HUNT POINT BEACH FLORA AND VEGETATION AND FAUNA ASSESSMENT

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Prepared for

BHP Billiton Iron Ore Pty Ltd

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PERMITS

This flora survey was undertaken under the following licences issued by the Department of Environment and Conservation: SL008933 issued to Todd Edwards.

STATEMENT OF LIMITATIONS

Scope of Services

This environmental site assessment report ('the report') has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and ENV. Australia Pty Ltd (ENV) ('scope of services'). In some circumstances the scope of services may have been limited by factors such as time, budget, access and/or site disturbance constraints.

Reliance on Data

In preparing the report, ENV has relied on data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ('the data'). Except as otherwise stated in the report, ENV has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or in part on the data, those conclusions are contingent upon the accuracy and completeness of the data. ENV will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, unavailable, misrepresented or otherwise not fully disclosed to ENV.

Environmental Conclusions

In accordance with the scope of services, ENV has relied on the data and has conducted environmental field monitoring and/or testing in the preparation of the report. The nature and extent of monitoring and/or testing conducted is described in the report.

Within the limitations imposed by the scope of services, the monitoring, testing, sampling and preparation of this report have been undertaken and performed in a professional manner, in accordance with generally accepted practices and using a degree of skill and care ordinarily exercised by reputable environmental consultants under similar circumstances. No other warranty, express or implied, is made.

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The report has been prepared for the benefit of the Client and for no other party. ENV assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including, without limitation, matters arising from any negligent act or omission of ENV or for any loss or damage suffered by any other party relying on the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions, and should make their own enquiries and obtain independent advice in relation to such matters.

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ENV will not be liable to update or revise the report to take into account any events or circumstances occurring or facts becoming apparent after the date of the report.

The scope of services did not include any assessment of the title to or ownership of the properties, buildings and structures referred to in the report, nor the application or interpretation of laws in the jurisdiction in which those properties, buildings and structures are located.

EXECUTIVE SUMMARY

ENV.Australia Pty Ltd (ENV) was commissioned by Fluor and SKM Iron Ore Joint Venture (FAST), on behalf of BHP Billiton Iron Ore Pty Ltd (BHPBIO), in August 2010 to undertake a Level One Flora and Vegetation Assessment and a Level One Terrestrial Vertebrate Fauna Assessment. The Survey area is located approximately two kilometres (km) north west of the town site of Port Hedland on Finucane Island, in the northern Pilbara.

The Level One Flora and Vegetation field survey was conducted on 19 August 2010 in conjunction with the Level One Fauna field survey, with two person-days invested in the field survey.

The objectives of the flora and vegetation assessment were to:

- review relevant flora and vegetation databases and previous flora studies;
- document the presence of plant species;
- document the presence of plant species of conservation significance;
- record the occurrence of introduced plant species;
- document, describe and map the vegetation associations present;
- describe the conservation significance of these vegetation associations; and
- assess and map vegetation condition.

The objectives of the fauna assessment were to:

- conduct a field survey to document the general habitat types of the Survey area as they relate to faunal assemblages;
- compile (from database searches) a list of terrestrial vertebrate fauna likely to occur in the Survey area; and
- identify (from database searches) terrestrial vertebrate fauna of conservation significance that may occur in the Survey area.

The Flora and Vegetation field survey recorded 37 taxa comprising 20 families and 33 genera. The most taxa rich plant families were Fabaceae (eight taxa), Poaceae (five taxa) and Amaranthaceae (four taxa). The plant genera with the highest number of taxa in the Survey area were *Acacia* with four and *Euphorbia* with two taxa.

No species listed under the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth), or Declared Rare Flora listed under the *Wildlife Conservation Act* 1950 (WA) were recorded in the Survey area.

One plant taxon, *Tephrosia rosea* var. *venulosa* (Priority 1), listed as Priority Flora by the Department of Environment and Conservation, was recorded in the Survey area.

An additional three Priority Flora may occur in the Survey area. These may have been absent at the time of survey, as the survey was not conducted in optimal conditions. These species are *Gomphrena pusilla* (Priority 2), *Pterocaulon* sp. A Kimberley Flora (B.J. Carter 599) (Priority 2) and *Goodenia nuda* (Priority 4).

The condition of vegetation in the Survey area was considered to be Good or Degraded, as a result of historic and present disturbances. There was a high number of introduced species recorded in the Survey area. These were; **Aloe vera*[1], **Aerva javanica* (Kapok), **Cenchrus ciliaris* (Buffel Grass), **Chloris barbata, *Indigofera sessiliflora, *Opuntia stricta* (Prickly Pear), **Yucca aloifolia* and **Portulaca oleracea* (Purslane). One of these, **Opuntia stricta*, is listed as a Declared Plant under the *Agriculture and Related Resources Protection Act* 1976.

Three ENV vegetation associations were mapped in the Survey area, in addition to Beach areas (which support little to no vegetation) and Cleared / Developed areas (supporting no vegetation). One vegetation association did not represent natural vegetation, as it comprised non-endemic (planted) vegetation on a constructed landform.

No vegetation associations recorded in the Survey area are listed as Threatened Ecological Communities under the *Environment Protection and Biodiversity Conservation Act* 1999 (Cth), as Environmentally Sensitive Areas under the *Environmental Protection Act* 1986 (WA), or as Priority Ecological Communities by the Department of Environment and Conservation. Furthermore, no groundwater dependent vegetation occurs within the Survey area.

One vegetation type mapped on a regional scale by Beard (1975) and re-assessed by Shepherd, Beeston and Hopkins (2001) occurs within the Survey area: Hummock grasslands, grass steppe, soft Spinifex (t1Hi / ABYDOS PLAIN 117). This vegetation association is considered to be well represented regionally.

The Survey area consists of one land system as described by van Vreeswyk *et al.* (2004), the Littoral land system. This land system is considered to be well represented regionally.

Two natural Fauna habitats were mapped in the Survey area: Dunes and Shoreline. A further habitat type, Rehabilitated, was also mapped in the Survey area. This habitat type comprised of planted vegetation and constructed landforms. There were also areas that had no habitat value which were Cleared / Developed. The Shoreline habitat was given high habitat value due to its importance for migratory marine birds. The habitat

[1] Asterisks denote introduced flora.

provides shelter, foraging and roosting sites for these species. During the survey it was noted that this habitat type is under represented in the broader area.

Five conservation significant species were recorded in the Survey area during the survey. These were the Eastern Reef Egret (*Egretta sacra*), Eastern Osprey (*Pandion haliaetus*), Ruddy Turnstone (*Arenaria interpres*), Whimbrel (*Numenius phaeopus*) and the Caspian Tern (*Sterna caspia*), all of which are migratory marine birds. Thirteen migratory bird species are classified as 'likely' to utilise the habitats present in the Survey area.

1 INTRODUCTION

1.1 THE PROJECT

ENV.Australia Pty Ltd (ENV) was commissioned in August 2010 by Fluor and SKM Iron Ore Joint Venture (FAST), on behalf of BHP Billiton Iron Ore (BHPBIO) to undertake Level One Flora and Vegetation and Terrestrial Vertebrate Fauna Assessments.

The objectives of the flora and vegetation assessment were to:

- review relevant flora and vegetation databases and previous flora studies;
- document the presence of plant species;
- document the presence of plant species of conservation significance;
- record the occurrence of introduced plant species;
- document, describe and map the vegetation associations present;
- describe the conservation significance of these vegetation associations; and
- assess and map vegetation condition.

The objectives of the fauna assessment were to:

- conduct a field survey to document the general habitat types as they relate to faunal assemblages;
- compile (from database searches) a list of terrestrial vertebrate fauna likely to occur; and
- identify (from database searches) terrestrial vertebrate fauna of conservation significance that may occur in the Survey area

1.2 LOCATION

The Survey area is located approximately two kilometres (km) north west of the town site of Port Hedland, on Finucane Island, in the northern Pilbara region of Western Australia (Figure 1). The total size of the Survey area is 67 ha.

1.3 ENVIRONMENTAL ATTRIBUTES

1.3.1 Climate

The Survey area is in the northern Pilbara region of Western Australia. The nearest accessible climate data to the Survey area is available from the Bureau of Meteorology (BoM) Port Hedland Airport weather station located approximately 10 kilometres south east of the Survey area.

The Pilbara has an arid-tropical climate with two distinct seasons, a hot summer from October to April and a mild winter from May to September. The Port Hedland area experiences a wide temperature range, with an average annual maximum temperature of 33°C (1948-2010), with an average annual minimum temperature of 19°C (1948-2010). In summer, maximum daytime temperatures may reach 49°C, whilst in winter, minimum night temperatures may drop to 3°C (BoM 2010).

Rainfall in the Pilbara is sporadic, and can occur in summer and winter. The Port Hedland area has an average annual rainfall of 310 mm (1942-2010) with the majority of rainfall occurring during the summer months (BoM 2010; Figure 2). Summer rainfall is typically associated with tropical storms in the north, or tropical cyclones that cross the coast and move inland. Winter rainfall is commonly the result of cold fronts moving north-easterly across the State (Beard 1975).

For the three months preceding the survey the Port Hedland area received 71 mm of rainfall (May to July 2010), compared to the long-term average (1948-2010) of 59 mm for the same period (BoM 2010).

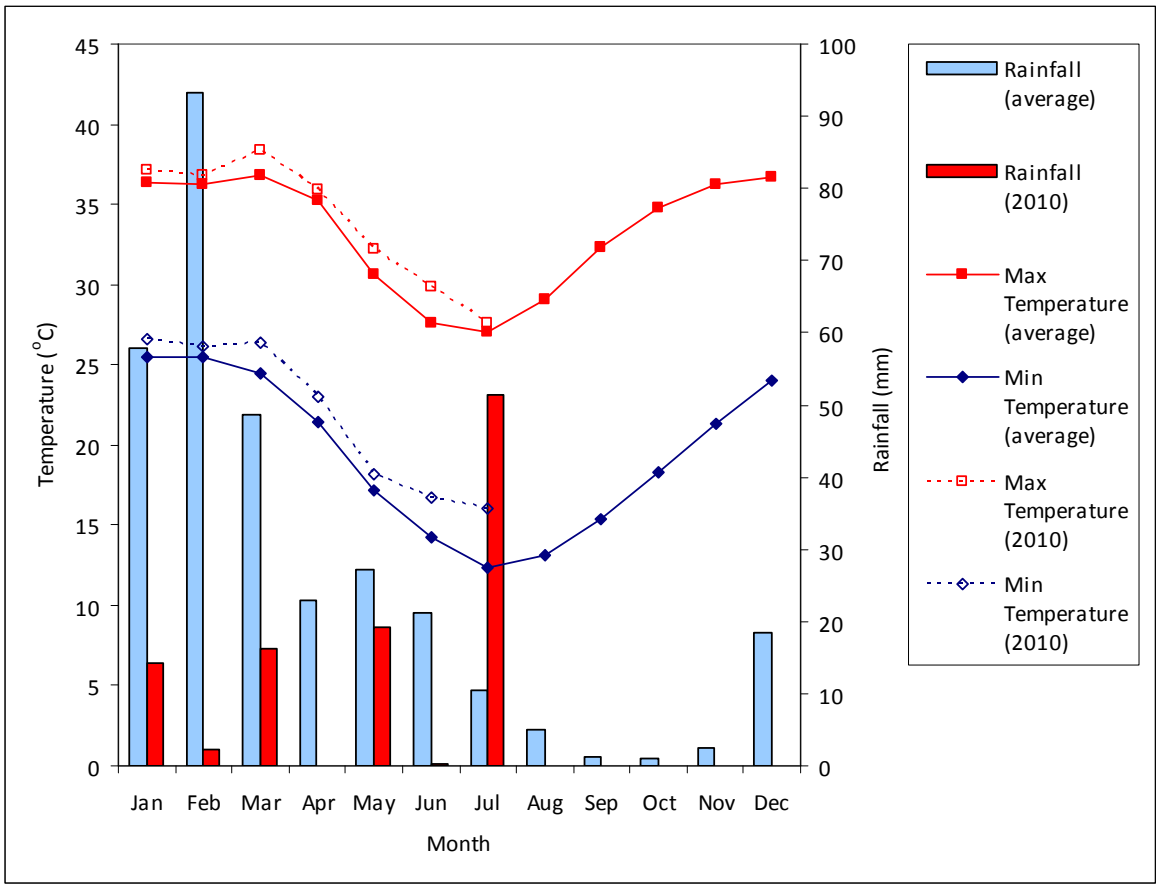

Figure 2: Average (1942-2010) and Actual (2010, year to date) Monthly Rainfall from and Average Maximum and Minimum (1948-2010) and Actual (2010) Monthly Temperatures at Port Hedland Airport from 1948-2010 (BoM 2010)

1.3.2 Interim Biogeographic Regionalisation for Australia

The Interim Biogeographic Regionalisation for Australia (IBRA) divides Australia into 85 bioregions based on major biological and geographical/geological attributes (Thackway and Cresswell 1995). These bioregions are subdivided into 404 subregions, as part of a refinement of the IBRA framework (Department of Environment, Water, Heritage and the Arts [DEWHA] 2010a).

The Survey area is located within the Roebourne subregion (PIL4) of the Pilbara region. The Roebourne subregion is characterised by quaternary alluvial and older colluvial coastal and sub-coastal plains with alluvial flats and river deltas (Kendrick and Stanley 2001). The vegetation is characterised by grass savannah of mixed bunch and hummock grasses and dwarf shrub steppe of *Acacia stellaticeps* or *A. pyrifolia* and *A. inaequilatera*, with the uplands dominated by *Triodia* hummock grassland (Kendrick and Stanley 2001). The ephemeral drainage lines are dominated by *Triodia* hummock grasslands while the alluvial flats and river deltas are dominated by Samphire and Mangroves (Kendrick and Stanley 2001).

1.3.3 Land Systems

Land system mapping is based on regional patterns of landscape, geology, soils and vegetation (DEWHA 2010b). The most recent land system mapping of the Pilbara, in which the Survey area is situated, was completed by van Vreeswyk *et al.* (2004). The mapping classifies the Pilbara region into 102 land systems.

The Survey area comprises one land system:

Littoral: Bare coastal mudflats with mangroves on seaward fringes, samphire flats, sandy islands, coastal dunes and beaches.

Much of this land system is made up of tidal flats, which support no vegetation. The land system is considered susceptible to erosion by coastal winds if plant cover is lost by fire or other disturbance (van Vreeswyk *et al.* 2004).

1.3.4 Geology

The following geological units occur in the Survey area, based on mapping by the Geological Survey of Western Australia (2006):

tm: Coastal (tide- dominated) mud and silt on mangrove flats; and

B2bkk: Carbonate – cemented coastal dunes: shelly calcarenite, locally quartzose; local carbonate – cemented beach conglomerate; dissected by present day drainage, and wave erosion.

1.3.5 Soils

One soil unit occurs in the Survey area, based on mapping by Bettenay, Churchward and McArthur (1967):

Lh1: Grey-brown pedal calcareous loamy earths; Coastal plains mainly beyond flooding influences: main soils are pedal calcareous earths with some associated high calcareous earths with minor areas of shallow calcareous loams; associated areas of hard red soils and some cracking clays.

1.3.6 Vegetation Association Mapping

Vegetation mapping of the Pilbara region was completed on a broad scale (1:1,000,000) by Beard (1975). The Survey area is situated in the Roebourne Botanical District in the Eremaean Botanical Province of Western Australia as per Beard (1975).

Only the northern 40% of the Survey area was mapped by Beard (1975), but it can be assumed the remainder of the Survey area would be the same vegetation type. The absence of mapping is most likely due to difference in scales of mapping/changes to cadastre.

The vegetation type mapped in the Survey area by Beard (1975) is as follows:

t1Hi / ABYDOS PLAIN 117: Hummock grasslands, grass steppe; soft spinifex.

Shepherd, Beeston and Hopkins (2001) re-assessed the mapping of Beard (1975), and updated vegetation boundaries to account for clearing in the intensive land use zone, and divided some larger vegetation units into smaller units. Vegetation associations described by Shepherd, Beeston and Hopkins (2001) correspond with those of Beard (1975) as indicated above.

Current Environmental Protection Authority (EPA) guidance recommends a standard level of native vegetation retention of at least 30% of each ecological community based on its pre-European extent in the State. Below this threshold level, species loss is known to accelerate exponentially at an ecosystem level (EPA 2000). These levels have been recognised in the *National Objectives and Targets for Biodiversity Conservation 2001-2005* (Commonwealth of Australia 2001), which recognises that the retention of 30% or more of the pre-clearing extent of each ecological community is generally necessary if Australia's biological diversity is to be protected.

1.4 PREVIOUS BIOLOGICAL STUDIES

Historically, the flora and fauna of the Pilbara has not been recorded systematically at a regional scale, with significant exceptions being flora studies by Burbidge (1959) and Beard (1975). More recently, the Department of Agriculture (van Vreeswyk *et al.* 2004) conducted an inventory and condition survey of the Pilbara. This report provides a regional inventory of flora and a description of land resources. A comprehensive and systematic field review by the Department of Environment and Conservation (DEC) of Pilbara regional fauna and flora is currently underway with the results pending.

In recent decades, an increase in resource development projects has resulted in a significant amount of site-specific (*i.e.* local scale) biological survey work being carried out, most of which is undertaken for approvals under the *Environmental Protection Act 1986* (WA).

Two larger scale surveys have been conducted in the vicinity of the survey area. Both of these surveys were conducted for the construction of rail lines. Therefore, these studies cover a large area, extending further south of the Survey area towards Newman. These surveys are reported in:

- *Vegetation and Flora Survey of the Proposed Fortescue Metals Group (FMG) Stage A Rail Corridor* (Biota 2004a);
- *Fauna Habitats and Fauna Assemblage of the Proposed FMG Stage A Rail Corridor* (Biota 2004b); and
- *Hope Downs Iron Ore, Rail and Port Projects, Public Environmental Reviews* (Hope Downs Management Services Pty Ltd 2000 and 2002).

There has also been a large number of site-specific flora, vegetation and fauna surveys in the vicinity of the Survey area (*i.e.* within 50 km) within the last five years. Those most relevant are:

- *Goldsworthy Rail Duplication Supplemental Flora and Vegetation Assessment* (ENV 2010a);
- *Great Northern Highway Road Bridge Flora and Vegetation Assessment* (ENV 2010b);
- *Finucane Island to Wedgefield Power Corridor Flora and Vegetation Assessment* (ENV 2010c);
- *Targeted Regional Tephrosia rosea var. venulosa Survey Data* (ENV 2010d);
- *Port Hedland to Nelson Point Dredging Approvals Flora and Fauna Review of DMMA H* (Biota 2009);
- *Outer Harbour Development Flora and Vegetation Assessment* (ENV 2009a);
- *Outer Harbour Development Priority Flora Assessment* (ENV 2009b);
- *Outer Harbour Development Fauna Assessment* (ENV 2009c);
- *Goldsworthy Rail Duplication Flora and Vegetation Assessment* (ENV 2009d);
- *Goldsworthy Rail Duplication Fauna Assessment* (ENV 2009e);
- *Boodarie Depot Flora and Vegetation Assessment* (ENV 2009f);
- *Port Hedland Nelson Point Dredging Approvals Targeted Species Assessment of DMMA H* (ENV 2009g);
- *Finucane Island Causeway Flora and Vegetation Assessment* (ENV 2009h);
- *A Biodiversity Assessment of the Utah Point Berth Development, Port Hedland* (Biota 2008a);
- *A Flora and Fauna Assessment of RGP5 Spoil Areas A and H, Port Hedland Harbour* (Biota 2008b);
- *Finucane Island (DMMA B2) Rare and Priority Flora Survey – Draft Version 3* (ecologia 2008); and
- *Hedland HBI Project – Boodarie Site – Flora, Vegetation and Vertebrate Fauna Survey* (Mattiske Consulting 1994).

A comprehensive bibliography of biological survey work undertaken in the Pilbara is available at the DEC website (DEC 2010a).

2 BACKGROUND TO SURVEY METHODOLOGY

2.1 PROTECTION OF FLORA, VEGETATION AND FAUNA

Flora, Vegetation and Fauna are protected formally by legislative measures and informally by non-legislative and policy measures, which are as follows:

Legislative Protection

- *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (*EPBC Act)*;
- *Wildlife Conservation Act 1950* (WA) *(WC Act);* and
- *Environmental Protection Act 1986* (WA) *(EP Act).*

Non-Legislative Protection

- Western Australian DEC Priority lists; and
- Recognition of locally significant flora and fauna populations by the DEC.

A short description of these Acts is given below. Definitions of the species conservation codes and ecological community categories used, and those used by the DEC, are provided in Appendix A.

EPBC Act

The *EPBC Act* aims to protect matters of national environmental significance, which are detailed in Appendix A.

Under the *EPBC Act*, the Commonwealth DEWHA lists threatened species and Threatened Ecological Communities (TECs) in certain categories determined by criteria set out in the Act (*www.environment.gov.au/epbc/index.html*). Projects likely to cause impacts on matters of national environmental significance (as defined in the *EPBC Act* – see Appendix A) should be referred to DEWHA for assessment under the *EPBC Act* (DEWHA 2010c).

WC Act

The Western Australian DEC lists flora and fauna taxa under the provisions of the *WC Act* as protected according to their need for protection (see Appendix A).

Flora is given Declared Rare Flora status when populations are geographically restricted or are threatened by local processes. In addition, under the WC Act, by Notice in the Western Australian Government Gazette of 9 October 1987, all native flora (spermatophytes, pteridophytes, bryophytes and thallophytes) is protected throughout the State.

The *WC Act* lists fauna taxa identified by the DEC as protected, which are classified as Schedule 1 to Schedule 4 according to their need for protection (see Appendix A).

The Act makes it an offence to 'take' threatened species without an appropriate licence.

EP Act

Declared Rare Flora (DRF) and TECs are given special consideration in environmental impact assessments, and have special status as Environmentally Sensitive Areas (ESA) under the *EP Act* and the *Environmental Protection (Clearing of Native Vegetation) Regulations* 2004. Significant habitat necessary for the maintenance of indigenous fauna is also considered under the *EP Act* and the *Environmental Protection (Clearing of Native Vegetation) Regulations* 2004.

DEC Priority Lists

The DEC lists 'Priority' flora and fauna that have not been assigned statutory protection under the *WC Act*, but which are under consideration for declaration as DRF or 'Scheduled' Fauna. Priority flora and fauna are in urgent need of further survey or require regular monitoring, and although not currently threatened may become so in the future. Appendix A provides definitions of Priority codes.

In addition, the DEC maintains a list of Priority Ecological Communities (PECs) which identifies those communities that need further investigation before possible nomination for TEC status.

Once listed, a community is a PEC, but only when endorsed by the Western Australian Minister for the Environment does it become a TEC, and therefore protected as an ESA under *Environmental Protection (Clearing of Native Vegetation) Regulations* 2004 (see Appendix B for definitions).

Recognition of Threatened Flora, Vegetation and Fauna

Certain populations or communities may be of local significance or interest to the DEC because of their patterns of distribution and abundance. For example, flora and fauna may be locally significant because they are range extensions to the previously known distribution or are newly discovered taxa (and therefore have the potential to be of more than local significance). In addition, many species are in decline as a result of threatening processes (primarily land clearing) and relict populations of such species assume local importance to the DEC. It is not uncommon for the DEC to make comment on these species of interest.

2.2 POLICY FRAMEWORK

The flora, vegetation and fauna assessment was carried out in a manner designed to be compliant with EPA requirements for the environmental surveying and reporting in Western Australia, as set out in the following documents:

- *Environmental Protection of Native Vegetation in Western Australia: Clearing of Native Vegetation with Particular Reference to Agricultural Areas. Position Statement No.2* (EPA 2000);
- *Terrestrial Biological Surveys as an Element of Biodiversity Protection. Position Statement No. 3* (EPA 2002);
- *EPA Guidance for the Assessment of Environmental Factors: Terrestrial Flora and Vegetation Surveys for Environmental Impact Assessment in Western Australia No. 51* (EPA 2004a); and
- *EPA Guidance for the Assessment of Environmental Factors: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia. Guidance Statement No. 56* (EPA 2004b).

3 FLORA AND VEGETATION SURVEY METHODOLOGY

3.1.1 Level of Assessment

A baseline flora and vegetation survey for environmental impact assessment should at least provide a comprehensive list of species in a given area. There are two levels of flora survey as delineated by the EPA:

- **Level One**: a 'desktop' study to collate historical knowledge conducted in conjunction with a reconnaissance survey (site inspection); and
- **Level Two**: an intensive study that incorporates a detailed and comprehensive survey to characterise the flora present, combined with a Level One survey.

The methodology of the current survey, a Level One survey, has been developed in consideration of the EPA *Guidance Statement No. 51* (EPA 2004b).

3.1.2 Desktop Study

The purpose of the desktop study was to gather background information on the Survey area and the flora and vegetation it may support. This involved a search of literature, databases, aerial photographs and maps for information relating to landforms likely to be found in the area.

A request for a database search was submitted to the DEC (19^0 53' - 20^0 47' S and 118^0 07' - 119^0 01' E GDA 94) to ascertain whether any DRF or Priority Flora or any TECs or PECs had been recorded in the Survey area or surrounds. The DEC provided results for a 50 km radial search (DEC 2010b). In addition, a literature review was conducted, together with a review of records of flora for the Survey area. These sources were used to compile a list of expected DRF, Priority Flora, and TECs or PECs that may occur in the Survey area.

3.1.3 Field Survey

The field survey was conducted on 19 August 2010, with one person-day invested in the flora and vegetation field survey.

Field staff collected flora information using 50 m x 50 m vegetation survey quadrats, relevés and opportunistic collections. For areas in which a 50 m x 50 m quadrat was inappropriate, suitable quadrat dimensions were used, whilst maintaining the same total search area. Two quadrats and three relevés were executed (Figure 3). The quadrats were selected as being representative of the flora and vegetation of each Survey area. Flora survey quadrat and relevé locations are presented in Appendix C and Figure 3.

Habitats that could potentially support DRF and/or Priority Flora identified by the DEC database search and literature review were targeted and searched.

Data was recorded using standardised field sheets designed in accordance with BHPBIO guidelines (BHPBIO 2009). The information noted at each quadrat included landscape features, soils, bare ground and disturbance levels (Condition Scales are presented in Appendix D). Each plant species at each quadrat was recorded, including information on height and percentage cover (Data Sheets and site photographs are presented in Appendix C). This enabled more accurate vegetation mapping to be undertaken, and provided greater detail of the species present. The opportunistic collections focussed mainly on the location of flora taxa not recorded in the quadrats, and in particular, potential Declared Rare and Priority Flora, and flora not well known or not currently described.

3.1.4 Taxonomic Identification

Where field identification of plant taxa was not possible, specimens were collected systematically for later identification by taxonomists utilising the resources of the WAH, through comparison with the use of identification keys and reference collection. Conservation significant species and species that were difficult to identify were validated by a taxonomist at the WAH, as per the BHPBIO guidelines (BHPBIO 2009).

The species recorded were checked against FloraBase (WAH 2010) to determine whether any are listed as DRF or Priority Flora. Species were also checked against the *EPBC Act* listing of Threatened species to determine whether any are federally listed.

3.1.5 Introduced Flora (Weeds)

The Environmental Weed Strategy for Western Australia (Department of Conservation and Land Management [CALM] 1999) contains criteria for the assessment and ranking of weeds in terms of their environmental impact on biodiversity. The Strategy defines environmental weeds as 'plants that establish themselves in natural ecosystems and proceed to modify natural processes, usually adversely, resulting in the decline of the communities they invade' (CALM 1999).

Plants may also be 'Declared' by the Agriculture Protection Board under the *Agriculture and Related Resources Protection Act 1976 (WA)* (*ARRP Act*). Declared Plants are gazetted under five categories (P1-P5), which define the action required. Details of the definitions of these categories are provided in Appendix E. A declaration may apply to the whole State, to districts or individual properties. If a plant is 'Declared', landholders are obliged to control that plant on their properties (Department of Agriculture and Food Western Australia [DAFWA] 2009).

3.1.6 Vegetation Associations Analysis

Quadrat vegetation descriptions were used to delineate vegetation associations based on their structure and composition. Vegetation associations were then mapped using notes and maps created in the field. Vegetation was categorised in three levels consistent with BHPBIO guidelines (BHPBIO 2009): Broad Floristic Formations, Vegetation Associations and Sub-Associations.

Once the vegetation associations were determined, they were checked against the listings of State TECs and PECs and Federal TECs. The vegetation associations were also checked against regional databases, such as Beard (1975), Shepherd, Beeston and Hopkins (2001) and Comprehensive Adequate and Representative (CAR) Reserve Analysis (DAFWA 2007), to determine their regional representation.

3.1.7 Mapping

Mapping was carried out in the field using GPS (Magellan) and in the office using GIS (OziExplorer and Microstation V7.0) hardware and software. The boundaries of the vegetation associations and condition were drawn over an aerial photograph with the aid of GPS coordinates taken throughout the field survey. The vegetation associations were then digitised and, using Microstation V7.0, and ESRI shape files were created with ARCGIS 9.3.

4 TERRESTRIAL FAUNA METHODOLOGY

4.1 LEVEL OF ASSESSMENT

A baseline field fauna survey for environmental impact assessment should at least provide a comprehensive list of species within a given area. There are two levels of fauna survey as delineated by the EPA:

- **Level One:** desktop study to collate historical knowledge, in conjunction with a reconnaissance survey (site inspection); and
- **Level Two:** trapping and opportunistic field survey to characterise the fauna present, combined with a Level One survey.

The methodology of the current survey, a Level One survey, has been developed in consideration of the EPA *Guidance Statement No. 56* (EPA 2004b).

4.2 DESKTOP REVIEW

The purpose of the desktop review was to gather background information on the Survey area and the fauna that it may support. This involved a search of the following sources:

- Western Australian Museum (WAM 2010) and DEC combined biological database NatureMap (DEC 2010c);
- Birds Australia's Birdata (Birds Australia 2010)
- DEC Threatened and Priority Fauna Database (DEC 2010d);
- DEWHA Protected Matters Search Tool (DEWHA 2010d), also known as an EPBC search; and
- Previous fauna surveys (e.g. previous ENV reports, other consultants reports, DEC reports).

Collectively, these sources were used to compile a list of species that have been previously recorded in the region (Appendix F). This list will invariably include some species that do not occur in the Survey area, because some fauna have a limited or patchy distribution, high level of habitat specificity, are locally extinct or were erroneously identified in previous surveys. Some records were excluded from this list, such as extinct species.

4.3 FIELD SURVEY

The field survey was conducted on 19 August 2010, with one person-day invested in the fauna field survey.

Broad fauna habitats were identified based on vegetation associations and known landforms. These fauna habitats were then assessed for their potential to support fauna, in particular species of conservation significance. Habitats were assessed on the basis of their complexity, the presence of microhabitats, including significant trees with hollows, loose bark, fallen hollow logs and leaf litter, and other habitat features likely to provide foraging opportunities and/or shelter for fauna, such as water bodies and rocky outcrops.

4.4 TAXONOMY

For species identified in the desktop assessment where there is doubt to their true taxonomy (through subsequent name changes or taxonomic reviews) an effort was made to determine the current scientific name for each taxon. However, in some cases old scientific names may be presented. Some taxa names may be followed by 'sp.', meaning that the species name was not given in the data source or the taxonomy is in doubt. Where there are previously recorded taxa that have the potential to be a conservation significant species, they will be discussed specifically in the results section.

5 FLORA AND VEGETATION RESULTS

5.1 VARIABLES INFLUENCING THE FLORA AND VEGETATION SURVEY

It is important to note the variables associated with individual surveys, as per guidelines detailed in EPA *Guidance Statement No. 51* (EPA 2004a). Survey variables relevant to the Flora and Vegetation Assessment of the Survey area are detailed in Table 1.

Table 1: Variables Associated with the Flora and Vegetation Survey

Variable	Impact on Survey Outcomes
Access Problems	The Survey area was accessible and adequately surveyed.
Experience levels	The scientists who executed the flora and vegetation survey were practitioners suitably qualified in their respective fields. • Field Staff: Todd Edwards (Senior Environmental Scientist / Botanist); • Taxonomy: Peter Jobson (Senior Taxonomist); and • Data Interpretation and Reporting: Todd Edwards and James Sansom (Environmental Biologist).
Timing[2], weather, season.	The current survey was undertaken on 19 August 2010. The area had received 71 mm of rain in the three months preceding the survey (May to July 2010) (BoM 2010). The long-term (1942-2010) average rainfall for this same period is 59 mm (BoM 2010). Flora composition changes over time, with flora having specific growing periods, especially annuals and ephemerals (some plants lasting for a markedly brief time, some only a day or two). Therefore, the results of botanical surveys in this location may differ from the results of this survey.
Scope: Life forms	The most ideal time for surveys in the Pilbara is following summer rainfall when temperature and rainfall conditions are optimal for growth. *Guidance Statement No. 51* (EPA 2004a) states flora surveys should be conducted following the season which normally contributes the most rainfall in the bioregion. The survey was conducted in the dry season, and as a result some perennial species lacked identifiable parts (*i.e.* flowers and fruits).

[2] EPA Guidance Statement 51 (2004a) stipulates that flora and vegetation surveys should be undertaken following the season that contributes the greatest rainfall in the region. In the Northern Province, this is after summer. In the Eremaean Province, rainfall is sporadic, and in the South-west Province the main rain is in winter. Short-term variations in normal weather patterns (e.g. drought) may necessitate supplementary survey work at other times of year or in later years to take into account temporal changes in diversity.

Variable	Impact on Survey Outcomes
	Annual species were also likely to have been absent due to the timing of the survey. The impact of this on DRF and Priority Flora searches is discussed in Section 5.2.2.
Sources of information	A number of flora and vegetation surveys have been undertaken in the local area as part of environmental impact assessment processes. Those most relevant to the current study are listed in Section 1.4.
Completeness	Thirty seven taxa (including species, subspecies, affinities and varieties) were recorded in the Survey area, with a richness of 17 taxa per quadrat. The level of taxa richness in the Survey area is low, but comparable to that recorded in nearby studies using similar methodology. Further discussion of species richness is detailed in Section 5.2.2.

5.1.1 Potentially Occurring Flora and Vegetation Communities of Conservation Significance

From previous surveys conducted in the area and database searches, no *EPBC Act* or DRF, and 10 Priority species were identified as potentially occurring in the Survey area.

Brief taxonomic descriptions of the 10 Priority flora that potentially occur in the Survey area are provided in Appendix A. The likelihood of the occurrence of these species within the Survey area is presented in Table 2.

The DEC database search found that no known TEC or PECs (relating to vegetation) occur within the Survey area or surrounding area.

From previous surveys conducted in the area, nine introduced plant species were identified as potentially occurring in the Survey area, and these species are listed in Appendix E.

Table 2: The Likelihood of Priority Flora Potentially Occurring in the Survey area Based on the Survey Results and Literature Review

Priority Flora	Annual or Perennial[1]	Suitable Conditions	Habitat Preference (WAH 2010)	Suitable Habitat Present	Number of DEC Records[2]	Closest Records	Comments	[3]Likelihood of Occurring in the Survey area
Abutilon pritzelianum (P1)	Perennial	Yes	Red sand dunes and sandplains	Yes	19	Approx. 22 km (DEC 2010d)	Identified in the DEC database search. Habitat suitable for this species occurs in the Survey area on the sandplains. However, it is previously only known from more inland locations.	Unlikely
Atriplex eremitis (P1)	Annual or Perennial	No	Open tussock grassland on low sandplains or saline plains	No	2	Approx. 40 km (DEC 2010d)	Identified in the DEC database search. However, suitable habitat is not considered to be present in the Survey area.	Unlikely

[1] Annual/Perennial status is determined from Florabase (WAH 2010). Annual/Perennial status was considered less in the Likelihood assessment because the dry conditions at the time of survey, meant only hardy perennials would be likely to persist.

[2] Number of records based on NatureMap (DEC 2010d); DEC database search results (DEC 2010b); and other flora and vegetation surveys (listed in Section 1.4).

[3] Likelihood of Occurring in the Survey area is determined based on the following criteria:

Present – recorded in current survey.

Likely – suitable habitat, close (<10 km) records and/or field survey completed in sub-optimal season, suggest species is likely to occur;

Possible – suitable habitat, records (<50 km) and/or field survey completed in sub-optimal season, suggests species possibly occurs; and

Unlikely – lack of suitable habitat, no records (<50 km) and/or field survey completed in optimal season, suggest species is unlikely to occur.

Priority Flora	Annual or Perennial[1]	Suitable Conditions	Habitat Preference (WAH 2010)	Suitable Habitat Present	Number of DEC Records[2]	Closest Records	Comments	[3]Likelihood of Occurring in the Survey area
Heliotropium muticum (P1)	Perennial	Yes	Red-brown sand on sandplains	Yes	3	Approx. 16 km (DEC 2010d) Recorded in nearby surveys by ENV (2009a)	Identified in the DEC database search. Habitat suitable for this species occurs in the Survey area on the sandplains. However, it is previously only known from more inland locations.	Unlikely
Ptilotus appendiculatus var. *minor* (P1)	Perennial	Yes	Red-brown alluvial sand on floodplains	No	1	Approx. 12 km (DEC 2010d)	Identified in the DEC search. Little is known of this species' habitat preference (only one record exists). Due to the degraded condition of vegetation at the Survey area it is considered unlikely to occur.	Unlikely
Tephrosia rosea var. *venulosa* (P1)	Perennial	Yes	Sandplains and dunes with red-brown sand	Yes	16	<2 km (DEC 2010d) Recorded in nearby surveys by ENV (2010a-d; 2009a, b, d)	This species was recorded in the Survey area, and identified in the DEC database searches. Refer to Section 5.2.3.	Present
Gomphrena pusilla (P2)	Annual	No	Fine beach sand, behind foredunes and	Yes	6	<1 km (DEC 2010d)	Identified in the DEC database search, and occurs on Finucane Island. Suitable habitat is present in the Survey area, although much of the Survey area is	Possible

Priority Flora	Annual or Perennial[1]	Suitable Conditions	Habitat Preference (WAH 2010)	Suitable Habitat Present	Number of DEC Records[2]	Closest Records	Comments	[3]Likelihood of Occurring in the Survey area
			on limestone				degraded. This species is an annual so may not have been identifiable at the time of survey. However, the likelihood of this species occurring is reduced because of the degraded nature of vegetation in the Survey area.	
Pterocaulon sp. A Kimberley Flora (B.J. Carter 599) (P2)	Perennial	Yes	Sand, sandy saline flats and pindan sandplain in coastal areas	Yes	16	<44 km (DEC 2010d) Recorded in nearby surveys by ENV (2009a, e)	Identified in the DEC database search. ENV has also recorded this species in the local area. Furthermore, this species is a perennial herb, it is not considered hardy, and may have been absent at the time of the survey, due to dry conditions. However, the likelihood of this species occurring is reduced because of the degraded nature of vegetation in the Survey area.	Possible
Gymnanthera cunninghamii (P3)	Perennial	Yes	Found on sandy soils in association with riverine habitats	No	22	Approx. 3 km (DEC 2010d)	Identified in the DEC database search. However, suitable habitat is not present in the Survey area.	Unlikely
Polymeria distigma (P3)	Perennial	Yes	Sandy soils	Yes	14	Approx. 30 km (DEC 2010d) Recorded in	Identified in the DEC database search. Habitat suitable for this species occurs in the Survey area on the sandplains.	Unlikely

Priority Flora	Annual or Perennial[1]	Suitable Conditions	Habitat Preference (WAH 2010)	Suitable Habitat Present	Number of DEC Records[2]	Closest Records	Comments	[3]Likelihood of Occurring in the Survey area
						nearby surveys by ENV (2009a)	However, it is previously only known from more inland locations.	
Goodenia nuda (P4)	Annual	No	Floodplains and sandplains	Yes	42	Approx. 8 km (DEC 2010d) Recorded in nearby surveys by ENV (2009a, b)	Identified in the DEC database search, in similar habitat and growing in association with similar vegetation. This species is an annual, and as such, it may have been absent at the time of survey, due to the survey timing. However, the likelihood of this species occurring is reduced because of the degraded nature of vegetation in the Survey area.	Possible

5.2 FIELD SURVEY

5.2.1 Flora Composition

A total of 37 taxa (including species, subspecies, affinities and varieties) were recorded within the Survey area. These 37 taxa consisted of 20 families, 15 of which were represented by only one taxon, and 33 genera, 30 of which were represented by only one taxon. All taxa were identified to family and genus level. Refer to Appendix G for the flora inventory.

The plant families with the highest number of taxa in the Survey area were:

- Fabaceae (eight);
- Poaceae (five); and
- Amaranthaceae (four).

The plant genera with the highest number of taxa in the Survey area were *Acacia* with four and *Euphorbia* with two taxa.

The most common taxon recorded in the Survey area was **Cenchrus ciliaris* (recorded in all quadrats and relevés). A matrix of taxa recorded at each quadrat and relevé is in Appendix H.

5.2.2 Flora Richness

The level of taxa richness recorded in the Survey area (17 taxa per quadrat) was comparable to that of other surveys conducted in the surrounding region, using similar methodology (Table 3).

The level of taxa richness in the Survey area would most likely have been greater if the survey was conducted after or during the summer season, when the region typically receives greater rainfall. Generally the most ideal time for surveys in the Pilbara is following summer rainfall when temperature and rainfall are optimal for growth. EPA *Guidance Statement No. 51* (EPA 2004a) states surveys should be conducted following the season which normally contributes the most rainfall in bioregions.

The degraded nature of the Survey area may also have contributed to reduced flora richness, for example, **Cenchrus ciliaris*, which is dominant at the Survey area, may have displaced native species, because it is known to be allelopathic (Nurdin and Fulbright 1990).

Overall, the composition of flora and vegetation in the Survey area is considered typical of that recorded in the local area, with a large component of introduced flora.

Table 3: Taxa Richness Comparison between Regional Surveys

Project	Taxa Richness per Quadrat[1]	Number of Quadrats	Survey Date	Rainfall Prior to Survey (3 months)	Rainfall Prior to Survey (6 months)
Current Survey	17	2	August 2010	71 mm	89.6 mm
Goldsworthy Rail Development Supplemental Flora and Vegetation Assessment (ENV 2010a)	11.3	11	January 2010	17.6 mm	18 mm
Goldsworthy Rail Duplication Flora and Vegetation Assessment (ENV 2009d)	20.6	37	October 2008	0.4 mm	60.6 mm
Outer Harbour Development Flora and Vegetation Assessment (ENV 2009a)	16.2 (summer season survey)	126	October 2007	9.4 mm	13.2 mm
	17.9 (winter season survey)	235	May 2008	103.6 mm	110 mm

5.2.3 Flora of Conservation Significance

No Threatened species pursuant to the *EPBC Act* were recorded during the field survey.

No flora gazetted as DRF pursuant to the *WC Act* were recorded in the Survey area.

One flora taxon, *Tephrosia rosea* var. *venulosa* (Priority 1), listed as Priority Flora by the DEC, was located in the Survey area. The taxonomy of the specimens collected in the Survey area has been validated by Steve Dillon at the WAH. The Chain of Custody form is provided in Appendix I.

[1] Taxa richness has been updated to account for changes in nomenclature and standardised to WAH (2010) nomenclature as per guidance provided by BHPBIO (2009).

Plate 1: *Tephrosia rosea* var. *venulosa* (Priority 1)

Tephrosia rosea var. *venulosa* (Plate 1) is an erect shrub to 1.7 m producing red flowers between August and September (WAH 2010). This species is known to favour red sands near creeks (WAH 2010) and is generally considered to be uncommon; it has only been recorded between Port Hedland and Cape Lambert.

Based on field observations, by ENV staff, the distribution of *Tephrosia rosea* var. *venulosa* suggests that it is a disturbance specialist, a pioneer species and/or a post-fire germinant (ENV 2009a). The species also appears to be associated with sandy soils. Little is known about the species' life-cycle, but it probably establishes a few years after disturbance (2-3 years), before being out-competed by other vegetation (5-7 years).

The distribution of *Tephrosia rosea* var. *venulosa* is mapped in Figure 4. Individuals were recorded from 33 separate locations within the Survey area (Appendix I). However, the total number of plants was not recorded individually because of the number and density of plants present, and limited survey time.

Three populations of differing densities of *Tephrosia rosea* var. *venulosa* have been mapped, as shown in Figure 4, and details are as follows:

- Population 1: a Low Open Shrubland of *Tephrosia rosea* var. *venulosa* occurring in the north of the Survey area, comprising an estimated 300 individuals (with approximately 0.02 plants per m^2);
- Population 2: a Low Open Shrubland of *Tephrosia rosea* var. *venulosa* occurring in the south east of the Survey area, comprising an estimated 1000+ individuals (with approximately 0.02 plants per m^2); and

- Population 3: an area of Scattered Shrubs of *Tephrosia rosea* var. *venulosa* occurring in south of the Survey area, comprising an estimated 100 individuals (with approximately 0.01 plants per m^2).

Areas where *Tephrosia rosea* var. *venulosa* occur may pose a constraint.

A further three Priority Flora may potentially occur in the Survey area, which were identified in the desktop review, but not recorded in the field survey.

These species may have been absent at the time of the survey, because the field survey was conducted in the drier time of the year, when conditions were not optimum for annual and non-hardy perennial flora. However, the likelihood of these species occurring is reduced to some extent because of the degraded nature of vegetation in the Survey area.

These species are:

- *Gomphrena pusilla* (Priority 2) – this species was identified in the DEC database search, and is known from one record found on Finucane Island. Suitable habitat is present in the Survey area. This species is an annual.

- *Pterocaulon* sp. A Kimberley Flora (B.J. Carter 599) (Priority 2) – this species was identified in the DEC database search and has been recorded in nearby surveys by ENV (2009a, e). Habitat suitable for this species occurs in the Survey area based on the species' habitat preference. It is a non hardy perennial.

- *Goodenia nuda* (Priority 4) – this species was identified in the DEC database search and has been recorded in nearby surveys by ENV (2009a, b). Habitat suitable for this species occurs in the Survey area based on the species' habitat preference. This species is an annual.

These species, along with the remaining Priority Flora, have been discussed in Table 2.

5.2.4 Introduced Species

Eight introduced species, **Cenchrus ciliaris* (Buffel Grass), **Aerva javanica* (Kapok), **Aloe vera*, **Chloris barbata*, **Indigofera sessiliflora*, **Opuntia stricta (*Common Prickly Pear*)*, **Yucca aloifolia*, and **Portulaca oleracea* (Purslane) were recorded in the Survey area. Table 4 contains the rating and criteria for the introduced species recorded in the Survey area, according to the Environmental Weed Strategy for Western Australia (CALM 1999).

Three of the introduced flora recorded in the Survey area are considered to be noteworthy, namely **Aerva javanica, *Cenchrus ciliaris* and *Opuntia stricta.*

**Cenchrus ciliaris* was the most dominant introduced species, and was recorded in all quadrats and relevés. This species has a High rating under the Environmental Weed Strategy for Western Australia (CALM 1999). The cover was generally high, with cover values ranging from 1% to 90%. The species occurred in both vegetation types in the

Survey area, and occurred in the rehabilitated areas. **Cenchrus ciliaris* is a perennial grass that occurs across much of northern Australia, and semi-arid areas (Hussey *et al.* 1997).

**Aerva javanica* also has a High rating under the Environmental Weed Strategy for Western Australia (CALM 1999). It was recorded at less than one percent, in one quadrat in the sandplain habitat (Figure 5). **Aerva javanica* is a perennial herb that is widespread in many types of vegetation from the Kimberley to Carnarvon (Hussey *et al.* 1997).

**Opuntia stricta* is listed as a Declared Plant under the *ARRP Act* 1976. This species is listed as P1 and P2 for the Port Hedland area. The movement of this species is therefore prohibited (P1) and it should be eradicated (P2). **Opuntia stricta* is a spreading erect shrub to 2 m high, which grows on sandy soils. It was recorded at one location on the sandplain habitat (Figure 5), and was probably historically planted in the Survey area. It was growing next to two other introduced species, **Yucca aloifolia* and **Aloe vera*, both common garden plants.

Table 4: Introduced Plant Species Listed by the Environmental Weed Strategy for Western Australia Located in the Survey Area

Taxon	Common Name	Criteria			
		Rating	Invasiveness	Distribution	Impacts
**Aerva javanica*	Kapok	High	Yes	Yes	Yes
**Aloe vera*	N/A	N/A	-	-	-
**Cenchrus ciliaris*	Buffel Grass	High	Yes	Yes	Yes
**Chloris barbata*	N/A	Low	-	-	-
**Indigofera sessiliflora*	N/A	N/A	-	-	-
**Opuntia stricta*	Common Prickly Pear	N/A - DP[1]	-	-	-
**Portulaca oleracea*	Purslane	N/A	-	-	-
**Yucca aloifolia*	N/A	Low	-	-	-

The locations of introduced species recorded within the Survey area are presented in Figure 5 and Appendix J.

1 **Opuntia stricta* is not rated under the Environmental Weed Strategy for Western Australia (CALM 1999), but is listed as a Declared Plant under the *ARRP Act* 1976.

5.2.5 Vegetation Associations

Three vegetation associations were described in the Survey area (Table 5). This is in addition to areas that are Cleared / Developed (which support no vegetation) and Beach areas (which support little to no vegetation).

The vegetation associations are mapped in Figure 6. Photographs and datasheets are provided in Appendix C.

No TECs, PECs or ESAs were recorded within the Survey area. No groundwater dependent ecosystems were recorded in the Survey area.

Table 5: Vegetation Associations in the Survey Area

Broad Floristic Formation	Description	Extent	Site
**Cenchrus* Closed Tussock Grassland (1a)	Closed Tussock Grassland of **Cenchrus ciliaris* with Scattered Shrubs of *Acacia stellaticeps* and *Acacia bivenosa* over Scattered Herbs of *Ipomoea pes-caprae* subsp. *brasiliensis* on Orange Sand on Sandplain.	12 ha	HPX01
Spinifex Open Tussock Grassland (1b)	Open Tussock Grassland of *Spinifex longifolius* and **Cenchrus ciliaris* with Shrubland of *Acacia stellaticeps* and *Santalum lanceolatum* over Scattered Herbs of *Ipomoea pes-caprae* subsp. *brasiliensis* and *Ptilotus exaltatus* var. *exaltatus* on Foreshore-Dunes.	7 ha	HPX02
Rehabilitated	Scattered Shrubs *of Acacia ampliceps* and *Casuarina obesa*[1] over Scattered Tussock Grass **Cenchrus ciliaris* on Red Brown Loamy on Rehabilitated – Low Hill.	14	HPXR01
Beach	Little to no vegetation. A few scattered *Ipomoea pes-caprae* subsp. *brasiliensis* and *Ptilotus exaltatus* var. *exaltatus* near to inland boundary.	10 ha	N/A
Cleared / Developed	No Vegetation	24 ha	N/A

Two of the vegetation associations in Table 5 above are described on the following pages. The vegetation of the Rehabilitated area is not described in detail because it comprised of non-natural (planted) vegetation and manmade landform.

1 *Casuarina obesa* is native to Western Australia, but introduced to the local area. The species is predominantly distributed in the southwest (WAH 2010). It is not considered a range extension, because it is a species that has been historically used in coastal rehabilitation, such as in the Survey area.

Broad Floristic Formation: **Cenchrus* Closed Tussock Grassland

Vegetation Association: 1a

Closed Tussock Grassland of **Cenchrus ciliaris* with Scattered Shrubs of *Acacia stellaticeps* and *Acacia bivenosa* over Scattered Herbs of *Ipomoea pes-caprae* subsp. *brasiliensis* on Orange Sand on Sandplain.

Mapped Colour: Green

Area: 12 ha **Current Survey Sites:** HPX01

Landform Description

Location and Landform: Occurs on the Sandplains in the Survey area.

Geology: Sand.

Soil Attributes: Orange-brown Sand.

Litter Cover: <1% Logs, <1% Twigs and <1% Leaves. **Bare Ground:** 5%

Vegetation Structure and Floristics

The Closed Tussock **Cenchrus ciliaris* Grassland is the diagnostic feature of this vegetation association.

Stratum	Key Characteristics
Overstorey	
Canopy Layer	N/A.
Midstorey	
Middle Shrub Layer	Scattered Shrubs of *Acacia bivenosa* and *Rhagodia eremaea.*
Lower Shrub Layer	Low Shrubland of *Acacia stellaticeps*, and *Tephrosia rosea* var. *venulosa* (in areas indicated in Figure 6)
Understorey	
Hummock Grasses	N/A
Tussock Grasses	Scattered Tussock Grass of **Cenchrus ciliaris*.

Vegetation Condition

Condition Rating: Degraded.

Disturbances: Nearby infrastructure, roads, tracks and introduced species.

Average Fire Age: Old.

Broad Floristic Formation: *Spinifex* Open Tussock Grassland

Vegetation Association: 1b

Open Tussock Grassland of *Spinifex longifolius* and **Cenchrus ciliaris* with Shrubland of *Acacia stellaticeps* and *Santalum lanceolatum* over Scattered Herbs of *Ipomoea pes-caprae* subsp. *brasiliensis* and *Ptilotus exaltatus* var. *exaltatus* on Foreshore-Dunes.

Mapped Colour: Yellow.

Area: 7 ha **Current Survey Sites:** HPX02

Landform Description

Location and Landform: Occurs on the Foreshore-Dunes in the Survey area.

Geology: Sand.

Soil Attributes: Orange-brown sandy loam.

Litter Cover: 2% Logs, <1% Twigs and 1% Leaves. **Bare Ground:** 20%

Vegetation Structure and Floristics

The Tussock Grassland of *Spinifex longifolius* and Scattered Shrubs of *Ipomoea pes-caprae* subsp. *brasiliensis* is the diagnostic feature of this vegetation association.

Stratum	Key Characteristics
Overstorey	
Canopy Layer	N/A.
Midstorey	
Middle Shrub Layer	Shrubland of *Acacia stellaticeps, Santalum lanceolatum, Adriana tomentosa* var. *tomentosa* and *Acacia bivenosa*.
Lower Shrub Layer	Scattered Herbs of *Ipomoea pes-caprae* subsp. *brasiliensis* and *Ptilotus exaltatus* var. *exaltatus* and *Crotalaria cunninghamii* subsp. *sturtii*. Some Scattered to Low Shrubland of *Tephrosia rosea* var. *venulosa* (in areas indicated in Figure 6)
Understorey	
Hummock Grasses	N/A.
Tussock Grasses	Open Tussock Grassland of *Spinifex longifolius* and**Cenchrus ciliaris*.

Vegetation Condition

Condition Rating: Good.

Disturbances: Nearby infrastructure, road, tracks and introduced species.

Average Fire Age: Old.

5.3 REGIONAL REPRESENTATION

5.3.1 Vegetation Associations

One vegetation type occurs in the Survey area based on regional scale mapping by Beard (1975) (Table 6); ABYDOS PLAIN 117 ('Hummock grasslands, grass steppe; soft spinifex'). This vegetation type has been correlated with mapping by Shepherd, Beeston and Hopkins (2001), who attempted to determine the current extent of these vegetation types in Western Australia (Table 6).

ENV vegetation associations have been roughly correlated with the Beard (1975) broad vegetation type (Table 6). Differences exist with the terminology used in the descriptions as they are based on different methods of categorising and characterising vegetation types, as well as being on different spatial scales of the analysis (*i.e.* region vs. local scale).

Shepherd, Beeston and Hopkins (2001) have estimated the current extent of Beard (1975) vegetation types in Western Australia, although outside the intensive landuse zone data is not comprehensive. Furthermore, the vegetation associations present in the Survey area are degraded and dominated by introduced species, which were not recognised in Beards' (1975) description. However, there are no other suitable regional vegetation datasets available for comparison.

Based on Shepherd, Beeston and Hopkins (2001) mapping, the ABYDOS PLAIN 117 vegetation type occurring in the Survey area is considered to remain at more than 99.9%. This is greater than the 30% threshold level recognised by the EPA (2000) and the Commonwealth of Australia (2001) for native vegetation retention.

Table 6: Regional Representation of Vegetation Types in the Survey area

	Pre-European area (ha)[1]	Current extent (ha)[1]	Remaining [1]	Pre-European % in IUCN Class I-IV Reserves[1]	Conservation Status[2]	ENV Vegetation Associations
IBRA Bioregion – Pilbara	17,804,187	17,794,646	99.9%	6.3%	Least Concern	N/A
Vegetation Type – State						
ABYDOS PLAIN 117	888,878.17	874,221.93	98%	13%	Least Concern	1a, 1b
Vegetation Type – Bioregion – Pilbara						
ABYDOS PLAIN 117	74,554.94	70,441.57	94%	12%	Least Concern	1a, 1b

5.3.2 Land Systems

The Survey area consists of one land system, the Littoral land system, as described by van Vreeswyk *et al.* (2004). The proportion of this land system in the Survey area, and the percentage of the land system in the Survey area is shown in Table 7. Only a small portion of the total extent of the land system occurs in the Survey area (<0.1%). Furthermore, the land system occurs along much of Pilbara coast line (approximately 50%), and covers a total of 0.9% or 1,577 km^2 of the Pilbara bioregion.

Table 7: Percentage of Land Systems' Total Extent within the Survey area

Land System	Total Area in Pilbara Bioregion (km^2)	Area of Land System in Survey area (km^2)	% of Land System within the Survey area
Littoral	1,577	2.14	<0.1%

5.3.3 Vegetation Condition

The condition of vegetation in the Survey area was Good or Degraded (Figure 7; Appendix D).

[1] Shepherd, Beeston and Hopkins (2001) and DAFWA (2007).

[2] Department of Natural Resources and Environment (2002).

The Good or Degraded condition of vegetation in the Survey area is likely to be a result of numerous disturbances recorded in the Survey area, including the close proximity of surrounding infrastructure, historic clearing, vehicle tracks and introduced species. The latter, is the greatest disturbance, with **Cenchrus ciliaris* dominating all the vegetation associations present in the Survey area. There was also evidence of erosion of the Foreshore-Dunes in the Survey area, most likely to be a result of coastal winds / storms and historic land use activities.

A large portion of the Survey area was also recorded as being Cleared / Developed (24 ha). In addition, a large portion of the Survey area was rehabilitated (14 ha). This rehabilitated area comprised of non-endemic vegetation (planted) on constructed landforms.

The fire age for the Survey area was considered to be Old (eight to 12 years since the last fire).

6 TERRESTRIAL FAUNA RESULTS

6.1 VARIABLES INFLUENCING THE TERRESTRIAL FAUNA SURVEY

It is important to note the variables associated with individual surveys, as per guidelines detailed in EPA *Guidance Statement No. 56* (EPA 2004b). Survey variables relevant to the Fauna Assessment of the Survey area are detailed in Table 8.

Table 8: Variables Associated with the Fauna Survey

Variable	Impact on Survey Outcomes
Access Problems	The Survey area was accessible and adequately surveyed.
Experience levels	The scientist that executed this survey is regarded as suitably qualified in the respective fields. **Site Reconnaissance** • John Trainer (Environmental Biologist / Zoologist). **Data Analysis and Reporting** • John Trainer.
Timing, weather, season.	The current survey was undertaken on 19 August 2010. The area had received 71 mm of rain in the three months preceding the survey (May to July 2010) (BoM 2010). The long-term (1942-2010) average rainfall for this same period is 59 mm (BoM 2010).
Scope: sampling methods/intensity	The survey carried out was a Level One survey comprising of a desktop review with a site reconnaissance and habitat assessment.
Sources of information	A number of fauna assessment surveys have been undertaken in the local area as part of environmental impact assessment processes. Those most relevant to the current study are listed in Section 1.4.

6.2 HABITAT ASSESSMENT

Two broad natural habitat types were identified in the Survey area; the Dunes and Shoreline habitat types (Table 9, Figure 8). A further habitat type, Rehabilitated, was also mapped in the Survey area. This habitat type comprised planted, non-endemic vegetation on constructed landforms. The remainder of the Survey area comprises Cleared / Developed areas. Six habitat assessments were conducted in the habitat types present in the Survey area (Appendix K).

Table 9: Fauna Habitat Types of the Survey Area

Habitat Type	Habitat Value	Area of Habitat Type (ha)
Dunes	Low	19 ha
Shoreline	High	10 ha
Rehabilitated	Low	14 ha
Cleared / Developed	N/A	24 ha
Total		67 ha

6.2.1 Dunes

This habitat consists of a grassland of *Spinifex longifolius* and **Cenchrus ciliaris* with scattered shrubs of *Acacia stellaticeps.* It is considered of low habitat value, as it lacks diversity of microhabitats for fauna to exploit and the low complexity of the vegetation structure provides limited niches. This habitat has soft soils that offer niches for ground-dwelling reptiles and mammals and is suitable for burrowing species such as the Central Netted Dragon (*Ctenophorus nuchalis*). The Dunes habitat comprises a moderate portion (28%) of the Survey area.

This habitat type has been observed to be widespread in the Port Hedland region and occurs elsewhere on Finucane Island. However, the Dunes habitat type is isolated and fragmented from other similar habitat in the vicinity, by infrastructure and by being located on an island. This limits the expansion of ground dwelling species from more core habitats into the Survey area, and thus reduces its value.

The habitat present in the Survey area does not appear to provide any significant breeding locations, nor are species reliant on it for any particular stage of their life cycle.

6.2.2 Shoreline

The Shoreline habitat type consists of tidal reef platforms, limestone outcropping and sandy beaches. The vegetation within this habitat type is very sparse and consists mainly of a few scattered *Ipomoea pes-caprae* subsp*. brasiliensis* and *Ptilotus exaltatus* var. *exaltatus*. The sandy beaches and tidal reef platforms of this habitat provide shelter, roosting and foraging opportunities for a number of different species including migratory waders and marine birds such as the Whimbrel (*Numenius phaeopus*) and the Ruddy Turnstone (*Arenaria interpres*). The shoreline habitat also provides nesting opportunities for marine birds such as the Silver Gull (*Larus novaehollandiae*) and Crested Terns (*Sterna bergii*).

The Shoreline habitat type was considered as high habitat value for fauna providing foraging, roosting and sheltering opportunities for an array of migratory marine birds. During the survey it was noted that this habitat type is under represented in the broader area. The shoreline habitat type comprises a small portion (15%) of the Survey

area. Observations of the immediate vicinity and the Port Hedland region show that this habitat type is not well represented.

6.2.3 Rehabilitated

This non-natural habitat consists of planted non-endemic vegetation and constructed landforms. It comprises of planted (non local) scattered shrubs of *Acacia ampliceps* and *Casuarina obesa* over scattered tussock grass **Cenchrus ciliaris* on constructed landforms (hills). The trees and shrubs within the rehabilitated site may provide a 'stepping stone' for aerial bird species to move from one habitat to the next. The stony and gullied substrate may provide some habitat for ground dwelling reptiles, particularly small reptiles that may shelter under and within cracks and crevices that are present. The Rehabilitated habitat is considered to have a low habitat value as it has limited ability to support species of conservation significance. The Rehabilitated habitat type comprises 21% of the Survey area.

6.2.4 Cleared / Developed

In addition to the habitat types described above, there were areas that have been Cleared / Developed. These provide little or no habitat value and principally consist of infrastructure (*i.e.* roads, laydown areas, rail and tracks). Cleared / Developed areas comprise 36% of the Survey area.

6.3 FAUNA ASSEMBLAGES

Fauna assemblages were collated from a desktop review, and grouped according to common nomenclature; Amphibians, Reptiles, Birds and Mammals. Many of these species are unlikely to occur in the Survey area on a regular basis since these records are from a large area encompassing a wide range of habitats. Furthermore small common ground dwelling reptile and mammal species tend to be habitat specific and bird species that potentially occur, more often than not occur on a transitory basis.

6.3.1 Amphibians

Eight species of amphibians have been previously recorded in the vicinity of the Survey area (Appendix F). The most common amphibians that may occur are the burrowing frogs, Sheep Frog (*Cyclorana maini*) and Centralian Burrowing Frog *(Platypectrum spenceri*).

6.3.2 Reptiles

Ninety-one species of reptiles have been previously recorded in the vicinity of the Survey area (Appendix F). Reptiles likely to occur in the Survey area include the Central Military Dragon (*Ctenophorus isolepis isolepis*) and the Narrow-banded Sand Swimmer (*Eremiascincus fasciolatus*).

Introduced reptiles that have previously been recorded in the general vicinity of the Survey area include the Asian House Gecko (**Hemidactylus frenatus*) and the Flowerpot Blind Snake (**Ramphotyphlops braminus*).

6.3.3 Birds

One hundred and eighty nine species of birds have been previously recorded in the vicinity of the Survey area (Appendix F). Birds likely to be common to the Survey area are the White-winged Fairy Wren (*Malurus leucopterus*), the Whistling Kite (*Haliastur sphenurus*), the Zebra Finch (*Taeniopygia guttata*), Australian Pied Oystercatcher (*Haematopus longirostris*) and the Silver Gull (*Larus novaehollandiae*).

6.3.4 Mammals

Forty four species of mammals have previously been recorded in the vicinity of the Survey area (Appendix F). The Sandy Inland Mouse (*Pseudomys hermenbergensis*) is likely to be the most common mammal occurring in the Survey area.

Introduced mammals that have previously been recorded in the general vicinity of the Survey area include the House Mouse (**Mus musculus*), Fox (**Vulpes vulpes*), Wild Dog (**Canus lupus familiaris*) and the Feral Cat (**Felis catus*).

6.4 CONSERVATION SIGNIFICANT FAUNA

6.4.1 Desktop Assessment Conservation Significant Fauna

A number of previously recorded conservation significant fauna will not occur in the Survey area due to limited or patchy distribution, high level of habitat specificity, or local extinction. Fifty-seven conservation significant species were identified as potentially occurring in the vicinity of the Survey area. Twenty-six of these are considered to 'likely' or 'possibly' occur within the Survey area; based on their ecology, habitats present and fauna records (DEC and in literature). The majority (twenty-three) of these species are listed as Migratory under the *EPBC Act* and are not considered Threatened or Rare within Western Australia. Five bird species of conservation significance were recorded during this survey (Appendix L, Figure 9). These species are discussed in Table 10.

Note species listed as 'Marine' under the *EPBC Act* are only given special protection in Commonwealth marine reserves, so are not considered conservation significant species in this assessment unless also listed under other categories (see Appendix A for a description of conservation codes).

Table 10: Conservation Significant Fauna Previously Recorded in the Vicinity of the Survey Area

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
REPTILES				
Woma (*Aspidites ramsayi*)	S4	The Woma inhabits spinifex within woodlands, heaths and shrublands. It is restricted to arid areas, where it shelters in hollow logs, animal burrows or thick vegetation (Cogger 2000). This species has been previously recorded in the Port Hedland area (ENV 2009c).	Due to the level of development on Finucane Island and the disjunctive nature of the habitat types present it is unlikely that this species would occur.	Unlikely
BIRDS				
Lesser Frigate Bird (*Fregata ariel*)	Mi	The Lesser Frigate Bird occurs in coastal areas of northern Western Australia and extends south to the Dampier Archipelago (Johnstone and Storr 1998). This species breeds on the tropical islands to the State's north and is a regular visitor during Summer-Autumn (Pizzey and Knight 2007).	No suitable habitat present within the Survey area. Spends most of its time at sea.	Unlikely
Cattle Egret (*Ardea ibis*)	Mi	The Cattle Egret (*Ardea ibis*) occurs in the wetter parts of Western Australia, in particular the Kimberley and the south-west. The species inhabits short grass, in particular damp pastures and wetlands, usually in the company of cattle and occasionally other livestock. In Western Australia it is an irregular visitor, occurring mostly in autumn, and is not thought to breed regularly (Johnstone and Storr 1998).	The Survey area lacks inundated pastures preferred by the Cattle Egret, thereby no suitable habitat occurs.	Unlikely
Eastern Great Egret (*Ardea modesta*)	Mi	The Eastern Great Egret (*Ardea modesta*) occurs in the Kimberley, Pilbara, and on the west coast from the Murchison River south, throughout the south-west, and east to Cape Arid. It inhabits mostly shallow fresh lakes, pools in rivers, lagoons, lignum swamps, clay pans and samphire flats, large dams and sewage ponds. It also inhabits shallow saltwater habitat such as mangrove creeks, tidal pools, samphire swamps and salt work ponds. It breeds colonially at wooded swamps and river pools, nesting in various riparian trees.	The Survey area lacks preferred habitat for this species.	Unlikely

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
Eastern Reef Egret (*Egretta sacra*)	Mi	The Eastern Reef Egret occurs in coastal areas along the entire West Australian coast, although it is more common in the warmer regions to the north. The species inhabits beaches, rocky shores, tidal rivers and inlets, mangroves, and exposed coral reefs. Although it is listed as migratory, the Eastern Reef Egret is largely sedentary in nature (Johnstone and Storr 1998).	Three individuals were recorded foraging on the tidal reef platforms and sand beaches of the Survey area.	Recorded
White-bellied Sea Eagle (*Haliaeetus leucogaster*)	Mi	The White-bellied Sea Eagle is distributed along the coast, islands and estuaries of Western Australia but not the lower west and south-west or far-east (Johnstone and Storr 1998). They feed on fish, sea snakes and nesting seabirds. Nests are usually placed on high ground such as rock pinnacles, rigid shrubs or in tall trees (Johnstone and Storr 1998). This species is known to occur in the Port Hedland area and has been recently recorded near the Survey area (ENV 2009c).	The White-bellied Sea Eagle may use the Survey area on a transitory basis, while searching for prey. However, no suitable nesting habitat is present in the Survey area.	Possible
Eastern Osprey (*Pandion haliaetus*)	Mi	The Eastern Osprey is distributed along the coast, islands and lower river courses of Western Australia. They feed on fish and other marine animals (Johnstone and Storr 1998). They nest in trees, cliffs and sometimes structures such as radio towers, often close to the water. Several individuals of the Eastern Osprey have previously been recorded near the Survey area (ENV 2009c).	A pair of Eastern Ospreys was recorded in the Survey area during the survey. They were observed foraging and feeding in both Dunes and Shoreline habitats.	Recorded
Peregrine Falcon (*Falco peregrinus*)	S4	The Peregrine Falcon is uncommon but wide-ranging across Australia. It occurs mainly along coastal cliffs, rivers and ranges as well as wooded watercourses and lakes. The Peregrine Falcon nests primarily on cliffs, granite outcrops and quarries, and feeds mostly on birds (Johnstone and Storr 1998).	This species may use the Survey area for foraging as part of a larger home range, but are not reliant upon the Survey area as no suitable breeding habitat exists.	Possible
Australian Bustard (*Ardeotis australis*)	P4	The Australian Bustard is typically widespread and nomadic, but locally scarce. This species is distributed across most of Western Australia, although is most prevalent in grasslands, especially tussock grasses, arid scrub and dry open woodlands (Morcombe 2000). The abundance of this species varies according to habitat and season, in particular the abundance of grasshoppers. Habitat loss has led to a decline in this species in the south-west (Johnstone and Storr 1998).	Although the Dunes habitat is suitable for this species the infrastructure and development over most of the island has left the habitats disjunct.	Unlikely

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
Common Sandpiper (*Actitis hypoleucos*)	Mi	The Common Sandpiper occurs along the coast of Western Australia, and in much of the interior. They inhabit sheltered salt and fresh waters such as estuaries, mangrove creeks, rocky coasts, salt lakes, river pools, lagoons, clay pans, drying swamps, flood waters, dams and sewage ponds (Johnstone and Storr 1998). They occasionally occur inland in a variety of wetlands (Geering, Agnew and Harding 2007). They are a non-breeding migrant to Western Australia occurring at any time of year, but mostly September to March in the south-west (Johnstone and Storr 1998).	The Shoreline of the Survey area provides suitable habitat for this species.	Likely
Ruddy Turnstone (*Arenaria interpres*)	Mi	The Ruddy Turnstone is a summer non-breeding migratory shorebird that occurs on the coast of the north-west, and west coast from Beagle Bay to Shark Bay (Johnstone and Storr 1998). It occurs primarily on rocky coasts and rocky reefs, as well as tidal mudflats and beaches and pebbly shores of near-coastal salt lakes and salt-work ponds (Johnstone and Storr 1998).	Five Ruddy Turnstones were recorded foraging on the tidal reef platforms and sandy beaches of the Survey area.	Recorded
Sharp-tailed Sandpiper *(Calidris acuminate*)	Mi	The Sharp-tailed Sandpiper is a summer non-breeding migratory shorebird that occurs along most of the coast of Western Australia except for the south coast, and in well-watered parts of the interior and casually in the arid east south of Lake Gregory (Johnstone and Storr 1998). It inhabits both coastal and inland areas but prefers non-tidal fresh or brackish wetlands (Geering, Agnew and Harding 2007).	Although this species' preferred habitat does not exist, it may utilise the shoreline of the Survey area during its migration.	Possible
Sanderling (*Calidris alba*)	Mi	The Sanderling is a small compact shorebird and is often found in small to large flocks, mostly on open beaches exposed to surf. This species has also been recorded within inter-tidal mudflats. This species distinctly dashes between waves when feeding and is known at high tide to roost among beach debris (Geering, Agnew and Harding 2007).	The Shoreline of the Survey area provides suitable habitat for this species.	Likely
Red Knot (*Calidris canutus*)	Mi	The Red Knot is a summer non-breeding migratory shorebird that occurs along most of the coast of Western Australia (Johnstone and Storr 1998). It inhabits larger inter-tidal mud and sand flats (Geering, Agnew and Harding 2007).	The Red Knots preferred habitat of tidal flats and sand flats are not present in the Survey area. However, this species may utilise the shoreline of the Survey area during its migration.	Possible

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
Curlew Sandpiper (*Calidris ferruginea*)	Mi	The Curlew Sandpiper is a summer non-breeding migratory shorebird that occurs along most of the coast of Western Australia. It inhabits exposed tidal mudflats, and less frequently on inland freshwater wetlands (Geering, Agnew and Harding 2007).	The Survey area does not contain any tidal mudflats which are the preferred habitat for this species.	Unlikely
Pectoral Sandpiper (*Calidris melanotos*)	Mi	The Pectoral Sandpiper is an uncommon summer non-breeding migratory shorebird that occurs sporadically along the coast of Western Australia (Geering, Agnew and Harding 2007). It inhabits shallow fresh waters, swamp margins, sewerage ponds and occasionally tidal areas (Pizzey and Knight 2007).	Although this species' preferred habitat does not exist, it may utilise the shoreline of the Survey area during its migration.	Possible
Red-necked Stint (*Calidris ruficollis*)	Mi	The Red-necked Stint is a summer non-breeding migratory shorebird that occurs along most of the coast of Western Australia. It inhabits a wide range of fresh and saltwater habitats such as tidal mudflats, salt marshes and sandy beaches (Pizzey and Knight 2007).	The Shoreline of the Survey area provides suitable habitat for this species	Likely
Long-toed Stint (*Calidris subminuta*)	Mi	The Long-toed Stint is an uncommon non-breeding summer migratory shorebird that occurs along the majority of the coast of Western Australia (Pizzey and Knight 2007). It inhabits the weedy margins of shallow wetlands - coastal and inland, sewerage ponds and tidal mudflats (Pizzey and Knight 2007).	The Survey area does not contain any shallow wetlands, sewerage ponds or tidal mudflats which are the preferred habitat for this species.	Unlikely
Great Knot (*Calidris tenuirostris*)	Mi	The Great Knot is a summer non-breeding migratory shorebird that occurs along most of the coast of Western Australia. It inhabits larger inter-tidal mud and sand flats (Geering, Agnew and Harding 2007).	Although this species' preferred habitat does not exist, it may utilise the shoreline of the Survey area during its migration.	Possible
Pin-tailed Snipe (*Gallinago stenura*)	Mi	The Pin-tailed Snipe is an uncommon migratory shorebird in Australia. This species is usually found in freshwater wetlands such as swamps, soaks, river pools, floodwaters and sewerage ponds (Geering, Agnew and Harding 2007).	The Survey area does not contain the preferred habitat of this species.	Unlikely
Broad-billed Sandpiper (*Limicola falcinellus*)	Mi	The Broad-billed Sandpiper is a scarce summer migrant to coastal areas through out Western Australia and occasionally inland areas (Pizzey and Knight 2007). It inhabits estuarine flats, coastal salt lakes and drying fresh water lakes (Johnstone and Storr 1998).	The Survey area does not contain the preferred habitat of this species.	Unlikely

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
Asian Dowitcher (*Limnodromus semipalmatus*)	Mi	The Asian Dowitcher is a relatively uncommon migratory shorebird in Western Australia. This species usually occurs solitarily or in very small flocks usually on intertidal mudflats. The Asian Dowitcher is a large shorebird with long legs and long straight slightly dropped bill (Geering, Agnew and Harding 2007).	The Survey area does not contain intertidal mudflats which are the preferred habitat of this species.	Unlikely
Black-tailed Godwit (*Limosa limosa*)	Mi	The Black-tailed Godwit is an uncommon summer non-breeding migratory shorebird that occurs along most of the coast of Western Australia (Geering, Agnew and Harding 2007). It inhabits fresh and brackish wetlands as well as inter-tidal mudflats (Geering, Agnew and Harding 2007). This Migratory bird breeds of the coast of Mongolia and Siberia. It migrates to Australian waters in September to May (Pizzey and Knight 2007).	The Survey area does not contain inhabits fresh or brackish wetlands or any intertidal mudflats which are the preferred habitat of this species.	Unlikely
Bar-tailed Godwit (*Limosa lapponica*)	Mi	The Bar-tailed Godwit a relatively common summer non-breeding migratory shorebird that occurs along most of the coast of Western Australia and typically inhabits inter-tidal mudflats (Geering, Agnew and Harding 2007).	The Survey area does not contain intertidal mudflats which are the preferred habitat of this species.	Unlikely
Eastern Curlew (*Numenius madagascariensis*)	Mi, P4	The Eastern Curlew is a large non-breeding migratory shorebird, found commonly along the north coast of Western Australia, but rarely south of Shark Bay. It inhabits a range of coastal habitats, but primarily inter-tidal mudflats, particularly on exposed seagrass beds or mudflats feeding on burrowing crabs or shrimps (Geering, Agnew and Harding 2007).	The Survey area does not contain intertidal mudflats which are the preferred habitat of this species.	Unlikely
Little Curlew (*Numenius minutus*)	Mi	The Little Curlew is a medium sized shorebird and is typically found on short, dry grasslands. Flocks are highly mobile moving unpredictably according to grassland conditions, often congregating in wetlands to drink when conditions are hot. This species breeds in north-east Siberia and migrates to the sub-coastal plains of northern Australia during summer (Geering, Agnew and Harding 2007).	The Dunes habitat of the Survey area is suitable habitat for this species.	Possible
Whimbrel (*Numenius phaeopus*)	Mi	The Whimbrel is a large non-breeding migratory shorebird, found commonly along the north coast of Western Australia, but less commonly south of Shark Bay (Geering, Agnew and Harding 2007). This species typically inhabits mudflats of estuaries or lagoons (Morcombe 2000).	An individual was recorded foraging in the Shoreline habitat of the Survey area.	Recorded

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
Red-necked Phalarope (*Phalaropus lobatus*)	Mi	In Australia this species is usually found on shallow, near-coastal wetlands, in water ranging from fresh to saline. The Red-necked Phalarope is a small distinctive marine shorebird with small slender neck and short, straight needle-like bill (Geering, Agnew and Harding 2007).	The Shoreline of the Survey area provides suitable habitat for this species.	Likely
Australian Painted Snipe (*Rostratula australis*)	VU, S1	The Australian Painted Snipe has a disjunct population across Western Australia, inhabiting inland and coastal shallow freshwater wetlands, including dams. Its low population numbers are threatened by wetland drainage and the diversion of water from rivers (Johnstone and Storr 1998).	The Survey area does not contain the preferred habitat of this species.	Unlikely
Grey-tailed tattler (*Tringa brevipes*)	Mi	The Grey-tailed Tattler is a non-breeding migratory shorebird, common on the north and west coasts of Western Australia, but rare on the south coast (Geering, Agnew and Harding 2007). It inhabits sheltered coasts with reef and rock platforms or with inter-tidal mudflats (Morcombe 2000).	The Shoreline of the Survey area provides suitable habitat for this species.	Likely
Wood Sandpiper (*Tringa glareola*)	Mi	The Wood Sandpiper is a summer non-breeding migratory shorebird that occurs along the coast and inland regions of Western Australia. It primarily inhabits freshwater wetlands and rarely inter-tidal mudflats (Geering, Agnew and Harding 2007).	The Survey area does not contain the freshwater wetlands or intertidal mudflats which are the preferred habitat of this species.	Unlikely
Common Greenshank (*Tringa nebularia*)	Mi	The Common Greenshank, is a non-breeding migratory shorebird, common along most of the coast of Western Australia (Geering, Agnew and Harding 2007). It inhabits intertidal mudflats, as well as fresh and saltwater wetlands of the coast or inland (Geering, Agnew and Harding 2007).	The Survey area does not contain the freshwater wetlands or intertidal mudflats which are the preferred habitat of this species.	Unlikely
Marsh Sandpiper (*Tringa stagnatilis*)	Mi	The Marsh Sandpiper is a summer non-breeding migratory shorebird that occurs along the coast and interior of Western Australia but in the south-west less frequently inland. It inhabits freshwater or saltwater wetlands but avoids open beaches and mudflats unless well protected (Geering, Agnew and Harding 2007).	Although this species' preferred habitat does not exist, it may utilise the shoreline of the Survey area during its migration.	Possible

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
Terek Sandpiper (*Xenus cinereus*)	Mi	The Terek Sandpiper is a summer non-breeding migratory shorebird that occurs along the north coast of Western Australia, but rarely south of Shark Bay. It inhabits exposed sea-grass beds in estuaries and bays or on inter-tidal mudflats fringed by mangroves (Geering, Agnew and Harding 2007).	Although this species' preferred habitat does not exist, it may utilise the shoreline of the Survey area during its migration.	Possible
Bush Stone-curlew (*Burhinus grallarius*)	P4	The Bush Stone-curlew inhabits dry open woodlands with a groundcover of small sparse shrubs, grass or litter of twigs. It tends to avoid dense forest, closed-canopy habitats (Morcombe 2000). This species generally occurs near a watercourse or swamp (Geering, Agnew and Harding 2007). Bush Stone-curlews are locally rare because of predation by foxes, the main concern for their regional decline (Johnstone and Storr 1998).	Although the Dunes habitat contains suitable habitat for this species the isolation of the island and the development over most of the island has left the habitats disjunct.	Unlikely
Greater Sand Plover (*Charadrius leschenaultii*)	Mi	The Greater Sand Plover is a summer non-breeding migratory shorebird that is common on the north and west coast of Western Australia. It inhabits exposed sand and mud flats (Geering, Agnew and Harding 2007).	The Shoreline of the Survey area provides suitable habitat for this species.	Likely
Lesser Sand Plover (*Charadrius mongolus*)	Mi	The Lesser Sand Plover is a summer non-breeding migratory shorebird that occurs on the north and west coast of Western Australia, but rarely south of Shark Bay. It inhabits exposed sand and mud flats and often intermingles with flocks of the Greater Sand Plover (Geering, Agnew and Harding 2007).	The Shoreline of the Survey area provides suitable habitat for this species.	Likely
Oriental Plover (*Charadrius veredus*)	Mi	The Oriental Plover occurs in the Kimberley and in the north-eastern interior at Lake Gregory and the north-west coastal plains (Johnstone and Storr 1998). This species is typically found on sparsely vegetated plains including samphire (in spinifex plains particularly after fire) as well as beaches.	The Dunes habitat of the Survey area is suitable habitat for this species.	Possible
Pacific Golden Plover (*Pluvialis fulva*)	Mi	The Pacific Golden Plover is a common summer migrant that has a widespread distribution along the West Australian coast. It inhabits salt or brackish marshes and near coastal salt lakes (Johnstone and Storr 1998). This Migratory bird breeds in Siberia and Alaska and migrates to Australian waters in August to April (Pizzey and Knight 2007). This species requires marine waters for habitat such as beaches, mudflats and among rocky areas; sometimes inland (Simpson and Day 2004).	The Shoreline of the Survey area provides suitable habitat for this species.	Likely

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
Grey Plover (*Pluvialis squatarola*)	Mi	The Grey Plover inhabits coastal areas, preferring marine shores of estuaries or lagoons on broad open mudflats, sandy bars or beaches and rocky coasts as well as coastal salt lakes and swamps (Morcombe 2000). They occasionally are found in drying freshwater lakes (Johnstone and Storr 1998).	The Shoreline of the Survey area provides suitable habitat for this species.	Likely
Oriental Pratincole (*Glareola maldivarum*)	Mi	The Oriental Pratincole occurs in the Kimberley and along the northern coast of Western Australia, and is a summer migrant. It occurs around tidal flats and floodwaters where it feeds aerially on flying insects and roosts on bare ground (Johnstone and Storr 1998).	Although suitable habitat does not exist, this species may utilise the shoreline of the Survey area during its migration.	Possible
White-winged Black Tern (*Chlidonias leucoptera*)	Mi	The White-winged Black Tern is a non-breeding migratory Tern that occurs regularly in northern Western Australia and rarely in the southern half of Western Australia (Barrett *et al.* 2003). It inhabits coastal marine habitats (such as estuaries, lagoons and harbours) and near-coastal freshwater wetlands (such as river pools, billabongs and inundated floodplains (Morcombe 2000).	The Shoreline of the Survey area provides suitable habitat for this species.	Likely
Little Tern (*Sterna albifrons*)	Mi	The Little Tern is distributed along the northern coast of Western Australia south to Broome. There are three sub populations that occur, two that breed in Australia and the third that migrates north to breed in Asia but spends the spring/summer in Australia (DEWHA 2010e). This species inhabits coastal and estuarine areas, breeding on sandy beaches and sand spits (Simpson and Day 2004).	The Shoreline of the Survey area provides suitable habitat for this species.	Likely
Lesser Crested Tern (*Sterna bengalensis*)	Mi	The Lesser Crested Tern is distributed along the north-western and upper west coasts of Western Australia and occasionally comes as far south as Shark Bay. This species inhabits mainly blue water seas around islands or reefs and commonly visits tidal creeks. It breeds on the many small islands found along the north-west coast (Johnstone and Storr 1998).	The Shoreline of the Survey area provides suitable habitat for this species.	Likely
Caspian Tern (*Sterna caspia*)	Mi	The Caspian Tern is distributed along the coast of Western Australia. It is scarce or uncommon north of Broome and uncommon to moderately common further south (Johnstone and Storr 1998). This species inhabits coastal areas as well as inland watercourses, saline and brackish lakes (Simpson and Day 2004).	Five individuals were recorded in the Shoreline habitat of the Survey area.	Recorded

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
Fork-tailed Swift (*Apus pacificus*)	Mi	The Fork-tailed Swift is a summer migrant (October-April) to Australia, that has not been recorded breeding in Australia (Barrett *et al*. 2003). The Fork-tailed Swift is an aerial species, which forages high above the tree canopy and rarely lower so is independent of terrestrial habitats in Australia (Johnstone and Storr 1998). It usually occurs in flocks of up to 2000 and is often seen accompanying Tree Martins and Masked Woodswallows (Johnstone and Storr 1998).	It is possible that the Fork-tailed Swift passes through the Survey area on a transitory basis. However, it is unlikely to use the habitats in the Survey area.	Possible
Rainbow Bee-eater (*Merops ornatus*)	Mi	The Rainbow Bee-eater is a common and widespread species in Western Australia, occurring in lightly wooded, often sandy country, preferring areas near water. This species feeds on airborne insects, and nests throughout its range in Western Australia in burrows excavated in sandy ground or banks, often at the margins of roads and tracks (Johnstone and Storr 1998).	The Rainbow Bee-eater may forage within the Survey area; however it is unlikely to use habitats of the Survey area for any breeding or sheltering purpose.	Likely
Barn Swallow (*Hirundo rustica*)	Mi	The Barn Swallow is a migratory species that breeds in north-east Asia, and is a rare visitor to northern coastal northern Western Australia from September to early April (Johnstone and Storr 2004). They occur in ones or twos or in small flocks up to 15 (or occasionally large flocks in the 100's) and sometimes attached to flocks of Welcome Swallows (Johnstone and Storr 2004). They forage mainly near towns and wetlands such as sewage and salt work ponds, river pools, swamps, tidal creeks and reservoirs (Johnstone and Storr 2004). They forage aerially on insects and nest in caves, cliffs under bridges and in buildings (Morcombe 2000).	It is possible that the Barn Swallow may forage within the Survey area. However, it is unlikely to use habitats of the Survey area for any breeding or sheltering purpose.	Possible
Star Finch (*Neochmia ruficauda* subsp. *Subclarescens*)	P4	The western subspecies of the Star Finch is confined to the Pilbara region of Western Australia (Pizzey and Knight 2007). The species occurs in grasslands with sparse vegetation, and feeds mainly on grass seeds and some small insects (Johnstone and Storr 2004). Like most finches this species needs regular water, so is likely to occur near permanent fresh water for most of the season then disperse out to a wider area during and after the wet season when ephemeral pools have water.	The lack of permanent fresh water suggests that the Survey area is unsuitable for this species.	Unlikely

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
MAMMALS				
Brush-tailed Mulgara (*Dasycercus blythi*)	P4	Brush-tailed Mulgara has recently been reviewed and has had its name changed from *Dasycercus cristicauda* which is listed as Vulnerable (EPBC Act) and as Schedule 1 (WC Act) to *Dasycercus blythi*. Currently the name *Dasycercus blythi* is only listed as Priority 4 by the DEC, with any updates yet to be made to the *EPBC Act* (*pers comm.* S. Peacock DEWHA). This species is found in central Western Australia in sandy regions, living in burrows (van Dyck and Strahan 2008). The DEC Threatened and Priority Database search returned one record of *Dasycercus blythi*, with the record being in 2008 at Boodarie (DEC 2010d).	Due to the isolation of the Survey area, level of development on Finucane Island and the disjunctive nature of the habitat types present, it is unlikely that this species would occur.	Unlikely
Crest-tailed Mulgara (*Dasycercus cristicauda*)	VU, S1	The Crest-tailed Mulgara (*Dasycercus cristicauda*) is a small carnivorous marsupial, now possibly extinct in Western Australia, where the most recent confirmed records are more than 50 years old (DEC 2010d), but it may persist in other parts of central Australia. Its position is uncertain because it is often confused with the closely-related Mulgara (*Dasycercus blythi*). Its habitat is grassland (especially Spinifex), and it persists in parts of north-western South Australia and south-eastern Northern Territory. It is threatened by loss of habitat and competition from introduced grazers (Menkhorst and Knight 2001).	This species is thought to be extinct in Western Australia.	Highly Unlikely
Northern Quoll (*Dasyurus hallucatus*)	EN, S1	The Northern Quoll occurs mainly in areas of open Eucalypt woodland within 200 km of the coast, although it has been recorded in a range of vegetation types, and is known to den in rock crevices. It favours rocky areas, taking refuge in rock crevices, and utilises gullies and drainage lines (van Dyck and Strahan 2008). The Northern Quoll may be locally common, but its former range has retracted considerably (van Dyck and Strahan 2008).	No suitable habitat is present in the Survey area. Possibly occurs in the greater Port Hedland area, but unlikely to use the Survey area.	Unlikely
Greater Bilby (*Macrotis lagotis*)	VU, S1	The Greater Bilby is confined to arid and semi arid parts of northern Australia and in Western Australia is limited to the Great Sandy Desert, Gibson Desert and Pilbara (van Dyck and Strahan 2008, DEWHA 2010e). It is now locally extinct from the southern half of Western Australia (DEHWA 2010e). The Greater Bilby occurs in tall shrublands and open woodlands in semi-arid regions, and hummock grasslands in arid Australia (DEWHA 2010e). The	The current distribution of this species does not extend far enough south to include the Survey area (van Dyck and Strahan 2008).	Unlikely

Conservation Significant Species	Conservation Status	Distribution and Ecology	Habitat Relevance	Likelihood
		presence of the Greater Bilby is characterised by its feeding habits, evident from the numerous scattered excavations up to 10 cm deep it leaves behind, from which soil has been scattered on all sides.		
Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*)	VU, S1	The Pilbara Leaf-nosed Bat (*Rhinonicteris aurantia*) requires deep caves or disused mine shafts in which to roost (van Dyck and Strahan 2008), at least in the dry season. These bats have been recorded in isolated populations in the Pilbara, and are present only where suitable roosting niches are available. They are generally sparsely distributed.	The foraging range of the Pilbara Leaf-nosed Bat is unlikely to extend far enough to include Finucane Island. Furthermore there are no suitable roosting locations in the vicinity of the Survey area.	Unlikely
Little Northern Freetail-bat (*Mormopterus loriae cobourgensis*)	P1	The Little Northern Freetail-bat inhabits mangrove communities, roosting in crevices and sprouts of the dead upper branches of the mangrove *Avicennia marina* (van Dyck and Strahan 2008). The genus for this species is in the process of being renamed in a recent taxonomic review of molossids by Terry Reardon, which has shown the genus *Mormopterus* does not occur in Australia (Churchill 2008).	The Survey area does not contain mangroves which is the preferred habitat for this species.	Unlikely
Lakeland Downs Mouse (*Leggadina lakedownensis*)	P4	The Lakeland Downs Mouse (*Leggadina lakedownensis*) occurs in a range of habitat types on seasonally inundated sandy-clay soils (van Dyck and Strahan 2008). In the Pilbara it occurs on stony hummock grasslands (Menkhorst and Knight 2001). It is generally rare, with scattered populations, and very little is known of its biology (van Dyck and Strahan 2008).	Due to the level of development on Finucane Island and the disjunctive nature of the habitat types present it is unlikely that this species would occur.	Unlikely
Western Pebble-mound Mouse (*Pseudomys chapmani*)	P4	The Western Pebble-mound Mouse is endemic to the Pilbara, and is confined to the central and eastern Pilbara, including Karijini National Park (Menkhorst and Knight 2001). Abandoned mounds to the east of its current range indicate a decline in distribution (van Dyck and Strahan 2008). Abandoned mounds are common in some areas, possibly as a result of land degradation from grazing and mining activities.	The Survey area is well outside of the known distribution for this species.	Unlikely

Key:

En	Listed as Endangered under the *EBPC Act* 1999
Vu	Listed as Vulnerable under the *EBPC Act* 1999.
S	Scheduled under the *WC Act* 1950.
P	Listed as Priority by the DEC.
Mi	Listed as Migratory under the *EBPC Act* 1999.
Recorded	Recorded during the field survey or site reconnaissance.
Likely	Suitable habitat is present in the Survey area and the Survey area is in the species known distribution.
Possible	Limited or no suitable habitat is present in Survey area but is nearby, the species has good dispersal abilities and is known from the general area.
Unlikely	No suitable habitat is present in Survey area but is nearby. The species has poor dispersal abilities, but is known from the general area; or suitable habitat is present, however the Survey area are outside of the species' known distribution.
Highly Unlikely	The species has poor dispersal abilities, no suitable habitat is present, and the species is uncommon; or the species is thought to be locally extinct.

6.4.2 Importance of Potentially Occurring Conservation Significant Fauna

No conservation significant Amphibians, Reptiles, or Mammals are considered as 'possibly' or 'likely' to utilise the habitats present in the Survey area. However, five migratory species, the Eastern Reef Egret (*Egretta sacra*), Eastern Osprey (*Pandion haliaetus*), Ruddy Turnstone (*Arenaria interpres*), Whimbrel (*Numenius phaeopus*) and the Caspian Tern (*Sterna caspia*) were recorded in the Survey area during the survey. Thirty-five migratory and two Priority listed bird species (Peregrine Falcon (*Falco peregrinus*) and Australian Painted Snipe (*Rostratula australis*)) are classified as 'possibly' or 'likely' to utilise the habitats present in the Survey area.

Migratory marine birds such as the Whimbrel (*Numenius phaeopus*) and Ruddy Turnstone (*Arenaria interpres*) may be impacted by disturbances in the Survey area. The Shoreline habitat of the Survey area is likely to attract an abundance of bird species as part of their migratory route. The limestone tidal platforms and sandy beaches are foraging and roosting sites for these species. Any increased traffic along the existing four-wheel drive track in the Survey area is likely to increase disruption to the feeding and roosting habits of these species.

Migratory marine birds such as the White bellied Sea Eagle (*Haliaeetus leucogaster*), Eastern Osprey (*Pandion haliaetus*), Eastern Reef Egret (*Egretta sacra*), Caspian Tern (*Sterna caspia*) and White-winged Black Tern (*Chlidonias leucoptera*), and terrestrial migratory birds such as the Fork-tailed Swift (*Apus pacificus*), Barn Swallow (*Hirundo rustica*) and Rainbow Bee-eater (*Merops ornatus*), are not expected to be impacted by the clearing of a small area of foraging habitat. This is due to the extent of similar habitat within the vicinity of the Survey area and the relativity small size of foraging habitat that will be lost.

The Peregrine Falcon (*Falco peregrinus*) is not thought to be impacted by the clearing of habitats within the Survey area for a number of reasons. This species is mobile and transitory, so is unlikely to occur in the Survey area on a regular basis. Habitat for this bird is also well represented outside the Survey area, and the habitat present is of a small size and fragmented. Therefore, impact is likely to be low.

The Australian Painted Snipe (*Rostratula australis*) is not thought to be impacted by the clearing of habitats within the Survey area. The Survey area does not contain a fresh water marsh or swamp which is the preferred habitat for this species. Therefore, it is only expected to occur intermittently as part of its migratory route and impact to this species is considered to be low.

7 SUMMARY

One Priority Flora taxon, *Tephrosia rosea* var. *venulosa* (Priority 1) was recorded in the Survey area. The boundaries of this taxons' populations were mapped in the Survey area.

No other Conservation Significant Flora was recorded in the Survey area. However, three additional Priority Flora may occur in the Survey area, which may have been absent at the time of survey due to the survey being conducted during suboptimal conditions. These include: *Gomphrena pusilla* (Priority 2), *Pterocaulon* sp. A Kimberley Flora (B.J. Carter 599) (Priority 2) and *Goodenia nuda* (Priority 4).

The condition of vegetation in the Survey area was considered to be Good or Degraded, as a result of historic and present disturbances. Eight introduced flora were recorded in the Survey area. One introduced species recorded in the Survey area, **Opuntia stricta* (Prickly Pear), is listed as a Declared Plant under the *ARRP Act* 1976. This species is listed as P1 and P2 for the Port Hedland area.

No vegetation associations in the Survey area are considered to represent TECs, PECs or ESAs. No vegetation associations in the Survey area are groundwater dependent ecosystems. The regional representation of the vegetation associations present in the Survey area are unlikely to be compromised by disturbances within the Survey area.

Five conservation significant fauna were recorded in the Survey area during the survey, all of which are migratory birds. These were the Eastern Reef Egret (*Egretta sacra*), Eastern Osprey (*Pandion haliaetus*), Ruddy Turnstone (*Arenaria interpres*), Whimbrel (*Numenius phaeopus*) and the Caspian Tern (*Sterna caspia*). Thirteen migratory bird species are classified as 'likely' to utilise the habitats present in the Survey area.

Two natural Fauna habitats were mapped in the Survey area, Dunes and Shoreline. A further habitat type, Rehabilitated, was also mapped in the Survey area. There were also areas that were Cleared / Developed, which had no habitat value. The Shoreline habitat was given high habitat value due to its importance as a site for migratory marine birds. This habitat provides shelter, foraging and roosting sites for migratory bird species during their migration. During the survey it was noted that this habitat type is under represented in the broader area.

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FIGURES

Indian
Ocean

Survey Area
Location

PORT HEDLAND

HIGHWAY

NORTH WEST COASTAL HIGHWAY

NORTHERN

GREAT

N

0 10 20 30 40 50

Kilometres

WA Location

Indian
Ocean

Derby
Broome
Figure 1
Area
Karratha
Port Hedland
Exmouth

WESTERN
AUSTRALIA

Geraldton
Kalgoorlie
PERTH
Bunbury
Albany

env Australia

CLIENT		JOB NO.
BHP Biliton Iron ore		10.145
AUTHOR	DRAWN	DATE
T. Edwards	S. Rho	09-09-2010
SCALE	PROJECTION	
1:1 000 000 @ A3	GDA49 MGA50	

Regional Location

Hunt Point Beach Flora and Vegetation and Fauna Assessment

FIGURE 1

CLIENT		JOB NO.
BHP Biliton Iron Ore		10.145
AUTHOR:	DRAWN	DATE
T. Edwards	S. Rho	09-09-2010
SCALE	PROJECTION	
1:5,000 @ A3	GDA 94 MGA 50	

env Australia

Flora Survey Quadrat and Releve Locations

Hunt Point Beach Flora and Vegetation and Fauna Assessment

FIGURE 3

env Australia

CLIENT	JOB NO.
BHP Biliton Iron Ore	10.145
AUTHOR: / DRAWN	DATE
T. Edwards / S. Rho	09-09-2010
SCALE	PROJECTION
1:5,000 @ A3	GDA 94 MGA 50

Locations of Conservation Significant Flora

Hunt Point Beach Flora and Vegetation and Fauna Assessment

FIGURE 4

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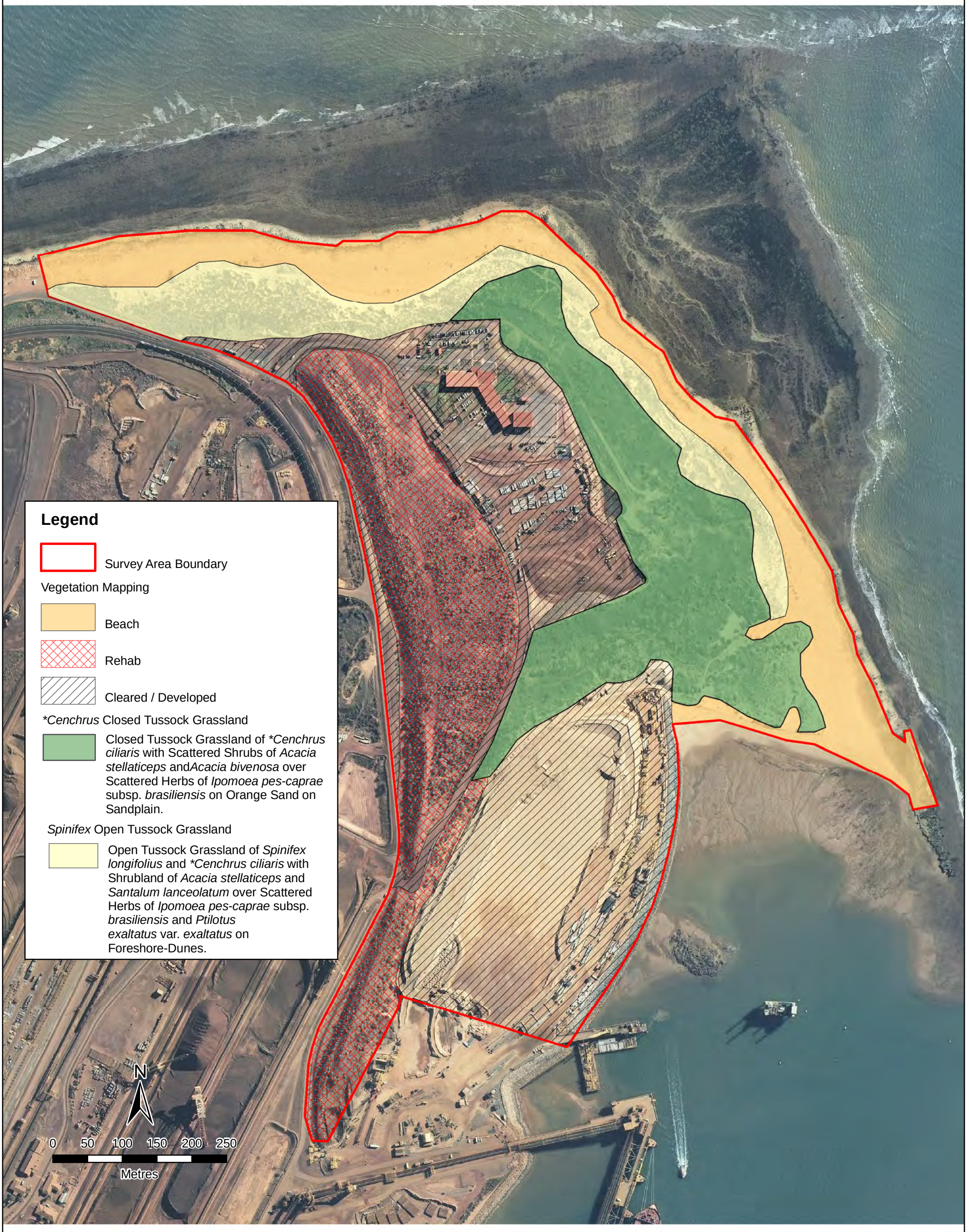
CLIENT	JOB NO.
BHP Biliton Iron Ore	10.145
AUTHOR: / DRAWN	DATE
T. Edwards / S. Rho	09-09-2010
SCALE / PROJECTION	
1:5,000 @ A3 / GDA 94 MGA 50	

Locations of Introduced Flora

Hunt Point Beach Flora and Vegetation and Fauna Assessment

FIGURE 5



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CLIENT	JOB NO.
BHP Biliton Iron Ore	10.145
AUTHOR: / DRAWN	DATE
T. Edwards / S. Rho	09-09-2010
SCALE / PROJECTION	
1:5,000 @ A3 / GDA 94 MGA 50	

Vegetation Mapping

Hunt Point Beach Flora and Vegetation and Fauna Assessment

FIGURE 6

CLIENT: BHP Biliton Iron Ore
JOB NO.: 10.145
AUTHOR: T. Edwards
DRAWN: S. Rho
DATE: 09-09-2010
SCALE: 1:5,000 @ A3
PROJECTION: GDA 94 MGA 50

Vegetation Condition Mapping

Hunt Point Beach Flora and Vegetation and Fauna Assessment

FIGURE 7

env Australia

CLIENT	JOB NO.
BHP Biliton Iron Ore	10.145
AUTHOR: T. Edwards	DRAWN S. Rho
DATE 09-09-2010	
SCALE 1:5,000 @ A3	PROJECTION GDA 94 MGA 50

Fauna Habitat Map

Hunt Point Beach Flora and Vegetation and Fauna Assessment

FIGURE 8

CLIENT		JOB NO.	
BHP Biliton Iron Ore		10.145	
AUTHOR:	DRAWN	DATE	
T. Edwards	S. Rho	09-09-2010	
SCALE	PROJECTION		
1:5,000 @ A3	GDA 94 MGA 50		

env Australia

Locations of Conservation Significant Fauna

Hunt Point Beach Flora and Vegetation and Fauna Assessment

FIGURE 9

APPENDIX A

DEFINITION OF FLORA AND FAUNA CONSERVATION CODES AND POTENTIALLY OCCURRING FLORA OF SIGNIFICANCE

APPENDIX A

DEFINITIONS OF FLORA AND FAUNA CONSERVATION CODES AND POTENTIALLY OCCURRING FLORA OF SIGNIFICANCE

A1: Categories of Declared Rare and Priority Flora

Conservation Code	Category
X	**Declared Rare Flora - Presumed Extinct Taxa** Taxa which have not been collected, or otherwise verified, over the past 50 years despite thorough searching, or of which all known wild populations have been destroyed more recently, and have been gazetted as such.
R	**Declared Rare Flora - Extant Taxa** "Taxa which have been adequately searched for and are deemed to be in the wild either rare, in danger of extinction, or otherwise in need of special protection and have been gazetted as such"
P1	**Priority One - Poorly Known Taxa** "Taxa which are known from one or a few (generally <5) populations which are under threat, either due to small population size, or being on lands under immediate threat, e.g. road verges, urban areas, farmland, active mineral leases, etc., or the plants are under threat, e.g. from disease, grazing by feral animals, etc. May include taxa with threatened populations on protected lands. Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey."
P2	**Priority Two - Poorly Known Taxa** "Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat (i.e. not currently endangered). Such taxa are under consideration for declaration as 'rare flora', but urgently need further survey."
P3	**Priority Three - Poorly Known Taxa** "Taxa which are known from several populations, and the taxa are not believed to be under immediate threat (i.e. not currently endangered), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but need further survey."
P4	**Priority Four - Rare Taxa** "Taxa which are considered to have been adequately surveyed and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5-10 years."

Source: Department of Environment and Conservation (2010). *Western Australian Flora Conservation Codes*. Department of Environment and Conservation, Perth, Western Australia. Online: http://florabase.calm.wa.gov.au.

A2: Categories of Threatened Flora Species

Category Code	Category
Ex	**Extinct** Taxa which at a particular time if, at the time, there is no reasonable doubt that the last member of the species has died**.**
ExW	**Extinct in the Wild** Taxa which is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
CE	**Critically Endangered** Taxa which at a particular time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
E	**Endangered** Taxa which is not critically endangered and it is facing a very high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
V	**Vulnerable** Taxa which is not critically endangered or endangered and is facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
CD	**Conservation Dependent** Taxa which at a particular time if, at that time, the species is the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within a period of 5 years.

Source: Environment Protection and Biodiversity Conservation Act 1999

A3: Significant Flora Species Potentially Occurring in the Project Area

Species	Code	Description (WAH 2010)
Abutilon pritzelianum	P1	Shrub, 1–1.5 m high with yellow, orange flowers. Found on red sand dunes.
Atriplex eremitis	P1	Shrub 0.3 m high; leaves grey, elliptic; fruit rhomboid to deltoid with 3 rounded lobes at the apex. Found in open tussock grassland on low sand plains or saline plains.
Heliotropium muticum	P1	Ascending to spreading perennial, herb to 0.3 m high.
Ptilotus appendiculatus* var. *minor	P1	Prostrate or ascending perennial, herb or shrub.
Tephrosia rosea* var. *venulosa	P1	Erect shrub to 1.7 m high with red, purple flowers. Found on red sand and near creeks.
Gomphrena pusilla	P2	Slender branching annual, herb to 0.2 m high with white flowers. Found on fine beach sand, behind foredunes and on limestone.
***Pterocaulon* sp. A Kimberley Flora (B.J. Carter 599)**	P2	Compact shrub to 0.5 m high with blue, purple, flowers. Found on sand, sandy saline flats and pindan sandplain in coastal areas.
Gymnanthera cunninghamii	P3	Erect shrub to 1–2 m high with cream, yellow, green flowers. Found on sandy soils.
Polymeria distigma	P3	Prostrate trailing herb with pink flowers. Found on sandy soils.
Goodenia nuda	P4	Erect to ascending herb to 0.5 m high with yellow flowers. Found on floodplains and sandplains.

Source: Department of Environment and Conservation Database Search (July 2010) and reports listed in Section 1.3.

A4: *Environment Protection and Biodiversity Conservation Act 1999* (*Cth*): Threatened Species and Threatened Ecological Communities Codes

The *EPBC Act* prescribes seven matters of national environmental significance:-

- World Heritage properties;
- National Heritage places;
- Wetlands of international importance;
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas; and
- Nuclear actions (including uranium mining).

Species in the categories ExW, CE, E, V and M (see below), and Threatened Ecological Communities in the CE and E categories are protected as matters of national environmental significance under the *EPBC Act*.

Category	Code	Category
Extinct	**Ex**	Taxa for which there is no reasonable doubt that the last member of the species has died.
Extinct in the Wild	**ExW**	Taxa known to survive only in cultivation, in captivity or as a naturalised population well outside its past range; or not recorded in its known and/or expected habitat at appropriate seasons anywhere in its past range despite exhaustive surveys over a timeframe appropriate to its life cycle and form.
Critically Endangered	**CE**	Taxa facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered	**E**	Taxa not critically endangered and facing a very high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria.
Vulnerable	**V**	Taxa not critically endangered or endangered and facing a high risk of extinction in the wild in the medium-term future, as determined in accordance with the prescribed criteria**.**
Conservation Dependent	**CD**	Taxa which are the focus of a specific conservation program, the cessation of which would result in the species becoming vulnerable, endangered or critically endangered within five years.

Category	Code	Category
Migratory	**Mi**	Taxa that migrate to Australia and its external territories, or pass through or over Australian waters during their annual migrations, that are included in an international agreement approved by the Minister for the Environment, Heritage and the Arts and that have been placed on the national List of Migratory Species under the provisions of the EPBC Act. At present there are four such agreements: • the Bonn Convention • the China-Australia Migratory Bird Agreement (CAMBA) • the Japan-Australia Migratory Bird Agreement (JAMBA) • the Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)
Marine	**Ma**	Taxa protected in a Commonwealth Marine Protected Area by virtue of section 248 of the *EPBC Act*. These taxa include certain seals, crocodiles, turtles and birds, as well as various marine fish. Commonwealth marine areas are matters of national environmental significance under the *EPBC Act*. An action will require approval if the: • action is taken in a Commonwealth marine area and the action has, will have, or is likely to have a significant impact on the environment, or • action is taken outside a Commonwealth marine area and the action has, will have, or is likely to have a significant impact on the environment in a Commonwealth marine area[1] The Commonwealth marine area is any part of the sea, including the waters, seabed, and airspace, within Australia's exclusive economic zone and/or over the continental shelf of Australia, that is not State or Northern Territory waters. The Commonwealth marine area stretches from 3 to 200 nautical miles (approximately 5-370 km) from the coast. Marine protected areas are marine areas which are recognised to have high conservation value.

A5: Western Australian Threatened Fauna Categories

Wildlife Conservation Act 1950 (WA)

Category	Code	Description
Schedule 1	S1	Rare or likely to become extinct.
Schedule 2	S2	Presumed extinct.
Schedule 3	S3	Birds subject to an agreement between the governments of Australia and Japan, the People's Republic of China & the Republic of Korea relating to the protection of migratory birds and birds in danger of extinction.
Schedule 4	S4	Other specially protected fauna.

A6: Department of Environment and Conservation Fauna Priority Codes

Category	Code	Description
Priority 1	P1	Taxa with few, poorly known populations on threatened lands.
Priority 2	P2	Taxa with few, poorly known populations on conservation lands.
Priority 3	P3	Taxa with several, poorly known populations, some on conservation lands.
Priority 4	P4	Taxa in need of monitoring: not currently threatened or in need of special protection, but could become so. Usually represented on conservation lands.
Priority 5	P5	Taxa in need of monitoring: not considered threatened, but the subject of a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

APPENDIX B

DEFINITIONS OF THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

APPENDIX B

DEFINITIONS OF THREATENED AND PRIORITY ECOLOGICAL COMMUNITIES

B1: Definitions of Threatened Ecological Communities

Presumed Totally Destroyed (PD)

An ecological community will be listed as presumed totally destroyed if there are no recent records of the community being extant **and either** of the following applies (A or B);

A) Records within the last 50 years have not been confirmed despite thorough searches or known or likely habitats **or**

B) All occurrences recorded within the last 50 years have since been destroyed.

Critically Endangered (CR)

An ecological community will be listed as **Critically Endangered** when it has been adequately surveyed and is found to be facing an extremely high risk of total destruction in the immediate future. This will be determined on the basis of the best available information, by it meeting **any one or more** of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 90% and **either or both** of the following apply (i or ii)

   i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is imminent (within approximately 5 years)

   ii) modification throughout its range is continuing such that in the immediate future (within approximately 5 years) the community is unlikely to be capable of being substantially rehabilitated.

B) Current distribution is limited, and **one or more** of the following apply (i, ii or iii):

   i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the immediate future (within approximately 5 years)

   ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes

   iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes

C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the immediate future (within approximately 5 years)

Endangered (EN)

An ecological community will be listed as **Endangered** when it has been adequately surveyed and is not Critically Endangered but is facing a very high risk of total destruction in the near future. This will be determined on the basis of the best available information, by it meeting **any one or more** of the following criteria (A, B or C):

A) The estimated geographic range, and/or total area occupied, and/or number of discrete occurrences since European settlement have been reduced by at least 70% and **either or both** of the following apply (i or ii)

i) geographic range, and/or total area occupied and/or number of discrete occurrences are continuing to decline such that total destruction of the community is likely in the short term (within approximately 10 years)
ii) modification throughout its range is continuing such that in the short term future (within approximately 10 years) the community is unlikely to be capable of being substantially restored or rehabilitated.

B) Current distribution is limited, and **one or more** of the following apply (i, ii or iii):

i) geographic range and/or number of discrete occurrences, and/or area occupied is highly restricted and the community is currently subject to known threatening processes which are likely to result in total destruction throughout its range in the short term future (within approximately 10 years)
ii) there are very few occurrences, each of which is small and/or isolated and extremely vulnerable to known threatening processes
iii) there may be many occurrences but total area is very small and each occurrence is small and/or isolated and extremely vulnerable to known threatening processes

C) The ecological community exists only as highly modified occurrences which may be capable of being rehabilitated if such work begins in the short term future (within approximately 10 years).

Vulnerable (VU)

An ecological community will be listed as **Vulnerable** when it has been adequately surveyed and is not Critically Endangered or Endangered but is facing a high risk of total destruction in the medium to long term future. This will be determined on the basis of the best available information, by it meeting **any one or more** of the following criteria (A, B or C):

A) The ecological community exists largely as modified occurrences which are likely to be capable of being substantially restored or rehabilitated.
B) The ecological community can be modified or destroyed and would be vulnerable to threatening processes, is restricted in area and/or range and/or is only found at a few locations.

C) The ecological community may still be widespread but is believed likely to move into a category of higher threat in the medium to long term future because of existing or impending threatening processes.

Source: Department of Environment and Conservation (2010). *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*. Department of Environment and Conservation, Perth, Western Australia. Online: www.naturebase.net/

B2: Definitions of Priority Ecological Communities

Possible threatened ecological communities that do not meet survey criteria or that are not adequately defined are added to the Priority Ecological Community Lists under Priorities 1, 2 and 3. These three categories are ranked in order of priority for survey and/or definition of the community, and evaluation of conservation status, so that consideration can be given to their declaration as threatened ecological communities. Ecological Communities that are adequately known, and are rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list, are placed in Priority 4. These ecological communities require regular monitoring. Conservation Dependent ecological communities are placed in Priority 5.

Priority One: Poorly known ecological communities Ecological communities with apparently few, small occurrences, all or most not actively managed for conservation (e.g. within agricultural or pastoral lands, urban areas, active mineral leases) and for which current threats exist. Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under immediate threat from known threatening processes across their range.

Priority Two: Poorly known ecological communities. Communities that are known from few small occurrences, all or most of which are actively managed for conservation (e.g. within national parks, conservation parks, nature reserves, State forest, unallocated Crown land, water reserves, etc.) and not under imminent threat of destruction or degradation.

Communities may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements, and/or are not well defined, and appear to be under threat from known threatening processes.

Priority Three: Poorly known ecological communities

(i) Communities that are known from several to many occurrences, a significant number or area of which are not under threat of habitat destruction or degradation or:

(ii) Communities known from a few widespread occurrences, which are either large or within significant remaining areas of habitat in which other occurrences may occur, much of it not under imminent threat, or;

(iii) Communities made up of large, and/or widespread occurrences, that may or not be represented in the reserve system, but are under threat of modification across much of their range from processes such as grazing by domestic and/or feral stock, and inappropriate fire regimes.

Communities may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and/or are not well defined, and known threatening processes exist that could affect them.

Priority Four: Ecological communities that are adequately known, rare but not threatened or meet criteria for Near Threatened, or that have been recently removed from the threatened list. These communities require regular monitoring.

(a) Rare. Ecological communities known from few occurrences that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These communities are usually represented on conservation lands.

(b) Near Threatened. Ecological communities that are considered to have been adequately surveyed and that do not qualify for Conservation Dependent, but that are close to qualifying for Vulnerable.

(c) Ecological communities that have been removed from the list of threatened communities during the past five years.

Priority Five: Conservation Dependent ecological communities. Ecological communities that are not threatened but are subject to a specific conservation program, the cessation of which would result in the community becoming threatened within five years.

Source: Department of Environment and Conservation (2010). *Definitions, Categories and Criteria for Threatened and Priority Ecological Communities*. Department of Environment and Conservation, Perth, Western Australia. Online: www.naturebase.net/

APPENDIX C
DATA SHEETS

APPENDIX C

DATA SHEETS

Hunt Point Beach **Site** HPX01

Flora Assessed by TE

Date 19/08/2010

TypeQ50 m x 50 m

Location

MGA Zone 50 664111**mE,** 7754660**mN**

Habitat Sandplain/ Dunal

Soil Orange sand

Rock Type Limestone/ Ironstone/ Quartz.

Vegetation **Broad Floristic Formation**:
**Cenchrus* Grassland

Vegetation Association:
Closed Tussock Grassland of **Cenchrus ciliaris* with Scattered Shrubs of *Acacia stellaticeps* and *Acacia bivenosa* over Scattered Herbs of *Ipomoea pes-caprae* subsp. *brasiliensis* on Orange Sand on Sand Plain.

Vegetation Sub- Association: Scattered Shrubs of *Acacia bivenosa* over Closed Tussock Grassland of **Cenchrus ciliaris* with Scattered Herbs of *Ipomoea pes-caprae* subsp. *Brasiliensis* on Orange Sand on Sand Plain.

Veg Condition Degraded

Fire Age Old

Notes Aspect: N, Slight
Bare ground: 5%.
Litter cover: + Logs; + Twigs; + Lvs.
Disturbance type: Introduced Species, Tracks, Marker pegs.

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	Acacia bivenosa	2%		2 m	NC	S
	Acacia stellaticeps	+		0.5 m	TP01-01	S
	Adriana tomentosa var. *tomentosa*	+		1 m	HPX01- 08	S
	**Aerva javanica*	+		0.6 m	TPOP04	F, H

**Cenchrus ciliaris*	90%	0.5 m	TPOP01	F, G
Cleome viscosa	+	0.2	HPX01- 07	H
Corchorus incanus subsp. *incanus*	+	0.5 m	HPX01- 02	S
Dactyloctenium radulans	+	<0.1 m	HPX01- 06	H
Eucalyptus camaldulensis subsp. *refulgens*	+	3 m	HPX01- 04	T
**Indigofera sessiliflora*	+	<0.1 m	HPX01- 03	S
Ipomoea pes-caprae subsp. *brasiliensis*	1%	0.5 m	HPX01- 01	H
Rhagodia eremaea	N/A	+	NC	S, AS
Rhynchosia minima	+	CL	HPX01- 10	As
Spinifex longifolius	+	0.8 m	HPX01- 09	G
Threlkeldia diffusa	+	0.2 m	HPX01- 05	S

Hunt Point Beach **Site** HPX02
Flora Assessed by TE

Date19/08/2010

Type Q100 m x 25 m

Location

MGA Zone 50 663441**mE,** 7754997**mN**
Habitat Coast, Dunal, Foreshore
Soil Sandy
Rock Type N/A
Vegetation **Broad Floristic Formation:**
Spinifex Open Grassland
Vegetation Association:
Open Tussock Grassland of *Spinifex longifolius* and **Cenchrus ciliaris* with Shrubland of *Acacia stellaticeps* and *Santalum lanceolatum* over Scattered Herbs of *Ipomoea pes-caprae* subsp. *brasiliensis* and *Ptilotus exaltatus* var. *exaltatus* on Foreshore.
Vegetation Sub- Association:
Open Tussock Grassland of *Spinifex longifolius* and **Cenchrus ciliaris* with Shrubland of *Acacia stellaticeps* and *Santalum lanceolatum* over Scattered Herbs of *Ipomoea pes-caprae* subsp. *brasiliensis* and *Ptilotus exaltatus* var. *exaltatus* on Foreshore.
Veg Condition Very Good - Good.
Fire Age Old
Notes Aspect: N
Bare ground: 20%.
Litter cover: 2% Logs; + Twigs; 1% Lvs.
Disturbance type: Introduced Species, Rubbish, Historically Cleared, Only One Tephrosia in the Area.

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	Acacia bivenosa	N/A		2 m	NC	S, As
	Acacia stellaticeps	20%		0.5 m	TP01- 01	S
	Adriana tomentosa var. *tomentosa*	N/A		1 m	HPX01- 08	S, As
	Amaranthus clementii	+		0.3 m	HPX02- 01	H
	Cassytha capillaris	+		CL	TP01- 11	H
	**Cenchrus ciliaris*	10%		0.5 m	TPOP01	G
	Cleome viscosa	+		0.1 m	HPX01- 07	H

Eragrostis xerophila	+	0.3 m	HPX02- 05	H
Euphorbia tannensis subsp. *eremophila*	+	0.2 m	HPXR03- 03	H
Gomphrena canescens subsp. *canescens*	+	0.2 m	HPX02- 03	H
Ipomoea pes-caprae subsp. *brasiliensis*	1%	CL	HPX01- 01	H
**Portulaca oleracea*	+	0.5 m	TPOP03	H
Ptilotus exaltatus var. *exaltatus*	1%	1 m	HPXR03- 01	H
Salsola tragus subsp. *grandiflora*	+	0.1 m	HPX02- 04	H
Salsola tragus subsp. *grandiflora*	+	0.2 m	HPX02- 02	H
Santalum lanceolatum	5%	2 m	HPXR03- 04	S
Spinifex longifolius	10%	0.5 m	HPX01- 09	G
Tephrosia rosea var. *venulosa* MS	+	0.5 m	HPXR02- 07	S

Hunt Point Beach **Site** HPXR01

Flora Assessed by TE

Date 19/08/2010 **Type** R

Location

MGA Zone 50 663741**mE,** 7754562**mN**
Habitat Rehabilitated - Hill
Soil Red Brown Loamy (Gullys)
Rock Type Mixed. (Limestone, Ironstone,quartz)
Rehabilitated area:
Scattered Shrubs *of Acacia ampliceps* and *Casuarina obesa* over Scattered Tussock Grass of **Cenchrus ciliaris* on Red Brown Loamy (Gullys) on Rehabilitated – Low Hill.
Veg Condition Good (Rehabilitated)
Fire Age N/A
Notes Aspect: E.
Bare ground: 95%.
Litter cover: + Logs; + Twigs; + Lvs.

Disturbance type: Rehabilitated area, irrigation lines, Introduced species, Port infrastructure

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	Acacia ampliceps	2%		2 m	HPXR01- 02	S
	Acacia bivenosa				NC	S
	Acacia pyrifolia	+		1.5 m	HPXR01- 04	S
	Casuarina obesa	2%		2.5 m	HPXR01- 01	S
	**Cenchrus ciliaris*	1%		0.5 m	TPOP01	F, G
	Pluchea tetranthera	+		0.5 m	HPXR01- 03	H
	**Portulaca oleracea*	+		0.5 m	TPOP03	H
	Salsola tragus subsp. *grandiflora*	+		0.5 m	HPX02- 02	H

Hunt Point Beach **Site** HPXR02

Flora Assessed by TE

Date 19/08/2010 **Type** R

Location

MGA Zone 50 664025**mE,** 7754517**mN**

Habitat Sandplain

Soil Red Brown Clay + Sand./Sand Dunes

Rock Type N/A

Vegetation **Broad Floristic Formation:**
**Cenchrus* Grassland

Vegetation Association Vegetation: Closed Tussock Grassland of **Cenchrus ciliaris* with Scattered Shrubs of *Acacia stellaticeps* and *Acacia bivenosa* over Scattered Herbs of *Ipomoea pes-caprae* subsp. *brasiliensis* on Orange Sand on Sand Plain.

Vegetation Sub- Association: Scattered Shrubs of *Acacia bivenosa* and *Acacia stellaticeps* over Tussock Grassland of **Cenchrus ciliaris* on Red Brown Clay and Sand. (Sand Dunes) on Sandplain

Veg Condition Degraded

Fire Age Old

Notes Aspect: N/A. (Undulating)
Bare ground: 30%.
Litter cover: + Logs; + Twigs; + Lvs.
Disturbance type: Introduced Species.

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	Acacia bivenosa	2%		2 - 3 m	NC	S
	Acacia stellaticeps	1%		0.5 m	TP01 - 01	S
	**Cenchrus ciliaris*	70%		0.5 m	TPOP01	G.
	**Portulaca oleracea*	+		0.5 m	TPOP03	H
	Tephrosia rosea var. *venulosa* MS	+		0.5 m	HPXOP- 01	S

Hunt Point Beach **Site** HPXRO3

Flora Assessed by TE

Date 19/08/2010 **Type** R

Location

MGA Zone 50 664066**mE,** 7754801**mN**

Habitat Sand Dune - Foreshore/ Coastal

Soil Orange Sand/ Beach Sand

Rock Type N/A

Vegetation **Broad Floristic Formation:**

Spinifex Open Grassland

Vegetation Association:

Open Tussock Grassland of *Spinifex longifolius* and **Cenchrus ciliaris* with Shrubland of *Acacia stellaticeps* and *Santalum lanceolatum* over Scattered Herbs of *Ipomoea pes-caprae* subsp. *brasiliensis* and *Ptilotus exaltatus* var. *exaltatus* on Foreshore.

Vegetation Sub-Association: Low scattered Shrubs of *Acacia stellaticeps* over Open Hummock Grassland of *Spinifex longifolius* with Very Open Tussock Grassland of **Cenchrus ciliaris* with Scattered Herbs of *Ipomoea pes-caprae subsp. brasiliensis* on Orange Sand/ Beach Sand on Sand Dune - Coastal/ Foreshore

Veg Condition Good

Fire Age Old

Notes Aspect: NE
Bare ground: 75%.
Litter cover: + Logs; 1% Twigs; 1% Lvs.
Disturbance type: Introduced Species, Wave erosion, Fence line, Fence posts.

SPECIES LIST:

Quad	Name	Cover	C Class	Height	Specimen	Notes
	Acacia stellaticeps	1%		0.5 m	TP01- 01	S
	**Cenchrus ciliaris*	5%		0.5 m	TPOP01	F, G
	Crotalaria cunninghamii subsp. *sturtii*	1%		0.8 m	HPXR03- 02	H
	Euphorbia tannensis subsp. *eremophil*a	N/A		0.2 m	HPXR03- 03	H, As

Ipomoea pes-caprae subsp. *brasiliensis*	5%	CL	HPX01- 01	F, H
**Portulaca oleracea*	+	0.5 m	TPOP03	F, H
Ptilotus exaltatus var. *exaltatus*	+	1 m	HPXR03- 01	F, H
Rhagodia eremaea	N/A	0.5 m	HPXR03- 05	S, As
Santalum lanceolatum	N/A	1.5 m	HPXR03- 04	S, As
Scaevola amblyanthera var. *centralis*	N/A	0.1 m	HPXR03- 06	G, As
Spinifex longifolius	20%	0.5 m	HPX01- 09	G

Hunt Point Opportunistic Collections

Name	Coll. Number	Zone	E	N	No. of individuals	Height (cm)	Flower colour
Cucumis maderaspatanus	HPXOP11	50	663721	7754463	1	CL	Yellow

APPENDIX D
VEGETATION CONDITION SCALE

APPENDIX D

VEGETATION CONDITION SCALE

Condition Scale Code	Condition Scale
P	**Pristine (1)** Pristine or nearly so, no obvious signs of disturbance
E	**Excellent (2)** Vegetation structure intact, disturbance affecting individual species and weeds are non-aggressive species.
VG	**Very Good (3)** Vegetation structure altered, obvious signs of disturbance. For example, disturbance to vegetation structure caused by repeated fires, the presence of some more aggressive weeds, dieback, logging and grazing.
G	**Good (4)** Vegetation structure significantly altered by very obvious signs of multiple disturbance. Retains basic vegetation structure or ability to regenerate it. For example, disturbance to vegetation structure caused by very frequent fires, the presence of some very aggressive weeds at high density, partial clearing, dieback and grazing.
D	**Degraded (5)** Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not to a state approaching good condition without intensive management. For example, disturbance to vegetation structure caused by very frequent fires, the presence of very aggressive weeds, partial clearing, dieback and grazing.
CD	**Completely Degraded (6)** The structure of the vegetation is no longer intact and the area is completely or almost completely without native species. These areas are often described as 'parkland cleared' with the flora comprising weed or crop species with isolated native trees or shrubs.

Source: Government of Western Australia (2000). *Bush Forever Volume 2: Directory of Bush Forever Sites*. Department of Environmental Protection, Perth, Western Australia.

APPENDIX E
ENVIRONMENTAL WEEDS, DECLARED PLANT CATEGORIES AND INTRODUCED FLORA POTENTIALLY OCCURRING IN THE SURVEY AREA

APPENDIX E

ENVIRONMENTAL WEEDS AND DECLARED PLANT CATEGORIES AND INTRODUCED FLORA POTENTIALLY OCCURRING IN THE PROJECT AREA

E1: Criteria used for Ranking Environmental Weeds

The Environmental Weed Strategy for Western Australia (CALM 1999) contains criteria for the assessment and ranking of weeds in terms of their environmental impact on biodiversity. These criteria are as follows:

- **Invasiveness –** ability to invade bushland in good to excellent condition or ability to invade waterways. (Score as yes or no).
- **Distribution** – wide current or potential distribution including consideration of known history of wide spread distribution elsewhere in the world. (Score as yes or no).
- **Environmental Impacts** – ability to change the structure, composition and function of ecosystems. In particular an ability to form a monoculture in a vegetation community. (Score as yes or no).

The rating of each weed is determined by the following scoring system:

- **High** - a weed species would have to score yes for all three criteria. Rating a weed species as high would indicate prioritising this weed for control and/or research i.e. prioritising funding to it.
- **Moderate** -a weed species would have to score yes for two of the above criteria. Rating a weed species as moderate would indicate that control or research effort should be directed to it if funds are available, however it should be monitored (possibly a reasonably high level of monitoring).
- **Mild** – a weed species scoring one of the criteria. A mild rating would indicate monitoring of the week and control where appropriate.
- **Low** – a weed species would score none of the criteria. A low ranking would mean that this species would require a low level of monitoring.

Source: Department of Conservation and Land Management (1999). *Environmental Weed Strategy for Western Australia*. Department of Conservation and Land Management, Perth, Western Australia.

E2: Standard Meanings of Declared Plant Categories

P1
Prohibits movement.

The movement of plants or their seeds is prohibited within the State.
This prohibits the movement of contaminated machinery and produce including livestock and fodder.

P2
Aim is to eradicate infestation.

Treat all plants to destroy and prevent propagation each year until no plants remain. The infested area must be managed in such a way that prevents the spread of seed or plant parts on or in livestock, fodder, grain, vehicles and/or machinery.

P3
Aims to control infestation by reducing area and/or density of infestation.

The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery.

Treat to destroy and prevent seed set all plants:
- Within 50m inside of the boundaries of the infestation;
- within 50m of roads and high water mark on waterways;
- within 50m of sheds, stock yards and houses.

Treatment must be done prior to seed set each year.
Properties with less than 20ha of infestation must treat the entire infestation.
Additional areas may be ordered to be treated.

P4
Aims to prevent infestation spreading beyond existing boundaries of infestation

The infested area must be managed in such a way that prevents the spread of seed or plant parts within and from the property on or in livestock, fodder, grain, vehicles and/or machinery.

Treat to destroy and prevent seed set all plants:
- within 50m inside of the boundaries of the infested property for one-leaf and 20m for two-leaf;
- within 50m of roads and high water mark on waterways;
- within 50m of sheds, stock yards and houses.

Treatment must be done prior to seed set each year. Properties with less than 20ha of infestation must treat the entire infestation.
Additional areas may be ordered to be treated.

Special considerations: In the case of P4 infestations where they continue across property boundaries there is no requirement to treat the relevant part of the property boundaries as long as the boundaries of the infestation as a whole are treated. There must be agreement between neighbours in relation to the treatment of these areas.

P5
Aims to control infestations on public lands.

Source: Department of Agriculture and Food (2008). *List of Declared Plants*. Department of Agriculture and Food, Western Australia. Online: http://www.agric.wa.gov.au/.

E3: Introduced Flora Species Potentially Occurring in the Project Area

Species	Rating	Description (WAH 2009)
***Aerva javanica**	High	Kapok Bush Has become a widespread weed of roadsides, creeklines and disturbed areas.
***Cenchrus ciliaris**	High	Buffel Grass Widely planted as a pastoral grass. Has become a widespread weed of roadsides, creeklines and most vegetation types in the Pilbara.
***Cenchrus setiger**	High	Birdwood Grass Erect, tussocky, stoloniferous perennial, herb or grass-like, to 0.5 m high. Fl. cream, purple, Apr–May. Brown sands, red loam, pindan soils. Sand dunes, plains, rangelands, stony hillsides, floodplains.
***Cynodon dactylon**	Moderate	Couch Grass Widely planted as a lawn grass.
***Stylosanthes hamata**	Moderate	Verano Stylo Occurs in a wide range of habitats such as seepage areas, creek banks, pool edges, lawns and disturbed vegetation.
***Chloris virgata**	Low	Feathertop Rhodes Grass Commonly found on sand dunes.
***Tribulus terrestris**	N/A	Caltrop Prostrate annual, herb, plants villous; leaflet pairs 4-7; cocci with distinct divergent, median spines 3-8 mm long. Fl. yellow, Jan–Dec. Often on sandy soils. Waste places
***Indigofera sessiliflora**	N/A	Semi-prostrate annual or biennial, herb, to 0.05 m high. Fl. red, Sep. Sand. Dunes.
***Portulaca oleracea**	N/A	Purslane Common on clay loam and sand on disturbed land.

Source: Refer to reports listed in Section 1.3.

APPENDIX F
PREVIOUSLY RECORDED VERTEBRATE FAUNA

APPENDIX F

Appendix F1: Previously Recorded Vertebrate Fauna - Amphibians

Key:

Western Australian Museum Records:
A = Listed in NatureMap (DEC 2010d)

Within 50km of Project Area:
B= Hedland HBI Project – Boodarie Site- Flora, Vegetation and Vertebrate Fauna (Mattiske 1994)
C= A Flora and Fauna Assessment of RGP5 Spoil Areas A and H, Port Hedland Harbour (Biota 2008b)
D = Outer Harbour Development Fauna Assessment (ENV 2009c)
E = Goldsworthy Rail Duplication Fauna Assessment (ENV 2009e)

Greater than 50km of Project Area:
F = Hope Downs Iron Ore Project, Rail and Port Public Environmental Review (Hope Downs Management Services Pty Ltd 2002)
G = FMG Stage A Rail Corridor (Biota 2004b)
H = Current Survey

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H
		EPBC	WC	DEC								
Hylidae (Tree Dwelling Frogs)												
Giant Frog	*Cyclorana australis*				x					x		
Sheep Frog	*Cyclorana maini*				x			x		x	x	
Little Red Tree Frog	*Litoria rubella*				x					x	x	
Limnodynastidae												
Northern Burrowing Frog	*Neobatrachus aquilonius*				x							
Desert Spadefoot	*Notaden nichollsi*				x			x		x	x	
Centralian Burrowing Frog	*Platyplectrum spenceri*				x			x		x	x	
Myobatrachidae (Ground Frogs)												
Gorge Toadlet	*Uperoleia glandulosa*				x							
Northwest Toadlet	*Uperoleia russelli*				x			x		x	x	

(x) denotes recorded during the survey

APPENDIX F

Appendix F2: Previously Recorded Vertebrate Fauna - Reptiles

Key:

Western Australian Museum Records:
A = Listed in NatureMap (DEC 2010d)

Within 50km of Project Area:
B= Hedland HBI Project – Boodarie Site- Flora, Vegetation and Vertebrate Fauna (Mattiske 1994)
C= A Flora and Fauna Assessment of RGP5 Spoil Areas A and H, Port Hedland Harbour (Biota 2008b)
D = Outer Harbour Development Fauna Assessment (ENV 2009c)
E = Goldsworthy Rail Duplication Fauna Assessment (ENV 2009e)

Greater than 50km of Project Area:
F = Hope Downs Iron Ore Project, Rail and Port Public Environmental Review (Hope Downs Management Services Pty Ltd 2002)
G = FMG Stage A Rail Corridor (Biota 2004b)
H = Current Survey

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H
		EPBC	WC	DEC								
Chelidae (Tortoises)												
Long-nosed Water Dragon	*Chelodina steindachneri*										x	
Agamidae (Dragons)												
Long-nosed Water Dragon	*Amphibolurus longirostris*				x	x	x	x	x	x	x	
Mulga Dragon	*Caimanops amphiboluroides*									x		
Ring-tailed Dragon	*Ctenophorus caudicinctus*				x			x		x	x	
Central Military Dragon	*Ctenophorus isolepis isolepis*				x	x		x	x	x	x	
Central Netted Dragon	*Ctenophorus nuchalis*				x			x		x		
Western Netted Dragon	*Ctenophorus reticulatus*									x		
	Diporiphora valens									x		
Common Two-lined Dragon	*Diporiphora winneckei*				x			x				
Bearded Dragon	*Pogona minor minor*							x		x		
Bearded Dragon	*Pogona minor mitchelli*				x			x				
	Tympanocryptis cephala				x			x			x	
Diplodactyllidae (Geckoes)												
Fat-tailed Gecko	*Diplodactylus conspicillatus*				x	x		x		x	x	
Pale-snouted Gecko	*Lucasium stenodactylum*				x	x		x		x	x	
	Lucasium wombeyi									x	x	
Beaked Gecko	*Rhynchoedura ornata*				x	x				x		
Northern Spiny-tailed Gecko	*Strophurus cillaris aberrans*				x			x		x		
Jewelled Gecko	*Strophurus elderi*				x					x	x	

APPENDIX F

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H
		EPBC	WC	DEC								
	Strophurus jeanae				x					x		
Carphodactylidae (Geckoes)												
Smooth Knob-tailed Gecko	*Nephrurus levis pilbarensis*				x			x		x	x	
Banded Knob-tailed Gecko	*Nephrurus wheeleri cinctus*									x		
Gekkonidae (Geckoes)												
	Gehyra nana					**x**						
	Gehyra pilbara				x							
Spotted Dtella	*Gehyra punctata*				x			x		x		
Tree Dtella	*Gehyra variegata*				x	x		x		x		
Asian House Gecko	**Hemidactylus frenatus*				x							
Bynoe's Gecko	*Heteronotia binoei*				x	x		x		x	x	
Pygopodidae (Legless Lizards)												
	Delma butleri					x		x				
	Delma haroldi				x					x		
	Delma nasuta									x	x	
	Delma pax				x	x				x	x	
	Delma tincta				x			x		x	x	
Burtons snake-lizard	*Lialis burtonis*				x					x	x	
Hooded Scaly-foot	*Pygopus nigriceps*				x	x				x		
Scincidae (Skinks)												
White-lipped Rainbow Skink	*Carlia munda*									x	x	
Desert Rainbow Skink	*Carlia triacantha*				x	x		x		x	x	
Buchanan's snake-eyed Skink	*Cryptoblepharus buchanani*				x							
	Ctenotus ariadnae									x		
	Ctenotus colletti					x						
	Ctenotus duricola				x			x		x	x	
	Ctenotus grandis titan					x		x		x	x	
	Ctenotus haloni				x							
	Ctenotus helenae				x			x		x	x	
Leopard Skink	*Ctenotus pantherinus ocellifer*				x	x		x	x	x	x	
	Ctenotus piankai					x		x				
	Ctenotus rubicundus									x	x	
	Ctenotus rufescens				x			x		x		
Rock Ctenotus	*Ctenotus saxatilis*				x	x		x		x	x	

APPENDIX F

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H
		EPBC	WC	DEC								
	Ctenotus serventyi				x			x				
	Ctenotus uber									x	x	
Spinifex-slender Blue Tongue	*Cyclodomorphus melanops melanops*									x	x	
Pygmy Spiny-tailed Skink	*Egernia depressa*							x		x		
	Egernia pilbarensis									x		
Narrow-banded Sand Swimmer	*Eremiascincus fasciolatus*				x			x				
Broad-banded Sand Swimmer	*Eremiascincus richardsonii*									x		
	Lerista bipes				x	x		x		x	x	
	Lerista clara				x							
	Lerista muelleri							x		x		
Common Dwarf Skink	*Menetia greyii*				x	x		x		x	x	
	Morethia ruficauda exquisita				x	x		x		x		
	Notoscincus ornatus ornatus					x				x		
	Proablepharus reginae									x	x	
Desert Bluetongue	*Tiliqua multifasciata*				x	x		x	x	x	x	
Varanidae (Monitors)												
Ridge-tailed Monitor	*Varanus acanthurus*				x	x		x		x	x	
Pygmy Mulga Monitor	*Varanus aff. gilleni*									x		
Short-tailed Monitor	*Varanus brevicauda*				x			x		x	x	
Pilbara Goanna	*Varanus bushi*							x				
Desert Pygmy Monitor	*Varanus eremius*				x			x		x	x	
Perentie	*Varanus giganteus*									x		
Sand Monitor	*Varanus gouldii*				x	x		x	x	x		
Yellow-spotted Monitor	*Varanus panoptes*									x		
Black-headed Monitor	*Varanus tristis*									x		
Typhlopidae (Blind Snakes)												
	Ramphotyphlops ammodytes				x	x		x		x	x	
Flowerpot Snake	**Ramphotyphlops braminus*				x							
Beaked Blind Snake	*Ramphotyphlops grypus*				x			x		x	x	
Pilbara Blind Snake	*Ramphotyphlops pilbarensis*				x							

APPENDIX F

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H
		EPBC	WC	DEC								
Boidae (Pythons)												
Pygmy Python	*Antaresia perthensis*				x					x		
Stimson's Python	*Antaresia stimsoni stimsoni*				x					x		
Black-headed Python	*Aspidites melanocephalus*				x			x		x		
Woma	*Aspidites ramsayi*		S4	P1	x			x		x		
Elapidae (Front-fanged Snakes)												
Desert Death Adder	*Acanthophis pyrrhus*				x							
Pilbara Death Adder	*Acanthophis wellsi*							x		x		
Shovel-nosed Snake	*Brachyurophis approximans*							x		x	x	
Yellow-faced Whip-Snake	*Demansia psammophis*							x		x	x	
Rufous Whip-Snake	*Demansia rufescens*				x			x				
Moon Snake	*Furina ornata*				x					x	x	
Mulga Snake	*Pseudechis australis*				x			x		x	x	
Ringed Snake	*Pseudonaja modesta*				x			x				
Gwardar	*Pseudonaja nuchalis*				x			x	x	x		
Desert Banded Snake	*Simoselaps anomalus*				x			x		x		
Rosen's Snake	*Suta fasciata*									x	x	
Spotted Snake	*Suta punctata*				x					x		
Pilbara Bandy Bandy Snake	*Vermicella snelli*									x		

(x) denotes recorded during the survey

APPENDIX F

Appendix F: Previously Recorded Vertebrate Fauna - Birds

Key:

Western Australian Museum Records:
A = Listed in NatureMap (DEC 2010d)

Within 50km of Project Area:
B = Birds Australia Records (Birds Australia 2010)
C = Hedland HBI Project – Boodarie Site- Flora, Vegetation and Vertebrate Fauna (Mattiske 1994)
D = A Flora and Fauna Assessment of RGP5 Spoil Areas A and H, Port Hedland Harbour (Biota 2008b)
E = Outer Harbour Development Fauna Assessment (ENV 2009c)
F = Goldsworthy Rail Duplication Fauna Assessment (ENV 2009e)

Greater than 50km of Project Area:
G = Hope Downs Iron Ore Project, Rail and Port Public Environmental Review (Hope Downs Management Services Pty Ltd 2002)
H = FMG Stage A Rail Corridor (Biota 2004b)
I =Currnet Survey

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H	I
		EPBC	WC	DEC									
Casuariidae (Cassowaries and Emus)													
Emu	*Dromaius novaehollandiae*						x		x		x	x	
Phasianidae (Pheasants and Quails)													
Brown Quail	*Coturnix ypsilophora*					x			x				
Anatidae (Ducks, Geese and Swans)													
Pacific Black Duck	*Anas superciliosa*					x			x		x	x	
Grey Teal	*Anas gracilis*					x			x		x		
Hardhead	*Aythya australis*								x				
Australian Wood Duck	*Chenonetta jubata*										x		
Black Swan	*Cygnus atratus*					x			x				
Plumed Whistling-duck	*Dendrocygna eytoni*								x				
Pink-eared Duck	*Malacorhynchus membranaceus*					x			x				
Podicipedidae (Grebes)													
Hoary-headed Grebe	*Poliocephalus poliocephalus*					x							
Australian Grebe	*Tachybaptus novaehollandiae*					x			x		x		
Anhingidae (Darters)													
Darter	*Anhinga melanogaster*						x		x		x		
Phalacrocoracidae (Cormorants and Darters)													
Little Pied Cormorant	*Microcarbo melanoleucos*								x		x		
Little Black Cormorant	*Phalacrocorax sulcirostris*					x					x		
Pied Cormorant	*Phalacrocorax varius*						x		x		x		x

APPENDIX F

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H	I
		EPBC	WC	DEC									
Fregatidae (FrigateBirds)													
Lesser Frigate Bird	*Fregata ariel*	Mi							x				
Pelecanidae (Pelicans)													
Australian Pelican	*Pelecanus conspicillatus*								x		x		
Ardeidae (Herons and Bitterns)													
Cattle Egret	*Ardea ibis*	Mi											
Eastern Great Egret	*Ardea modesta*	Mi							x				
White-faced Heron	*Ardea novaehollandiae*						x		x		x	x	
White-necked Heron	*Ardea pacifica*										x		
Striated Heron	*Butorides striatus*								x		x		
Little Egret	*Egretta garzetta*					x		x	x		x		
Eastern Reef Egret	*Egretta sacra*	Mi							x		x		x
Nankeen Night Heron	*Nycticorax caledonicus*				x		x				x		
Threskiornithidae (Ibises and Spoonbills)													
Australian White ibis	*Threskiornis molucca*							x	x	x	x		
Straw-necked Ibis	*Threskiornis spinicollis*					x					x		
Ciconiidae (Storks)													
Black-necked Stork	*Ephippiorhyynchus asiaticus*					x					x	x	
Accipitridae (Kites, Hawks and Eagles)													
Brown Goshawk	*Accipiter fasciatus*										x		
Wedge-tailed Eagle	*Aquila audax*								x		x		
Swamp Harrier	*Circus approximans*							x					
Spotted Harrier	*Circus assimilis*				x		x		x		x	x	
Black-shouldered Kite	*Elanus caeruleus*					x	x		x		x		
Letter-winged Kite	*Elanus scriptus*						x						
White-bellied Sea Eagle	*Haliaeetus leucogaster*	Mi					x		x				
Brahminy Kite	*Haliastur indus*					x	x	x	x	x	x		
Whistling Kite	*Haliastur sphenurus*					x			x	x	x	x	
Black-breasted Buzzard	*Hamirostra melanosternon*										x		
Little Eagle	*Hieraaetus morphnoides*								x		x		
Black Kite	*Milvus migrans*						x		x		x		
Eastern Osprey	*Pandion haliaetus*	Mi				x	x		x	x			x
Falconidae (Falcons)													
Nankeen Kestrel	*Falco cenchroides*					x	x		x	x	x	x	
Brown Falcon	*Falco berigora*						x		x	x	x	x	

APPENDIX F

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H	I
		EPBC	WC	DEC									
Australian Hobby	*Falco longipennis*					x	x		x		x		
Peregrine Falcon	*Falco peregrinus*		S4								x		
Rallidae (Waterhens)													
Eurasian Coot	*Fulica atra*					x							
Buff-banded Rail	*Gallirallus philippensis*				x								
Otidae (Bustards)													
Australian Bustard	*Ardeotis australis*			P4	x		x		x		x	x	
Turnicidae (Button-quails)													
Little Button-quail	*Turnix velox*				x		x		x		x		
Scolopacidae (Sandpipers and Snipes)													
Common Sandpiper	*Actitis hypoleucos*	Mi				x	x		x		x		
Ruddy Turnstone	*Arenaria interpres*	Mi			x				x				
Sharp-tailed Sandpiper	*Calidris acuminata*	Mi			x	x							
Sanderling	*Calidris alba*	Mi			x								
Red Knot	*Calidris canutus*	Mi							x				
Curlew Sandpiper	*Calidris ferruginea*	Mi			x				x				
Pectoral Sandpiper	*Calidris melanotos*	Mi											
Red-necked Stint	*Calidris ruficollis*	Mi			x	x			x				
Long-toed Stint	*Calidris subminuta*	Mi											
Great Knot	*Calidris tenuirostris*	Mi			x		x		x				
Pin-tailed Snipe	*Gallinago stenura*	Mi			x								
Broad-billed Sandpiper	*Limicola falcinellus*	Mi			x								
Asian Dowitcher	*Limnodromus semipalmatus*	Mi			x								
Bar-tailed Godwit	*Limosa lapponica*	Mi							x				
Black-tailed Godwit	*Limosa limosa*	Mi											
Eastern Curlew	*Numenius madagascariensis*	Mi		P4	x		x	x	x		x		
Little Curlew	*Numenius minutus*	Mi											
Whimbrel	*Numenius phaeopus*	Mi					x	x	x		x		x
Red-necked Phalarope	*Phalaropus lobatus*	Mi			x								
Australian Painted Snipe	*Rostratula australis*	VU	S1										
Grey-tailed tattler	*Tringa brevipes*	Mi			x				x		x		
Wood Sandpiper	*Tringa glareola*	Mi				x							
Common Greenshank	*Tringa nebularia*	Mi					x		x				
Marsh Sandpiper	*Tringa stagnatilis*	Mi			x				x				
Terek Sandpiper	*Xenus cinereus*	Mi			x		x		x				

APPENDIX F

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H	I
		EPBC	WC	DEC									
Burhinidae (Stone-curlews)													
Bush Stone-curlew	*Burhinus grallarius*			P4							x		
Haematopodidae (Oystercatches)													
Sooty Oystercatcher	*Haematopus fuliginosus*								x				
Australian Pied Oystercatcher	*Haematopus longirostris*								x		x		x
Recurvirostridae (Stilts)													
Black-winged Stilt	*Himantopus himantopus*					x					x		
Red-necked Avocet	*Recurvirostra novaehollandiae*				x	x							
Charadriidae (Plovers, Lapwings and Dotterels)													
Greater Sand Plover	*Charadrius leschenaultii*	Mi					x		x				
Lesser Sand Plover	*Charadrius mongolus*	Mi			x				x				
Red-capped Plover	*Charadrius ruficapillus*				x	x			x		x		
Oriental Plover	*Charadrius veredus*	Mi					x		x				
Black-fronted Dotterel	*Elseyornis melanops*					x			x		x	x	
Pacific Golden Plover	*Pluvialis fulva*	Mi											
Grey Plover	*Pluvialis squatarola*	Mi							x				
Glareolidae (Pratincoles and Old-world Shore Birds)													
White-winged Black Tern	*Chlidonias leucoptera*	Mi			x	x							
Oriental pratincole	*Glareola maldivarum*	Mi				x							
Laridae (Gulls and Terns)													
Silver Gull	*Larus novaehollandiae*					x	x		x	x	x		x
Little Tern	*Sterna albifrons*	Mi						x	x				
Lesser Crested Tern	*Sterna bengalensis*	Mi							x				
Crested Tern	*Sterna bergii*								x		x		
Caspian Tern	*Sterna caspia*	Mi			x	x			x		x		x
Whiskered Tern	*Sterna hybrida*				x	x			x				
Fairy Tern	*Sterna nereis*								x				
Gull-billed Tern	*Sterna nilotica affinis*				x	x	x		x		x		
Columbidae (Pigeons and Doves)													
Diamond Dove	*Geopelia cuneata*					x			x		x	x	
Bar-shouldered Dove	*Geopelia humeralis*										x		
Peaceful Dove	*Geopelia striata placida*					x		x	x	x	x		
Spinifex Pigeon	*Geophaps plumifera*							x	x		x	x	
Crested Pigeon	*Ocyphaps lophotes*					x	x	x	x	x	x	x	x
Common Bronzewing	*Phaps chalcoptera*						x				x		

APPENDIX F

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H	I
		EPBC	WC	DEC									
Cacatuidae (Cockatoos)													
Galah	*Cacatua roseicapilla*					x	x		x	x	x	x	
Little Corella	*Cacatua sanguinea*								x	x	x	x	x
Psittacidae (Lorikeets and Parrots)													
Australian Ringneck	*Barnardius zonarius*						x				x		
Budgerigar	*Melopsittacus undulatus*					x	x		x		x	x	
Cockatiel	*Nymphicus hollandicus*						x		x		x	x	
Mulga Parrot	*Psephotus varius*										x		
Cuculidae (Cuckoos)													
Horsfield's Bronze-Cuckoo	*Chrysococcyx basalis*					x	x		x		x	x	
Black-eared Cuckoo	*Chrysococcyx osculans*										x		
Pallid Cuckoo	*Cuculus pallidus*					x			x		x	x	
Centropidae (Coucals)													
Pheasant Coucal	*Centropus phasianus*								x		x		
Strigidae (Hawk-owls)													
Southern Boobook Owl	*Ninox novaeseelandiae*						x				x		
Tytonidae (Barn Owls)													
Eastern Barn Owl	*Tyto alba*				x				x				
Podargidae (Frogmouths)													
Tawny Frogmouth	*Podargus strigoides*								x		x	x	
Caprimulgidae (Nightjars)													
Spotted Nightjar	*Eurostopodus argus*						x		x		x		
Aegothelidae (Owlet-nightjars)													
Australian Owlet-nightjar	*Aegotheles cristatus*								x		x		
Apodidae (Swifts)													
Fork-tailed Swift	*Apus pacificus*	Mi										x	
Halcyonidae (Kingfishers)													
Blue-winged Kookaburra	*Dacelo leachii*					x				x	x		
Collared Kingfisher	*Todiramphus chloris*						x		x				
Red-backed Kingfisher	*Todiramphus pyrrhopygia*					x	x		x		x	x	x
Sacred Kingfisher	*Todiramphus sanctus*					x	x		x	x	x	x	
Meropidae (Bee-eaters)													
Rainbow Bee-eater	*Merops ornatus*	Mi				x	x	x	x	x	x	x	
Maluridae (Fairy-wrens)													
Variegated Fairy-wren	*Malurus lamberti*				x	x	x		x		x	x	

APPENDIX F

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H	I
		EPBC	WC	DEC									
White-winged Fairy-wren	*Malurus leucopterus*						x	x	x	x	x	x	
Rufous-crowned Emu-wren	*Stipiturus ruficeps*										x		
Pardalotidae (Pardalotes, Scrubwrens, Gerygones and Thornbills)													
Inland Thornbill	*Acanthiza apicalis*										x		
Slaty-backed Thornbill	*Acanthiza robustirostris*										x		
Chestnut-rumped Thornbill	*Acanthiza uropygialis*										x		
Western Gerygone	*Gerygone fusca mungi*										x		
Mangrove Warbler	*Gerygone levigaster*										x		
Dusky Gerygone	*Gerygone tenebrosa*				x	x	x		x				
Red-browed Pardalote	*Pardalotus rubricatus*					x	x		x		x		
Striated Pardalote	*Pardalotus striatus*					x							
Weebill	*Smicrornis brevirostris*							x			x	x	
Meliphagidae (Honeyeaters)													
Spiny-cheeked Honeyeater	*Acanthagenys rufogularis*										x		
Black Honeyeater	*Certhionyx niger*								x		x		
Crimson Chat	*Epthianura tricolor*										x		
Grey-headed Honeyeater	*Lichenostomus keartlandi*										x		
White-plumed Honeyeater	*Lichenostomus penicillatus*					x	x	x	x	x	x	x	
Singing Honeyeater	*Lichenostomus virescens*					x	x	x	x	x	x	x	x
Brown Honeyeater	*Lichmera indistincta*					x	x	x	x	x	x	x	x
Yellow-throated Miner	*Manorina flavigula*					x	x		x	x	x	x	
Petroicidae (Australian Robins)													
Mangrove Robin	*Eopsaltria pulverulenta*				x	x	x		x		x		
Hooded Robin	*Petroica cucullata*										x		
Red-capped Robin	*Petroica goodenovii*										x		
Pomatostomidae (Australian Babblers)													
White-browed Babbler	*Pomatostomus superciliosus*										x		
Grey-crowned Babbler	*Pomatostomus temporalis*										x		
Pachycephalidae (Whistlers)													
Grey Shrike-thrush	*Colluricincla harmonica*										x		
Crested Bellbird	*Oreoica gutturalis*										x		
White-breasted Whistler	*Pachycephala lanioides*				x	x	x	x	x				
Mangrove Golden Whistler	*Pachycephala melanura*						x		x		x		
Rufous Whistler	*Pachycephala rufiventris*						x				x	x	

APPENDIX F

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H	I
		EPBC	WC	DEC									
Dicruridae (Flycatchers)													
Magpie-Lark	*Grallina cyanoleuca*					x	x	x	x	x	x	x	x
Grey Fantail	*Rhipidura fuliginosa*					x							
Willie Wagtail	*Rhipidura leucophrys*					x	x	x	x	x	x	x	
Mangrove Grey Fantail	*Rhipidura phasiana*						x		x		x		
Campephagidae (Cuckoo-shrikes)													
Black-faced Cuckoo-shrike	*Coracina novaehollandiae*					x	x	x	x	x	x	x	x
White-winged Triller	*Lalage tricolor*					x			x	x	x		
Artamidae (Woodswallows)													
Black-faced Woodswallow	*Artamus cinereus*				x	x	x		x	x	x	x	
White-breasted Woodswallow	*Artamus leucorynchus*				x	x	x	x	x				x
Little Woodswallow	*Artamus minor*										x		
Masked Woodswallow	*Artamus personatus*										x		
White-browed Woodswallow	*Artamus superciliosus*								x		x		
Pied Butcherbird	*Cracticus nigrogularis*					x	x				x	x	
Australian Magpie	*Gymnorhina tibicen*										x	x	
Grey Butcherbird	*Cracticus torquata*										x		
Corvidae (Ravens and Crows)													
Little Crow	*Corvus bennetti*						x				x		
Torresian Crow	*Corvus orru*				x	x		x	x	x			
Western Crow	*Corvus orru cecilae*										x	x	
Ptilonorhynchidae (Bowerbirds)													
Western Bowerbird	*Chlamydera guttata*				x						x		
Hirundinidae (Swallows)													
White-backed Swallow	*Cheramoeca leucosterna*						x						
Fairy Martin	*Hirundo ariel*					x	x		x		x		
Tree Martin	*Hirundo nigricans*					x	x		x	x	x		
Welcome Swallow	*Hirundo neoxena*						x						
Barn Swallow	*Hirundo rustica*	Mi				x							
Zosteropidae (White-eyes)													
Yellow White-eye	*Zosterops luteus*					x	x		x		x		

APPENDIX F

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H	I
		EPBC	WC	DEC									
Sylviidae (Old World Warblers)													
Austrlian Reed Warbler	*Acrocephalus stentoreus*										x		
Brown Songlark	*Cincloramphus cruralis*						x		x		x		
Rufous Songlark	*Cincloramphus mathewsi*				x				x		x	x	
Spinifex Bird	*Eremiornis carteri*								x		x	x	
Alauidae (Songlarks)													
Singing Bushlark	*Mirafra javanica*						x		x	x	x		
Dicaeidae (Flower-peckers)													
Mistletoebird	*Dicaeum hirundinaceum*											x	
Passeridae (Finches and Allies)													
Painted Finch	*Emblema pictum*								x		x	x	
Star Finch (Western)	*Neochmia ruficauda subsp. subclarescens*			P4	x	x							
Eurasian Tree Sparrow	**Passer montanus*				x								
Zebra Finch	*Taeniopygia guttata*					x	x	x	x	x	x	x	
Motacillidae (Pipits and True Wagtails)													
Australian Pipit	*Anthus novaeseelandiae*					x	x	x	x	x	x	x	
Eastern Yellow Wagtail	*Motacilla tschutschensis*				x								

(x) denotes recorded during the survey

APPENDIX F

Appendix F4: Previously Recorded Vertebrate Fauna - Mammals

Key:

Western Australian Museum Records:
A = Listed in NatureMap (DEC 2010d)

Within 50km of Project Area:
B= Hedland HBI Project – Boodarie Site- Flora, Vegetation and Vertebrate Fauna (Mattiske 1994)
C= A Flora and Fauna Assessment of RGP5 Spoil Areas A and H, Port Hedland Harbour (Biota 2008b)
D = Outer Harbour Development Fauna Assessment (ENV 2009c)
E = Goldsworthy Rail Duplication Fauna Assessment (ENV 2009e)

Greater than 50km of Project Area:
F = Hope Downs Iron Ore Project, Rail and Port Public Environmental Review (Hope Downs Management Services Pty Ltd 2002)
G = FMG Stage A Rail Corridor (Biota 2004b)
H = Current Survey

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H
		EPBC	WC	DEC								
Tachyglossidae (Echidnas)												
Echidna	*Tachyglossus aculeatus*									x	x	
Dasyuridae (Carnivorous Marsupials)												
Kultarr	*Antechinomys laniger*				x							
Brush-tailed Mulgara	*Dasycercus blythi*			P4	x							
Crest-tailed Mulgara	*Dasycercus cristicauda*	VU	S1								x	
Northern Quoll	*Dasyurus hallucatus*	EN	S1		x						x	
Little Red Kaluta	*Dasykaluta rosamondae*				x	x		x		x	x	
Pilbara Ningaui	*Ningaui timealeyi*									x	x	
Planigale	*Planigale sp.*									x	x	
Rory's Pseudantechinus	*Pseudantechinus roryi*									x		
Stripe-faced Dunnart	*Sminthopsis macroura*					x				x	x	
Lesser Hairy-footed Dunnart	*Sminthopsis youngsoni*				x			x		x		
Peramelidae (Bilbys)												
Greater Bilby	*Macrotis lagotis*	VU	S1		x					x		
Macropodidae (Kangaroos)												
Euro	*Macropus robustus*				x	x	x	x	x	x	x	
Red Kangaroo	*Macropus rufus*					x				x		x
Rothschild's Rock-wallaby	*Petrogale rothschildi*									x		

APPENDIX F

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H
		EPBC	WC	DEC								
Emballonuridae (Sheathtail-bats)												
Yellow-bellied Sheathtail-bat	*Saccolaimus flaviventris*							x				
Common Sheathtail-bat	*Taphozous georgianus*				x			x				
Hipposideridae (Leafnosed-bats)												
Pilbara Leaf-nosed Bat	*Rhinonicteris aurantia*	VU	S1									
Vespertilionidae (Ordinary Bats)												
Gould's Wattled Bat	*Chalinolobus gouldii*							x				
Arnhem Long-eared Bat	*Nyctophilus arnhemensis*				x			x				
Lesser Long-eared Bat	*Nyctophilus geoffroyi*				x			x				
Little Broad-nosed Bat	*Scotorepens greyii*							x				
Finlayson's Cave Bat	*Vespadelus finlaysoni*				x			x				
Molossidae (Freetail-bats)												
Northern Freetail-bat	*Chaerephon jobensis*				x			x				
Beccari's Freetail-bat	*Mormopterus beccarii*							x				
Little Northern Freetail-bat	*Mormopterus loriae cobourgensis*			P1	x			x				
Muridae (Rodents)												
Lakeland Downs Mouse	*Leggadina lakedownensis*			P4						x	x	
House Mouse	**Mus musculus*					x		x		x		
Spinifex-hopping Mouse	*Notomys alexis*							x		x		
Western Pebble-mound Mouse	*Pseudomys chapmani*			P4								
Delicate Mouse	*Pseudomys delicatulus*				x					x		
Desert Mouse	*Pseudomys desertor*							x		x	x	
Sandy Inland Mouse	*Pseudomys hermannsburgensis*				x	x		x		x	x	
Western Chestnut Mouse	*Pseudomys nanus*							x				
Common Rock-rat	Zyzomys argurus							x		x		

APPENDIX F

COMMON NAME	SCIENTIFIC NAME	Conservation Codes			A	B	C	D	E	F	G	H
		EPBC	WC	DEC								
Leporidae												
European Rabbit	**Oryctolagus cuniculus*							x				
Canidae (Dingo)												
Dingo	*Canis lupus dingo*					x				x	x	
Wild Dog	**Canis lupus familiaris*					x	x	x				
Fox	**Vulpes vulpes*						x	x	x	x		
Felidae (Cats)												
Feral Cat	**Felis catus*					x	x	x	x	x		
Equidae (Horses)												
Donkey	**Equus asinus*											
Horse	**Equus caballus*					x		x		x		
Camelidae												
Camel	**Camelus dromedarius*									x	x	
Bovidae (Cattle)												
European Cattle	**Bos taurus*					x	x	x	x	x		

(x) denotes recorded during the survey

(*) denotes introduced species.

(#) denotes species name that is no longer current.

APPENDIX G
FLORA TAXA INVENTORY

APPENDIX G

FLORA TAXA INVENTORY

Family	Species Name
Amaranthaceae	**Aerva javanica*
	Amaranthus clementii
	Gomphrena canescens subsp. *canescens*
	Ptilotus exaltatus var. exaltatus
Asparagaceae	**Yucca aloifolia*
Asphodelaceae	**Aloe vera*
Asteraceae	*Pluchea tetranthera*
Cactaceae	**Opuntia stricta*
Casuarinaceae	*Casuarina obesa*
Chenopodiaceae	*Rhagodia eremaea*
	Salsola tragus subsp. *grandiflora*
	Threlkeldia diffusa
Cleomaceae	*Cleome viscosa*
Convolvulaceae	*Ipomoea pes-caprae* subsp. *brasiliensis*
Cucurbitaceae	*Cucumis maderaspatanus*
Euphorbiaceae	*Adriana tomentosa* var. *tomentosa*
	Euphorbia tannensis subsp. *eremophila*
Fabaceae	*Acacia ampliceps*
	Acacia bivenosa
	Acacia pyrifolia
	Acacia stellaticeps
	Crotalaria cunninghamii subsp. *sturtii*
	**Indigofera sessiliflora*
	Rhynchosia minima
	Tephrosia rosea var. *venulosa* MS
Goodeniaceae	*Scaevola amblyanthera* var. *centralis*
Lauraceae	*Cassytha capillaris*
Malvaceae	*Corchorus incanus* subsp. *incanus*
Myrtaceae	*Eucalyptus camaldulensis* subsp. *refulgens*
Poaceae	**Cenchrus ciliaris*
	**Chloris barbata*
	Dactyloctenium radulans
	Eragrostis xerophila
	Spinifex longifolius
Portulacaceae	**Portulaca oleracea*
Santalaceae	*Santalum lanceolatum*
Zygophyllaceae	*Tribulus hirsutus*
Total Taxa	**37**

APPENDIX H
MATRIX OF TAXA BY SITE

APPENDIX H

MATRIX OF TAXA BY SITE

NAME	HPX01	HPX02	HPXR01	HPXR02	HPXRO3	HPXOP
Acacia ampliceps			2%			
Acacia bivenosa	2%	N/A	nc	2%		
Acacia pyrifolia			+			
Acacia stellaticeps	+	20%		1%	1%	
Adriana tomentosa var. *tomentosa*	+	+				
**Aerva javanica*	+					
**Aloe vera*						+
Amaranthus clementii		+				
Cassytha capillaris		+				
Casuarina obesa			2%			
**Cenchrus ciliaris*	90%	10%	1%	70%	5%	
**Chloris barbata*						+
Cleome viscosa	+	+				
Corchorus incanus subsp. *incanus*	+					
Crotalaria cunninghamii subsp. *sturtii*					1%	
Cucumis maderaspatanus						+
Dactyloctenium radulans	+					
Eragrostis xerophila		+				
Eucalyptus camaldulensis subsp. *refulgens*		+				
Euphorbia tannensis subsp. *eremophila*		+			+	
Gomphrena canescens subsp. *canescens*		+				
**Indigofera sessiliflora*	+					
Ipomoea pes-caprae subsp. *brasiliensis*	1%	+			5%	
**Opuntia stricta*						+
Pluchea tetranthera			+			
**Portulaca oleracea*		+	+	+	+	
Ptilotus exaltatus var. *exaltatus*		1%			+	
Rhagodia eremaea	+				+	
Rhynchosia minima	+					
Salsola tragus subsp. *grandiflora*		+	+			
Santalum lanceolatum		5%			+	
Scaevola amblyanthera var. *centralis*					+	
Spinifex longifolius	+	10%			20%	
Tephrosia rosea var. *venulosa* MS		+		+		+
Threlkeldia diffusa	+					
Tribulus hirsutus						+
**Yucca aloifolia*						+

APPENDIX I
LOCATION OF CONSERVATION SIGNIFICANT FLORA AND CHAIN OF CUSTODY FORM

APPENDIX I

LOCATION OF CONSERVATION SIGNIFICANT FLORA

Taxa	Specimen Number	# Easting	# Northing	Approx. No. Plants
Tephrosia rosea var *venulosa*	Boundary of Population 1	N/A	N/A	300+
	Boundary of Population 2	N/A	N/A	1000+
	Boundary of Population 3	N/A	N/A	100+
	HPXOP01	663926	7754474	3
	HPXOP01	663916	7754407	4
	HPXOP01 (NC)	663959	7754474	2
	HPXOP01 (NC)	663967	7754475	15
	HPXOP01 (NC)	663947	7754469	1
	HPXOP01 (NC)	663941	7754457	1
	HPXOP01 (NC)	663920	7754439	2
	HPXOP01 (NC)	664062	7754472	1
	HPXOP01 (NC)	664061	7754455	5
	HPXOP01 (NC)	664063	7754432	20
	HPXOP01 (NC)	664087	7754429	4
	HPXOP02	664106	7754437	12
	HPXOP02 (NC)	664141	7754575	36
	HPXOP02 (NC)	664157	7754603	40
	HPXOP02 (NC)	664160	7754637	15
	HPXOP03	663856	7754979	22
	HPXOP03 (NC)	663821	7754984	25
	HPXOP03 (NC)	663796	7754988	15
	HPXOP03 (NC)	663768	7754976	1
	HPXOP03 (NC)	663712	7754969	6
	HPXOP04	663661	7754955	300+ (within Population 1)
	HPXOP05	663536	7754959	
	HPXOP06	663464	7754955	

Taxa	Specimen Number	# Easting	# Northing	Approx. No. Plants
	HPXOP01 (NC)	663982	7754550	1
	HPXOP01 (NC)	663775	7754306	6
	HPXOP09	663697	7754153	2
	HPXOP09 (NC)	663731	7754242	2
	HPXOP09 (NC)	663635	7754467	3
	TEF1	664138	7754473	1000+ (within Population 2)
	TEF2	664161	7754434	
	TEF3	664230	7754460	
	HPX02.07	663441	7754997	1

Australian Geocentric 1994 (GDA94), Zone 50K

CHAIN OF CUSTODY

Submission of flora specimens to BHPB funded botanist

Company ENV.Australia

Date submitted 15.9.2010

Date results required ASAP

bhpbilliton

Project Area	Specimen No	Consultant ID	Habit	Habitat	Consultant Comment	Steve Dillon ID	ID date	Steve Dillon Comment
Hunt Point	Tef 3	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Hunt Point	Tef 2	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Hunt Point	HP02.07	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		Atypical in that the adaxial leaflet surface is completely glabrous.
Hunt Point	Tef 1	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP25	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPO09.09	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		Indumentum on leaves more appressed than most specimens but few leaves present & all v. young. Indumentum on stems & fws more typical.
Tug Harbour	TPOP08	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP11	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP14B	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP17	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP13	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TP03.02	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP11	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP23	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP14A	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP28	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Hunt Point	HPOP02	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Hunt Point	HPOP03	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Hunt Point	HPOP01	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Hunt Point	HPOP09	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Hunt Point	HPOP04	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Hunt Point	HPOP06	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Hunt Point	HPOP05	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP30	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP27	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP26	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP07	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP12	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		
Tug Harbour	TPOP29	Tephrosia rosea var venulosa	low shrub	coastal sandplain	See comment below	*Tephrosia rosea* var. *venulosa*		

Note, this form was provided by the WAH and has not been edited by ENV. Specimens listed included those from the current survey, and other surveys conducted at the same instance.

APPENDIX J
LOCATION OF INTRODUCED FLORA

APPENDIX J

LOCATION OF INTRODUCED FLORA

Taxa	Site Number	# Easting	# Northing
**Aerva javanica*	HPX01	664111	7754660
**Aloe vera*	HPXOP	663916	7754960
**Cenchrus ciliaris*	Polygon	N/A	N/A
**Chloris barbata*	HPXOP10	663574	7754801
** Indigofera sessiliflora*	HPX01	664111	7754660
**Opuntia stricta*	HPXOP	663916	7754960
**Portulaca oleracea*	HPX02	663441	7754997
	HPXR01	663641	7754269
	HPXR02	664025	7754517
	HPXR03	664066	7754801
**Yucca aloifolia*	HPXOP	663916	7754960

Australian Geocentric 1994 (GDA94), Zone 50K

APPENDIX K
HABITAT ASSESSMENT DATA SHEETS

APPENDIX K

HABITAT ASSESSMENT DATA SHEETS

Habitat Assessment - HA 1B

Generic

Broad Fauna Habitat: Dunes
UTM Co-ordinates Easting: 663930 **Northing:** 7754470

Habitat Value: Low

Total Area of Habitat: 19.4 ha

Proportion of Project Area: 29%

Habitat Structure and Microhabitats

Aspect:	Flat	**Exfoliating Slabs:**	nil	
Soils:	Red Sand	**Surface rocks:**	Small: None	Large: None
Boulders:	nil	**Tree Hollows:**	Small: None	Large: None
Cracks:	nil	**Caves:**	nil	Crevices: No
Cliffs :	nil	**Suitability for bats:**	nil	
Litter Cover:	Woody Debris 0%, Bare Ground 30%			

Vegetation

Stratum	Vegetation Species	Cover	Height
Overstorey:	-		
Midstorey :	*Acacia stellaticeps*	10-30%	2.0m
Understorey:	**Cenchrus ciliaris*	30-70%	0.5m
Condition Rating:	Degraded		
Disturbance:	Weeds, rubbish		
Fire Age	Old		

Other Relevant Information:
Unsuitable for the Western Pebble-mound Mouse.

Habitat Assessment - HA 2B

Generic

Broad Fauna Habitat: Dunes
UTM Co-ordinates Easting: 663863 **Northing:** 7754973

Habitat Value: Low

Total Area of Habitat:	19.4 ha
Proportion of Project Area:	29%

Habitat Structure and Microhabitats

Aspect:	Depression	**Exfoliating Slabs:**	nil	
Soils:	Red Sand	**Surface rocks:**	Small: Common	Large: None
Boulders:	nil	**Tree Hollows:**	Small: None	Large: None
Cracks:	nil	**Caves:**	nil	Crevices: No
Cliffs :	nil	**Suitability for bats:**	nil	
Litter Cover:	Woody Debris 0%, Bare Ground 25%			

Vegetation

Stratum	**Vegetation Species**	**Cover**	**Height**
Overstorey:	-		
Midstorey :	*Acacia stellaticeps*	10-30%	2.0m
Understorey:	**Cenchrus ciliaris*	30-70%	0.5m
Condition Rating:	Degraded		
Disturbance:	Weeds, rubbish		
Fire Age	Old		

Other Relevant Information:
Unsuitable for the Western Pebble-mound Mouse

Habitat Assessment - HA 3B

Generic

Broad Fauna Habitat: Dunes
UTM Co-ordinates Easting: 663466 **Northing:** 7755005

Habitat Value: Low

Total Area of Habitat:	19.4 ha
Proportion of Project Area:	29%

Habitat Structure and Microhabitats

Aspect:	Flat	**Exfoliating Slabs:**	nil	
Soils:	White Sand	**Surface rocks:**	Small: None	Large: None
Boulders:	nil	**Tree Hollows:**	Small: None	Large: None
Cracks:	nil	**Caves:**	nil	Crevices: No
Cliffs :	nil	**Suitability for bats:**	nil	
Litter Cover:	Woody Debris 0%, Bare Ground 40%			

Vegetation

Stratum	Vegetation Species	Cover	Height
Overstorey:	-		
Midstorey :	*Santalum lanceolatum*	10-30%	1.5m
Understorey:	*Ptilotus exaltatus* var. *exaltatus*	30-70%	0.3m
Condition Rating:	Good		
Disturbance:	Weeds, rubbish		
Fire Age	Old		

Other Relevant Information:
Unsuitable for the Western Pebble-mound Mouse.

Habitat Assessment - HA 4B

Generic

Broad Fauna Habitat: Shoreline

UTM Co-ordinates Easting: 664299 **Northing:** 7754360

Habitat Value: High

Total Area of Habitat:	10.3 ha
Proportion of Project Area:	15.4%

Habitat Structure and Microhabitats

Aspect:	Flat	**Exfoliating Slabs:**	nil	
Soils:	Red Sand	**Surface rocks:**	Small: None	Large: None
Boulders:	nil	**Tree Hollows:**	Small: None	Large: None
Cracks:	nil	**Caves:**	nil	Crevices: No
Cliffs :	nil	**Suitability for bats:**	nil	
Litter Cover:	Woody Debris 0%, Bare Ground 100%			

Vegetation

Stratum	**Vegetation Species**	**Cover**	**Height**
Overstorey:	-		
Midstorey :	-		
Understorey:	-		
Condition Rating:	N/A		
Disturbance:	rubbish		
Fire Age	N/A		

Other Relevant Information:
Limestone Platform with Waders

No Vegetation

Habitat Assessment - HA 5B

Generic

Broad Fauna Habitat: Shoreline

UTM Co-ordinates Easting: 664017 **Northing:** 7754892

Habitat Value: High

Total Area of Habitat:	19.4 ha
Proportion of Project Area:	29%

Habitat Structure and Microhabitats

Aspect:	Flat	**Exfoliating Slabs:**	nil	
Soils:	White Sand	**Surface rocks:**	Small: None	Large: Rare
Boulders:	nil	**Tree Hollows:**	Small: None	Large: None
Cracks:	nil	**Caves:**	nil	Crevices: No
Cliffs :	nil	**Suitability for bats:**	nil	
Litter Cover:	Woody Debris 0%, Bare Ground 90%			

Vegetation

Stratum	Vegetation Species	Cover	Height
Overstorey:	-		
Midstorey :	-		
Understorey:	*Ipomea pes-caprae* subsp. *brasiliensis*	2-10%	0.2m
Condition Rating:	Good		
Disturbance:	rubbish		
Fire Age	N/A		

Other Relevant Information:

Limestone Platform with Waders

Limited Vegetation

Habitat Assessment - HA 6B

Generic

Broad Fauna Habitat: Shoreline
UTM Co-ordinates Easting: 663424 **Northing:** 7755060

Habitat Value: High

Total Area of Habitat:	19.4 ha
Proportion of Project Area:	29%

Habitat Structure and Microhabitats

Aspect:	Flat	**Exfoliating Slabs:**	nil	
Soils:	White Sand	**Surface rocks:**	Small: None	Large: None
Boulders:	nil	**Tree Hollows:**	Small: None	Large: None
Cracks:	nil	**Caves:**	nil	Crevices: No
Cliffs :	nil	**Suitability for bats:**	nil	
Litter Cover:	Woody Debris 0%, Bare Ground 90%			

Vegetation

Stratum	Vegetation Species	Cover	Height
Overstorey:	-		
Midstorey :	-		
Understorey:	*Ipomea pes-caprae* subsp. *brasiliensis*	2-10%	0.4m
Condition Rating:	Good		
Disturbance:	Rubbish		
Fire Age	N/A		

Other Relevant Information:
Limestone Platform

Limited Vegetation

Habitat Assessment - HA 7A

Generic

Broad Fauna Habitat: Rehabilitated Vegetation
UTM Co-ordinates Easting: 663741 **Northing:** 7754562

Habitat Value: Low

Total Area of Habitat:	14 ha
Proportion of Project Area:	21%

Habitat Structure and Microhabitats

Aspect:	Hill / Gullies	**Exfoliating Slabs:**	nil	
Soils:	Red brown loam	**Surface rocks:**	Small: Moderate	Large: None
Boulders:	nil	**Tree Hollows:**	Small: None	Large: None
Cracks:	nil	**Caves:**	nil	Crevices: No
Cliffs :	nil	**Suitability for bats:**	nil	
Litter Cover:	Woody Debris 0%, Bare Ground 95%			

Vegetation

Stratum	Vegetation Species	Cover	Height
Overstorey:	-		
Midstorey :	*Acacia ampliceps* and *Casuarina obesa*	4%	2-2.5m
Understorey:	**Cenchrus ciliaris*	1%	0.5m
Condition Rating:	Good / Degraded		
Disturbance:	Rehabilitated area, irrigation lines, Introduced species, Port infrastructure and rubbish.		
Fire Age	N/A		

Other Relevant Information:
Limited Vegetation – Low diversity of micro niches.

APPENDIX L
LOCATIONS OF CONSERVATION SIGNIFICANT FAUNA

APPENDIX L

LOCATIONS OF CONSERVATION SIGNIFICANT FAUNA

Species Name	Common Name	Listing	#Eastings	#Northings
Pandion haliaetus	Eastern Osprey	EPBC – Mi	664216	7754435
Egretta sacra	Eastern Reef Egret	EPBC – Mi	664325	7754346
Sterna caspia	Caspian Tern	EPBC – Mi	664325	7754346
Arenaria interpres	Ruddy Turnstone	EPBC – Mi	664325	7754346
Numenius phaeopus	Whimbrel	EPBC – Mi	664075	7754842

[#]Australian Geocentric 1994 (GDA94) Zone 50K