins 1993 and references therein). Nonetheless, as the crested tern is considered migratory, there must be regard for the legal frameworks in place for the protection of the species.

The crested tern is widespread in all coastal areas of Australia, mainly from the lower marine reaches of estuaries to waters of the continental shelf. The species breeds exclusively on continental islands, and the nearest colonies can be found on Penguin Island and Rottnest Island. Breeding occurs, primarily, between October and February (Marchant & Higgins 1993). A study into the diet of crested terns breeding on Penguin Island showed the species feeds primarily on schooling bait fishes such as blue sprat, sandy sprat and Australian sardine (J.N. Dunlop, unpub. data). When not feeding or at the colony, crested terns often aggregate on sandbars and wide sandy beaches on islands and near river mouths but may also roost on maritime infrastructure.

Crested terns are frequently seen within the Leschenault Estuary, Koombana Precinct and/or on its shorelines and structures, including the Casuarina Boat Harbour (BirdLife Australia 2023; Cornell Lab of Ornithology 2023). Known roost sites occur on maritime structures of the Casuarina Boat Harbour, along the shorelines of Koombana Bay and the Outer Harbour (McKenna Point), Point Douro on the Leschenault Estuary and on the beach to the north of Wyalup-Rocky Point, Bunbury (south of the Outer Harbour).

Depending on the type and level of activity associated with the Casuarina Boat Harbour, there is the potential for disturbance of roosting crested terns, which may result in terns relocating to alternative roost sites in the area, at least in the short term. In the longer term, the new structures may provide additional roosting places or terns may relocate to alternative roosting sites.

As the crested tern does not nest within the Koombana Precinct, there are limited requirements for management. Considerations being made in relation to the timing of dredging for the KBMS development for little penguins and Australian fairy tern will also be effective for this species. Therefore, the crested tern will not be further considered in this management plan (i.e. for monitoring, management, and mitigation).

4.1.9 Migratory shorebirds

There are several species of trans-equatorial migratory shorebirds that have the potential to utilise the shoreline and or seawalls of Koombana Bay. These birds are listed as marine and migratory under the EPBC Act and protected under the Bonn, CAMBA, JAMBA, ROKAMBA and the Wildlife Conservation Plan for Migratory Shorebirds (Commonwealth of Australia 2015) and several are listed as threatened species (see Table 4-1).

At least nine species and have been recorded during ad-hoc surveys around Koombana Bay, including the urban environments of the Outer Harbour (McKenna Point) and/or Casuarina Boat Harbour (BirdLife Australia 2023; Cornell Lab of Ornithology 2023). Species such as the whimbrel *Numenius phaeopus*, common sandpiper *Actitis hypoleucos* and grey-tailed tattler *Tringa brivipes* may be found roosting on seawalls, while the remaining species (identified in Table 4-1) would be restricted to shorelines (Cornell University 2023; pers. obs. Greenwell). Comparatively, the adjacent Leschenault Estuary supports a greater diversity and abundance of shorebirds owing to its numerous natural habitat types, including tidal flats, shallow waters, sandbars, shoreline, and marsh – conditions that are more suitable for feeding, including probing into mud, and roosting (Raines et al. 2000; BirdLife Australia 2023; Cornell Lab of Ornithology 2023).

Trans-equatorial migratory shorebirds migrate from their northern hemisphere breeding grounds after breeding along the East Asian-Australasian Flyway (EAAF), a major flyway for migratory birds. The EAAF stretches from the Russian Far East and Alaska, southwards through East Asia and South-east Asia, to Australia and New Zealand, encompassing 22 countries (Figure 4 3).

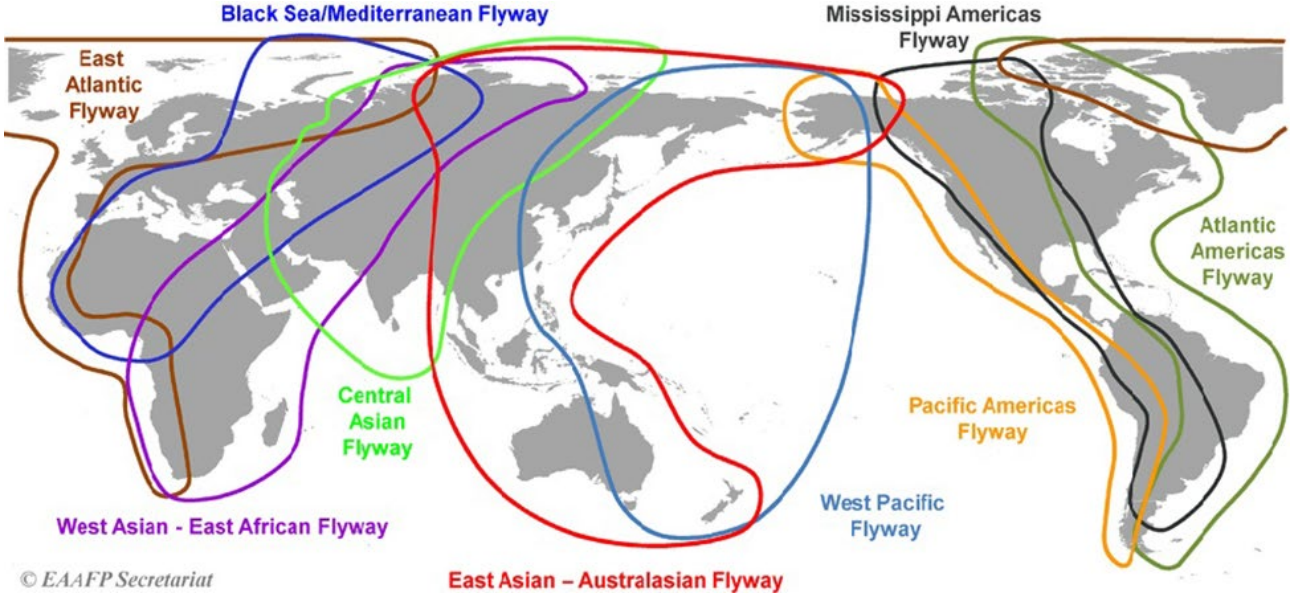


Figure 4-3: Global migratory shorebird flyways, including the East Asian–Australasian flyway (shown in red)

Arriving from around September in south-western Australia, they spend the Austral summer in Australia where they feed, predominantly, on marine, estuarine or freshwater invertebrates. Mature individuals return to the northern hemisphere for the breeding season, generally leaving by mid-April but noting the timing of departure varies among species (Table 4-2) (BirdLife Australia 2023). Immature birds are known to overwinter in Australia, thus small numbers of shorebirds may be present during this time.

Many shorebirds are highly site faithful to their stop-over and wintering sites (Leyrer et al. 2006; Minton et al. 2006; Buchanan et al. 2011; Coleman & Milton 2012; Coleman & Bush 2020). Where site faithfulness persists and birds are displaced after habitat is lost, it has the potential to hamper survival probability (Burton et al. 2006). Some species are more flexible and have shown an ability to shift their non-breeding distribution in response to changing environmental and climatic conditions (Austin & Rehfisch 2005; Maclean et al. 2008; Verkuil et al. 2012). There is limited publicly available data for south-western Australia, due mainly to a lack of mark-recapture studies in the region. However, while there is the potential for habitat to be lost to development, the Outer Harbour (McKenna Point) and Casuarina Boat Harbours provide limited opportunities for shorebird feeding and roosting, with relatively few/intermittent sightings, particularly compared to the adjacent Leschenault Estuary, which is a far more important area for this group of birds (Birdata 2023; Cornell Lab of Ornithology 2023).

Depending on the type and level of activity, associated with the KBMS project/Casuarina Boat Harbour development, there is the potential for disturbance of roosting migratory shorebirds, which may result in shorebirds relocating to alternative roost sites in the area, such as the Leschenault Estuary, at least in the short term. As migratory shorebirds do not nest within the Koombana Precinct (and the Koombana Precinct is artificial/low habitat value for shorebirds), there are limited requirements for management. Therefore, this group of species will not be further considered in this management plan (i.e. for monitoring, management, and mitigation).

5 SITE THREATS

5.1 Natural threats to birdlife in the Koombana Precinct

5.1.1 Tidal inundation or egg burial

There are three species that occur in the Koombana Precinct, which could be impacted by tidal inundation or egg burial and include the fairy tern, red-capped plover and Australian pied oystercatcher. Nest failure among beach-nesting birds is naturally high and includes both tidal inundation of nests and egg burial during strong wind events (Garnett & Franklin 2014). In some years, fairy tern eggs appear to have been buried at McKenna Point West during very strong storm winds (pers. comm. C. Taylor/DBCA).

Tidal inundation is a persistent source of failure among fairy tern colonies (Greenwell & Dunlop 2023), but artificially wide/elevated beaches at McKenna Point sand traps may reduce the potential for colony flooding, where beaches are maintained to support a nesting attempt.

Red-capped plovers and Australian pied oystercatchers have tended to nest higher up on the beach at McKenna Point and in the area between the breakwater and the BP groyne at the end of Casuarina Drive. However, the degree to which these species may be impacted by inundation or strong winds is less well-known as breeding is dispersed, pairs nest singularly and over a relatively protracted period (mainly July-January) and individual nests are not regularly monitored throughout the duration of the nesting period.

5.1.2 Predation – native species

There are four species that occur in the Koombana Precinct, which are impacted by predation from native species and include the fairy tern, red-capped plover, Australian pied oystercatcher and banded lapwing. Native birds such as silver gulls, nankeen kestrel *Falco cenchroides*, and peregrine falcon are a threat to ground nesting species such as red-capped plovers and Australian fairy terns and have been observed in and around fairy tern colonies within the Koombana Precinct (Greenwell & Dunlop 2023). Silver gulls were observed predating the eggs of fairy terns at an establishing colony at McKenna Point in 2023 (pers. comm. C. Taylor/DBCA, L. Nicholson/BirdLife Australia) but are likely to be less problematic once colonies are well established and being defended by a large number of terns.

In urban areas, the presence of humans and modification of habitat may increase the abundance of silver gulls and ravens (i.e. ‘increaser species’, considered as facultative scavengers). These increaser species can have important flow-on effects for beach-nesting birds, such as an increased risk of egg and/or chick predation by scavenging silver gulls and Australian ravens (Rees et al. 2015; Greenwell & Dunlop 2023). In some locations, these animals may initially be targeting food-scraps associated with people (Rees et al. 2015; Dunlop & Greenwell 2023).

A local wild dog, which is provisioned by the community, may also be seen as a predator by nesting birds. The dog is often observed in the Casuarina Boat Harbour Development Area but was excluded during the 2022–2023 fairy tern breeding season. It is unclear whether this dog presents a real threat to the terns. However, the dog appears unable to access the McKenna Point beaches (pers. Comm C. Taylor/DBCA).

5.2 Human-induced threats to birdlife in the Koombana Precinct

5.2.1 Direct disturbance

Direct disturbance of birds is most likely to occur in the terrestrial environment, particularly for nesting or roosting species. Prospecting, nesting and/or roosting birds may be disturbed by beach users undertaking a wide range of recreational activities, or in the case of McKenna Point, which has restricted access, contractors accessing the site for maintenance and sand extraction activities (Greenwell & Dunlop 2023) (see Section 5.2.2). In addition, prospecting and/or nesting birds have the potential to be disturbed in the Casuarina Boat Harbour laydown area, if management action is not taken to deter birds from nesting there, i.e. hydro-mulching to darken the substrate (see Section 6.3.2).

The three beach-nesting species (i.e. fairy tern, red-capped plover and Australian pied oystercatcher) are highly sensitive to disturbance during their breeding period. Fairy terns are most vulnerable during the prospecting and early colony formation stage and high levels of disturbance may result in the abandonment

of a nesting attempt. Disturbance of red-capped plovers and Australian pied oystercatchers may be less noticeable to the untrained observer as these species defend their nests by leaving the nest site and leading potential predators away during the incubation period. More distinctive behaviours may be observed during the chick rearing period, such as broken wing displays, while oystercatcher parents may also give alarm calls (for detail, see Maguire 2008).

Disturbance of nesting birds is likely to lower the chances of breeding success, particularly, when disturbance is prolonged, frequent, or where it occurs during the early incubation period (Dunlop & Greenwell 2023). Eggs and small chicks cannot regulate their body temperature and rely on the adults for warmth or shade. When nest-attending parents are forced to leave their nests for extended periods, eggs or nestlings may suffer mortality either through thermal stress or predation (Dunlop & Greenwell 2023). Gulls and ravens have been known to opportunistically plunder exposed nests during periods of human disturbance (Commonwealth of Australia 2020b).

The banded lapwing is vulnerable to disturbance whilst nesting due to their preference for open, short, and sparse grassland habitat, immediately adjacent to access roads within the Outer Harbour (McKenna Point) and Casuarina Boat Harbour, but also due to their highly cryptic eggs and chicks. Vehicular traffic and machinery around the Outer Harbour pose a direct threat to the survival of eggs, and flightless young that cannot easily escape or are forced to relocate by crossing busy roads.

Red-capped plover and Australian pied oystercatcher chicks may be sensitive to disturbance, depending on the location of nest sites or un-fledged young. However, known breeding appears to occur away from the Casuarina Boat Harbour and KBMS project area. Other bird species that may be affected by direct disturbance are nesting bridled tern and silver gull, if current nesting sites are situated south of the wharf in the Casuarina Boat Harbour. While roosting birds have the potential to be disturbed, as they are not motivated to return to specific locations to attend to mates, eggs or chicks, will likely relocate to other areas away from human activity.

5.2.2 Sand extraction activities

Coastal engineering such as seawalls, groynes and boat harbours, change patterns of sedimentation and erosion, which have the potential to alter habitat availability for shorebirds and/or nest site selection by beach-nesting birds. The western spur groyne, Outer Harbour breakwater and BP groyne on the western side of the breakwater act as sediment traps and create artificially wide beaches that are attractive for beach nesting species, including the fairy tern, red-capped plover and Australian pied oystercatcher (Figure 5-1).

Inappropriate sand management regimes (i.e. extraction of sand in the lead up to or during the breeding season) have the potential to remove nesting habitat. The extraction of too much sand may lower the beach profile to the extent there becomes an increased risk of tidal inundation of nests during periods of high tide (e.g. spring tides) and storm events and/or precludes breeding. Furthermore, earth moving equipment, operated during the nesting season, also has the potential to disrupt nesting activity causing the abandonment and/or mortality of eggs/chicks.

It is thought that increased sand inundation of the Outer Harbour and shipping channel occurs as a result of coastal process transporting sand around Point McKenna when sand traps, created by groynes, are full and are therefore bypassed (Southern Ports 2017). Subsequently, sand extraction from the sand traps is required to maintain safe navigational depths within the Outer Harbour and shipping channel.

There is currently no formal procedure for sand trap clearing. Excavated sand is, however, a potential source for beach renourishment at several south-western beaches, including Koombana Bay. Volumetric analysis by Shore Coastal Pty Ltd (2009), using rectified aerial imagery from 2008 suggests volumes, which could potentially be extracted for beach nourishment elsewhere, are in the order of 65,000 m^3 and 35,000 m^3 at the Western spur groyne and in the Outer Harbour sand traps (McKenna Point West and McKenna Point East) respectively (Shore Coastal Pty Ltd 2009). Beach profiling, volumetric and accumulation rate assessment would be useful for determining the how much sand, and when, could be taken without negatively impacting habitat availability for beach-nesting birds, but also to buffer against storms and swells (see also Section 6.3.1).

Sand has been extracted from the three sand traps over the last few years to assess whether sand removal reduces the volume of sand that ends up in front of the shipping channel each year and to avoid dredging, which is at significant cost to the SPA (pers. comm. D. Gordon/SPA). The build-up of sand has been variable among years and yet, there are no clear patterns about sedimentation rates (pers. comm. D. Gordon/SPA).

To assist in maintaining safe navigational depths in the harbour, the volume and frequency of sand removal from the traps will continue to be at the discretion of the SPA (pers. comm. D. Gordon/SPA). The SPA is committed to working cooperatively with DBCA and others, as it is currently doing, to avoid where possible, any sand removal activities that may jeopardise the fairy tern breeding season (pers. comm. D. Gordon/ SPA). Potential nesting activity by other beach-nesting species (i.e. red-capped plover, Australian pied oystercatcher) should also be monitored prior to any sand extraction to ensure these birds are not inadvertently impacted.

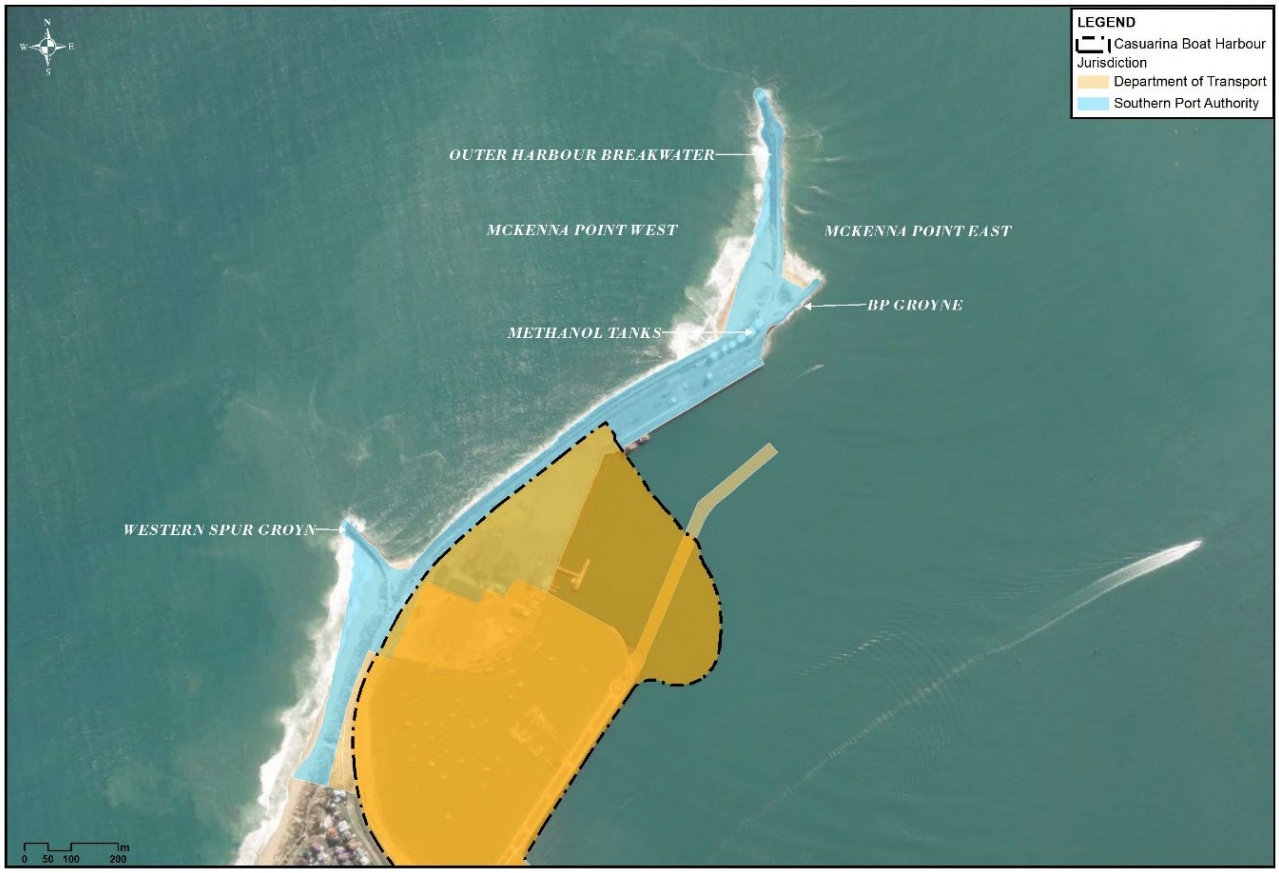


Figure 5-1: Engineered structures and installations within the Bunbury Outer Harbour

5.2.3 Predation - invasive species

Black rats *Rattus rattus* are known to occur within the Outer Harbour and Casuarina Harbour, and an ad-hoc control program is implemented by SPA in the lead up to the fairy tern breeding season. In 2019–2020, tracks purportedly belonging to a cat *Felis catus*, were observed near McKenna Point (Greenwell & Dunlop 2023). In December 2023, four deceased fairy terns were found within the fairy tern nesting colony at West McKenna Point with injuries suggesting a terrestrial ground predator. Subsequently, wildlife monitoring cameras positioned near the groyne detected a red fox *Vulpes vulpes*. However, there was no direct evidence that fox predation occurred, and no eggs were predated, which is typical of foxes. Several dead adults were subsequently found in December and January with bodies left in situ. It is possible, but not confirmed, that rats may be the cause of mortality.

Black rats, cats and foxes have been identified as key invasive predators impacting the breeding success of seabirds in Australia and have the potential to impact locally breeding species (Jones 2010; Dunlop et al. 2015; Greenwell & Dunlop 2023). These invasive species are a major cause of colony failure for nesting fairy terns in Western Australia (Greenwell & Dunlop 2023) and in less well-lit areas where predators are less easily detected, other roosting or nesting birds may be impacted. The transportation of building materials and storage containers have the potential to harbour rodents and may require additional controls to prevent supplementation of the population. As part of the KBMS operations, measures to reduce any potential biosecurity risk are required to be adopted in accordance with the *Biosecurity Act 2015* and Biosecurity Regulations 2016.

5.2.4 Dredging activities

Physical injury or mortality from vessel collisions, underwater noise production, and increased temporary total suspended solids (TSS) are the key pathways in which dredging can directly affect the little penguin and diving species such as terns (fairy tern and crested tern) or cormorants. Suspended sediment from unmitigated dredging activities could have an impairing effect on sight abilities (Morris et al. 1985; Jefferson et al. 2009) and alter fish feeding ability. Dredging may also affect the behaviour of the finfish on which these birds' prey (Wilber and Clarke 2001).

The fairy tern is a 'blue' or clear water foraging species that feeds by plunge diving into clear, shallow waters to depths of up to ~30 cm to collect small forage fishes such as sandy sprat, blue sprat, and southern sea garfish *Hyporhamphus melanochir* (Greenwell et al. 2021). Fairy terns could, potentially, be impacted by dredging activities between October and February, when they return to the lower west coast region to breed (often in the Bunbury area), however, dredging activities will not be undertaken between December to March, i.e. the peak fairy tern breeding and chick hatching period.

As per the 'Marine environmental quality modelling' assessment, the net sedimentation zone of influence (ZoI) of dredging-related material was predicted to be spatially limited to within several hundreds of meters of the phase 1 trailing suction hopper dredging of Casuarina Boat Harbour, and within the Koombana Bay Sailing Club marina and Casuarina Boat Harbour (GHD 2023). Therefore, the modelled worst case ZoI scenario is likely to occur in an area that is of low foraging quality for fairy terns.

Other diving species, such as crested terns could potentially be impacted by increased turbidity in the water column but noting these birds do not breed locally and appear to feed over much wider areas (see Section 4.1.9).

The little penguin breeds between April and December, and during this time typically remain within proximity of their breeding colonies (for detail, see Section 4.1.1). Therefore, little penguin foraging activity is likely to be lower in Koombana Bay, at least for incubating and chick-rearing adults, during the breeding period (April to December), compared to the non-breeding period (December to March), due to the considerable distance from the breeding grounds, which would take numerous days for a return trip (>130 km, Penguin Island and Garden Island). Given the relatively small ZoI and avoidance of dredging during the summer non-breeding period, impacts are likely to be limited for dredging related to this development.

5.2.5 Light pollution

An increase in artificial light can disrupt critical animal behaviours and cause physiological changes (Russart and Nelson 2018). Increased light emissions during the construction and operation of the KBMS development proposal could lead to increased light impacts to marine fauna in the vicinity. The bird species that may be affected by an increase in artificial light emissions are nesting seabirds i.e. silver gulls and bridled terns along the eastern seawall from the Casuarina Boat Harbour to the BP sand trap (Department of Energy and the Environment 2020).

The potential for artificial light emissions to impact shorebirds and seabirds during construction is low, as construction works will be undertaken during nominated daylight hours, with likely lighting requirements for nighttime operations limited to security / safety purposes (RPS 2023). The SPER commits to "Biological and artificial light monitoring / auditing will be undertaken in accordance with the National Light Pollution Guidelines for Wildlife (DCCEEW 2023) to confirm the anticipated impacts and provide a feedback mechanism for adaptive lighting management. This will include a pre-development artificial light survey for comparison against the post development outcomes, with reporting and adaptive management measures (if required) implemented through the agreed KBMS governance framework" (RPS 2023a).

5.2.6 Noise

High levels of anthropogenic underwater sound can have negative impacts on little penguins and diving birds; ranging from displacement from an area, and in more severe cases temporary hearing loss, physical injury or mortality (Richardson et al. 1995). Of the focus species for the Koombana Precinct, those that could be affected by underwater noise is the little penguin. The greatest source of noise will be associated with piling for construction of boating facilities and jetties.

Underwater noise modelling was undertaken by SVT Engineering Consultants for the KBMS strategic proposal using a Monterey Miami Parabolic Equation model, which was rigorously tested and validated for shallow water environments and was, therefore, considered to be a robust model for assessment of impacts from the KBMS strategic proposal (RPS 2023a).

"The Underwater Noise Assessment (SVT Engineering Consultants 2018) concluded that the impacts associated with underwater noise associated with construction of the future proposals are manageable, with minimal impact on marine fauna, because:

- The likelihood of impact of injury to marine fauna could be managed with the use of a 500 m exclusion zone during piling, based on the largest range for behavioural disturbance of dolphins.
- This exclusion zone is reasonable as they are within a visual range and are typically used by marine mammal observers.
- The Underwater Noise Assessment (SVT Engineering Consultants 2018; Appendix T) is an overestimation of the potential underwater noise impacts or a worst-case scenario for the Casuarina Boat Harbour and KBSC marina future proposals as the modelling has been undertaken for an open water environment. However, piling will be undertaken for these proposals after the construction of the breakwaters. Hence the surrounding waters will be shielded, to a degree, from underwater noise by the constructed breakwaters. Notwithstanding the likely shielding effect of the constructed breakwaters, a conservative 500 m exclusion zone from piling activities will be implemented during the construction of each future proposal to mitigate the risk to marine fauna" (RPS 2023a). The Marine Fauna Management Plan identifies a series of noise mitigation controls, which will be adopted to reduce any potential impacts to little penguins see (RPS 2023b).

Subsequent investigations have identified that the hammering of piles is not possible for the development of the Casuarina Boat Harbour due to the occurrence of a basalt substrate. Consequently, piles will be drilled instead, resulting in a much lower noise output than what has been predicted in the SPER, further reducing impacts to marine fauna.

5.2.7 Vessel traffic

Disturbance due to vessel movements within Koombana Bay is considered an existing threat to birds in Koombana Bay, particularly while foraging (RPS 2023a). Disturbance to foraging birds during key life stages can have effects on energetic costs and subsequently lead to physiological changes that reduce individual fitness and reproductive success (Agness et al. 2013).

Of the focus species for the Koombana Precinct, the little penguin is the most likely to be affected by vessel traffic. Boat strike causing mortality of little penguins has been recorded in inshore coastal environments (Cannell et al. 2016). Risk of collision, including propeller injuries, to little penguins could result from an increase in the number of vessels using the Koombana Bay during construction and maintenance of the Casuarina Boat Harbour development but noting any potential impacts will be managed in accordance with the Marine Fauna Management Plan (2023b). Whilst most of the construction activities will be undertaken using land-based machinery, a small number of vessels will be used throughout the construction phase for various marine-based activities and vessels will be transporting dredged sediment to and from the offshore disposal area during the winter months. However, adult little penguins are less likely to be present during the winter/spring breeding period.

5.2.8 Habitat loss

Urban expansion and densification are a key driver of habitat loss in Australia and has been identified as a major factor in the decline of birdlife in our cities (Campbell et al. 2022). Future developments and increased commercialisation and industrialisation of the Koombana Precinct have the potential to further decrease the extent of habitat available for species utilising the area. The birds most likely to be affected by habitat loss are the fairy tern, Australian pied oystercatcher, red-capped plover and banded lapwing.

Any potential changes in land tenure and loss of habitat at the Outer Harbour (McKenna Point) will have implications for the former three mentioned species. The availability of fairy tern nesting habitat will need to be considered in the longer term, given the high importance of the area for the conservation of the lower west coast population (Dunlop & Greenwell 2020) and the lack of other suitable/secure sites around the Bunbury region.

In the Casuarina Boat Harbour area, increased hardstand areas are reducing the habitat available for banded lapwing. However, as part of future landscaping plans within the Casuarina Boat Harbour area, there is an opportunity to improve the habitat that supports banded lapwing.

5.2.9 Climate change

Anthropogenic climate change was identified as of particular concern by stakeholders as an emerging threat for birdlife within the Koombana Precinct, particularly beach-nesting species. Beach-nesting birds have been identified as a group of taxa likely to be exposed to sea-level rise and the only birds for which climate change was a certain threat (Garnett et al. 2013). Inundation of nesting areas and increased storm surges is likely to increase in the future. Due to the presence of invasive predators and increased human use of coastlines, beach-nesting birds are predicted to have less leeway to adapt to rising sea levels that they presumably had during the last sea level rise events (Garnett et al. 2013).

Predicted coastal flood modelling for 2100 suggests that under highest tide scenarios, many of the beaches within the Koombana Precinct, and Bunbury region more broadly, will be inundated to a much greater extent compared to current day (FrontierSI & NGIS Australia 2021). Understanding the potential impacts of increased sea levels and changes in coastal geomorphological processes on locally occurring species, will be critical for informing adaptation strategies and options for the conservation of the three beach-nesting species, particularly fairy terns, which have a narrow habitat niche.

It was acknowledged that consideration of climate change impacts for the long-term conservation of birdlife is warranted. However, further information is required and is currently beyond the scope of this management plan. Thus, any potential mitigation or management actions related to anthropogenic climate change is not considered further in this plan but should be considered during each annual review.

5.2.10 Cumulative impacts

Cumulative impacts have the potential to occur in the short term because of simultaneous construction activities, or in the longer term through the gradual accumulation of development and anthropogenic pressures over time. The impacts related to cumulative activities will likely vary among species due to differences in their timing of occurrence, habitat use and sensitivity (see Section 4.1), but also depending on the timing and duration of operations.

The potential for short term cumulative effects (on a local scale) may be observed when the timing of construction or dredging coincides with other activities during a period of high sensitivity. Longer term impacts will likely arise due to increasing human disturbance, habitat loss, the attraction of increaser native species (e.g. gulls and ravens) combined with natural pressures.

The little penguin (if present within Koombana Bay) is the most likely candidate to be impacted by short term cumulative impacts. For example, a combination of dredging activity, underwater noise (both of which may also impact the species by causing changes to prey distributions) and increased vessel traffic would have the potential to impact little penguin. However, it is unlikely that both dredging and piling are undertaken simultaneously (pers. comm. M. Willis/DoT).

For the three beach-nesting species, natural threats (such as tidal inundation and egg burial), direct human disturbance, sand extraction activities, increased predation by native or invasive species and habitat loss have the potential to cause cumulative stress to their populations with longer term implications. The Outer Harbour (McKenna Point) is an important breeding area for the fairy tern and is relatively unique in that it is currently secure with limited public access, facilitating opportunities for improved invasive predator management. The McKenna Point West beach is artificially wide and sand accumulation can be managed to support future nesting by the species. Actions undertaken to support fairy terns will likely have important flow-on effects for both Australian pied oystercatcher and red-capped plover.

For the banded lapwing, increased human disturbance including vehicle traffic, habitat loss and predation by increasing numbers of native gulls or ravens may lead to reduced breeding success in both the short and longer term but also become so great, the area no longer supports a nesting attempt. For the silver gull, increased light pollution, noise and human disturbance may disrupt breeding attempts of this species in a particular area, but this species adapts well within the urban environment and even when habitat is lost displaced pairs will likely find alternative areas for nesting within a short period.

It is expected that any potential cumulative effects can be mitigated through forward planning, collaboration with other stakeholders and by having regard for the timing of species sensitivity.

6 MONITORING, MITIGATION AND MANAGEMENT

6.1 Overarching management and mitigation measures for KBMS

Management and mitigation measures to reduce impacts to birdlife and other marina fauna are identified in the 'Marine fauna management plan' (RPS 2023b) and 'Marine construction monitoring and management plan' (RPS 2023c). Species specific controls are listed under the species subheadings below. Management and mitigation measures that are more broadly applicable to birdlife and the KBMS project activities include:

- Project staff will be inducted into the avifauna and marine fauna management plans to ensure any potential impacts related to construction activities are avoided or minimised. Construction and operational staff associated with the KBMS project will be given an environmental induction outlining the species that may be encountered and the behaviour cues that may indicate nesting.
- Light pollution. The project will reduce artificial light emissions affecting the marine environment during construction and operation in line with Commonwealth guidance. General construction work (i.e. breakwater forming) to be limited to daylight hours only. However, trailing suction hopper dredge dredging will be undertaken on a 24-hour basis. Artificial lighting on dredging vessel will be of lowest allowable intensity to meet legislative and regulatory requirements for human safety / navigational purposes. Light spill will be reduced by shielding lights and using directional alignment to point only at the work area and not into the marine environment. The project will adopt best practice lighting design consistent with the National Light Pollution Guidelines for Wildlife (DCCEEW 2023) to reduce light pollution on marine fauna during operation, including:
  - Start with natural darkness and only add light for specific purposes
  - Use adaptive light controls to manage light timing, intensity and colour
  - Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill
  - Use the lowest intensity lighting appropriate for the task
  - Use non-reflective, dark coloured surfaces
  - Use lights with reduced or filtered blue, violet and ultra-violet wavelengths (RPS 2023b).
- Noise. The project will reduce the risk of displacement of breeding seabirds and shorebirds from elevated onshore noise during construction and operation through:
  - Implementation of MCMMP (RPS 2023) provides the monitoring and management framework to address the potential for elevated onshore noise emissions during construction (RPS 2023b).
  - Operational noise levels are not anticipated to be noticeably different than existing levels and are unlikely to have a material impact on marine fauna behaviours (RPS 2023b).

Current practices for the protection of nesting birds from direct disturbance for all TBW3.1 construction activities, including the KBMS project include (Draft DoT Bird Management Plan):

- The erection of site fences around working areas to limit construction traffic to the approved construction zone.
- In the event seabird nesting activity is identified in open areas adjacent to, but outside of fenced construction zones, nests or colonies will be isolated with rope and star picket fences and signage, placed in accordance with Maguire (2008) (Figure 6-2). The size of the area to be isolated will vary according to the number of nests and species
- Orange bunting is not recommended as it can cause disturbance to beach-nesting species and lead to nest abandonment but also may restrict chicks from being able to access foraging areas (if crosshatch bunting is used). As such, bunting is no longer used for beach-nesting bird management (pers. comm. L. Nicholson, G. Maguire)

- Access corridors to construction zones and across open areas shall be inspected by the contractor for nests prior to initial use. High use of corridors and construction zones are likely to be prohibitive for nest establishment. However, after any halt in site activity, after the weekend or a suspension of work, areas will again be searched prior to commencement of construction activities.
- If construction activities are expected to commence during the nesting season, pre-emptive measures will be employed in advance of site establishment to discourage birds from nesting in the expected working areas (see fairy tern, Section 6.3.2 and bridled tern, Section 6.8).

6.2 Little penguin

The potential threats for little penguin include dredging activities, underwater noise and vessel traffic. To mitigate any potential impacts to this species related to new construction or maintenance activities, a range of monitoring and management actions have been identified below.

Little penguins are not known to breed locally within Koombana Bay and the area between Warnbro Sound and Cape Naturaliste has no natural offshore islands. However, there is precedence of new colony establishment within seawalls elsewhere in Australia and seawalls may be used as surrogate islands (such as those on Garden Island, Western Australian and the St Kilda Breakwater, Victoria). The little penguin population in the Perth region has been declining (Cannell et al. 2011; Cannell 2018; Cannell 2020; Greenwell et al. 2022), but colonisation of the outer harbour seawalls could result if Bunbury has more reliable baitfish stocks (J.N. Dunlop pers. comm.). Identification of little penguins foraging locally may indicate that prospecting may already been occurring (pers. comm. J.N. Dunlop), but further observations would be required to understand any changes in behaviour.

While the chance of identifying new nesting activity in Koombana Bay is low, any observations of any little penguins on or within seawalls surrounding Casuarina Boat Harbour should be followed up and immediately reported to DBCA, to rule out any potential breeding activity. Understanding any changes in the breeding distribution of the population would allow for appropriate mitigation to be developed and implemented.

For major construction and dredging activities that take place as part of the KBMS project, marine fauna observers (MFO's) that are being used to observe for cetaceans, pinnipeds and marine turtles will also observe and record little penguin presence (RPS 2023b). Construction vessel crews will undertake inductions covering procedures to minimise collision risk to marine fauna including little penguins and the dedicated MFO will report observations of marine fauna to vessel master as soon as practicable. This information will be relayed to other vessels operating in the area if appropriate to reduce collision risk (RPS 2023b). Vessels will implement control measures (e.g. vessel speed, start-up, caution and approach distances) if little penguins are observed within 300 m, derived from Australian National Guidelines for Whale and Dolphin watching 2017, in order to reduce the risk of vessel strike, entrainment and disturbance (RPS 2023b).

During transit, a maximum speed of six knots will be maintained if a little penguin is sighted within 300 m of the vessel. For compliance with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.04), vessel masters will implement precautionary measures to avoid vessel strikes (RPS 2023b). To minimise the risk of little penguin entrainment, prior to commencing dredging or excavating:

- The contractor must check for little penguins within a 150 m observation zone and a 50 m exclusion zone.
- Dredging or excavating can only commence if no little penguins have been observed in 50 m exclusion zone.
- If any little penguins are sighted during dredging or excavating in the exclusion zones, dredging will cease until they have left the monitoring zones or have not been sighted for 30 minutes (RPS 2023b).
- Standard mitigation practices will be adopted to reduce the risk of injury to marine fauna from piling noise and include 15 min observation prior to soft start over 500 m exclusion zone, in the event that a little penguin is detected (RPS 2023b). Piling will not commence until any penguin is outside a 500 m exclusion zone and must be absent from the 500 m exclusion zone for at least 20 minutes prior to commencement (RPS 2023b). A five-minute soft start at a lower hammer energy will commence before ramping up to full energy (RPS 2023b).
- To reduce the potential for negative cumulative impacts to little penguins, multiple construction and dredging activities will be avoided during the summer period.

Management actions for Casuarina Boat Harbour and TBW3.1 development activities:

- Monitoring of potential breeding activity (DoT)
- Monitoring during vessel operations to prevent collision risk (DoT)
- Reduction of vessel speed to 6 km/h if a little penguin is sighted within 300 m of a steaming vessel (DoT)
- Implementation of noise mitigations to during piling operations (DoT)
- No dredging will occur during the months of December to March (DoT).

6.3 Australian fairy tern

The potential threats for fairy tern include tidal inundation and egg burial, direct disturbance, sand extraction activities, habitat loss, predation by native and invasive species, and dredging. To mitigate any potential impacts to this species, a range of monitoring and management actions have been identified.

In the lead-up to the breeding season, DBCA and volunteers from the Western Australian Fairy Tern Network and BirdLife Australia make regular observations of fairy terns within the region, consistent with the 'Recovery Plan for the Australian Fairy Tern *Sternula nereis nereis*' (Commonwealth of Australia 2020b). Information about breeding behaviour is used to inform appropriate site management by local land and wildlife management agencies, such as the erection of temporary signage and fencing.

DBCA Bunbury routinely monitors breeding activity on the conservation estate and works closely with the SPA to undertake monitoring and management within the secure area at McKenna Point West. Other potential fairy tern breeding sites include the lay down area at Casuarina Boat Harbour and McKenna Point East. In the event that fairy terns nest on publicly accessible beaches, additional interventions will be required and include the installation of signage and/or seasonal fencing around the nesting site by the relevant land/wildlife management authority as per guidelines developed by Dunlop and Greenwell (2023) and Maguire (2008).

6.3.1 McKenna Point

The most frequently used nesting site for the fairy tern in the Bunbury region is the wide beach at McKenna Point West (Figure 6-1, Table 4-3). Fairy terns have long been attracted to the mouth of the Leschenault Estuary (pers. comm. J.N. Dunlop). The breakwater located at the northern end of the beach acts as a sand trap, creating an artificially wide beach at the mouth of a productive estuary, which is attractive to fairy terns for nesting. The relatively complex substrate, i.e. coarse gained sand combined with shell and seagrass wrack, likely makes this an attractive habitat. The site is being actively managed (i.e. it is a managed site, Dunlop & Greenwell 2023) to provide a habitat for the species.

In the lead-up to the breeding season, the SPA undertakes rodent control and cat trapping, as needed, to reduce the potential for predation, which may be informed by camera monitoring (in-kind support provided by DBCA). The DBCA make ad-hoc observations to assess for potential fairy tern nesting activity during the breeding season.

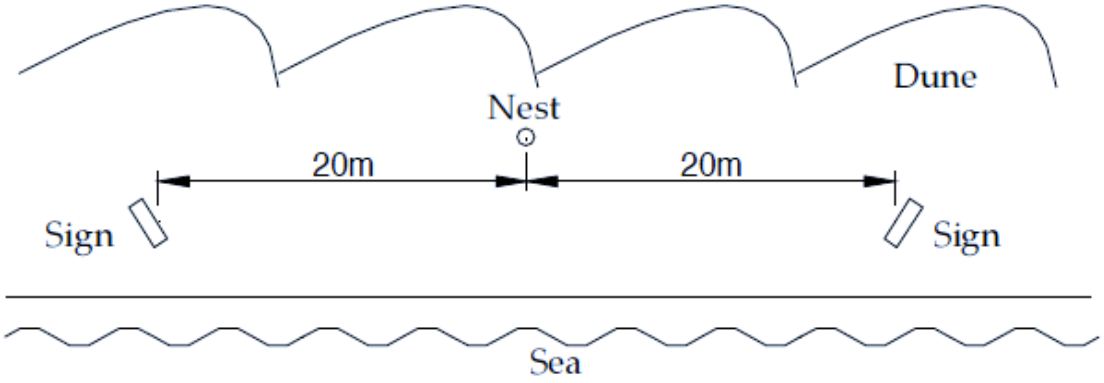
Management of the McKenna Point sand traps (West and East) (including predator management) by the SPA is the single most important management measure for the fairy tern within the Koombana Precinct and is necessary to ensure the area remains suitable for nesting in the future when environmental conditions are favourable (e.g. locally abundant prey and habitat availability). Sand management and maintenance dredging is currently managed by SPA under the 'Bunbury port development long term monitoring and management plan' (Southern Ports 2021).

A sand trap management plan detailing the rates of sand accumulation, and the frequency and volume of sand extraction required to prevent sand traps overfilling and being bypassed to maintain safe navigational depths within the harbour has not been developed. In future, this information should be used to help inform the timing and volume of any sand extraction activities that also allow for the maintenance of the secure nesting area at McKenna Point West for the fairy tern and other beach utilising species.

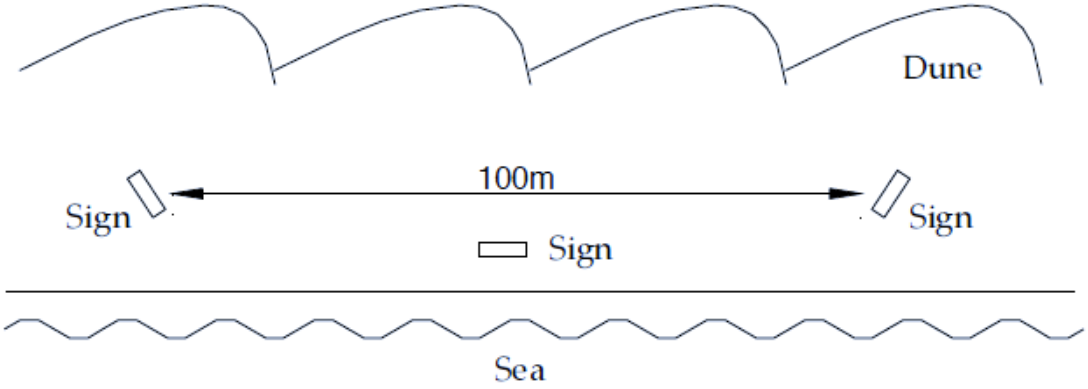
Monitoring, mitigation, and management interventions specific to McKenna Point include:

- Avoiding, where possible, sand-trap excavation in the lead-up to the breeding season (the time frame should be guided by advice from coastal engineer based on the rates of sediment accretion) and for the duration of the breeding season, to ensure the beach at McKenna Point is sufficiently wide and elevated to support a nesting attempt by fairy tern (SPA)
- Engagement of a pest control company on SPA managed land to control introduced invasive predators i.e. bait for rodents and trap for feral cats (SPA)
- Fox monitoring and/or control within the Bunbury area (CoB)
- Regular monitoring to determine any early breeding behaviour or nesting activity (SPA/DBCA)
- In the event breeding is identified, site access will need to be managed by SPA and include the locking of gates to prevent site access to external contractors together with the deployment of signage that identifies active nesting (SPA)
- If/when a nesting attempt is identified, signage will be installed as per the best practices identified by Maguire (2008). A minimum of two signs should be placed at least 20 m on either side of the nest to alert people to the presence of a nest (Figure 6-2) (SPA/DBCA)
- Installation of chick shelters around the expected time of chick hatching to increase chick survival (Maguire et al. 2011) (DBCA)
- DoT to consult with SPA to avoid in-combination (cumulative) impacts of construction of Casuarina Boat Harbour and SPA sand extraction activities at McKenna Point (West and East), to ensure nesting habit is available to fairy terns within the Outer Harbour area during the nesting period (see Section 5.2.10 (DoT/SPA).

Figure 6-1: McKenna Point west (a) nesting colony of Australian fairy terns in 2020–2021 (image: Jane Putland, WA Fairy Tern Network); (b) chick shelter installed to provide protection to juvenile fairy terns in 2017–2018 (image: Kim Williams/DBCA); and (c) beach at McKenna Point West in October 2023 (image: Christine Taylor/DBCA)



During the incubation period, two signs should be spaced at least 20 m either side of the nest, facing the direction people are likely to approach from.



After hatching, signs should be placed along 100 m of beach, at or above the high tide mark, where the chicks are frequently observed.

Figure 6-2: Recommended protocol for signage placement to protect beach-nesting birds (Maguire 2008)

6.3.2 Casuarina Boat Harbour

The laydown area for the KBMS project within the Casuarina Boat Harbour is a flat approximately 1.7 ha site located immediately above the seawall on the eastern side of the Outer Harbour, to the north of the public jetty and south of the wharf. The area is, largely, clear of vegetation and has a stable substrate consisting of coarse lightly coloured sand, interspersed with a sparse layer of building rubble, increasing substrate complexity (Figure 6-3). These features are likely very attractive to prospective breeding fairy terns.

During the 2022–2023 summer, the laydown area supported a successful colony of approximately 60 pairs of fairy terns (pers. comm. C. Taylor/DBCA). At least 50 juveniles were estimated to have fledged from the site. No fairy terns were observed prospecting the site in the 2023–2024 breeding season, but two colonies established at McKenna Point, of which one failed (see Section 4.1.3).

Given the previously successful breeding at this site, it is possible fairy terns may return to the laydown area in future years before the land is fully developed. To reduce the potential for disturbance and to prevent fairy terns from selecting the site for nesting, preventative measures will be undertaken. This will be achieved by changing the colour of the substrate through the application of a dark, brown-coloured hydro-mulch. Successful application has been achieved on Garden Island and is used seasonally by the Department of Defence to prevent fairy terns from nesting on the Causeway, where they are at risk of vehicle strike (pers. obs. C. Greenwell).

While management measures will be undertaken to prevent fairy terns nesting in construction areas prior to their nesting season, it is possible that the terns will still attempt to nest, or succeed in nesting, in these areas. In this situation, additional measures will be undertaken to avoid or minimise disturbance of the nesting terns.

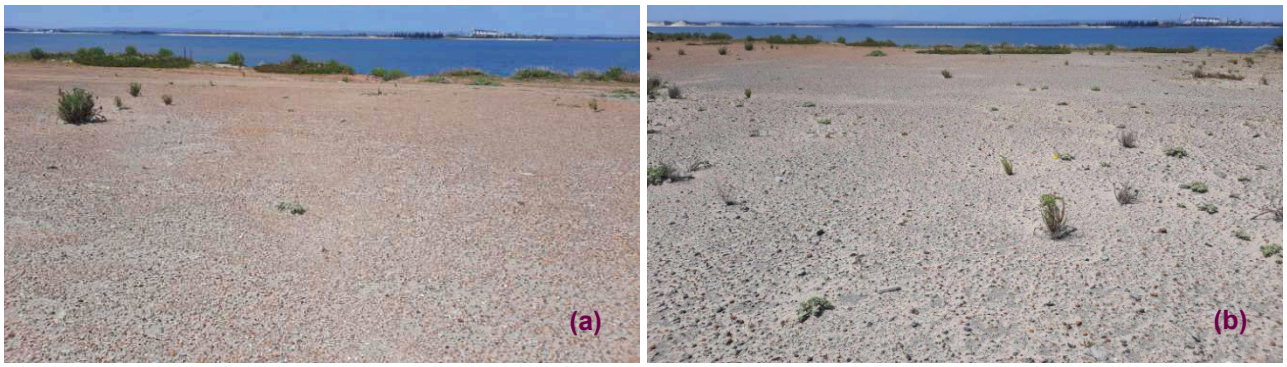


Figure 6-3: Laydown area for the KBMS project within the Casuarina Boat Harbour, utilised by Australian fairy tern during the 2022–2023 breeding season

These additional measures will include ceasing all operations that have the potential to cause a disturbance to fairy terns while they remain at the site; erecting temporary signage and rope fencing if there is any potential for incursions by construction workers; informing all site staff to avoid the area until breeding activities conclude and the terns have left the site and installation of chick shelters (methods as per Maguire 2008; Maguire 2011; Dunlop & Greenwell 2023). Depending on the size of the colony, the breeding period can be relatively protracted as not all eggs are laid at the same time and the presence of nesting individuals often has a social facilitation effect, resulting in additional birds joining the colony over time. In very large, successful colonies, nesting may extend over three months of the breeding season (between October and February).

Proactive management of the McKenna Point West site will help to prevent fairy terns nesting on the laydown area (see Section 6.3.1). DoT will consult with SPA to avoid, where possible, in-combination impacts of construction of Casuarina Boat Harbour and SPA's sediment maintenance at McKenna Point to ensure nesting habit is available to fairy terns within the Outer Harbour area during the nesting period.

Management actions for Outer Harbour (McKenna Point East and West):

- Prevention of sand extraction in the lead-up to and during the breeding season; contractor access restricted (SPA)
- Monitoring of breeding activity (October to February) (SPA, supported by DBCA)
- Installation of signage on gates if breeding behaviour is identified (SPA, supported by DBCA)
- Installation of beach signage if breeding behaviour is identified (SPA, supported by DBCA)
- Restrict contractor access if breeding identified (SPA)
- Installation of chick shelters (DBCA).

Management actions for Casuarina Boat Harbour:

- Preventative hydro-mulching of Casuarina Boat Harbour laydown area (DoT)
- Monitoring of breeding activity (DoT)
- Installation of signage in the event breeding is occurring (DoT)
- Installation of temporary rope fence (DoT)
- Education and site access restrictions to prevent disturbance (DoT)
- Installation of chick shelters (DBCA/DoT).

If it is not practicable to delay or modify construction activities to avoid or minimise disturbance to the nesting terns, on advice from a fairy tern expert, a Ministerial Authorisation under section 40 of the BC Act would be required to take or disturb a threatened species (C. Taylor/DBCA 2023b). It is unclear whether such an approval would be granted to remove eggs or chicks from an actively nesting colony.

6.4 Australian pied oystercatcher

The potential threats for Australian pied oystercatcher are likely to be direct disturbance, sand extraction activities, habitat loss and predation by native and invasive species. There has been no management for Australian pied oystercatcher within the Koombana Precinct to date as nesting appears to have been limited to beaches that are not publicly accessible, i.e. within the Outer Harbour (i.e. McKenna Point East, McKenna Point West or near the methanol tanks). This is likely due to oystercatchers preferring undisturbed beaches for nesting.

As long as the Outer Harbour remains closed to the public and nesting takes place away from construction activity, there is no requirement for specific management, except where sand extraction has the potential to disrupt a nesting attempt.

Prior to construction activities or sand extraction taking place, observations of potential nesting will be undertaken (during the active nesting period; September–January) to ensure birds will not be impacted by the operation of heavy machinery or sand removal. See Sections 4.1.3 and 5.2.1 and Maguire (2008) for details on the timing of breeding and breeding behaviour.

If/when a nesting attempt is identified, signage should be as per the best practices identified by Maguire (2008). A minimum of two signs should be placed at least 20 m on either side of the nest to alert people to the presence of a nest. After hatching, signs will be placed along a 100 m stretch of beach, along the high tide mark, where the chicks are frequently sighted (Figure 6-2) (Maguire 2008).

Management actions for Casuarina Boat Harbour:

- Monitoring of breeding activity (DoT)
- Installation of signage in the unlikely event breeding is occurring (DoT).

Management actions for Outer Harbour (McKenna Point East and West, methanol tanks):

- Monitoring of breeding activity prior to sand extraction activities (SPA)
- Prevention of sand extraction from beach nesting is occurring (SPA).

In the event oystercatchers are found nesting on publicly accessible beaches within the Koombana Precinct, such as Koombana Beach, the same protocol of signage placement can be followed by the relevant land/wildlife management authority (Figure 6-2).

6.5 Red-capped plover

The potential threats for Red-capped plover are likely to be direct disturbance, sand extraction activities, habitat loss and predation by native and invasive species. There has been no management for red-capped plover within the Koombana Precinct as nesting appears to have been limited to beaches that are not publicly accessible, where disturbance impacts are minimal, i.e. within the Outer Harbour (i.e. McKenna Point East, McKenna Point West or near the methanol tanks). As long as the Outer Harbour remains closed to the public and nesting takes place away from construction activity, there is no requirement for specific management, except where sand extraction has the potential to disrupt a nesting attempt.

Prior to construction activities or sand extraction taking place, observations of potential nesting will be undertaken (during the active nesting period; July–January) to ensure birds will not be impacted by the operation of heavy machinery or sand removal. See Sections 4.1.6 and 5.2.1 and Maguire (2008) for details on the timing of breeding and breeding behaviour.

When a nesting attempt is identified, signage should be as per the best practices identified by Maguire (2008). A minimum of two signs should be placed at least 20 m on either side of the nest to alert people to the presence of a nest. After hatching, signs will be placed along a 100 m stretch of beach, along the high tide mark, where the chicks are frequently sighted (Figure 6-2) (Maguire 2008).

In the event red-capped plovers are found nesting on publicly accessible beaches, the same protocol of signage placement can be followed by the relevant land/wildlife management authority.

Management actions for Casuarina Boat Harbour:

- Monitoring of breeding activity (DoT)
- Installation of signage in the unlikely event breeding is occurring (DoT).

Management actions for Outer Harbour (McKenna Point East and West, methanol tanks):

- Monitoring of breeding activity prior to sand extraction activities (SPA)
- Prevention of sand extraction from beach nesting is occurring (SPA).

6.6 Banded lapwing

The potential threats for banded lapwing include direct disturbance, habitat loss and predation by native and invasive species. Nesting attempts by banded lapwing within the Casuarina Boat Harbour (see Figure 4-2) are actively managed by the DoT. Prior to construction activities taking place, observations of potential nesting will be undertaken (during the active nesting period; June–November) to ensure birds will not be impacted by the operation of heavy machinery or sand removal. In publicly accessible areas, observations of banded lapwing nesting behaviour may be observed and reported to the DoT by the community.

If/when a nesting attempt is identified, fencing and signage should be as per previous DoT protocols and the best practices identified by Maguire (2008). Protocols for nest protection include:

- The installation of a temporary 6x6 m wire fence using 100 × 150 mm open (sheep) mesh protection around the nest (Figure 6-4This area is smaller than the 20 m by Maguire (2008). However, additional signage (see below) will be used to increase the buffer around the nest, whilst the wire fencing will reduce the potential for incursions by off-leash dogs in publicly accessible areas (as opposed to a rope fence alternative)
- A minimum of two signs should be placed at least 20 m on either side of the nest to alert people to the presence of a nest and to prevent birds flushing from their nests when approached (Figure 6-2)
- After hatching, signs will be placed where the chicks are frequently sighted and the temporary fencing removed.
- A-frame chick shelters (or similar) will be installed (and trialled) as a way of providing shade for very small chicks that lack true feathers, which are required for thermoregulation. A study on the provision of artificial shelter on beaches showed that it increases shorebird nesting success (Maguire et al. 2011). Numerous options are available, but A-frame shelters (Figure 6-1b) are effective, cheap to construct and easily transported and stored (Maguire et al. 2011).

Figure 6-4: Example of temporary fencing installed to protect nesting banded lapwing in the Casuarina Boat Harbour

Management actions in Casuarina Boat Harbour:

- Monitoring of breeding activity (DoT)
- Installation of signage if breeding is occurring (DoT)
- Installation fencing if breeding is occurring (DoT)
- Installation of chick shelters (DoT).

6.7 Silver gull

The potential threats for silver gull include direct disturbance, habitat loss and light pollution. Concerns with respect to this species are not so much related to conservation as their numbers are increasing, as to animal welfare in cases where birds' nest in inconvenient places and/or become a nuisance. The challenge for silver gull management is that hundreds of gulls occur and breed within the Inner Harbour; thus, the opportunity for recruitment to new areas, including new KBMS and the Casuarina Boat Harbour is high. Thus, localised gull management efforts (i.e. within the Casuarina Boat Harbour) are not likely to be successful.

Instead, a collaborative management program may be required in the future to reduce the number of individuals breeding/occurring within the region – to reduce nuisance problems, potential disease transmission, and the impact gulls have on the viability of other native bird species (Department of Conservation and Land Management 1993). A 'Silver gull action plan for the Perth metropolitan area' has been developed and identifies the strategies required to limit gull population growth (Department of Conservation and Land Management 1993).

It is possible that silver gulls will initially be attracted to new activities through their association with humans (Halfmoon Biosciences 2006). An important step in reducing the number of birds present within the Casuarina Boat Harbour area will be to prevent gulls from accessing food waste by ensuring appropriate disposal of rubbish in sealed bins, emptying bins regularly and to avoid the feeding of birds (Department of Conservation and Land Management 1993). Staff will be made aware of the presence of silver gulls, and their ability to take advantage of food scraps and other feeding opportunities. A "no feeding wildlife" policy will be adopted, and organic or edible waste shall be disposed of in lidded bins (Halfmoon Biosciences 2006).

Nesting pairs are known to occur nearby around the wharf, but it is unclear whether silver gulls will actively nest within the KBMS project area, including the Casuarina Boat Harbour laydown area and adjacent seawalls. Should gulls be identified as nesting in areas proposed for development, appropriate mitigation, and licensed controls will need to be developed and implemented. However, gulls are less likely to establish nests in areas of active construction and human presence compared to the low visitor access areas around the wharf.

Silver gulls are dependent upon fresh water, as they are less efficient at extracting salt from saltwater than other seabirds (Halfmoon Biosciences 2006). Any freshwater plumbing will be regularly checked for leaks, to prevent opportunities for drinking. If gulls are found to be aggregating around particular sites, an assessment of why they are there will be undertaken, and actions will be taken to prevent silver gulls continuing to aggregate in specific areas (e.g. limiting freshwater outputs and appropriate rubbish disposal) (Halfmoon Biosciences 2006).

Management actions in Casuarina Boat Harbour:

- Staff will be made aware of the presence of silver gulls, and their ability to take advantage of food scraps and other feeding opportunities. A "no feeding wildlife" policy will be adopted, and organic or edible waste shall be disposed of in lidded bins (DoT)
- Any freshwater plumbing should be regularly checked for leaks, to prevent opportunities for drinking. If gulls are found to be aggregating around particular sites, an assessment of why they are there will be undertaken, and actions will be taken to prevent silver gulls continuing to aggregate in specific areas (DoT)
- Should gulls be identified as nesting in areas proposed for development, appropriate mitigation, and licensed controls will need to be developed and implemented (DoT).

6.8 Bridled tern

The potential threats for bridled tern include direct disturbance and light pollution. High levels of disturbance as a threat for this species, with the potential for colony abandonment; although, habituation may occur at sites exposed to long-term, continuous and predictable human activity (Haney et al. 1999' Commonwealth of Australia 2020a).

The current location and extent of bridled tern nesting colony in the Casuarina Boat Harbour is unknown. However, bridled terns have an expanding and increasing population due to the changing ocean climate and this is what is driving the colonization of the outer harbour seawalls (Dunlop and Surman 2012).

As such, monitoring will be undertaken during the breeding season to determine whether the proposed new marine structures overlap bridled tern nesting sites. If nesting areas are found to overlap the proposed new KBMS structures within the Casuarina Boat Harbour, action will be pre-emptively taken prior to the breeding season to prevent terns from nesting, such as the installation of mesh along the seawall.

Bridled terns are protected as a migratory species under the EPBC Act and the 'Wildlife conservation plan for seabirds (Commonwealth of Australia 2020a). While the development area is located outside of Commonwealth areas, the EPBC Act prevents actions (Section 140) or approvals under Strategic Assessments (Section 146L) that are inconsistent with Australia's migratory species' obligations under the CMS, JAMBA, CAMBA or ROKAMBA (Commonwealth of Australia 2020a). Key obligations relevant to this proposal and bridled terns are identified below.

Wildlife Conservation Plan for Seabirds

- Quantify the breeding population in Australia
- Quantify and manage the potential impacts of human disturbance
- Implement best practice quarantine measures at breeding colonies to reduce the risk of any invasive species (Commonwealth of Australian 2020a).

CAMBA – Article IV

"Each Contracting Party shall endeavour, in accordance with its laws and regulations in force, to:

(a) establish sanctuaries and other facilities for the management and protection of migratory birds and also of their environment; and

(b) take appropriate measures to preserve and enhance the environment of migratory birds. In particular, each Contracting Party shall:

(i) seek means to prevent damage to migratory birds and their environment, and

(ii) endeavour to take such measures as may be necessary to restrict or prevent the importation and introduction of animals and plants which are hazardous to the preservation of migratory birds and their environment" (Commonwealth of Australia 1988).

JAMBA – Article VI

"Each Government shall endeavour to take appropriate measures to preserve and enhance the environment of birds protected under the provisions of this Agreement. In particular, it shall:

(a) seek means to prevent damage to such birds and their environment;

(b) endeavour to take such measures as may be necessary to control the importation of animals and plants which it determines to be hazardous to the preservation of such birds; and

(c) endeavour to take such measures as may be necessary to control the introduction of animals and plants which could disturb the ecosystems of unique island environments" (Commonwealth of Australia 1981).

While Koombana Bay appears to support nesting bridled terns (see Section 4.1.7) and is identified as a BIA (foraging in high numbers) for this species (DCCEEW 2021), there are probably only a small number of pairs at the current time and Casuarina Boat Harbour is not considered an important breeding area for the species. However, to satisfy legislative requirements and prevent the disturbance of a migratory, potentially nesting species, monitoring will take place during the current breeding season (2023/24). If it is discovered that nesting is occurring in the 2023/24 breeding season, wire mesh to prevent use of crevices in the rock wall will be installed in areas identified for future development, prior to future nesting attempts in 2024/25 and beyond.

Management actions for Casuarina Boat Harbour:

- Monitoring of breeding activity (DoT)
- Installation of wire mesh over seawall in areas of proposed development, prior to 2024/25 in the event breeding is occurring in 2023/24 (DoT).

While Koombana Bay appears to support nesting bridled terns (see Section 4.1.7) and is identified as a BIA (foraging in high numbers) for this species (DCCEEW 2021), there are probably only a small number of pairs at the current time and Casuarina Boat Harbour is not considered an important breeding area for the species. However, to satisfy legislative requirements and prevent the disturbance of a migratory, potentially nesting species, monitoring will take place during the current breeding season (2023/24). If it is discovered that nesting is occurring in the 2023–2024 breeding season, wire mesh to prevent use of crevices in the rock wall will be installed in areas identified for future development, prior to future nesting attempts in 2024–2025 and beyond.

Management actions for Casuarina Boat Harbour:

- Monitoring of breeding activity (DoT)
- Installation of wire mesh over seawall in areas of proposed development, prior to 2024/25 in the event breeding is occurring in 2023/24 (DoT).

6.9 Agreed management actions for birdlife within the Koombana Precinct

Table 6-1 summarises the agreed management actions identified for birds within the Koombana Precinct and the parties responsible for their implementation (as per Section 6.2–6.8). This table includes actions additional to those already described in the Marine Fauna Management Plan (RPS 2023) and Section 6.1.

Table 6-1: Agreed management actions identified for birds within the Koombana Precinct and parties responsible for their implementation

Item	Species	Timing	Action/ impact	Management activity	Stakeholder
1	Little penguin	Year-round	Dredging, underwater noise, vessel traffic (Koombana Bay)	• MFOs that are being used to observe marine mammals will also observe and record little penguin presence (RPS 2023b). • Construction vessel crews will undertake inductions covering procedures to minimise collision risk to marine fauna including little penguins and the dedicated MFO will report observations of marine fauna to vessel master as soon as practicable. This information will be relayed to other vessels operating in the area if appropriate to reduce collision risk (RPS 2023b). During transit, a maximum speed of six knots will be maintained if a little penguin is sighted within 300 m of the vessel. To minimise the risk of little penguin entrainment, prior to commencing dredging or excavating: • The contractor will check for little penguins within a 150 m observation zone and a 50 m exclusion zone • Dredging or excavating can only commence if no little penguins have been observed in 50 m exclusion zone • If penguins are sighted during dredging or excavating in the exclusion zones, dredging will cease until they have left the monitoring zones or have not been sighted for 30 minutes (RPS 2023b). • Standard mitigation practices will be adopted to reduce the risk of injury to marine fauna from piling noise and include 15 min observation prior to soft start over 500 m exclusion zone, in the event that a little penguin is detected (RPS 2023b). Piling will not commence until any penguin is outside a 500 m exclusion zone and must be absent from the 500 m exclusion zone for at least 20 minutes prior to commencement (RPS 2023b). A five-minute soft start at a lower hammer energy will commence before ramping up to full energy (RPS 2023b). To reduce the potential for negative cumulative impacts to little penguins, multiple construction and dredging activities will be avoided during the summer period (December to March).	DoT
2	Fairy tern	September–March	Disturbance (Outer Harbour)	**McKenna Point** • Avoiding, where possible, sand-trap excavation in the lead-up to the breeding season (the time frame should be guided by advice from coastal engineer based on the rates of sediment accretion) and for the duration of the breeding season, to ensure the beach at McKenna Point is sufficiently wide and elevated to support a nesting attempt by fairy tern • Engagement of a pest control company on SPA managed land to control introduced invasive predators i.e. bait for rodents and trap for feral cats • Regular monitoring to determine any early breeding behaviour or nesting activity • If breeding is identified, site access will be managed by SPA, including locking of gates to prevent site access to contractors and deployment of signage that identifies active nesting	SPA
				• Fox monitoring and/or control within the Bunbury area	CoB
				• Regular monitoring to determine any early breeding behaviour or nesting activity • If/when a nesting attempt is identified, a minimum of two signs should be placed at least 20 m on either side of the nest to alert people to the presence of a nest. Installation of chick shelters around the expected time of chick hatching to increase chick survival	DBCA
3	Fairy tern	September–March	Disturbance (Casuarina Boat Harbour)	**Casuarina Boat Harbour** • Application of a dark, brown-coloured hydro-mulch at the Casuarina Boat Harbour laydown area in September to prevent fairy tern nesting If fairy terns found nesting or attempting to nest, within the Casuarina Boat Harbour, it will be necessary to allow breeding to be completed. To ensure the protection of nesting birds, additional measures will include: • Cessation of operations that have the potential to cause a disturbance to fairy terns while they remain at the site and inform site staff to avoid the area until breeding activities conclude • Installation of temporary signage and rope fencing if there is any potential for incursions by construction workers • Installation of chick shelters. Assistance from DBCA to be requested. • Consult with SPA to avoid in-combination (cumulative) impacts of construction of Casuarina Boat Harbour and SPA sand extraction activities at McKenna Point (West and East), to ensure nesting habit is available to fairy terns within the Outer Harbour area during the nesting period. If construction cannot be delayed or modified to avoid or minimise disturbance to nesting terns, a Section 40 Ministerial Authorisation will be required.	DoT
4	Australian pied oystercatcher Red-capped plover	September–January	Disturbance, habitat removal (Outer Harbour)	• Prior to construction activities or sand extraction taking place, observations of potential nesting will be undertaken (during the active nesting period; September–January) to ensure birds will not be impacted by the operation of heavy machinery or sand removal. • If/when a nesting attempt is identified, a minimum of two signs should be placed at least 20 m on either side of the nest to alert people to the presence of a nest. • After chick hatching, signs will be placed along a 100 m stretch of beach, along the high tide mark, where the chicks are frequently sighted .	SPA
5	Australian pied oystercatcher Red-capped plover	September–January	Disturbance (Casuarina Boat Harbour)	• Prior to construction activities, observations of potential nesting will be undertaken to ensure birds will not be impacted by the operation of heavy machinery • Observations of nesting will be undertaken at mobilisation and after any halt in site activity, e.g. after the weekend or a suspension of work areas. If/when a nesting attempt is identified, a minimum of two signs should be placed at least 20 m on either side of the nest to alert people to the presence of a nest.	DoT
6	Banded lapwing	June–November	Disturbance (Casuarina Boat Harbour)	• Prior to construction activities taking place, observations of potential nesting will be made by project staff to ensure birds will not be impacted by the operation of heavy machinery • Observations of nesting will be undertaken at mobilisation and after any halt in site activity, e.g. after the weekend or a suspension of work areas If/when a nesting attempt is identified, protocols for nest protection include: • The installation of a temporary 6x6 m wire fence using 100x150 mm open (sheep) mesh protection around the nest. • A minimum of two signs should be placed at least 20 m on either side of the nest to prevent birds flushing from their nests when approached (Figure 6-2) • After hatching, signs will be placed where the chicks are frequently sighted and the temporary fencing removed • A-frame chick shelters (or similar) will be installed (and trialled) as a way of providing shade for very small chicks	DoT
7	Silver gull	Year-round	Disturbance (Casuarina Boat Harbour)	• Provided lidded bins and introduce no feeding wildlife policy (DoT) • Monitoring of aggregation activity and take steps to eliminate opportunities for drinking or feeding (DoT).	DoT

Item	Species	Timing	Action/ impact	Management activity	Stakeholder
8	Bridled tern	September–April	Disturbance (Casuarina Boat Harbour)	• Monitoring during the breeding season to determine whether the proposed new marine structures overlap bridled tern nesting sites. • Action will be pre-emptively taken prior to the breeding season to prevent terns from nesting, such as the installation of mesh along the seawall if area use is identified.	DoT

7 PLAN REVIEW

This management plan will be reviewed annually by the SWDC and relevant government agencies in conjunction with stakeholders, as identified in Table 2-1. The aims of the review are to:

- Assess success and the ongoing requirements for monitoring and management measures including the need for the plan to be updated and implemented for the next annual cycle.
- Assess and update list of threats to determine if there are changes that need to be accounted for in the following year.
- Update conservation status of birds, relevant legislative requirements and add any new individual species at risk, if required.
- Incorporate new stakeholder feedback.

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