



Memorandum

7 May 2020

To	Public Transport Authority		
From	GHD Pty Ltd		
Subject	METRONET – Morley to Ellenbrook Stage 1	Job no.	12530736
	Matters of National Environmental Significance Assessment		

1 Introduction

1.1 Background

The Public Transport Authority of Western Australia (PTA) is proposing to develop the Morley-Ellenbrook Line (MEL) Project as part of Western Australian Government's METRONET program aimed at increasing the size of Perth's railway network. The MEL Project is a 21 kilometre (km) railway that will connect the existing Midland line in Bayswater to Ellenbrook in Perth's north-eastern suburbs, approximately 22 km northeast of the Perth central business district (CBD). The MEL Project will include new stations at Morley, Noranda, Malaga, Whiteman Park and Ellenbrook, and provision for a potential future station at Bennett Springs.

The MEL Project route commences at Bayswater Station on the Midland Line and terminates at Ellenbrook. The Public Transport Authority (PTA) is currently progressing Stage 1 of the Morley-Ellenbrook Line (MEL), Bayswater to Malaga Rail Works (the Project). The route follows the centre median of Tonkin Highway, heading north through the Reid Highway interchange, before leaving the median in Malaga between Marshall Road and Hepburn Avenue. The Project area covers 203.94 hectares (ha). The Project area is presented in Figure 1 (Appendix A). The Project will require the clearing of 1.28 ha of native vegetation (of which 0.27 ha is classified as Good to Degraded or Good to Completely Degraded). The Project will also require clearing of 8.37 ha of non-native vegetation (planted/revegetation). Stage 2 of the MEL Project will extend from Malaga to Ellenbrook.

A number of ecological investigations have previously been undertaken across the Stage 1 and Stage 2 Project areas including Level 1 and Level 2 fauna surveys and habitat assessments for threatened black cockatoo species.

1.2 Scope of works and purpose

PTA commissioned GHD Pty Ltd (GHD) to complete an assessment of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Matters of National Environmental Significance (MNES) in relation to the Stage 1 component of the MEL Project.

GHD understands that PTA intends to use this assessment to support the Native Vegetation Clearing Permit (NVCP) for the Project.



Memorandum

The objectives of the assessment memorandum are to:

- Describe the potential MNES present within the Project area
- Assess the potential for the Project to cause significant impacts to MNES
- Identify the likelihood of a referral for the Project under the EPBC Act.

1.3 Limitations and assumptions

This memorandum has been prepared by GHD for Public Transport Authority and may only be used and relied on by Public Transport Authority for the purpose agreed between GHD and the Public Transport Authority as set out in Section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Public Transport Authority arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible. The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the memorandum and are subject to the scope limitations set out in the memorandum.

The opinions, conclusions and any recommendations in this memorandum are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared. The opinions, conclusions and any recommendations in this memorandum are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

GHD has prepared this memorandum on the basis of information provided by Public Transport Authority and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

GHD has not been involved in the preparation of the Project's Native Vegetation Clearing Permit and has had no contribution to, or review of the Project's Native Vegetation Clearing Permit other than in the preparation of this memorandum. GHD shall not be liable to any person for any error in, omission from, or false or misleading statement in, any other part of the Native Vegetation Clearing Permit.

2 Methodology

The MNES assessment was undertaken in two stages: a desktop assessment and an impact assessment. A desktop assessment was undertaken in order to identify and describe the potential MNES present within the Project area. As part of the desktop assessment, publically available information, and previous ecological surveys and information provided by the PTA were reviewed. A database search of the Department of Agriculture, Water and Environment (DAWE) Protected Matters Search Tool (PMST) was undertaken to identify species listed under the EPBC Act potentially occurring within the Project area. A 10 km buffer around the Project area was applied to the PMST search. A copy of the PMST search results is presented in Appendix B. An assessment was then



Memorandum

undertaken to determine the likelihood of the MNES to occur within the Project area. For each MNES known to or are likely to occur in the Project area, an assessment of the potential for the Project to cause significant impacts was undertaken.

3 Matters of National Environmental Significance (MNES)

3.1 Relevance of MNES to the Project area

Based on the PMST search of the Project area, the relevance of MNES was determined. Table 3-1 presents a summary of the relevant MNES for the Project. The relevant MNES are further assessed for their likelihood of occurrence in the Project area in Section 3.2.

Table 3-1 Summary of MNES relevance to the Project area

Matter of MNES	Relevance to the Project area
Listed threatened ecological communities	Relevant. Eight threatened ecological communities potentially occur in the Project area. See Section 3.2.1.
Listed threatened species	Relevant. Listed threatened species potentially occur in the Project area: 28 flora species and 11 fauna species. See Section 3.2.2.
Listed migratory species	Relevant. Six listed migratory species potentially occur in the Project area. See Section 3.2.3.
Wetlands of international importance	Not relevant. No Wetlands of international importance present in the vicinity of the Project. The closest Ramsar wetland, Forrestdale and Thomsons Lakes, lies approximately 26 km to the south to southwest of the Project.
Commonwealth marine areas	Not relevant. Project is located inland, approximately 16 km east of the coastline. Commonwealth marine areas lie 3 km offshore.
World Heritage properties	Not relevant. No World Heritage Properties present in the vicinity of the Project.
National Heritage places	Not relevant. No National Heritage places present in the vicinity of the Project.
Nuclear action	Not relevant. Project is not a nuclear action.



Memorandum

Matter of MNES	Relevance to the Project area
Great Barrier Reef Marine Park	Not relevant. Project is on the west coast of Australia.
Protection of water resources from coal seam gas	Not relevant. Project does not involve coal seam gas or coal mine development.

3.2 Likelihood of occurrence

3.2.1 Threatened ecological communities

A search of the EPBC Act PMST identified eight threatened ecological communities (TECs) potentially occurring within 10 km of the Project area. A summary of these TECs are presented in Table 3-2. None of the TECs are known to occur within the Project area.

The Banksia Woodlands of the Swan Coastal Plain ecological community is known to occur within two locations in Stage 2 of the MEL Project (RPS 2019 as cited in ELA 2020). However, based on the vegetation assessments of the Stage 1 Project area undertaken by GHD (2019) and GHD (2020a), none of the vegetation types represent occurrences of the Banksia Woodlands of the Swan Coastal Plain (TEC). There were no patches of Banksia woodland that meet the key diagnostic characteristics of condition and patch size thresholds.

Table 3-2 Threatened ecological communities within 10 km of the Project area

Community name	EPBC Act Conservation status	Description
Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain	Endangered	The habitat of this community is characterised by continuous discharge of groundwater in raised areas of peat. The peat and surrounds provide a stable, permanently moist series of microhabitats. Intact vegetated tumulus springs are only found at four locations. There is a high level of heterogeneity of invertebrate fauna assemblages between these sites, but all are associated with a rich, healthy fauna. Typical and common native vascular plant species associated with the tumulus springs are the trees <i>Banksia littoralis</i> , <i>Melaleuca preissiana</i> and <i>Eucalyptus rudis</i> , and the shrubs <i>Agonis linearifolia</i> , <i>Pteridium esculentum</i> , <i>Astartea fascicularis</i> and <i>Cyclosorus interruptus</i> . A range of non-vascular plants have also been located on peat mounds associated with the community.
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	The ecological community is a woodland associated with the Swan Coastal Plain of southwest Western Australia. A key diagnostic feature is a prominent tree layer of Banksia, with scattered eucalypts and other tree species often present among or emerging above the Banksia canopy. The understorey is a species rich mix of sclerophyllous shrubs, graminoids and forbs. The ecological community is characterised by a high endemism and considerable localised variation in species composition across its range.
Clay Pans of the Swan Coastal Plain	Critically Endangered	The clay pan communities occur where clay substrate is low in the landscape and forms an impermeable layer close to the surface. These wetlands that rely on rainfall and local surface drainage to fill are



Memorandum

Community name	EPBC Act Conservation status	Description
		considered unlikely to be connected to groundwater. The clay pans then dry out to form a relatively impervious substrate in summer. A suite of perennial plants that propagate by underground bulbs, tubers or corms (geophytes), and annual herbs flower sequentially as the clay pans dry out. The clay pans are the most diverse of the Swan Coastal Plain wetlands and contain a number of local endemic flora.
<i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils of the Swan Coastal Plain	Endangered	The <i>Corymbia calophylla</i> - <i>Kingia australis</i> woodlands on heavy soils of the Swan Coastal Plain ecological community is a woodland community located on heavy soils of the eastern side of the Swan Coastal Plain between Ruabon and Guildford. Typical and common native plant taxa in the community are: <i>Corymbia calophylla</i> ; the shrubs <i>Banksia dallanneyi</i> , <i>Philotheca spicata</i> , <i>Kingia australis</i> and <i>Xanthorrhoea preissii</i> ; herbs, rushes and sedges, <i>Cyathochaeta avenacea</i> , <i>Dampiera linearis</i> , <i>Haemodorum laxum</i> , <i>Desmodcladus fasciculatus</i> , <i>Mesomelaena tetragona</i> and <i>Tetraria octandra</i> . The introduced grass <i>Briza maxima</i> is also common in the community, although weed cover in most occurrences is currently quite low.
Shrublands and Woodlands of the eastern Swan Coastal Plain	Endangered	The Shrublands and Woodlands of the eastern Swan Coastal Plain ecological community is a woodland mainly on the transitional soils of the Ridge Hill Shelf, on the Swan Coastal Plain adjacent to the Darling Scarp, and extends onto the alluvial clays deposited on the eastern fringe of the Swan Coastal Plain, and also into adjacent aeolian deposits. The community mainly occurs as a shrubland, or a woodland of <i>Banksia attenuata</i> and <i>Banksia menziesii</i> , or <i>Corymbia calophylla</i> , sometimes with <i>Allocasuarina fraseriana</i> , over a shrub layer that can include the species <i>Adenanthos cygnorum</i> , <i>Hibbertia huegelii</i> , <i>Scaevola repens</i> var. <i>repens</i> , <i>Allocasuarina humilis</i> , <i>Bossiaea eriocarpa</i> , <i>Hibbertia hypericoides</i> and <i>Stirlingia latifolia</i> . A suite of herbs including <i>Conostylis aurea</i> , <i>Trachymene pilosa</i> , <i>Lomandra hermaphrodita</i> , <i>Burchardia umbellata</i> and <i>Patersonia occidentalis</i> , and the sedges <i>Mesomelaena pseudostygia</i> , <i>Mesomelaena tetragona</i> , and <i>Lyginia barbata</i> often occur in the community. The weeds <i>Gladiolus caryophyllaceus</i> and <i>Ursinia anthemoides</i> are also common.
Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain	Endangered	The Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain ecological community occurs on the heavy soils of the eastern side of the Swan Coastal Plain. It is defined on the basis of rare limestone-influenced substrates. Where the best developed limestone occurs, near Gingin, the plant community is located on shallow black clay or sandy clay soils on limestone. Typical and common native species in areas of best developed limestone are the tree <i>Casuarina obesa</i> , the mallees <i>Eucalyptus decipiens</i> and <i>E. foecunda</i> and the shrubs <i>Melaleuca huegelii</i> , <i>Alyogyne huegelii</i> var. <i>huegelii</i> , <i>Grevillea curviloba</i> , <i>Grevillea evanescens</i> , <i>Melaleuca acerosa</i> , and the herb <i>Thysanotus arenarius</i> . Where the limestone substrate is less well developed and limestone may occur as nodules or chunks, the flora assemblages can be influenced by other characteristics of the substrate, such as clay content, with the presence of calcicoles such as <i>Alyogyne</i> sp. <i>Rockingham</i> , <i>A. hakeifolia</i> , <i>Carex theca</i> , <i>Hibbertia spicata</i> subsp. <i>spicata</i> , <i>Lechenaultia linarioides</i> , <i>Thysanotus arenarius</i> , <i>Gahnia trifida</i> , <i>Eremophila glabra</i> and <i>Melaleuca brevifolia</i> providing evidence of the limestone influence.



Memorandum

Community name	EPBC Act Conservation status	Description
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	<p>The Subtropical and Temperate Coastal Saltmarsh consists of an assemblage of plants, animals and micro-organisms associated with saltmarsh in coastal regions of sub-tropical and temperate Australia (south of 23 °S latitude). The habitat is coastal areas under tidal influence. In southern latitudes saltmarsh are the dominant habitat in the intertidal zone and often occur in association with estuaries. It is typically restricted to the upper intertidal environment, generally between the elevation of the mean high tide, and the mean spring tide. The community consists mainly of salt-tolerant vegetation (halophytes) including: grasses, herbs, reeds, sedges and shrubs. Succulent herbs and grasses generally dominate and vegetation is generally <0.5 m tall with the exception of some reeds and sedges. Many species of nonvascular plants are also found in saltmarsh, including epiphytic algae, diatoms and cyanobacterial mats.</p> <p>Saltmarsh consists of many vascular plant species but is dominated by relatively few families. There is also typically a high degree of endemism at the species level. The two most widely represented coastal saltmarsh plant families are the Chenopodiaceae and Poaceae. Four structural saltmarsh forms are currently recognised based on dominance of a particular vegetation type:</p> <ul style="list-style-type: none"> • dominance by succulent shrubs (e.g. <i>Tecticornia</i>) • dominance by grasses (e.g. <i>Sporobolus virginicus</i>) • dominance by sedges and grasses (e.g. <i>Juncus kraussii</i>, <i>Gahnia trifida</i>) • dominance by herbs (e.g. low-growing creeping plants such as <i>Wilsonia backhousei</i>, <i>Samolus repens</i>, <i>Schoenus nifens</i>).
Tuart (<i>Eucalyptus gomphocephala</i>) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	<p>This community includes the assemblage of plants, animals and other organisms that occur in association with Tuart (<i>Eucalyptus gomphocephala</i>) on the Swan Coastal Plain of Western Australia. It occurs where there are multiple Tuart trees with crowns separated by a distance of no more than 60 m, with an understorey containing a minimum number of native plant species or demonstrating other important conservation values. Tuart trees are primary defining feature of this ecological community. Other trees can also form part of the canopy, and commonly include: Peppermint (<i>Agonis flexuosa</i>), Bull Banksia (<i>Banksia grandis</i>), Candlestick Banksia (<i>Banksia attenuata</i>), or Jarrah (<i>Eucalyptus marginata</i>). Plant species in the understorey vary from the north to the south of the Swan Coastal Plain and may include herbs, grasses and shrubs.</p>



Memorandum

3.2.2 Listed threatened species

Flora

A search of the EPBC Act PMST identified 28 listed threatened flora species potentially occurring within 10 km of the Project area. A likelihood of occurrence assessment was undertaken of these species (Appendix C), which determined that all flora species were **unlikely** to occur.

The Project area is predominantly characterised by cleared land (189.9 ha), with a minority covered by remnant native vegetation (3.15 ha) and non-native planted/revegetation (12.41 ha) (GHD 2020a). Where remnant vegetation is remaining, the patches are small and completely dominated by introduced species (grasses/herbs). The majority of the remnant native vegetation is of a Degraded to Completely Degraded condition.

Fauna

A search of the EPBC Act PMST identified 11 listed threatened flora species potentially occurring within 10 km of the Project area. It is noted that shorebirds, oceanic and/or pelagic species identified in the database search have been excluded from this assessment given the distance from, and lack of, marine habitat within the Project area. In addition, species that are aquatic species have also been excluded (i.e. *Galaxiella nigrostriatal* [Black-striped Minnow] and *Westralunio carteri* [Carter's Freshwater Mussel]).

A likelihood of occurrence assessment was undertaken of the identified fauna species (Appendix C), which determined that two black cockatoo species are **known to occur** in the Project area. These species are summarised in Table 3-3. The remaining fauna species were determined to be **unlikely** or **highly unlikely** to occur.

Due to the conservation status and known habitat decline of the two black cockatoo species and known occurrence in the Project area, it is necessary for the further assessment of the potential for the Project to cause significant impacts to the species. This impact assessment is presented in Section 4.

Table 3-3 Listed threatened fauna species known to occur in the Project area

Species	Common name	EPBC Act Conservation status	Likelihood of occurrence in Project area
<i>Calyptorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo, Karrak	Vulnerable	Recorded Forest Red-tailed Black Cockatoo were recorded foraging within the Project area during the ELA (2020) survey in both Stage 1 and Stage 2 of the Project area and have been observed on numerous occasions during previous fauna surveys (Terrestrial Ecosystems 2018, AECOM 2016, Coffey 2015a as cited in ELA 2020). There are also numerous records of the species in proximity to the Project area (DBCA 2019b as cited in ELA 2020). Suitable habitat for the species occurs within the Paddocks with Eucalyptus/Corymbia and Mixed Eucalyptus/Corymbia Woodland habitats.



Memorandum

Species	Common name	EPBC Act Conservation status	Likelihood of occurrence in Project area
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo, Short-billed Black-Cockatoo	Endangered	Recorded Carnaby's Cockatoo has been observed within Wotton Reserve in Stage 1 of the Project, as well as a number of other locations either within the Project area or in close proximity (i.e. 50% of individual fauna records provided from the DBCA database search undertaken by ELA (2020) were Carnaby's Cockatoo). Suitable foraging and potential breeding and roosting habitat occurs within both Stages 1 and 2 of the Project. The species was also observed foraging during the ELA (2020) survey in Stage 2 of the Project, near Ellenbrook, and has previously been observed foraging and flying over the Project in various locations including Stage 1 and Stage 2 (Terrestrial Ecosystems 2018, Coffey 2015a; DBCA 2019 as cited in ELA 2020).

3.2.3 Listed migratory species

A search of the EPBC Act PMST identified six listed migratory species potentially occurring within 10 km of the Project area. A likelihood of occurrence assessment was undertaken of the identified migratory species (Appendix C), which determined that all migratory species are **unlikely** to occur in the Project area. It is noted that species that have a conservation status (e.g. Endangered) in addition to a "Migratory" listing were reviewed under Section 3.2.2 "Listed threatened species".

4 Impact assessment

Based on the desktop assessment undertaken in Section 3, it is considered that assessment for the potential for the Project to cause significant impacts to the following MNES (listed threatened fauna species) is required:

- Carnaby's Cockatoo
- Forest Red-tailed Black-Cockatoo.

4.1 Relevant policy and guidance

- Matters of National Environmental Significance, Significant impact guidelines 1.1 (DoE 2013)
- EPBC Act referral guidelines for three threatened black cockatoo species (SEWPAC 2012)



Memorandum

4.2 Potential impacts and risks

The Project construction activities may result in potential impacts to the MNES through:

- Direct impacts to the habitat for the listed threatened fauna due to clearing and ground disturbance
- Direct impacts to listed threatened fauna through injury or mortality from collision with vehicles or machinery
- Indirect impacts to the listed threatened fauna or their habitats from activities such as:
 - Introduction and/or spread of weeds
 - Introduction and/or spread of plant disease
 - Attraction of feral animals and increased competition with invasive species
 - Noise emissions from construction equipment
 - Spills and/or leaks from storage and handling of hazardous materials and waste

4.3 Assessment of potential impacts

Table 4-1 provides an assessment of the potential for significant impacts to occur to the Carnaby's Cockatoo and the Forest Red-tailed Black-Cockatoo as a result of the Project using specific significance criteria in the EPBC Act referral guideline for three black cockatoo species (SEWPAC 2012).



Memorandum

Table 4-1 Significance of potential impacts on two Black Cockatoo species

Significance criteria	Carnaby's Cockatoo Assessment	Forest Red-tailed Black-Cockatoo
High risk of significant impacts: referral recommended		
Clearing of any known nesting tree	<p>No known nesting trees in the Project area.</p> <p>Within the Project area, of the 53 potential black cockatoo breeding trees (DBH >500 mm) identified by GHD (2020b), only one contained a suitable natural hollow and five contained nesting boxes (Figure 1). Twenty-nine potential black cockatoo habitat trees will be cleared. Twenty-four potential black cockatoo habitat trees are contained within the native vegetation retention areas (NVRAs), including one with a nesting box and one with a suitable natural hollow (Figure 1).</p>	<p>No known breeding habitat within the Project area.</p> <p>The closest known breeding site is located approximately 18 km southwest of Project area (Stage 1) at Murdoch University (Terrestrial Ecosystems 2018; Murdoch University 2015 as cited in ELA 2020).</p> <p>Previous surveys of the Project area (Stage 1) have identified the presence of potential black cockatoo breeding trees (GHD 2020b; GHD 2019; ELA 2020).</p> <p>With the use of NVRAs, a significant amount of potential breeding habitat will be maintained. Twenty-nine potential black cockatoo habitat trees will be cleared. Twenty-four potential black cockatoo habitat trees are contained within the NVRAs, including one with a nesting box and one with a suitable natural hollow (Figure 1).</p>
Clearing or degradation of any part of a vegetation community known to contain breeding habitat	<p>No known breeding habitat within the Project area.</p> <p>The closest known breeding site is located approximately 18 km northwest of Stage 2 of the Project at Joondalup Health Campus (Roberts 2016 as cited in ELA 2020).</p> <p>Previous surveys of the Project area (Stage 1) have identified the presence of potential black cockatoo breeding trees (GHD 2020b; GHD 2019; ELA 2020).</p> <p>With the use of NVRAs, a significant amount of potential breeding habitat will be maintained. Twenty-nine potential black cockatoo habitat trees will be cleared. Twenty-four potential black cockatoo habitat trees are contained within the NVRAs, including one with a nesting box and one with a suitable natural hollow (Figure 1).</p>	<p>No known breeding habitat within the Project area.</p> <p>The closest known breeding site is located approximately 18 km southwest of Project area (Stage 1) at Murdoch University (Terrestrial Ecosystems 2018; Murdoch University 2015 as cited in ELA 2020).</p> <p>Previous surveys of the Project area (Stage 1) have identified the presence of potential black cockatoo breeding trees (GHD 2020b; GHD 2019; ELA 2020).</p> <p>With the use of NVRAs, a significant amount of potential breeding habitat will be maintained. Twenty-nine potential black cockatoo habitat trees will be cleared. Twenty-four potential black cockatoo habitat trees are contained within the NVRAs, including one with a nesting box and one with a suitable natural hollow (Figure 1).</p>
Clearing of more than 1 ha of quality foraging habitat	<p>Both GHD (2019) and ELA (2020) have identified foraging habitat in the Project area. GHD (2019) identified black cockatoo foraging evidence under one <i>Corymbia calophylla</i> tree. With the use of NVRAs (Figure 1), the majority of quality foraging habitat will be maintained.</p> <p>The majority of the potential black cockatoo habitat trees identified by GHD occur in native vegetation (GHD 2020a; GHD 2020b).</p> <p>The quality black cockatoo foraging habitat present is considered the native vegetation types VT04 and VT07, as these have vegetation conditions classified above degraded (Good to Degraded or Good to Completely Degraded). Only 0.27 ha will be</p>	<p>Both GHD (2019) and ELA (2020) have identified foraging habitat in the Project area. GHD (2019) identified foraging evidence under one <i>Corymbia calophylla</i> tree. ELA (2020) identified the Forest Red-tailed Black-Cockatoo foraging, as well foraging evidence, in the Stage 1 Project area. With the use of NVRAs (Figure 1), the majority of quality foraging habitat will be maintained.</p> <p>The majority of the potential black cockatoo habitat trees identified by GHD occur in native vegetation (GHD 2020a; GHD 2020b). The quality black cockatoo foraging habitat present is considered the native vegetation types VT04 and VT07, as these</p>



Memorandum

Significance criteria	Carnaby's Cockatoo Assessment	Forest Red-tailed Black-Cockatoo
	cleared of what is considered quality foraging habitat (vegetation condition is Good to Degraded or Good to Completely Degraded).	have vegetation conditions classified above degraded (Good to Degraded or Good to Completely Degraded). Only 0.27 ha will be cleared of what is considered quality foraging habitat (vegetation condition is Good to Degraded or Good to Completely Degraded).
Clearing or degradation (including pruning the top canopy) of a known night roosting site	<p>No known roosting sites in the Project area.</p> <p>Suitable roosting tree species for the Carnaby's Cockatoo are known to be present in the Project area (ELA 2020; GHD 2019; GHD 2020b). Four suitable roosting tree species for the Carnaby's Cockatoo were identified by GHD in the Project area:</p> <ul style="list-style-type: none"> • <i>Corymbia calophylla</i> • <i>Eucalyptus gomphocephala</i> • <i>Eucalyptus marginata</i> • <i>Eucalyptus rudis</i> <p>These roosting tree species are consistent with the suitable breeding tree species presented in Figure 1.</p>	<p>No known roosting sites in the Project area.</p> <p>Suitable roosting tree species for the Carnaby's Cockatoo are known to be present in the Project area (ELA 2020; GHD 2019; GHD 2020b). Three suitable roosting tree species for the Carnaby's Cockatoo were identified by GHD in the Project area:</p> <ul style="list-style-type: none"> • <i>Corymbia calophylla</i> • <i>Eucalyptus gomphocephala</i> • <i>Eucalyptus marginata</i> <p>These roosting tree species are consistent with the suitable breeding tree species presented in Figure 1.</p>
Creating a gap of greater than 4 km between patches of black cockatoo habitat	Any clearing associated with the Project is not expected to create a gap of greater than 4 km between patches of black cockatoo habitat. With the use of NVRAs (Figure 1), the majority of black cockatoo habitat in the Project area will be maintained.	
Uncertainty: referral recommended or contact the department		
Degradation (such as through altered hydrology or fire regimes) of more than 1 ha of foraging habitat. Significance will depend on the level and extent of degradation and the quality of the habitat.	It is expected that with the use of NVRAs (Figure 1), the majority of quality foraging habitat will be maintained. It is expected that management measures relating to site access, waste, weeds and disease will be undertaken during construction to prevent degradation.	
Clearing or disturbance in areas surrounding black cockatoo breeding, foraging or night roosting habitat that has the potential to degrade habitat through introduction of invasive species, edge effects, hydrological changes, increased human visitation or fire.	Previous surveys of the Project area have identified that the vegetation is already highly disturbed with reduced species diversity due to previous clearing, edge effects, weeds and rubbish dumping (GHD 2020a; ELA 2020; GHD 2019). There is the potential that clearing of any land adjacent to potential breeding/foraging/night roosting habitat may contribute to further degradation of the remaining habitat. However, it is expected that management measures relating to site access, waste, weeds and disease will be undertaken during construction to prevent degradation.	



Memorandum

Significance criteria	Carnaby's Cockatoo Assessment	Forest Red-tailed Black-Cockatoo
Actions that do not directly affect the listed species but that have the potential for indirect impacts such as increasing competitors for nest hollows.	Clearing of black cockatoo habitat and the clearing/disturbance of land adjacent to black cockatoo habitat in the Project area has the potential to increase indirect impacts, such as increased competition for nest hollows with other species and edge effects. GHD (2019) noted that one potential breeding tree, which had a nesting box installed, was being utilised by bees at the time of the survey.	
Actions with the potential to introduce known plant diseases such as <i>Phytophthora</i> spp. to an area where the pathogen was not previously known.	The development of the Project has the potential to introduce or spread plant diseases, given that there will be increased human visitation to the Project area. However, it is expected that standard hygiene management measures will be undertaken during construction to prevent the spread of disease.	



Memorandum

5 Conclusion

Based on the impact assessment undertaken in Section 4, the Project is not expected to cause significant direct impacts to the Carnaby's Cockatoo and the Forest Red-tailed Black-Cockatoo, which are MNES known to occur in the Project area. For the black cockatoo species, the Project will:

- Not clear any known breeding trees
- Not clear any known breeding habitat
- Not clear more than 1 ha of quality foraging habitat
- Not create a gap of greater than 4 km between patches of black cockatoo habitat

In addition, the Project unlikely to result in significant indirect impacts.

It is expected that the majority of black cockatoo habitat in the Project area will be retained and a variety of construction management measures will be undertaken to mitigate potential impacts.



Memorandum

References

360 Environmental 2014, *Tonkin Grad Separations Flora, Vegetation and Fauna Survey*. Prepared for Main Roads Western Australia dated February 2014.

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Memorandum

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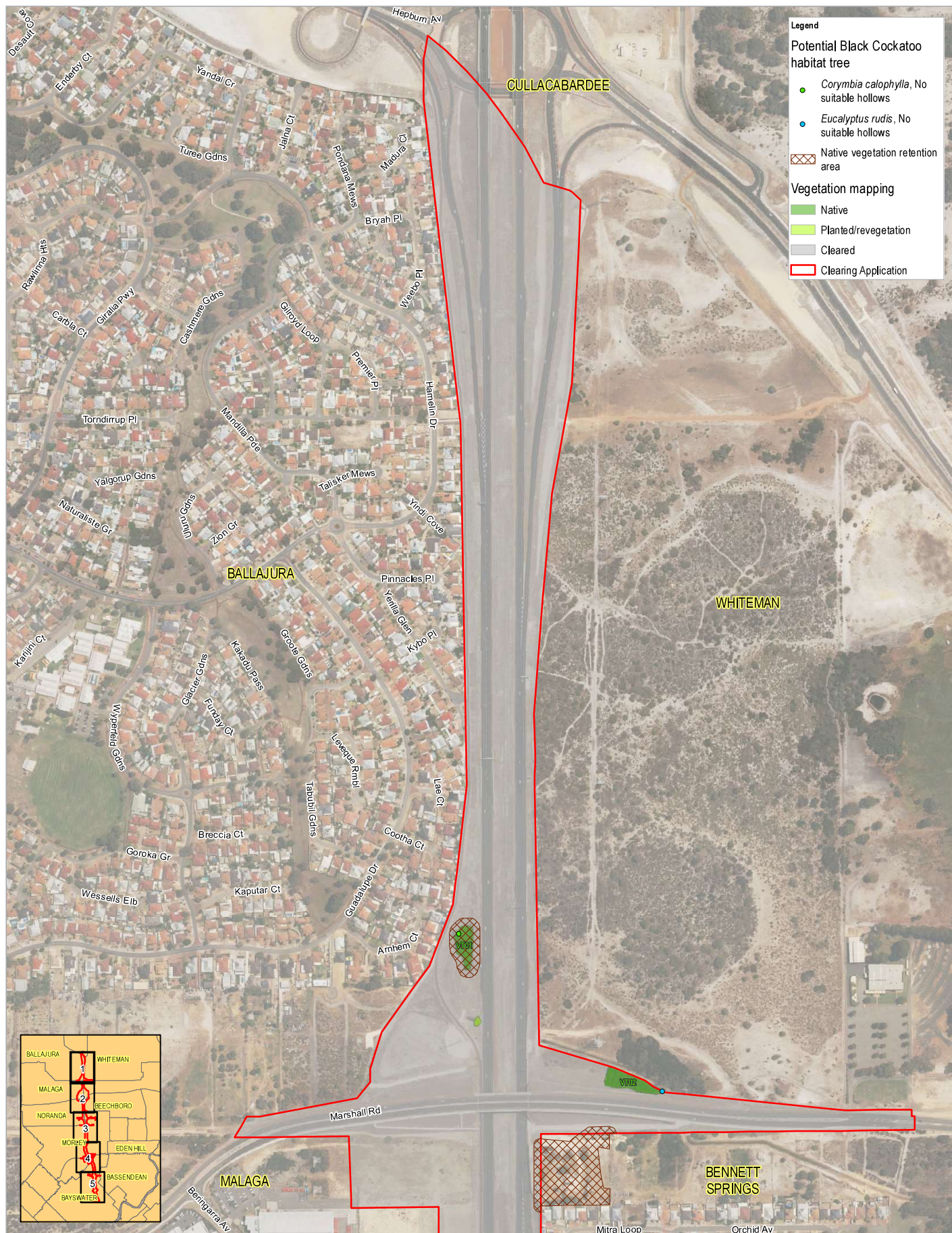
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Memorandum

Appendix A – Figures

Figure 1: Potential Black Cockatoo Habitat Trees



Paper Size ISO A3
0 75 150
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1984
Grid: GDA 1994 MGA Zone 50



Public Transport Authority
Malaga to Bayswater EPBC Act MNES Assessment

Project No. 61-12530736
Revision No. 1
Date 06/05/2020

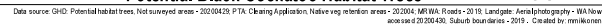
Page 1 of 5

Potential Black Cockatoo Habitat Trees

FIGURE 1

© 01/11/2019 07:34:04 50 Maps Working 1 2501796_001_BIC Trees_Rev1.mxd
Print date: 06 May 2020 - 12:40

Data source: GHD - Potential habitat trees. Not surveyed areas - 20200426 PTA. Clearing Application. Native veg retention areas - 202004. NRT WA Roads - 2018. Landgate: Aerial photography - WA Now
access: 02/05/2020. Suburb boundaries - 2019. Created by: mm/mcm





Paper Size ISO A3
0 75 150
Metres
Map Projection: Transverse Mercator
Horizontal Datum: GDA 1984
Grid: GDA 1994 MGA Zone 50



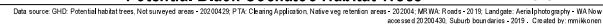
Public Transport Authority
Malaga to Bayswater EPBC Act MNES Assessment

Project No. 61-12530736
Revision No. 1
Date 06/05/2020

Page 4 of 5

Potential Black Cockatoo Habitat Trees

FIGURE 1





Memorandum

Appendix B – PMST results



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 24/04/20 15:58:33

[Summary](#)

[Details](#)

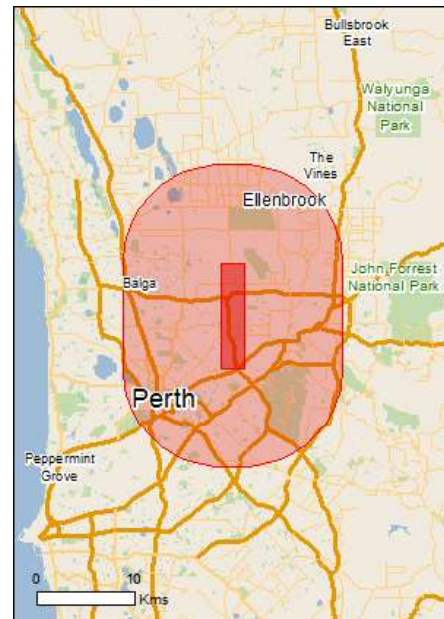
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

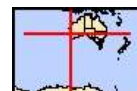
[Acknowledgements](#)



This map may contain data which are
©Commonwealth of Australia
(Geoscience Australia), ©PSMA 2010

[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	8
Listed Threatened Species:	65
Listed Migratory Species:	47

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	6
Commonwealth Heritage Places:	4
Listed Marine Species:	56
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	15
Regional Forest Agreements:	1
Invasive Species:	46
Nationally Important Wetlands:	4
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Assemblages of plants and invertebrate animals of tumulus (organic mound) springs of the Swan Coastal Plain	Endangered	Community known to occur within area
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Clay Pans of the Swan Coastal Plain	Critically Endangered	Community likely to occur within area
Corymbia calophylla - Kingia australis woodlands on heavy soils of the Swan Coastal Plain	Endangered	Community known to occur within area
Shrublands and Woodlands of the eastern Swan Coastal Plain	Endangered	Community known to occur within area
Shrublands and Woodlands on Muchea Limestone of the Swan Coastal Plain	Endangered	Community known to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Roosting known to occur within area

Name	Status	Type of Presence
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Thalassarche cauta cauta Shy Albatross [82345]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta steadi White-capped Albatross [82344]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Fish		
Galaxiella nigrostriata Blackstriped Dwarf Galaxias, Black-stripe Minnow	Endangered	Species or species

Name	Status	Type of Presence
[88677]		habitat may occur within area
Insects		
Hesperocolletes douglasi		
Douglas' Broad-headed Bee, Rottnest Bee [66734]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Bettongia penicillata ogilbyi		
Woylie [66844]	Endangered	Species or species habitat known to occur within area
Dasyurus geoffroi		
Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat known to occur within area
Neophoca cinerea		
Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Pseudocheirus occidentalis		
Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat likely to occur within area
Other		
Westralunio carteri		
Carter's Freshwater Mussel, Freshwater Mussel [86266]	Vulnerable	Species or species habitat known to occur within area
Plants		
Acacia anomala		
Grass Wattle, Chittering Grass Wattle [8153]	Vulnerable	Species or species habitat may occur within area
Andersonia gracilis		
Slender Andersonia [14470]	Endangered	Species or species habitat likely to occur within area
Anigozanthos viridis subsp. terraspectans		
Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat may occur within area
Austrostipa bronwenae		
[87808]	Endangered	Species or species habitat may occur within area
Banksia mimica		
Summer Honeypot [82765]	Endangered	Species or species habitat likely to occur within area
Caladenia huegelii		
King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Calytrix breviseta subsp. breviseta		
Swamp Starflower [23879]	Endangered	Species or species habitat likely to occur within area
Chamelaucium sp. Gingin (N.G.Marchant 6)		
Gingin Wax [88881]	Endangered	Species or species habitat may occur within area
Conospermum undulatum		
Wavy-leaved Smokebush [24435]	Vulnerable	Species or species habitat likely to occur within area
Diplolaena andrewsii		
[6601]	Endangered	Species or species habitat likely to occur within area
Diuris drummondii		
Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur

Name	Status	Type of Presence within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Eleocharis keigheryi Keighery's Eleocharis [64893]	Vulnerable	Species or species habitat likely to occur within area
Fremophila glabra subsp. chlorella [84927]	Endangered	Species or species habitat known to occur within area
Eucalyptus argutifolia Yanchep Mallee, Wabbling Hill Mallee [24263]	Vulnerable	Species or species habitat may occur within area
Eucalyptus x balanites Cadda Road Mallee, Cadda Mallee [87816]	Endangered	Species or species habitat may occur within area
Grevillea christineae Christine's Grevillea [64520]	Endangered	Species or species habitat likely to occur within area
Grevillea curviloba subsp. curviloba Curved-leaf Grevillea [64908]	Endangered	Species or species habitat known to occur within area
Grevillea curviloba subsp. incurva Narrow curved-leaf Grevillea [64909]	Endangered	Species or species habitat likely to occur within area
Grevillea thelemanniana Spider Net Grevillea [32835]	Critically Endangered	Species or species habitat known to occur within area
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Macarthuria keigheryi Keighery's Macarthuria [64930]	Endangered	Species or species habitat likely to occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat likely to occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat likely to occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat known to occur within area
Trithuria occidentalis Swan Hydatella [42224]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Reptiles		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Listed Migratory Species		
[Resource Information]		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Diomedea amsterdamensis		
Amsterdam Albatross [64405]	Endangered	Species or species habitat may occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Species or species habitat likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli		
Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta		
Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Migratory Marine Species		

Name	Threatened	Type of Presence
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat may occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area
Migratory Terrestrial Species		
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area

Name	Threatened	Type of Presence
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land		[Resource Information]
The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.		
Name		
Commonwealth Land -		
Defence - BUSHMEAD RIFLE RANGE		
Defence - HOLDFAST BARRACKS		
Defence - PALMER BARRACKS - SOUTH GUILDFORD		
Defence - RAAF CAVERSHAM		
Defence - SWAN BARRACKS		
Commonwealth Heritage Places		[Resource Information]
Name	State	Status
Historic		
Inglewood Post Office	WA	Listed place

Name	State	Status
Perth General Post Office	WA	Listed place
South Perth Post Office	WA	Listed place
Victoria Park Post Office	WA	Listed place

Listed Marine Species	[Resource Information]
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* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat likely to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species

Name	Threatened	Type of Presence
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	habitat may occur within area Species or species habitat likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Species or species habitat likely to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area

Name	Threatened	Type of Presence
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Thalassarche cauta Shy Albatross [89224]	Vulnerable*	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Species or species habitat likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Mammals		
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat known to occur within area

Extra Information

State and Territory Reserves		[Resource Information]
Name	State	
Dundas Road	WA	
Helena River	WA	
Kings Park	WA	
Milyu	WA	
Perth Zoo	WA	
Swan River	WA	
Unnamed WA1919/893	WA	
Unnamed WA29815	WA	
Unnamed WA33618	WA	
Unnamed WA36440	WA	
Unnamed WA37997	WA	
Unnamed WA44853	WA	
Unnamed WA46919	WA	
Unnamed WA46920	WA	
Unnamed WA49079	WA	

Regional Forest Agreements		[Resource Information]
Note that all areas with completed RFAs have been included.		
Name	State	
South West WA RFA	Western Australia	

Invasive Species		[Resource Information]
Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.		

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area

Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf		Species or species habitat likely to occur

Name	Status	Type of Presence
Madeiravine, Potato Vine [2643]		within area
Asparagus aethiopicus		
Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides		
Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus		
Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus		
Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica		
Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris		
Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera		
Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera		
Boneseed [16905]		Species or species habitat likely to occur within area
Eichhornia crassipes		
Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista linifolia		
Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana		
Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana		
Broom [67538]		Species or species habitat may occur within area
Lantana camara		
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum		
African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea		
Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp.		
Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata		
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur

Name	Status	Type of Presence
Sagittaria platyphylla		within area
Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii		
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta		
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla		
Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area
Nationally Important Wetlands		
		[Resource Information]
Name	State	
Palmer Barracks, Guildford	WA	
Perth Airport Woodland Swamps	WA	
RAAF Caversham	WA	
Swan-Canning Estuary	WA	

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-31.83914 115.91213,-31.83914 115.93218,-31.92112 115.93218,-31.92112 115.91213,-31.83914 115.91213

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [Office of Environment and Heritage, New South Wales](#)
- [Department of Environment and Primary Industries, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment, Water and Natural Resources, South Australia](#)
- [Department of Land and Resource Management, Northern Territory](#)
- [Department of Environmental and Heritage Protection, Queensland](#)
- [Department of Parks and Wildlife, Western Australia](#)
- [Environment and Planning Directorate, ACT](#)
- [Birdlife Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Museum Victoria](#)
- [Australian Museum](#)
- [South Australian Museum](#)
- [Queensland Museum](#)
- [Online Zoological Collections of Australian Museums](#)
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
- [Northern Territory Herbarium](#)
- [Western Australian Herbarium](#)
- [Australian National Herbarium, Canberra](#)
- [University of New England](#)
- [Ocean Biogeographic Information System](#)
- [Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [Geoscience Australia](#)
- [CSIRO](#)
- [Australian Tropical Herbarium, Cairns](#)
- [eBird Australia](#)
- [Australian Government – Australian Antarctic Data Centre](#)
- [Museum and Art Gallery of the Northern Territory](#)
- [Australian Government National Environmental Science Program](#)
- [Australian Institute of Marine Science](#)
- [Reef Life Survey Australia](#)
- [American Museum of Natural History](#)
- [Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.



Memorandum

Appendix C – Likelihood of occurrence

- Flora likelihood of occurrence assessment
- Fauna likelihood of occurrence assessment



Memorandum

Parameters of flora likelihood of occurrence assessment

Assessment outcome	Description
Known	Species recorded within Project area from field survey results (none as this is a desktop search only).
Likely	Large areas of suitable habitat occur in the project area.
Possible	Areas of suitable habitat occur/may occur in the project area.
Unlikely	Suitable habitat does not occur in the project area.
Highly unlikely	Suitable habitat does not occur in the project area and/or the project area is outside the natural distribution of the species.
Other considerations	Date of known records, cryptic nature of species, anecdotal evidence from previous studies/surveys

Flora likelihood of occurrence assessment

Species	Common name	EPBC Act Conservation status	Description / habitat (if available)	Likelihood of occurrence within the Project area	Source
<i>Acacia anomala</i>	Grass Wattle, Chattering Grass Wattle	Vulnerable	Slender, rush-like shrub, 0.2-0.5 m high, Fl. yellow, Aug to Sep. Lateritic soils. Slopes.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007– WA Herbarium 1998–
<i>Andersonia gracilis</i>	Slender Andersonia	Endangered	Slender erect or open straggly shrub, 0.1-0.5(-1) m high. Fl. white-pink-purple, Sep to Nov. White/grey sand, sandy clay, gravelly loam. Winter-wet areas, near swamps.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007– WA Herbarium 1998–
<i>Anigozanthos viridis</i> subsp. <i>terraspectans</i>	Dwarf Green Kangaroo Paw	Vulnerable	Rhizomatous, perennial, herb, 0.05-0.2 m high. Fl. green/yellow-green, Aug to Sep. Grey sand, clay loam. Winter-wet depressions.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007– WA Herbarium 1998–

Memorandum

Species	Common name	EPBC Act Conservation status	Description / habitat (if available)	Likelihood of occurrence within the Project area	Source
<i>Austrostipa bronwenae</i>	-	Endangered	Clumping perennial grass to 0.8 m tall, flower spike to 1.5 m. Known to occur in dark brown loam/clay in swamps, seasonal wetlands.	Unlikely There are no records in the vicinity of the Project area.	DBCA 2007– WA Herbarium 1998–
<i>Banksia mimica</i>	Summer Honeypot	Endangered	Prostrate, lignotuberous shrub, 0.15-0.4 m high. Fl. yellow-brown, Dec or Jan to Feb. White or grey sand over laterite, sandy loam.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007– WA Herbarium 1998–
<i>Caladenia huegelii</i>	King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid	Endangered	Tuberous, perennial, herb, 0.25-0.6 m high. Fl. green & cream & red, Sep to Oct. Grey or brown sand, clay loam.	Unlikely There are two records within 1 km of the Project area; however there is no suitable habitat present. Remnant vegetation remaining in the Project area is completely dominated by introduced species (grasses/herbs).	DBCA 2007– WA Herbarium 1998–
<i>Calyptrix breviseta</i> subsp. <i>breviseta</i>	Swamp Starflower	Endangered	Shrub, 0.2-1 m high. Fl. purple-blue, Aug to Oct. White or yellow sand, sandy loam.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007– WA Herbarium 1998–
<i>Chamelaucium lullfitzii</i>	Gingin Wax	Endangered	Erect open branching shrub with white flowers up to 1.8 m. Known to occur in banksia Woodland on white/grey sand, slopes.	Unlikely Distribution known to occur in Chittering and Gingin.	DBCA 2007–
<i>Conospermum undulatum</i>	Wavy-leaved Smokebush	Vulnerable	Erect, compact shrub, 0.6-2 m high. Fl. white-other, May to Oct. Grey or yellow-orange clayey sand.	Unlikely There is a record within 5 km of the Project area, however there is no suitable habitat within the Project area. Remnant vegetation remaining in the Project area is completely dominated by	DBCA 2007– WA Herbarium 1998–

Memorandum

Species	Common name	EPBC Act Conservation status	Description / habitat (if available)	Likelihood of occurrence within the Project area	Source
<i>Diplolaena andrewsii</i>	-	Endangered	Erect shrub, 0.5-1 m high, inner involucral bracts glabrous, leaves broadly cordate. Fl. red, Jul to Oct. Loam, clay. Granite outcrops & hillsides.	introduced species (grasses/herbs). Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Diuris drummondii</i>	Tall Donkey Orchid	Vulnerable	Tuberous, perennial, herb, 0.5-1.05 m high. Fl. yellow, Nov to Dec or Jan. Low-lying depressions, swamps.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Diuris micrantha</i>	Dwarf Bee-orchid	Vulnerable	Tuberous, perennial, herb, 0.3-0.6 m high. Fl. yellow & brown, Sep to Oct. Brown loamy clay. Winter-wet swamps, in shallow water.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Diuris purdiei</i>	Purdie's Donkey-orchid	Endangered	Tuberous, perennial, herb, 0.15-0.35 m high. Fl. yellow, Sep to Oct. Grey-black sand, moist. Winter-wet swamps.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Drakaea elastica</i>	Glossy-leafed Hammer Orchid, Glossy-leafed, Hammer Orchid, Warty Hammer Orchid	Endangered	Tuberous, perennial, herb, 0.12-0.3 m high. Fl. red & green & yellow, Oct to Nov. White or grey sand. Low-lying situations adjoining winter-wet swamps.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Drakaea micrantha</i>	Dwarf Hammer-orchid	Vulnerable	Tuberous, perennial, herb, 0.15-0.3 m high. Fl. red & yellow, Sep to Oct. White-grey sand.	Unlikely There may be suitable habitat; however, there are no records in the vicinity of the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Eleocharis keigheryi</i>	Keighery's Eleocharis	Vulnerable	Rhizomatous, clumped perennial, grass-like or herb (sedge), to 0.4 m high. Fl. green,	Unlikely	DBCA 2007 – WA Herbarium 1998 –

Memorandum

Species	Common name	EPBC Act Conservation status	Description / habitat (if available)	Likelihood of occurrence within the Project area	Source
<i>Eremophila glabra</i> subsp. <i>chlorella</i>	-	Endangered	Aug to Nov. Clay, sandy loam. Emergent in freshwater: creeks, claypans.	There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Eucalyptus argutifolia</i>	Yanchep Mallee, Wabbling Hill Mallee	Vulnerable	Prostrate & spreading or sprawling shrub, 0.2-1 m high. Fl. green-yellow, Jul to Nov. Sandy clay. Winter-wet depressions.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Eucalyptus x balanites</i>	Cadda Road Mallee, Cadda Mallee	Endangered	(Mallee), 1.5-4 m high, bark smooth. Fl. white, Mar to Apr. Shallow soils over limestone. Slopes or gullies of limestone ridges, outcrops.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Grevillea christineae</i>	Christine's Grevillea	Endangered	(Mallee), to 5 m high, bark rough, flaky. Fl. white, Oct to Dec or Jan to Feb. Sandy soils with lateritic gravel.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Grevillea curviloba</i>	Curved-leaf Grevillea	Endangered	Erect, wiry shrub, 0.5-0.6 m high. Fl. white-cream, Aug to Sep. Clay loam, sandy clay, often moist.	Unlikely There may be suitable habitat, but no records exist in the vicinity of the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Grevillea thelemanniana</i>	Spider Net Grevillea	Critically Endangered	Prostrate to erect shrub, 0.1-2.5 m high. Fl. white-cream, Aug to Oct. Grey sand, sandy loam. Winter-wet heath.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Lepidosperma rostratum</i>	Beaked Lepidosperma	Endangered	Spreading, lignotuberous shrub, 0.3-1.5 m high. Fl. pink-red, May to Nov. Sand, sandy clay. Winter-wet low-lying flats.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
			Rhizomatous, tufted perennial, grass-like or herb (sedge), 0.5 m high. Fl. brown. Peaty sand, clay.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –

Memorandum

Species	Common name	EPBC Act Conservation status	Description / habitat (if available)	Likelihood of occurrence within the Project area	Source
<i>Macarthuria keigheryi</i>	Keighery's Macarthuria	Endangered	Erect or spreading perennial, herb or shrub, 0.2-0.4 m high, 0.3-0.6 m wide. Fl. Sep to Dec or Feb to Mar. White or grey sand.	Unlikely There may be suitable habitat, but no records exist in the vicinity of the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Synaphea</i> sp. <i>Fairbridge Farm (D. Papenfus 696)</i>	Selena's Synaphea	Critically Endangered	Dense, clumped shrub, to 0.3 m high, to 0.4 m wide. Fl. yellow. Oct. Sandy with lateritic pebbles. Near winter-wet flats, in low woodland with weedy grasses.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Thelymitra dedmaniarum</i>	Cinnamon Sun Orchid	Endangered	Tuberous, perennial, herb, to 0.8 m high. Fl. yellow, Nov to Dec or Jan. Granite.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Thelymitra stellata</i>	Star Sun-orchid	Endangered	Tuberous, perennial, herb, 0.15-0.25 m high. Fl. yellow & brown. Oct to Nov. Sand, gravel, lateritic loam.	Unlikely There is no suitable habitat within the Project area.	DBCA 2007 – WA Herbarium 1998 –
<i>Trithuria occidentalis</i>	Swan Hydatella	Endangered	Tufted annual reddish herb, 2/3 cm high. Known to occur in shallow muddy claypan, sandy clay, low-lying depressions.	Unlikely There are no records in the vicinity of the Project area and no suitable habitat present.	DBCA 2007 – WA Herbarium 1998 –



Memorandum

Parameters of fauna likelihood of occurrence assessment

Assessment outcome	Description
Recorded	Recorded during survey either as direct observation or indirect evidence (scats, possum drey, Black cockatoo foraging residue)
Likely	Species are likely to occur in the project area where there is suitable habitat within the project area and there are recent records of occurrence of the species in close proximity to the project area. OR Species known distribution overlaps with the project area and there is suitable habitat within the project area.
Unlikely	Species assessed as unlikely include those species previously recorded within 5 km of the project area however: <ul style="list-style-type: none"> • There is limited (i.e. the type, quality and quantity of the habitat is generally poor or restricted) habitat in the project area. • The suitable habitat within the project area is isolated from other areas of suitable habitat and the species has no capacity to migrate into the project area. OR <ul style="list-style-type: none"> • Those species that have a known distribution overlapping with the project area however: • There is limited habitat in the project area (i.e. the type, quality and quantity of the habitat is generally poor or restricted). • The suitable habitat within the project area is isolated from other areas of suitable habitat and species has no capacity to migrate into the project area.
Highly unlikely	Species that are considered highly unlikely to occur in the project area include: <ul style="list-style-type: none"> • Those species that have no suitable habitat within the project area. • Those species that have become locally extinct, or are not known to have ever been present in the region of the project area.



Memorandum

Fauna likelihood of occurrence assessment

Species	Common name	EPBC Act Conservation status	Description / habitat	Likelihood of occurrence within the Project area
Birds				
<i>Botaurus poeciloptilus</i>	Australasian Bittern	Endangered	The Australasian Bittern population can be divided into two sub-populations, the south-eastern and south-western sub-populations. The south-western sub population in WA likely only occurs on the western coastal plain between Lancelin and Busselton, where it prefers freshwater wetlands with tall dense vegetation (TSSC 2019a).	Unlikely The species mainly occurs further south in southwest WA. A waterbird survey undertaken identified that there was a lack of suitable habitat available for many waterbird species within the Project area (RPS 2019 as cited in ELA 2020). This species is therefore considered unlikely to occur.
<i>Calidris ferruginea</i>	Curlw Sandpiper	Critically Endangered, Migratory, Marine	Curlw Sandpipers generally occur around the coasts but are also quite widespread inland. Records occur in all states during the non-breeding period, and also during the breeding season when many non-breeding birds remain in Australia rather than migrating north. The species generally inhabits intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons (DAWE 2020b).	Unlikely There is no suitable habitat for this species within the Project area, and the species generally occurs further south in WA.
<i>Calyptrorhynchus banksii naso</i>	Forest Red-tailed Black-Cockatoo, Karrak	Vulnerable	The Forest Red-tailed Black Cockatoo is found in southwest WA with populations extending north to Perth and east to Wundowie, Mount Helena, Christmas Tree Well, North Bannister, Mount Saddleback, Rocky Gully and the upper King River (SEWPAC 2012). Forest Red-tailed Black Cockatoo foraging habitat includes Jarrah and Marri woodlands and forests, but the species will also feed on she-oak and introduced Cape Lilac.	Recorded Forest Red-tailed Black Cockatoo were recorded foraging within the Project area during the ELA (2020) survey in both Stage 1 and Stage 2 of the Project area and have been observed on numerous occasions during previous fauna surveys (Terrestrial Ecosystems 2018, AECOM 2016, Coffey 2015a as cited in ELA 2020). There are also numerous records of the species in proximity to the Project area (DBCA 2019b as cited in ELA 2020). Suitable habitat for the species occurs within the Paddocks with

Memorandum

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<i>Calyptorhynchus baudinii</i>	Baudin's Cockatoo, Long-billed Black-Cockatoo	Endangered	Baudin's Cockatoo is found in southwest WA with populations extending from Albany northward to Gidgegannup and Mundaring (east of Perth), and inland to the Stirling Ranges and near Kojonup (DAWE 2020, SEWPAC 2012). Baudin's Cockatoo foraging habitat includes Eucalyptus and/or Corymbia woodlands and forests and proteaceous woodland and heath (SEWPAC 2012).	<i>Eucalyptus/Corymbia</i> and Mixed <i>Eucalyptus/Corymbia</i> Woodland habitats. Unlikely There are a few records of Baudin's Cockatoo in proximity to Stage 1 and Stage 2 of the Project Area, but no records within the Project Area itself. The species may infrequently be seen foraging in proximity to Part 2 of the Study Area but would typically return to the hills to roost at night. They are highly unlikely to breed, roost or depend upon any habitats within the Project Area (ELA 2020). They are unlikely to occur in Stage 1 of the Project area given the lack of records and highly fragmented nature of the vegetation available.
<i>Calyptorhynchus latirostris</i>	Carnaby's Cockatoo, Short-billed Black-Cockatoo	Endangered	Carnaby's Cockatoo is endemic to southwest WA with populations extending from the Murchison River to Esperance, and inland to Coorow, Kellerberrin and Lake Cronin (DAWE 2020b, SEWPAC 2012). Foraging habitat for this species includes native shrubland, kwongan heathland and woodland dominated by proteaceous plant species including Banksia, Hakea and Grevillea, Eucalypt and Corymbia woodlands and pine plantations (SEWPAC 2012).	Recorded Carnaby's Cockatoo has been observed within Wotton Reserve in Stage 1 of the Project, as well as a number of other locations either within the Project area or in close proximity (i.e. 50% of individual fauna records provided from the DBCA database search undertaken by ELA (2020) were Carnaby's Cockatoo). Suitable foraging and potential breeding and roosting habitat occurs within both Stages 1 and 2 of the Project. The species was also observed foraging during the ELA (2020) survey in Stage 2 of the Project, near Ellenbrook, and has previously been observed foraging and flying over the Project in various locations including Stage 1 and Stage 2 (Terrestrial



Memorandum

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<i>Leipoa ocellata</i>	Malleefowl	Vulnerable	The Malleefowl is found in semi-arid to arid shrublands and low woodlands, especially those dominated by mallee and/or acacias (DAWE 2020b). In WA, malleefowl are most commonly seen in reserves and private property within and around the Wheatbelt region. Conservation areas where they are known to occur include the areas surrounding Dryandra State Forest, Fitzgerald River National Park, Stirling Range National Park, Kalbarri National Park, Mount Manning – Helena and Aurora Ranges Conservation Park. (DBCA 2019).	Ecosystems 2018, Coffey 2015a; DBCA 2019 as cited in ELA 2020). Highly unlikely This species has had local extinctions in southwest WA and remaining range is highly fragmented due to extensive land clearing. This species is locally extinct from the Swan Coastal Plain.
<i>Rostratula australis</i>	Australian Painted Snipe	Endangered	The Australian Painted Snipe has been recorded at wetlands in all states of Australia, however it is most common in eastern Australia. This species generally inhabits shallow terrestrial freshwater wetlands, including temporary and permanent lakes, swamps and claypans, sometimes utilising areas that are lined with trees, or that have some scattered fallen or washed-up timber (DAWE 2020b).	Unlikely Australian Painted Snipe are most common in Eastern Australia and are rarely recorded in Western Australia. The species is considered unlikely to occur anywhere in the Project area.
<i>Apus pacificus</i>	Fork-tailed Swift	Migratory	The Fork-tailed Swift is a non-breeding visitor to all states and territories of Australia. In Western Australia there are widespread but scattered records of the Fork-tailed Swift along much of the coastline, with some sparsely scattered inland records, especially in the Wheatbelt. They are almost exclusively aerial, and are most commonly found over inland	Unlikely This species is predominantly an aerial species and does not rely on terrestrial habitats. It may occasionally be seen foraging over the Project area but is unlikely to solely rely on any of the habitats present.

Memorandum

Species	Common name	EPBC Act Conservation status	Description / habitat	Likelihood of occurrence within the Project area
<i>Actitis hypoleucos</i>	Common Sandpiper	Migratory, Marine	plains, but sometimes above foothills or in coastal areas (DAWE 2020b). The Common Sandpiper is found along all coastlines of Australia and in many areas inland, and is widespread in small numbers. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores. It has been recorded in estuaries and deltas of streams, as well as on banks farther upstream; around lakes, pools, billabongs, reservoirs, dams and claypans, and occasionally piers and jetties (DAWE 2020b).	Unlikely Since this species predominately utilise coastal and inland wetlands, and there are no wetlands located within the Project area, it is unlikely for the Common Sandpiper to rely on any of the habitats present.
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	Migratory, Marine	The Sharp-tailed Sandpiper spends the non-breeding season in Australia. Most of the population migrates to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. In Western Australia there are widespread but scattered records of the species along much of the coastline, with inland records from Newman, east to Lake Cohen, south to Boulder and west to Meekatharra (DAWE 2020b).	Unlikely Since this species predominately utilises coastal and inland freshwater and saline habitats, and there are no wetlands located within the Project area, it is unlikely for the Sharp-tailed Sandpiper to rely on any of the habitats present.
<i>Calidris melanotos</i>	Pectoral Sandpiper	Migratory, Marine	The Pectoral Sandpiper prefers shallow fresh to saline wetlands. The species is usually found in coastal or near coastal habitat but occasionally found further inland. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands (DAWE 2020b).	Unlikely This species has been rarely recorded in WA and recorded in locations not in the vicinity of the Project area. In addition, since there are no wetlands located within the Project area, it is unlikely for the Pectoral Sandpiper to rely on any of the habitats present.



Memorandum

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<i>Pandion haliaetus</i>	Osprey	Migratory, Marine	Ospreys occur in littoral and coastal habitats and terrestrial wetlands of tropical and temperate Australia and offshore islands. They are mostly found in coastal areas but occasionally travel inland along major rivers, particularly in northern Australia. They may occur over atypical habitats such as heath, woodland or forest when travelling to and from foraging sites (DAWE 2020b).	Unlikely This species may occasionally be seen travelling over the Project area travelling to and from foraging sites, but is unlikely to solely rely on any of the habitats present. This species relies on coastal and wetland habitats, while no wetlands occur in the Project area.
<i>Tringa nebularia</i>	Common Greenshank	Migratory, Marine	The Common Greenshank is a wader species that occurs in a variety of coastal and inland wetlands. In WA, it occurs around most of the coast from Cape Arid in the south to Carnarvon in the north-west and has the widest distribution of any shorebird in Australia. The species spends the non-breeding season in Australia but migrates north to breed (DAWE 2020b).	Unlikely The species is known to occur nearby at Lake Gnangara (~7 km west). However, a waterbird survey identified that there was a lack of suitable habitat available for many waterbird species within the Project area (Terrestrial Ecosystems 2019 as cited in ELA 2020). This species is therefore considered unlikely to occur.
Insects				
<i>Hesperocolletes douglasi</i>	Douglas' Broad-headed Bee, Rottnest Bee	Critically Endangered	The Douglas' Broad-headed Bee is presumed extinct on Rottnest Island. A population is known to exist in one location in Pinjar WA in an area of Banksia woodland TEC, as a female bee was discovered in a survey in 2015. The geographic range, however, is unknown (TSSC 2019b).	Highly unlikely Due to the distance of Pinjar (approximately 26 km) from the Project area and the lack of Banksia woodland TEC present within the Project area (GHD 2019; GHD 2020a), it is unlikely that the species would rely on habitat in the Project area.
Mammals				
<i>Bettongia penicillata ogilbyi</i>	Woylie	Endangered	Woylies prefer patches of dense undergrowth with a continuous canopy that provide refuges against introduced predators. Scattered Woylie populations may be found throughout	Unlikely There is a translocated population of Woylie within Whiteman Park (AECOM 2016, DEC 2012a as cited in ELA 2020), which occurs within 1 km of the Project area. These

Memorandum

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			the jarrah forest in the south-west corner of Western Australia (DEC 2012a).	individuals occur within a protected zone/fenced area within Whiteman Park. The species is considered unlikely to occur within the Project area itself given the lack of suitable, contiguous habitat and lack of recent (wild) records.
<i>Dasyurus geoffroyi</i>	Chuditch, Western Quoll	Vulnerable	Chuditch currently only occurs in areas dominated by sclerophyll forest or drier woodland, heath and mallee shrubland and require adequate numbers of suitable den and refuge sites and sufficient prey biomass to survive (DEC 2012b). The majority of records are found in the contiguous Jarrah forests of the south west of Western Australia.	Highly unlikely There are no known established populations of Chuditch within the Greater Perth metropolitan area. There is also a lack of suitable habitat for this species within the Project area itself and so the species is considered highly unlikely to occur.
<i>Pseudocheirus occidentalis</i>	Western Ringtail Possum	Critically Endangered	The Western Ringtail Possum occurs in the southwest of WA where it inhabits the peppermint woodlands and peppermint/tuart forests on the southern extremity of the Swan Coastal Plain (DPaW 2017).	Highly unlikely The Project area occurs outside the known distribution of this species.