6 Appendices

Appendix 1. Explanation of fauna values.

Fauna values are the features of a site and its fauna that contribute to biodiversity, and it is these values that are potentially at threat from a development proposal. Fauna values can be examined under the five headings outlined below. It must be stressed that these values are interdependent and should not be considered equal, but contribute to an understanding of the biodiversity of a site. Understanding fauna values provides opportunities to predict and therefore mitigate impacts.

Assemblage characteristics

Uniqueness. This refers to the combination of species present at a site. For example, a site may support an unusual assemblage that has elements from adjacent biogeographic zones, it may have species present or absent that might be otherwise expected, or it may have an assemblage that is typical of a very large region. For the purposes of impact assessment, an unusual assemblage has greater value for biodiversity than a typical assemblage.

Completeness. An assemblage may be complete (i.e. has all the species that would have been present at the time of European settlement), or it may have lost species due to a variety of factors. Note that a complete assemblage, such as on an island, may have fewer species than an incomplete assemblage (such as in a species-rich but degraded site on the mainland).

Richness. This is a measure of the number of species at a site. At a simple level, a species rich site is more valuable than a species poor site, but value is also determined, for example, by the sorts of species present.

Vegetation/substrate associations (VSAs)

VSAs combine broad vegetation types, the soils or other substrate with which they are associated, and the landform. In the context of fauna assessment, VSAs are the environments that provide habitats for fauna. The term habitat is widely used in this context, but by definition an animal's habitat is the environment that it utilises (Calver *et al.* 2009), not the environment as a whole. Habitat is a function of the animal and its ecology, rather than being a function of the environment. For example, a species may occur in eucalypt canopy or in leaf-litter on sand, and that habitat may be found in only one or in several VSAs. VSAs are not the same as vegetation types since these may not incorporate soil and landform, and recognise floristics to a degree that VSAs do not. Vegetation types may also not recognise minor but often significant (for fauna) structural differences in the environment. VSAs also do not necessarily correspond with soil types, but may reflect some of these elements.

Because VSAs provide the habitat for fauna, they are important in determining assemblage characteristics. For the purposes of impact assessment, VSAs can also provide a surrogate for detailed information on the fauna assemblage. For example, rare, relict or restricted VSAs should automatically be considered a significant fauna value. Impacts may be significant if the VSA is rare, a large proportion of the VSA is affected and/or the VSA supports significant fauna. The disturbance of even small amounts of habitat in a localised area can have significant impacts to fauna if rare or unusual habitats are disturbed.

Patterns of biodiversity across the landscape

This fauna value relates to how the assemblage is organised across the landscape. Generally, the fauna assemblage is not distributed evenly across the landscape or even within one VSA. There may be zones of high biodiversity such as particular environments or ecotones (transitions between VSAs). There may also be zones of low biodiversity. Impacts may be significant if a wide range of species is affected even if most of those species are not significant per se.

Species of conservation significance

Species of conservation significance are of special importance in impact assessment. The conservation status of fauna species in Australia is assessed under Commonwealth and State Acts such as the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Western Australian *Biodiversity Conservation Act 2016* (BC Act). In addition, the Western Australian Department of Biodiversity, Conservation and Attractions (DBCA) recognises priority levels, while local populations of some species may be significant even if the species as a whole has no formal recognition. Therefore, two broad levels of conservation significance can be recognised and are used for the purposes of this report, and are outlined below. A full description of the conservation significance categories, schedules and priority levels mentioned below is provided in Appendix 2.

Conservation Significance (CS) 1: Species listed under State or Commonwealth Acts.

Species listed under the EPBC Act are assigned to categories recommended by the International Union for the Conservation of Nature and Natural Resources (IUCN), or are listed as migratory. Migratory species are recognised under international treaties such as the China Australia Migratory Bird Agreement (CAMBA), the Japan Australia Migratory Bird Agreement (JAMBA), the Republic of South Korea Australia Migratory Bird Agreement (ROKAMBA), and/or the Convention on the Conservation of Migratory Species of Wild Animals (CMS; also referred to as the Bonn Convention). The BC Act uses a series of Schedules to classify status, but also recognizes the IUCN categories and ranks species within the Schedules using the categories of IUCN (2012).

Conservation Significance (CS) 2: Species listed as Priority by the DBCA but not listed under State or Commonwealth Acts.

In Western Australia, the DBCA has produced a supplementary list of Priority Fauna, being species that are not considered threatened under the BC Act but for which the DBCA feels there is cause for concern. Some Priority species are also assigned to the Conservation Dependent category of the IUCN.

Invertebrates

Invertebrate species considered to be short range endemics (SREs) often have no legislative or published recognition and their significance is based on interpretation of distribution information. Harvey (2002) notes that the majority of species that have been classified as short-range endemics have common life history characteristics such as poor powers of dispersal or confinement to discontinuous habitats. Several groups, therefore, have particularly high instances of short-range endemic species: Gastropoda (snails and slugs), Oligochaeta (earthworms), Onychophora (velvet worms), Araneae (mygalomorph spiders), Pseudoscorpionida (pseudoscorpions), Schizomida (schizomids), Diplopoda (millipedes), Phreatoicidea (phreatoicidean crustaceans), and Decapoda

(freshwater crayfish). The poor understanding of the taxonomy of many of the short-range endemic species hinders their conservation (Harvey 2002).

Introduced species

In addition to these conservation levels, species that have been introduced (INT) are indicated throughout the report. Introduced species may be important to the native fauna assemblage through effects by predation and/or competition.

Ecological processes upon which the fauna depend

These are the processes that affect and maintain fauna populations in an area and as such are very complex; for example, populations are maintained through the dynamic of mortality, survival and recruitment being more or less in balance, and these are affected by a myriad of factors. The dynamics of fauna populations in a project may be affected by processes such as fire regime, landscape patterns (such as fragmentation and/or linkage), the presence of feral species and hydrology. Impacts may be significant if processes are altered such that fauna populations are adversely affected, resulting in declines and even localised loss of species. Threatening processes as outlined in Appendix 3 are effectively the ecological processes that can be altered to result in impacts upon fauna.

Appendix 2. Categories used in the assessment of conservation status.

IUCN categories (based IUCN 2012) as used for the *Environment Protection and Biodiversity Conservation Act 1999* and the Western Australian *Biodiversity Conservation Act 2016*.

Extinct	Taxa not definitely located in the wild during the past 50 years.
Extinct in the Wild (Ex)	Taxa known to survive only in captivity.
Critically Endangered (CR)	Taxa facing an extremely high risk of extinction in the wild in the immediate future.
Endangered (E)	Taxa facing a very high risk of extinction in the wild in the near future.
Vulnerable (V)	Taxa facing a high risk of extinction in the wild in the medium-term future.
Near Threatened	Taxa that risk becoming Vulnerable in the wild.
Conservation Dependent	Taxa whose survival depends upon ongoing conservation measures. Without these measures, a conservation dependent taxon would be classed as Vulnerable or more severely threatened.
Data Deficient (Insufficiently Known)	Taxa suspected of being Rare, Vulnerable or Endangered, but whose true status cannot be determined without more information.
Least Concern.	Taxa that are not Threatened.

Schedules used in the WA *Biodiversity Conservation Act 2016*

Schedule 1 (S1)	Critically Endangered fauna.
Schedule 2 (S2)	Endangered fauna
Schedule 3 (S3)	Vulnerable Migratory species listed under international treaties.
Schedule 4 (S4)	Presumed extinct fauna
Schedule 5 (S5)	Migratory birds under international agreement
Schedule 6 (S6)	Conservation dependant fauna
Schedule 7 (S7)	Other specially protected fauna

WA DBCA Priority species (species not listed under the *WA Biodiversity Conservation Act 2016*, but for which there is some concern).

Priority 1 (P1)	Taxa with few, poorly known populations on threatened lands.
Priority 2 (P2)	Taxa with few, poorly known populations on conservation lands; or taxa with several, poorly known populations not on conservation lands.
Priority 3 (P3)	Taxa with several, poorly known populations, some on conservation lands.
Priority 4. (P4)	Taxa in need of monitoring. Taxa which are considered to have been adequately surveyed, or for which sufficient knowledge is available, and which are considered not currently threatened or in need of special protection, but could be if present circumstances change.
Priority 5 (P5)	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years (IUCN Conservation Dependent).

Appendix 3. Explanation of threatening processes.

Potential impacts of proposed developments upon fauna values can be related to threatening processes. This is recognised in the literature (e.g. Gleeson and Gleeson 2012) and under the EPBC Act, in which threatening processes are listed. Processes that may impact fauna values are discussed below. Rather than being independent of one another, processes are complex and often interrelated. They are the mechanisms by which fauna can be affected by development. Impacts may be significant if large numbers of species or large proportions of populations are affected.

Note that the terms direct and indirect impacts are used by the DotE (2013), SEWPaC (2013) and EPA (2016), but there is some inconsistency in how these are defined. The federal guidance does not define direct impact but has a very broad definition of indirect, and makes the statement (DotE 2013) '*Consideration should be given to all adverse impacts that could reasonably be predicted to follow from the action, whether these impacts are within the control of the person proposing to take the action or not. Indirect impacts will be relevant where they are sufficiently close to the proposed action to be said to be a consequence of the action, and they can reasonably be imputed to be within the contemplation of the person proposing to take the action*.' Indirect impacts therefore can even include what the DotE (2013) calls facilitated impacts, which are the result of third party actions triggered by the primary action. In contrast, the EPA (2016) defines direct impacts to '*include the removal, fragmentation or modification of habitat, and mortality or displacement of individuals or populations.*' This document then lists as indirect impacts what in many cases are the consequences of the removal, fragmentation or modification of habitat. For example, '*disruption of the dispersal of individuals required to colonise new areas inhibiting maintenance of genetic diversity between populations'* is a consequence of habitat fragmentation. Impacts of light, noise and even roadkill are defined as indirect but they are clearly the result of the action and in control of the person taking the action. Roadkill is as direct a form of mortality as can be observed, but it is considered as an indirect impact in the context of a development presumably because it is not directly linked to land clearing. The EPA (2016) makes a strong distinction between removal of vegetation (direct impact) and the consequences of such clearing and other aspects of a development (indirect impacts). It is not obvious how this distinction between direct and indirect impacts is helpful in the EIA process, as the key aim is to ensure that all impacts that result from a project are addressed in this assessment process. Interestingly, Gleeson and Gleeson (2012), in a major review of impacts of development on wildlife, do not use the terms direct or indirect. In the following outlines of threatening processes that can cause impacts, the emphasis is upon interpreting how a threatening process will cause an impact. For example, loss of habitat (threatening process) can lead to population decline and to population fragmentation, which are two distinct impacts, with population decline considered a direct impact and fragmentation an indirect impact by the EPA (2016).

Loss of habitat affecting population survival

Clearing for a development can lead to habitat loss for a species with a consequent decline in population size. This may be significant if the smaller population has reduced viability. Conservation significant species or species that already occur at low densities may be particularly sensitive to habitat loss affecting population survival.

Loss of habitat leading to population fragmentation

Loss of habitat can affect population movements by limiting movement of individuals throughout the landscape as a result of fragmentation (Gleeson and Gleeson 2012, Soule *et al.* 2004). Obstructions associated with the development, such as roads, pipes and drainage channels, may also affect movement of small, terrestrial species. Fragmented populations may not be sustainable and may be sensitive to effects such as reduced gene flow.

Degradation of habitat due to weed invasion leading to population decline

Weed invasion, such as through introduction by human boots or vehicle tyres, can occur as a result of development and if this alters habitat quality, can lead to effects similar to habitat loss.

Increased mortality

Increased mortality can occur during project operations; for example, roadkill, animals striking infrastructure, and entrapment in trenches. Roadkill as a cause of population decline has been documented for several medium-sized mammals in eastern Australia (Dufty 1989; Jones 2000). Increased mortality due to roadkill is often more prevalent in habitats that have been fragmented (Scheick and Jones 1999; Clevenger and Waltho 2000; Jackson and Griffin 2000).

Increased mortality of common species during development is unavoidable and may not be significant for a population. However, the cumulative impacts of increased mortality of conservation significant species or species that already occur at low densities may have a significant impact on the population.

Species interactions, including predation and competition

Changes in species interactions often occur with development. Introduced species, including the feral Cat, Red Fox and Rabbit, may have adverse impacts upon native species and development can alter their abundance. In particular, some mammal species are very sensitive to introduced predators and the decline of many mammals in Australia has been linked to predation by the Red Fox, and to a lesser extent, the feral Cat (Burbidge and McKenzie 1989). Introduced grazing species, such as the Rabbit, Goat, Camel and domestic livestock, can also degrade habitats and deplete vegetation that may be a food source for other species.

Changes in the abundance of some native species at the expense of others, due to the provision of fresh watering points, can also be a concern. Harrington (2002) found the presence of artificial fresh waterpoints in the semi-arid mallee rangelands to influence the abundance and distribution of certain bird species. Common, water-dependent birds were found to out-compete some less common, water-independent species. Over-abundant native herbivores, such as kangaroos, can also adversely affect less abundant native species through competition and displacement.

Hydroecology

Interruptions of hydroecological processes can have major effects because they underpin primary production in ecosystems and there are specific, generally rare habitats that are hydrology-dependent. Fauna may be impacted by potential changes to groundwater level and chemistry and altered flow regime. These changes may alter vegetation across large areas and may lead to habitat degradation or loss. Impacts upon fauna can be widespread and major. Changes to flow regime across the landscape may alter vegetation and may lead to habitat degradation or loss, affecting

fauna. For example, Mulga has a shallow root system and relies on surface sheet flow during flood events. If surface sheet flow is impeded, Mulga can die (Kofoed 1998), which may impact on a range of fauna associated with this vegetation type.

Fire

The role of fire in the Australian environment and its importance to vertebrate fauna has been widely acknowledged (Gill *et al.* 1981; Fox 1982; Letnic *et al.* 2004). It is also one of the factors that has contributed to the decline and local extinction of some mammal and bird species (Burbidge and McKenzie 1989). Fire is a natural feature of the environment but frequent, extensive fires may adversely impact some fauna, particularly mammals and short-range endemic species. Changes in fire regime, whether to more frequent or less frequent fires, may be significant to some fauna. Impacts of severe fire may be devastating to species already occurring at low densities or to species requiring long unburnt habitats to survive. In terms of conservation management, it is not fire *per se* but the fire regime that is important, with evidence that infrequent, extensive and intense fires adversely affect biodiversity, whereas frequent fires that cover small areas and are variable in both season and intensity can enhance biodiversity. Fire management may be considered the responsibility of managers of large tracts of land, including managers of mining tenements.

Dust, light, noise and vibration

Impacts of dust, light, noise and vibration upon fauna are difficult to predict. Some studies have demonstrated the impact of artificial night lighting on fauna, with lighting affecting fauna behaviour more than noise (Rich and Longcore 2006). Effects can include impacts on predator-prey interactions, changes to mating and nesting behaviour, and increased competition and predation within and between invertebrates, frogs, birds and mammals.

The death of very large numbers of insects has been observed around some remote mine sites and attracts other fauna, notably native and introduced predators (M. Bamford, pers. obs). The abundance of some insects can decline due to mortality around lights, although this has previously been recorded in fragmented landscapes where populations are already under stress (Rich and Longcore 2006). Artificial night lighting may also lead to disorientation of migratory birds. Aquatic habitats and open habitats such as grasslands and dunes may be vulnerable to light spill.

Appendix 4. Ecological and threatening processes identified under legislation and in the literature.

Ecological processes are processes that maintain ecosystems and biodiversity. They are important for the assessment of impacts of development proposals, because ecological processes make ecosystems sensitive to change. The issue of ecological processes, impacts and conservation of biodiversity has an extensive literature. Following are examples of the sorts of ecological processes that need to be considered.

Ecological processes relevant to the conservation of biodiversity in Australia (Soule *et al.* 2004):

- Critical species interactions (highly interactive species);
- Long distance biological movement;
- Disturbance at local and regional scales;
- Global climate change;
- Hydroecology;
- Coastal zone fluxes;
- Spatially-dependent evolutionary processes (range expansion and gene flow); and
- Geographic and temporal variation of plant productivity across Australia.

Threatening processes (EPBC Act)

Under the EPBC Act, a key threatening process is an ecological interaction that threatens or may threaten the survival, abundance or evolutionary development of a threatened species or ecological community. There are currently 20 key threatening processes listed by the federal Department of the Environment (DotE 2014b):

- Competition and land degradation by rabbits.
- Competition and land degradation by unmanaged goats.
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*).
- Incidental catch (bycatch) of Sea Turtle during coastal otter-trawling operations within Australian waters north of 28 degrees South.
- Incidental catch (or bycatch) of seabirds during oceanic longline fishing operations.
- Infection of amphibians with chytrid fungus resulting in chytridiomycosis.
- Injury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris.
- Invasion of northern Australia by Gamba Grass and other introduced grasses.
- Land clearance.
- Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants.
- Loss of biodiversity and ecosystem integrity following invasion by the Yellow Crazy Ant (*Anoplolepis gracilipes*) on Christmas Island, Indian Ocean.
- Loss of climatic habitat caused by anthropogenic emissions of greenhouse gases.
- Novel biota and their impact on biodiversity.
- Predation by European red fox.
- Predation by exotic rats on Australian offshore islands of less than 1000 km^2 (100,000 ha).
- Predation by feral cats.
- Predation, Habitat Degradation, Competition and Disease Transmission by Feral Pigs.
- Psittacine Circoviral (beak and feather) Disease affecting endangered psittacine species.
- The biological effects, including lethal toxic ingestion, caused by Cane Toads (*Bufo marinus*).
- The reduction in the biodiversity of Australian native fauna and flora due to the red imported fire ant, *Solenopsis invicta* (fire ant).

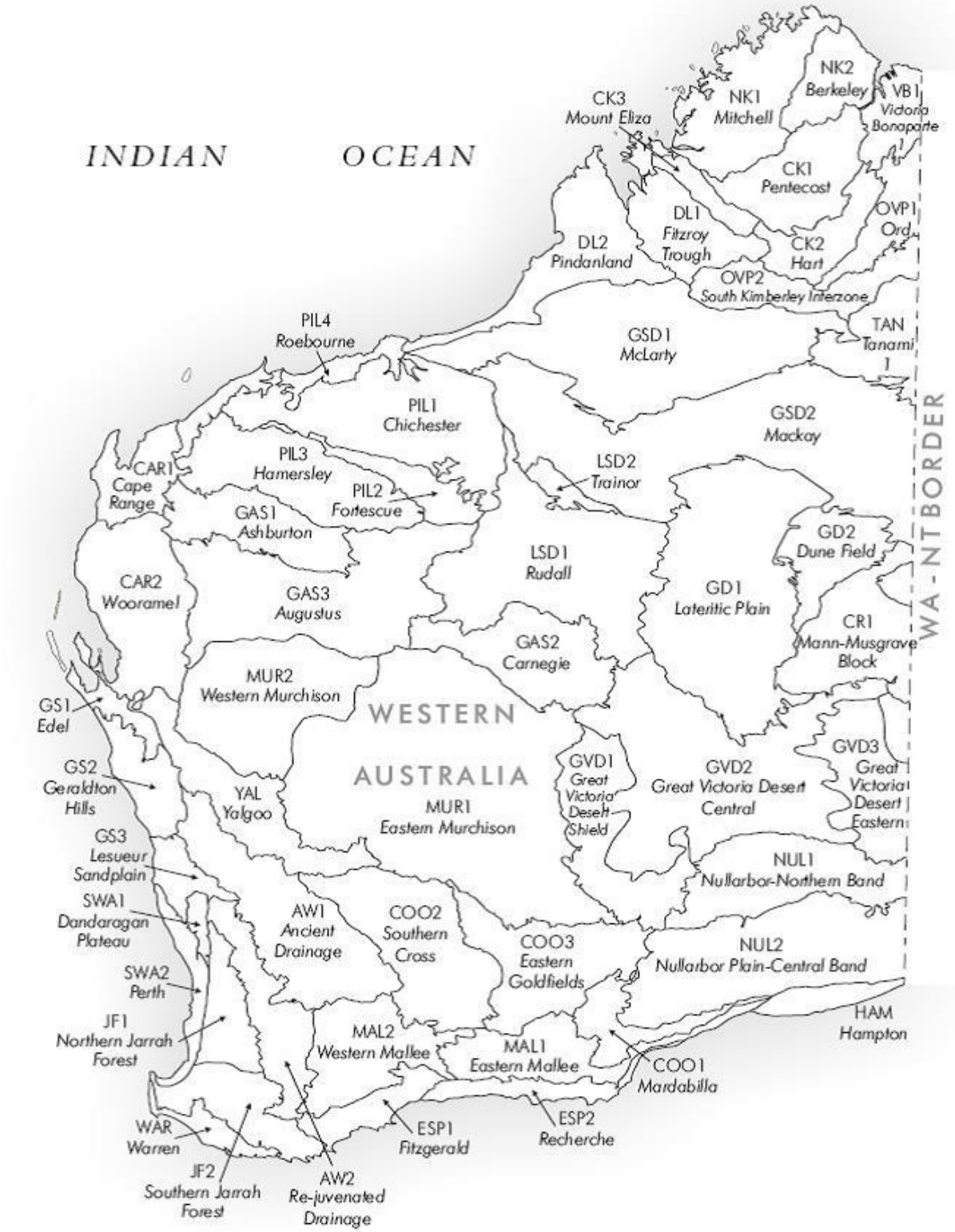
General processes that threaten biodiversity across Australia (The National Land and Water Resources Audit):

- Vegetation clearing;
- Increasing fragmentation, loss of remnants and lack of recruitment;
- Firewood collection;
- Grazing pressure;
- Feral animals;
- Exotic weeds;
- Changed fire regimes;
- Pathogens;
- Changed hydrology—dryland salinity and salt water intrusion;
- Changed hydrology— such as altered flow regimes affecting riparian vegetation; and
- Pollution.

In addition to the above processes, DSEWPaC (now DoEE) produced Significant Impact Guidelines that provide criteria for the assessment of the significance of impacts. These criteria provide a framework for the assessment of significant impacts. The criteria are listed below.

- Will the proposed action lead to a long-term decrease in the size of a population?
- Will the proposed action reduce the area of occupancy of the species?
- Will the proposed action fragment an existing population?
- Will the proposed action adversely affect habitat critical to the survival of a species?
- Will the proposed action disrupt the breeding cycle of a population?
- Will the proposed action modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline?
- Will the proposed action result in introducing invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat?
- Will the proposed action introduce disease that may cause the species to decline?
- Will the proposed action interfere with the recovery of the species?

Appendix 5. Interim Biogeographic Regionalisation of Australia (IBRA) Subregions in Western Australia.



Appendix 6. Scoring system for the assessment of foraging value of vegetation for black-cockatoos. Revised 18th June 2019.

Bamford Consulting Ecologists

Introduction

Application of the Offset Assessment Guide (offsets guide) developed by the federal environment department for assessing black-cockatoo foraging habitat requires the calculation of a score out of 10. The following system has been developed by Bamford Consulting to provide an objective scoring system that is practical and can be used by trained field zoologists with experience in the environments frequented by the species.

Calculating the total score (out of 10) requires the following steps:

A Determining a score out of six for the vegetation composition, condition and structure; plus

B Determining a score out of three for the context of the site; plus

C Determining a score out of one for species density.

D Determining the total score out of 10, which may require moderation for context and species density with respect to the vegetation composition. This includes consideration of pine plantations as a special case for foraging value.

Calculation of scores and the moderation process are described in detail below.

A. Vegetation composition, condition and structure scoring

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
0	No foraging value. No Proteaceae, eucalypts or other potential sources of food. Examples: • Water bodies (e.g. salt lakes, dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).	No foraging value. No eucalypts or other potential sources of food. Examples: • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).	No foraging value. No eucalypts or other potential sources of food. Examples: • Water bodies (e.g. dams, rivers); • Bare ground; • Developed sites devoid of vegetation (e.g. infrastructure, roads, gravel pits).
1	Negligible to low foraging value. Examples: • Scattered specimens of known food plants but projected foliage cover of these is < 2%. This could include urban areas with scattered foraging trees; • Paddocks that are partly vegetated with melons or other known food-source weeds (e.g. *Erodium* spp.) that represent a short-term and/or seasonal food source; • Blue Gum plantations (foraging by Carnaby's Black-Cockatoos has been reported but appears to be unusual).	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. This could include urban areas with scattered foraging trees.	Negligible to low foraging value. Scattered specimens of known food plants but projected foliage cover of these < 1%. Could include urban areas with scattered foraging trees.

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
2	Low foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, have < 10% projected foliage cover; • Woodland with tree banksias 2-5% projected foliage cover; • Open eucalypt woodland/mallee of small-fruited species; • Paddocks that are densely vegetated with melons or other known food-source weeds (e.g. *Erodium* spp.) that represent a short-term and/or seasonal food source.	Low foraging value. Examples: • Woodland with scattered specimens of known food plants (e.g. Marri and Jarrah) 1-5% projected foliage cover; • Urban areas with scattered foraging trees.	Low foraging value. Examples: • Woodland with scattered specimens of known food plants (e.g. Marri, Jarrah or Sheoak) 1-5% projected foliage cover; • Urban areas with scattered food plants such as Cape Lilac, *Eucalyptus caesia* and *E. erythrocorys*.
3	Low to Moderate foraging value. Examples: • Shrubland in which species of foraging value, such as shrubby banksias, have 10-20% projected foliage cover; • Woodland with tree banksias 5-20% projected foliage cover; • Eucalypt Woodland/Mallee of small-fruited species; • Eucalypt Woodland with Marri < 10% projected foliage cover.	Low to Moderate foraging value. Examples: • Eucalypt Woodland with known food plants (especially Marri) 5-20% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).	Low to Moderate foraging value. Examples: • Eucalypt Woodland with known food plants (especially Marri and Jarrah) 5-20% projected foliage cover; • Parkland-cleared Eucalypt Woodland/Forest with known food plants 10-40% projected foliage cover (poor long-term viability without management); • Younger areas of (managed) revegetation with known food plants 10-40% projected foliage cover (establishing food sources with good long-term viability).

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
4	Moderate foraging value. Examples: • Woodland/forest with tree banksias 20-40% projected foliage cover; • Eucalypt Woodland/Forest with Marri 20-40% projected foliage cover.	Moderate foraging value. Examples: • Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths. • Eucalypt Woodland/Forest with diverse, healthy understorey and known food trees (especially Marri) 10-20% projected foliage cover. • Orchards with highly desirable food sources (e.g. apples, pears, some stone fruits).	Moderate foraging value. Examples: • Marri-Jarrah Woodland/Forest with 20-40% projected foliage cover; • Marri-Jarrah Forest with 40-60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Sheoak Forest with 40-60% projected foliage cover.
5	Moderate to High foraging value. Examples: • Banksia Forest with 40-60% projected foliage cover; • Banksia Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths; • Pine plantations with trees more than 10 years old (but see pine note below in moderation section).	Moderate to High foraging value. Examples: • Marri-Jarrah Forest with 40-60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths.	Moderate to High foraging value. Examples: • Marri-Jarrah Forest with 40-60% projected foliage cover; • Marri-Jarrah Forest with > 60% projected foliage cover but vegetation condition reduced due to weed invasion and/or some tree deaths. • Sheoak Forest with > 60% projected foliage cover.

Site Score	Description of Vegetation Values		
	Carnaby's Black-Cockatoo	**Baudin's Black-Cockatoo**	**Forest Red-tailed Black-Cockatoo**
6	High foraging value. Example: • Banksia Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).	High foraging value. Example: • Marri-Jarrah Forest with > 60% projected foliage cover and vegetation condition good with low weed invasion and/or low tree deaths (indicating it is robust and unlikely to decline in the medium term).

Vegetation structural class terminology follows Keighery (1994).

B. Site context.

The maximum score is given in situations where foraging habitat is supporting breeding birds. It can also be given in fragmented landscapes where there is little foraging habitat remaining and thus what is left has a high contextual value. The site context score is species-specific as it depends upon factors such as the vegetation type and extent, and the presence of breeding birds, and the following table, developed by Bamford consulting in conjunction with DEE, provides a *guide* to the assignation of site context scores (note that 'local area' is defined as within a 15 km radius of the centre point of the study site):

Site Context Score	Percentage of the existing native vegetation within the 'local' area that the study site represents.	
	'Local' breeding known/likely	'Local' breeding unlikely
3	> 5%	> 10%
2	1 - 5%	5 - 10%
1	0.1 - 1%	1 - 5%
0	< 0.1%	< 0.1%

C. Species density.

Assignation of the species density score (0 or 1) is based upon the black-cockatoo species being either abundant or not abundant, and is species specific. A score of 1 is used where the species is seen or reported regularly and/or there is abundant foraging evidence. Regularly is when the species is seen at intervals of every few days or weeks for at least several months of the year. A score of 0 is used when the species is recorded or reported very infrequently and there is little or no foraging evidence.

Note that context and species density scores are affected by the vegetation score and this is discussed below.

D. Moderation of scores for the calculation of a value out of 10.

The foraging value score provides a numerical value that reflects the significance of vegetation as foraging habitat for Black-Cockatoos, and this numerical value is designed to provide the information needed by the Federal Department of the Environment and Energy (DoEE) to assess impact significance and offset requirements. The foraging value of the vegetation depends upon the type, density and condition of trees and shrubs in an area, and can be influenced by the context such as the availability of foraging habitat nearby. The BCE scoring system for value of foraging habitat has three components as detailed above. These three components are drawn from the DoEE offsets guide but the scoring approach was developed by Bamford Consulting Ecologists.

A A score out of six for the vegetation composition, condition and structure; plus

B A score out of three for the context of the site; plus

C A score out of one for species density.

Foraging value can thus be assigned a score out of six, based upon site vegetation characteristics, or a score out of 10 if context and species density are considered. Assigning a score out of 10 represents step D and may require moderation rather than simple addition.

The score out of six for vegetation characteristics and value can be compared across a site, while a score out of 10 is the overall foraging value and is used for the purposes of aiding offset calculations. The calculation out of 10 requires the vegetation characteristics (out of 6) to be combined with the scores given for context and species density. It is considered that the context and density scores are not independent of vegetation characteristics; otherwise habitat of absolutely no value for black-cockatoo foraging (such as concrete or a wetland) could get a foraging score out of 10 as high as 4 if it occurred in an area where the species breed (context score of 3) and are abundant (species density score of 1). Similarly, vegetation of negligible or low characteristics which could not support black-cockatoos could be assigned a score as high as 6 out of 10. In that case, the score of 6 would be more a reflection of nearby vegetation of high characteristics than of the foraging value of the negligible to low scoring vegetation. The Black-Cockatoos would only be present because of vegetation of high characteristics, so applying the context and species density scores to vegetation of low characteristics would not give a true reflection of their foraging value.

For this reason, the context and species density scores need to be moderated for the vegetation characteristic score to prevent vegetation of little or no foraging value receiving an excessive score out of 10. A simple approach is to assign a context and species density score of zero to sites with a characteristic score of low (2), negligible (1) or none (0), on the basis that birds will not use such areas unless they are adjacent to at least low-moderate quality foraging habitat ($\geq$3). Pine plantations are an exception to this rule (see below). The approach to calculating a score out of 10 can be summarised as follows:

Vegetation composition, condition and structure score	Context score	Species density score
3-6 (low/moderate to high value)	Assessed as per B above	Assessed as per C above
0-2 (no to low value; except pines)	0	0

Pine plantations

Pine plantations are an important foraging resource for Carnaby's Black-Cockatoo (only) but are not directly comparable with native vegetation. In comparing native vegetation with pine plantations for the purpose of calculating offsets, the following should be noted:

- Pine plantations are a commercial crop established with the intention of being harvested and thus have short-term availability (30-50 years), whereas native vegetation is available indefinitely if protected.

- Although pines provide a high abundance of food in the form of seeds, they are a limited food resource compared with native vegetation which provides seeds, insect larvae, flowers and nectar. The value of insect larvae in the diet of Carnaby's Black-Cockatoo has not been quantified, but in the vicinity of Perth, the birds forage very heavily on insect larvae in young cones of *Banksia attenuata* in winter, ignoring the seeds in these cones and seeds in older cones on the same trees (Scott and Black 1981; M. Bamford pers. obs.). This suggests that insect larvae are of high nutritional importance immediately prior to the breeding season.
- Pine plantations have very little biodiversity value other than their importance as a food source for Carnaby's Black-Cockatoos. They inhibit growth of other flora. While this is not a factor for direct consideration with respect to Carnaby's Black-Cockatoo, it is a factor in regional conservation planning of which offsets for the cockatoos are a part.
- Due to the temporary nature of pines as a food source, site context differs between pines and native vegetation.

Taking the above points into consideration, it is possible to assign pine plantations a foraging value as follows:

- Site condition. The actual foraging value of pines is high. Stock *et al.* (2013) report that it takes nearly twice as many seeds of *Pinus pinaster* to meet the daily energy requirements for Carnaby's Black-Cockatoo compared with Marri, and three times as many *P. pinaster* seeds compared with Slender Banksia. However, pines are planted at a high density so the food supply per hectare can be high. Taking account of the lack of variety of food from pines, this suggests a site condition score of 4 or 5 out of 6 (5 is used in Section A above). As a source of food, pines are thus comparable to the best banksia woodland. This site condition score then needs to be adjusted to take account of the short-term nature of the food supply (for pine plantations to be harvested. Where pines are 'ornamental', such as in some urban contexts, they can be treated as with other trees in urban landscapes). The foraging value of a site after pines are harvested will effectively be 0, or possibly 1 if there is some retention. It is proposed that this should approximately halve the site condition score; young pine plantations could be redacted slightly less than old plantations on the basis that a young plantation provides a slightly longer term food supply. If a maximum site condition score of 5 is given, then a young plantation (>10 but <30 years old) could be assigned a score of 3, and an old plantation (>30 years old) could be assigned a score of 2. Plantations <10 years old and thus not producing large quantities of cones could also get a score of 2, but recognising they may increase in value. It also needs to be recognised that pine plantations are of value even if they are old and destined to be harvested in the near future. Therefore, while such a pine plantation might receive a characteristic score of only 2, it would receive a high context and density score reflective of the current value of the vegetation.
- Site context. Although a temporary food source, pines can be very important for Carnaby's Black-Cockatoo in some contexts; they could be said to carry populations in areas where there is little native vegetation. The system for assigning a context score as outlined above (Section B) also applies to pines. Thus, a context score of 3 can be given where pines are a significant

proportion of foraging habitat (>5% if breeding occurs; >10% if no breeding), but where pines are a small part of the foraging landscape they will receive a context score of less than this.

- Species density. As outlined above (Section C), pines will receive a species density score of 1 where Carnaby's Black-Cockatoo are regular visitors.

Based on the above, pine plantations that represent a substantial part of the foraging landscape, such as in the region immediately north of Perth, would receive a total score (out of 10) of 6; young plantations in this area would receive a score of 7. In contrast, isolated and small plantations in rural landscapes could receive a score of just 2 if they are only a small proportion of foraging habitat and Carnaby's Black-Cockatoo are not regularly present.

Appendix 7. Vertebrate fauna expected to occur in the project area.

Status codes:

CS1, CS2, CS3 = (summary) levels of conservation significance. See Appendix 1 for full explanation.
EPBC Act listings: E = Endangered, V = Vulnerable, M = Migratory (see Appendix 2).
Biodiversity Conservation Act 2016 listings: S1 to S7 = Schedules 1 to 7 (see Appendix 2).
DBCA Priority species: P1 to P4 = Priority 1 to 4 (see Appendix 2).
LS = considered to be of local significance by Bamford Consulting Ecologists (see Appendix 1).
Int = introduced species.

Expected Occurrence categories:

See Section 2.2.3 for explanation of expected occurrence categories.

Species marked with a tilde (~) are entirely dependent on wetland areas.

Species	Common Name	Status	Expected Occurrence
Galaxiidae (Galaxiids)			
Galaxias occidentalis ~	Western Minnow		Resident
Gobiidae (Gobies)			
Pseudogobius olorum ~	Blue-spot Goby		Irregular visitor
Poeciliidae (Livebearers)			
Gambusia holbrooki ~	Eastern Mosquitofish	Int	Resident
Hylidae (Tree frogs)			
Litoria adelaidensis ~	Slender Tree Frog		Resident
Litoria moorei ~	Motorbike Frog		Resident
Limnodynastidae (Burrowing frogs)			
Heleioporus albopunctatus	Western Spotted Frog		Resident
Heleioporus eyrei	Moaning Frog		Resident
Heleioporus psammophilus	Sand Frog		Resident
Limnodynastes dorsalis	Western Banjo Frog		Resident

Species	Common Name	Status	Expected Occurrence
Neobatrachus kunapalari	Kunapalari Frog		Resident
Neobatrachus pelobatoides	Humming Frog		Resident
Myobatrachidae (Ground frogs)			
Crinia pseudinsignifera	Bleating Froglet		Resident
Myobatrachus gouldii	Turtle Frog		Resident
Pseudophryne guentheri	Crawling Toadlet		Resident
Cheluidae (Side-necked freshwater tortoises)			
Chelodina steindachneri ~	Flat-shelled Tortoise		Irregular visitor
Carphodactylidae (Carphodactylid geckoes)			
Underwoodisaurus milii	Southern Barking Gecko		Resident
Diplodactylidae (Diplodactylid geckoes)			
Crenadactylus ocellatus	South-western Clawless Gecko		Resident
Diplodactylus ornatus			Resident
Diplodactylus polyophthalmus	Spotted Sandplain Gecko		Resident
Diplodactylus pulcher			Resident
Lucasium alboguttatum			Resident
Lucasium maini			Resident
Strophurus spinigerus spinigerus			Resident
Gekkonidae (Gekkonid geckoes)			
Christinus marmoratus	Marbled Gecko		Resident
Gehyra variegata			Resident
Heteronotia binoei	Bynoe's Gecko		Resident
Pygopodidae (Legless lizards)			

	Species	Common Name	Status	Expected Occurrence
	Aprasia repens			Resident
	Delma concinna concinna			Resident
	Delma fraseri			Resident
	Delma grayii			Resident
	Lialis burtonis	Burton's Legless-Lizard		Resident
	Pletholax gracilis			Resident
	Pygopus lepidopodus	Common Scaly Foot		Resident
Agamidae (Dragons)				
	Ctenophorus adelaidensis	Western Heath Dragon		Resident
	Ctenophorus maculatus maculatus			Resident
	Ctenophorus nuchalis	Central Netted Dragon		Resident
	Ctenophorus reticulatus	Western Netted Dragon		Resident
	Ctenophorus scutulatus			Resident
	Moloch horridus	Thorny Devil		Resident
	Pogona minor minor	Western Bearded Dragon		Resident
Scincidae (Skinks)				
	Cryptoblepharus buchananii	Fence Skink		Resident
	Ctenotus australis			Resident
	Ctenotus fallens			Resident
	Ctenotus impar			Resident
	Ctenotus pantherinus pantherinus			Resident
	Ctenotus schomburgkii			Resident
	Cyclodomorphus celatus			Resident

	Species	Common Name	Status	Expected Occurrence
	Eremiascincus richardsonii	Broad-banded Sand Swimmer		Resident
	Lerista christinae			Resident
	Lerista distinguenda			Resident
	Lerista elegans			Resident
	Lerista gerrardii			Resident
	Lerista kingi			Resident
	Lerista lineopunctulata			Resident
	Lerista planiventralis decora			Resident
	Lerista praepedita			Resident
	Liopholis multiscutata			Resident
	Menetia greyii			Resident
	Morethia obscura			Resident
	Tiliqua occipitalis	Western Bluetongue		Resident
	Tiliqua rugosa rugosa	Bobtail		Resident
Varanidae (Monitors and goannas)				
	Varanus gouldii	Bungarra or Sand Goanna		Resident
	Varanus tristis tristis	Tree Goanna		Resident
Typhlopidae (Blind snakes)				
	Anilios australis			Resident
	Anilios waitii			Resident
Pythonidae (Pythons)				
	Antaresia stimsoni stimsoni	Stimson's Python		Resident
	Aspidites ramsayi	Woma	CS2 (P1)	Locally extinct?

	Species	Common Name	Status	Expected Occurrence
	Morelia spilota imbricata	Carpet Python (southwest)	CS3 (LS)	Resident
Elapidae (Venomous land snakes)				
	Demansia psammophis psammophis	Yellow-faced Whipsnake		Resident
	Echiopsis curta	Bardick		Resident
	Neelaps bimaculatus	Black-naped Snake		Resident
	Neelaps calonotos	Black-striped Snake	CS2 (P3)	Resident
	Parasuta gouldii			Resident
	Parasuta monachus			Resident
	Pseudechis australis	Mulga Snake		Resident
	Pseudonaja mengdeni	Gwardar; Western Brown Snake		Resident
	Pseudonaja modesta	Ringed Brown Snake		Resident
	Simoselaps bertholdi	Jan's Banded Snake		Resident
Casuariidae (Emus and Cassowaries)				
	Dromaius novaehollandiae	Emu		Resident
Megapodidae (mound builders)				
	Leipoa ocellata	Malleefowl	CS1 (V,S3)	Irregular visitor
Anatidae (Ducks, Geese and Swans)				
	Oxyura australis ~	Blue-billed Duck	CS2 (P4)	Irregular visitor
	Malacorhynchus membranaceus ~	Pink-eared Duck		Irregular visitor
	Cygnus atratus ~	Black Swan		Regular visitor
	Aythya australis ~	Hardhead		Irregular visitor
	Spatula rhynchotis ~	Australasian Shoveler		Irregular visitor
	Anas superciliosa ~	Pacific Black Duck		Regular visitor

Species	Common Name	Status	Expected Occurrence
Anas gracilis ~	Grey Teal		Regular visitor
Anas castanea ~	Chestnut Teal		Irregular visitor
Biziura lobata ~	Musk Duck		Irregular visitor
Chenonetta jubata ~	Australian Wood Duck		Regular visitor
Phasianidae (Pheasants and Quail)			
Coturnix pectoralis	Stubble Quail		Resident
Synoicus ypsilophorus	Brown Quail		Vagrant
Podicipedidae (Grebes)			
Tachybaptus novaehollandiae ~	Australasian Grebe		Irregular visitor
Poliocephalus poliocephalus ~	Hoary-headed Grebe		Irregular visitor
Podiceps cristatus ~	Great Crested Grebe		Vagrant
Columbidae (Pigeons and Doves)			
Columba livia	Rock Dove/Feral Pigeon	Int	Vagrant
Spilopelia senegalensis	Laughing Dove	Int	Irregular visitor
Phaps chalcoptera	Common Bronzewing		Resident
Phaps elegans	Brush Bronzewing		Resident
Ocyphaps lophotes	Crested Pigeon		Resident
Geopelia cuneata	Diamond Dove		Vagrant
Geopelia placida	Peaceful Dove		Vagrant
Cuculidae (Cuckoos)			
Chalcites basalis	Horsfield's Bronze-Cuckoo		Regular migrant
Chalcites osculans	Black-eared Cuckoo		Irregular visitor
Chalcites lucidus	Shining Bronze-Cuckoo		Regular migrant

Species	Common Name	Status	Expected Occurrence
Cacomantis flabelliformis	Fan-tailed Cuckoo		Regular migrant
Heteroscenes pallidus	Pallid Cuckoo		Regular migrant
Otididae (Bustards)			
Ardeotis australis	Australian Bustard	CS3 (LS)	Irregular visitor
Podargidae (Frogmouths)			
Podargus strigoides	Tawny Frogmouth		Resident
Eurostopodidae (Eared Nightjars)			
Eurostopodus argus	Spotted Nightjar		Regular visitor
Aegothelidae (Owlet-nightjars)			
Aegotheles cristatus	Australian Owlet-nightjar		Resident
Apodidae (Swifts and Swiftlets)			
Apus pacificus	Fork-tailed Swift	CS1 (M,S5)	Vagrant
Rallidae (Crakes, Rails and Swamphens)			
Hypotaenidia philippensis ~	Buff-banded Rail		Irregular visitor
Porzana fluminea ~	Australian Spotted Crake		Irregular visitor
Zapornia pusilla ~	Baillon's Crake		Irregular visitor
Zapornia tabuensis ~	Spotless Crake		Irregular visitor
Porphyrio porphyrio ~	Purple Swamphen		Irregular visitor
Tribonyx ventralis	Black-tailed Native-hen		Irregular visitor
Fulica atra ~	Eurasian Coot		Irregular visitor
Burhinidae (Stone-curlews)			
Burhinus grallarius	Bush Stone-curlew		Irregular visitor
Recurvirostridae (Stilts and Avocets)			

Species	Common Name	Status	Expected Occurrence
Cladorhynchus leucocephalus ~	Banded Stilt		Irregular visitor
Recurvirostra novaehollandiae ~	Red-necked Avocet		Irregular visitor
Himantopus leucocephalus ~	Pied Stilt		Irregular visitor
Charadriidae (Plovers, Dotterel and Lapwings)			
Charadrius ruficapillus ~	Red-capped Plover		Regular visitor
Elseyornis melanops ~	Black-fronted Dotterel		Regular visitor
Vanellus tricolor ~	Banded Lapwing		Regular visitor
Erythrogonys cinctus ~	Red-kneed Dotterel		Irregular visitor
Charadrius australis	Inland Dotterel		Irregular visitor
Scolopacidae (Snipe, Sandpipers, Godwits, Curlew, Stints and Phalaropes)			
Calidris acuminata ~	Sharp-tailed Sandpiper	CS1 (M,S5)	Irregular visitor
Calidris ferruginea ~	Curlew Sandpiper	CS1 (C,M,S3,S5)	Irregular visitor
Calidris ruficollis ~	Red-necked Stint	CS1 (M,S5)	Irregular visitor
Calidris melanotos ~	Pectoral Sandpiper	CS1 (M,S5)	Irregular visitor
Actitis hypoleucos ~	Common Sandpiper	CS1 (M,S5)	Irregular visitor
Tringa nebularia ~	Common Greenshank	CS1 (M,S5)	Irregular visitor
Tringa glareola ~	Wood Sandpiper	CS1 (M,S5)	Vagrant
Tringa stagnatilis ~	Marsh Sandpiper	CS1 (M,S5)	Vagrant
Turnicidae (Button-quail)			
Turnix varius	Painted Button-quail		Resident
Turnix velox	Little Button-quail		Irregular visitor
Laridae (Gulls, Terns and Noddies)			
Chroicocephalus novaehollandiae ~	Silver Gull		Irregular visitor

	Species	Common Name	Status	Expected Occurrence
	Gelochelidon nilotica ~	Common Gull-billed Tern	CS1 (M,S5)	Irregular visitor
	Hydroprogne caspia ~	Caspian Tern	CS1 (M,S5)	Irregular visitor
	Chlidonias hybrida ~	Whiskered Tern		Irregular visitor
	Thalasseus bergii ~	Crested Tern		Irregular visitor
Pelicanidae (Pelican)				
	Pelecanus conspicillatus ~	Australian Pelican		Irregular visitor
Ardeidae (Herons, Egrets and Bitterns)				
	Nycticorax caledonicus ~	Nankeen Night-Heron		Irregular visitor
	Ardea pacifica ~	White-necked Heron		Irregular visitor
	Ardea alba ~	Great Egret		Irregular visitor
	Egretta novaehollandiae ~	White-faced Heron		Regular visitor
Threskiornithidae (Ibis and Spoonbills)				
	Threskiornis moluccus	Australian White Ibis		Regular visitor
	Threskiornis spinicollis	Straw-necked Ibis		Regular visitor
	Platalea flavipes ~	Yellow-billed Spoonbill		Irregular visitor
	Plegadis falcinellus	Glossy Ibis	CS1 (M,S5)	Vagrant
Phalacrocoracidae (Cormorants and Shags)				
	Microcarbo melanoleucos ~	Little Pied Cormorant		Irregular visitor
	Phalacrocorax carbo ~	Great Cormorant		Vagrant
	Phalacrocorax sulcirostris ~	Little Black Cormorant		Vagrant
Anhingidae (Darter)				
	Anhinga novaehollandiae ~	Australasian Darter		Vagrant
Accipitridae (Eagles, Kites, Goshawks)				

Species	Common Name	Status	Expected Occurrence
Elanus axillaris	Black-shouldered Kite		Resident
Hamirostra melanosternon	Black-breasted Buzzard		Vagrant
Lophoictinia isura	Square-tailed Kite		Regular visitor
Aquila audax	Wedge-tailed Eagle		Resident
Hieraaetus morphnoides	Little Eagle		Resident
Circus assimilis	Spotted Harrier		Irregular visitor
Accipiter fasciatus	Brown Goshawk		Resident
Accipiter cirrocephalus	Collared Sparrowhawk		Resident
Haliastur sphenurus	Whistling Kite		Resident
Milvus migrans	Black Kite		Vagrant
Tytonidae (Masked Owls)			
Tyto alba	Barn Owl		Resident
Strigidae (Hawk-Owls)			
Ninox novaeseelandiae	Southern Boobook		Resident
Meropidae (Bee-eaters)			
Merops ornatus	Rainbow Bee-eater		Regular migrant
Alcedinidae (Kingfishers)			
Todiramphus sanctus	Sacred Kingfisher		Regular migrant
Todiramphus pyrrhopygius	Red-backed Kingfisher		Irregular visitor
Dacelo novaeguineae	Laughing Kookaburra	Int	Resident
Falconidae (Falcons)			
Falco cenchroides	Nankeen Kestrel		Resident
Falco longipennis	Australian Hobby		Resident

Species	Common Name	Status	Expected Occurrence
Falco berigora	Brown Falcon		Resident
Falco peregrinus	Peregrine Falcon	CS1 (S7)	Regular visitor
Cacatuidae (Cockatoos and Corellas)			
Nymphicus hollandicus	Cockatiel		Vagrant
Calyptorhynchus banksii samueli	Inland Red-tailed Black-Cockatoo		Resident
Calyptorhynchus latirostris	Carnaby's Black-Cockatoo	CS1 (E,S2)	Regular migrant
Eolophus roseicapilla	Galah		Resident
Cacatua leadbeateri	Major Mitchell's Cockatoo	CS3 (LS)	Vagrant
Cacatua pastinator	Western Corella		Resident
Cacatua sanguinea	Little Corella		Resident
Psittaculidae (Parrots, Lorikeets and Rosellas)			
Polytelis anthopeplus	Regent Parrot		Irregular visitor
Psephotellus varius	Mulga Parrot		Irregular visitor
Barnardius zonarius	Australian Ringneck		Resident
Pezoporus flaviventris	Western Ground Parrot	CS1 (C,S1)	Locally extinct?
Neophema elegans	Elegant Parrot		Resident
Glossopsitta porphyrocephala	Purple-crowned Lorikeet		Irregular visitor
Melopsittacus undulatus	Budgerigar		Irregular visitor
Maluridae (Fairy-wrens, Emu-wrens and Grasswrens)			
Malurus pulcherrimus	Blue-breasted Fairy-wren		Resident
Malurus lamberti	Variegated Fairy-wren		Resident
Malurus splendens	Splendid Fairy-wren		Resident
Malurus leucopterus	White-winged Fairy-wren		Resident

Species	Common Name	Status	Expected Occurrence
Stipiturus malachurus	Southern Emu-wren		Resident
Meliphagidae (Honeyeaters and Chats)			
Sugomel niger	Black Honeyeater		Irregular visitor
Lichmera indistincta	Brown Honeyeater		Resident
Phylidonyris novaehollandiae	New Holland Honeyeater		Resident
Phylidonyris niger	White-cheeked Honeyeater		Resident
Nesoptilotis leucotis	White-eared Honeyeater		Irregular visitor
Melithreptus brevirostris	Brown-headed Honeyeater		Resident
Glyciphila melanops	Tawny-crowned Honeyeater		Resident
Acanthorhynchus superciliosus	Western Spinebill		Resident
Certhionyx variegatus	Pied Honeyeater		Irregular visitor
Epthianura tricolor	Crimson Chat		Irregular visitor
Epthianura albifrons	White-fronted Chat		Resident
Acanthagenys rufogularis	Spiny-cheeked Honeyeater		Resident
Anthochaera lunulata	Western Wattlebird		Resident
Anthochaera carunculata	Red Wattlebird		Resident
Gavicalis virescens	Singing Honeyeater		Resident
Purnella albifrons	White-fronted Honeyeater		Irregular visitor
Manorina flavigula	Yellow-throated Miner		Resident
Pardalotidae (Pardalotes)			
Pardalotus punctatus	Spotted Pardalote		Irregular visitor
Pardalotus striatus	Striated Pardalote		Resident
Acanthizidae (Thornbills and Gerygones)			

Species	Common Name	Status	Expected Occurrence
Gerygone fusca	Western Gerygone		Resident
Smicrornis brevirostris	Weebill		Resident
Pyrrholaemus brunneus	Redthroat		Resident
Calamanthus cautus	Shy Heathwren		Resident
Calamanthus campestris	Rufous Fieldwren		Resident
Sericornis frontalis	White-browed Scrubwren		Resident
Aphelocephala leucopsis	Southern Whiteface		Vagrant
Acanthiza chrysorrhoa	Yellow-rumped Thornbill		Resident
Acanthiza apicalis	Inland Thornbill		Resident
Acanthiza uropygialis	Chestnut-rumped Thornbill		Vagrant
Acanthiza inornata	Western Thornbill		Resident
Pomatostomidae (Australian Babblers)			
Pomatostomus superciliosus	White-browed Babbler		Resident
Neosittidae (Sittellas)			
Daphoenositta chrysoptera	Varied Sittella		Resident
Campephagidae (Cuckoo-shrikes and Trillers)			
Coracina novaehollandiae	Black-faced Cuckoo-shrike		Resident
Lalage tricolor	White-winged Triller		Resident
Pachycephalidae (Whistlers, Shrike-thrushes and allies)			
Pachycephala rufiventris	Rufous Whistler		Resident
Pachycephala pectoralis occidentalis	Western Whistler		Resident
Colluricincla harmonica	Grey Shrike-thrush		Resident
Oreoicidae (Australo-Papuan Bellbirds)			

Species	Common Name	Status	Expected Occurrence
Oreoica gutturalis	Crested Bellbird		Resident
Psophodidae (Whipbirds and Wedgebills)			
Psophodes nigrogularis	Western Whipbird		Locally extinct
Psophodes occidentalis	Chiming Wedgebill		Vagrant
Artamidae (Woodswallows, Currawongs, Butcherbirds and Magpie)			
Strepera versicolor	Grey Currawong		Irregular visitor
Gymnorhina tibicen	Australian Magpie		Resident
Cracticus nigrogularis	Pied Butcherbird		Resident
Cracticus torquatus	Grey Butcherbird		Resident
Artamus personatus	Masked Woodswallow		Irregular visitor
Artamus cyanopterus	Dusky Woodswallow		Irregular visitor
Artamus cinereus	Black-faced Woodswallow		Resident
Rhipiduridae (Fantails)			
Rhipidura leucophrys	Willie Wagtail		Resident
Rhipidura albiscapa	Grey Fantail		Resident
Corvidae (Crows and Ravens)			
Corvus orru	Torresian Crow		Vagrant
Corvus bennetti	Little Crow		Irregular visitor
Corvus coronoides	Australian Raven		Resident
Monarchidae (Monarch and Flycatchers)			
Grallina cyanoleuca	Magpie-lark		Resident
Petroicidae (Australian Robins)			
Petroica goodenovii	Red-capped Robin		Resident

Species	Common Name	Status	Expected Occurrence
Microeca fascinans	Jacky Winter		Resident
Drymodes brunneopygia	Southern Scrub-robin		Resident
Eopsaltria griseogularis	Western Yellow Robin		Resident
Quoyornis georgianus	White-breasted Robin		Resident
Melanodryas cucullata	Hooded Robin		Resident
Dicaeidae (Flowerpeckers)			
Dicaeum hirundinaceum	Mistletoebird		Resident
Estrildidae (Weaver Finches)			
Taeniopygia guttata	Zebra Finch		Irregular visitor
Motacillidae (Pipits and Wagtails)			
Anthus novaeseelandiae	Australasian Pipit		Resident
Locustellidae (Grassbirds)			
Cincloramphus cruralis	Brown Songlark		Regular visitor
Cincloramphus mathewsi	Rufous Songlark		Regular visitor
Acrocephalidae (Reed-Warblers)			
Acrocephalus australis ~	Australian Reed-Warbler		Resident
Hirundinidae (Swallows and Martins)			
Cheramoeca leucosterna	White-backed Swallow		Resident
Petrochelidon ariel	Fairy Martin		Regular visitor
Petrochelidon nigricans	Tree Martin		Resident
Hirundo neoxena	Welcome Swallow		Resident
Zosteropidae (White-eyes)			
Zosterops lateralis	Silvereye		Resident

Species	Common Name	Status	Expected Occurrence
Tachyglossidae (Echidnas)			
Tachyglossus aculeatus acanthion	Short-beaked Echidna		Resident
Dasyuridae (Dasyurids)			
Dasyurus geoffroii fortis	Chuditch	CS1 (V,S3)	Locally extinct
Parantechinus apicalis	Dibbler	CS1 (E,S2)	Locally extinct
Sminthopsis crassicaudata	Fat-tailed Dunnart		Resident
Sminthopsis dolichura	Little long-tailed Dunnart	CS3 (LS)	Resident
Sminthopsis fuliginosus fuliginosus	Grey-bellied Dunnart		Resident
Sminthopsis granulipes	White-tailed Dunnart		Resident
Peramelidae (Bandicoots)			
Isoodon fusciventer	Quenda	CS2 (P4)	Locally extinct
Perameles bougainville	Shark Bay Bandicoot, Little Marl	CS1 (E,S3)	Locally extinct
Thylacomyidae (Bilbies)			
Macrotis lagotis	Bilby, Dalgyte	CS1 (V,S3)	Locally extinct
Tarsipedidae (Honey Possum)			
Tarsipes rostratus	Honey Possum, Noolbenger		Resident
Phalangeridae (Brushtail possums)			
Trichosurus vulpecula hypoleucus	Brushtail Possum		Resident
Potoroidae (Potoroos and bettongs)			
Bettongia lesueur graii	Burrowing Bettong, Boodie	CS1 (Ex,S4)	Locally extinct
Bettongia penicillata ogilbyi	Brush-tailed Bettong, Woylie	CS1 (E,S1)	Locally extinct
Macropodidae (Kangaroos)			
Lagostrophus fasciatus fasciatus	Banded Hare-wallaby	CS1 (V,S3)	Locally extinct

	Species	Common Name	Status	Expected Occurrence
	Macropus fuliginosus melanops	Western Grey Kangaroo		Resident
	Notamacropus eugenii derbianus	Tammar	CS2 (P4)	Locally extinct
	Notamacropus irma	Brush Wallaby	CS2 (P4)	Resident
	Osphranter robustus erubescens	Euro, Biggada		Resident
	Osphranter rufus	Red Kangaroo, Marlu		Vagrant
Muridae (Rats and mice)				
	Mus musculus	House Mouse	Int	Resident
	Pseudomys albocinereus albocinereus	Ash-grey Mouse, Noodji		Resident
	Pseudomys fieldi	Shark Bay Mouse	CS1 (V,S3)	Locally extinct
	Rattus fuscipes fuscipes	Western Bush Rat		Resident
	Rattus tunneyi tunneyi	Pale Field-rat		Locally extinct
Megadermatidae (Ghost Bat)				
	Macroderma gigas	Ghost Bat	CS1 (S3)	Locally extinct
Molossidae (Freetail bats)				
	Austronomus australis	White-striped Free-tailed Bat		Resident
Vespertilionidae (Vespertillionid bats)				
	Chalinolobus gouldii	Gould's Wattled Bat		Resident
	Chalinolobus morio	Chocolate Wattled Bat		Resident
	Nyctophilus geoffroyi geoffroyi	Lesser Long-eared Bat		Resident
	Nyctophilus major major	Greater Long-eared Bat		Resident
	Vespadelus regulus	Southern Forest Bat		Resident
Canidae (Dogs)				
	Canis lupus dingo	Dingo		Vagrant

	Species	Common Name	Status	Expected Occurrence
	Canis lupus familiaris	Dog	Int	Vagrant
	Vulpes vulpes	Red Fox	Int	Resident
Suidae (Pigs)				
	Sus scrofa	Pig	Int	Vagrant
Bovidae (Horned ruminants)				
	Capra hircus	Goat	Int	Vagrant

Appendix 8. Species recorded during the February 2020 field investigations.

Species	Common Name
Ctenophorus maculatus maculatus	
Varanus gouldii	Bungarra or Sand Goanna
Dromaius novaehollandiae	Emu
Phaps chalcoptera	Common Bronzewing
Ocyphaps lophotes	Crested Pigeon
Aquila audax	Wedge-tailed Eagle
Falco cenchroides	Nankeen Kestrel
Eolophus roseicapilla	Galah
Malurus splendens	Splendid Fairy-wren
Phylidonyris niger	White-cheeked Honeyeater
Calamanthus campestris	Rufous Fieldwren
Coracina novaehollandiae	Black-faced Cuckoo-shrike
Pachycephala rufiventris	Rufous Whistler
Gymnorhina tibicen	Australian Magpie
Artamus cinereus	Black-faced Woodswallow
Rhipidura leucophrys	Willie Wagtail
Corvus coronoides	Australian Raven
Anthus novaeseelandiae	Australasian Pipit
Petrochelidon nigricans	Tree Martin
Hirundo neoxena	Welcome Swallow
Macropus fuliginosus melanops	Western Grey Kangaroo