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WOODSIDE ENERGY LTD
JAMES PRICE POINT: LIGHT INDUSTRIAL AREA, WORKERS'
ACCOMMODATION CAMP AND SOUTHERN PIPELINE
TERRESTRIAL VERTEBRATE FAUNA ASSESSMENT

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REV 8 NOVEMBER 2012

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ecologia Environment
1025 Wellington Street
WEST PERTH WA 6005
Phone: 08 9322 1944
Fax: 08 9322 1599
Email: admin@ecologia.com.au

TABLE OF CONTENTS

EXECUTIVE SUMMARY.....	VI
1 INTRODUCTION	1
1.1 PROJECT OVERVIEW	1
1.2 LEGISLATIVE FRAMEWORK	1
1.3 SURVEY OBJECTIVES.....	3
2 BIOPHYSICAL ENVIRONMENT.....	5
2.1 CLIMATE	5
2.2 VEGETATION	7
2.3 LAND SYSTEMS.....	12
2.4 BIOGEOGRAPHY	14
3 METHODS.....	17
3.1 DETERMINATION OF SURVEY DESIGN AND INTENSITY.....	17
3.2 LITERATURE REVIEW AND DATABASE SEARCHES	17
3.3 SURVEY TIMING	18
3.4 SITE SELECTION	19
3.5 SAMPLING METHODS.....	22
3.6 SURVEY EFFORT.....	24
3.7 TAXONOMY AND NOMECLATURE.....	26
3.8 ANIMAL ETHICS.....	26
3.9 DATA ANALYSIS	26
3.10 CONSERVATION SIGNIFICANT FAUNA.....	27
3.11 SURVEY TEAM	28
4 RESULTS.....	29
4.1 LITERATURE REVIEW	29
4.2 SURVEY RESULTS	29
4.3 CONSERVATION SIGNIFICANT FAUNA.....	31
4.4 FAUNA HABITATS	56

4.5	FAUNA HABITAT ANALYSIS.....	58
4.6	SURVEY ADEQUACY.....	60
4.7	SURVEY LIMITATIONS.....	60
5	DISCUSSION.....	64
6	CONCLUSION	66
7	REFERENCES.....	68

TABLES

Table 2.1 – Rainfall Preceding the Surveys (Broome Airport Records).	6
Table 2.2 – Vegetation Associations in the Survey Areas.....	7
Table 2.3 – Vegetation Communities in the Vicinity of the Project Area (after Biota 2011).	11
Table 2.4 – Land Systems in the Survey Areas.	12
Table 3.1 – Factors Influencing Survey Design.	17
Table 3.2 – Fauna Databases Searched to Determine the Potential Vertebrate Fauna Assemblage of the Project Area.	18
Table 3.3 – Previous Biological Survey Reports within 150 km of the Project Area.	18
Table 3.4 – Summary of Survey Timing and Duration.	18
Table 3.5 – Survey Site Information.	19
Table 3.6 – Survey Effort.	25
Table 3.7 – References Used for Identification.	26
Table 3.8 – Likelihood of Occurrence Categories.	27
Table 3.9 – Field Survey Personnel.....	28
Table 3.10 – External Consultants.	28
Table 4.1 – Comparison of Results of Previous Fauna Surveys.	29
Table 4.2 – Tern Species Potentially Occurring.	36
Table 4.3 – Wader Species Potentially Occurring.....	39
Table 4.4 – Sea Turtle Species Potentially Occurring in the Project Area.	47
Table 4.5 – Conservation Significant Fauna Occurring or Potentially Occurring in the Project Area....	49
Table 4.6 – Amount of Fauna Habitat in Project Area.....	56
Table 4.7 – Summary of Survey Limitations.	61

FIGURES

Figure 1.1 – Location of the Project Area.....	4
Figure 2.1 – Climatic Summary Data at Broome Airport from 1939 to 2011.....	5
Figure 2.2 – Rainfall During the Six Months Prior to the 31st May 2011 (BoM 2011).	6
Figure 2.3 – Vegetation Associations of the Project Area.	9
Figure 2.4 – Vegetation Units mapped by Biota (2010).	10
Figure 2.5 – Land Systems of the Project Area.....	13
Figure 2.6 – Biogeographic Regions of the Project Area.	15
Figure 3.1 – Location of Fauna Sites within the Project Area.....	21
Figure 3.2 – Diagram of Systematic Sampling Trap Arrangement.....	23
Figure 4.1 – Conservation Significant Fauna Recorded within the Project Area.....	55
Figure 4.2 – Non-metric Multidimensional Scaling of Fauna Trapping Data.....	58
Figure 4.3 – Fauna Habitats of the Project Area.	59
Figure 4.4 – Species Accumulation Curve of Terrestrial Fauna.	60

APPENDICES

Appendix A Explanation of Conservation Codes.....	72
Appendix B Daily Weather Data during Surveys.....	76
Appendix C Fauna Recorded During Surveying and Regional Fauna Data.....	78
Appendix D Site Descriptions	104
Appendix E Voucher Specimens Lodged with WA Museum.....	108
Appendix F Fauna Species Recorded During Trapping	110
Appendix G Potential Bilby Diggings and Burrows	118
Appendix H Species of Conservation Significance with a Low Likelihood of Occurrence within the Project Area	126

ACRONYMS

BoM	Bureau of Meteorology
CAMBA	China-Australia Migratory Bird Agreement
CES	Consolidated Environmental Services
DEC	Department of Environment and Conservation
EAP	Environmental Advisory Panel
DSEWPaC	Department of Sustainability, Environment, Water, Population and Community
DSD	Department of State Development
EIA	Environmental Impact Assessment
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
JAMBA	Japan-Australian Migratory Bird Agreement
JPP	James Price Point
LIA	Light Industrial Area
LNG	Liquefied Natural Gas
NEAT	North-east Access Track
NHMRC	National Health and Medical Research Centre
SAC	Species Accumulation Curve
SAR	Strategic Assessment Report
SKM	Sinclair Knight Merz
SP	Southern Pipeline
WAC	Workers' Accommodation Camp
WC Act	<i>Wildlife Conservation Act 1950</i>

EXECUTIVE SUMMARY

Woodside Energy Ltd (Woodside), as operator of the proposed Browse LNG Development, plans to commercialise the Browse Joint Venture's three gas and condensate fields, Brecknock, Calliance and Torsa, located 425 km north of Broome off the Kimberly coast. Gas and liquids from these fields will be extracted using offshore facilities then brought to an onshore Liquefied Natural Gas (LNG) plant for processing at the Western Australian Government's planned Browse LNG Precinct, near James Price Point, about 60 kilometres north of Broome. The Department of State Development, as the Precinct proponent, is conducting a Strategic Assessment Report (SAR) of the Area. The LNG Precinct is proposed to include a Light Industrial Area (LIA), Workers' Accommodation Camp (WAC) and Southern Pipeline (SP) (Department of State Development 2010).

ecologia Environment (*ecologia*) were commissioned by Woodside via Sinclair Knight Merz (SKM)/Consolidated Environmental Services (CES) Partnership to undertake baseline studies for vertebrate fauna within the BLNG development area (approximately 42 km²) (Figure 1.1), comprising the following survey areas:

- Light Industrial Area (LIA);
- Workers' Accommodation Camp (WAC); and
- Southern Pipeline (SP).

This report provides:

- a review of background information (including literature and database searches);
- an inventory of vertebrate fauna species occurring in the project area incorporating recent published and unpublished records;
- an inventory of species of biological and conservation significance recorded or likely to occur within the project area and surrounds;
- a description of fauna habitats occurring in the project area;
- a description of the characteristics of the faunal assemblage;
- an appraisal of the current knowledge base for the area, including a review of previous surveys conducted in the area that are relevant to the current study; and
- a review of regional and biogeographical significance, including the conservation status of species recorded or those that are likely to occur in the project area.

The survey was undertaken using a variety of sampling techniques, both systematic and opportunistic. Trapping surveys (Level 2) were selected to be undertaken in the WAC and LIA. A Level 1 survey was sufficient for the SP area, which includes a much larger area than the actual proposed disturbance footprint, given previous Level 2 and targeted fauna surveys had been undertaken there. Trapping sites were selected on the basis of accessibility, fauna habitat and the likelihood that the habitat supports fauna of conservation significance. However, an on-site assessment of the LIA revealed that, due to limitations in accessibility, only a limited Level 1 survey was possible for ethical reasons.

Survey effort within the project area included the following:

- Trapping for terrestrial mammals and herpetofauna was undertaken using a standardised trapping format, comprising a combination of pitfall traps, Elliott box traps, funnel traps and cage traps. Traps were open for a combined total of 1340 trap-nights.
- Bird surveys comprising both systematic walking transects and opportunistic observations of birds made while transiting within the project area. A total of 119 bird surveys were completed (48 survey hours).
- Bat echolocation calls were detected using recording devices to determine bat assemblage and distribution. Seven recordings were made at different sites within the WAC survey area over six nights (72 hours of recording).
- Targeted diurnal searches were made for cryptic fauna species by searching beneath the bark of dead trees, breaking open old logs, stumps and dead free-standing trees, investigating burrows, and over-turning logs and stones. A total of 89 hours and 10 minutes were expended.
- Opportunistic recordings of any signs of fauna were recorded throughout the duration of the survey periods, including those found while travelling, and during trap establishment within the project area during the day. Tracks, diggings, scats, burrows and nests were recorded where possible. A total of 62 hours were spent conducting opportunistic searches while travelling between survey sites on foot.
- Remote camera trapping using baited motion-sensing cameras was carried out for a total of 432 hours.
- Targeted searches and trapping were undertaken to determine the presence of Bilbies in the project area, including: 40 cage trap nights, 35 person hours of diurnal searches for secondary evidence, and 432 camera trap hours. Potential burrows and diggings were found while transiting on site and during opportunistic searches. Each burrow or digging was photographed and the location recorded. Cage and remote-sensing camera traps were set up in the vicinity of old Bilby burrows.

The current survey resulted in the identification of 11 native mammal species, 82 bird species, 33 reptile species and two amphibian species.

Eight native mammals were recorded within the project area, including one murid (mouse), one dasyurid (dunnart), and six chiropterans (bats), as well as one canid (dingo), for which there is still debate as to whether it is a native or introduced species. Potential presence of an additional two species was recorded through secondary evidence: Bilby (*Macrotis lagotis*) and Agile Wallaby (*Macropus agilis*).

A total of 82 bird species were recorded in the project area. The bird assemblage was most diverse in the SP survey area, with 76 species recorded. This is likely to reflect the diversity and quality of the fauna habitats present in that area. The WAC and North-east Access Track bird surveys yielded 52 species. Honeyeaters were the most abundant bird species observed in the project area during the current survey.

The reptile fauna of the project area comprised 33 species including 12 skinks, six geckoes, one pygopod (legless lizard), four agamids (dragons), three varanids (goannas), five elapids (front-fanged

snakes), one blind snake and one python. One Leopard Ctenotus (*Ctenotus pantherinus*) was found well outside its previously known distribution, constituting a range extension.

Two amphibian species (Green Tree Frog and Ornate Burrowing Frog) were recorded on this survey. These results may be attributed to the relative uniformity of trapping sites and the fairly dry conditions during surveying.

The main conclusions of the terrestrial vertebrate fauna assessment were:

- The survey methods to sample for terrestrial fauna were consistent with the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* to sample for terrestrial fauna. Species accumulation curves showed that survey adequacy from the current survey was moderate, but when previous surveys in the area are taken into account, adequacy is generally sufficient.
- The vertebrate fauna survey conducted at JPP found that the land systems, vegetation communities and habitats supported a diverse group of fauna, including conservation significant fauna, but they were not restricted to occurring within the project area.
- Ten mammal, seventy-eight bird and ten reptile species of conservation significance potentially occur in the project area.
- Eight conservation significant vertebrate fauna species were recorded within, or in close proximity to the project area, and an additional 59 conservation significant species have a medium or high likelihood of occurrence at the project area. The remaining 31 conservation significant species have a low likelihood of occurrence within the project area.
- Several survey limitations occurred as a result of access and Woodside safety requirements. However, the majority of these limitations were addressed during the survey, or can be overcome through additional surveying. Although the LIA area was selected for a Level 2 vertebrate fauna survey, access limitations only permitted a Level 1 survey. Due to previous survey effort and habitat homogeneity, agreement was reached between Woodside and DEC prior to the survey that the approach taken was acceptable in light of these limitations. On site reconnaissance could only be conducted in the far northwest corner of the LIA. Habitat assessments for the remainder of the LIA survey area were extrapolated based on data provided by *ecologia* (2011) flora surveys. Further survey effort in this area would be of benefit. Survey effort within the WAC and SP represented that of a Level 2 survey.
- Five fauna habitat types were recorded within the project area. The majority of these occur extensively surrounding the project area and are continuous with it.
- The Dampierland Burrowing Snake is the only species known to occur within the project area with unknown potential for impact at a regional level. The regional impacts to all other species are thought to be low.
- Additional targeted surveying in the LIA and far eastern edge of the WAC is recommended to confirm the presence of Bilbies.

1 INTRODUCTION

1.1 PROJECT OVERVIEW

Woodside Energy Ltd (Woodside), as operator of the proposed Browse LNG Development, plans to commercialise the Browse Joint Venture's three gas and condensate fields, Brecknock, Calliance and Torsa, located 425km north of Broome off the Kimberly coast. Gas and liquids from these fields will be extracted using offshore facilities then brought to an onshore Liquefied Natural Gas (LNG) plant for processing at the Western Australian Government's planned Browse LNG Precinct, near James Price Point, about 60 kilometres north of Broome. The Department of State Development, as the Precinct proponent, is conducting a Strategic Assessment Report (SAR) of the Area. The LNG Precinct is proposed to include a Light Industrial Area (LIA), Workers' Accommodation Camp (WAC) and Southern Pipeline (SP) (Department of State Development 2010).

ecologia Environment (*ecologia*) was commissioned by Woodside via Sinclair Knight Merz (SKM)/Consolidated Environmental Services (CES) Partnership to undertake baseline studies for vertebrate fauna within the BLNG development area (approximately 42 km²) (Figure 1.1), comprising the following survey areas:

- Light Industrial Area (LIA);
- Workers' Accommodation Camp (WAC); and
- Southern Pipeline (SP).

The WAC is rectangular in shape and covers an area 20.6 km² aligned on a NEE-SSW bearing. This area is located approximately 1 km from the coast. The LIA is located north of the WAC and is almost rectangular in shape with the SW corner truncated. The LIA is 9.7 km² in area and approximately 1.5 km from the coast. The SP is a longitudinal polygon that runs along 5 km of coastline between JPP and Quondong Point and encompasses an area of 11.5 km², a much larger than the actual proposed disturbance footprint.

The survey area provided to *ecologia* and referred to as the Southern Pipeline (SP) in this study represents a larger area than the currently approved disturbance footprint for the Southern Pipeline option of the BLNG Development. This report assesses the vertebrate fauna of this larger area and further impact evaluation within the reduced disturbance footprint will occur as part of the relevant environmental referral documentation to be developed by Woodside.

1.2 LEGISLATIVE FRAMEWORK

The *Environmental Protection Act 1986* is "an Act to provide for an Environmental Protection Authority, for the prevention, control and abatement of environmental pollution, for the conservation, preservation, protection, enhancement and management of the environment and for matters incidental to or connected with the foregoing." Section 4a of this Act outlines five principles that are required to be addressed to ensure that the objectives of the Act are addressed. Three of these principles are relevant to native fauna and flora:

- *The Precautionary Principle*

Where there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

- *The Principles of Intergenerational Equity*

The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

- *The Principle of the Conservation of Biological Diversity and Ecological Integrity*

Conservation of biological diversity and ecological integrity should be a fundamental consideration.

In addition to these principles, projects undertaken as part of the Environmental Impact Assessment (EIA) process are required to address guidelines produced by the Environmental Protection Authority (EPA), in this case Guidance Statement No. 56: *Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (EPA 2004), principles outlined in EPA Position Statement No. 3: *Terrestrial Biological Surveys as an Element of Biodiversity Protection* (EPA 2002) and the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010).

Native flora and fauna in WA that are formally recognised as rare, threatened with extinction, or as having high conservation value are protected at a federal level under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and at a state level under the *Wildlife Conservation Act 1950* (WC Act). International agreements include the Japan-Australian Migratory Bird Agreement (JAMBA) and the China-Australia Migratory Bird Agreement (CAMBA).

The EPBC Act was developed to provide for the protection of the environment, especially those aspects of the environment that are matters of national environmental significance, to promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources, and to promote the conservation of biodiversity. The EPBC Act includes provisions to protect native species (and in particular to prevent the extinction and promote the recovery of threatened species) and to ensure the conservation of migratory species. In addition to the principles outlined in Section 4a of the EPBC Act, Section 3a of the EPBC Act includes a principle of ecologically sustainable development dictating that decision-making processes should effectively integrate both long-term and short-term economic, environmental, social and equitable considerations. Schedule 1 of the EPBC Act contains a list of species that are considered Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable and Conservation Dependent. Definitions of categories relevant to fauna occurring or potentially occurring in the project area are provided in Appendix A.

The Western Australian WC Act was developed to provide for the conservation and protection of wildlife in WA. Under Section 14 of this Act, all flora and fauna within WA is protected; however, the Minister may, via a notice published in the *Government Gazette*, declare a list of fauna identified as rare, likely to become extinct, or otherwise in need of special protection (Appendix A). The current listing was gazetted in August 2010.

In addition, the Department of Environment and Conservation (DEC) maintains a Threatened and Priority Fauna list which includes species removed from the WC Act and other species known from only a few populations, or in need of monitoring. Five Priority codes are recognised (Appendix A).

1.3 SURVEY OBJECTIVES

The EPA's objectives with regards to fauna management are to:

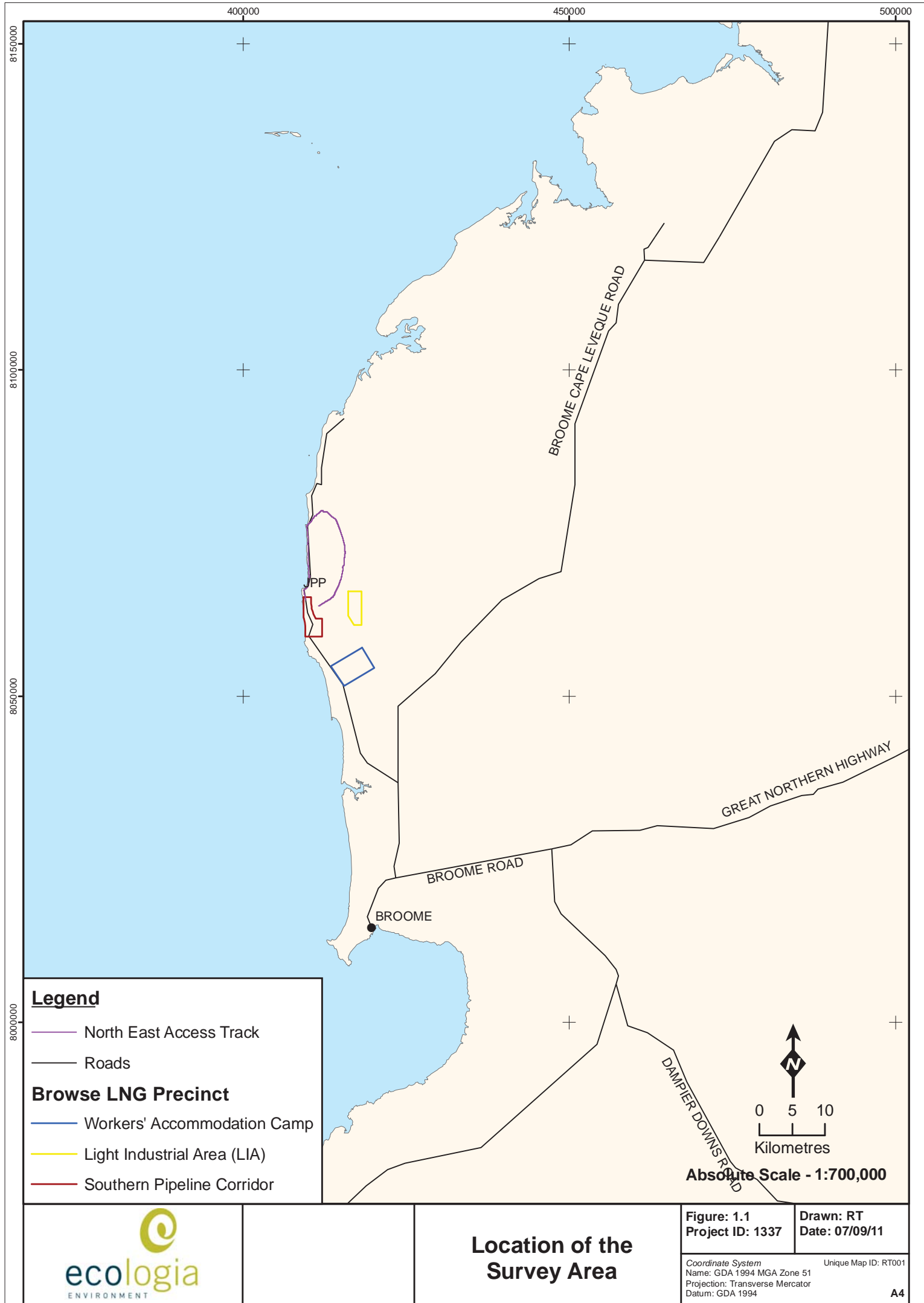
- maintain the abundance, species diversity and geographical distribution of terrestrial fauna; and

- protect Specially Protected (Threatened) fauna, consistent with the provisions of the WC Act.

The aim of this study was to provide sufficient information to the EPA to assess the impact of the project on the vertebrate fauna of the project area, thereby ensuring that these objectives will be upheld.

This report satisfies the requirements documented in *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment*, Guidance Statement No. 56 and Position Statement No. 3, by providing:

- a review of background information (including literature and database searches);
- an inventory of vertebrate fauna species occurring in the project area incorporating recent published and unpublished records;
- an inventory of species of biological and conservation significance recorded or likely to occur within the project area and surrounds;
- a description of fauna habitats occurring in the project area;
- a description of the characteristics of the faunal assemblage;
- an appraisal of the current knowledge base for the area, including a review of previous surveys conducted in the area that are relevant to the current study; and
- a review of regional and biogeographical significance, including the conservation status of species recorded or those that are likely to occur in the project area.



2 BIOPHYSICAL ENVIRONMENT

2.1 CLIMATE

The project area is situated in the Kimberley region of WA at the south-west edge of the Dampier Peninsula. The area has a dry, hot, tropical climate with two distinct seasons: the 'wet' from around December to March, and the 'dry' for the rest of the year. Rainfall is highly variable in the region due to the inconsistent nature of the movement and occurrence of thunderstorms and tropical systems. Tropical cyclones can occur as late as April, but are most common in January and February. Rainfall during the cooler months is usually associated with cloud bands originating from tropical waters to the north-west (BoM 2011). The average temperature over summer is over 33 °C, with warm overnight minima of around 26 °C (BoM 2011). Winter temperatures are quite mild, with average maximum and minimum temperatures in July being 26.9 °C and 12.0 °C respectively (BoM 2011).

The closest Bureau of Meteorology (BoM) weather station to the project area is Broome Airport, located 51.8 km south of the project area. This station was selected as a reference to provide the best indication of the local climatic conditions of the project area (Figure 2.1).

The mean annual rainfall for Broome is 607 mm, although this can be quite variable with over 75% of the annual rainfall usually falling between January and March (BoM 2011). The mean number of rainfall days (≥ 1 mm) a year is only 35.1. Generally, the wettest month is February, with a mean of 179.1 mm falling over an average of 9.1 rainfall days. In terms of temperature, the hottest month is April and the coldest is July, with means of 34.3 °C and 28.8 °C respectively (Figure 2.1).

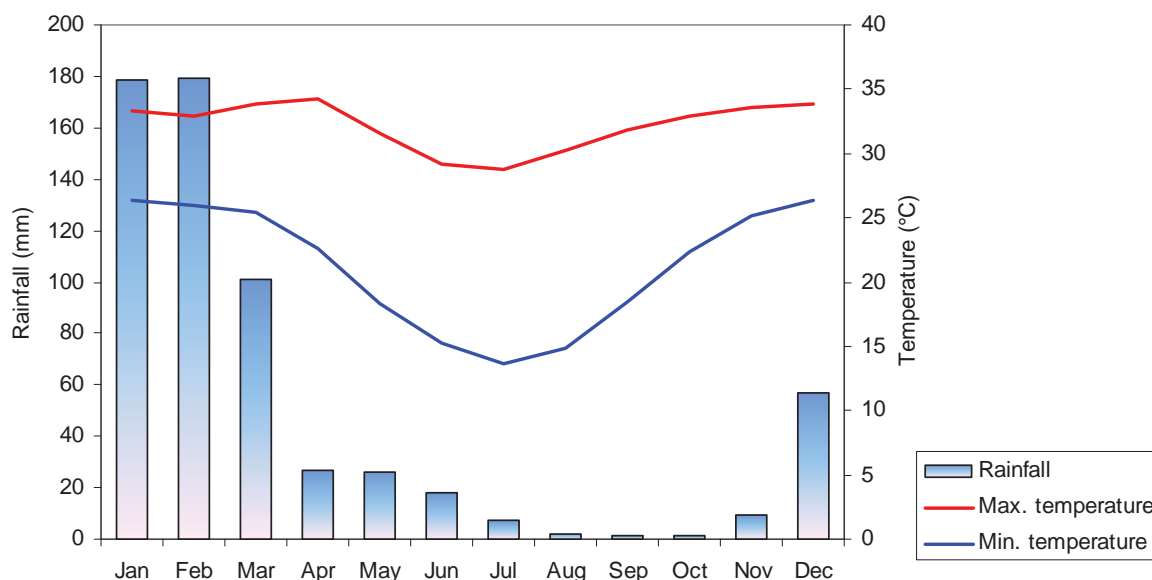


Figure 2.1 – Climatic Summary Data at Broome Airport from 1939 to 2011.

Table 2.1 shows that rainfall at Broome Airport in the 2009 wet season (December 2008 – March 2009) was close to average. The 2010 wet season was extremely dry, although the annual rainfall was somewhat made up by a large rainfall event in July. In contrast, the 2011 wet season had much higher rainfall than average due to the three tropical cyclones which occurred in the Kimberley region

over this period. Figure 2.2 shows the effect these cyclones had on rainfall in WA in the six months prior to the surveys, with the Kimberley region receiving 150-300% of its typical rainfall.

Table 2.1 – Rainfall Preceding the Surveys (Broome Airport Records).

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Total Monthly Rainfall (mm)													
2009	180.6	203.4	76.8	0	5.6	6.2	1	0.6	0	0.6	46.2	179.4	700.4
2010	140	6.4	31	71.6	26.4	0	110.8	1.8	4.4	7.8	57.8	85.8	543.8
2011	449.2	275	87.2	18.6	0.4								
Mean Monthly Rainfall (mm)													
1939 - 2011	178.5	179.1	100.8	26.7	26.4	18	7.4	1.7	1.4	1.4	9.1	56.8	607

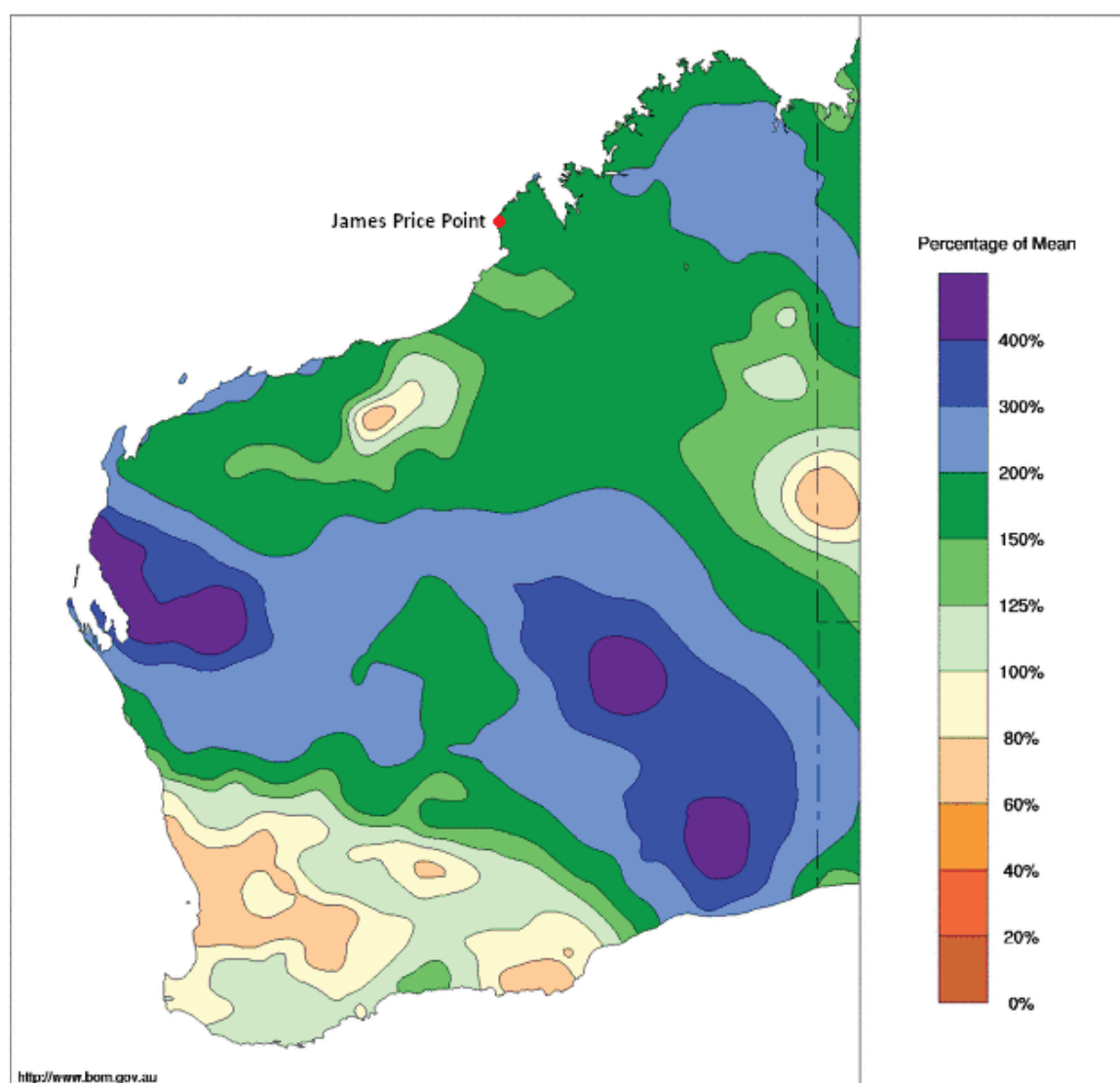


Figure 2.2 – Rainfall During the Six Months Prior to the 31st May 2011 (BoM 2011).

This vertebrate fauna assessment comprised two survey periods, April and May 2011, the weather for which is provided in Appendix B. The first survey in April 2011 consisted of hot days exceeding 30 °C, with overnight minima typically in the low 20s, but cooling (reaching as low as 15.4 °C) towards

the end of the survey. The average maximum temperatures were slightly lower on the second survey than on the first, with high 20s and low 30s recorded. However, the minimum temperatures remained above 20 °C, even at night.

2.2 VEGETATION

The Dampier Peninsula, in which the project area is located, lies within the Northern Botanical Province. The vegetation of Western Australia was originally mapped at the 1:1,000,000 scale by Beard (1979), and was subsequently reinterpreted and updated to reflect the National Vegetation Information System standards (Shepherd *et al.* 2002). Two of the vegetation types identified by Shepherd *et al.* (2002) are found within the project area: Vegetation Associations 129 and 750. The majority of the three survey areas consist of vegetation type 750 (Figure 2.3), which is described as being mainly shrublands and pindan, comprised of *Acacia tumida* shrubs with medium height grey box and cabbage gum woodland, over ribbon grass and curly spinifex (Shepherd *et al.* 2002). The SP area also contains small areas of Vegetation Association 129, described as bare areas with drift sand. Both vegetation types are well-represented outside the three survey areas, with less than 0.2% of their total post-European extent occurring in the three survey areas (Table 2.2).

Table 2.2 – Vegetation Associations in the Survey Areas

Survey Area	Vegetation Association	Total Area in WA (km ²)	Area in survey area (km ²)	Percent of the survey area	Percent of total Vegetation Association
Workers' Accommodation Camp	750	12415.59	20.60	100.00	0.17
Light Industrial Area	750	12415.59	9.70	100.00	0.08
Southern Pipeline	750	12415.59	11.54	99.90	0.09
	129	957.07	0.01	0.01	0.00

Vegetation of the JPP area, incorporating the current survey areas, was mapped at a finer scale by Biota (2011), and updated for the current survey areas by Ecologia (2011) (Figure 2.4), with the general area of the current surveys mapped as containing eight vegetation communities (Table 2.3). *Ecologia* surveyed six of these vegetation communities in the current survey. Descriptions of each vegetation type are provided below.

1. Monsoon Vine Thicket – Evergreen

Celtis philippensis, *Diospyros humilis*, *Mimusops elengi*, *Sersalisia sericea* and occasional *Pittosporum moluccanum* (Priority 4 flora) over *Exocarpus latifolius*, *Glycosmis macrophylla* and *G. trifoliata* over vines including *Abrus precatorius*, *Caesalpinia major*, *Capparis lasiantha* and the invasive *Passiflora foetida* var. *hispida* with *Enneapogon caerulescens* and *Cymbopogon procerus*.

2. Monsoon Vine Thicket – Deciduous

Bauhinia cunninghamii, *Croton habrophyllus*, *Grewia breviflora*, *Gyrocarpus americanus* and *Terminalia petiolaris* over *Bridelia tomentosa*, *Flueggea virosa* subsp. *melanthesoides*, *Grewia retusifolia*, *Pavetta kimberleyana* and *Premna acuminata* over vines including *Abrus precatorius*, *Caesalpinia major*, *Capparis lasiantha* and the invasive *Passiflora foetida* var. *hispida* with *Enneapogon caerulescens* and *Cymbopogon procerus*

3. Drainage Basin

Lophostemon grandiflorus subsp. *grandiflorus* (P3), *Corymbia bella*, *Acacia colei*, *Ehretia saligna*, *Hakea macrocarpa*, *Santalum lanceolatum* and *Senna costata* over *Solanum cunninghamii*, *Croton habrophyllus* and *Bridelia tomentosa* with dense grasses of *Aristida holathera* var. *holathera*, *Cymbopogon procerus* and *Setaria apiculata* and vines *Abrus precatorius*, *Passiflora foetida* var. *hispida* and *Tinospora smilacina*.

4. Open Forest

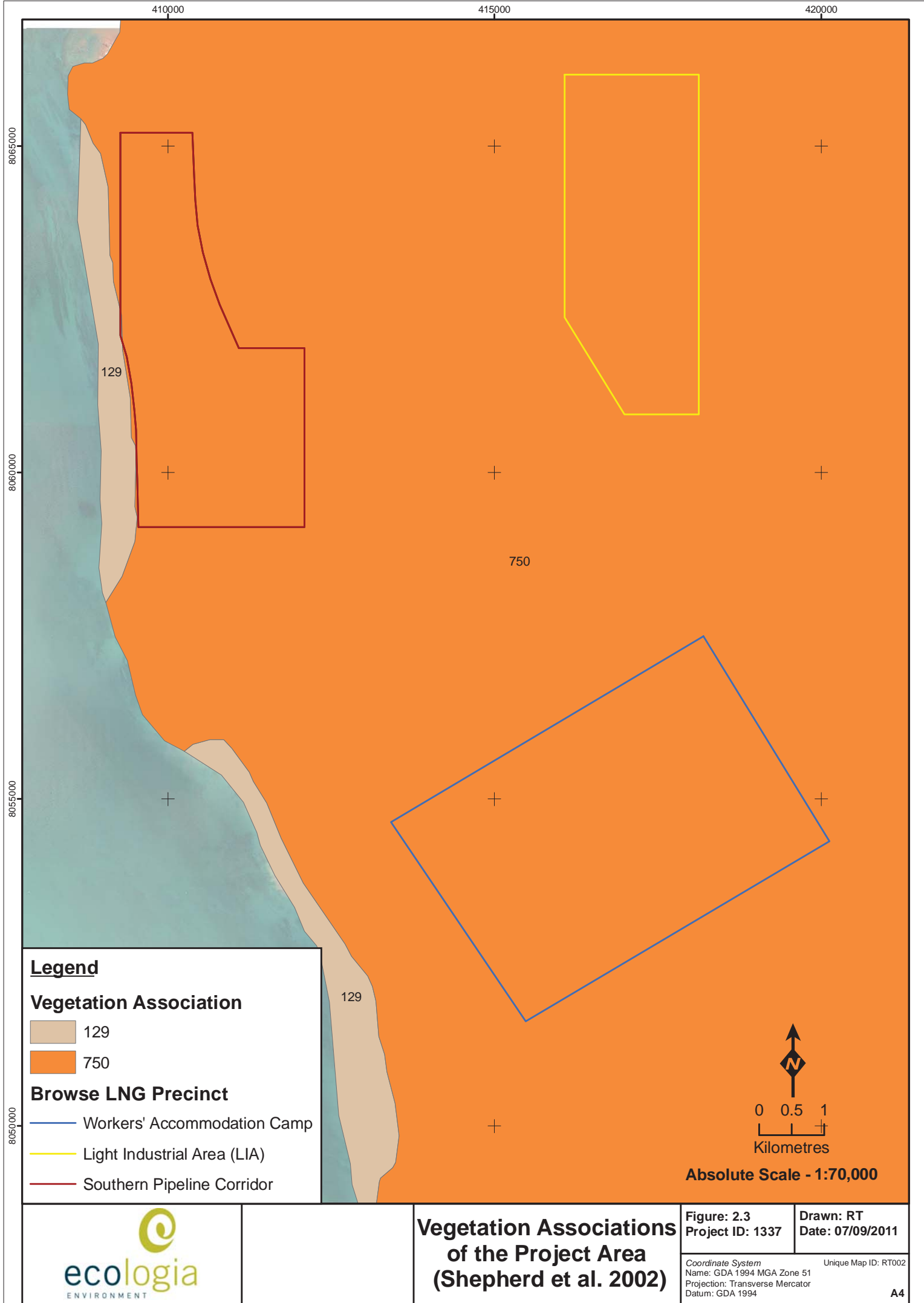
Eucalyptus miniata and *Corymbia dampieri* over variably dense understorey of Acacias, including *A. eriopoda*, *A. monticola*, *A. tumida*, and *A. platycarpa* and *Grevillea pyramidalis*, over *A. hippuroides*, *Dodonaea hispidula* var. *arida* and *Gossypium rotundifolium* over *Aristida holathera* var. *holathera*, *Sorghum plumosum* and *Triodia schinzii*

5. Open Woodland

Eucalyptus miniata, *E. jensenii* or *Corymbia polycarpia* over *Acacia monticola*, *A. tumida*, *A. eriopoda*, *A. platycarpa* over *Bridelia tomentosa*, *Corchorus sidoides*, *Dodonaea hispidula* var. *arida*, *Microstachys chamelea* and *Waltheria indica* over grasses *Aristida contorta*, *Cymbopogon procerus*, and vines *Cassytha filiformis*, *Passiflora foetida* var. *hispida*.

6. Pindan shrubland

Mixed *Acacia* species (commonly *A. eriopoda* and *A. tumida*) with scattered *Corymbia dampieri* and *C. zygophylla* over *Carissa lanceolata*, *Dodonaea hispidula*, *Trichodesma zeylanicum*, *Acacia adoxa*, *Gossypium australe* and *Waltheria indica* over *Triodia schinzii*, *Chrysopogon pallidus*, *Aristida holathera* var. *holathera* and *Eriachne obtusa*.



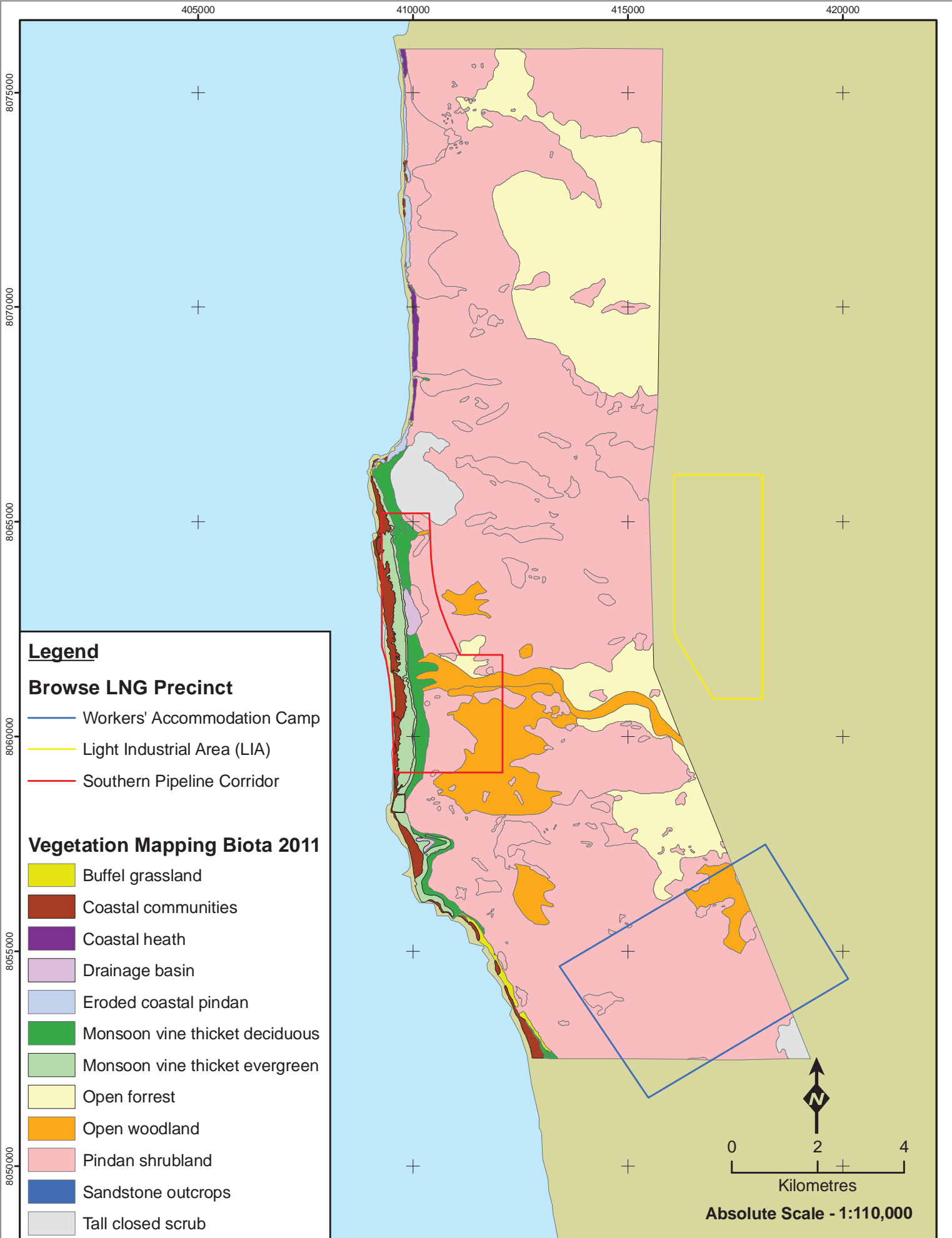


Table 2.3 – Vegetation Communities in the Vicinity of the Project Area (after Biota 2011).

Vegetation Type	Description
Coastal Communities (cc)	Sparsely vegetated mobile foredunes, usually including Beach Spinifex (<i>Spinifex longifolius</i>), along with the sedges <i>Fimbristylis cymosa</i> and <i>F. sericea</i> , which were usually dominant in blow-out areas. Stabilised dunes were dominated by <i>Spinifex longifolius</i> .
Monsoon Evergreen Vine Thickets (evt)	Discrete, closed-canopy patches, more commonly on the coastal dunes and sometimes extending into the swales. The evergreen trees included <i>Celtis philippensis</i> , <i>Diospyros humilis</i> , <i>Mimusops elengi</i> , <i>Sersalisia sericea</i> and the Priority 4 species <i>Pittosporum moluccanum</i> . Shrubs included <i>Exocarpos latifolius</i> , <i>Glycosmis macrophylla</i> and <i>G. trifoliata</i> . Typical vines included <i>Abrus precatorius</i> , <i>Caesalpinia major</i> , <i>Capparis lasiantha</i> , <i>Gymnanthera oblonga</i> , <i>Jacquemontia paniculata</i> , <i>Opilia amentacea</i> , <i>Sarcostemma viminale</i> subsp. <i>brunonianum</i> , <i>Tinospora smilacina</i> and <i>Tylophora cinerascens</i> .
Monsoon Deciduous Vine Thickets (dvt)	Typical deciduous tree species included <i>Bauhinia cunninghamii</i> , <i>Croton habrophyllus</i> , <i>Grewia breviflora</i> , <i>Gyrocarpus americanus</i> and <i>Terminalia petiolaris</i> . Deciduous shrub species included <i>Bridelia tomentosa</i> , <i>Flueggea virosa</i> subsp. <i>melanthesoides</i> , <i>Grewia retusifolia</i> , <i>Pavetta kimberleyana</i> and <i>Premna acuminata</i> . Vine species were similar to those recorded in the evergreen vine thickets. The Priority 3 grass <i>Eriachne semiciliata</i> was only recorded from deciduous vine thickets.
Drainage Basins (db)	Areas subject to ephemeral freshwater flooding, ponding or seepage, and found behind coastal sand dunes subject to seasonal inundation. Such areas were often associated with monsoon vine thicket but were characterised by the occurrence of Lardik (<i>Lophostemon grandiflorus</i>) and the paperbark Karnbor (<i>Melaleuca dealbata</i>), neither of which were recorded from vine thickets.
Tall Closed Scrub (tcs)	Complex mosaic, devoid of eucalypts and dominated by dense wattles. The major dominants were <i>Acacia monticola</i> and <i>A. colei</i> , with some <i>A. eriopoda</i> , <i>Hakea arborescens</i> and <i>H. macrocarpa</i> , and with <i>Acacia hippuroides</i> , <i>Calytrix exstipulata</i> , <i>Dodonaea hispidula</i> and <i>Lithomyrtus retusa</i> in the understorey.
Pindan Shrubland (ps)	Ubiquitous grassland dominated by a sparse upper layer composed mainly of eucalypts with a variably dense thicket-forming middle layer of wattles. Dominated by mixed <i>Acacia</i> species (particularly <i>A. eriopoda</i> and <i>A. tumida</i>), with widely scattered Ghost Gums (<i>Corymbia flavescens</i>) near the coast and scattered Bloodwoods (<i>Corymbia dampieri</i> and <i>C. zygophylla</i>) and occasional Darwin Box (<i>Eucalyptus tectifica</i>) elsewhere. Understorey shrubs included Conkerberry (<i>Carissa lanceolata</i>), <i>Dodonaea hispidula</i> , Camel Bush (<i>Trichodesma zeylanicum</i>), <i>Acacia adoxa</i> , <i>Gyrostemon tepperi</i> , Native Cotton (<i>Gossypium australe</i>), <i>Gonocarpus leptothecus</i> , <i>Waltheria indica</i> and <i>Solanum cunninghamii</i> . The principal grasses are Soft Spinifex (<i>Triodia schinzii</i>), Ribbon Grass (<i>Chrysopogon pallidus</i>), Sorghum (<i>Sorghum stipoideum</i>) and Bunch Speargrass (<i>Heteropogon contortus</i>).
Open Woodland (ow)	Manowan or Woollybutt (<i>Eucalyptus miniata</i>) on sandy soils, with Long-fruited Bloodwood (<i>Corymbia polycarpa</i>) confined to seasonally inundated areas such as along Kundandu Creek. Localised patches of Wandii Ironbark (<i>Eucalyptus jensenii</i>) occurred throughout the open woodland, and were often associated with <i>Acacia monticola</i> .
Open Forest (of)	Relatively dense tree cover, with an upper layer of <i>Eucalyptus miniata</i> and an understorey of wattles that included <i>Acacia eriopoda</i> , <i>A. tumida</i> and <i>A. platycarpa</i> . Grass species were similar to those in the pindan shrubland but also included Annual Sorghum (<i>Sorghum stipoideum</i>) and Bunch Speargrass (<i>Heteropogon contortus</i>).

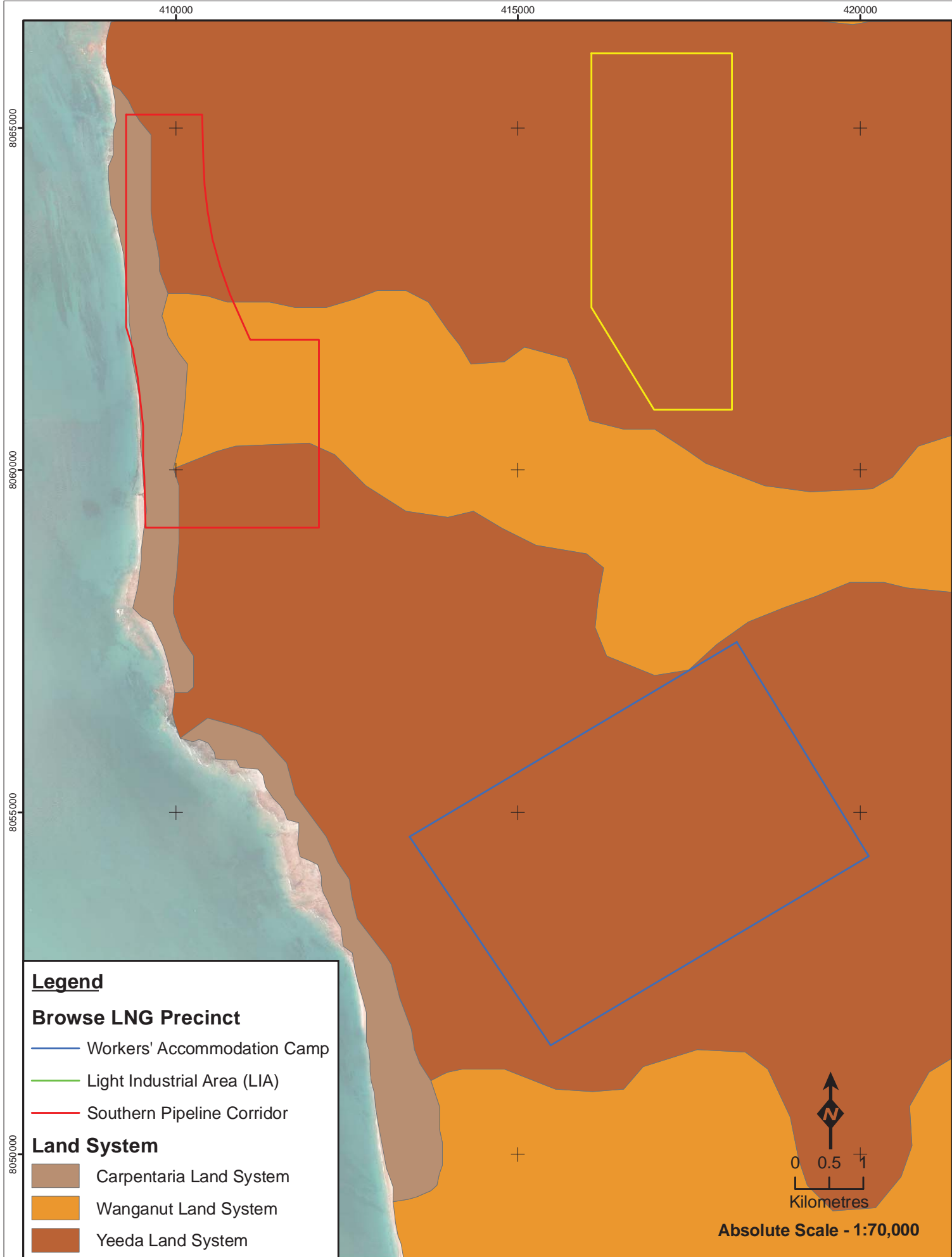
2.3 LAND SYSTEMS

Land systems are described using the biophysical characteristics of geology, landforms, vegetation and soils. The project area contains three land systems: Wanganut, Yeeda and Carpentaria (Table 2.4 and Figure 2.5). The Wanganut land system is characterised by low-lying sandplains and dune fields with drainage formations, supporting pindan acacia shrublands with emergent eucalypt trees. The Yeeda land system is similarly described as: sandplains with red and yellow sands, supporting pindan acacia shrublands with emergent eucalypt trees. The Carpentaria land system consists of coastal flats and associated sandy margins and dunes, and saline sands and muds. Such terrain can support paperbark thickets, samphire meadows or extensive bare mud flats with fringing mangrove forests (McKenzie and Kenneally 1983).

The Yeeda land system is found throughout the WAC and LIA survey areas, and makes up the greatest portion of the SP area (39.8%). The SP area also contains the Wanganut and Carpentaria land systems. All three of the land systems found within the project area are well-represented outside of them, as each area makes up less than 0.5% of the total land system area in WA.

Table 2.4 – Land Systems in the Survey Areas.

Project Area	Land System	Total Area in WA (km ²)	Area in Survey Area (km ²)	Percent of the Survey Area	Percent of Total Land System
Workers' Accommodation Camp	Yeeda	21244.4	20.6	100	0.097
Light Industrial Area	Yeeda	21244.4	9.7	100	0.046
Southern Pipeline	Wanganut	7188.0	3.9	34.1	0.055
	Yeeda	21244.4	4.6	39.8	0.022
	Carpentaria	6131.8	3.0	26.1	0.490

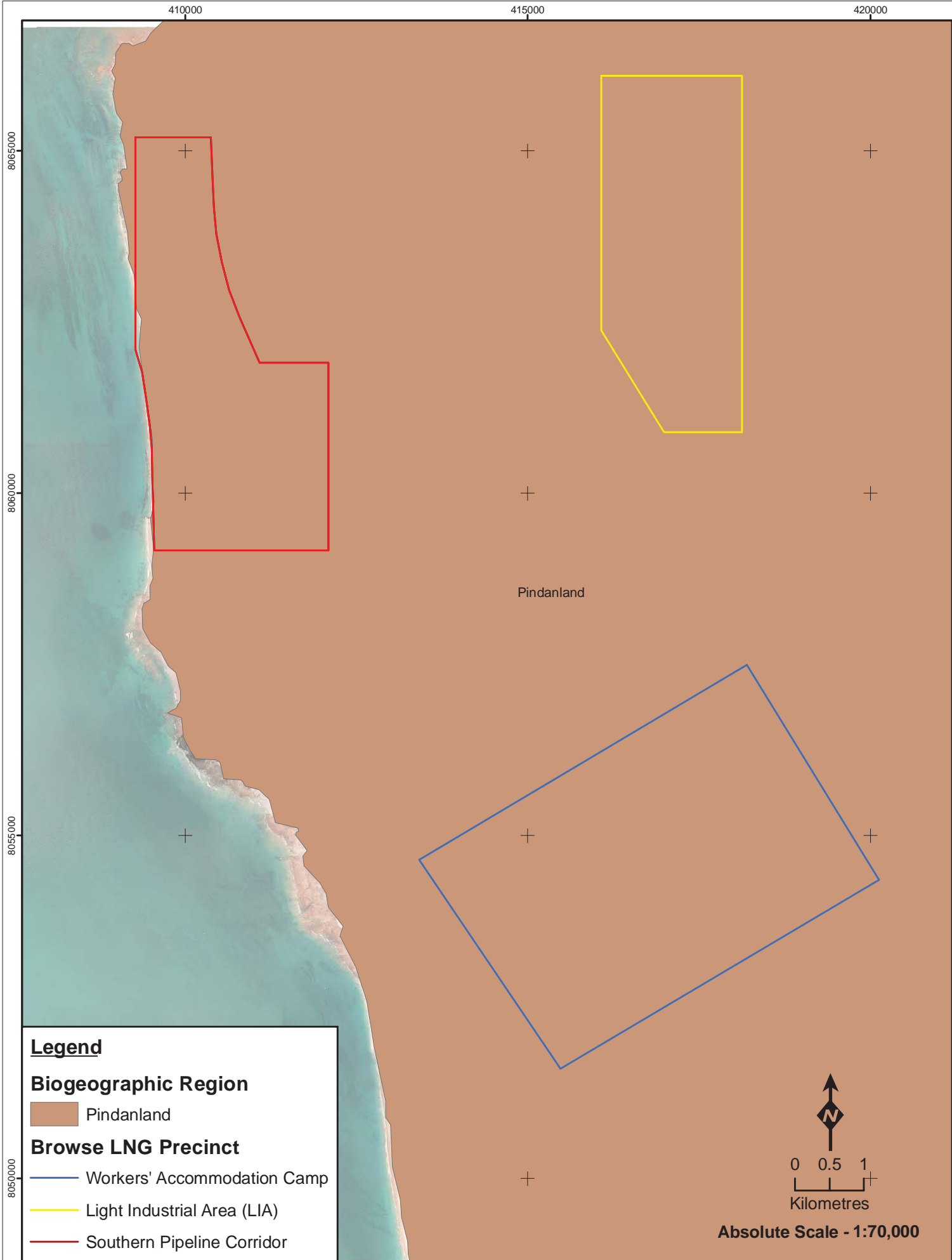


2.4 BIOGEOGRAPHY

The Interim Biogeographic Regionalisation for Australia (IBRA) classifies the Australian continent into bioregions of similar geology, landform, vegetation, fauna and climate characteristics (DSEWPac 2010). According to the IBRA (Version 6.1), the project area is located in the Dampierland bioregion. With an area of 88,130 km², the Dampierland bioregion is smaller than most. This is typical of bioregions situated along the coast where vegetation is less uniform than in the arid interior.

The Dampierland bioregion is further divided into the subregions Fitzroy Trough (DL1) and Pindanland (DL2), the latter of which includes the project area (Figure 2.6). The Pindanland subregion is made up of the western part of Dampierland (including the hinterland of Eighty Mile Beach), and the sandplains of the Dampier Peninsula, covering 51,989 km² (Graham 2001). The terrain of the Pindanland subregion is a fine-textured sand-sheet with subdued dunes, supporting vegetation that is described primarily as pindan.

The dominant land use categories within the Pindanland subregion are unallocated crown land, crown reserves and native pastures for grazing (Graham 2001). The principal limiting factors and threatening processes are considered to be feral animals (donkeys, cats, foxes), wildfire, weeds, land clearing (for agriculture or construction), erosion, human disturbance, and grazing or pastoral activities (Graham 2001). The IBRA protection level of the subregion is 0.01 – 5%, meaning that not only are ecosystems under-represented, the management of existing parks and reserves is also ranked as poor to fair. More pertinently, monsoon vine thicket ecosystems are considered to be inadequately represented and under threat (Graham 2001). The full extent is not known of the main threatening processes (wildfire, weeds, feral animals) in the Dampierland bioregion, compounding the paucity of knowledge on the status of critical weight range mammals there (Graham 2001).



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3 METHODS

3.1 DETERMINATION OF SURVEY DESIGN AND INTENSITY

Prior to the development of field survey methods, a review was undertaken of factors likely to influence survey design and intensity (Table 3.1). Based on this review, it was deemed necessary for Level 2 surveys to be conducted within the WAC and LIA, and Level 1 surveys within the SP due to the extensive previous surveying in this area.

Table 3.1 – Factors Influencing Survey Design.

Factor	Relevance
Bioregion-level of existing survey knowledge of the region and associated ability to predict accurately.	Six previous biological surveys have been conducted within 100 km of the project area (<i>ecologia</i> 2004; ENV 2008; Biota 2009; Rogers <i>et al.</i> 2009; AECOM 2010; Biota 2010).
Landform special characteristics/specific fauna/specific context of the landform characteristics and their distribution and rarity in the region.	Landforms of the project area are typical of the Pindanland subregion.
Lifeforms, life cycles, types of assemblages and seasonality (e.g. migration) of species likely to be present.	The best time to survey for all fauna groups in the Kimberley is the wet season (typically December to March), or soon after. A dry season (April to August) survey can also be conducted. Migratory waders are only present over summer (September to April).
Level of existing knowledge and results of previous regional sampling (e.g. species accumulation curves, species/area curves).	Three prior Level 2 surveys within 100 km have been conducted, as well as one targeted shorebird survey and one targeted fauna survey. One Level 1 survey has also been conducted. Level 1, 2 and targeted surveys have previously been conducted within the WAC and SP areas. See Table 3.3.
Number of different habitats or degree of similarity between habitats within a survey area.	The majority of the three project areas have very similar habitat, particularly the Workers' Accommodation Camp and LIA areas. There are a few distinct areas of more unique habitat types (e.g. monsoon vine thicket, coastal dunes) within the SP.
Climatic constraints (e.g. temperature or rainfall that preclude certain sampling methods).	The Kimberley region experiences hot summers with occasional cyclonic rain events, followed by warm winters with little rain. Rainfall is highly unpredictable.
Sensitivity of the environment to the proposed activities.	Coastal habitats (found within the SP) are potentially more sensitive to impact than the extensive areas of continuous habitat found further inland (WAC and LIA).
Size, shape and location of the proposed activities.	There are three survey areas, all near JPP, North of Broome. The WAC comprises a rectangular area (roughly 4 km x 5 km) adjacent to Manari Road. This road runs through the SP area (2.5 km x 6 km). The rectangular LIA lies to the east of the SP area, and is approximately 2 km x 5.5 km.
Scale and impact of the proposal.	The project area covers three infrastructure areas, each under 20 km ² , with a total area of approximately 42 km ² .

3.2 LITERATURE REVIEW AND DATABASE SEARCHES

Several databases were consulted in the preparation of potential fauna (and conservation significant fauna) lists, with searches conducted within 50 km of the project area (Table 3.2). In addition, nine publications reporting on vertebrate fauna surveys conducted predominantly within 150 km of the

project area were consulted (Table 3.3). The results of all database searches and previous surveys are presented in Appendix C.

Table 3.2 – Fauna Databases Searched to Determine the Potential Vertebrate Fauna Assemblage of the Project Area.

Database	Search Details
DEC Threatened Fauna Database	Records within 50 km of the project area
DEC NatureMap	Records within 40 km of the project area
Birds Australia Birdata	Records within 50 km of the project area
Department of Sustainability, Environment, Water, Population and Community (DSEWPoC) protected matters database	Species likely to occur within 10 km of the project area

Table 3.3 – Previous Biological Survey Reports within 150 km of the Project Area.

Survey Location and Author(s)	Distance to Project Area (km)	Comments
Beagle Bay Fauna Assessment (<i>ecologia</i> 2004)	75	1-phase Level 2 survey
Perpendicular Head-North Head, Packer Island, Gourdon Bay and Coulomb-Quondong Vertebrate Fauna Assessment (ENV 2008)	0 - 130	1-phase Level 2 survey
James Price Point Terrestrial Fauna Survey (Biota 2009)	0	1-phase Level 2 survey
James Price Point Browse LNG Precinct Targeted Terrestrial Fauna Survey (Biota 2010)	0	1-phase Level 2 survey
Supplementary Terrestrial Fauna and Habitat Assessment (AECOM 2010)	0	1-phase Level 1 survey
Browse LNG Precinct Access Road: Targeted Fauna Survey – Greater Bilby (AECOM 2011)	0	Targeted Bilby survey
Monitoring Yellow Sea Migrants in Australia (MYSMA) (Rogers <i>et al.</i> 2009)	0 - 375	Targeted shorebird survey
Assessment of Birds Utilising Habitat within the Vine Thickets and Woodlands of James Price Point (Bamford 2011)	0	Targeted bird survey
Browse Project Greater Bilby Survey of the James Price Point Area - Summary Report (ENV 2011)	0	Targeted Bilby survey

3.3 SURVEY TIMING

The surveys were conducted at the start of the dry season, with the first survey from 10/04/11 to 21/04/11 and the second survey from 27/04/11 to 08/05/11. The surveys followed a much wetter than average wet season owing to the three tropical cyclones experienced by the Kimberley region (Table 2.1). Temperatures recorded during the survey periods (Appendix B) were still representative of the wet season, suggesting survey timing was ideal.

Table 3.4 – Summary of Survey Timing and Duration.

Survey	Dates	Duration (Days)	Person Days
Survey 1	10/04/11 – 21/04/11	12	55
Survey 2	27/04/11 – 08/05/11	12	46
Total		24	101

3.4 SITE SELECTION

Trapping surveys (Level 2) were selected to be undertaken in the WAC and LIA, while a Level 1 survey was conducted in the SP area. Trapping sites were selected on the basis of accessibility, fauna habitat and the likelihood that the habitat supports conservation significant fauna.

The WAC area is rectangular, approximately 4 km x 5 km in size, located on the east side of Manari Road, south of JPP. Level 1, 2 and targeted surveys have previously been conducted within the WAC (Biota 2009, 2010). Two trapping sites were set up in the WAC, with additional transects and opportunistic surveys conducted throughout the area. The WAC consisted solely of Pindan shrubland fauna habitat. Therefore, trapping sites were placed in areas of different vegetation density, and transects and opportunistic surveys spread out to cover the complete range of vegetation composition and density.

The LIA is approximately 2 km x 5.5 km, located 7 km inland. Level 1, 2 and targeted surveys have previously been conducted within the LIA (Biota 2009, 2010). Due to limitations in accessibility to the LIA (see Table 4.7), trapping sites were unable to be placed within this survey area (though one opportunistic survey was conducted). To compensate, two trapping sites were installed along the North-east Access Track (NEAT), 3 km to the west and north of the LIA. Agreement between the DEC and Woodside was reached prior to the survey to undertake systematic trapping in similar representative habitat as present in the LIA (i.e. NEAT area). The NEAT sites were placed in open woodland and dense pindan shrubland respectively. Due to the access limitations, fauna habitats of the LIA could not be fully surveyed, but are likely to be predominantly the Pindan shrubland fauna habitat.

The SP area lies along the coast just north of JPP and includes a much larger area (2.5 km x 6 km) than the actual proposed disturbance footprint. Level 2 fauna surveys and targeted fauna surveys have previously been undertaken within the SP area. Therefore, a Level 1 fauna survey (transects and opportunistic surveys) was considered appropriate and conducted in this area to cover areas that had not been previously investigated.

Descriptions and photographs of all trapping sites are provided in Appendix D. Survey site information is presented in Table 3.5 and all trapping, opportunistic and transect surveys are mapped in Figure 3.1.

Table 3.5 – Survey Site Information.

Site Name	Survey Type	Coordinates		Fauna Habitat	Vegetation Association	Land System
		Easting	Northing			
JPP S1	Trapping	417219	8053852	Pindan Shrubland	750	Yeeda
JPP S2	Trapping	414444	8054226	Pindan Shrubland	750	Yeeda
JPP S3	Trapping	413015	8064691	Pindan Shrubland	750	Yeeda
JPP S4	Trapping	415327	8069272	Open Forest	750	Wanganut
Bilby1	Targeted trapping	414048	8054119	Pindan Shrubland	750	Yeeda
Bat1	Bat recording	417819	8056022	Pindan Shrubland	750	Yeeda
Bat2	Bat recording	414998	8055004	Pindan Shrubland	750	Yeeda
Bat3	Bat recording	417211	8053848	Pindan Shrubland	750	Yeeda
Bat4	Bat recording	416202	8055317	Pindan Shrubland	750	Yeeda
Bat5	Bat recording	415967	8052828	Pindan Shrubland	750	Yeeda

Site Name	Survey Type	Coordinates		Fauna Habitat	Vegetation Association	Land System
		Easting	Northing			
WAC Opp sites	Diurnal opportunistic searches	Numerous - refer to Figure 3.1		Pindan Shrubland	750	Yeeda
WAC transects	Walking transect	Numerous - refer to Figure 3.1		Pindan Shrubland	750	Yeeda
SP transects	Walking transect	Numerous - refer to Figure 3.1		Pindan Shrubland, Monsoon Vine Thicket, Open Forest, Coastal Communities	750	Yeeda Wanganut Carpentaria
LIA transect	Walking transect	Refer to Figure 3.1		Pindan Shrubland, Open Forest	750	Yeeda

Datum: WGS84

Zone: 51K

1045000

1050000

1055000

8065000

8055000

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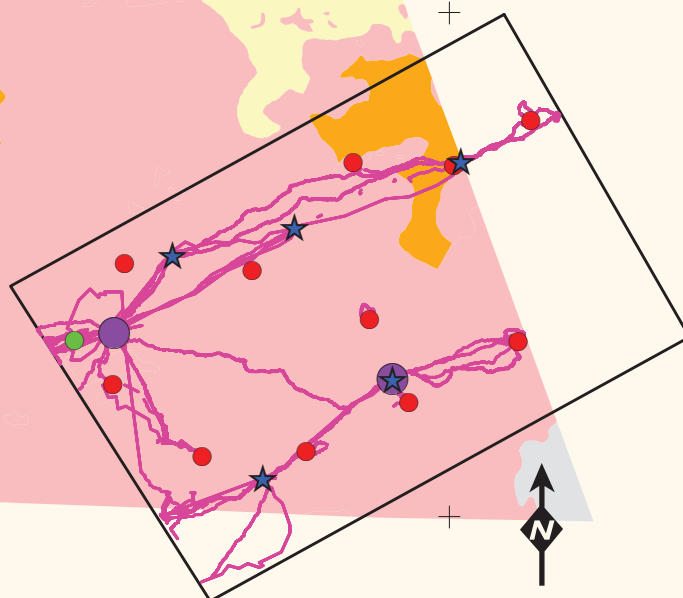
8045000

Legend**Survey type**

- Trapping
- ★ Anabat Site
- Targeted Bilby Trapping Site
- Opportunistic Searches
- Walking transects

Vegetation Mapping Biota 2010

- Buffel grassland
- Coastal communities
- Coastal heath
- Drainage basin
- Eroded coastal pindan
- Monsoon vine thicket deciduous
- Monsoon vine thicket evergreen
- Open forrest
- Open woodland
- Pindan shrubland
- Sandstone outcrops
- Tall closed scrub

0 1 2
Kilometres**Absolute Scale - 1:75,000**

3.5 SAMPLING METHODS

The survey methods adopted by *ecologia* were aligned with the EPA's Guidance Statement No. 56 (EPA 2004), Position Statement No. 3 (EPA 2002) and *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* (EPA 2010).

The survey was undertaken using a variety of sampling techniques, both systematic and opportunistic. Systematic sampling refers to data methodically collected over a fixed time period in a discrete habitat type, using an equal or standardised sampling effort. The resulting information can be analysed statistically, facilitating comparisons between habitats. Opportunistic sampling includes data collected non-systematically from both fixed sampling sites and as opportunistic records from chance encounters with fauna.

3.5.1 Systematic Sampling

3.5.1.1 Terrestrial Mammals and Herpetofauna

Trapping for terrestrial mammals and herpetofauna was undertaken using a standardised trapping format comprising a combination of pitfall traps, Elliott box traps, funnel traps and cage traps.

Each trapping site consisted of ten trapping units (Figure 3.2) placed approximately 25 m apart along a transect within a single habitat unit. Each trapping unit consisted of a pitfall trap and associated drift fence. The pitfall traps alternate between PVC pipe (16 cm x 50 cm) and 20 L plastic buckets (30 cm x 40 cm) and are dug in level with the ground surface. Each pitfall trap is bisected by a flywire drift fence (30 cm high x 6 m long). A funnel trap (Ecosystematica Type III) was placed at the end of each drift fence. Two medium sized Elliott box traps (9 cm x 9 cm x 32 cm) were placed in association with each trapping unit – one in close proximity to the pitfall trap, and one placed in between two trapping units. The Elliott traps were baited with universal bait (a mixture of peanut butter, rolled oats and sardines). Two cage traps were placed at each trapping site, at the start and end of each trap line. The cage traps were also baited with universal bait.

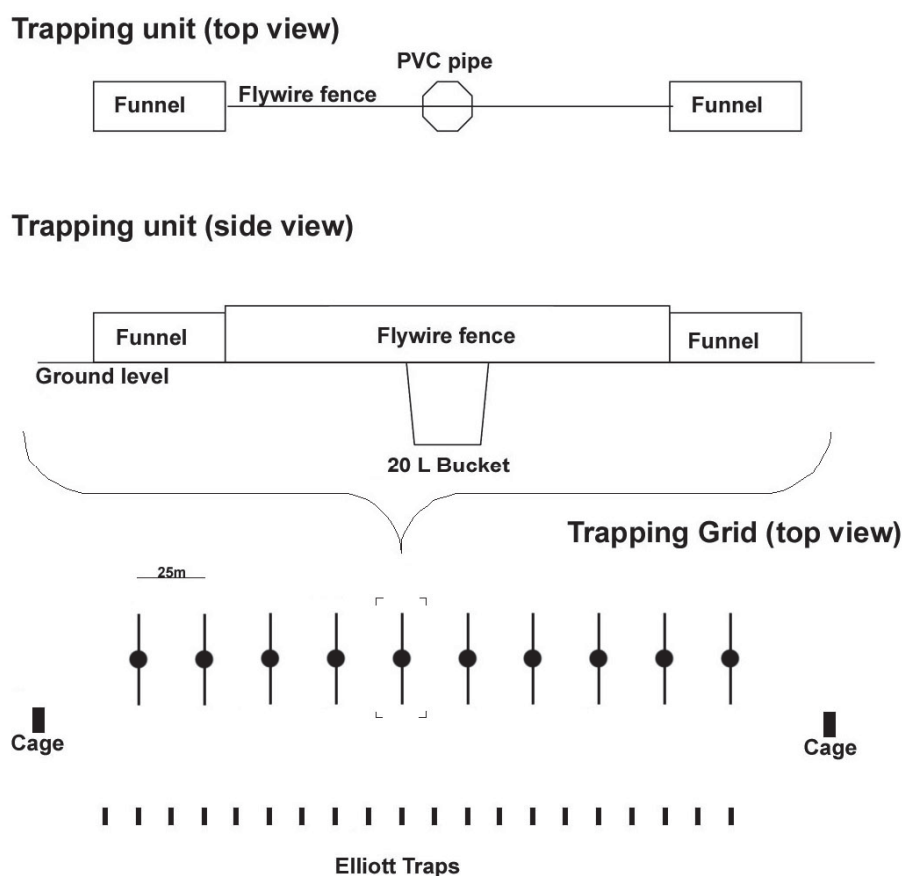


Figure 3.2 – Diagram of Systematic Sampling Trap Arrangement.

3.5.1.2 Bat

Bat echolocation calls were detected within the WAC using an Sm2bat 384 kHz and an Anabat II system. The Anabat bat detector is able to transform ultrasonic bat echolocation calls using zero crossing. The resulting calls were saved on an Olympus digital recorder. The Sm2bat has a high sampling frequency, enabling calls to be recorded without being transformed. Species can then be identified from their unique acoustic calls. Seven recordings were made at different sites within the WAC survey area over six nights. Recordings were made from sunset to sunrise.

3.5.2 Opportunistic Surveys

3.5.2.1 Avifauna

Multiple walking transects of the study area were conducted between 6:00 am and 1:00 pm each day, with species and abundance recorded by an experienced ornithologist. Areas containing habitats likely to support uncommon or cryptic species were targeted during the optimal post-dawn hours. Opportunistic observations of birds made while transiting within the project area were also recorded. A total of 119 bird surveys were completed, resulting in a total of 48 survey hours (Table 3.6).

3.5.2.2 Targeted Bilby Searching

On the basis of the habitats observed while surveying, specific searches and trapping were undertaken to determine the presence of Bilbies in the project area. Potential burrows and diggings were found while transiting on site and during opportunistic searches. Each burrow or digging was photographed and the location recorded. Cage and remote-sensing camera traps were set up in the vicinity of old potential Bilby burrows identified in the WC area. The coordinates for these burrows are presented in Appendix G. Ten cage traps, baited with a mix of universal bait and truffle oil, were set up for four nights. Two baited Bushnell Trophy Cam motion-sensing camera traps were installed for nine days. The cameras are able to capture photographs and videos of animals during both the day and night.

3.5.2.3 Diurnal Searching

Both trapping and opportunistic sites were searched by hand for cryptic species, which comprised searching beneath the bark of dead trees, breaking open old logs, stumps and dead free-standing trees, investigating burrows, and over-turning logs and stones. In addition, any signs of fauna were recorded throughout the duration of the survey periods, including those found while searching and travelling, and during trap establishment within the project area during the day. Tracks, diggings, scats, burrows and nests were recorded where possible.

3.5.2.4 Nocturnal Searching

No nocturnal surveys were possible due to logistical, and health and safety limitations.

3.6 SURVEY EFFORT

Survey effort expended within the project area included the following:

- traps were open for a combined total of 1340 trap-nights;
- 47 hours and 48 minutes were spent surveying for birds;
- approximately 89 hours and 10 minutes were spent on opportunistic diurnal searching;
- 62 hours were spent conducting opportunistic searches while travelling between survey sites on foot;
- camera trapping using baited motion-sensing cameras was carried out for a total of 432 hours;
- 72 hours of recordings were analysed to determine bat assemblage and distribution; and
- 35 hours were spent searching for secondary evidence of Bilbies.

Total survey effort per site is presented in Table 3.6.

Table 3.6 – Survey Effort.

Site	Pit Traps (trap nights)	Funnels (trap nights)	Elliotts (trap nights)	Cages (trap nights)	Bird Survey (min)	Diurnal Opp Search (min)	Diurnal Opp while Travelling on Foot (min)	Bat Recording (min)	Camera Trapping (min)
JPP S1	60	120	120	12	60	180	-	-	-
JPP S2	60	120	120	12	120	120	-	-	-
JPP S3	70	140	140	14	-	0	-	-	-
JPP S4	60	120	120	12	-	60	-	-	-
Targeted Bilby Trapping Site	n/a	n/a	n/a	40	-	120	-	-	25920
Opportunistic surveys WAC	n/a	n/a	n/a	n/a	978	1750	3720	4320	-
Opportunistic surveys SP	n/a	n/a	n/a	n/a	1310	3060	-	-	-
Opportunistic surveys LIA	n/a	n/a	n/a	n/a	400*	60	-	-	-
Total	250	500	500	90	2868	5350	3720	4320	25920

*Surveys were conducted along the NEAT approximately 3 km from the LIA

3.7 TAXONOMY AND NOMENCLATURE

Nomenclature for mammals, reptiles and amphibians within this report is as per *Western Australian Museum Checklist of the Vertebrates of Western Australia*, birds according to Christidis and Boles (2008). References used for fauna identification are listed in Table 3.7.

Table 3.7 – References Used for Identification.

Fauna Group	Field Guide
Mammals	Menkhorst and Knight (2011), Van Dyck and Strahan (2008)
Bats	Churchill (1998), Menkhorst and Knight (2011)
Birds	Simpson and Day (2004)
Reptiles	Cogger (2000), Wilson and Swan (2010)
Geckos	Storr <i>et al.</i> (1990), Wilson and Swan (2010)
Skinks	Storr <i>et al.</i> (1990), Wilson and Swan (2010)
Dragons	Storr <i>et al.</i> (1990), Wilson and Swan (2010)
Varanids	Storr <i>et al.</i> (1990), Wilson and Swan (2010)
Legless Lizards	Storr <i>et al.</i> (1990), Wilson and Swan (2010)
Snakes	Storr <i>et al.</i> (1990), Wilson and Swan (2010)
Amphibians	Tyler and Doughty (2009), Cogger (2000)

3.8 ANIMAL ETHICS

Surveying was conducted as per *ecologia's* Animal Ethics Code of Practice, which conforms to Section 5 of the *Australian code of practice for the care and use of animals for scientific purposes* (NHMRC 2004).

In most cases, fauna were identified in the field and released at the point of capture. Where the taxonomy of specimens was not clearly discernable, or when species were collected that are known to exhibit significant morphological variation or are not yet fully described, vouchers specimens were lodged with the WA Museum (Appendix E). Voucher specimens were maintained according to WA Museum guidelines to ensure minimum stress to captured animals.

3.9 DATA ANALYSIS

3.9.1 Survey Adequacy

There are three general methods of estimating species richness from sample data: extrapolating species-accumulation curves (SACs), fitting parametric models of relative abundance, and using non-parametric estimators (Bunge and Fitzpatrick 1993; Colwell and Coddington 1994; Gaston 1996). In this report, the level of survey adequacy was estimated using SACs, which graphically illustrate the accumulation of new species as more individuals are recorded. Ultimately, the asymptote is reached at the level at which no new species are present. To eliminate features caused by random or periodic temporal variation, the sample order was randomised 1,000 times using EstimateS (version 8, Colwell 2009). In order to estimate the theoretical maximum for each fauna group, a Michaelis-Menten enzyme kinetic curve was calculated and used as a stopping rule technique.

Only the results of trapping are included in SAC analysis, as this form of analysis assumes a standard sampling effort. Therefore, species recorded through opportunistic methods are not included. All

trapped terrestrial fauna (mammals, reptiles, amphibians) are included in the analysis. Avifauna data were collected through transects of varying length and time and as a result cannot be analysed statistically.

3.9.2 Habitat Assessment

Analysis of the fauna survey data was undertaken to determine the similarities in fauna communities and identify any unique fauna habitats.

To analyse differences in species diversity between habitats, the data were subjected to log transformation. To test whether the differences in species diversity between habitat types were significant, analyses of similarity (ANOSIM) (Clarke 1993) comparisons were made using the one-way ANOSIM function. ANOSIM was calculated using the Bray-Curtis Similarity Index with 999 permutations. Non-metric multidimensional scaling (MDS) was also applied to the Bray-Curtis similarity matrix. Resulting stress values below 0.20 were considered to indicate a good fit of the scaling to the matrix. The dimensions that reduced the majority of the "raw stress" were chosen for the final scaling. Analysis was undertaken using the PAST software package (Hammer *et al.* 2001).

Analysis was carried out on the trapping data from the current survey. Avifauna data were collected through transects of varying length and time and as a result avifauna habitats could not be analysed statistically.

3.10 CONSERVATION SIGNIFICANT FAUNA

After the results of the literature review, database searches and survey results were compiled, fauna species that are listed under current legislative frameworks were identified. Three conservation lists have been developed at national (EPBC Act) and state level (WC Act and DEC priority list).

The likelihood of a conservation significant species being present within the project was determined by examining:

- fauna habitats and their condition known to exist within the project area;
- distance of previously recorded conservation significant species from the project area;
- frequency of occurrence of conservation significant species records in the region; and
- time passed since conservation significant species were recorded within, or surrounding, the project area.

For each conservation significant species potentially occurring in the project area, the examined factors were collated and assigned to their corresponding category (Table 3.8).

Table 3.8 – Likelihood of Occurrence Categories.

HIGH	Species recorded within, or in proximity to, the project area within 50 years; suitable habitat occurs
MEDIUM	Species recorded outside project area, but within 100 km; limited suitable habitat occurs
LOW	Species rarely, or not recorded, within 100 km of project area, and/or suitable habitat does not occur

3.11 SURVEY TEAM

Field survey team members are listed in Table 3.9, and external consultants are listed in Table 3.10. The survey was conducted under DEC Regulation 17 Licence SF007958.

Table 3.9 – Field Survey Personnel.

Survey Member	Expertise	Qualification	Experience
Bret Stewart	Herpetology	B.Sc.	9 years
George Swann	Ornithology	-	40 years
Jordon Vos	Herpetology	-	10 years
Leigh Smith	Herpetology	-	2 years
Jesse Forbes-Harper	Field Assistant	B.Sc. (Hons)	1 year
Sean White	Field Assistant	B.Sc.	3 years

Table 3.10 – External Consultants.

External Consultant	Institution	Relevant Experience
Bob Bullen	Bat Call WA	Expert in bat call analysis
Thomas Parkin	WA Museum	Taxonomic expert in reptiles

4 RESULTS

4.1 LITERATURE REVIEW

The potential fauna assemblage of the project area was determined using the results of database searches and records of previous surveys within close proximity to the project area. Based on these results, there is the potential for 36 native mammal species, six introduced mammal species, 296 bird species, 88 reptile species, and ten amphibian species to occur within the project area (Table 4.1, Appendix C).

Table 4.1 – Comparison of Results of Previous Fauna Surveys.

Survey	Mammals Native (introduced)	Birds	Reptiles	Amphibians
<i>ecologia</i> (2004)	6 (1)	65	28	4
AECOM (2010)	5 (3)	103	17	0
Biota (2009)	10 (2)	68	39	4
Biota (2010)	3 (1)	n/a	27	1
ENV (2008)	27 (6)	177	56	8
Rogers <i>et al.</i> (2009)	n/a	80	n/a	n/a
NatureMap	18 (2)	233	52	7
DEC Threatened and Priority Fauna Search	5 (0)	12	2	0
DSEWPaC Protected Matters Search	2 (2)	12	9	0
Birddata	n/a	276	n/a	n/a
This survey	11	82	33	2
Total	36 (6)	296	88	10

4.2 SURVEY RESULTS

The current survey resulted in the identification of 11 native mammal species, 82 bird species, 33 reptile species and two amphibian species (Appendix F). Two species not previously recorded from the project area were recorded during this survey; Australian Bustard (*Ardeotis australis*) and Flock Bronzewing (*Phaps histrionica*).

4.2.1 Mammals

Nine native mammals were recorded within the project area, including: one murid (mouse), one dasyurid (Lesser Hairy-footed Dunnart; *Sminthopsis youngsoni*) and six chiropterans (bats), as well as one canid (dingo), for which there is still debate as to whether it is a native or introduced species. The Lesser Hairy-footed Dunnart was previously unrecorded in the area (Appendix C). Secondary evidence observed during the current survey suggests an additional two species potentially occur in the project area: Bilby (*Macrotis lagotis*) and Agile Wallaby (*Macropus agilis*).

Secondary evidence of the Bilby and Agile Wallaby were recorded while opportunistically searching and traversing the study areas on foot. Macropod tracks and part of an Agile Wallaby's skull were found in the SP area. Four large burrows were observed in the WAC and in and around the LIA (Appendix G). Based on the size (approximately 15-18 cm high x 10-15 cm wide) and depth (greater than 50 cm) of the burrows and a review of the potential burrowing species in the study area, it was thought likely that these burrows were constructed by Bilbies (EPBC Vulnerable; WC Act Schedule 1). No discernible tracks were found near any of the burrows. One of these burrows was found in the WAC in an area easily accessible on foot. The vicinity of this burrow was searched extensively, and many digging signs were found and photographed (Appendix G). This burrow at the WAC was considered the most likely burrow to have had recent activity. As such, two baited camera traps were set up for 9 nights near the burrow and 10 cage traps were set up for 4 nights. No further evidence of Bilbies, or other species which may have created the burrows, was recorded.

Delicate Mice (*Pseudomys delicatulus*) appear to be quite common in the area. Many individuals were recorded on this survey across all trapping sites. Two Lesser Hairy-footed Dunnarts (*Sminthopsis youngsoni*) were recorded in the WAC survey area. Although the species is common throughout the arid interior of subtropical WA and Northern Territory, these were the first records of this species in the JPP area. The nearest previous record is 140 km to the south-east (DEC NatureMap).

Dingoes were observed several times each day on baited camera traps at the targeted Bilby trapping site in the WAC, and well-worn paths with dog footprints were observed in the SP. Dingoes appear to be abundant in these survey areas. As in most areas of Australia, dingoes have interbred with domestic dogs and, given the proximity of the project area to Broome, it is highly likely that all dingoes in the area are a cross between dog and dingo.

4.2.2 Birds

A total of 82 bird species were recorded in the project area. The bird assemblage was most diverse in the SP survey area, with 76 species recorded. This is likely to reflect the diversity and quality of the fauna habitats present in that area (given that the SP area was nearest the coast), as well as relative survey effort. The SP contained patches of monsoon vine thicket, open woodland, and coastal communities in addition to the pindan vegetation which dominated the other survey areas. Coastal species observed only within the SP include Australian and Sooty Oystercatcher, Red-capped Plover, Australian Pelican, Brahminy Kite, Crested Tern and EPBC listed Migratory species such as Common Tern, Lesser Crested Tern, Brown Booby, Lesser Frigatebird, and White-bellied Sea-Eagle. The Oystercatchers were seen on the rocks along the shoreline. The Lesser Frigatebird and Brown Booby were observed in flight over the coastal dunes and adjacent monsoon vine thicket. A pair of Flock Bronzewings, which are rarely recorded in the area, were seen flying south over the coastal dunes against strong ESE winds. The open woodlands along Kundandu Creek (which runs east-west through the middle of the SP survey area) support mature eucalypts with abundant tree hollows suitable for cavity-nesting birds.

Only 52 species were recorded in the WAC and NEAT (near LIA) areas. Pindan vegetation consisting of patches of open eucalypt over mixed acacia shrubs was the only fauna habitat present in these areas. The habitat varied only slightly in density and composition of vegetation. Honeyeaters (Meliphagidae) accounted for a large proportion of the species diversity in the pindan vegetation, with 10 species recorded. Honeyeaters were by far the most abundant species, constituting one third of the birds observed on this survey, with the Singing Honeyeater alone accounting for half that figure (1,004 of the total 6,124 bird observations).

4.2.3 Reptiles

The reptile fauna of the project area comprised 33 species including 12 skinks, six geckoes, one pygopod (legless lizard), four agamids (dragons), three varanids (goannas), five elapids (front-fanged snakes), one blind snake and one python. This included one species previously unrecorded from the area (Appendix C); Northern Dtella (*Gehyra australis*).

The soft sandy substrate throughout the project area supports many burrowing and sand-swimming species such as *Ramphotyphlops diversus*, *Varanus gouldii*, *Eremiascincus isolepis*, *Lerista apoda*, *L. bipes*, and *L. griffini*. *V. gouldii* burrows and diggings were abundant throughout the WAC and the pindan shrublands of the SP. *Strophurus ciliaris* was abundant on standing burnt sticks in pindan shrubland. *Gehyra pilbara* was often found under bark on dead trees supporting termite colonies. One *Ctenotus pantherinus* was recorded for the survey at JPP Site 1, which is well outside its previously known distribution.

4.2.4 Amphibians

Only two amphibian species, the Green Tree Frog (*Litoria caerulea*) and Ornate Burrowing Frog (*Platyplectrum ornatum*) were recorded on this survey. The low numbers and diversity of amphibians can be attributed to the relative uniformity of trapping sites (mostly pindan shrubland), the fairly dry conditions during surveying, and the timing of surveying (generally daytime).

4.2.5 Introduced Species

Nine introduced species potentially occur within the project area (Appendix C). These include Asian House Gecko (*Hemidactylus frenatus*), Rock Dove/ Domestic Pigeon (*Columba livia*), Indian Peafowl (*Pavo cristatus*), and the mammals: House Mouse (*Mus musculus*), Black Rat (*Rattus rattus*), Red Fox (*Vulpes vulpes*), Cat (*Felis catus*), Donkey (*Equus asinus*) and Cow (*Bos taurus*). Additionally, Dog/Dingo (*Canis lupus*), for which there is still debate as to whether they are a native or introduced species (see 4.2.1), were recorded in this survey (Appendix C, F).

4.3 CONSERVATION SIGNIFICANT FAUNA

Five bird species of conservation significance were recorded within the project area during the current survey (Figure 4.1): Fork-tailed Swift, Lesser Frigatebird, White-bellied Sea-eagle, Australian Bustard and Rainbow Bee-eater. Another three conservation significant bird species were observed over the ocean, just outside the project area: Brown Booby, Common Tern and Lesser Crested Tern. All these species are listed as Schedule 3, Migratory, with the exception of Australian Bustard, which is Priority 4. None of the mammal, reptile or amphibian species directly observed during the current survey were of conservation significant status. However, burrows and diggings thought to be those of the Bilby (Vulnerable) were observed during this survey.

Based on database searches and the results of previous biological surveys in the surrounding area, 10 mammal, 76 bird and 10 reptile species of conservation significance potentially occur in the project area. However, based on fauna habitats present, only three mammal, 56 bird and eight reptile species have a medium or high likelihood of occurrence. Information on the distribution, ecology, likelihood of occurrence and potential impacts to the 65 conservation significant species that are likely to occur within the project area are described below and summarised in Table 4.5.

The remaining 29 conservation significant species were considered to be of low likelihood of occurrence within the project area. These are summarised in Appendix H, with the exception of the

Golden-backed Tree-rat which, as a requirement of Woodside, is discussed below and included in Table 4.5 rather than Appendix H.

4.3.1 Conservation Significant Mammals

4.3.1.1 Golden Bandicoot (*Isoodon auratus auratus*).

Conservation Status: EPBC Act Vulnerable, WC Act Schedule 1.

Distribution and Habitat: The Golden Bandicoot was widely distributed throughout northern and central Australia until the 1930s, when it disappeared from almost all of its former range (Ellis *et al.* 1991; McKenzie *et al.* 2008). It is now restricted to rocky sandstone spinifex habitats and vine thickets in the northern Kimberley, as well as several offshore islands.

Ecology: The Golden Bandicoot is a small omnivorous marsupial, feeding on ants and termites, moths, centipedes, insect larvae, turtle eggs, small reptiles and plant material. Little is known of its biology, but field observations on Barrow Island suggest that it is a nocturnal species which forages in open habitat between clumps of spinifex. They are a solitary species, although their home ranges have some overlap. Home ranges vary from 2 to 35 ha and are centred on a nest site (Palmer *et al.* 2003).

Likelihood of Occurrence: Medium. There have only been three previous records of the species within 80 km of the project area, with the latest record from 1971 (NatureMap). The monsoon vine thickets within the SP potentially provide suitable habitat for the species, however the lack of recent records gives this species only a medium likelihood of occurrence. Previous relevant survey effort in the monsoon vine thicket within the SP includes two 'standard' trapping grids (Biota 2009), three Elliott trap lines (Biota 2010), and 11 transects (AECOM 2010). Additional transects and opportunistic surveys were conducted during the current survey. No evidence of Golden Bandicoot was observed.

Potential Impacts: If Golden Bandicoots do occur in the area, vegetation clearing will result in a loss of habitat within the monsoon vine thicket vegetation of the SP. Similar habitat occurs to the north and south of the survey area, although monsoon vine thicket is relatively restricted in size. Impacts to the species on a regional scale are expected to be low.

4.3.1.2 Bilby (*Macrotis lagotis*)

Conservation Status: EPBC Act Vulnerable, WC Act Schedule 1.

Distribution and Habitat: Once common over 70% of mainland Australia's arid and semiarid regions, Bilbies are currently patchily distributed through the Tanami, Great Sandy and Gibson Deserts, as well as near Broome and on the Dampier Peninsula (Maxwell *et al.* 1996; Johnson 2008). Isolated populations also occur in south-west Queensland and to the north-east of Alice Springs. Bilbies occur in a variety of habitats, including spinifex grassland, acacia shrubland, open woodland, and cracking clays (Maxwell *et al.* 1996; Johnson 2008). The species underwent a sudden and widespread collapse in population size in the early 1900s, and the distribution may still be contracting and fragmenting. Reasons for the decline include predation by feral predators on both young and adult bilbies, competition from rabbits and livestock, reduced food as a result of changed fire regimes, and drought (Maxwell *et al.* 1996; O'Malley 2006; Johnson 2008).

Ecology: The Bilby is a nocturnal marsupial with soft silky fur (Pavey 2006). It uses its strong forelimbs and claws to construct an extensive tunnel system up to 3 m long and 1.8 m deep in which

it shelters during the day. Its long tongue is an adaptation to their specialised diet of seeds, insects, bulbs, fruit and fungi (Johnson 2008).

Likelihood of Occurrence: High. There are numerous Bilby records from within 100 km of the project area, suggesting the presence of suitable habitat for the species. However, the majority of these records were made prior to 1970, indicating a recent decline. Potential Bilby burrows and diggings were observed during the current survey in the WAC and adjacent to the LIA (Appendix G and Figure 4.1). Given the close proximity of the burrows identified in the current survey to the LIA, it is likely that additional burrows exist within the area.

Woodside has provided images of the burrows and diggings photographed on the current survey for review by Dr Ric How of the WA Museum as part of the Woodside Environmental Advisory Panel (EAP). His opinion was that several of the burrows photographed during this survey appeared to have been made by Bilbies, and that there is strong evidence that Bilbies are present in the area (R. How, EAP, pers. comm.). However, the burrows looked more like feeding holes than breeding burrows (R. How, EAP, pers. comm.). Some of the burrows were too small to have been made by Bilbies, and are more likely to be from smaller mammals or monitor lizards (R. How, EAP, pers. comm.). Woodside also provided images of the burrows and diggings to Dr Richard Southgate of Envisage Environmental Services. Woodside produced a likelihood rating assessed against each image based on Woodside's communications with Dr Southgate (Appendix G). Four of the images were rated as "likely" evidence of Bilbies while the rest were rated as "possible."

Other targeted Bilby studies conducted by ENV Australia for Woodside in 2011 have not recorded any direct evidence of Bilbies. However, at least one burrow system which was "almost certain to be that of a Bilby" (ENV 2011) was identified. This conclusion was based on the presence of a pop hole (exit hole that has no spoil on the surface, as it has been dug from under the surface), which was too large to have been dug by any other species that occur in the area. This assessment was confirmed by the Woodside EAP reviewer Ric How. Burrows and tracks thought to be those of the Bilby were also previously observed by AECOM (AECOM 2010, 2011) both within the SP and within 5 km to the south-east. AECOM (2011) concluded that "the species appears to frequent the project area and the proposed access road alignment".

Motion cameras and cage traps set up during the current survey beside the burrows did not capture any Bilbies. However, the cameras and cage traps were baited with universal bait (oats, peanut butter, and sardine mixture) which attracted at least four Dingoes to the area. The Dingoes were recorded at least twice each day by the motion cameras. The presence of Dingoes in the area may have decreased the likelihood of Bilbies being present in the area at the time of surveying, as Dingos are a potential predator. A full survey of the southern end of the LIA was not completed and, hence, additional burrows may occur in this area. The observation of a small number of burrows in the areas surveyed most likely indicates a small number of vagrant Bilbies occurring in the area rather than a resident colony. This finding is consistent with the conclusions expressed in previous reports (AECOM 2010, 2011).

Potential Impacts: Bilbies are likely to occur within all three survey areas on an occasional basis. Since there are unlikely to be any resident individuals, the clearing of vegetation within this area will be unlikely to impact any individuals directly, but will reduce the amount of habitat in the local area. The Bilby's preferred habitat of open woodland and Acacia shrubland is common in the region, and hence low regional impacts to the species are anticipated.

4.3.1.3 Little Northern Freetail Bat (*Mormopterus loriae cobourgiana*)

Conservation Status: DEC Priority 1

Distribution and Habitat: This small subspecies of bat is common in, but confined to, coastal and sub-coastal areas of the top-end of the Northern Territory and the semi-arid part of the tropical coastline of WA, from Lake McLeod to Point Torment (Duncan *et al.* 1999).

Ecology: The Little Northern Freetail Bat roosts in small spouts and crevices in the dead upper branches of mangroves (Milne *et al.* 2008). They emerge at dusk and form swarms of up to 100 before dispersing to forage singly or in pairs. Their wings are adapted for speed not manoeuvrability, hence they hunt their diet of flying insects in open spaces above the canopy or in gaps created by creeks or roads through the forests. It has also been known to scurry about on surfaces catching crawling insects (Milne *et al.* 2008). Females give birth to a single young in the summer wet season and lactate until March (Milne *et al.* 2008).

Likelihood of Occurrence: High. The Little Northern Freetail Bat has been previously recorded in close proximity to the project area (ENV 2008 and NatureMap). No mangrove roosting habitat is present within the project area; however, they are likely to occasionally hunt within the project area.

Potential Impacts: There will be no impact to roosting colonies of the species. The only local or regional impact will be a small loss of potential foraging habitat. Similar habitat occurs to both the north and south of the project area and hence no significant impacts are anticipated.

4.3.1.4 Golden-backed Tree-rat (*Mesembriomys macrurus*)

Conservation Status: EPBC Act Vulnerable, DEC Priority 4.

Distribution and Habitat: The Golden-backed Tree-rat is distributed throughout the near-coastal, north-western Kimberley in a variety of habitats, including rainforest patches, eucalypt woodlands over tussock and hummock grasses, rugged sandstone screes and coastal beaches surrounded by such vegetation (Palmer *et al.* 2003; McKenzie and Kerle 2008).

Ecology: The species is nocturnal and arboreal and it is known to feed on flowers, fruits, termites, ants and beetles. The bulk of their diet is flowers and fruits on rainforest edges and termites in eucalypt woodland (McKenzie and Kerle 2008). Golden-backed Tree-rats roost predominantly in tree hollows (Palmer *et al.* 2003).

The factors most frequently cited as the cause for decline in this species are predation and changed fire regimes, which cause a reduction of understorey trees and shrubs that Golden-backed Tree-rats rely on for food. Opening up the understorey makes the animals vulnerable to predation by feral cats (Palmer *et al.* 2003).

Likelihood of Occurrence: Low. The monsoon vine thicket communities within the SP area potentially provide habitat to Golden-backed Tree-Rat. However, the only relevant record of Golden-backed Tree-rat in the area was made in Broome in 1895 (NatureMap). Furthermore, the species' typical range is north-east of Derby, placing the project area outside the typical range of the species.

Potential Impacts: No impacts on the Golden-backed Tree-rat are expected as a result of the project as the species is unlikely to occur in project area.

4.3.2 Conservation Significant Birds

4.3.2.1 Tern Species

Conservation Status: Refer to Table 4.2.

Distribution and Habitat: Eight conservation significant tern species potentially occur at JPP: Bridled Tern, Little Tern, Fairy Tern, Caspian Tern, White-winged Black Tern, Roseate Tern, Common Tern, Lesser Crested Tern. Fairy, Caspian and Roseate Terns occur across much of the WA coastline, while the remaining terns are typically found along the north-west coast of WA. All the terns occur in open ocean, along coastlines, in sheltered seas or estuaries.

Ecology: Terns hunt primarily for fish and cephalopods in open water, and only come ashore to roost or breed. Little, White-winged Black and Common Terns are non-breeding visitors to Australia, Bridled Terns are a breeding visitor, while the remaining species are resident in Australia. Terns predominantly breed on offshore islands or coastal areas.

Likelihood of Occurrence: Rogers *et al.* (2009) states that large flocks of terns have been recorded along the coast in this region. These eight tern species each have a medium to high likelihood of occurrence within the project area (refer to Table 4.5). They are likely to feed in the ocean off JPP and occasionally fly over or roost in coastal areas, and potentially the SP.

Potential Impacts: These species will not utilise any habitats within the WAC or LIA. They may occasionally fly over or roost along the coastline within the SP; however, this area does not present important hunting or breeding habitat for the species. There are no known records of any of these species breeding within, or in close vicinity to the project area. Due to the presence of similar habitat to the north and south of the project area, no impacts to the species are anticipated.

Table 4.2 – Tern Species Potentially Occurring.

Species Name	Common Name	Conservation Status		
		EPBC Act	WC Act	DEC
<i>Sterna anaethetus</i>	Bridled Tern	M	S3	
<i>Sternula albifrons</i>	Little Tern	M	S3	
<i>Sternula nereis</i>	Fairy Tern	VU		
<i>Sterna caspia</i>	Caspian Tern	M	S3	
<i>Chlidonias leucopterus</i>	White-winged Black Tern	M	S3	
<i>Sterna dougallii</i>	Roseate Tern	M	S3	
<i>Sterna hirundo</i>	Common Tern	M	S3	
<i>Thalasseus bengalensis</i>	Lesser Crested Tern	M	S3	

4.3.2.2 Fork-tailed Swift (*Apus pacificus*)

Conservation Status: EPBC Act Migratory, WC Act Schedule 3

Distribution and Habitat: The Fork-tailed Swift is a small, insectivorous species with a white throat and rump, and a deeply forked tail (Morcombe 2000). It is distributed from central Siberia and throughout Asia, breeding in north-east and mid-east Asia, and wintering in Australia and south New Guinea. It is a relatively common trans-equatorial migrant from October to April throughout mainland Australia (Simpson and Day 2004). In WA, the species begins to arrive in the Kimberley in

late September, the Pilbara in November and in the South-west by mid-December (Johnstone and Storr 1998). In WA, the Fork-tailed Swift is considered uncommon to moderately common near the north-west, west and south-east coasts, common in the Kimberley and rare or scarce elsewhere (Johnstone and Storr 1998).

Ecology: Fork-tailed swifts are nomadic in response to broad-scale weather pattern changes. They are attracted to thunderstorms where they can be seen in flocks, occasionally up to 2,000 birds. They rarely land, living almost exclusively in the air and feeding entirely on aerial insects, especially nuptial swarms of beetles, ants, termites and native bees (Simpson and Day 2004).

Likelihood of Occurrence: High. Fork-tailed Swifts were recorded during the current survey from the SP, and have previously been recorded from numerous locations within and surrounding the project area (AECOM 2010; Bamford 2011, NatureMap, Birdata).

Potential Impacts: The Fork-tailed Swift is an entirely aerial species in Australia and hence is unlikely to be impacted by the development of the project area.

4.3.2.3 Lesser Frigatebird (*Fregata ariel*)

Conservation Status: EPBC Act Migratory, WC Act Schedule 3

Distribution and Habitat: The Lesser Frigatebird is a migratory bird found mainly in the Northern seas of WA, south to the Dampier Archipelago, and more commonly in the Kimberley than the Pilbara (Johnstone and Storr 1998). It is found in Australia from October to May, and breeds during the rest of the year on islands in the south Atlantic, Pacific and Indian Oceans (Johnstone and Storr 1998).

Ecology: Is usually found alone at sea, but can occur in twos or small groups, often near feeding terns and boobies (Johnstone and Storr 1998). Adults appear to feed on flying fish and herrings (Johnstone and Storr 1998).

Likelihood of Occurrence: High. Lesser Frigatebirds are commonly recorded offshore in the vicinity of the project area (NatureMap, Birdata). A single individual was observed during the current survey flying along the coast within the SP. The species is predominantly an ocean-dwelling bird but will occasionally fly or roost along coastlines. As a result, individuals may occasionally occur along the coast within the SP. They will not occur within the WAC or LIA.

Potential Impacts: Lesser Frigatebirds are unlikely to utilise habitats within the SP directly except for occasional roosting. Since similar habitat occurs to the north and south of the survey area, no impacts on either a local or regional scale are anticipated.

4.3.2.4 Brown Booby (*Sula leucogaster*)

Conservation Status: EPBC Act Migratory, WC Act Schedule 3.

Distribution and Habitat: Brown Boobies occur throughout the coastal areas surrounding northern Australia. They are commonly found in north-western Western Australia, often offshore (Menkhorst and Knight 2011).

Ecology: Brown Boobies are found in singly or in small flocks, flying close to waves with casual wingbeats and gliding. They will often dive from low levels and take fish from the waves in low flight. Brown Boobies roost on coral cays, buoys, beacons, trees, or rigging of ships (Menkhorst and Knight 2011). This species breeds all year, with autumn and spring peaks (Menkhorst and Knight 2011).

Brown Boobies will nest in a scrape of sand, on a low collection of sponges or seaweeds, or on the edges of cliffs and in small clearings on islands.

Likelihood of Occurrence: High. Brown Boobies were recorded during this survey (observed offshore, SP area) and previously (ENV 2008, NatureMap, Birddata; Rogers *et al.* 2009). The species is predominantly an ocean-dwelling bird but will occasionally fly or roost along coastlines. As a result, individuals may occasionally occur along the coast within the SP. They will not occur within the WAC or LIA.

Potential Impacts: Brown Boobies are unlikely to utilise habitats within the SP directly except for occasional roosting. Since similar habitat occurs to the north and south of the survey area, no impacts on either a local or regional scale are anticipated.

4.3.2.5 Eastern Great Egret (*Ardea modesta*)

Conservation Status: EPBC Act Migratory, WC Act Schedule 3

Distribution and Habitat: Eastern Great Egrets mainly inhabit shallow water bodies; both fresh (lakes, lagoons, swamps and floodwaters) and saline (mangrove creeks, estuaries and tidal pools) (Johnstone and Storr 1998). They occur across a large part of WA, including the south-west, Kimberley and Pilbara (Johnstone and Storr 1998). The Great Egret is common to very common in the well-watered Kimberley flatlands, and scarce to moderately common elsewhere within its range (Johnstone and Storr 1998).

Ecology: This species' diet consists predominantly of small fish and crustaceans. They breed colonially in trees standing in water around wooded swamps and river pools, 4-13 m above water (Morcombe 2000). The nest is built as a rough, loose, shallow platform. Four eggs are laid in summer in the Kimberley and during the spring in regions further south (Johnstone and Storr 1998).

Likelihood of Occurrence: Medium. There are numerous previous records of the Eastern Great Egret from creeks and wetlands in the region (ENV 2008, NatureMap, Birddata; Rogers *et al.* 2009). There is a drainage basin and a single creekline in the project area: Kundandu Creek in the SP. This creek dries out during the dry season, and did not contain water during the current survey. During the wet season, when the creek or drainage basin contains water, Eastern Great Egrets may occasionally visit to hunt for food. No suitable habitat for the species is present in the WAC or LIA.

Potential Impacts: Eastern Great Egret may only occur in the SP on an occasional basis when Kundandu Creek or the drainage basin contains water. Neither of these areas is likely to be an important food source area for the species. Development of the SP is unlikely to result in either local or regional impacts to the species.

4.3.2.6 Eastern Reef Egret (*Egretta sacra*)

Conservation Status: EPBC Act Migratory, WC Act Schedule 3

Distribution and Habitat: This migratory species is found along most of WA's coastline and a large number of islands, occasionally as far as Albany in the south, but commonly in the Kimberley (Johnstone and Storr 1998). The Eastern Reef Egret prefers mangrove creeks and rocky shores, tidal mud and reef flats, or saltwork ponds (Johnstone and Storr 1998).

Ecology: The Eastern Reef Egret breeds in WA from July to November, usually individual breeding pairs (on islands) but also in small colonies (e.g. at Yardie Creek), laying 1– 3 eggs in the Kimberley

and 2–4 further south (Johnstone and Storr 1998). As a waterbird, it likely feeds mostly on small fish and crustaceans or other invertebrates.

Likelihood of Occurrence: High. There are numerous records of Eastern Reef Egret from coastal areas around JPP (NatureMap, Birddata, ENV 2008, Rogers *et al.* 2009). They have a high likelihood of foraging along the rocky coastline within the SP. They will not occur within the WAC or LIA due to lack of suitable (coastal) habitat.

Potential Impacts: Development of the SP will reduce a small amount of foraging habitat for the species. The presence of similar habitat along the coast to the north and south of the survey area will result in no local or regional impacts to the species.

4.3.2.7 Wader Species

Conservation Status: Refer to Table 4.3.

Distribution and Habitat: Thirty-one wader species potentially occur within the project area (Table 4.3). Waders predominantly occur on coastal beaches and headlands, inland lakes, estuaries, mudflats and grassy plains. They are non-breeding migrants to Australia, breeding in Siberia and north-east Asia and overwintering in Australia, Taiwan and New Zealand. Individuals are present in Australia typically between September and April (Johnstone and Storr 1998).

Ecology: Waders feed on a range of invertebrates, including molluscs, insects and worms (Johnstone and Storr 1998), which are either extracted from the mud or sand with a long beak, or hunted on the surface of the mud, sand or grass. Waders can occur singly, in small flocks (up to 100 birds) or in large mixed flocks that can contain thousands of birds.

Likelihood of Occurrence: Most of the 31 wader species listed below are commonly recorded along coasts, rivers and grassy plains in the Dampier Peninsula. However, Rogers *et al.* (2009), who provided an extensive description of migratory birds in the area, state that large concentrations of waders do not occur along the west coast of the Dampier Peninsula, including around JPP. It is highly likely that all 31 species will occasionally roost and forage along the coastline within the SP. No suitable habitat for waders occurs within the WAC or LIA.

Potential Impacts: Waders only occur in small numbers within the survey area and, hence, the coastal areas within the SP are unlikely to provide important habitat to the species. Similar habitat occurs along the coast to the north and south of the SP and thus no local or regional impacts are anticipated.

Table 4.3 – Wader Species Potentially Occurring.

Species	Common Name	Conservation Status		
		EPBC Act	WC Act	DEC
<i>Pluvialis fulva</i>	Pacific Golden Plover	M	S3	–
<i>Pluvialis squatarola</i>	Grey Plover	M	S3	–
<i>Charadrius dubius</i>	Little Ringed Plover	M	S3	–
<i>Charadrius leschenaultii</i>	Greater Sand Plover	M	S3	–
<i>Charadrius mongolus</i>	Lesser Sand Plover	M	S3	–
<i>Charadrius veredus</i>	Oriental Plover	M	S3	–
<i>Limosa limosa</i>	Black-tailed Godwit	M	S3	–
<i>Limosa lapponica</i>	Bar-tailed Godwit	M	S3	–
<i>Numenius minutus</i>	Little Curlew	M	S3	–
<i>Numenius phaeopus</i>	Whimbrel	M	S3	–

Species	Common Name	Conservation Status		
		EPBC Act	WC Act	DEC
<i>Numenius madagascariensis</i>	Eastern Curlew	M	S3	P4
<i>Xenus cinereus</i>	Terek Sandpiper	M	S3	—
<i>Actitis hypoleucos</i>	Common Sandpiper	M	S3	—
<i>Tringa brevipes</i>	Grey-tailed Tattler	M	S3	—
<i>Tringa glareola</i>	Wood Sandpiper	M	S3	—
<i>Tringa nebularia</i>	Common Greenshank	M	S3	—
<i>Tringa stagnatilis</i>	Marsh Sandpiper	M	S3	—
<i>Tringa totanus</i>	Common Redshank	M	S3	—
<i>Arenaria interpres</i>	Ruddy Turnstone	M	S3	—
<i>Limnodromus semipalmatus</i>	Asian Dowitcher	M	S3	—
<i>Calidris tenuirostris</i>	Great Knot	M	S3	—
<i>Calidris canutus</i>	Red Knot	M	S3	—
<i>Calidris alba</i>	Sanderling	M	S3	—
<i>Calidris ruficollis</i>	Red-necked Stint	M	S3	—
<i>Calidris subminuta</i>	Long-toed Stint	M	S3	—
<i>Calidris melanotos</i>	Pectoral Sandpiper	M	S3	—
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	M	S3	—
<i>Calidris ferruginea</i>	Curlew Sandpiper	M	S3	—
<i>Limicola falcinellus</i>	Broad-billed Sandpiper	M	S3	—
<i>Philomachus pugnax</i>	Ruff	M	S3	—
<i>Phalaropus lobatus</i>	Red-necked Phalarope	M	S3	—

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

Conservation Status: EPBC Act Migratory, WC Act Schedule 3

Distribution and Habitat: The White-bellied Sea-Eagle is considered moderately common in the Houtman Abrolhos Islands off Geraldton and in addition to Australia, the species is found in New Guinea, Indonesia, China, south-east Asia and India. White-bellied Sea-eagles occur in coastal and near coastal areas across Australia inhabiting most types of habitats except closed forest.

Ecology: It feeds mainly off aquatic animals, such as fish, turtles and sea snakes, but it takes birds and mammals as well. It breeds almost wholly on islands, building a large stick nest, which is used for many seasons in succession (Johnstone and Storr 1998; RPS 2008). The breeding season ranges from May to September in the north and in winter and spring in Australia's south (Morcombe 2000).

Likelihood of Occurrence: High. White-bellied Sea-eagles are common in coastal areas surrounding the project area (Birddata) and were recorded during the current survey within the SP. A Sea-eagle nest was also recorded along the coast north of Coulomb Point in 2009 (AECOM 2010). No suitable habitat for the species occurs in the WAC or LIA, although they may occasionally overfly these areas due to their proximity to the coast. Sea-eagles are likely to regularly visit the coast within the SP. The species rarely nests on the mainland and no evidence of nesting has been recorded within the project area.

Potential Impacts: White-bellied Sea-eagles are unlikely to rely heavily on the habitats within the SP for either hunting or breeding and hence any impacts to this area are unlikely to impact the species on either a local or regional scale.

4.3.2.9 Eastern Osprey (*Pandion cristatus*)

Conservation Status: EPBC Act Migratory

Distribution and Habitat: The Eastern Osprey is a large (50-60cm), highly-visible and water-dependent bird of prey with a world-wide distribution (Henny 1986; Wink *et al.* 2004). It occurs around most of the Australian coastline inhabiting coastal areas favouring mangroves, rivers and estuaries, inshore seas as well as coastal islands (Simpson and Day 2004). The species is uncommon to rare or absent from closely settled parts of south-eastern Australia and does not occur in Victoria or Tasmania.

Ecology: It feeds mostly on fish, but also sea snakes, seabirds, turtles, amphibians, large lizards as well as invertebrates including crustaceans, sea snails, and beetles (Henny 1986; Johnstone and Storr 1998). Breeding takes place from autumn to spring and eggs being laid in April in the North and as late as October in the South of Australia. Osprey nests are large and usually placed at the top of a trees, prominent headlands or communication towers (Henny 1986; Simpson and Day 2004). Some nests are re-used for decades (Morcombe 2000).

Degradation and removal of habitat, and disturbance to nesting sites have been identified as threats to the Osprey's survival (Henny 1986).

Likelihood of Occurrence: High. Osprey are common in coastal areas surrounding the project area (Birddata, Biota 2009). No suitable habitat for the species occurs in the WAC or LIA, although they may occasionally overfly these areas due to their proximity to the coast. Osprey are likely to regularly fly along the coast within the SP. The species rarely nests on the mainland and no evidence of nesting has been recorded within the project area.

Potential Impacts: Osprey do not rely on the habitats within the SP for either hunting or breeding and hence any impacts to this area are unlikely to impact the species on either a local or regional scale.

4.3.2.10 Rainbow Bee-eater (*Merops ornatus*)

Conservation Status: EPBC Act Migratory, WC Act Schedule 3

Distribution and Habitat: The Rainbow Bee-eater is scarce to common throughout much of WA, except for the arid interior, preferring lightly wooded, preferably sandy, country near water (Johnstone and Storr 1998).

Ecology: In WA, the Rainbow Bee-eater can occur as a resident, breeding visitor, post-nuptial nomad, passage migrant or winter visitor. It nests in burrows usually dug at a slight angle on flat ground, sandy banks or cuttings, and often at the margins of roads or tracks (Simpson and Day 2004). Eggs are laid at the end of the metre long tunnel from August to January (Boland 2004). Bee-eaters are most susceptible to predation.

Likelihood of Occurrence: High. There are numerous previous records of the species from within and surrounding the project area (*ecologia* 2004; ENV 2008; Biota 2009; AECOM 2011; Bamford 2011, Birddata). During the survey, Rainbow Bee-eaters were recorded frequently in all three survey areas.

Potential Impacts: Rainbow Bee-eaters are common across Australia in a wide variety of habitats. Clearing of vegetation within the project area will result in a loss of habitat in the local area. However, the presence of extensive areas of similar habitat surrounding the project area will result in

no local or regional impact to the species. The only exception will be if clearing occurs during the breeding season, when the destruction of nests may occur, resulting in a minor local impact.

4.3.2.11 Barn Swallow (*Hirundo rustica*)

Conservation Status: EPBC Act Migratory

Distribution and Habitat: The Barn Swallow is a migratory holarctic species which breeds in the northern hemisphere and is a summer (September to early April) visitor to northern Australia. They are predominantly found around towns and wetlands, including sewage and saltworks ponds, river pools, swamps, tidal creeks and reservoirs (Johnstone and Storr 2004).

Ecology: Typically seen in small numbers, although occasionally in much larger flocks containing hundreds of birds. The barn swallow is an aerial insectivore, able to catch flying insects due to its high level of manoeuvrability in the air.

Likelihood of Occurrence: Medium. Although there are numerous records of Barn Swallow to the south of the project area, around Broome and Roebuck Plains (Birddata, NatureMap), there is little habitat for the species within the project area. As a result, Barn Swallow may occasionally occur within the project area, while either overflying the area or hunting for insects along Kundandu Creek or the drainage basin when they contain water.

Potential Impacts: The project area does not represent important foraging or breeding habitat for the species and hence no local or regional impacts are anticipated as a result of the development.

4.3.2.12 Red-rumped Swallow (*Cecropis daurica*)

Conservation Status: WC Act Schedule 3

Distribution and Habitat: The Red-rumped Swallow is found from the Mediterranean region and eastwards to Japan. It is a rare, vagrant summer visitor to northern Australia, in ones, twos or small flocks, occasionally attached to larger flocks of Barn Swallows, Fairy Martins or Tree Martins (Johnstone and Storr 2004). The various sightings of this species demonstrate that it prefers open country with fresh water nearby (Johnstone and Storr 2004).

Ecology: The Red-rumped Swallow breeds across the entirety of its main range (Johnstone and Storr 2004). It is an aerial insectivore, likely feeding on small beetles, flies and flying termites.

Likelihood of Occurrence: Medium. Although the Red-rumped Swallow is a rare vagrant to Australia, several of the records are from around Broome and Willie Creek (Birddata). As a result, the species may occasionally overfly the project area and hawk for insects.

Potential Impacts: Red-rumped Swallows are rare in Australia and are predominantly an aerial species. As a result, no local or regional impacts are anticipated as a result of development of the project area.

4.3.2.13 Peregrine Falcon (*Falco peregrinus*)

Conservation Status: WC Act Schedule 4

Distribution and Habitat: This nomadic or sedentary falcon is widespread in many parts of Australia and some of its continental islands, but absent from most deserts and the Nullarbor Plain. The species is considered to be moderately common in the Stirling Range, uncommon in the Kimberley,

Hamersley and Darling Ranges, and rare or scarce elsewhere (Johnstone and Storr 1998). The Peregrine Falcon occurs most commonly near cliffs along coasts, rivers and ranges and around wooded watercourses and lakes.

Ecology: Peregrines feed almost entirely on birds, especially parrots and pigeons. Peregrines primarily nest on ledges on cliffs, granite outcrops and in quarries, but may also nest in tree hollows around wetlands. Eggs are predominantly laid in September (Johnstone and Storr 1998; Olsen *et al.* 2006).

Likelihood of Occurrence: High. There are numerous records of the species from the Dampier Peninsula (Birddata, NatureMap) and single individuals were previously recorded within the SP (Biota 2009, AECOM 2010). Suitable hunting habitat occurs throughout all three areas, particularly the SP, and suitable breeding habitat along coastal cliffs is also present within the SP.

Potential Impacts: No significant impacts to Peregrine Falcons at either a local or regional scale are anticipated due to the small extent of the project area, the ability of the Peregrine Falcon to move away from disturbance if present, and the presence of similar habitat in the surrounding the region. The only exception will be if development of the SP occurs during the breeding season, when the destruction or desertion of nests may occur, resulting in a minor local impact.

4.3.2.14 Flock Bronzewing (*Phaps histrionica*)

Conservation Status: DEC Priority 4

Distribution and Habitat: Also known as the Flock Pigeon, the Flock Bronzewing is an irregular, non-breeding visitor to the continent. It is most common on the black-soil plains of the south-east Kimberley, but is also found in the adjacent North-eastern interior and the coastal and riverine plains between Port Hedland and Carnarvon. Its preferred habitat is treeless or sparsely wooded plains near water. It is not a frequent visitor to the state, but has been recorded in flocks of up to 100,000 individuals in the 1980s and 1990s (Johnstone and Storr 1998).

Ecology: The Flock Bronzewing is gregarious, often feeding and drinking in groups, but is very wary. During the day, the species has been seen resting on the ground in tussock grassland (Ayers *et al.* 1996). Nesting occurs on the ground in the cover of a bush, lower branch, grass tussock or in the dusty, bare ground around bores (Higgins and Davies 1996). It feeds on seeds of grasses and herbaceous plants (NSW National Parks and Wildlife Service 1999b).

Likelihood of Occurrence: High. There are a small number of records of the species from east of Broome (Birddata) and from Packer Island (ENV 2008). Two individuals were recorded during the current survey within the SP. The coastal area within the SP is the only area within the project area that contains the Open Forest habitat preferred by the Flock Bronzewing in this region, and they are likely to occasionally visit this area.

Potential Impacts: This species is uncommon in the area and is highly unlikely to rely on the area for either foraging or breeding. Development of the project area will not result in any local or regional impacts to the species.

4.3.2.15 Grey Falcon (*Falco hypoleucos*)

Conservation Status: DEC Priority 4

Distribution and Habitat: Grey Falcons are a rare, nomadic species sparsely distributed across much of arid and semi-arid Australia. In WA, they are restricted to the northern half, occurring in a variety of habitats ranging from wooded drainage systems through to open spinifex plains. Grey Falcons once occurred across much of WA, with sightings as far south as York and New Norcia during colonial times. However, the current distribution is now thought to be restricted to north of 26 °S (Johnstone and Storr 1998). Because the distribution of this species is very scarce over an extremely large area, sightings of this species are very uncommon.

The Grey Falcon occurs in a wide variety of arid habitats including open woodlands and open acacia shrubland, hummock and tussock grasslands, low shrublands and may also be seen around swamps and waterholes that attract prey (Ehmann and Watson 2008).

Ecology: Like other falcons this species preys primarily on birds, such as parrots and pigeons, although reptiles and mammals are also taken (Ehmann and Watson 2008). Two to three eggs are laid in winter in the nests of other birds of prey and ravens, typically in tall eucalypt trees near water (Garnett and Crowley 2000; Ehmann and Watson 2008).

Likelihood of Occurrence: Medium. Grey Falcon are generally uncommon in the region, with only four previous records of the species within 100 km of the project area (DEC records, Birddata). However, all three survey areas contain suitable habitat for the species; therefore, it is moderately likely to occasionally visit these areas to hunt.

Potential Impacts: The project area does not represent important hunting or breeding habitat for the species, and similar habitat occurs surrounding the project area. As a result, no local or regional impacts to the species are anticipated.

4.3.2.16 Australian Bustard (*Ardeotis australis*)

Conservation Status: DEC Priority 4

Distribution and Habitat: The Australian Bustard occurs Australia-wide and utilises a number of open habitats, including open or lightly wooded grasslands, chenopod flats, plains and heath lands (Johnstone and Storr 1998).

Ecology: It is a nomadic species, ranging over very large areas and its abundance varies locally and seasonally from scarce to common, largely dependent on rainfall and food availability. The bustard has an omnivorous diet, feeding on grasses, seeds, fruit, insects and small vertebrates.

Although the population size is still substantial, there has been a large historical decline in abundance, particularly south of the tropics, but also across northern Australia (Garnett and Crowley 2000). This is a result of hunting, degradation of its grassland habitat by sheep and rabbits and predation by foxes and cats (Frith 1976; Garnett and Crowley 2000). Bustards readily desert nests in response to disturbance by humans, sheep or cattle (Garnett and Crowley 2000).

Likelihood of Occurrence: High. Bustards are common in the area (Birddata) and were recorded during the current survey from Pindan shrubland and open woodland in the WAC, LIA and along the NEAT.

Potential Impacts: Clearing of vegetation within all three survey areas will result in a loss of habitat for the Australian Bustard. However, the widespread nature of the species and the presence of similar habitat surrounding the project area will result in little impact to the species on either a local or regional scale. The only exception will be if clearing occurs during the breeding season, when the destruction of nests may occur, resulting in a minor local impact.

4.3.2.17 Bush Stone-curlew (*Burhinus grallarius*)

Conservation Status: DEC Priority 4

Distribution and Habitat: The Bush Stone-curlew occurs across much of Australia, except the arid interior and central south coast, preferring lightly wooded country near thickets or long grass that acts as daytime shelter (Johnstone and Storr 1998). The Bush Stone-curlew inhabits woodlands, dry and open grasslands and croplands with cover nearby (NSW National Parks and Wildlife Service 1999a).

Ecology: The species is insectivorous, preying primarily upon beetles, although they will also eat seeds and shoots, frogs, lizards and snakes (Marchant and Higgins 1993; NSW National Parks and Wildlife Service 1999a). They are usually seen in pairs, although may occasionally flock together during the breeding season (August to January) and are generally nocturnal, especially on moonlight nights (NSW National Parks and Wildlife Service 1999a). Historically, this species was widely distributed throughout much of WA, but it is now considered rare, with an estimated Australian population of 15,000 individuals (Garnett and Crowley 2000). Since Bush Stone-curlews are a ground dwelling and non-migratory species they are quite susceptible to local disturbances by humans and to predation by cats and foxes (Frith 1976; Johnstone and Storr 1998). They are most common where land disturbance is minimal and generally become rare or extinct around human settlements (Johnstone and Storr 1998).

Likelihood of Occurrence: High. Bush Stone-curlew have been recorded previously from around Broome and the Roebuck Plains (Birddata, DEC records) and were also previously recorded from north of Coulomb Point by Biota (2009). Suitable habitat for the species occurs within all three survey areas and there is likely to be a small number of resident individuals in the area.

Potential Impacts: Clearing of vegetation within all three survey areas will result in a loss of habitat for the Bush Stone-curlew. However, the widespread nature of the species and the presence of similar habitat surrounding the project area will result in little impact to the species on either a local or regional scale. The only exception will be if clearing occurs during the breeding season (August – March), when the destruction of nests may occur, resulting in a minor local impact.

4.3.2.18 Chestnut-backed Button-quail (*Turnix castanotus*)

Conservation Status: DEC Priority 4

Distribution and Habitat: The distribution of the Chestnut-backed Button-quail is limited to the north-west region of the Kimberley. Its preferred habitat is savannah woodlands in lateritic or sandstone country (Johnstone and Storr 1998).

Ecology: This moderately common species is usually found in small parties of up to eight birds (Johnstone and Storr 1998). Like other Button-quails, it most likely feeds on seeds and small insects, and breeds on the ground using nests concealed by grass.

Likelihood of Occurrence: Medium. This species typically occurs east of Derby; however, there are a small number of records from Roebuck Plains (DEC records) and a pair of birds was recorded 5 km south of the WAC (AECOM 2010). There is therefore the potential for a small number of individuals to be resident within any of the three survey areas.

Potential Impacts: The small number of individuals likely to be present, and the presence of similar habitat surrounding the project area will likely result in little impact to the species on either a local or

regional scale. The only exception will be if clearing occurs during the breeding season, when the destruction of nests may occur, resulting in a minor local impact.

4.3.2.19 Pictorella Mannikin (*Heteromunia pectoralis*)

Conservation Status: DEC Priority 4

Distribution and Habitat: This small, nomadic passerine occurs in the south of the Kimberley region of WA, preferring tropical woodland as well as lightly wooded grasslands, particularly of spinifex on hard, red soils (Johnstone and Storr 2004; Simpson and Day 2004).

Ecology: The species normally occurs in pairs or small parties, though flocks of up to 200 have been observed towards the end of the dry season. Feeding usually occurs on the ground and diet consists mainly of fallen grass seeds and small insects. The species is a solitary breeder, building nests in low tussocks of grass and laying clutches of four to six eggs between January and April. Both sexes share in nest building and the fourteen day incubation. The fledging period is 20 to 23 days (Morcombe 2000; Johnstone and Storr 2004).

Likelihood of Occurrence: Medium. Pictorella Mannikin are uncommon on the Dampier Peninsula, however there are a small number of records from Willie Creek and Roebuck Plains (Birddata, NatureMap). The species preferred habitat of tropical woodland is present in all three survey areas and hence they may occasionally visit any of these areas to forage.

Potential Impacts: The small number of individuals likely to be present, and the presence of similar habitat surrounding the project area, will likely result in little impact to the species on either a local or regional scale.

4.3.3 Conservation Significant Reptiles

4.3.3.1 Sea Turtles

Conservation Status: Refer to Table 4.4.

Survey Effort: Sea turtles have been briefly assessed in this section of the report, but have been assessed in further detail by RPS (2010).

Distribution and Habitat: Sea turtles are found throughout the world's tropical to warm temperate seas. Six species of sea turtle potentially occur in the waters surrounding JPP (refer to Table 4.4). Except for the Pacific Ridley Turtle, which is found only the northern-most coast of Australia, all species are found right across northern and eastern Australia (Wilson and Swan 2010). A detailed report on sea turtles in relation to the proposed BLNG Precinct and the JPP area has been prepared for Woodside and included as part of the SAR for the DSD (DSD 2010; RPS 2010).

Ecology: Sea turtles are characterised by having feet modified to form flippers and having a heavily armoured shell. Each species has a different diet, ranging from predominantly herbivorous (e.g. Green Turtle) to predominantly carnivorous (e.g. Loggerhead Turtle) (Wilson and Swan 2010). They are wholly aquatic for most of their lives, but females must return to land to breed. Females return to their natal beaches to breed, but due to the energy intensive process of developing eggs, several years can elapse between clutches (Wilson and Swan 2010). Nesting occurs on tropical and subtropical beaches.

Likelihood of Occurrence and Potential Impacts: All six species are known to occur in the waters off the Kimberley coast (NatureMap, DEC records). In particular, Loggerhead Turtles, Green Turtles and Flatback Turtles have been recorded in close proximity to JPP (NatureMap, DEC records). Flatback Turtles were previously recorded breeding in high densities at Quondong and Coulomb Point (Biota 2009). Targeted surveys have previously been completed to assess the occurrence of, and potential impacts to, sea turtles (Biota 2009; DSD 2010; RPS 2010). As sea turtles fall beyond the scope of this terrestrial fauna assessment, please refer to these other studies for further information on sea turtles in the JPP area.

Table 4.4 – Sea Turtle Species Potentially Occurring in the Project Area.

Species Name	Common Name	Conservation Status		
		EPBC Act	WC Act	DEC
<i>Caretta caretta</i>	Loggerhead Turtle	EN	S1	–
<i>Chelonia mydas</i>	Green Turtle	VU	S1	–
<i>Eretmochelys imbricata</i>	Hawksbill Turtle	VU	S1	–
<i>Lepidochelys olivacea</i>	Pacific Ridley Turtle	EN	S1	–
<i>Natator depressus</i>	Flatback Turtle	VU	S1	–
<i>Dermochelys coriacea</i>	Leathery Turtle	EN	S1	–

4.3.3.2 *Lerista separanda*

Conservation Status: DEC Priority 2

Distribution and Habitat: *Lerista separanda* is found in sandy soils along the south-west Kimberley coastline, between Kimbleton and Nita Downs (Wilson and Swan 2010).

Ecology: There is little information on the ecology of this species. *L. separanda* is one of the smallest species in the genus and has a fused lower eyelid (Wilson and Swan 2010). Whereas most other *Lerista* species have greatly reduced or only two limbs, *L. separanda* has retained all four limbs. This strongly suggests that it is not only able to push its way through sand but also walk across it.

Likelihood of Occurrence: High. *L. separanda* has previously been recorded from sandy pindan woodland in close proximity to the WAC and SP (Biota 2009). The presence of similar habitat within all three survey areas indicates it is likely to occur in all areas.

Potential Impacts: *L. separanda* is likely to be resident within all three survey areas. Since the species has a limited ability to move away from disturbance, there will likely be a loss of local individuals as a result of vegetation clearing within the survey areas. The presence of similar habitat surrounding the project area will likely result in no regional impacts to the species.

4.3.3.3 Dampierland Burrowing Snake (*Simoselaps minimus*)

Conservation Status: DEC Priority 2

Distribution and Habitat: This snake species is only known from the western side of the Dampier Peninsula. Its preferred habitat is on coastal dunes or the sandy areas between dunes and adjacent acacia shrublands (Wilson and Swan 2010).

Ecology: Little is known of the Dampierland Burrowing Snake's ecology. It is presumably similar to other *Simoselaps* species, which are sand-swimmers that feed entirely on skinks, mostly of the *Lerista* genus (Wilson and Swan 2010), of which six species potentially occur in the project area.

Likelihood of Occurrence: High. A single individual of *S. minimus* was previously recorded within the SP (Biota 2009) in monsoon vine thicket on coastal sand. The species is likely to occur throughout the coastal area within the SP, which provides suitable habitat for the species, but is unlikely to occur in the WAC or LIA.

Potential Impacts: *S. minimus* is a poorly known species with very little ecological data available (as noted by How and Shine 1999; Reed and Shine 2002; Wilson and Swan 2010). What is known is that *S. minimus* has a highly restricted range, with the SP falling within this area. *S. minimus* has a limited ability to move away from disturbance, and thus there will likely be a loss of local individuals as a result of vegetation clearing within the SP. Vegetation clearing in the SP is likely to result in a local impact; however, due to the limited information available on this species, the regional impacts are unknown.

Table 4.5 – Conservation Significant Fauna Occurring or Potentially Occurring in the Project Area.

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence	Regional Impacts
	EPBC Act	WC Act	DEC				
Mammals							
Golden Bandicoot (<i>Isodon auratus auratus</i>)	VU	S1		Rocky sandstone spinifex and vine thickets.	Three previous records within 80 km of project area, with latest record from 1971 (NatureMap).	MEDIUM Suitable habitat present and known to previously occur in area, although no recent records.	LOW Species uncommon in area and suitable habitat present outside the project area, though this is relatively restricted in size.
Bilby (<i>Macrotis lagotis</i>)	VU	S1		Variety of habitats on soft soil, including spinifex grassland, acacia shrubland, open woodland, and cracking clays.	Numerous records within 100 km of project area (NatureMap, DEC records). Majority of records prior to 1970. Potential burrows and diggings observed during current survey.	HIGH Numerous previous records, suitable habitat present, and potential burrows observed.	LOW Species has large home ranges and often follows food resources during the year. Suitable habitat widespread surrounding the project area.
Little Northern Freetail Bat (<i>Mormopterus loriae cobourgiana</i>)			P1	Roost in mangrove stands, hunt in mangroves and forests.	Recorded within 10 km of project area in 2008 (ENV 2008) and within 120 km to both north and south in a range of habitats (vine thicket, pindan woodland, dunes, lakes).	HIGH Recently recorded near project area. No roosting habitat present, but likely to hunt within project area.	LOW No roosting habitat will be impacted. Small loss of potential foraging habitat; however, similar habitat is present outside the project area.
Golden-backed Tree-rat (<i>Mesembriomys macrurus</i>)	VU		P4	Rainforest patches, eucalypt woodlands, sandstone scree and coastal beaches surrounded by such vegetation.	Single record from Broome in 1895 (NatureMap). Species' typical range is north-east of Derby.	LOW Project area outside typical range of the species. No recent local records.	LOW Unlikely to occur in project area.
Birds							
Fairy Tern (<i>Sternula nereis</i>)	VU			Sheltered seas, estuaries and coastal lakes.	Small number of records within 150 km of project area (Birdata, ENV 2008).	MEDIUM Northern extent of typical range. Suitable habitat in SP.	LOW Uncommon in area and suitable habitat present outside the project area.

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence	Regional Impacts
	EPBC Act	WC Act	DEC				
Bridled Tern (<i>Sterna anaethetus</i>)	M	S3		Offshore seas and coastlines.	Numerous records from offshore in the Kimberley (Birddata, NatureMap).	MEDIUM Likely to occur off JPP, but will only occasionally occur onshore, within project area.	LOW Predominantly occurs offshore. Similar habitat widespread along coast to north and south.
Little Tern (<i>Sternula albifrons</i>)	M	S3		Sheltered seas, estuaries and mangrove creeks.	Numerous records from coastline surrounding project area (Birddata, NatureMap), including Quondong Point (Rogers <i>et al.</i> 2009).	HIGH Previously recorded in close proximity to project area. Likely to occur along coastline in SP.	LOW Hunts for food offshore. Similar habitat widespread along coast to north and south.
Caspian Tern (<i>Sterna caspia</i>)	M	S3		Sheltered seas, coastlines, and inland watercourses.	Numerous records from near coastal areas around Broome and JPP (Birddata, Rogers <i>et al.</i> 2009).	HIGH Previously recorded in close proximity to project area. Likely to occur along coastline in SP.	LOW Hunts for food offshore. Similar habitat widespread along coast to north and south.
White-winged Black Tern (<i>Chlidonias leucopterus</i>)	M	S3		Estuaries and sheltered seas.	Numerous records from near coastal areas around Broome, including Quondong Point (Birddata, Rogers <i>et al.</i> 2009).	HIGH Previously recorded in close proximity to project area. Likely to occur along coastline in SP.	LOW Hunts for food offshore. Similar habitat widespread along coast to north and south.
Roseate Tern (<i>Sterna dougallii</i>)	M	S3		Offshore seas.	Numerous records from near coastal and offshore areas around Broome, including Coulomb Point (Birddata, Rogers <i>et al.</i> 2009).	HIGH Previously recorded in close proximity to project area. Likely to occur along coastline in SP.	LOW Hunts for food offshore. Similar habitat widespread along coast to north and south.
Common Tern (<i>Sterna hirundo</i>)	M	S3		Sheltered seas and estuaries.	Numerous records from near coastal and offshore areas around Broome (Birddata). Recorded offshore during current survey.	HIGH Recorded offshore during current survey. Likely to occur along coastline in SP.	LOW Hunts for food offshore. Similar habitat widespread along coast to north and south.

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence	Regional Impacts
	EPBC Act	WC Act	DEC				
Lesser Crested Tern (<i>Thalasseus benghalensis</i>)	M	S3		Offshore and coastal seas, estuaries.	Numerous records from near coastal areas around Broome (Birdata). Recorded offshore during current survey.	HIGH Recorded offshore during current survey. Likely to occur along coastline in SP.	LOW Hunts for food offshore. Similar habitat widespread along coast to north and south.
Fork-tailed Swift (<i>Apus pacificus</i>)	M	S3		Almost entirely aerial lifestyle over a variety of habitats.	Numerous records within and surrounding project area. Recorded during current survey.	HIGH Recorded during current survey.	LOW Species is entirely aerial in this region and will not be impacted by the project.
Lesser Frigatebird (<i>Fregata ariel</i>)	M	S3		Offshore seas.	Numerous records within 100 km of project area (NatureMap, Birdata). Recorded during survey in SP.	HIGH Typically occurs offshore, but observed flying inshore in SP.	LOW Predominantly occurs offshore. Similar habitat widespread along coast to north and south.
Brown Booby (<i>Sula leucogaster</i>)	M	S3		Offshore seas and coastal areas	Numerous records from offshore and along the coast around JPP (NatureMap, Birdata). Recorded offshore during current survey	HIGH Recorded off JPP during this and previous surveys. Observed offshore.	LOW Predominantly occurs offshore. Similar habitat widespread along coast to north and south.
Eastern Great Egret (<i>Ardea modesta</i>)	M	S3		Floodwaters, rivers, shallows of wetlands, intertidal mud-flats.	Numerous records within 100 km of project area.	MEDIUM Likely to occasionally visit creekline in SP when it contains water.	LOW Species only likely to occur within project area in low numbers when water present. Low quality habitat, with more suitable habitat present outside project area.
Eastern Reef Egret (<i>Egretta sacra</i>)	M	S3		Tidal reef and mud flats, mangrove creeks and rocky shores.	Numerous records from JPP and surrounding areas (NatureMap, Birdata, ENV 2008, Rogers <i>et al.</i> 2009).	HIGH Previously recorded from JPP. Likely to hunt along rocky coastline in SP.	LOW Some foraging habitat impacted but similar habitat present along the coast.

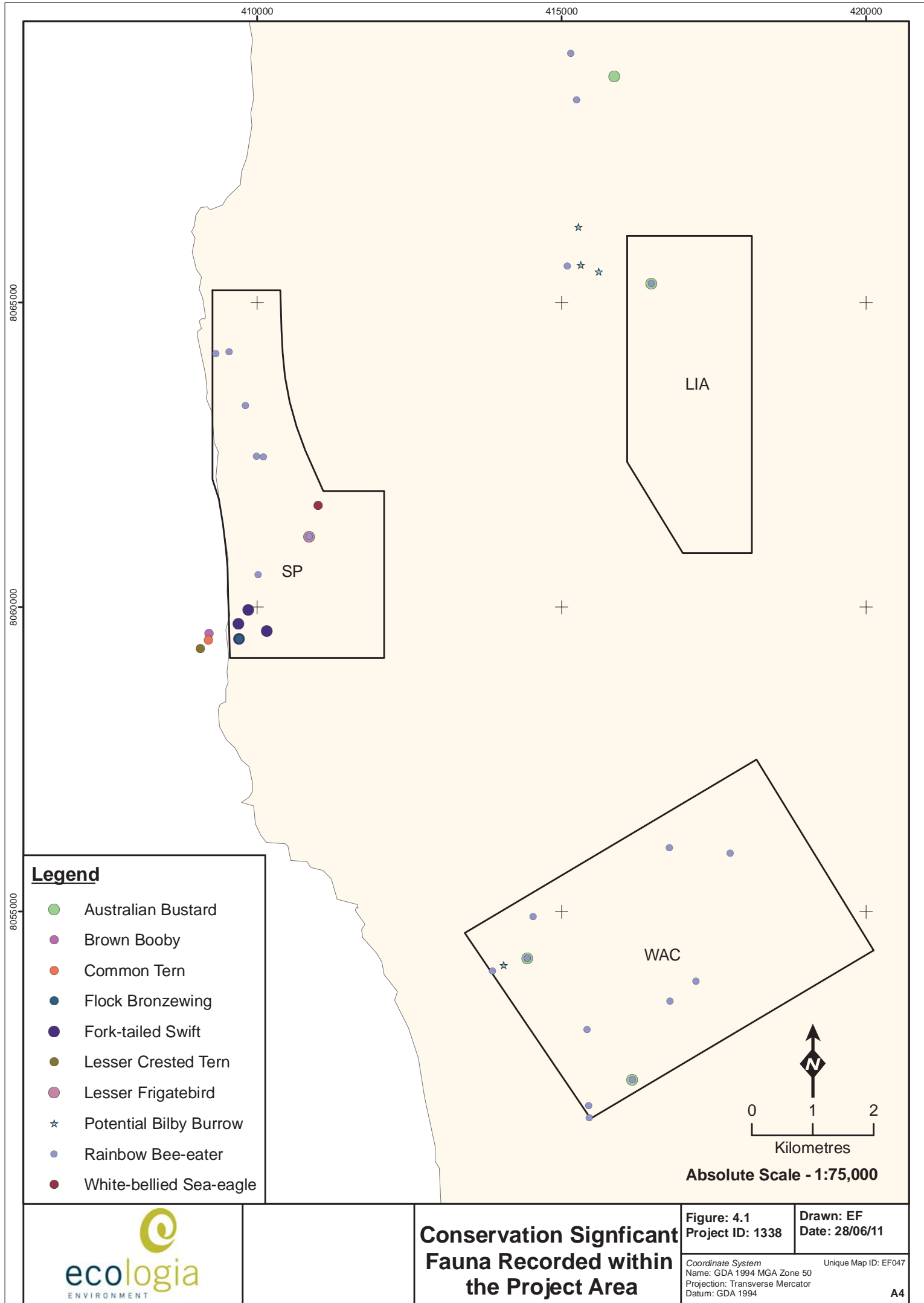
Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence	Regional Impacts
	EPBC Act	WC Act	DEC				
Waders*	M	S3		Coastal and inland lakes.	Most waders listed are commonly recorded along coasts, rivers and plains in the region (Birddata).	HIGH Most species are likely to occur along the coastal area in the SP.	LOW Typically occur in low numbers within project area. Some foraging habitat impacted but similar habitat present along the coast to north and south.
White-bellied Sea-eagle (<i>Haliaeetus leucogaster</i>)	M	S3		Coastal and near coastal water bodies.	Numerous records from coastal areas within and surrounding project area (Birddata). Recorded during current survey.	HIGH Common in area and previously recorded from project area.	LOW Some potential foraging habitat impacted but similar habitat present along the coast. No impact to breeding anticipated.
Eastern Osprey (<i>Pandion cristatus</i>)	M			Mangroves, rivers, estuaries, inland seas, coastal islands.	Numerous records from coastal areas within and surrounding project area (Biota 2009, Birddata).	HIGH Common in area and previously recorded from project area.	LOW Some potential foraging habitat impacted but similar habitat present along the coast. No impact to breeding anticipated.
Rainbow Bee-eater (<i>Merops ornatus</i>)	M	S3		Open country, most vegetation types, dunes, banks.	Numerous records from within and surrounding project area (e.g. Bamford 2011, Birddata). Recorded during current survey.	HIGH Recorded during current survey.	LOW Species migratory and widespread, suitable habitat present in surrounding areas.
Barn Swallow (<i>Hirundo rustica</i>)	M	S3		Towns and wetlands, including sewage and saltwork ponds, river pools and tidal creeks.	Numerous records from around Broome and Roebuck Plains (Birddata, NatureMap).	MEDIUM Numerous records within 50 km of project area. Little suitable habitat.	LOW Species migratory and widespread. Little suitable habitat within project area, more suitable habitat present in surrounding areas.
Red-rumped Swallow (<i>Cecropis daurica</i>)		S3		Open country, usually near fresh water.	Small number of records from around Broome and Willie Creek (Birddata).	MEDIUM Some nearby records. Species may occasionally overfly the area.	LOW Species migratory and widespread, suitable habitat present in surrounding areas.

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence	Regional Impacts
	EPBC Act	WC Act	DEC				
Peregrine Falcon (<i>Falco peregrinus</i>)		S4		Coastal cliffs, riverine gorges and wooded watercourses.	Numerous records from the Dampier Peninsula (Birddata, NatureMap). Previously recorded within project area (Biota 2009, AECOM 2010).	HIGH Previously recorded within SP. Suitable hunting and breeding habitat.	LOW Small amount of foraging and breeding habitat impacted but similar habitat present along the coast outside project area.
Flock Bronzewing (<i>Phaps histrionica</i>)			P4	Sparsely wooded plains near water.	Small number of records from Dampier Peninsula (Birddata, ENV 2008). Recorded during current survey.	HIGH Recorded in SP during current survey.	LOW Species unlikely to permanently reside in project area, little suitable habitat.
Grey Falcon (<i>Falco hypoleucos</i>)			P4	Lightly wooded coastal and riverine plains.	Four records of the species from around Broome, latest record from 1999 (DEC records, Birddata).	MEDIUM Generally uncommon in area, but may occasionally visit areas of suitable habitat.	LOW Species unlikely to permanently reside in project area, little suitable habitat.
Australian Bustard (<i>Ardeotis australis</i>)			P4	Open grasslands, chenopod flats and low heathland.	Numerous records from within and surrounding project area (Birddata). Recorded during current survey.	HIGH Recorded during current survey.	LOW Species is common in the surrounding area, extensive suitable habitat present in the region.
Bush Stone-curlew (<i>Burhinus grallarius</i>)			P4	Lightly wooded country next to daytime shelter of thickets or long grass.	Records from around Broome and Roebuck Plains (Birddata, DEC records) and previously recorded from JPP (Biota 2009).	HIGH Previously recorded in area. Suitable habitat present.	LOW Extensive suitable habitat in surrounding region.
Chestnut-backed Button-quail (<i>Turnix castanotus</i>)			P4	Savanna woodlands in sandstone and lateritic country.	Small number of records from Roebuck Plains (DEC records) and 15km south of survey (AECOM 2010).	MEDIUM Outside normal species range, but local recent records indicate possible presence in project area.	LOW Species unlikely to permanently reside in project area, suitable habitat widespread in surrounding area.
Pictorella Mannikin (<i>Heteromunia pectoralis</i>)			P4	Tropical woodland, tussock grassland near water.	Small number of records from Willie Creek and Roebuck Plains (Birddata, NatureMap).	MEDIUM Uncommon in area, but may occasionally visit areas of suitable habitat in project area.	LOW Species unlikely to permanently reside in project area, more suitable habitat present outside project area.

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence	Regional Impacts
	EPBC Act	WC Act	DEC				
Reptiles							
Sea Turtles**	EN/ VU	S1		Open ocean.	All 6 species are known to occur off the Kimberley coast. There is a single record of a Loggerhead Turtle and numerous records of the Flatback Turtle off JPP.	UNASSESSED Beyond scope of this report. See earlier targeted surveys (Biota 2009; DSD 2010; RPS 2010).	UNASSESSED Beyond scope of this report. See earlier targeted surveys (Biota 2009; DSD 2010; RPS 2010).
<i>Lerista separanda</i>			P2	Sandy areas.	Previously recorded at JPP (Biota 2009) and within 100 km to north and south (ENV 2008).	HIGH Previously recorded in area, suitable habitat present.	LOW Some loss of individuals locally, but abundant suitable habitat surrounding project area.
Dampierland Burrowing Snake (<i>Simoselaps minimus</i>)			P2	Coastal dunes.	Previously recorded at JPP (Biota 2009).	HIGH Previously recorded in area; suitable habitat present in SP.	UNKNOWN Species only known from a 200-km stretch of coast surrounding JPP. Ecology poorly understood.

* Refer to Table 4.3 for list of individual species.

** Refer to Table 4.4 for list of individual species.



4.4 FAUNA HABITATS

Six different fauna habitats were recorded within the project area:

- Pindan Shrubland
- Coastal Communities
- Open Forest/Woodland
- Monsoon Vine Thicket
- Drainage Basin
- Tall Closed Scrub

The presence and distribution of these fauna habitats, particularly within the LIA and WAC, in the project area was supplemented with data from the *ecologia* flora and vegetation survey (*ecologia* 2011). These habitats are detailed in Figure 4.3 and Table 4.6 and described in greater detail below. An additional habitat, Coastal Heath, was recorded previously in the vicinity of the project area, but does not occur inside it (Biota 2009). For further information on the vegetation areas, consult the flora survey conducted by Biota (2009).

Table 4.6 – Amount of Fauna Habitat in Project Area.

	Total Area in Vicinity of Project Area* (km ²)	Area in SP (km ²)	Area in WAC (km ²)	Area in LIA (km ²)	Combined Infrastructure (km ²)	% of Total Area
Pindan Shrubland	116.25	3.91	20.60	9.70	34.21	29.4
Coastal Communities	1.91	1.16	0	0	1.16	60.7
Open Forest/ Woodland	36.40	2.77	0	0	2.77	7.6
Monsoon Vine Thicket	5.15	3.26	0	0	3.26	63.3
Drainage Basin	0.32	0.26	0	0	0.26	81.3
Tall Closed Scrub	2.65	0.02	0	0	0.02	0.8
Coastal Heath	0.35	0	0	0	0	0

* Based on vegetation mapping from Biota (2011).

4.4.1 Pindan Shrubland

Pindan shrublands within the project area reflects the vegetation mapping completed by Biota (2009) and roughly corresponds to the Yeeda land system (Figure 2.5). When present, the overstorey consists of very open to scattered eucalypt (*Corymbia*) species. *Acacia* shrubs (primarily *A. eriopoda* and *A. monticola*) range from very dense (JPP Site 2, JPP Site 3) to open (JPP Site 1). The substrate is pindan with a cover of dense to open tussock grasses. Reptile species expected to favour the more open, grassy areas include the skinks *Ctenotus pantherinus* and *C. serventyi* and the Short-tailed Pygmy Monitor (*Varanus brevicauda*). Bearded Dragons (*Pogona minor*) and spiny-tailed geckos (*Strophurus ciliaris*) cling to branches of low shrubs and burnt snags. Arboreal species such as the Frilled Lizard (*Chlamydosaurus kingii*) and Chameleon Dragon (*Chelosania brunnea*) would be

expected in areas with taller *Corymbia* and *Eucalyptus* trees. Areas of dense leaf litter, as under dense patches of *Acacia* and scattered *Sersalisia sericea* trees, are favoured by fossorial skinks such as *Eremiascincus isolepis*, *Lerista apoda*, and *L. griffini*. Fairy-wrens and Honeyeaters are the most common bird species in this habitat type. They can be found feeding amongst the low *Acacia* shrubs. Mammal diversity recorded in this habitat was quite low, however the Bilby has a high potential of occurring in pindan shrubland due to the open vegetation and sandy substrate. This was supported with the discovery of a potential Bilby burrow in this habitat type. Other species of conservation significance found in this habitat type include Rainbow Bee-eater (EPBC Act Migratory) and Australian Bustard (DEC Priority 4) (both located during current survey), and the skink *Lerista separanda* (DEC Priority 2) (previously recorded).

4.4.2 Coastal Communities

Coastal communities occupy the foredunes along the coast within the SP survey area. *Spinifex longifolius* grass with scattered patches of *Crotalaria* and *Terminalia* shrubs cover loose coastal sands. Rocky intertidal areas and beaches provide habitat for shorebirds including many conservation significant species. Thirty-one wader species listed as Migratory under the EPBC Act potentially forage in the intertidal zone (see Section 4.3.2.7). Burrowing skink species, particularly *Eremiascincus isolepis* and *Lerista bipes*, are abundant in the vegetated areas of the primary dune, where the Dampierland Burrowing Snake is also present. Beaches that are contiguous with sandy dunes above the high tide mark may be used by sea turtles for nesting. Six sea turtle species listed under the EPBC Act potentially occur in the area; however, only one species, the Flatback Turtle *Natator depressus* (EPBC Vulnerable), has thus far been observed nesting in the area (Biota 2009). Flock Bronzewings were observed flying over this habitat on this survey; however they are not expected to reside in the area.

4.4.3 Open Forest/Woodland

A patch of open forest follows along Kundandu Creek in the SP study area, and a regional trapping site was placed in this habitat on the NEAT (JPP Site 4). This habitat roughly corresponds to the Wanganut land system (Figure 2.5). The vegetation is open *Eucalyptus miniata* and other eucalypt species over an open to moderately dense understory of mixed *Acacia* species. The substrate is yellow sand with a moderate to dense cover of tussock grasses.

The reptile and mammal fauna assemblages are broadly similar to the pindan shrublands, but more arboreal species would be expected. The SIMPROF analysis conducted by Biota (2009) confirms the similarity of terrestrial fauna and avifauna between these habitats. The open woodlands observed in the SP had many hollows which may be important for cavity-nesting birds, as well as Northern Brushtail Possums (*Trichosurus vulpecula arnhemensis*) and some bat species. Taller trees may provide nesting habitat for raptor species. Conservation significant fauna occurring in this habitat include the Bilby, Rainbow Bee-eater, Australian Bustard, and (potentially) *Lerista separanda*.

4.4.4 Monsoon Vine Thicket

Monsoon Vine Thickets, a Threatened Ecological Community (TEC), occur along a narrow band within 1 km of the coast line in the SP survey area. *Terminalia ferdinandiana* and *Diospyros humilis* low trees and shrubs on coastal sand are the dominant vegetation of this habitat. Conservation significant fauna potentially occurring in the vine thickets of the SP include the Dampierland Burrowing Snake (*Simoselaps minimus*; DEC Priority 4), and *Lerista separanda*. The Dampierland Burrowing Snake was found in this habitat type within the SP by Biota (2009). The conservation

significant Golden-backed Tree-Rat (EPBC Vulnerable; DEC Priority 4) also potentially occurs in monsoon vine thickets in the SP area, but has a low likelihood of occurrence.

4.4.5 Drainage Basin

A single drainage basin lies in the SP, located between Monsoon Vine Thicket and Pindan Shrubland. This area is subject to ephemeral freshwater flooding during and after the wet season. During the current survey the area was dry and the vegetation appeared similar to surrounding areas; however, when the area contains water it is likely to attract a distinctly different fauna assemblage to the surrounding area. At this time it may provide habitat for a variety of waterbirds, including ducks, egrets, ibis and cormorants. This diversity has been recognised by Biota (2010), which described the vegetation of Drainage Basins as being of 'High conservation value'.

4.4.6 Tall Closed Shrub

Tall Closed Scrub was only mapped in a small area in the northernmost part of the project area. No surveys were conducted in this habitat. This area is a complex mosaic, devoid of eucalypts and dominated by dense wattles (*Acacia* spp.) (Biota 2010).

4.5 FAUNA HABITAT ANALYSIS

Two fauna habitats (Pindan Shrubland and Open Forest) were sampled with trapping sites during the current survey. Similar species abundance was recorded in both trapped habitats (16 and 14 species recorded respectively). A one-way ANOSIM test of the trapping sites showed that the habitat types were moderately similar ($R=0.3$, $p=0.03$). The MDS plot (Figure 4.2) visually showed a slight difference between the two habitat types. However, caution is required when interpreting the results as stress value (0.25) was greater than 0.2.

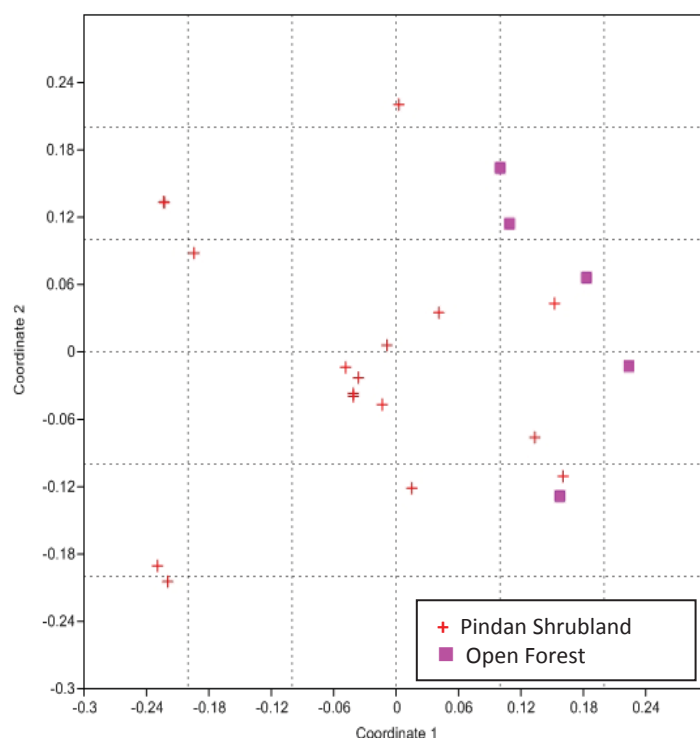


Figure 4.2 – Non-metric Multidimensional Scaling of Fauna Trapping Data.

405000

410000

415000

420000

8075000

8070000

8065000

8060000

8055000

Legend

- Pindan Shrubland
- Coastal Communities
- Open Forest
- Vine thicket
- Drainage Basin
- Buffel grassland
- Coastal heath
- Eroded coastal pindan
- Sandstone outcrops
- Tall closed scrub

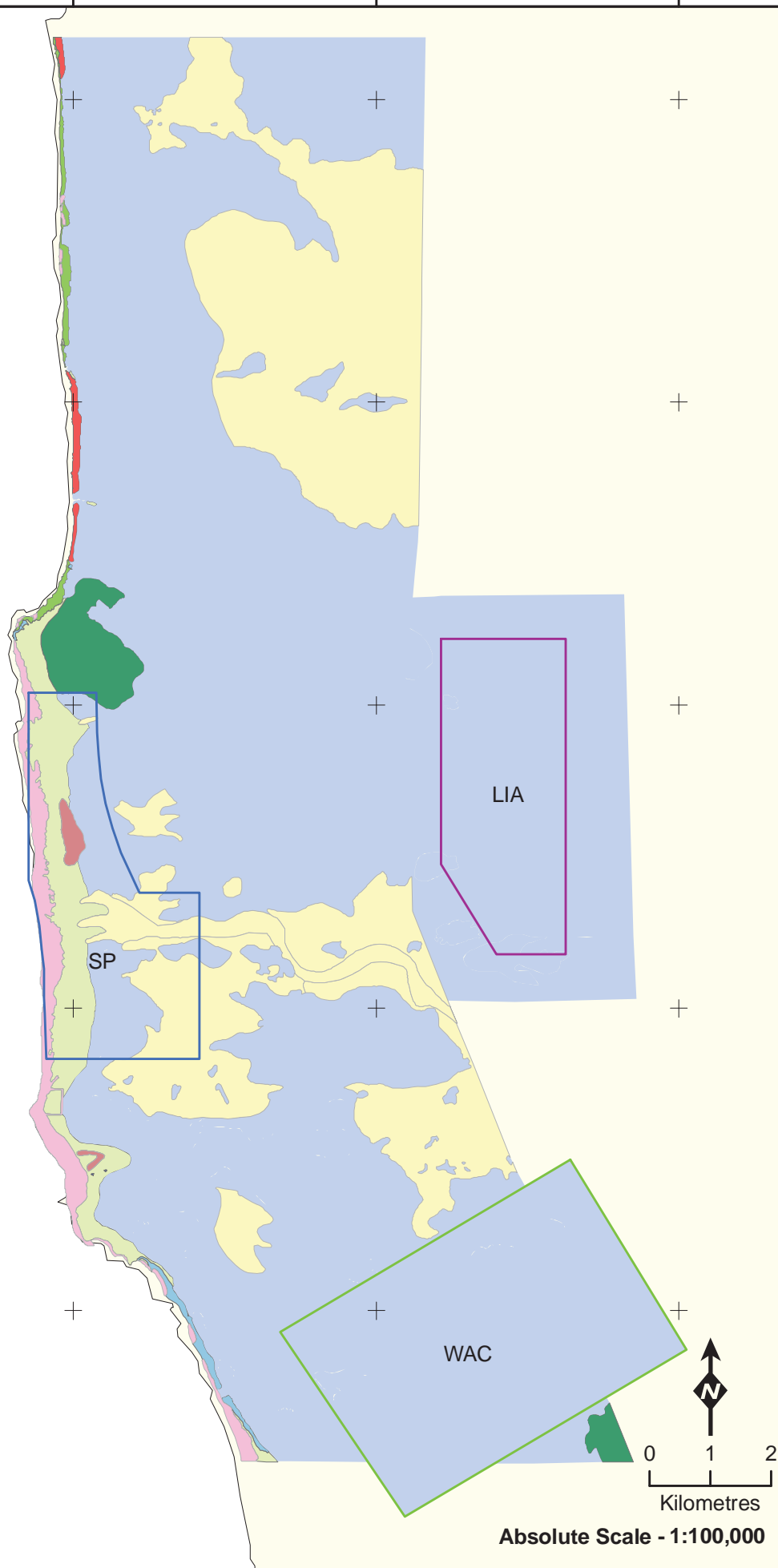


Figure: 4.3
Project ID: 1338

Drawn: EF
Date: 28/06/11

Coordinate System
Name: GDA 1994 MGA Zone 51
Projection: Transverse Mercator
Datum: GDA 1994

Unique Map ID: EF049

A4

4.6 SURVEY ADEQUACY

A species accumulation curve (SAC) through 1,000 randomisations of the sample sequence of the complete data set gave a smooth curve that has not yet reached an asymptote. The Michaelis-Menten estimator, used as stopping rule, indicated that the survey was only 51.4% sufficient at the break point of seven sampling nights. However, the complete dataset of 25 sampling nights resulted in 74.4% sufficiency. These results indicate that although the majority of species were recorded during the survey, additional survey effort would likely uncover at least 11 additional species.

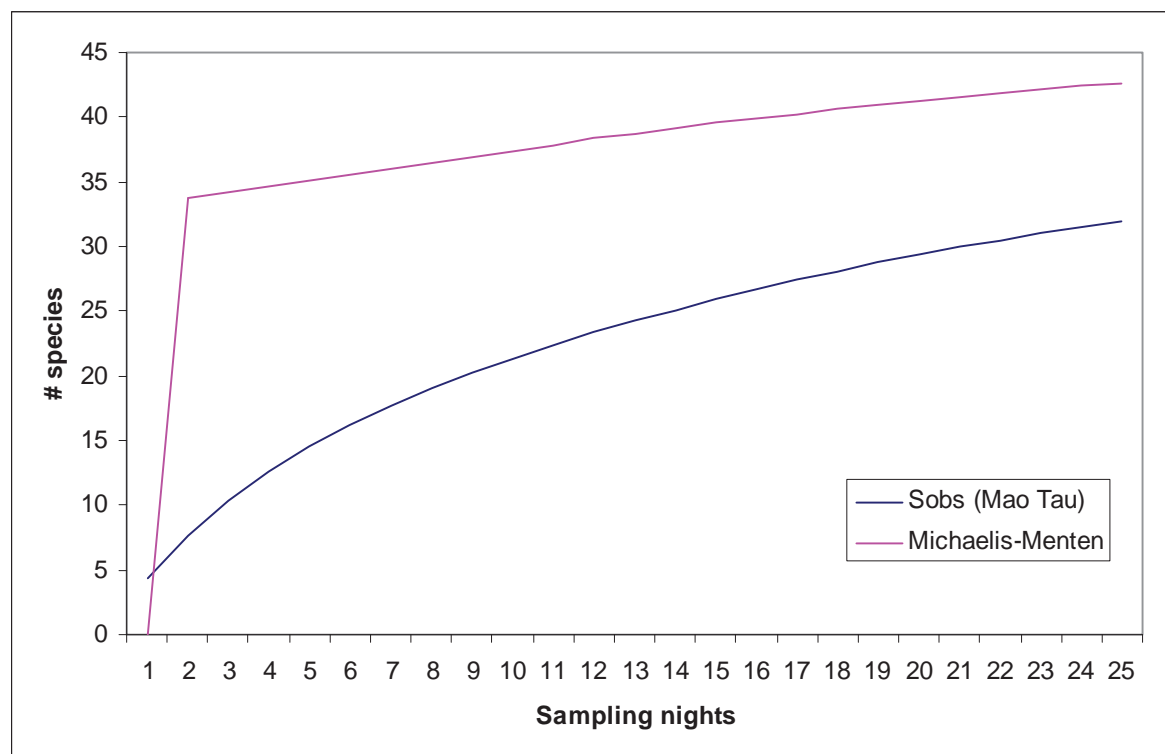


Figure 4.4 – Species Accumulation Curve of Terrestrial Fauna.

4.7 SURVEY LIMITATIONS

Although adequate surveying was conducted in both the SP and WAC survey areas, restricted access to certain areas (particularly the LIA) and Woodside safety/security requirements also resulted in several limitations to the survey.

The LIA had extremely limited access due to the long distance of this area from the NEAT. As a result, no trapping was able to be conducted within this area for ethical reasons, and only a single opportunistic search of the area was made. These limitations reduced the completeness of the fauna assessment for the LIA; however, an agreement between DEC and Woodside clarified that a Level 2 survey would not be required by DEC for the LIA area, owing to previous survey effort and the homogeneity of habitat in the area.

To compensate for these limitations, two trapping sites were set up along the NEAT, and the results of these surveys were used to extrapolate to the LIA based on the vegetation recorded during a flora survey of the area. This needs to be considered when interpreting survey findings.

The SP has been subject to numerous previous surveys in addition to the current survey, resulting in a generally sufficient survey effort for the area.

The WAC was adequately surveyed using trapping and diurnal opportunistic survey methods.

As a result of safety constraints, no nocturnal surveys were conducted. This may have reduced the likelihood of encountering nocturnal species such as the Golden Bandicoot or Bilby. In order to compensate, two baited motion-cameras (camera traps) were set up that are able to capture photographs and videos of animals during both the day and night. The motion-cameras were each set up for approximately 9 days, although due to safety and time constraints they were only able to be set up in a single location, in habitat suitable for Bilbies but not suitable for Golden Bandicoot. The motion-cameras showed that the bait was frequently visited by dingoes, which may have reduced potential activity of Bilbies in the area.

In preparing this report, Woodside engaged additional external expertise in relation to assessing vertebrate fauna and Bilby evidence in particular. Dr Richard Southgate (from Envisage Environmental Services) and Dr Ric How (from the Western Australian Museum and member of Woodside's independent external EAP) have assessed images of burrows and diggings and determined the likelihood in relation to possible Bilby evidence (Appendix G). Ecologia has not independently contacted these external sources to verify how the assessments of likelihood were determined. These assessments were made using images only and may not account for additional characteristics of burrows observed by Ecologia staff on site. Where burrows were recorded but no images exist, the expertise of the field personnel was used to determine the potential likelihood of Bilby evidence. Many burrows observed within the project area were unlikely to have been created by Bilbies, as these were assessed as being made by other fauna such as monitor lizards (*Varanus* spp.).

Limitations of the current survey are summarised in Table 4.7.

Table 4.7 – Summary of Survey Limitations.

Constraint	Relevant (yes/no)			Comment
	WAC	SP	LIA	
Competency/ experience of the consultant carrying out the survey.	No	No	No	All principal members of the survey team were experienced in fauna survey methods and species identification in the Kimberley region.
Scope (what faunal groups were sampled and were some sampling methods not able to be employed because of constraints such as weather conditions).	No	No*	Yes	The LIA and some parts of the WAC study area could not be surveyed due to access and safety constraints. The habitat characteristics and suitability of these areas for conservation significant species were assessed based on vegetation mapping (ecologia 2011) and previous reports.
Proportion of fauna identified, recorded and/ or collected.	No	No	No	All fauna were identified in the field or vouchered for identification at the WA Museum.

Constraint	Relevant (yes/no)			Comment
	WAC	SP	LIA	
Sources of information (previously available information as distinct from new data).	No	No	No	Four surveys of the Browse LNG Precinct and two previous surveys within 100 km of the project area were reviewed together with database searches.
The proportion of the task achieved and further work which might be needed.	No	No	Yes	One phase of trapping was completed within the WAC and opportunistic foraging and habitat assessments were conducted with in the SP. The LIA was not surveyed for fauna, and only one opportunistic survey and habitat assessment was conducted within this area.
Timing/ weather/ season/ cycle.	Yes (partial)	No*	Yes	Bird surveys in the WAC and SP were often conducted at a suboptimal time of day as safety constraints limited survey timing. No nocturnal surveys were conducted, but have been done previously in the SP. The timing of the survey was not optimal for migratory waders. Few amphibians were recorded due to both the lack of fresh water bodies and the drop off in rainfall in March.
Disturbances which affected results of the survey (e.g. fire, flood, accidental human intervention).	Yes (partial)	Yes (partial)	Yes (partial)	The vegetation in portions of the WAC, SP, and LIA were degraded by recent (2009) high-intensity fire.
Intensity.	Yes	No*	Yes	Surveys and ground truthing could not be conducted within the LIA. Woodside safety management procedures limited the available time at the survey sites to between the hours of 6 am and 1 pm due to relatively long travel requirements from Broome. Therefore, foraging and bird surveys were often conducted at suboptimal times of day.
Completeness.	Yes (partial)	No	Yes	The LIA and some eastern parts of the WAC were not fully surveyed due to access constraints.
Resources (e.g. degree of expertise available in animal identification to taxon level).	No	No	No	All field personnel were experienced in trapping and foraging techniques and identification of fauna.
Remoteness and/ or access problems.	Yes	No	Yes	Access to LIA and eastern WAC area extremely limited. Long commutes and early site departure times limited survey effort. Inaccessibility of LIA resulted in little surveying in this area. Trapping sites were installed along the NEAT and results extrapolated to the LIA.
Availability of contextual (e.g. biogeographic) information on the region).	No	No	No	Six previous surveys in the region together with database searches provided adequate contextual information.

Constraint	Relevant (yes/no)			Comment
	WAC	SP	LIA	
Efficacy of sampling methods (i.e. any groups not sampled by survey methods).	Yes	No*	Yes	As no nocturnal surveys were conducted, certain nocturnal species such as Bilby and Golden Bandicoot were not surveyed effectively. Nocturnal surveys have been conducted during previous surveys of the SP.

* Previous surveys in this area compensate for limitations of current survey

5 DISCUSSION

Based on the results of the literature review, there is the potential for 36 native mammal species, 296 bird species, 88 reptile species and 10 amphibian species to occur within the project area. The current survey only identified approximately 30% of this total; however, many of the 'missing' species are either vagrants or occur in habitat types that are not present in the project area. Species accumulation curves demonstrated that 74% of the ground fauna were identified through trapping. The area has a high level of bird diversity, especially along the coast, and additional survey effort would likely have uncovered many additional species. Furthermore, the area is known to support large numbers of migratory terns and waders between September and April (Rogers *et al.* 2009). Although the rainfall of the 2010/11 wet season was uncharacteristically high, surveys were carried out after the peak period of migratory bird activity.

The number of species recorded during the current survey is comparable to previous surveys in the area (*ecologia* 2004; ENV 2008; Biota 2009; Rogers *et al.* 2009; AECOM 2010; Biota 2010). The only exception is the ENV (2008) survey which recorded a significantly higher number of all fauna groups. This is due to the survey covering a much wider area, from Gourdon Bay to Packer Island.

The most obvious species groups that were missing during the current survey were the waders and waterbirds which are typically common in the Kimberley region. The majority of waders are migratory and thus were not present at the time of surveying. There were no areas of surface water present within the project area during the period of assessment, which prevented the likely presence of waterbirds. However, this area may provide suitable habitat for these species when water collects within the drainage basin near the SP area after heavy rain.

The WAC consisted solely of Pindan shrubland fauna habitat. Six habitat types were found in the SP area, consisting of coastal communities along the coast, flanked by monsoon vine thicket, then Pindan shrubland occurring approximately 1 km from the coast and continuing inland, and a small area of tall closed shrub. Open forest/woodland occurred along Kundandu Creek which runs east-west through the middle of the SP survey area and a drainage basin occurs to the north of this. The fauna habitats of the LIA could not be fully surveyed. However, based on habitat assessments of the northern end of the LIA combined with land system mapping, vegetation mapping, and previous flora surveys, the area is likely to consist predominantly of the Pindan shrubland fauna habitat.

Based on an analysis of the current survey data collected by *ecologia* and previous data collected by Biota, the fauna habitats appear to be generally similar based on fauna species present. However, based on the non-metric multidimensional scaling (MDS) plots and an assessment of the vegetation present, the assemblages of the monsoon vine thicket and coastal communities may be distinct from the Pindan shrubland and open forest in the remainder of the area. The Pindan shrubland and open forest habitats are widespread and continuous in the area, containing only 29.4% and 7.6% respectively of this habitat type in the immediate vicinity of the project area. Pindan shrubland and open forest roughly correspond to the land systems Yeeda and Wanganut respectively. Based on land system mapping, the survey areas contain only 0.16% and 0.05% of these land systems within WA. No regional impacts to these habitat types are anticipated as a result of the project and most fauna are likely to be able to relocate to surrounding areas of similar habitat.

The majority of drainage basin habitat in the area occurs within the SP area. However, the fauna of this area are typically similar to those from open forest habitat and no additional impacts are anticipated. Additional habitat for waterbird species may become available outside of the SP area

following rainfall; however, the water is ephemeral and is not known to represent important habitat for any conservation significant species.

The monsoon vine thicket and coastal communities within the SP each constitute over 60% of this habitat type in the vicinity of the project area. The habitat only occurs in a thin coastal strip; however, it roughly corresponds to the Carpentaria land system, of which only 0.5% of the total area within WA occurs within the SP. Although these habitat types may occur at other areas along the coast of the Dampier Peninsula, the pocket of habitat within the SP is relatively isolated from areas of similar habitat, particularly to the north. Due to the relatively high percentage of habitat that may be impacted in the vicinity of the project area, combined with the isolated nature of the habitat, may result in a moderate impact to the fauna supported by these two habitat types.

The monsoon vine thicket and coastal communities within the SP area provide potential habitat to several conservation significant species, including Golden Bandicoot, Golden-backed Tree-Rat, Dampierland Burrowing Snake, terns and migratory waders along the coast, and sea turtles along the beaches.

The Dampierland Burrowing Snake has the highest potential for impact due to the proposed project of species known to occur in the project area. The species was previously recorded from Monsoon Vine Thicket within the SP (Biota 2009) and has only previously been recorded from the western side of the Dampier Peninsula. Given the species' limited ability to move away from disturbance, development in the area in its currently proposed form is likely to result in the loss of individuals. Furthermore, any habitat fragmentation resulting from development in the SP may potentially restrict the movement of individuals between populations to the north and south, isolating local populations. However, the impacts cannot be determined with certainty as insufficient ecological information is available on this species.

The most significant species of conservation significance potentially occurring in the project area is the Bilby. Potential Bilby burrows and diggings were found during the current survey. It is difficult to conclusively ascertain to which species these burrows and diggings may belong. However, upon review of burrows found within and surrounding the project area, it is highly likely that at least some of the diggings and burrows were made by Bilbies. Further surveys will be required within the LIA and the far eastern section of the WAC to delineate the occurrence of Bilbies within the project area and to assess the potential impacts to the species as a result of the project.

6 CONCLUSION

The main conclusions of the terrestrial vertebrate fauna assessment are:

- The survey methods were consistent with the *Technical Guide – Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment* to sample for terrestrial fauna. Species accumulation curves showed that survey adequacy from the current survey was moderate, but when previous surveys in the area are taken into account, adequacy is sufficient overall.
- The vertebrate fauna survey conducted at JPP found that the land systems, vegetation communities and habitats supported a diverse group of fauna, including conservation significant fauna, but they were not restricted to occurring solely within the project area.
- Eight conservation significant vertebrate fauna species were recorded within, or in close proximity to the project area, and an additional 59 conservation significant species have a medium or high likelihood of occurrence at the project area. The remaining 31 conservation significant species have a low likelihood of occurrence within the project area.
- Several survey limitations occurred as a result of access and Woodside safety requirements. However, the majority of these limitations were addressed during the survey, or can be overcome through additional surveying. Although the LIA area was selected for a Level 2 vertebrate fauna survey, access limitations only permitted a Level 1 survey. Due to previous survey effort and habitat homogeneity, agreement was reached between Woodside and DEC prior to the survey that the approach taken was acceptable in light of these limitations. On site reconnaissance could only be conducted in the far northwest corner of the LIA. Habitat assessments for the remainder of the LIA survey area were extrapolated based on data provided by *ecologia* (2011) flora surveys. Further survey effort in this area would be of benefit, as insufficient information was collected. Survey effort within the WAC and SP represented that of a Level 2 survey.
- Six fauna habitat types were recorded within the project area. The majority of these occur extensively surrounding the project area and are continuous with it.
- The Dampierland Burrowing Snake is the only species known to occur within the project area with unknown potential for impact at a regional level. The regional impacts to all other species are thought to be low.
- Additional targeted surveying in the LIA and far eastern edge of the WAC is recommended to confirm the presence of Bilbies.

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7 REFERENCES

- AECOM. 2010. Supplementary Terrestrial Fauna and Habitat Assessment: James Price Point, WA. Unpublished report for the Department of State Development.
- Prepared by AECOM for Main Roads Western Australia. 2011. Browse LNG Precinct Access Road: Targeted Fauna Survey – Greater Bilby
- Ayers, D., Nash, S., and Bagget, K. 1996. Threatened Species of Western NSW.
- Bamford Consulting Ecologists 2011. Assessment of Birds Utilising Habitat within the Vine Thickets and Woodlands of James Price Point, WA. Field Report, May 2011. Unpublished Report Prepared for Woodside Energy Ltd.
- Beard, J. S. 1979. *Kimberley. The vegetation of the Kimberley area*. Vegetation Survey of Western Australia 1:1,000,000 series, explanatory notes and map. University of Western Australia Press, Nedlands, WA.
- Biota Environmental Sciences. 2009. James Price Point Terrestrial Fauna Survey: Wet Season. Unpublished report for the Department of State Development.
- Biota Environmental Sciences. 2010. James Price Point Browse LNG Precinct Targeted Terrestrial Fauna Survey. Unpublished report for ERM on behalf of Woodside.
- Biota. 2011. James Price Point, Vegetation Monitoring Program Phase 1 Data Report. Unpublished report for Sinclair Knight Merz and Woodside Energy Ltd, by Biota Environmental Sciences.
- Boland, C. R. J. 2004. Breeding biology of Rainbow Bee-eaters (*Merops ornatus*): a migratory, colonial, cooperative bird. *The Auk*. 121 (3):811-823.
- BoM. 2011. Climate Data Online, Bureau of Meteorology. Accessed <http://www.bom.gov.au/climate/data/>.
- Bunge, J. and Fitzpatrick, M. 1993. Estimating the number of species: A review. *Journal of the American Statistical Association*. 88:364-373.
- Christidis, L. and Boles, W. E. 2008. *Systematics and Taxonomy of Australian Birds*. CSIRO Publishing, Collingwood.
- Churchill, S. 1998. *Australian Bats*. Reed New Holland, Sydney.
- Clarke, K. R. 1993. Non-parametric multivariate analyses of changes in community structure. *Australian Journal of Ecology*. 18:117-143.
- Cogger, H. G. 2000. *Reptiles and Amphibians of Australia*. Reed New Holland, Sydney.
- Colwell, R. K. 2009. EstimateS: Statistical estimation of species richness and shared species from samples. Version 8.
- Colwell, R. K. and Coddington, J. A. 1994. Estimating terrestrial biodiversity through extrapolation. *Philosophical Transactions of the Royal Society (Series B)*. 345:101-118.
- Department of State Development. 2010. Browse Liquefied Natural Gas Precinct – Strategic Assessment Report, Part 3: Environmental Assessment – Marine Impacts.
- Department of Sustainability, Environment, Water, Population and Communities. 2010. Maps: Australia's bioregions (IBRA)

- Duncan, A., Baker, G. B., and Montgomery, N. 1999. The Action Plan for Australian Bats. Environment Australia, Canberra.
- ecologia Environment. 2004. Beagle Bay Big Tree Country Tropical Timber Plantation Project. Fauna Assessment Survey. Unpublished report for Tropical Timber Plantations Pty Ltd.
- ecologia Environment. 2011. Woodside Energy Ltd James Price Point Light Industrial Area, Workers' Accommodation Camp and Southern Pipeline Vegetation and Flora Survey. Unpublished report prepared for Woodside Energy Ltd.
- Ehmann, H. and Watson, M. 2008. Grey Falcon, *Falco hypoleuca* in Government of Australia. South Australian Arid Lands Natural, ed, South Australia.
- Ellis, M., Wilson, P., and Hamilton, S. 1991. The Golden Bandicoot, *Isodon auratus* Ramsay 1887, in western New South Wales during European times. Australian Zoologist. 27 (1 &2):36-37.
- ENV Australia. 2008. Perpendicular Head-North Head, Packer Island, Gourdon Bay and Coulomb-Quondong Vertebrate Fauna Assessment. Unpublished report for the Department of Industry and Resources.
2011. Browse Project Greater Bilby Survey of the James Price Point Area: Summary Report.
- Environmental Protection Authority. 2002. Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection.
- Environmental Protection Authority. 2004. Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia.
- Environmental Protection Authority and the Department of Environment and Conservation. 2010. Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment. Technical report for the Environmental Protection Authority and the Department of Environment and Conservation.
- Frith, A. J. 1976. Readers Digest Complete Birds of Australia. Readers Digest, Sydney.
- Garnett, S. T. and Crowley, G. M. 2000. The Action Plan for Australian Birds. Environment Australia, Canberra.
- Gaston, K. J. 1996. Species richness: measure and measurement. In: Biodiversity, a biology of number and difference. Blackwell Science, Cambridge.
- Graham, G. 2001. Dampierland 2 (DL2 – Pindanland subregion). A Biodiversity Audit of Western Australia's 53 Biogeographic Subregions in 2002
- Department of Environment and Conservation, Perth.
- Hammer, Ø., Harper, D. A. T., and Ryan, P. D. 2001. PAST: Paleontological Statistics Software Package for Education and Data Analysis. Palaeontologia Electronica. 4.
- Henny, C.J. 1986. Osprey (*Pandion haliaetus*). Section 4.3.1., US Army corps of engineers wildlife resources management manual.
- Higgins, P. J. and Davies, S. J. J. F. 1996. Handbook of Australian, New Zealand and Antarctic Birds. Volume 3: Snipe to Pigeons, Oxford University Press, Melbourne.
- How, R. A. and Shine, R. 1999. Ecological traits and conservation biology of five fossorial 'sand-swimming' snake species (Simoselaps: Elapidae) in south-western Australia. Journal of Zoology. 249:269-282.

- Johnson, K. A. 2008. Bilby, *Macrotis lagotis*. pp. 191-193 in van Dyck, S., and Strahan, R., eds. The Mammals of Australia. Reed New Holland, Sydney.
- Johnstone, R. E. and Storr, G. M. 1998. Handbook of Western Australian Birds, Volume I - Non-Passerines (Emu to Dollarbird). Western Australian Museum, Perth.
- Johnstone, R. E. and Storr, G. M. 2004. Handbook of Western Australian Birds, Volume II - Passerines (Blue-winged Pitta to Goldfinch). Western Australian Museum, Perth.
- Marchant, S. and Higgins, P. J. 1993. Handbook of Australian, New Zealand and Antarctic Birds. Oxford University Press, Melbourne.
- Maxwell, S., Burbidge, A. A., and Morris, K. D., eds. 1996. The 1996 Action Plan for Australian Marsupials and Monotremes. Wildlife Australia, Canberra.
- McKenzie, N. L. and Kenneally, K. F. 1983. Part I: Background and Environment pp. 5-23 in McKenzie, N. L., ed. *Wildlife of the Dampier Peninsula, South-west Kimberley, Western Australia*. Western Australian Wildlife Research Centre, Department of Fisheries and Wildlife, Perth, Western Australia.
- McKenzie, N. L. and Kerle, J. A. 2008. Golden-backed Tree-rat *Mesembriomys macrurus*. pp. 593-595 in van Dyck, S., and Strahan, R., eds. Mammals of Australia. Reed New Holland Publishers, Sydney.
- McKenzie, N. L., Morris, K. D., and Dickman, C. R. 2008. Golden Bandicoot *Isodon auratus*. pp. 176-178 in van Dyck, S., and Strahan, R., eds. Mammals of Australia, 3rd Edition, Reed New Holland Publishers, Sydney.
- Menkhorst, P. and Knight, F. 2011. *A Field Guide to the Mammals of Australia*. Oxford University Press, Melbourne.
- Milne, D. J., Armstrong, K. N., and McKenzie, N. L. 2008. Western Little Free-tailed Bat, *Mormopterus loriae cobourgiana*. pp. 488-489 in Van Dyck, S., and Strahan, R., eds. The Mammals of Australia. Reed New Holland, Sydney.
- Morcombe, M. 2000. Field Guide to Australian Birds. Steve Parish Publishing Pty Ltd., Archerfield, Australia.
- National Health and Medical Research Council. 2004. Australian code of practice for the care and use of animals for scientific purposes.
- NSW National Parks and Wildlife Service. 1999a. Bush Stone-curlew *Burhinus grallarius* (Latham, 1801). NSW National Parks and Wildlife Service, Hurstville, NSW www.npws.nsw.gov.au.
- NSW National Parks and Wildlife Service. 1999b. Flock Bronzewing *Phaps histrionica*. Threatened Species Information. NSW National Parks and Wildlife Service Hurstville, NSW. www.npws.nsw.gov.au.
- O'Malley, C. 2006. Australian Threatened Species, Greater Bilby, *Macrotis lagotis* in Threatened Species Network, ed. Northern Territory Government.
- Olsen, J., Fuentes, E., Dykstra, R., and Rose, A. B. 2006. Male Peregrine Falcon *Falco peregrinus* fledged from a cliff-nest found breeding in a stick-nest. Australian Field Ornithology. 23:8-14.
- Palmer, C., Tayler, R., and Burbidge, A. 2003. Recovery Plan for the Golden Bandicoot *Isodon auratus* and Golden-backed Tree-rat *Mesembriomys macrurus* 2004-2009 in Northern Territory Department of Infrastructure Planning and Environment, ed, Darwin.

- Pavey, C. 2006. Threatened Species of the Northern Territory, Greater Bilby *Macrotis lagotis* in Department of Natural Resources Environment and the Arts, ed. Parks and Wildlife Commission Northern Territory.
- Reed, R. N. and Shine, R. 2002. Lying in Wait for Extinction: Ecological Correlates of Conservation Status among Australian Elapid Snakes. *Conservation Biology*. 16:451-461.
- Rogers, D., Hassell, C., Oldland, J., Clemens, R., Boyle, A., and Rogers, K. 2009. Monitoring Yellow Sea Migrants in Australia (MYSMA): North-western Australian shorebird surveys and workshops.
- RPS. 2008. Migratory Birds in Bridgewater North ODP, ed. EBPC Referral,.
- RPS Group. 2010. Woodside Browse Turtle Technical Report: Ecology of Marine Turtles of the Dampier Peninsula and the Lacepede Island Group, 2009–2010.
- Shepherd, D. P., Beeston, G. R., and Hopkins, A. J. M. 2002. Native Vegetation in Western Australia. Technical Report 249. Department of Agriculture, Western Australia, South Perth.
- Simpson, K. and Day, N. 2004. Field Guide to the Birds of Australia. Penguin Group, Camberwell.
- Storr, G. M., Smith, L. A., and Johnstone, R. E. 1990. Lizards of Western Australia III: Geckos and Pygopods. Western Australian Museum, Perth.
- Tyler, M. J. and Doughty, P. 2009. Field Guide to Frogs of Western Australia. Western Australian Museum, Perth.
- Van Dyck, S. and Strahan, R. 2008. *The Mammals of Australia*. Reed New Holland, Sydney.
- Wilson, S. and Swan, G. 2010. *A Complete Guide to Reptiles of Australia*. New Holland Publishers, Sydney.
- Wink, M., Sauer-Guerth, H., Witt, H. H. 2004. Phylogenetic Differentiation of the Osprey *Pandion haliaetus* inferred from nucleotide sequences of the mitochondrial cytochrome b gene.

Appendix A Explanation of Conservation Codes

Appendix A1 Definitions of relevant categories under the *Environment Protection and Biodiversity Conservation Act 1999*.

Category	Definition
Endangered (EN)	The species is likely to become extinct unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate; or its numbers have been reduced to such a critical level, or its habitats have been so drastically reduced, that it is in immediate danger of extinction.
Vulnerable (VU)	Within the next 25 years, the species is likely to become endangered unless the circumstances and factors threatening its abundance, survival or evolutionary development cease to operate.
Migratory (M)	Species are defined as migratory if they are listed in an international agreement approved by the Commonwealth Environment Minister, including: <ul style="list-style-type: none"> the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animal) for which Australia is a range state; the agreement between the Government of Australian and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their environment (CAMBA); or the agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA).

Appendix A2 Definition of Schedules under the *Wildlife Conservation Act 1950*.

Schedule	Definition
Schedule 1 (S1)	Fauna which are rare or likely to become extinct, are declared to be fauna that is in need of special protection.
Schedule 2 (S2)	Fauna which are presumed to be extinct, are declared to be fauna that is in need of species protection.
Schedule 3 (S3)	Birds which are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, are declared to be fauna that is in need of species protection.
Schedule 4 (S4)	Declared to be fauna that is in need of species protection, otherwise than for the reasons mentioned above.

Appendix A3 Definition of Department of Environment and Conservation Priority Codes.

Priority	Definition
Priority 1 (P1)	<i>Taxa with few, poorly known populations on threatened lands.</i> Taxa which are known from few specimens or sight records from one or a few localities, on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, active mineral leases. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 2 (P2)	<i>Taxa with few, poorly known populations on conservation lands.</i> Taxa which are known from few specimens or sight records from one or a few localities, on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant crown land, water reserves, etc. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 3 (P3)	<i>Taxa with several, poorly known populations, some on conservation lands.</i> Taxa which are known from few specimens or sight records from several localities, some of which are on lands not under immediate threat of habitat destruction or degradation. The taxon needs urgent survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna.
Priority 4 (P4)	<i>Taxa in need of monitoring.</i> 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 if present circumstances change. These taxa are usually represented on conservation lands.
Priority 5 (P5)	<i>Taxa in need of monitoring.</i> 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.

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Appendix B Daily Weather Data During Surveys

Date	Mean Minimum Temperature (°C)	Mean Maximum Temperature (°C)	Rainfall (mm)
Survey 1 (Workers' Accommodation)			
10/4/2011	25.8	35.2	0
11/4/2011	22.6	35.2	0
12/4/2011	21.3	34.5	0
13/4/2011	22.4	34.9	0
14/4/2011	22.4	34.8	0
15/4/2011	23.3	35.6	0
16/4/2011	23.2	34.7	0
17/4/2011	22.7	33.9	0
18/4/2011	17.8	30.4	0
19/4/2011	15.4	31.5	0
20/4/2011	15.5	32.5	0
21/4/2011	15.8	33.4	0
Survey 2 (Southern Pipeline and Light Industrial Area)			
27/4/2011	19.4	32.6	0
28/4/2011	22.1	33.8	0
29/4/2011	20.9	32.8	0
30/4/2011	22.2	31.4	0
1/5/2011	22.2	33.8	0
2/5/2011	21.7	32.3	0
3/5/2011	21.1	33.4	0
4/5/2011	20.8	33.5	0
5/5/2011	22.9	29.1	0
6/5/2011	21.5	28.4	0
7/5/2011	20.3	26.7	0.4
8/5/2011	20.3	28.4	0

Appendix C Fauna Recorded During Surveying and Regional Fauna Data

Appendix C1: Mammals

Family and Species	Common name	Conservation Status			Beagle Bay (ecologia 2004)	James Price Point (AECOM 2010)	James Price Point (AECOM 2011)	James Price Point (Biota 2009)	James Price Point (Biota 2010)	Dampier Peninsula (ENV 2008)	Quondong Point (ENV 2011)	NatureMap	DEC Threatened and Priority Fauna Search	DSEWPaC Protected Matters Search	ecologia 2011
		EPBC Act	WC Act	DEC											
TACHYGLOSSIDAE															
<i>Tachyglossus aculeatus</i>	Echidna					S				✓					
DASYURIDAE															
<i>Dasyercus blythi</i>	Brush-tailed Mulgara	VU												✓	
<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart														✓
PERAMELIDAE															
<i>Isoodon auratus</i>	Golden Bandicoot	VU	S1									✓	✓		
THYLACOMYIDAE															
<i>Macrotis lagotis</i>	Bilby	VU	S1			S	S			S	S	✓	✓	✓	S
PHALANGERIDAE															
<i>Trichosurus vulpecula arnhemensis</i>	Northern Brushtail Possum				✓					✓					
<i>Wyulda squamicaudata</i>	Scaly-tailed Possum			P3									✓		
POTOROIDAE															
<i>Bettongia lesueur</i>	Burrowing Bettong	VU	S1									✓			
MACROPODIDAE															
<i>Macropus agilis</i>	Agile Wallaby					✓		✓	✓	✓		✓			S
<i>Macropus robustus</i>	Euro									✓					
<i>Macropus rufus</i>	Red Kangaroo									✓					
PTEROPODIDAE															
<i>Pteropus scapulatus</i>	Little Red Flying-fox											✓			
EMBALLONURIDAE															
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail Bat							✓		✓		✓			✓
<i>Taphozous georgianus</i>	Common Sheathtail Bat									✓					
MOLOSSIDAE															

Family and Species	Common name	Conservation Status			Beagle Bay (ecologia 2004)	James Price Point (AECOM 2010)	James Price Point (AECOM 2011)	James Price Point (Biota 2009)	James Price Point (Biota 2010)	Dampier Peninsula (ENV 2008)	Quondong Point (ENV 2011)	NatureMap	DEC Threatened and Priority Fauna Search	DSEWPaC Protected Matters Search	ecologia 2011
		EPBC Act	WC Act	DEC											
<i>Chaerophon jobensis</i>	Northern Freetail Bat							✓		✓		✓			✓
<i>Mormopterus beccarii</i>	Beccari's Freetail Bat									✓					
<i>Mormopterus loriae</i>	Little Northern Freetail Bat			P1						✓		✓			
<i>Tadarida australis</i>	White-striped Freetail Bat									✓					
VESPERTILIONIDAE															
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat							✓		✓		✓			✓
<i>Chalinolobus nigrogriseus</i>	Hoary Wattled Bat				✓			✓		✓		✓			✓
<i>Miniopterus schreibersii orianae</i>	Common Bentwing Bat									✓					
<i>Nyctophilus arnhemensis</i>	Arnhem Land Long-eared Bat							✓		✓		✓			
<i>Nyctophilus bifax daedalus</i>	Northwestern Long-eared Bat											✓			
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat									✓		✓			✓
<i>Pipistrellus westralis</i>	Northern Pipistrell									✓					
<i>Scotorepens greyii</i>	Little Broad-nosed Bat				✓			✓		✓		✓			✓
<i>Scotorepens sanborni</i>	Northern broad-nosed Bat							✓		✓					
<i>Vespadelus caurinus</i>	Western Cave Bat									✓					
<i>Vespadelus douglasorum</i>	Yellow-lipped Cave Bat			P2	✓										
<i>Vespadelus finlaysoni</i>	Finlayson's Cave Bat									✓					
MURIDAE															
<i>Mesembriomys macrurus</i>	Golden-backed Tree Rat	VU		P4								✓	✓		
<i>Leggadina lakedownensis</i>	Lakeland Downs Mouse			P4						✓					
<i>Pseudomys delicatulus</i>	Delicate Mouse				✓	S		✓	✓	✓		✓			✓
<i>Pseudomys nanus</i>	Western Chestnut Mouse				✓					✓		✓			
<i>Rattus tunneyi</i>	Pale Field Rat									✓	✓				
<i>Hydromys chrysogaster</i>	Water Rat			P4									✓		
CANIDAE															

Family and Species	Common name	Conservation Status			Beagle Bay (ecologia 2004)	James Price Point (AECOM 2010)	James Price Point (AECOM 2011)	James Price Point (Biota 2009)	James Price Point (Biota 2010)	Dampier Peninsula (ENV 2008)	Quondong Point (ENV 2011)	NatureMap	DEC Threatened and Priority Fauna Search	DSEWPaC Protected Matters Search	ecologia 2011
		EPBC Act	WC Act	DEC											
<i>Canis lupus</i>	Dog/Dingo					✓		✓	✓	✓		✓			✓
INTRODUCED MAMMALS															
<i>Mus musculus</i>	House Mouse							✓		✓		✓			
<i>Rattus rattus</i>	Black Rat					✓				✓					
<i>Vulpes vulpes</i>	Red Fox									✓				✓	
<i>Felis catus</i>	Cat				✓	✓		✓	✓	✓		✓		✓	
<i>Equus asinus</i>	Donkey				✓					✓					
<i>Bos taurus</i>	Cow					✓				✓					

S – Secondary signs found

Appendix C2: Birds

Family and Species	Common name	Conservation Status			Beagle Bay (ecologia 2004)	James Price Point (AECOM 2010)	James Price Point (Biota 2009)	James Price Point (Bamford 2011)	Dampier Peninsula (ENV 2008)	North-West WA (Rogers <i>et al.</i> 2009)	NatureMap	DEC Threatened and Priority Fauna Search	DSEWPac Protected Matters Search	Birdata	<i>ecologia</i> 2011
		EPBC Act	WC Act	DEC											
PHASIANIDAE															
<i>Coturnix ypsilophora</i>	Brown Quail					✓	✓	✓	✓		✓			✓	✓
<i>*Pavo cristatus</i>	Indian Peafowl													✓	
ANSERANATIDAE															
<i>Anseranas semipalmata</i>	Magpie Goose										✓		✓	✓	
ANATIDAE															
<i>Dendrocygna eytoni</i>	Plumed Whistling-duck								✓	✓	✓			✓	
<i>Dendrocygna arcuata</i>	Wandering Whistling-duck								✓	✓	✓			✓	
<i>Stictonetta naevosa</i>	Freckled Duck													✓	
<i>Cygnus atratus</i>	Black Swan										✓			✓	
<i>Tadorna radjah</i>	Radjah Shelduck													✓	
<i>Tadorna tadornoides</i>	Australian Shelduck													✓	
<i>Chenonetta jubata</i>	Australian Wood Duck									✓				✓	
<i>Malacorhynchus membranaceus</i>	Pink-eared Duck									✓	✓			✓	
<i>Nettapus pulchellus</i>	Green Pygmy-Goose									✓	✓			✓	
<i>Ana querquedula</i>	Garganey										✓			✓	
<i>Anas rhynchotis</i>	Australasian Shoveler										✓			✓	
<i>Anas gracilis</i>	Grey Teal								✓	✓	✓			✓	
<i>Anas castanea</i>	Chestnut Teal													✓	
<i>Anas superciliosa</i>	Pacific Black Duck								✓	✓	✓			✓	
<i>Aythya australis</i>	Hardhead								✓	✓	✓			✓	
PODICIPEDIDAE															
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe								✓	✓	✓			✓	

Family and Species	Common name	Conservation Status			Beagle Bay (ecologia 2004)	James Price Point (AECOM 2010)	James Price Point (Biota 2009)	James Price Point (Bamford 2011)	Dampier Peninsula (ENV 2008)	North-West WA (Rogers <i>et al.</i> 2009)	NatureMap	DEC Threatened and Priority Fauna Search	DSEWPac Protected Matters Search	Birddata	ecologia 2011
		EPBC Act	WC Act	DEC											
<i>Poliocephalus poliocephalus</i>	Hoary-headed Grebe									✓	✓			✓	
<i>Podiceps cristatus</i>	Great Crested Grebe													✓	
COLUMBIDAE															
<i>*Columba livia</i>	Rock Dove/ Domestic Pigeon													✓	
<i>Phaps histrionica</i>	Flock Bronzewing			P4					✓					✓	✓
<i>Ocyphaps lophotes</i>	Crested Pigeon				✓	✓	✓	✓	✓		✓			✓	
<i>Geopelia cuneata</i>	Diamond Dove				✓		✓	✓	✓		✓			✓	✓
<i>Geopelia striata</i>	Peaceful Dove				✓	✓	✓	✓	✓		✓			✓	✓
<i>Geopelia humeralis</i>	Bar-shouldered Dove				✓	✓	✓	✓	✓		✓			✓	✓
<i>Ducula bicolor</i>	Pied Imperial Pigeon													✓	
PODARGIDAE															
<i>Podargus strigoides</i>	Tawny Frogmouth				✓	✓	✓	✓	✓		✓			✓	✓
EUROSTOPODIDAE															
<i>Eurostopodus argus</i>	Spotted Nightjar					✓			✓		✓			✓	
AEGOTHELIDAE															
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar				✓	✓		✓	✓		✓			✓	✓
APODIDAE															
<i>Hirundapus caudacutus</i>	White-throated Needletail	M	S3											✓	
<i>Apus pacificus</i>	Fork-tailed Swift	M	S3		✓	✓		✓			✓		✓	✓	✓
<i>Apus affinis</i>	House Swift													✓	
HYDROBATIDAE															
<i>Hydrobates leucorhoa</i>	Leach's Storm-Petrel	M	S3								✓			✓	
OCEANITIDAE															
<i>Oceanites oceanicus</i>	Wilson's Storm-Petrel	M	S3								✓			✓	

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		EPBC Act	WC Act	DEC											
DIOMEDEIDAE															
<i>Thalassarche chrysostoma</i>	Grey-headed Albatross	EN	S1									✓			
PROCELLARIIDAE															
<i>Bulweia bulweii</i>	Bulwer's Petrel													✓	
<i>Ardenna pacificus</i>	Wedge-tailed Shearwater	M	S3											✓	
<i>Ardenna tenuirostris</i>	Short-tailed Shearwater	M	S3											✓	
<i>Calonectris leucomelas</i>	Streaked Shearwater	M	S3								✓			✓	
<i>Puffinus huttoni</i>	Hutton's Shearwater										✓			✓	
FREGATIDAE															
<i>Fregata ariel</i>	Lesser Frigatebird	M	S3			✓	✓		✓	✓	✓			✓	✓
SULIDAE															
<i>Sula dactylatra</i>	Masked Booby	M	S3								✓				
<i>Sula leucogaster</i>	Brown Booby	M	S3						✓	✓	✓			✓	✓
ANHINGIDAE															
<i>Anhinga novaehollandiae</i>	Australasian Darter								✓	✓	✓			✓	
PHALACROCORACIDAE															
<i>Microcarbo melanoleucos</i>	Little Pied Cormorant								✓	✓	✓			✓	
<i>Phalacrocorax carbo</i>	Great Cormorant										✓			✓	
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant								✓	✓	✓			✓	
<i>Phalacrocorax varius</i>	Pied Cormorant					✓			✓	✓	✓			✓	
PELECANIDAE															
<i>Pelecanus conspicillatus</i>	Australian Pelican					✓			✓	✓	✓			✓	✓
CICONIIDAE															
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork								✓	✓	✓			✓	
ARDEIDAE															

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		EPBC Act	WC Act	DEC											
<i>Ixobrychus dubius</i>	Australian Little Bittern			P4							✓	✓		✓	
<i>Ixobrychus flavicollis</i>	Black Bittern			P3								✓		✓	
<i>Ardea pacifica</i>	White-necked Heron								✓	✓	✓			✓	
<i>Ardea modesta</i>	Eastern Great Egret	M	S3						✓	✓	✓		✓	✓	
<i>Ardea intermedia</i>	Intermediate Egret										✓			✓	
<i>Egretta picata</i>	Pied Heron								✓		✓			✓	
<i>Egretta novaehollandiae</i>	White-faced Heron					✓			✓	✓	✓			✓	
<i>Ardea ibis</i>	Cattle Egret	M	S3						✓		✓		✓	✓	
<i>Butorides striatus</i>	Striated Heron								✓	✓	✓			✓	
<i>Egretta garzetta</i>	Little Egret								✓	✓	✓			✓	
<i>Egretta sacra</i>	Eastern Reef Egret	M	S3						✓	✓	✓			✓	
<i>Nycticorax caledonicus</i>	Nankeen Night Heron						✓				✓			✓	
THRESKIORNITHIDAE															
<i>Plegadis falcinellus</i>	Glossy Ibis	M	S3						✓	✓	✓			✓	
<i>Threskiornis molucca</i>	Australian White Ibis								✓	✓	✓			✓	
<i>Threskiornis spinicollis</i>	Straw-necked Ibis					✓			✓	✓	✓			✓	
<i>Platalea regia</i>	Royal Spoonbill									✓	✓			✓	
<i>Platalea flavipes</i>	Yellow-billed Spoonbill										✓			✓	
ACCIPITRIDAE															
<i>Pandion cristatus</i>	Eastern Osprey	M				✓	✓		✓		✓			✓	
<i>Elanus axillaris</i>	Black-shouldered Kite					✓			✓		✓			✓	
<i>Lophoictinia isura</i>	Square-tailed Kite						✓		✓		✓			✓	✓
<i>Hamirostra melanosternon</i>	Black-breasted Buzzard										✓			✓	
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	M	S3			✓	✓	✓	✓		✓		✓	✓	✓
<i>Haliastur sphenurus</i>	Whistling Kite					✓			✓		✓			✓	

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<i>Haliastur indus</i>	Brahminy Kite					✓		✓	✓		✓			✓	✓
<i>Milvus migrans</i>	Black Kite				✓	✓			✓		✓			✓	✓
<i>Accipiter fasciatus</i>	Brown Goshawk				✓	✓	✓	✓	✓		✓			✓	✓
<i>Accipiter cirrhocephalus</i>	Collared Sparrowhawk				✓				✓		✓			✓	
<i>Accipiter novaehollandiae</i>	Grey Goshawk													✓	
<i>Circus assimilis</i>	Spotted Harrier								✓		✓			✓	
<i>Circus approximans</i>	Swamp Harrier								✓		✓			✓	
<i>Erythrotriorchis radiatus</i>	Red Goshawk	VU	S1								✓				
<i>Aquila audax</i>	Wedge-tailed Eagle										✓			✓	
<i>Hieraaetus morphnoides</i>	Little Eagle								✓		✓			✓	✓
FALCONIDAE															
<i>Falco cenchroides</i>	Nankeen Kestrel				✓	✓	✓		✓		✓			✓	✓
<i>Falco berigora</i>	Brown Falcon				✓	✓	✓	✓	✓		✓			✓	✓
<i>Falco longipennis</i>	Australian Hobby					✓					✓			✓	
<i>Falco hypoleucos</i>	Grey Falcon			P4								✓		✓	
<i>Falco subniger</i>	Black Falcon													✓	
<i>Falco peregrinus</i>	Peregrine Falcon		S4			✓	✓		✓		✓	✓		✓	
GRUIDAE															
<i>Grus rubicunda</i>	Brolga								✓	✓	✓			✓	
RALLIDAE															
<i>Porphyrio porphyrio</i>	Purple Swamphen								✓		✓			✓	
<i>Rallina fasciata</i>	Red-legged Crane								✓						
<i>Gallirallus philippensis</i>	Buff-banded Rail								✓		✓			✓	
<i>Porzana pusilla</i>	Baillon's Crane										✓			✓	
<i>Porzana fluminea</i>	Australian Spotted Crane													✓	

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<i>Porzana tabuensis</i>	Spotless Crake										✓			✓	
<i>Amaurornis cinerea</i>	White-browed Crake										✓			✓	
<i>Tribonyx ventralis</i>	Black-tailed Native-hen										✓			✓	
<i>Fulica atra</i>	Eurasian Coot									✓	✓			✓	
OTIDIDAE															
<i>Ardeotis australis</i>	Australian Bustard			P4	✓				✓		✓	✓		✓	✓
BURHINIDAE															
<i>Burhinus grallarius</i>	Bush Stone-curlew			P4	✓		✓		✓		✓	✓		✓	
<i>Esacus magnirostris</i>	Beach Stone-curlew					✓			✓		✓			✓	
HAEMATOPODIDAE															
<i>Haematopus longirostris</i>	Australian Pied Oystercatcher					✓	✓		✓	✓	✓			✓	✓
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher					✓			✓	✓	✓			✓	✓
RECURVIROSTRIDAE															
<i>Himantopus himantopus</i>	Black-winged Stilt								✓	✓	✓			✓	
<i>Recurvirostra novaehollandiae</i>	Red-necked Avocet									✓	✓			✓	
<i>Cladorhynchus leucocephalus</i>	Banded Stilt													✓	
CHARADRIIDAE															
<i>Pluvialis fulva</i>	Pacific Golden Plover	M	S3						✓	✓	✓			✓	
<i>Pluvialis squatarola</i>	Grey Plover	M	S3						✓	✓	✓			✓	
<i>Charadrius dubius</i>	Little Ringed Plover	M	S3								✓			✓	
<i>Charadrius leschenaultii</i>	Greater Sand Plover	M	S3			✓			✓	✓	✓			✓	
<i>Charadrius mongolus</i>	Lesser Sand Plover	M	S3			✓				✓	✓			✓	
<i>Charadrius ruficapillus</i>	Red-capped Plover								✓	✓	✓			✓	✓
<i>Charadrius veredus</i>	Oriental Plover	M	S3							✓	✓		✓	✓	

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<i>Euseyornis melanops</i>	Black-fronted Dotterel					✓			✓	✓	✓			✓	
<i>Erythronyctes alba</i>	Red-kneed Dotterel								✓	✓	✓			✓	
<i>Vanellus miles</i>	Masked Lapwing					✓			✓	✓	✓			✓	
<i>Vanellus tricolor</i>	Banded Lapwing													✓	
JACANIDAE															
<i>Irediparra gallinacea</i>	Comb-crested Jacana								✓		✓			✓	
ROSTRATULIDAE															
<i>Rostratula australis</i>	Australian Painted Snipe	VU	S1									✓	✓	✓	
SCOLOPACIDAE															
<i>Gallinago stenura</i>	Pint-tailed Snipe	M	S3											✓	
<i>Gallinago megala</i>	Swinhoe's Snipe	M	S3							✓	✓			✓	
<i>Limosa limosa</i>	Black-tailed Godwit	M	S3							✓	✓			✓	
<i>Limosa lapponica</i>	Bar-tailed Godwit	M	S3			✓			✓	✓	✓			✓	
<i>Numenius minutus</i>	Little Curlew	M	S3							✓	✓			✓	
<i>Numenius phaeopus</i>	Whimbrel	M	S3			✓			✓	✓	✓			✓	
<i>Numenius madagascariensis</i>	Eastern Curlew	M	S3	P4		✓			✓	✓	✓	✓		✓	
<i>Numenius arquata</i>	Eurasian Curlew	M	S3							✓					
<i>Xenus cinereus</i>	Terek Sandpiper	M	S3							✓	✓			✓	
<i>Actitis hypoleucos</i>	Common Sandpiper	M	S3				✓		✓	✓	✓			✓	
<i>Tringa brevipes</i>	Grey-tailed Tattler	M	S3			✓			✓	✓	✓			✓	
<i>Tringa glareola</i>	Wood Sandpiper	M	S3			✓				✓	✓			✓	
<i>Tringa nebularia</i>	Common Greenshank	M	S3			✓			✓	✓	✓			✓	
<i>Tringa stagnatilis</i>	Marsh Sandpiper	M	S3							✓	✓			✓	
<i>Tringa totanus</i>	Common Redshank	M	S3											✓	
<i>Arenaria interpres</i>	Ruddy Turnstone	M	S3			✓			✓	✓	✓			✓	

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<i>Limnodromus semipalmatus</i>	Asian Dowitcher	M	S3							✓	✓			✓	
<i>Calidris tenuirostris</i>	Great Knot	M	S3						✓	✓	✓			✓	
<i>Calidris canutus</i>	Red Knot	M	S3							✓	✓			✓	
<i>Calidris alba</i>	Sanderling	M	S3			✓			✓	✓	✓			✓	
<i>Calidris ruficollis</i>	Red-necked Stint	M	S3			✓			✓	✓	✓			✓	
<i>Calidris subminuta</i>	Long-toed Stint	M	S3							✓	✓			✓	
<i>Calidris melanotos</i>	Pectoral Sandpiper	M	S3							✓	✓			✓	
<i>Calidris acuminata</i>	Sharp-tailed Sandpiper	M	S3			✓				✓	✓			✓	
<i>Calidris ferruginea</i>	Curlew Sandpiper	M	S3							✓	✓			✓	
<i>Limicola falcinellus</i>	Broad-billed Sandpiper	M	S3							✓				✓	
<i>Philomachus pugnax</i>	Ruff	M	S3							✓				✓	
<i>Phalaropus lobatus</i>	Red-necked Phalarope	M	S3											✓	
TURNICIDAE															
<i>Turnix maculosus</i>	Red-backed Button-quail							✓	✓					✓	
<i>Turnix castanotus</i>	Chestnut-backed Button-quail			P4		✓									
<i>Turnix pyrrhothorax</i>	Red-chested Button-quail					✓					✓			✓	✓
<i>Turnix velox</i>	Little Button-quail				✓				✓					✓	✓
GLAREOLIDAE															
<i>Glareola maldivarum</i>	Oriental Pratincole	M	S3							✓			✓	✓	
<i>Stiltia isabellae</i>	Australian Pratincole								✓	✓	✓			✓	
STERCORARIIDAE															
<i>Stercorarius parasiticus</i>	Arctic Jaeger	M	S3											✓	
LARIDAE															
<i>Anous stolidus</i>	Common Noddy	M	S3								✓			✓	

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<i>Onychoprion anaethetus</i>	Bridled Tern	M	S3								✓			✓	
<i>Sternula albifrons</i>	Little Tern	M	S3			✓			✓	✓	✓		✓	✓	
<i>Sternula nereis</i>	Fairy Tern	VU							✓					✓	
<i>Gelochelidon nilotica</i>	Gull-billed Tern					✓			✓	✓	✓			✓	
<i>Hydroprogne caspia</i>	Caspian Tern	M	S3							✓	✓			✓	
<i>Chlidonias hybrida</i>	Whiskered Tern								✓	✓	✓			✓	
<i>Chlidonia leucopterus</i>	White-winged Black Tern	M	S3						✓	✓	✓			✓	
<i>Sterna dougallii</i>	Roseate Tern	M	S3						✓	✓	✓			✓	
<i>Sterna sumatrana</i>	Black-naped Tern	M	S3						✓						
<i>Sterna hirundo</i>	Common Tern	M	S3			✓				✓	✓			✓	✓
<i>Thalasseus bengalensis</i>	Lesser Crested Tern	M	S3			✓			✓	✓	✓			✓	✓
<i>Thalasseus bergii</i>	Crested Tern					✓			✓	✓	✓			✓	✓
<i>Chroicocephalus novaehollandiae</i>	Silver Gull					✓			✓	✓	✓			✓	
<i>Xema sabini</i>	Sabine's Gull										✓			✓	
CACATUIDAE (PSITTACIDAE)															
<i>Calyptorhynchus banksii</i>	Red-tailed Black-Cockatoo				✓	✓			✓		✓			✓	✓
<i>Eolophus roseicapillus</i>	Galah				✓				✓		✓			✓	
<i>Cacatua sanguinea</i>	Little Corella					✓			✓		✓			✓	
<i>Nymphicus hollandicus</i>	Cockatiel										✓			✓	✓
PSITTACIDAE															
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet				✓		✓	✓			✓			✓	✓
<i>Trichoglossus haematodus rubritorquis</i>	Red-collared Lorikeet					✓			✓		✓				
<i>Psitteuteles versicolor</i>	Varied Lorikeet				✓		✓		✓		✓			✓	✓
<i>Aprosmictus erythropterus</i>	Red-winged Parrot				✓	✓	✓	✓	✓		✓			✓	✓
<i>Polytelis alexandrae</i>	Princess Parrot	VU		P4								✓			

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<i>Melopsittacus undulatus</i>	Budgerigar								✓		✓			✓	
CUCULIDAE															
(Centropodidae) <i>Centropus phasianinus</i>	Pheasant Coucal				✓	✓	✓	✓	✓		✓			✓	✓
<i>Scythrops novaehollandiae</i>	Channel-billed Cuckoo					✓					✓			✓	
<i>Chalcites basalis</i>	Horsfield's Bronze-Cuckoo				✓	✓	✓		✓		✓			✓	✓
<i>Chalcites osculans</i>	Black-eared Cuckoo					✓	✓				✓			✓	
<i>Chalcites lucidus</i>	Shining Bronze-Cuckoo										✓				
<i>Chalcites minutillus</i>	Little Bronze-Cuckoo				✓				✓		✓			✓	✓
<i>Cacomantis pallidus</i>	Pallid Cuckoo				✓	✓			✓		✓			✓	✓
<i>Cacomantis variolosus</i>	Brush Cuckoo				✓	✓	✓		✓		✓			✓	
<i>Cuculus optatus</i>	Oriental Cuckoo					✓								✓	
STRIGIDAE															
<i>Ninox connivens</i>	Barking Owl								✓		✓			✓	
<i>Ninox novaeseelandiae</i>	Southern Boobook				✓				✓		✓			✓	✓
TYTONIDAE															
<i>Tyto javanica</i>	Eastern Barn Owl										✓			✓	
<i>Tyto longimembris</i>	Eastern Grass Owl								✓		✓			✓	
HALCYONIDAE															
<i>Dacelo leachii</i>	Blue-winged Kookaburra				✓	✓	✓		✓		✓			✓	✓
<i>Todiramphus pyrrhopygius</i>	Red-backed Kingfisher					✓	✓		✓		✓			✓	
<i>Todiramphus sanctus</i>	Sacred Kingfisher				✓	✓	✓	✓	✓		✓			✓	✓
<i>Todiramphus chloris</i>	Collared Kingfisher								✓		✓			✓	
MEROPIDAE															
<i>Merops ornatus</i>	Rainbow Bee-eater	M	S3		✓	✓	✓	✓	✓		✓		✓	✓	✓

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		EPBC Act	WC Act	DEC											
CORACIIDAE															
<i>Eurystomus orientalis</i>	Dollarbird					✓	✓				✓			✓	✓
CLIMACTERIDAE															
<i>Climacteris melanura</i>	Black-tailed Treecreeper				✓				✓					✓	
PTILINORHYNCHIDAE															
<i>Ptilonorhynchus nuchalis</i>	Great Bowerbird				✓	✓	✓	✓	✓		✓			✓	✓
MALURIDAE															
<i>Malurus elegans</i>	Red-winged Fairy-wren										✓			✓	
<i>Malurus lamberti</i>	Variegated Fairy-wren					✓	✓	✓	✓		✓			✓	✓
<i>Malurus melanocephalus</i>	Red-backed Fairy-wren				✓	✓	✓		✓		✓				✓
ACANTHIZIDAE															
<i>Smicrornis brevirostris</i>	Weebill				✓		✓		✓		✓			✓	✓
<i>Gerygone levigaster</i>	Mangrove Gerygone					✓			✓		✓			✓	
<i>Gerygone fusca</i>	Western Gerygone								✓		✓			✓	
<i>Gerygone tenebrosa</i>	Dusky Gerygone								✓		✓			✓	
<i>Gerygone albogularis</i>	White-throated Gerygone				✓	✓	✓	✓	✓		✓			✓	✓
PARDALOTIDAE															
<i>Pardalotus rubricatus</i>	Red-browed Pardalote					✓	✓		✓		✓			✓	
<i>Pardalotus striatus</i>	Striated Pardalote				✓		✓	✓	✓		✓			✓	✓
MELIPHAGIDAE															
<i>Certhionyx variegatus</i>	Pied Honeyeater								✓						
<i>Lichenostomus virescens</i>	Singing Honeyeater				✓	✓	✓	✓	✓		✓			✓	✓
<i>Lichenostomus unicolor</i>	White-gaped Honeyeater					✓	✓	✓	✓		✓			✓	✓
<i>Lichenostomus keartlandi</i>	Grey-headed Honeyeater													✓	
<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater						✓				✓				

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		EPBC Act	WC Act	DEC											
<i>Lichenostomus flavescens</i>	Yellow-tinted Honeyeater				✓		✓		✓		✓			✓	✓
<i>Lichenostomus penicillatus</i>	White-plumed Honeyeater					✓	✓				✓				
<i>Purnella albifrons</i>	White-fronted Honeyeater													✓	
<i>Manorina flavigula</i>	Yellow-throated Miner								✓					✓	
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater													✓	
<i>Conopophila rufogularis</i>	Rufous-throated Honeyeater				✓	✓	✓		✓		✓			✓	✓
<i>Epthianura tricolor</i>	Crimson Chat								✓						
<i>Epthianura aurifrons</i>	Orange Chat													✓	
<i>Epthianura crocea</i>	Yellow Chat										✓			✓	
<i>Sugomel niger</i>	Black Honeyeater													✓	
<i>Myzomela erythrocephala</i>	Red-headed Honeyeater					✓			✓		✓			✓	
<i>Cissomela pectoralis</i>	Banded Honeyeater				✓						✓			✓	✓
<i>Lichmera indistincta</i>	Brown Honeyeater				✓	✓	✓	✓	✓		✓			✓	✓
<i>Melithreptus gularis</i>	Black-chinned Honeyeater				✓	✓	✓	✓	✓		✓			✓	✓
<i>Melithreptus albogularis</i>	White-throated Honeyeater				✓	✓			✓		✓			✓	✓
<i>Philemon argenteiceps</i>	Silver-crowned Friarbird					✓			✓						
<i>Philemon citreogularis</i>	Little Friarbird				✓	✓	✓	✓	✓		✓			✓	✓
POMATOSTOMIDAE															
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler				✓	✓	✓	✓	✓		✓			✓	✓
NEOSITTIDAE															
<i>Daphoenositta chrysoptera</i>	Varied Sittella				✓	✓	✓		✓		✓			✓	✓

Family and Species	Common name	Conservation Status			Beagle Bay (ecologia 2004)	James Price Point (AECOM 2010)	James Price Point (Biota 2009)	James Price Point (Bamford 2011)	Dampier Peninsula (ENV 2008)	North-West WA (Rogers <i>et al.</i> 2009)	NatureMap	DEC Threatened and Priority Fauna Search	DSEWPaC Protected Matters Search	Birdata	ecologia 2011
		EPBC Act	WC Act	DEC											
CAMPEPHAGIDAE															
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike				✓	✓	✓	✓	✓		✓			✓	✓
<i>Coracina papuensis</i>	White-bellied Cuckoo-shrike										✓			✓	
<i>Lalage sueurii</i>	White-winged Triller				✓	✓		✓	✓		✓			✓	✓
PACHYCEPHALIDAE															
<i>Pachycephala melanura</i>	Mangrove Golden Whistler								✓		✓			✓	
<i>Pachycephala rufiventris</i>	Rufous Whistler				✓	✓	✓	✓	✓		✓			✓	✓
<i>Pachycephala lanioides</i>	White-breasted Whistler								✓		✓			✓	
<i>Colluricincla harmonica</i>	Grey Shrike-thrush				✓	✓	✓	✓	✓		✓			✓	✓
<i>Oreoica gutturalis</i>	Crested Bellbird								✓						
ORIOOLIDAE															
<i>Oriolus sagittatus</i>	Olive-backed Oriole				✓	✓			✓		✓			✓	✓
ARTAMIDAE															
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow					✓	✓	✓	✓		✓			✓	
<i>Artamus personatus</i>	Masked Woodswallow				✓			✓	✓		✓			✓	✓
<i>Artamus superciliosus</i>	White-browed Woodswallow								✓					✓	✓
<i>Artamus cinereus</i>	Black-faced Woodswallow				✓	✓	✓	✓	✓		✓			✓	✓
<i>Artamus minor</i>	Little Woodswallow				✓	✓	✓	✓	✓		✓			✓	✓
<i>Cracticus torquatus</i>	Grey Butcherbird						✓				✓			✓	
<i>Cracticus nigrogularis</i>	Pied Butcherbird				✓	✓	✓	✓	✓		✓			✓	✓
<i>Cracticus tibicen</i>	Australian Magpie										✓			✓	

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		EPBC Act	WC Act	DEC											
RHIPIDURIDAE (DICRURIDAE)															
<i>Rhipidura albiscapa</i>	Grey Fantail								✓		✓			✓	
<i>Rhipidura phasiana</i>	Mangrove Grey Fantail								✓		✓			✓	
<i>Rhipidura rufiventris</i>	Northern Fantail					✓	✓	✓	✓		✓			✓	✓
<i>Rhipidura leucophrys</i>	Willie Wagtail				✓	✓	✓		✓		✓			✓	✓
CORVIDAE															
<i>Corvus bennetti</i>	Little Crow				✓				✓		✓			✓	
<i>Corvus orru</i>	Torresian Crow				✓	✓	✓	✓	✓		✓			✓	✓
MONARCHIDAE (DICRURIDAE)															
<i>Myiagra ruficollis</i>	Broad-billed Flycatcher								✓		✓			✓	
<i>Myiagra rubecula</i>	Leaden Flycatcher				✓	✓	✓				✓			✓	✓
<i>Myiagra inquieta</i>	Restless Flycatcher				✓	✓	✓	✓	✓		✓			✓	✓
<i>Grallina cyanoleuca</i>	Magpie-lark				✓	✓			✓		✓			✓	
PETROICIDAE															
<i>Microeca fascians</i>	Jacky Winter				✓	✓	✓		✓		✓			✓	✓
<i>Microeca flavigaster</i>	Lemon-bellied Flycatcher								✓		✓			✓	
<i>Petroica goodenovii</i>	Red-capped Robin													✓	
<i>Melanodryas cucullata</i>	Hooded Robin				✓				✓		✓			✓	
<i>Peneonanthe pulverulenta</i>	Mangrove Robin										✓			✓	
ALAUDIDAE															
<i>Mirafrja javanica</i>	Horsfield’s Bushlark								✓		✓			✓	
CISTICOLIDAE (SYLVIIDAE)															
<i>Cisticola exilis</i>	Golden-headed Cisticola						✓				✓			✓	
ACROCEPHALIDAE (SYLVIIDAE)															
<i>Acrocephalus australis</i>	Australian Reed-Warbler								✓		✓			✓	

Family and Species	Common name	Conservation Status			Beagle Bay (ecologia 2004)	James Price Point (AECOM 2010)	James Price Point (Biota 2009)	James Price Point (Bamford 2011)	Dampier Peninsula (ENV 2008)	North-West WA (Rogers <i>et al.</i> 2009)	NatureMap	DEC Threatened and Priority Fauna Search	DSEW/PaC Protected Matters Search	Birddata	ecologia 2011
		EPBC Act	WC Act	DEC											
MEGALURIDAE (SYLVIIDAE)															
<i>Megalurus timoriensis</i>	Tawny Grassbird								✓					✓	
<i>Megalurus gramineus</i>	Little Grassbird										✓			✓	
<i>Cincloramphus mathewsi</i>	Rufous Songlark							✓	✓					✓	✓
<i>Cincloramphus cruralis</i>	Brown Songlark								✓		✓			✓	✓
TIMALIIDAE (ZOSTEROPIDAE)															
<i>Zosterops luteus</i>	Yellow White-eye					✓		✓	✓		✓			✓	
<i>Zosterops lateralis</i>	Silveryeye													✓	
HIRUNDINIDAE															
<i>Hirundo rustica</i>	Barn Swallow	M	S3								✓		✓	✓	
<i>Hirundo neoxena</i>	Welcome Swallow										✓			✓	
<i>Petrochelidon ariel</i>	Fairy Martin								✓		✓			✓	✓
<i>Petrochelidon nigricans</i>	Tree Martin				✓		✓	✓	✓		✓			✓	✓
<i>Cecropis daurica</i>	Red-rumped Swallow		S3											✓	
MUSCICAPIDAE															
<i>Cyanoptila cyanomelana</i>	Blue-and-White Flycatcher													✓	
STURNIDAE															
<i>Sturnus vulgaris</i>	Common Starling										✓			✓	
NECTARINIIDAE (DICAIEIDAE)															
<i>Dicaeum hirundinaceum</i>	Mistletoebird				✓	✓		✓	✓		✓			✓	✓
ESTRILDIDAE															
<i>Taeniopygia guttata</i>	Zebra Finch						✓	✓	✓		✓			✓	
<i>Taeniopygia bichenovii</i>	Double-barred Finch						✓		✓		✓			✓	✓
<i>Poephila acuticauda</i>	Long-tailed Finch				✓	✓	✓		✓		✓			✓	✓
<i>Emblema pictum</i>	Painted Finch													✓	

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		EPBC Act	WC Act	DEC											
<i>Erythrura gouldiae</i>	Gouldian Finch	EN, M	S1						✓			✓	✓		
<i>Lonchura castaneothorax</i>	Chestnut-breasted Mannikin													✓	
<i>Heteromunia pectoralis</i>	Pictorella Mannikin			P4					✓		✓	✓		✓	
MOTACILLIDAE															
<i>Anthus novaeseelandiae</i>	Australasian Pipit					✓	✓		✓		✓			✓	
<i>Motacilla flava</i>	Yellow Wagtail								✓					✓	

* Introduced species

Appendix C3: Reptiles

Family and Species	Common name	Conservation Status			Beagle Bay (ecologia 2004)	James Price Point (AECOM 2010)	James Price Point (Biota 2009)	James Price Point (Biota 2010)	Dampier Peninsula (ENV 2008)	NatureMap	DEC Threatened and Priority Fauna Search	DSEWPaC Protected Matters Search	ecologia 2011
		EPBC Act	WC Act	DEC									
CROCODYLIDAE													
<i>Crocodylus johnstoni</i>	Freshwater Crocodile		S4									✓	
<i>Crocodylus porosus</i>	Salt-water Crocodile		S4						✓			✓	
CHELONIIDAE													
<i>Caretta caretta</i>	Loggerhead Turtle	EN	S1							✓		✓	
<i>Chelonia mydas</i>	Green Turtle	VU	S1									✓	
<i>Eretmochelys imbricata</i>	Hawksbill Turtle	VU	S1									✓	
<i>Lepidochelys olivacea</i>	Pacific Ridley Turtle	EN	S1									✓	
<i>Natator depressus</i>	Flatback Turtle	VU	S1							✓		✓	
DERMOCHELYIDAE													
<i>Dermochelys coriacea</i>	Leathery Turtle	EN	S1									✓	
DIPLODACTYLIDAE													
<i>Diplodactylus conspicillatus</i>	Fat-tailed Gecko					✓	✓	✓	✓	✓			✓
<i>Lucasium stenodactylum</i>	Sand-plain Gecko				✓		✓	✓	✓	✓			✓
<i>Oedura rhombifer</i>						✓			✓	✓			
<i>Rhynchoedura ornata</i>	Beaked Gecko				✓					✓			
<i>Strophurus ciliaris</i>					✓	✓	✓	✓	✓	✓			✓
<i>Strophurus jeanae</i>									✓				
<i>Strophurus taeniatus</i>									✓				
GEKKONIDAE													
<i>Gehyra australis</i>													✓
<i>Gehyra nana</i>									✓				
<i>Gehyra pilbara</i>					✓		✓		✓	✓			✓

Family and Species	Common name	Conservation Status			Beagle Bay (ecologia 2004)	James Price Point (AECOM 2010)	James Price Point (Biota 2009)	James Price Point (Biota 2010)	Dampier Peninsula (ENV 2008)	NatureMap	DEC Threatened and Priority Fauna Search	DSEWPaC Protected Matters Search	ecologia 2011
		EPBC Act	WC Act	DEC									
<i>Gehyra punctata</i>							✓		✓				
<i>Gehyra variegata</i>						✓			✓				
<i>Heteronotia binoei</i>	Bynoe's Gecko				✓		✓	✓	✓	✓			✓
<i>*Hemidactylus frenatus</i>	Asian House Gecko								✓				
PYGOPODIDAE													
<i>Delma borea</i>									✓	✓			
<i>Delma tincta</i>							✓		✓	✓			
<i>Lialis burtonis</i>						✓	✓	✓	✓	✓			✓
<i>Pygopus nigriceps</i>					✓								
<i>Pygopus steelescotti</i>	Northern Hooded Scaly-foot						✓			✓			
SCINCIDAE													
<i>Carlia munda</i>					✓				✓	✓			✓
<i>Carlia rufilatus</i>							✓	✓	✓	✓			✓
<i>Carlia triacantha</i>					✓								
<i>Cryptoblepharus carnabyi</i>					✓								
<i>Cryptoblepharus metallicus</i>									✓				
<i>Cryptoblepharus ruber</i>	Tawny Snake-eyed Skink						✓	✓	✓	✓			✓
<i>Cryptoblepharus tyttos</i>	Pygmy Snake-eyed Skink									✓			
<i>Ctenotus colletti</i>									✓				
<i>Ctenotus helenae</i>									✓				
<i>Ctenotus inornatus</i>					✓	✓	✓	✓	✓	✓			✓
<i>Ctenotus pantherinus</i>													✓
<i>Ctenotus serventyi</i>					✓		✓			✓			✓
<i>Eremiascincus isolepis</i>					✓	✓	✓	✓	✓	✓			✓
<i>Eremiascincus richardsonii</i>	Banded Skink								✓				

Family and Species	Common name	Conservation Status			Beagle Bay (ecologia 2004)	James Price Point (AECOM 2010)	James Price Point (Biota 2009)	James Price Point (Biota 2010)	Dampier Peninsula (ENV 2008)	NatureMap	DEC Threatened and Priority Fauna Search	DSEWPaC Protected Matters Search	ecologia 2011
		EPBC Act	WC Act	DEC									
<i>Lerista apoda</i>							✓	✓		✓			✓
<i>Lerista bipes</i>							✓	✓	✓	✓			✓
<i>Lerista greeri</i>									✓				
<i>Lerista griffini</i>					✓		✓	✓		✓			✓
<i>Lerista labialis</i>									✓				
<i>Lerista separanda</i>				P2			✓		✓	✓	✓		
<i>Menetia greyii</i>								✓		✓			
<i>Menetia maini</i>										✓			
<i>Morethia ruficauda</i>									✓				
<i>Morethia storri</i>					✓		✓			✓			✓
<i>Proablepharus tenuis</i>							✓						
<i>Tiliqua multifasciata</i>	Central Blue-tongue						✓		✓	✓			
<i>Tiliqua scincoides</i>	Common Blue-tongue				✓	✓	✓	✓	✓	✓			✓
AGAMIDAE													
<i>Amphibolurus gilberti</i>	Gilbert's Dragon					✓	✓	✓	✓	✓			✓
<i>Chelosania brunnea</i>	Chameleon Dragon								✓	✓			
<i>Chlamydosaurus kingii</i>	Friiled Lizard				✓	✓	✓	✓	✓	✓			✓
<i>Ctenophorus caudicinctus</i>	Ring-tailed Rock Dragon								✓				
<i>Ctenophorus isolepis</i>	Military Dragon								✓				
<i>Ctenophorus nuchalis</i>	Central Netted Dragon								✓	✓			
<i>Dipophora magna</i>					✓								
<i>Dipophora pindan</i>					✓	✓	✓	✓	✓	✓			✓
<i>Diporiphora winneckeii</i>	Canegrass Dragon									✓			
<i>Diporiphora sp.</i>					✓								
<i>Pogona minor</i>	Dwarf Bearded Dragon				✓	✓	✓	✓	✓	✓			✓

Family and Species	Common name	Conservation Status			Beagle Bay (ecologia 2004)	James Price Point (AECOM 2010)	James Price Point (Biota 2009)	James Price Point (Biota 2010)	Dampier Peninsula (ENV 2008)	NatureMap	DEC Threatened and Priority Fauna Search	DSEWPaC Protected Matters Search	ecologia 2011
		EPBC Act	WC Act	DEC									
VARANIDAE													
<i>Varanus acanthurus</i>	Spiny-tailed Monitor					✓			✓				
<i>Varanus brevicauda</i>	Short-tailed Pygmy Monitor						✓			✓			✓
<i>Varanus gouldii</i>	Gould's Monitor				✓	✓	✓		✓	✓			✓
<i>Varanus panoptes</i>	Yellow-spotted Monitor					✓	✓						
<i>Varanus scalaris</i>	Spotted Tree Monitor				✓								
<i>Varanus tristis</i>	Black-headed Monitor					✓	✓	✓	✓	✓			✓
TYPHLOPIDAE													
<i>Ramphotyphlops diversus</i>					✓		✓	✓	✓	✓			✓
BOIDAE													
<i>Antaresia childreni</i>	Children's Python									✓			
<i>Antaresia stimsoni</i>	Stimson's Python				✓	✓	✓		✓	✓			
<i>Aspidites melanocephalus</i>	Black-headed Python				✓			✓	✓	✓			✓
<i>Liasis olivaceus</i>	Olive Python								✓	✓			
COLUBRIDAE													
<i>Dendrelaphis punctulata</i>	Common Tree Snake							✓	✓	✓			
ELAPIDAE													
<i>Astrotia stokesii</i>	Stokes' Sea Snake									✓			
<i>Brachyurops roperi</i>	Northern Shovel-nosed Snake				✓		✓	✓		✓			✓
<i>Demansia angusticeps</i>							✓	✓					✓
<i>Demansia olivacea</i>	Olive Whipsnake								✓	✓			
<i>Demansia psammophis</i>	Yellow-faced Whipsnake								✓				
<i>Ephalophis greyae</i>	Mangrove Sea Snake											✓	
<i>Furina ornata</i>	Moon Snake				✓		✓	✓	✓	✓			✓
<i>Pseudechis australis</i>	Mulga Snake						✓	✓	✓				✓


Family and Species	Common name	Conservation Status			Beagle Bay (ecologia 2004)	James Price Point (AECOM 2010)	James Price Point (Biota 2009)	James Price Point (Biota 2010)	Dampier Peninsula (ENV 2008)	NatureMap	DEC Threatened and Priority Fauna Search	DSEWPaC Protected Matters Search	ecologia 2011
		EPBC Act	WC Act	DEC									
<i>Pseudonaja mengdeni</i>	Western Brown Snake				✓								✓
<i>Pseudonaja nuchalis</i>	Northern Brown Snake						✓		✓	✓			
<i>Simoselaps anomalus</i>	Desert Banded Snake								✓				
<i>Simoselaps minimus</i>	Dampierland Burrowing Snake			P2			✓		✓	✓	✓		
<i>Suta punctata</i>	Spotted Snake						✓	✓	✓	✓			

* Introduced species

Appendix C4: Amphibians

Family and Species	Common name	Conservation Status			Beagle Bay (ecologia 2004)	James Price Point (Biota 2009)	James Price Point (Biota 2010)	Dampier Peninsula (ENV 2008)	NatureMap	DEC Threatened and Priority Fauna Search	DSEWPaC Protected Matters Search	ecologia 2011
		EPBC Act	WC Act	DEC								
HYLIDAE												
<i>Cyclorana australis</i>	Giant Frog				✓	✓		✓	✓			
<i>Cyclorana longipes</i>	Long-footed Frog					✓			✓			
<i>Litoria caerulea</i>	Green Tree Frog				✓	✓		✓	✓			✓
<i>Litoria coplandi</i>	Copland's Rock Frog							✓				
<i>Litoria nasuta</i>	Rocket Frog							✓				
<i>Litoria rothii</i>	Northern Laughing Tree Frog							✓	✓			
<i>Litoria rubella</i>	Little Red Tree Frog				✓			✓				
LIMNODYNASTIDAE												
<i>Notaden nichollsi</i>	Desert Spadefoot								✓			
<i>Platyplectrum ornatum</i>	Ornate Burrowing Frog					✓	✓	✓	✓			✓
MYOBATRACHIDAE												
<i>Uperoleia talpa</i>	Mole Toadlet				✓			✓	✓			

Appendix D Trapping Site Descriptions

Vegetation and Fauna Habitat Description	Site Photo
<p>JPP S1</p> <p>Habitat type: Pindan Shrubland <i>Corymbia greeniana</i> open woodland, over <i>Acacia eriopoda</i> shrubland, areas of <i>Triodia schinzii</i> dense hummock grassland and <i>Chrysopogon pallidus</i> open tussock grassland on pindan sand.</p> <p>Coordinates: 51K, 0417211 E, 8053848 N</p>	
<p>JPP S2</p> <p>Habitat type: Pindan Shrubland <i>Corymbia zygophylla</i> open woodland, over dense mixed acacia shrubland– <i>Acacia eriopoda</i> dominant with <i>Acacia platycarpa</i>, <i>Premna acuminata</i>, <i>Clerodendrum floribundum</i> over <i>Aristida hygrometrica</i> and <i>Chrysopogon pallidus</i> tussock grassland on pindan sand.</p> <p>Coordinates: 51K, 0414444 E, 8054225 N</p>	

<p>JPP S3</p> <p>Habitat type: Pindan Shrubland</p> <p><i>Eucalyptus miniata</i> open low trees over dense <i>Acacia eriopoda</i> and <i>Dodonaea hispidula</i> shrubland over <i>Chrysopogon pallidus</i> open tussock grassland on pindan sand.</p> <p>Coordinates: 51K, 0413012 E, 8064692 N</p>	
<p>JPP S4</p> <p>Habitat type: Open Woodland</p> <p><i>Eucalyptus miniata</i> open woodland over open <i>Acacia tumida</i> shrubland over open <i>Eriachne obtusa</i>, <i>Chrysopogon pallidus</i> open tussock grassland on yellow inland sandplains.</p> <p>Coordinates: 51K, 0415328 E, 8069272 N</p>	

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Appendix E Voucher Specimens Lodged with WA Museum

WAM Reference	Species	Common Name	Capture Date	Capture Location
R172323	<i>Gehyra australis</i>	Northern Dtella	29/4/11	51K 415327E, 8069272N
R172372	<i>Gehyra pilbara</i>	Pilbara Dtella	29/4/11	51K 415327E, 8069272N
R172360	<i>Lerista griffini</i>		30/4/11	51K 415327E, 8069272N
R172324	<i>Lerista bipes</i>		30/4/11	51K 415327E, 8069272N

Appendix F Fauna Species Recorded During Trapping

Appendix F1: Mammal Observations per Site

Family and Species	Common Name	WA			LIA			SP
		JPP S1	JPP S2	OPP	JPP S3	JPP S4	OPP	OPP
DASYURIDAE								
<i>Sminthopsis youngsoni</i>	Lesser Hairy-footed Dunnart		2					
THYLACOMYIDAE								
<i>Macrotis lagotis</i>	Bilby			S			S	S
MACROPODIDAE								
<i>Macropus agilis</i>	Agile Wallaby							S
EMBALLONURIDAE								
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheathtail Bat			A				
MOLOSSIDAE								
<i>Chaerophon jobensis</i>	Northern Freetail Bat			A				
VESPERTILIONIDAE								
<i>Chalinolobus gouldii</i>	Gould’s Wattled Bat			A				
<i>Chalinolobus nigrogriseus</i>	Hoary Wattled Bat			A				
<i>Nyctophilus geoffroyi</i>	Lesser Long-eared Bat			A				
<i>Scotorepens greyii</i>	Little Broad-nosed Bat			A				
MURIDAE								
<i>Pseudomys delicatulus</i>	Delicate Mouse	5	7		5	1		
CANIDAE								
<i>Canis lupus</i>	Dog/Dingo	S	S	4				S

S Secondary evidence

A Identified from acoustic recording

Appendix F2: Bird Observations per Site

Family and Species	Common Name	WA	LIA	SP
PHASIADAE				
<i>Coturnix ypsilophora</i>	Brown Quail			6
COLUMBIDAE				
<i>Phaps histrionica</i>	Flock Bronzewing			2
<i>Geopelia cuneata</i>	Diamond Dove	4		184
<i>Geopelia striata</i>	Peaceful Dove	27	9	98
<i>Geopelia humeralis</i>	Bar-shouldered Dove	29	2	149
PODARGIDAE				
<i>Podargus strigoides</i>	Tawny Frogmouth	7		4
AEGOTHELIDAE				
<i>Aegotheles cristatus</i>	Australian Owlet-nightjar	5	2	
APODIDAE				
<i>Apus pacificus</i>	Fork-tailed Swift			48
FREGATIDAE				
<i>Fregata ariel</i>	Lesser Frigatebird			1
SULIDAE				
<i>Sula leucogaster</i>	Brown Booby			3
PELECANIDAE				
<i>Pelecanus conspicillatus</i>	Australian Pelican			1
ACCIPITRIDAE				
<i>Lophoictinia isura</i>	Square-tailed Kite			5
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle			2
<i>Haliastur indus</i>	Brahminy Kite			3
<i>Milvus migrans</i>	Black Kite	1		
<i>Accipiter fasciatus</i>	Brown Goshawk	3		16
<i>Hieraaetus morphnoides</i>	Little Eagle			1
FALCONIDAE				
<i>Falco cenchroides</i>	Nankeen Kestrel	2	2	10
<i>Falco berigora</i>	Brown Falcon	8	4	31
OTIDIDAE				
<i>Ardeotis australis</i>	Australian Bustard	2	1	2
HAEMATOPODIDAE				
<i>Haematopus longirostris</i>	Australian Pied Oystercatcher			2
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher			4
CHARADRIIDAE				
<i>Charadrius ruficapillus</i>	Red-capped Plover			1
TURNICIDAE				
<i>Turnix pyrrhotorax</i>	Red-chested Button-quail	1		
<i>Turnix velox</i>	Little Button-quail	6	1	1
LARIDAE				
<i>Sterna hirundo</i>	Common Tern			3
<i>Thalasseus bengalensis</i>	Lesser Crested Tern			5
<i>Thalasseus bergii</i>	Crested Tern			18
CACATUIDAE (PSITTACIDAE)				
<i>Calyptrorhynchus banksii</i>	Red-tailed Black-Cockatoo			7
<i>Nymphicus hollandicus</i>	Cockatiel	9		15
PSITTACIDAE				

Family and Species	Common Name	WA	LIA	SP
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet	7	4	55
<i>Psitteuteles versicolor</i>	Varied Lorikeet			3
<i>Aprosmictus erythropterus</i>	Red-winged Parrot	96	9	78
CUCULIDAE				
<i>Centropus phasianinus</i>	Pheasant Coucal	7	1	14
<i>Chalcites basal</i>	Horsfield's Bronze-Cuckoo	7	1	
<i>Chalcites minutillus</i>	Little Bronze-Cuckoo			1
<i>Cacomantis pallidus</i>	Pallid Cuckoo	1		7
STRIGIDAE				
<i>Ninox novaeseelandiae</i>	Southern Boobook	2		1
HALCYONIDAE				
<i>Dacelo leachii</i>	Blue-winged Kookaburra		2	6
<i>Todiramphus sanctus</i>	Sacred Kingfisher			1
MEROPIIDAE				
<i>Merops ornatus</i>	Rainbow Bee-eater	47	11	21
CORACIIDAE				
<i>Eurystomus orientalis</i>	Dollarbird	4		
PTILINORHYNCHIDAE				
<i>Ptilonorhynchus nuchalis</i>	Great Bowerbird	9	2	111
MALURIDAE				
<i>Malurus lamberti</i>	Variegated Fairy-wren	37	11	33
<i>Malurus melanocephalus</i>	Red-backed Fairy-wren	85	7	22
ACANTHIZIDAE				
<i>Smicronis brevirostris</i>	Weebill	17	31	
<i>Gerygone albogularis</i>	White-throated Gerygone	5		3
PARDALOTIDAE				
<i>Pardalotus striatus</i>	Striated Pardalote	41	100	33
MELIPHAGIDAE				
<i>Lichenostomus virescens</i>	Singing Honeyeater	221	90	693
<i>Lichenostomus unicolor</i>	White-gaped Honeyeater			84
<i>Lichenostomus flavescens</i>	Yellow-tinted Honeyeater		40	110
<i>Conopophila rufogularis</i>	Rufous-throated Honeyeater	17		20
<i>Cissomela pectoralis</i>	Banded Honeyeater			6
<i>Lichmera indistincta</i>	Brown Honeyeater	222	84	99
<i>Melithreptus gularis</i>	Black-chinned Honeyeater	12		24
<i>Melithreptus albogularis</i>	White-throated Honeyeater	3	7	2
<i>Philemon citreogularis</i>	Little Friarbird	34	14	252
POMATOSTOMIDAE				
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler	124	15	174
NEOSITTIDAE				
<i>Daphoenositta chrysoptera</i>	Varied Sittella	9	3	9
CAMPEPHAGIDAE				
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	47	35	66
<i>Lalage sueurii</i>	White-winged Triller	29	9	49
PACHYCEPHALIDAE				
<i>Pachycephala rufiventris</i>	Rufous Whistler	32	23	56
<i>Colluricincla harmonica</i>	Grey Shrike-thrush	43	13	149
ORIOIDAE				
<i>Oriolus sagittatus</i>	Olive-backed Oriole		1	8

Family and Species	Common Name	WA	LIA	SP
ARTAMIDAE				
<i>Artamus personatus</i>	Masked Woodswallow	1		8
<i>Artamus superciliosus</i>	White-browed Woodswallow			26
<i>Artamus cinereus</i>	Black-faced Woodswallow	31	5	4
<i>Artamus minor</i>	Little Woodswallow			51
<i>Cracticus nigrogularis</i>	Pied Butcherbird	77	30	24
RHIPIDURIDAE (DICRURIDAE)				
<i>Rhipidura rufiventris</i>	Northern Fantail			5
<i>Rhipidura leucophrys</i>	Willie Wagtail	26	2	14
CORVIDAE				
<i>Corvus orru</i>	Torresian Crow	7	2	33
MONARCHIDAE (DICRURIDAE)				
<i>Myiagra rubecula</i>	Leaden Flycatcher			1
<i>Myiagra inquieta</i>	Restless Flycatcher	3		13
PETROICIDAE				
<i>Microeca fascians</i>	Jacky Winter	3	7	2
MEGALURIDAE (SYLVIIDAE)				
<i>Cincloramphus mathewsi</i>	Rufous Songlark		2	11
<i>Cincloramphus cruralis</i>	Brown Songlark			2
HIRUNDINIDAE				
<i>Petrochelidon ariel</i>	Fairy Martin			27
<i>Petrochelidon nigricans</i>	Tree Martin			901
NECTARINIIDAE (DICAIEIDAE)				
<i>Dicaeum hirundinaceum</i>	Mistletoebird	2		40
ESTRILDIDAE				
<i>Taeniopygia bichenovii</i>	Double-barred Finch			3
<i>Poephila acuticauda</i>	Long-tailed Finch	24	2	4

Appendix F3: Herpetofauna Observations per Site

Family and Species	Common Name	WA			LIA			SP
		JPP S1	JPP S2	OPP	JPP S3	JPP S4	OPP	OPP
Reptiles								
DIPLODACTYLIDAE								
Diplodactylus conspicillatus	Fat-tailed Gecko		3		2	1		
Lucasium stenodactylum	Sand-plain Gecko		1	1	1	2		
Strophurus ciliaris		7	7	11				
GEKKONIDAE								
Gehyra australis						2		
Gehyra pilbara			2	3		4	1	3
Heteronotia binoei	Bynoe's Gecko	1						
PYGOPODIDAE								
Lialis burtonis			1	1	2			
SCINCIDAE								
Carlia munda								3
Carlia rufilatus		4	1	8		1		
Cryptoblepharus ruber	Tawny Snake-eyed Skink		1	4				3
Cryptoblepharus sp				2				
Ctenotus inornatus		15	6	5	3	4	1	1
Ctenotus pantherinus		1						
Ctenotus serventyei		2						
Eremiascincus isolepis			2	7	1			3
Lerista apoda		1		2			1	1
Lerista bipes		1		1		2		
Lerista griffini		1	1	1	1	8	1	1
Morethia storri			1			1		
Tiliqua scincoides	Common Blue-tongue	1						
AGAMIDAE								
Amphibolurus gilberti	Gilbert's Dragon	1	1	4	1			4
Chlamydosaurus kingii	Frilled Lizard						1	
Diporiphora pindan		7	9	21	1	1	1	3
Pogona minor	Dwarf Bearded Dragon	1	1	3	1			
VARANIDAE								
Varanus brevicauda	Short-tailed Pygmy Monitor	6						
Varanus gouldii	Gould's Monitor		1	1				
Varanus tristis	Black-headed Monitor			1				1
TYPHLOPIDAE								
Ramphotyphlops diversus			1					
BOIDAE								
Aspidites melanocephalus	Black-headed Python			1				
ELAPIDAE								
Brachyuropsis roperi	Northern Shovel-nosed Snake		2					
Demansia angusticeps			1					
Furina ornata	Moon Snake			1		3		
Pseudechis australis	Mulga Snake			1				

Family and Species	Common Name	WA			LIA			SP
		JPP S1	JPP S2	OPP	JPP S3	JPP S4	OPP	OPP
<i>Pseudonaja mengdeni</i>	Western Brown Snake		1					
Amphibians								
HYLIDAE								
<i>Litoria caerulea</i>	Green Tree Frog	3	1		3	1		
LIMNODYNASTIDAE								
<i>Platyplectrum ornatum</i>	Ornate Burrowing Frog					1		

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Appendix G Potential Bilby Diggings and Burrows

Name	Easting	Northing	Status*
Bilby Burrow LIA1	415612	8065513	Possible
Bilby Burrow LIA2	415320	8065620	Possible
Bilby Burrow LIA3	415275	8066247	Possible
Bilby Burrow WAC	414048	8054119	Likely
Digging LIA1	416286	8065208	Possible
Digging LIA2	415389	8065766	Possible
Digging SP1	409549	8064500	Possible
Digging SP2	411084	8059862	Possible
Digging WAC1	414048	8054119	Likely
Digging WAC2	414314	8054163	Possible
Digging WAC3	414318	8054175	Possible
Digging WAC4	414318	8054175	Possible
Digging WAC5	414428	8053698	Likely
Digging WAC6	414428	8053698	Likely
Digging WAC7	414571	8053706	Possible
Digging WAC8	414992	8054976	Possible
Digging WAC9	414992	8054976	Possible
Digging WAC10	415412	8054781	Likely
Digging WAC11	415798	8055068	Possible
Digging WAC12	415798	8055068	Possible
Digging WAC13	416759	8055973	Possible
Digging WAC14	417346	8056010	Possible
Digging WAC15	417346	8056010	Possible
Digging WAC16	417820	8056001	Possible
Digging WAC17	418540	8056365	Possible
Digging WAC18	418540	8056365	Possible
Digging WAC19	418581	8056562	Possible

Datum: WGS84

Zone: 51 K

*Likelihood that burrow or digging represents evidence of Bilby activity as assessed by
Dr Richard Southgate (Envisage Environmental Services) based on images provided by Woodside

Insert burrow map here

Bilby Burrow LIA1



Bilby Burrow LIA2
Scale: Pencil = 150 mm



Bilby Burrow LIA3

Scale: Pencil = 150 mm



Bilby Burrow WAC



Other potential Bilby diggings in the vicinity of 'Bilby Burrow WAC'

Scale: Camera Case = 130 mm long X 85 mm wide





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Appendix H Species of Conservation Significance with a Low Likelihood of Occurrence within the Project Area

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DEC			
Mammals						
Brush-tailed Mulgara (<i>Dasycercus blythi</i>)	VU			Sandy areas with moderately dense spinifex with ‘runways’ between clumps.	Listed as potentially occurring by DSEWPac, but not currently thought to occur in the Kimberley region.	LOW No records from the Kimberley region.
Scaly-tailed Possum (<i>Wyulda squamicaudata</i>)			P3	Woodland and closed forest.	Single individual recorded 50 km south of project area in 1970 (DEC records). Normal distribution does not extend west of Derby (Van Dyck and Strahan 2008).	LOW Outside of typical range for species.
Burrowing Bettong (<i>Bettongia lesueur</i>)	VU	S1		Most habitats except those with dense vegetation, preferably with loam soils.	Two previous records 50 km east and south-east of the project area in 1895 (NautreMap).	LOW Extinct on mainland Australia.
Yellow-lipped Cave Bat (<i>Vespadalus douglasorum</i>)			P2	Forage in tropical open woodlands, usually adjacent to waterways lined with melaleuca and pandanus. Roost in sandstone and limestone caves, usually near water.	Single previous record 75 km north-east of project area in 2003 (<i>ecologia</i> 2004) which represents the western most record of the species.	LOW Project area outside typical range of the species. No roosting habitat present.
Lakeland Downs Mouse (<i>Leggadina lakedownensis</i>)			P4	Spinifex and tussock grassland on cracking clays. Also acacia shrubland, samphire, woodlands, and stony ranges.	Record of two individuals from Gourdon Bay, 110 km south-west of project area (ENV 2008).	LOW Few local records.
Water Rat (<i>Hydromys chrysogaster</i>)			P4	Permanent fresh or brackish water, sheltered coastal beaches, mangroves, offshore islands.	Single record from mangroves near Broome in 1971 (DEC records). No other records within 200 km (NatureMap).	LOW Few recent local records.
Birds						
Red Goshawk (<i>Erythrotriorchis radiatus</i>)	VU	S1		Coastal and subcoastal forests, tropical woodlands.	Single record from Barred Creek in 1976 (NatureMap).	LOW Project area outside typical range of the species.
White-throated Needletail (<i>Hirundapus caudacutus</i>)	M	S3		Aerial, often associated with coastal and mountain regions.	Single record from WA from Roebuck Bay (Birdata). Typically occurs on east coast of Australia.	LOW Rare vagrant in WA. Only a single previous record.

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DEC			
Leach's Storm-Petrel (<i>Hydrobates leucorhoa</i>)	M	S3		Offshore seas.	Single record from ocean off JPP in 2001 (NatureMap).	LOW Does not occur onshore.
Wilson's Storm-Petrel (<i>Oceanites oceanicus</i>)	M	S3		Offshore seas.	Numerous recent records from ocean off JPP (NatureMap).	LOW Likely to occur off JPP, but will not occur onshore, within project area.
Grey-headed Albatross (<i>Thalassarche chrysostoma</i>)	EN	S1		Offshore seas.	Single record from Broome, no date given (DEC records). Species uncommon north of Geraldton.	LOW Species uncommon in area. Does not occur onshore.
Wedge-tailed Shearwater (<i>Ardenna pacificus</i>)	M	S3		Offshore seas.	Three records within 100 km of project area (Birdata).	LOW May occasionally occur off JPP, but will not occur onshore, within project area.
Short-tailed Shearwater (<i>Ardenna tenuirostris</i>)	M	S3		Offshore seas.	Single record from Broome (Birdata). Typically only occurs on south coast of Australia.	LOW Species uncommon in area. Does not occur onshore.
Streaked Shearwater (<i>Calonectris leucomelas</i>)	M	S3		Offshore seas.	Several recent records within 60 km to south of project area.	LOW Likely to occur off JPP, but will not occur onshore, within project area.
Masked Booby (<i>Sula dactylatra</i>)	M	S3		Offshore seas.	Records within 100 km of project area.	LOW Likely to occur off JPP, but will not occur onshore, within project area.
Australian Little Bittern (<i>Ixobrychus dubius</i>)			P4	Dense beds of tall rushes in freshwater swamps, around lakes or along rivers.	Single record 25 km south of project area from 2001 (NatureMap).	LOW Species uncommon in area, few local records. No suitable habitat within project area.

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DEC			
Black Bittern (<i>Ixobrychus flavicollis</i>)			P3	Freshwater pools, swamps, lagoons with dense trees and waterside vegetation.	Single record from Broome in 1898 (DEC records).	LOW Species uncommon in area, few local records. No suitable habitat within project area.
Cattle Egret (<i>Ardea ibis</i>)	M	S3		Grassy wetlands.	Numerous records along the Roebuck Plains (NatureMap, Birdata). Sparse records outside this area.	LOW No suitable habitat.
Glossy Ibis (<i>Plegadis falcinellus</i>)	M	S3		Well vegetated wetlands, wet pastures, floodwaters, floodplains and occasionally dry grasslands.	Numerous records from the Roebuck Plains and Willie Creek.	LOW No suitable habitat.
Australian Painted Snipe (<i>Rostratula australis</i>)	VU	S1		Shallow inland wetlands.	Several records from Roebuck Plains (Birdata, NatureMap).	LOW No suitable habitat.
Pin-tailed Snipe (<i>Gallinago stenura</i>)	M	S3		Wet grasslands and open, wooded swamps.	Single record from Broome in 2004 (NatureMap).	LOW Species is a rare migrant to Australia. No suitable habitat.
Swinhoe's Snipe (<i>Gallinago megala</i>)	M	S3		Wet grasslands and open, wooded swamps.	Small number of records from Broome, Roebuck Plains, Willie Creek (NatureMap)	LOW No suitable habitat.
Eurasian Curlew (<i>Numenius arquata</i>)	M	S3		Estuaries, mudflats, mangroves.	Single record from Eighty Mile Beach (Rogers <i>et al.</i> 2009). This is the first accepted record of the species in Australia.	LOW Very rare migrant to Australia.
Oriental Pratincole (<i>Glareola maldivarum</i>)	M	S3		Open plains around swamps and claypans.	Numerous records from around Broome and Roebuck Plains (Birdata, NatureMap).	LOW No suitable habitat.
Common Noddy (<i>Anous stolidus</i>)	M	S3		Offshore seas.	Numerous records from offshore in the Kimberley (Birdata, NatureMap).	LOW Likely to occur off JPP, but will not occur onshore, within project area.
Black-naped Tern (<i>Sterna sumatrana</i>)	M	S3		Coastal and offshore seas.	Single record from Packer Island (ENV 2008).	LOW Species rarely occurs in WA.

Species	Conservation Significance			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DEC			
Princess Parrot (<i>Polytelis alexandrae</i>)	VU		P4	Lightly wooded country in desert areas.	Single record from Broome in 1999 (DEC records).	LOW Project area well outside species typical range.
Gouldian Finch (<i>Erythrura gouldiae</i>)	EN	S1		Rocky hills with hollow-bearing eucalypts close to small waterholes.	Two records from Broome (no date given; DEC records). Anecdotal evidence of the species occurring at Packer Island, 130 km north-east of project area.	LOW Few local records, no suitable habitat.
Reptiles						
Freshwater Crocodile (<i>Crocodylus johnstoni</i>)		S4		Freshwater rivers and billabongs.	Known to occur in Kimberley region, but no previous records from west of Derby (NatureMap).	LOW No previous records in area.
Salt-water Crocodile (<i>Crocodylus porosus</i>)		S4		Tidal rivers, coastal floodplains, billabongs.	Known to occur in Kimberley region, but only a single previous record west of Derby (ENV 2008).	LOW Only a single previous record within 100 km of project area.