APPENDIX B

GHD FLORA AND FAUNA ASSESSMENT

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Landcorp

Report for Karratha Land Release - Amendment 21

Flora and Fauna Assessment

September 2011

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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1. Introduction

1.1 Background

The Shire of Roebourne is currently updating the Karratha Town Planning Scheme No 8 as a part of its 'City Growth Plan'. The City Growth Plan is to develop Karratha as the major City of the North and make it an attractive choice for future development.

Part of the proposed Amendment 21 is to re-zone a number of sites which have been identified as having potential for development. The Amendment is designed to coordinate the growth of Karratha to include the infill of existing areas and support expansion of current residential and industrial zones.

LandCorp has commissioned GHD to undertake a flora and fauna assessment of a number of Development Areas (DAs) proposed for re-zoning to identify constraints based on the conclusions of the Preliminary Environmental Impact Assessment (PEIA) prepared by GHD (GHD, 2011).

1.2 Study Area

The study srea lies within the Shire of Roebourne in the Pilbara Region of Western Australia, and contains 18 DAs from 9 precincts (identified in the City Growth Plan) in and around Karratha. Table 1 identifies the DAs surveyed as part of this flora and fauna assessment, the precinct in which they occur and the area they cover.

The location of the 18 DAs (study area) is presented in Figure 1, Appendix A.

Table 1 Precinct, Development Areas and size of development area in hectares

Precinct	Development Area (DA)	Area (Ha)
City Centre	DA 40	22.3
Existing Townsite	DA 31	5.3
Gap Ridge / Seven Mile	DA 13	189.5
	DA 26	194.5
Nickol / Baynton	DA 27	79.9
	DA 28	91.0
	DA 29	18.0
The Links	DA 35	19.1
Karratha Hills	DA 16	71.8
	DA 32	79.8
	DA 38	21.4
	DA 42	91.6
Regals Valley	DA 14	406.4

Precinct	Development Area (DA)	Area (Ha)
	DA 15	578.9
Airport	DA 30	112.9
Karratha Industrial Estate	DA 17	253.3
	DA 41	84.1
	DA 43	229.9

1.3 Scope of Works

The flora and fauna assessment included both field and desktop assessments. The desktop assessment included:

- A review of the Department of Environment and Conservation's (DEC) Rare and Threatened Flora database;
- A review of the DEC's Threatened Fauna database;
- A review of local and regional significance of plant communities;
- A review of the Western Australian Museum database for threatened and endangered fauna;
- A review of the DEC's Environmentally Sensitive Areas (ESAs); and
- A review of the Department of the Environment, Water, Heritage and Arts (DEWHA) database for areas listed under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The field survey verified the desktop study and provided a detailed assessment of the existing environment in the survey area and its relationship to adjoining areas. The field survey included the following actions and details:

- An inventory of the vascular plant species in the study area, undertaken by assessment of 50 m x 50 m quadrats and walking transect survey methods;
- A review of, and search for, significant flora species;
- An inventory of dominant exotic plants, including declared noxious plants and environmental weed species;
- Advice on whether weeds are likely to spread to and result in environmental harm to adjacent areas of native vegetation that is in good or better conditions;
- A description and location, including mapping, of plant communities;
- A rating of condition of the vegetation communities or areas using a published rating scale, as used in the assessment of vegetation in Bush Forever Sites (Government of Western Australia, 2000);
- A review of the local and regional significance of the plant communities in terms of their intrinsic value, extent, rarity and condition;

- Assessment of potential clearing against the Environmental Protection Act's Ten Clearing Principles (Schedule 5). Each principle has been assessed in accordance with the DEC's Guideline to Assessment – Clearing of Native Vegetation;
- An inventory of the vertebrate fauna species observed in the survey areas through targeted searches and opportunistic recordings of species;
- A night time spotlighting survey of areas likely to support cryptic and nocturnal species;
- An assessment of the habitat available for all species and particularly of the significant fauna species listed in the Preliminary Assessment.

2. Desktop Assessment

2.1 Climate

The study area is located within the Pilbara region of Western Australia. The Pilbara region is subject to an arid-tropical climate with two distinct seasons; a hot summer from October to April and a mild winter from May to September. The average yearly evaporation exceeds rainfall by as much as 2,500 mm per year. Seasonally low but unreliable rainfall, together with high temperatures and high diurnal temperature variations are also characteristic climatic features of the region.

The majority of the Pilbara has a bimodal rainfall distribution, resulting in two rainfall maxima per year. From January to March, rain results from storms penetrating from the north, producing sporadic and intense thunderstorms. Tropical cyclones and depressions moving southwards from northern Australian waters also cause heavy rainfall events. From May to June cold fronts move easterly across Western Australia and may occasionally reach the Pilbara Region. These fronts produce light winter rains that are generally ineffective for extensive plant growth. Surface water can be found in some pools and springs in the Pilbara Region all year round, although watercourses only flow briefly due to the short wet season.

The closest official Bureau of Meteorology (BoM, 2011) weather recording stations are at Karratha Aero. Recorded climatic data for both stations is summarised in Table 2.

Table 2 Climatic data for Karratha Aero

Parameter	Value
Mean Annual Maximum Temperature Range	26.3° (Jul) – 36.1° (Mar)
Mean Annual Minimum Temperature Range	13.8° (Jul) – 26.8° (Jan)
Mean Annual Rainfall	289.1 mm
Mean Annual Days of Rain per year	19.9

2.2 Biogeography

The Development Areas are located within the Roebourne subregion of the Pilbara Bioregion Interim Biogeographic Regionalisation of Australia (IBRA) region. Kendrick and Stanley (2001) described the Roebourne subregion as:

> Quaternary alluvial and older colluvial coastal and subcoastal plains with a grass savannah of mixed bunch and hummock grasses, and dwarf shrub steppe of *Acacia stellaticeps* or *A. pyrifolia* and *A. inaequilatera*. Uplands are dominated by *Triodia* hummock grasslands. Ephemeral drainage lines support *Eucalyptus victrix* or *Corymbia hamersleyana* woodlands. Samphire, *Sporobolus* and mangal occur on marine alluvial flats and river deltas. Resistant linear ranges of basalts occur across the coastal plains, with minor exposures of granite. Islands are either Quaternary sand accumulations, or composed of basalt or limestone, or combinations of any of these three. Climate is arid (semi-desert) tropical with

highly variable rainfall, falling mainly in summer. Cyclonic activity is significant, with several systems affecting the coast and hinterland annually.

2.3 Land Systems

Land systems mapping is based on regional patterns in topography, geology, soils and vegetation. Van Vreeswyk *et al.* (2004) completed an inventory of the land systems occurring in the Pilbara bioregion. The mapping classifies the Pilbara region into 102 land systems. The study area occurs on the following land systems:

- **Horseflat land system:** Gilgaied clay plains supporting tussock grasslands and minor grassy snakewood shrublands;
- **Ruth land system:** Sandy coastal plains and saline clay plains supporting soft and hard spinifex grasslands and minor tussock grasslands;
- **Cheerawarra:** Hills and ridges of volcanic and other rocks supporting hard spinifex (occasionally soft spinifex) grasslands; and
- **Littoral land system:** Bare coastal mudfats with mangroves on seaward fringes, samphire flats, sandy islands, coastal dunes and beaches.

2.4 Botanical District

The study area lies within the Fortescue Botanical District as defined by Beard (1975). This Botanical District is then further divided into nine subdivisions by Beard with the study area lying within the Abydos Plain.

The vegetation communities of the Abydos Plain area are influenced by the parent geological material of the area, which is Quaternary alluvium near the coast and Archaean granite further inland (Beard, 1975). Quaternary alluvial deposits near the coast are essentially sandy with cracking clays in smaller portions. Mudflats, dunes and marshes characterise the littoral zone. Vegetation near the coast is predominantly shrub steppe. Spinifex associations with scattered shrubs (mostly *Acacia* species) or small trees (*Hakea lorea*, *Grevillea wickhamii*) dominate the granite areas and small rises of the plain. Watercourses may support *Eucalyptus camaldulensis* or *Melaleuca leucodendron* but are generally lined by a diverse shrub assemblage.

There are also areas of extensive grass plains on the Abydos Plain where finer grained alluvia have been deposited, particularly those derived from the weathering of basic rocks. These communities consist of open plains of grass (dominated by two or three species) or of mixed grass and Spinifex with scattered individuals of *Acacia inaequilatera* (Beard, 1975).

2.5 Vegetation Types, Extent and Status

Broad-scale vegetation mapping of the area undertaken by Beard (1975) indicates two vegetation associations are present within the study area. They consist of:

- Association 589: Mosaic: Short bunch grassland – savannah / grass plain (Pilbara) / Hummock grasslands, grass steppe; soft spinifex.
- Association 157: Hummock grasslands, grass steppe; hard spinifex, *Triodia wiseana*.

A vegetation type is considered under-represented if there is less than 30% of its original distribution remaining. From a purely biodiversity perspective, and not taking into account any other land degradation issues, there are several key criteria now being applied to vegetation (EPA, 2000). These are detailed below:

The "threshold level" below which species loss appears to accelerate exponentially at an ecosystem level is regarded as being at 30% of the pre-European/pre-1750 extent for the vegetation type;

10% of the pre-European/pre-1750 extent for the vegetation type is regarded as being a level representing *Endangered*; and

Clearing which would put the threat level into the class below should be avoided.

Such status can be delineated into five (5) classes:

Presumed Extinct: Probably no longer present in the bioregion

*Endangered**: <10% of pre-European extent remains

*Vulnerable**: 10-30% of pre-European extent exists

*Depleted**: >30% and up to 50% of pre-European extent exists

Least Concern: >50% pre-European extent exists and subject to little or no degradation over a majority of this area.

* Or a combination of depletion, loss of quality, current threats and rarity gives a comparable status

The extent of remnant native vegetation has been assessed by the Government of Western Australia (2010), based on vegetation association mapping undertaken by Beard (1975). The remaining extent of the vegetation associations present within the study area for the Local Government Area (LGA), and State, is detailed in Table 3.

Table 3 Vegetation association, extent and status within the study area

Vegetation association	Vegetation description	Region	Pre-European extent (ha)	Current extent (ha)	% remaining	% Pre-European extent in IUCN Class I-IV Reserves
157	Hummock grasslands, grass steppe; hard Spinifex, *Triodia wiseana*	State	502,728	501,513	99.76	17.95
		LGA1	73,039	71,824	98.34	-
589	Mosaic: Short bunch grassland – savannah / grass plain (Pilbara) / Hummock grasslands, grass steppe; soft spinifex	State	809,753	809,636	99.99	1.60
		LGA1	314,673	314,578	99.97	-

The extent of the vegetation associations identified within the study area are considered of *Least Concern*, with more than 50% of the pre-European extent considered to be remaining.

2.6 Threatened and Priority Ecological Communities

Ecological communities are defined as 'naturally occurring biological assemblages that occur in a particular type of habitat' (English and Blythe, 1997). Threatened Ecological Communities (TECs) are ecological communities that have been assessed and assigned to one of four categories related to the status of the threat to the community, i.e. Presumed Totally Destroyed, Critically Endangered, Endangered, Endangered and Vulnerable.

The Department of Environment and Conservation (DEC) maintains a list of TECs. Some of these TECs are protected under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). DEC listed ecological communities are given special consideration in environmental impact assessments and have special status under the land clearing regulations of the *Environmental Protection Act 1986*. The Environmental Protection Authority's (EPA's) position on TECs states that proposals that result in the direct loss of TECs are likely to require formal assessment.

Possible TECs that do not meet survey criteria are added to the DEC's Priority Ecological Community (PEC) Lists under Priorities 1, 2 and 3 (DEC, 2011a). These are ecological communities that are adequately known; are rare but not threatened, not meet criteria for Near Threatened. PECs 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.

A search of the EPBC Protected Matters Search Tool and DEC's TEC database indicates that there are no TECs within or in close proximity of the study area.

The DEC database search did however identify 32 occurrences of three types of PECs within 50 km of the study area. Mapping showing the extent of the PECs is provided in Figure 1, Appendix A. It should be noted that the PEC mapping which is provided by DEC, illustrates the PEC with a nominated buffer zone.

The PECs identified within and in close proximity to the study area are described as follows:

1. **Roebourne Plains coastal grasslands with gilgai micro-relief on deep cracking clays (Roebourne Plains gilgai grasslands) (Priority 1)**

Desktop results identified twenty occurrences of this PEC within 50 km of the study area.

The Roebourne Plains coastal grasslands with gilgai micro-relief occur on deep cracking clays that are self-mulching and emerge on depositional surfaces. The Roebourne Plains gilgai grasslands occur on micro-relief of deep cracking clays, surrounded by clay plains/flats and sandy coastal and alluvial plains. The gilgai depressions supports ephemeral and perennial tussock grasslands dominated by *Sorghum* sp. and *Eragrostis xerophila* (Roebourne Plains grass) along with other native species including *Astrebla pectinata* (barley mitchell grass), *Eriachne benthamii* (swamp wanderrie grass), *Chrysopogon fallax* (golden beard grass) and *Panicum decompositum* (native millet). Restricted to the Karratha area, this community differs from the surrounding clay flats of the Horseflat land system which are dominated by *Eragrostis xerophila* and other perennial tussock grass species (*Eragrostis* mostly).

2. **Horseflat Land System of the Roebourne Plains (Priority 3)**

Desktop searches identified ten occurrences of this PEC within 50 km of the study area. This PEC is described as the remainder of the Horseflat land system – not including the Roebourne Plains gilgai

grasslands and the Chenopod association of the Roebourne Plains area. This PEC occurs from Cape Preston to Balla Balla (Whim Creek).

3. **Burrup Peninsula Rock Pool Communities (Priority 1)**

Desktop searches identified two occurrences of this PEC within 50 km of the study area. This PEC consists of Calcareous tufa deposits and interesting aquatic snails. This PEC is restricted to the Burrup peninsula and does not occur within the study area.

2.7 Conservation Significant Flora

Species of significant flora are protected under both State and Commonwealth Acts. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act and the State *Wildlife Conservation Act 1950* (WC Act) can trigger referral to the Department of Environment, Sustainability, Environment, Water, Population and Communities (DSEWPaC) and/or the EPA. A description of Conservation Categories delineated under the EPBC Act is detailed in Appendix B. These are applicable to threatened flora and fauna species.

A search of the EPBC Act Protected Matters Search Tool (DEWHA, 2009) identified no Commonwealth protected flora species within 10 km of the study area.

In addition to the EPBC Act, significant flora in Western Australia is protected by the *Wildlife Conservation Act 1950*. This Act, which is administered by the DEC, protects Declared Rare Flora (DRF) species. Also in Western Australia, the DEC produces a supplementary list of Priority Flora, these being species that are not considered Threatened under the WC Act but for which the Department feels there is a cause for concern. These species have no special legislative protection, but their presence would normally be considered relevant to an assessment of the conservation status of an area. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened flora. A description of the DEC's Conservation Codes that relate to flora species is provided in Appendix B.

A search of the DEC's Rare Flora Databases, Western Australian Herbarium (WAHERB) and Western Australian Museum (WAM) *NatureMap* records was undertaken (DEC, 2011b). No DRF have been recorded within 10 km of the study area. The search did however identify nine Priority flora species within 10 km of the study area. These species are outlined in Table 4.

During the field investigation no DRF or Priority species were recorded.

Table 4 Significant flora species known to occur in the vicinity of the study area (Source: DEC, WAHERB and *NatureMap* databases)

Species	Status	Description/Habitat
Acacia glaucocaesia	Priority 3	Dense, glabrous shrub or tree, 1.8-6 m high. Flowers Jul-Sep. Occurs on red loam, sandy loam, clay on floodplains.
Atriplex lindleyi subsp. *conduplicata*	Priority 3	Monoecious, short-lived annual or perennial, herb, ca 0.2 m high. Occurs on crabhole plains.
Eragrostis lanicaulis	Priority 3	Knotty or bulbous rhizomatous, perennial, grass-like or herb, 0.45-0.5 m high. Flowers March-May or Aug-

Species	Status	Description/Habitat
		Oct. Occurs on red sandy clay on flats.
Stackhousia clementii	Priority 3	Dense broom-like perennial, herb, to 0.45 m high. Occurs on skeletal soils on sandstone hills.
Tephrosia bidwillii	Priority 3	Shrub, 0.3-0.9 m high. Flowers May or August.
Terminalia supranitifolia	Priority 3	Spreading, tangled shrub or tree, 1.5-3 m high. Flowers May or Jul or Dec. Occurs on sand among basalt rocks.
Themeda sp. Hamersley Station (M.E. Trudgen 11431)	Priority 3	Tussocky perennial, grass-like or herb, 0.9-1.8 m high. Flowers August. Occurs on clay pan, grass plain.
Vigna sp. Rockpiles (R. Butcher et al. RB 1400)	Priority 3	No available information.
Rhyncosia bungarensis	Priority 4	Compact, prostrate shrub, to 0.5 m high. Occurs on pebbly, shingly coarse sand amongst boulders on banks of flow line in the mouth of a gully in a valley wall.

2.8 Conservation Significant Fauna

The conservation of fauna species and their significance status is currently assessed under both State and Commonwealth Acts. The acts include the WC Act; *Wildlife Conservation (Specially Protected Fauna) Notice 2003,* and the EPBC Act. Any activities that are deemed to have a significant impact on species that are recognised by the EPBC Act and the WC Act can trigger referral to DSEWPaC and/or the EPA.

In Western Australia, the DEC also produces a supplementary list of Priority Fauna, these being species that are not considered Threatened under the WC Act but for which the Department feels there is a cause for concern. These species have no special legislatory protection, but their presence would normally be considered. Such taxa need further survey and evaluation of conservation status before consideration can be given to declaration as threatened fauna. Relevant Federal and State conservation codes are provided in further detail in Appendix B.

Desktop searches of the EPBC Act Protected Matters Search Tool and WAM *NatureMap* database identified four Threatened fauna species listed under the EPBC Act and WC Act, as potentially occurring within 10 km of the study area. Four DEC listed Priority fauna species have been recorded within 10 km of the study area. These species are listed in Table 5.

The EPBC Act Protected Matters Search Tool also identified 28 bird species listed as Marine and/or Migratory under the EPBC Act (Bonn Convention) to potentially occur in the study area. The results of the desktop searches are provided in Appendix C.

It should be noted that some species that appear in the *EPBC Act* Protected Matters Search Tool are often not likely to occur within the specified area, as the search provides an approximate guidance to matters of national significance that require further investigation. The records from the DEC searches of

threatened fauna provide more accurate information for the general area; however some records of sightings or trappings can be dated and often misrepresent the current range of threatened species.

Table 5 Listing of potentially occurring Threatened and Priority fauna species within 10 km of the study area, with information source.

Species	Common Name	Listing under WC Act or DEC Priority List	Listing under EPBC Act	EPBC Act Protected Matters Search Tool	NatureMap
Mammals					
Dasyurus hallucatus	Northern Quoll	Schedule 1	Endangered	x	x
Rhinonicteris aurantia	Pilbara Leaf-nosed Bat	Schedule 1	Vulnerable	x	
Pseudomys chapmani	Western Pebble-mound Mouse	Priority 4			x
Birds					
Macronectes giganteus	South Giant-Petrel	Schedule 1	Endangered	x	
Ardeotis australis	Australian Bustard	Priority 4			x
Numenius madagascariensis	Eastern Curlew	Priority 4			x
Reptiles					
Liasis olivaceus barroni	Pilbara Olive Python	Schedule 1	Vulnerable	x	
Notoscincus butleri		Priority 4			x

3. Methodology

3.1 Vegetation and Flora

The vegetation and flora field surveys were undertaken with regards to the EPA's Guidance Statements No. 51, where possible. GHD's qualified ecologists conducted the field flora survey on 11-17th August 2011.

The flora and vegetation survey was conducted using quadrats and relévés (unbounded search areas) across the study area. The relévés included recording a list of flora species visible at the time and mapping of vegetation types and conditions (including weed status). Aerial photography was used to assist in the delineation of vegetation types present in the study area. Detailed information was collected in sixteen 50 x 50 metre quadrats and ten relévés in the delineated vegetation types.

A list of flora species collated from the quadrats and relévés was generated for the study area. Where identification of flora species was uncertain, confirmation was made at the Western Australian State Herbarium.

The presence of Declared Rare or Priority Flora was assessed. Suitable habitat for DRF and Priority Flora species was searched. Vegetation was also assessed to determine the presence of TECs and PECs within the study area.

3.1.1 Flora identification

Species that were well known to the survey botanists were identified in the field, while species that were unknown were collected and assigned a unique number to facilitate tracking. All plant species collected during the field survey were dried and fumigated in accordance with the requirements of the Western Australian Herbarium. Plant species were identified by the use of local and regional flora keys and by comparison with the named species held at the Western Australian Herbarium. Plant taxonomists who are considered to be an authority on a particular plant group were consulted, when necessary.

The conservation status of all recorded flora was compared against the current lists available on *FloraBase* (DEC, 2010) and the EPBC Threatened species database provided by DSEWPaC (2010).

3.2 Fauna

GHD's qualified ecologists conducted the fauna investigation in conjunction with the flora investigation. The fauna survey included desktop investigations and field surveys, conducted with regard to the EPA's Guidance Statement No. 56, where possible. The fauna survey was an opportunistic survey and did not involve any fauna trapping.

The survey involved visual and aural surveys for any fauna species utilising the study area. The study area was also searched for any fauna signs, such as tracks, scats, bones, diggings and feeding signs. Surveys also included systematic searching across all habitat types, which is an effective method of surveying for many reptile species. This involved searching through microhabitats where reptiles are known to frequent, including turning over logs or rocks, turning over leaf litter and examining hollow logs. Reptiles were also sighted as they basked during the day. Species – specific search strategies were used to identify any protected species in the area or evidence that they utilise the study area.

Nocturnal searches and road cruising were also conducted in areas likely to support cryptic and nocturnal species. Nocturnal searches involved using head torches and hand held spotlights while road cruising was conducted at low speed through the study area, looking for fauna. The total time spent during night searching was eight hours.

Fauna assessment was consistent with the EPA Guidance Note for the *Assessment of Environmental Factors for Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia* (Guidance Statement No. 56) (EPA, 2004).

3.3 Nomenclature

Nomenclature used in this report follows that used by the DEC's FloraBase program and Western Australian Museum FaunaBase program as they are deemed to contain the most up-to-date species information for Western Australia.

3.4 Limitations

Complete flora and vegetation assessments can require multiple surveys, at different times of year, and over a period of a number of years, to enable observation of all species present. Some flora species, such as annuals, are only available for collection at certain times of the year, and others are only identifiable at certain times (such as when they are flowering). Additionally, climatic and stochastic events (such as fire) may affect the presence of plant species. Species that have a very low abundance in the area are more difficult to locate, due to above factors. Therefore, while this flora survey was relatively exhaustive, it is possible that some species with low abundance, or with a very restricted range in the study area, may have been overlooked.

The flora surveys were also restricted to predominantly flowering plants, with consideration of some other vascular plants such as cycads. Non-vascular plants were not systematically searched for, as the information available on these plants is generally limited.

The fauna survey undertaken was a reconnaissance survey only and thus only sampled those species that can be easily seen, heard or have distinctive signs, such as tracks, scats, diggings etc. It provides a brief snapshot of those species present at the time of sampling (daytime), in one season, in one year. Not all potentially occurring species would be recorded during a single survey due to spatial and temporal variations in fauna population numbers. Extensive detailed fauna surveys, involving trapping surveys, are required to obtain a more comprehensive list of fauna species that may utilise the site.

This survey was aimed at identifying the terrestrial vertebrate fauna of the study area; no sampling for invertebrates or aquatic species occurred.

4. Results and Discussion

4.1 Vegetation Associations

The quadrat and relevé data was analysed and sites grouped together according to similar species composition, structure, dominance at the stratum level, soils and landform.

The vegetation in the study area was classified into ten vegetation associations, including cleared/highly disturbed vegetation and the DEC aboretum. The majority of the study area was dominated by *Triodia* hummock grasslands with open to scattered shrublands of *Acacia* species while tussock grasslands dominated the cracking clay plains.

The vegetation associations of the study area are described in detail in Table 6 and are mapped on Figure 2, Appendix A.

Table 6 Vegetation types recorded within the study area

No.	Broad Vegetation Type	Vegetation Description	Site Photo	Study Area
V1	*Triodia* Hummock Grassland	Hummock Grassland of *Triodia wiseana* and *Triodia pungens* with Scattered Shrubs of *Acacia pyrifolia*, *Senna glutinosa* subsp. *glutinosa* and *Trichodesma zeylanicum* over Low Open Shrubland of *Indigofera monophylla*, *Corchorus tectus* and *Ptilotus clementii* over Very Open Herbs of *Rhyncosia minima*, *Gomphrena cunninghamii* and *Oldenlandia crouchiana* and on rocky undulating slopes and hills.		DA13, DA16, DA17, DA32, DA38, DA42, DA43.
V2	*Eucalyptus* Low Woodland	Low Woodland of *Eucalyptus victrix*, *Terminalia canescens* and *Flueggea virosa subsp. melanthesoides* over High Shrubland of *Acacia pyrifolia, Acacia coriacea* subsp. *pendens* and *Acacia colei* over Open Shrubland of *Sesbannia cannabina, Senna glutinosa* subsp. *glutinosa* and *Indigofera monophylla* over Tussock grassland of *Cenchrus ciliaris*, *Triodia pungens* and *Triodia wiseana* over Scattered Sedges and Herbs of *Cyperus vaginatus*, *Sida fibulifera* and *Stemodia grossa* along minor creeklines.		DA15, DA16, DA17, DA27, DA28, DA32, DA25, DA38, DA41, DA42, DA43.

No.	Broad Vegetation Type	Vegetation Description	Site Photo	Study Area
V3	*Eragrostis* Tussock Grassland	Tussock Grassland of *Eragrostis xerophila*, *Dichanthium sericeum* subsp. *humilius*, **Cenchrus ciliaris* and *Panicum decompositum* with Scattered Shrubs of *Acacia xiphophylla*, *Ptilotus exaltatus* and *Salsola tragus* over Scattered Herbs of *Sida fibulifera*, *Streptaglossa* spp. and *Goodenia muelleriana* on cracking clay plains.		DA17, DA26, DA27, DA29, DA35, DA40, DA43
V4	Mosaic *Acacia* Shrubland/Triodia Hummock Grassland	Mosaic Shrublands of *Acacia pyrifolia, A inaequilatera, A. xiphophylla*, *A. bivenosa*, *A. coriacea* subsp. *pendens* and *Senna glutinosa* subsp. *glutinosa*, over Low Open Shrublands of *Indigofera monophylla*, *Corchorus walcottii, Senna notablis, Ptilotus* spp., and **Aerva javanica* over Hummock Grassland of *Triodia wiseana* and *T. pungens* and Tussock Grasses of **Cenchrus ciliaris*, *Aristida* spp., *Enneapogon caerulescens* and *Eragrostis* spp. over Scattered Mixed Herbs on gravelly sandy/clay plains.		DA13, DA15, DA17, DA26, DA27, DA28, DA29, DA35, DA41, DA43.

No.	Broad Vegetation Type	Vegetation Description	Site Photo	Study Area
V5	*Acacia* High Shrubland	High Shrubland of *Acacia inaequilatera* and *Grevillea pyramidalis* over Shrubland of *Acacia bivenosa, A. pyrifolia* and *A. coriacea* subsp. *pendens* over Low Shrubland of *Corchorus tectus, Indigofera monophylla, Diplopeltis eriocarpa* and *Ptilotus* spp. over Hummock Grassland of *Triodia wiseana*, *T. pungens* and *Chrysopogon fallax* over Very Open Mixed Herbs on Floodplain.		DA16, DA32
V6	*Eucalyptus* Low Open Forest	Low Open Forest *of Eucalyptus victrix* and *Corymbia hamersleyana* over High Shrubland of *Acacia colei, A. coriacea* subsp. *pendens* and *A. sclerosperma* subsp. *sclerosperma* over Low Open Shrubland of *Cleome viscosa, Crotularia medicarginea* var. *neglecta* and *Indigofera* spp. over Tussock Grassland of **Cenchrus ciliaris, Aristida latifolia* and *Panicum decompositum* with Very Open Hummock Grasses of *Triodia pungens* over Mixed Open herbs and Sedges along creeklines.		DA13, DA26

No.	Broad Vegetation Type	Vegetation Description	Site Photo	Study Area
V7	*Tecticornia* Low Open Shrubland	Low Open Shrubland of *Tecticornia ?auriculata*, *Atriplex codonocarpa*, *Salsola tragus* and *Lawrencia viridgrisea* over Very Open Grasses of *Eragrostis falcata*, *Panicum decompositum* and *Triodia angusta* on mudflats.		DA30
V8	*Acacia* Shrubland	Shrubland of *Acacia bivenosa*, *A. sclerosperma* subsp. *sclerosperma* and *Scaevola spinescens* over Low Open Shrubland of *Ptilotus exaltatus*, *Corchorus walcottii* and *Ptilotus clementii* over Hummock Grassland of *Triodia pungens* and Tussock Grassland of **Cenchrus ciliaris, Chrysopogon fallax* and *Dichanthium sericeum* subsp. *humilius* over Very Open Herbs of *Goodenia microptera*, *Ptilotus helipteroides* and *Cassytha filiformis* on loamy plains.		DA30

No.	Broad Vegetation Type	Vegetation Description	Site Photo	Study Area
V9	Cleared/highly disturbed	Areas which have been predominantly cleared and/or are highly disturbed and contain little to no native flora species. These areas usually contain infrastructure and any remaining vegetation is generally dominated by weed and/or planted species.		DA13, DA17, DA26, DA30, DA35, DA40, DA43.
V10	DEC Arboretum	Planted introduced species		DA17

4.2 Flora Diversity

A total of 199 plant taxa (including subspecies and varieties) representing 42 families and 116 plant genera were recorded in the survey area. This total is comprised of 187 native species and 12 introduced (exotic) species.

Dominant families recorded from the study area included:

- Fabaceae 50 taxa;
- Poaceae 32 taxa
- Amaranthaceae 16 taxa; and
- Malvaceae 14 taxa.

Eleven taxa in the collection could not be positively identified to species level due to the absence of adequate flowering parts and/or fruiting bodies. None of these specimens matched descriptions of any conservation significant species previously recorded from the vicinity of the study area.

A flora species list is provided in Table 15.

4.3 Vegetation Condition

The vegetation condition of the study area was assessed using the vegetation condition rating scale developed by Keighery (1994) that recognises the intactness of vegetation, which is defined by the following:

- Completeness of structural levels;
- Extent of weed invasion;
- Historical disturbance from tracks and other clearing or dumping; and
- The potential for natural or assisted regeneration.

The scale, therefore, consists of six (6) rating levels as outlined in Table 7.

Table 7 Vegetation condition rating scale

Vegetation condition rating	Vegetation condition	Description
1	*Pristine or Nearly So.*	No obvious signs of disturbance.
2	*Excellent*	Vegetation structure intact, disturbance affecting individual species, and weeds are non-aggressive species.
3	*Very Good*	Vegetation structure altered, obvious signs of disturbance.
4	*Good*	Vegetation structure significantly altered by very obvious signs of multiple disturbances retains basic vegetation structure or ability to regenerate it.
5	*Degraded*	Basic vegetation structure severely impacted by disturbance. Scope for regeneration but not in a state approaching good condition without intensive management.
6	*Completely Degraded*	The structure of the vegetation is no longer intact and the area is completely or almost without native species.

The vegetation condition of the study area is discussed separately for each of the nine precincts in sections 4.3 to 4.11. The vegetation condition of the study area is mapped on Figure 3, Appendix A.

4.4 City Centre (DA-40)

4.4.1 Vegetation Associations

Two vegetation associations were identified within DA-40.

V3: *Eragrostis* Tussock Grassland

Tussock Grassland of *Eragrostis xerophila*, *Dichanthium sericeum* subsp. *humilius*, **Cenchrus ciliaris* and *Panicum decompositum* with Scattered Shrubs of *Acacia xiphophylla*, *Ptilotus exaltatus* and *Salsola tragus* over Scattered Herbs of *Sida fibulifera*, *Streptaglossa* spp. and *Goodenia muelleriana* on cracking clay plains.

V9: Cleared / highly disturbed

Areas which have been predominantly cleared and/or are highly disturbed and contain little to no native flora species. These areas usually contain infrastructure and any remaining vegetation is generally dominated by weed and/or planted species.

4.4.2 Threatened and Priority Ecological Communities

No TECs were identified within DA-40.

Surveys targeted the areas of tussock grasslands within or in close proximity to PEC buffer zones. Based on the limited information available and number of similarities, vegetation association V3 consisting of an *Eragrostis* Tussock Grassland is potentially the Horseflat Land System of the Roebourne Plains PEC (Priority 3). The majority of DA-40 consists of vegetation association V3 and occurs on the Horseflat land system. The tussock grassland vegetation association V3 has affinities with the Horseflat land system PEC including:

- Presence of gilgai micro-relief and cracking clays; and
- Presence of key indicator species *Eragrostis xerophila.*

The Horseflat land system of the Roebourne Plains PEC are dominated by *Eragrostis xerophila* and other perennial tussock (*Eragrostis* mostly) grass species. Site DA-40 was dominated by *Eragrostis xerophila* and the weed species **Cenchrus ciliaris* with other tussock grasses including *Dichanthium sericeum* subsp. *humilius* and *Panicum decompositum*. Chenopod species were also present in moderate numbers, including *Salsola tragus* and *Sclerolaena bicornis*.

Much of the site has previously been cleared or highly degraded due to neighbouring activities, particularly the western half of the site. There is a small area within the site that remains in very good condition.

4.4.3 Vegetation Condition

The vegetation condition across the site varies from Very Good to Completely Degraded. Prior disturbances within DA-40 have resulted in substantial impacts to some parts of the precinct. The main causes of disturbance have been from clearing, inappropriate vehicle access and weed invasion.

4.4.4 Weeds

The most common and dominant weed species within this site are **Cenchrus ciliaris* (buffel grass), **Portulaca oleracea* and **Aerva javanica* (kapok bush). These species were scattered across the site with buffel grass and kapok bush more prevalent in areas with a higher degree of disturbance. These weed species are common and widespread within the Pilbara region.

No weeds listed as Declared under section 37 of the *Agricultural and Related Resources Protection Act 1976* (WA) or as Weeds of National Significance (WONs) by the Australian Government were recorded at the site.

4.4.5 Conservation Significant Flora

No flora of conservation significance was identified within site DA-40.

4.4.6 Fauna Habitat

Site DA-40 contains two broad fauna habitat types based on predominant landforms, soil and vegetation structure in the area:

1. Tussock grassland/chenopod plains; and
2. Minor drainage line.

In general, the site provides some habitat value for predominantly birds and reptiles. Much of the site has been disturbed from adjacent development and vehicle tracks and therefore provides limited habitat for fauna species. The vegetation communities within DA-40 are present in the surrounding area in similar and/or better condition to that within the site.

4.4.7 Fauna Diversity

The field survey recorded 24 fauna species within DA-40, including eighteen bird, two reptile and four mammal species. Of these, three are introduced species, including the dog (*Canus lupis domesticus*), fox (*Vulpes vlpes*) and cat (*Felis catus*). The species recorded within the site are listed in Table 16, Appendix E.

4.4.8 Conservation Significant Fauna

No fauna of conservation significance were recorded from DA-40.

No habitat types were recorded that are considered to be specific to the site or a significant habitat type for threatened fauna.

4.5 Existing Townsite (DA-31)

4.5.1 Vegetation Associations

One vegetation association was identified within DA-31.

V4: Mosaic *Acacia* Shrubland/*Triodia* Hummock Grassland

Mosaic Shrublands of *Acacia pyrifolia, A inaequilatera, A. xiphophylla*, *A. bivenosa*, *A. coriacea* subsp. *pendens* and *Senna glutinosa* subsp. *glutinosa*, over Low Open Shrublands of *Indigofera monophylla*, *Corchorus walcottii, Senna notabilis, Ptilotus* spp., and **Aerva javanica* over Hummock Grassland of *Triodia wiseana* and *T. pungens* and Tussock Grasses of **Cenchrus ciliaris*, *Aristida* spp., *Enneapogon caerulescens* and *Eragrostis* spp. over Scattered Mixed Herbs on gravelly sandy/clay plains.

4.5.2 Threatened and Priority Ecological Communities

No TECs or PECs were identified as occurring within site DA-31

4.5.3 Vegetation Condition

The vegetation condition across the site was classified as Very Good. DA-41 appears to have experienced some historical disturbance as the area is dominated by *Acacia bivenosa* and several grass species including **Cenchrus ciliaris*. These species show a positive response to disturbance, increasing rapidly in number in the years after the disturbance occurred. The main causes of current and ongoing disturbance have been from previous clearing around the edges of the site, vehicle and pedestrian tracks and weed invasion. This site is completely surrounded by roads and housing.

4.5.4 Weeds

Two weed species were identified within DA-31, these were **Cenchrus ciliaris* and **Portulaca oleracea*. **Cenchrus ciliaris* had a percentage cover of 30% while **Portulaca oleracea* occurred at <2%. Both species are common and widespread weeds within the Pilbara region.

There were no weeds listed as Declared under section 37 of the *Agricultural and Related Resources Protection Act 1976* (WA) or as Weeds of National Significance (WONs) by the Australian Government.

4.5.5 Conservation Significant Flora

No flora of conservation significance was identified within site DA-31.

4.5.6 Fauna Habitat

Site DA-31 contains one broad fauna habitat type based on predominant landforms, soil and vegetation structure in the area: Acacia shrubland/hummock grassland flats.

The site provides some habitat value for predominantly birds and reptiles. Much of the site has been disturbed as a result of surrounding infrastructure, its proximity to housing, and use by the public for recreation purposes. Given the proximity of the site to housing and limited existing linkages to surrounding habitat, the habitat value of the site is limited. The vegetation communities within DA-31 are present in the surrounding region in similar and/or better condition to that within the site.

4.5.7 Fauna Diversity

The field survey recorded fourteen fauna species within DA-31, including ten bird, two reptile and two mammal species. Of these, two are introduced species, including the dog (*Canus lupis domesticus*) and cat (*Felis catus*). The species recorded within the site are listed in Table 16, Appendix E.

4.5.8 Conservation Significant Fauna

No fauna of conservation significance were recorded from DA-31.

No habitat types were recorded that are considered to be specific to the site or a significant habitat type for threatened fauna.

4.6 Gap Ridge/Seven Mile (DA-13 and DA-26)

4.6.1 Vegetation Associations

Five vegetation associations were identified within sites DA-13 and DA-26.

V1: *Triodia* Hummock Grassland

Hummock Grassland of *Triodia wiseana* and *Triodia pungens* with Scattered Shrubs of *Acacia pyrifolia*, *Senna glutinosa* subsp. *glutinosa* and *Trichodesma zeylanicum* over Low Open Shrubland of *Indigofera monophylla*, *Corchorus tectus* and *Ptilotus clementii* over Very Open Herbs of *Rhyncosia minima*, *Gomphrena cunninghamii* and *Oldenlandia crouchiana* and on rocky undulating slopes and hills.

V3: *Eragrostis* Tussock Grassland

Tussock Grassland of *Eragrostis xerophila*, *Dichanthium sericeum* subsp. *humilius*, **Cenchrus ciliaris* and *Panicum decompositum* with Scattered Shrubs of *Acacia xiphophylla*, *Ptilotus exaltatus* and S*alsola tragus* over Scattered Herbs of *Sida fibulifera*, *Streptaglossa* spp. and *Goodenia muelleriana* on cracking clay plains.

V4: Mosaic *Acacia* Shrubland/*Triodia* Hummock Grassland

Mosaic Shrublands of *Acacia pyrifolia, A inaequilatera, A. xiphophylla*, *A. bivenosa*, *A. coriacea* subsp. *pendens* and *Senna glutinosa* subsp. *glutinosa*, over Low Open Shrublands of *Indigofera monophylla*, *Corchorus walcottii, Senna notablis, Ptilotus* spp., and **Aerva javanica* over Hummock Grassland of *Triodia wiseana* and *T. pungens* and Tussock Grasses of **Cenchrus ciliaris*, *Aristida* spp., *Enneapogon caerulescens* and *Eragrostis* spp. over Scattered Mixed Herbs on gravelly sandy/clay plains.

V6: *Eucalyptus* Low Open Forest

Low Open Forest *of Eucalyptus victrix* and *Corymbia hamersleyana* over High Shrubland of *Acacia colei, A. coriacea* subsp. *pendens* and *A. sclerosperma* subsp. *sclerosperma* over Low Open Shrubland of *Cleome viscosa, Crotularia medicarginea* var. *neglecta* and *Indigofera* spp. over Tussock Grassland of **Cenchrus ciliaris, Aristida latifolia* and *Panicum decompositum* with Very Open Hummock Grasses of *Triodia pungens* over Mixed Open herbs and Sedges along creeklines.

V9: Cleared / highly disturbed

Areas which have been predominantly cleared and/or are highly disturbed and contain little to no native flora species. These areas usually contain infrastructure and any remaining vegetation is generally dominated by weed and/or planted species.

4.6.2 Threatened and Priority Ecological Communities

No TECs were identified within sites DA-13 and DA-26 and no PECs identified within site DA-13.

DA-26 occurs within the buffer area of an existing known PEC, Roebourne Plains gilgai grasslands (Priority 1). The Roebourne Plains PEC supports ephemeral and perennial tussock grasslands dominated by *Sorghum* sp. and *Eragrostis xerohphila* along with other native species including *Astrebla pectinata, Eriachne benthamii, Chrysopogon fallax* and *Panicum decompositum* and ephemeral herbs dominated by Fabaceae (*Desmodium* spp. and *Glycine* sp.). Considering the species composition of vegetation association V3, it is not considered to represent the Roebourne Plains PEC.

Based on the limited information available and number of similarities, vegetation association V3 consisting of an *Eragrostis* Tussock Grassland is potentially the Horseflat Land System of the Roebourne Plains PEC (Priority 3). Patches of DA-26 consist of vegetation association V3 and occur on the Horseflat land system.

The tussock grassland vegetation association V3 has affinities with the Horseflat land system PEC including:

- Presence of gilgai micro-relief and cracking clays; and
- Presence of key indicator species *Eragrostis xerophila.*

The Horseflat land system of the Roebourne Plains PEC are dominated by *Eragrostis xerophila* and other perennial tussock (*Eragrostis* mostly) grass species.

The vegetation within DA-26 is considered to be predominantly in excellent to very good condition. The areas defined within DA-26 as vegetation association V3 are surrounded by a mosaic of *Acacia* shrublands and *Triodia* hummock grasslands on clay plains.

4.6.3 Vegetation Condition

The vegetation condition within DA-13 ranged from Excellent to Completely Degraded. The majority of the vegetation was classified as Excellent, with areas adjacent to the existing tracks and previously cleared areas such as under the powerlines were considered to be Excellent to Very Good. The creek on the western edge of the site has several weed species and shows multiple signs of disturbance as it crosses Dampier Highway. There are also road works and construction of a bridge underway within the site, adjacent to Dampier Highway. The existing accommodation area has been completely cleared and is classified as Completely Degraded.

The vegetation condition within DA-26 ranged from Excellent to Completely Degraded. The majority of the vegetation was classified as Excellent to Very Good, with the vegetation structure generally intact. Obvious signs of disturbance within the site included multiple vehicle tracks and presence of rubbish. A small area in the north west of the site is completely cleared and classified as completely degraded. This area appeared to be in use as a soil storage/construction compound.

4.6.4 Weeds

Six weed species were identified within DA-13 and DA-26, these were **Cenchrus ciliaris*, **Portulaca oleracea*, **Cynodon dactylon*, **Gossypium hirsutum*, **Passiflora foetida* var. *hispida,* and **Aerva javanica*. **Cenchrus ciliaris* and **Portulaca oleracea* were scattered across all areas with **Cenchrus ciliaris* more prevalent within the creek and areas of disturbance. **Cynodon dactylon*, and **Passiflora foetida* var. *hispida* were found within the creek and **Gossypium hirsutum* was only recorded from DA-26.

There were no weeds listed as Declared under section 37 of the *Agricultural and Related Resources Protection Act 1976* (WA) or as Weeds of National Significance (WONs) by the Australian Government.

4.6.5 Conservation Significant Flora

No flora of conservation significance was identified within either DA-13 or DA-26.

4.6.6 Fauna Habitat

Site DA-13 and DA-26 contains three broad fauna habitat types based on predominant landforms, soil and vegetation structure in the area:

1. Acacia shrublands/hummock grassland flats
2. Tussock grassland on cracking clay plains
3. Major creekline.

The *Acacia* shrublands/*Triodia* hummock grasslands and tussock grasslands on cracking clay plains provide habitat value for bird and reptile species and some small mammal species. Diversity of vertebrate fauna in grasslands is generally low, which can largely be attributed to low habitat complexity and relative homogeneity of the environment. However cracking clays and grasslands are have been found to support s small range of animals that are unlikely to be found in other habitat types. The major creekline provides good fauna habitat for a number of species of birds, reptiles, mammals and amphibians, particularly during the wet season. There are no permanent waterholes within the sites. The creekline supports a number of larger trees including *Eucalyptus victrix* and *Corymbia hamersleyana* which would provide important habitat for some fauna species, particularly birds.

Current road works and bridge construction within Site DA-13, the presence of an accommodation village and proximity to main roads and housing have somewhat reduced the habitat value of these sites. The vegetation communities present within sites DA-13 and DA-26 occur in the surrounding region in similar and/or better condition to that within the sites.

4.6.7 Fauna Diversity

The field survey recorded 51 fauna species within DA-13, including 44 bird, five reptile and two mammal species. Of these, one is an introduced species, cat (*Felis catus*).

The field survey recorded 13 fauna species within DA-26, including twelve bird and one reptile species.

The species recorded within each site are listed in Table 16, Appendix E.

4.6.8 Conservation Significant Fauna

No fauna of conservation significance were recorded from DA-13 or DA-26. However, three fauna species were recorded which are listed under the EPBC Act as Migratory. The Wandering Whistling Duck (*Dendrocygna arcuata*), Bridled Tern (*Onychoprion anaethetus*) and Rainbow Bee-eater (*Merops ornatus*) were all recorded from site DA-13. The Bridled Tern and Wandering Whistling Duck were located in association with the adjacent wastewater treatment plant. The Rainbow Bee-eater is a common and widespread bird species. Sites DA-13 and DA-26 are not considered to be significant habitat for these species

No habitat types were recorded that are considered to be specific to the site or a significant habitat type for threatened fauna.

4.7 Nickol/Baynton (DA-27, DA-28 and DA-29)

4.7.1 Vegetation Associations

Three vegetation associations were identified within sites DA-27, DA-28 and DA-29.

V2: *Eucalyptus* Low Woodland

Low Woodland of *Eucalyptus victrix*, *Terminalia canescens* and *Flueggea virosa subsp. melanthesoides* over High Shrubland of *Acacia pyrifolia, Acacia coriacea* subsp. *pendens* and *Acacia colei* over Open Shrubland of *Sesbannia cannabina, Senna glutinosa* subsp. *glutinosa* and *Indigofera monophylla* over Tussock grassland of *Cenchrus ciliaris*, *Triodia pungens* and *Triodia wiseana* over Scattered Sedges and Herbs of *Cyperus vaginatus*, *Sida fibulifera* and *Stemodia grossa* along minor creeklines.

V3: *Eragrostis* Tussock Grassland

Tussock Grassland of *Eragrostis xerophila*, *Dichanthium sericeum* subsp. *humilius*, **Cenchrus ciliaris* and *Panicum decompositum* with Scattered Shrubs of *Acacia xiphophylla*, *Ptilotus exaltatus* and S*alsola tragus* over Scattered Herbs of *Sida fibulifera*, *Streptaglossa* spp. and *Goodenia muelleriana* on cracking clay plains.

V4: Mosaic *Acacia* Shrubland/*Triodia* Hummock Grassland

Mosaic Shrublands of *Acacia pyrifolia, A inaequilatera, A. xiphophylla*, *A. bivenosa*, *A. coriacea* subsp. *pendens* and *Senna glutinosa* subsp. *glutinosa*, over Low Open Shrublands of *Indigofera monophylla*, *Corchorus walcottii, Senna notablis, Ptilotus* spp., and **Aerva javanica* over Hummock Grassland of *Triodia wiseana* and *T. pungens* and Tussock Grasses of **Cenchrus ciliaris*, *Aristida* spp., *Enneapogon caerulescens* and *Eragrostis* spp. over Scattered Mixed Herbs on gravelly sandy/clay plains.

4.7.2 Threatened and Priority Ecological Communities

No TECs were identified within DA-27, DA-28 and DA-29 and no PEC's were identified within DA-28.

DA-27, DA-28 and DA-29 occur within or in close proximity to the buffer area of an existing known PEC, Roebourne Plains gilgai grasslands (Priority 1). The Roebourne Plains PEC supports ephemeral and perennial tussock grasslands dominated by *Sorghum* sp. and *Eragrostis xerohphila* along with other native species including *Astrebla pectinata, Eriachne benthamii, Chrysopogon fallax* and *Panicum decompositum* and ephemeral herbs dominated by Fabaceae (*Desmodium* spp. and *Glycine* sp.). Considering the species composition of vegetation association V3, it is not considered to represent the Roebourne Plains PEC.

Based on the limited information available and number of similarities, vegetation association V3 consisting of an *Eragrostis* Tussock Grassland is potentially the Horseflat Land System of the Roebourne Plains PEC (Priority 3). Patches of DA-27 and DA-29 consists of vegetation association V3 and occur on the Horseflat land system.

The tussock grassland vegetation association V3 has affinities with the Horseflat land system PEC including:

- Presence of gilgai micro-relief and cracking clays; and
- Presence of key indicator species *Eragrostis xerophila.*

The Horseflat land system of the Roebourne Plains PEC are dominated by *Eragrostis xerophila* and other perennial tussock (*Eragrostis* mostly) grass species.

The vegetation within DA-27 and DA-29 was considered to be predominantly in excellent to very good condition. The areas defined within DA-27 and DA-29 as vegetation association V3 were surrounded by a mosaic of *Acacia* shrublands and *Triodia* hummock grasslands on clay plains.

4.7.3 Vegetation Condition

The vegetation condition within sites DA-27, DA-28 and DA-29 is generally in Excellent condition. The vegetation structure throughout the sites is generally intact and contains little to no weed species. Areas along vehicle tracks, roads and other disturbances, where weed species are more common, are considered to be in Very Good condition. The most obvious signs of disturbances across the sites included vehicle tracks, bike trails, rubbish and weeds.

4.7.4 Weeds

Six weed species were identified within DA-27, DA-28 and DA-29, these were **Cenchrus ciliaris*, **Cenchrus setiger*, **Aerva javanica*, **Stylosanthes scabra, *Portulaca oleracea* and **Aerva javanica*. Weed species were most dominant along roads and tracks and other areas of disturbance.

There were no weeds listed as Declared under section 37 of the *Agricultural and Related Resources Protection Act 1976* (WA) or as Weeds of National Significance (WONs) by the Australian Government.

4.7.5 Conservation Significant Flora

No flora of conservation significance was identified within either sites DA-27, DA-28 or DA-29.

4.7.6 Fauna Habitat

Sites DA-27, DA-28 and DA-29 contain two broad fauna habitat types based on predominant landforms, soil and vegetation structure in the area:

1. Mixed hummock and tussock grasslands on clay plains
2. Minor creekline.

In general, the site provides habitat value for birds and reptiles and some mammal species. Diversity of vertebrate fauna in grasslands is generally low, which can largely be attributed to low habitat complexity and relative homogeneity of the environment. However cracking clays and grasslands are have been found to support a small range of animals that are unlikely to be found in other habitat types. The vegetation within the area is generally intact however many vehicle and motorbike tracks have dissected the areas.

The vegetation communities within sites DA-27, DA-28 and DA-29 are present in the surrounding area in similar and/or better condition to that within the site.

4.7.7 Fauna Diversity

The field survey recorded thirteen fauna species within sites DA-27, DA-28 and DA-29, including eleven bird and two reptile species.

The species recorded within each site are listed in Table 16, Appendix E.

4.7.8 Conservation Significant Fauna

No fauna of conservation significance were recorded from sites DA-27, DA-28 or DA-29.

No habitat types were recorded that are considered to be specific to the site or a significant habitat type for threatened fauna.

4.8 The Links (DA-35)

4.8.1 Vegetation Associations

Three vegetation associations were identified within DA-35.

V2: *Eucalyptus* Low Woodland

Low Woodland of *Eucalyptus victrix*, *Terminalia canescens* and *Flueggea virosa subsp. melanthesoides* over High Shrubland of *Acacia pyrifolia, Acacia coriacea* subsp. *pendens* and *Acacia colei* over Open Shrubland of *Sesbannia cannabina, Senna glutinosa* subsp. *glutinosa* and *Indigofera monophylla* over Tussock grassland of *Cenchrus ciliaris*, *Triodia pungens* and *Triodia wiseana* over Scattered Sedges and Herbs of *Cyperus vaginatus*, *Sida fibulifera* and *Stemodia grossa* along minor creeklines.

V3: *Eragrostis* Tussock Grassland

Tussock Grassland of *Eragrostis xerophila*, *Dichanthium sericeum* subsp. *humilius*, **Cenchrus ciliaris* and *Panicum decompositum* with Scattered Shrubs of *Acacia xiphophylla*, *Ptilotus exaltatus* and S*alsola tragus* over Scattered Herbs of *Sida fibulifera*, *Streptaglossa* spp. and *Goodenia muelleriana* on cracking clay plains.

V4: Mosaic *Acacia* Shrubland/*Triodia* Hummock Grassland

Mosaic Shrublands of *Acacia pyrifolia, A inaequilatera, A. xiphophylla*, *A. bivenosa*, *A. coriacea* subsp. *pendens* and *Senna glutinosa* subsp. *glutinosa*, over Low Open Shrublands of *Indigofera monophylla*, *Corchorus walcottii, Senna notablis, Ptilotus* spp., and **Aerva javanica* over Hummock Grassland of *Triodia wiseana* and *T. pungens* and Tussock Grasses of **Cenchrus ciliaris*, *Aristida* spp., *Enneapogon caerulescens* and *Eragrostis* spp. over Scattered Mixed Herbs on gravelly sandy/clay plains.

4.8.2 Threatened and Priority Ecological Communities

No TECs were identified within DA-35.

Surveys targeted the areas of tussock grasslands within or in close proximity to PEC buffer zones. Based on the limited information available and number of similarities, vegetation association V3 consisting of an *Eragrostis* Tussock Grassland is potentially the Horseflat Land System of the Roebourne Plains PEC (Priority 3). The southern portion of DA-35 consists of vegetation association V3 and occurs on the Horseflat land system. The tussock grassland vegetation association V3 has affinities with the Horseflat land system PEC including:

- Presence of gilgai micro-relief and cracking clays; and
- Presence of key indicator species *Eragrostis xerophila.*

The Horseflat land system of the Roebourne Plains PEC are dominated by *Eragrostis xerophila* and other perennial tussock (*Eragrostis* mostly) grass species. Site DA-35 was dominated by *Eragrostis xerophila* and the weed species **Cenchrus ciliaris* with other tussock grasses including *Dichanthium sericeum* subsp. *humilius, Eriachne benthamii, Sporobolus australasicus* and *Panicum decompositum*.

Much of the site has been highly disturbed as a result of its proximity to surrounding infrastructure and the coastline, with areas been cleared and/or degraded from vehicles and construction of the adjacent accommodation village.

4.8.3 Vegetation Condition

The vegetation condition within site DA-35 ranged from Very Good to Completely Degraded. Weed species, in particular **Cenchrus ciliaris* and **Aerva javanica* are widespread within the site, particularly within the sandy areas and minor creekline. The main causes of current and ongoing disturbances to the site have been a result of previous clearing for tracks, drainage from the adjacent accommodation village, vehicles and pedestrians and weed invasion.

4.8.4 Weeds

Four weed species were identified within DA-35, these were **Cenchrus ciliaris*, **Cenchrus setiger*, **Aerva javanica*, **Chloris barbata*, and **Cynodon dactylon*.

There were no weeds listed as Declared under section 37 of the *Agricultural and Related Resources Protection Act 1976* (WA) or as Weeds of National Significance (WONs) by the Australian Government.

4.8.5 Conservation Significant Flora

No flora of conservation significance were identified within DA-35.

4.8.6 Fauna Habitat

Site DA-35 contains three broad fauna habitat types based on predominant landforms, soil and vegetation structure in the area:

1. Mixed hummock and tussock grasslands on clay plains
2. Hummock grassland on sandy plains
3. Minor creekline

In general, the site provides some habitat value for birds, reptiles and some mammal species. Diversity of vertebrate fauna in grasslands is generally low, which can largely be attributed to low habitat complexity and relative homogeneity of the environment. However cracking clays and grasslands are have been found to support s small range of animals that are unlikely to be found in other habitat types. The areas containing hummock grasslands on sandy soils provides good habitat for reptiles and small mammals, particularly burrowing species. The minor creekline is highly degraded and contains limited habitat value.

The vegetation communities within site DA-35 are present in the surrounding area in similar and/or better condition to that within the site.

4.8.7 Fauna Diversity

The field survey recorded eighteen fauna species within site DA-35, including twelve bird, five reptile and one mammal species.

The species recorded within each site are listed in Table 16, Appendix E.

4.8.8 Conservation Significant Fauna

No fauna of conservation significance were recorded from DA-35.

No habitat types were recorded that are considered to be specific to the site or a significant habitat type for threatened fauna.

4.9 Karratha Hills (DA-16, DA-32, DA-38 and DA-42)

4.9.1 Vegetation Associations

Three vegetation associations were identified within DA-16, DA-32, DA-38 and DA-42.

V1: *Triodia* Hummock Grassland

Hummock Grassland of *Triodia wiseana* and *Triodia pungens* with Scattered Shrubs of *Acacia pyrifolia*, *Senna glutinosa* subsp. *glutinosa* and *Trichodesma zeylanicum* over Low Open Shrubland of *Indigofera monophylla*, *Corchorus tectus* and *Ptilotus clementii* over Very Open Herbs of *Rhyncosia minima*, *Gomphrena cunninghamii* and *Oldenlandia crouchiana* and on rocky undulating slopes and hills.

V2: *Eucalyptus* Low Woodland

Low Woodland of *Eucalyptus victrix*, *Terminalia canescens* and *Flueggea virosa subsp. melanthesoides* over High Shrubland of *Acacia pyrifolia, Acacia coriacea* subsp. *pendens* and *Acacia colei* over Open Shrubland of *Sesbannia cannabina, Senna glutinosa* subsp. *glutinosa* and *Indigofera monophylla* over Tussock grassland of *Cenchrus ciliaris*, *Triodia pungens* and *Triodia wiseana* over Scattered Sedges and Herbs of *Cyperus vaginatus*, *Sida fibulifera* and *Stemodia grossa* along minor creeklines.

V5: *Acacia* High Shrubland

High Shrubland of *Acacia inaequilatera* and *Grevillea pyramidalis* over Shrubland of *Acacia bivenosa, A. pyrifolia* and *A. coriacea* subsp. *pendens* over Low Shrubland of *Corchorus tectus, Indigofera monophylla, Diplopeltis eriocarpa* and *Ptilotus* spp. over Hummock Grassland of *Triodia wiseana*, *T. pungens* and *Chrysopogon fallax* over Very Open Mixed Herbs on Floodplain.

4.9.2 Threatened and Priority Ecological Communities

No TECs or PECs were identified as occurring within sites DA-16, DA-32, DA-38 or DA-42.

4.9.3 Vegetation Condition

The vegetation within sites DA-16, DA-32, DA-38 and DA-42 was generally in Pristine to Excellent condition. The vegetation structure was generally intact, with little to no obvious signs of disturbance. Weed species, in particular **Cenchrus ciliaris* and **Aerva javanica,* were generally confined to road verges and vehicle tracks, creeklines and areas of previous clearing or disturbance.

4.9.4 Weeds

Eleven weed species were identified within sites DA-16, DA-32, DA-38 or DA-42, these were **Cenchrus ciliaris*, **Cenchrus setiger*, **Aerva javanica*, **Chloris barbata*, **Cynodon dactylon*, **Acetosa vesicaria*, **Gossypium hirsutum, *Portulaca oleracea, *Stylosanthes scabra* and **Vachellia farnesiana*.

There were no weeds listed as Declared under section 37 of the *Agricultural and Related Resources Protection Act 1976* (WA) or as Weeds of National Significance (WONs) by the Australian Government.

4.9.5 Conservation Significant Flora

No flora of conservation significance was identified within sites DA-16, DA-32, DA-38 or DA-42.

4.9.6 Fauna Habitat

Sites DA-16, DA-32, DA-38 and DA-42 contains four broad fauna habitat types based on predominant landforms, soil and vegetation structure in the area:

1. Hummock grasslands on rocky hills and slopes
2. Rock outcrops and breakaways
3. Acacia shrublands
4. Minor creeklines

The Karratha Hills precinct consists of a diversity of habitats which provides excellent habitat for mammals, birds, reptiles and amphibians. The vegetation in the area is generally considered to be in pristine to excellent condition although there are a number of vehicle tracks which traverse through the sites. The habitats present within the sites are considered to be widespread and common in the Pilbara region and are not considered to be of regional significance. However a number of habitat types may be of local significance. These include the rocky hill slopes, rock outcrops and breakaways and creeklines. These habitat types are common in the Pilbara however they do support many endemic species to the Pilbara and provide suitable habitat for threatened fauna. The breakaways and rocky outcrops contain good crevices and habitat for a number of endemic reptile species to the Pilbara (including *Egernia pilbarensis* and *Egernia depressa*). The breakaways and creeklines also provide suitable habitat for the threatened Pilbara Olive Python, which has the potential to occur within the area. This habitat type is also suitable for the threatened Northern Quoll. Creeklines/riparian areas contain larger habitat trees and possibly act as a corridor for fauna species. This habitat type generally supports the greatest diversity and abundance of fauna species, particularly birds and reptiles.

4.9.7 Fauna Diversity

The field survey recorded 41 fauna species within sites DA-16, DA-32, DA-38 or DA-42, including 29 bird, seven reptile, four mammal and one amphibian species.

The species recorded within each site are listed in Table 16, Appendix E.

4.9.8 Conservation Significant Fauna

Evidence of one species of conservation significance was recorded from the Karratha Hills Precinct. A number of abandoned Western Pebble-mound Mouse (*Pseudomys chapmani*) mounds of various ages were recorded at sites DA-16, DA-38 and DA-42. The Pebble-mound Mouse is listed by the DEC as a Priority 4. The locations of mounds recorded during the survey are listed in Table 8.

NatureMap records (2011) indicate that this species has not been recorded from the Karratha area since 1979 and from the Burrup Peninsula since 1983. The persistence of abandoned mounds in isolated, coastal ranges in the Pilbara indicates considerable recent decline (Van Dyck and Strahan, 2008). Recent surveys have recorded this species on Dixon Island (approximately 20 km north-east of Karratha), however none were recorded on the adjacent mainland (Gaikhorst pers. comm.). It is possible that this species is present within the Karratha Hills Precinct; however it is likely to persist in very low numbers.

Table 8 Recorded location of Pebble-mound Mouse mounds

Site	Easting	Northing	Comments
DA 38	484782	7706895	old
DA 38	484833	7706930	old
DA 38	484863	7706922	old
DA 38	485230	7706913	old
DA 16	481500	7704316	old
DA 16	481488	7704261	quite fresh but no fresh holes present
DA 42	483866	7705495	old

Plate 1 Westerm Pebble-mound Mouse mound located at DA16

One fauna species was recorded which is listed under the EPBC Act as Migratory. The Rainbow Bee-eater (*Merops ornatus*) was recorded from sites DA-16 and DA-32. The Rainbow Bee-eater is a common and widespread bird species. The Karratha Hills Precinct is not considered to be significant habitat for this species.

The Karratha Hills Precinct was surveyed for any evidence for the presence of the Threatened Northern Quoll. A number of targeted surveys have been conducted previously by various consultants and government agencies on the nearby Burrup Peninsula. The Northern Quoll has not been recorded in DEC's surveys since 1993. No evidence for the presence of the Northern Quoll was recorded during this survey. However the habitat types within the Karratha Hills Precinct does provide suitable habitat for this

species. At present it is unlikely that Northern Quolls persist within the Karratha Hills Precinct given the presence of feral cats and dogs and close proximity to the town site. If present, they are likely to persist in very low numbers. A targeted trapping program would be required to further investigate the potential presence of this species.

The Karratha Hills Precinct also provides suitable habitat for the Pilbara Olive Python. This species typically prefers gorges and areas of permanent water. The creeklines, rocky outcrops and small gullies within the sites all provide suitable habitat for this species. There was one small pond of water remaining within a creekline in site DA-32; however there are no large permanent water bodies present within the precinct. This species is known to occur around Karratha and Burrup Peninsula and therefore may occur within sites DA-16, DA-32, DA-38 or DA-42. This species was not recorded during the field survey.

4.10 Regals Valley (DA-14 and DA-15)

4.10.1 Vegetation Associations

Two vegetation associations were identified within DA-14 and DA-15.

V2: *Eucalyptus* Low Woodland

Low Woodland of *Eucalyptus victrix*, *Terminalia canescens* and *Flueggea virosa subsp. melanthesoides* over High Shrubland of *Acacia pyrifolia, Acacia coriacea* subsp. *pendens* and *Acacia colei* over Open Shrubland of *Sesbannia cannabina, Senna glutinosa* subsp. *glutinosa* and *Indigofera monophylla* over Tussock grassland of *Cenchrus ciliaris*, *Triodia pungens* and *Triodia wiseana* over Scattered Sedges and Herbs of *Cyperus vaginatus*, *Sida fibulifera* and *Stemodia grossa* along minor creeklines.

V4: Mosaic *Acacia* Shrubland/*Triodia* Hummock Grassland

Mosaic Shrublands of *Acacia pyrifolia, A inaequilatera, A. xiphophylla*, *A. bivenosa*, *A. coriacea* subsp. *pendens* and *Senna glutinosa* subsp. *glutinosa*, over Low Open Shrublands of *Indigofera monophylla*, *Corchorus walcottii, Senna notablis, Ptilotus* spp., and **Aerva javanica* over Hummock Grassland of *Triodia wiseana* and *T. pungens* and Tussock Grasses of **Cenchrus ciliaris*, *Aristida* spp., *Enneapogon caerulescens* and *Eragrostis* spp. over Scattered Mixed Herbs on gravelly sandy/clay plains.

4.10.2 Threatened and Priority Ecological Communities

No TECs or PECs were identified as occurring within sites DA-14 and DA-15.

4.10.3 Vegetation Condition

The vegetation within sites DA-14 and DA-15 was generally in Pristine to Excellent condition. The vegetation structure was generally intact, with little to no obvious signs of disturbance. Weed species, in particular **Cenchrus ciliaris* and **Aerva javanica,* were generally confined to road verges and vehicle tracks, creeklines and areas of previous clearing or disturbance.

4.10.4 Weeds

Six weed species were identified within sites DA-14 and DA-15, these were **Cenchrus ciliaris*, **Cenchrus setiger*, **Aerva javanica*, **Portulaca oleracea, *Stylosanthes scabra* and **Vachellia farnesiana*.

There were no weeds listed as Declared under section 37 of the *Agricultural and Related Resources Protection Act 1976* (WA) or as Weeds of National Significance (WONs) by the Australian Government.

4.10.5 Conservation Significant Flora

No flora of conservation significance was identified within either DA-14 or DA-15.

4.10.6 Fauna Habitat

Sites DA-14 and DA-15 contains two broad fauna habitat types based on predominant landforms, soil and vegetation structure in the area:

1. Acacia shrublands/Hummock grassland plains
2. Minor creeklines

Sites DA-14 and DA-15 contain vegetation in excellent condition providing good habitat for fauna, in particular birds, reptiles and mammals. The area consists of a mosaic of *Acacia* shrublands and *Triodia* hummock grasslands on clay/loamy flats.

The vegetation communities present within sites DA-14 and DA-15 are present in the surrounding area in similar and/or better condition to that within the site.

4.10.7 Fauna Diversity

The field survey recorded 30 fauna species within sites DA-14 and DA-15, including 26 bird, three reptile and one mammal species.

The species recorded within each site are listed in Table 16, Appendix E.

4.10.8 Conservation Significant Fauna

No fauna of conservation significance were recorded from sites DA-14 and DA-15.

One fauna species was recorded which is listed under the EPBC Act as Migratory. The Rainbow Bee-eater (*Merops ornatus*) was recorded from site DA-15. The Rainbow Bee-eater is a common and widespread bird species. Sites DA-14 and DA-15 are not considered to be significant habitat for this species.

No habitat types were recorded that are considered to be specific to the site or a significant habitat type for threatened fauna.

4.11 Airport (DA-30)

4.11.1 Vegetation Associations

Three vegetation associations were identified within DA-30.

V7: *Tecticornia* Low Open Shrubland

Low Open Shrubland of *Tecticornia ?auriculata*, *Atriplex codonocarpa*, *Salsola tragus* and *Lawrencia viridgrisea* over Very Open Grasses of *Eragrostis falcata*, *Panicum decompositum* and *Triodia angusta* on mudflats.

V8: *Acacia* Shrubland

Shrubland of *Acacia bivenosa*, *A. sclerosperma* subsp. *sclerosperma* and *Scaevola spinescens* over Low Open Shrubland of *Ptilotus exaltatus*, *Corchorus walcottii* and *Ptilotus clementii* over Hummock Grassland of *Triodia pungens* and Tussock Grassland of **Cenchrus ciliaris, Chrysopogon fallax* and *Dichanthium sericeum* subsp. *humilius* over Very Open Herbs of *Goodenia microptera*, *Ptilotus helipteroides* and *Cassytha filiformis* on loamy plains.

V9: Cleared / highly disturbed

Areas which have been predominantly cleared and/or are highly disturbed and contain little to no native flora species. These areas usually contain infrastructure and any remaining vegetation is generally dominated by weed and/or planted species.

4.11.2 Threatened and Priority Ecological Communities

No TECs or PECs were identified as occurring within site DA-30.

4.11.3 Vegetation Condition

Site DA-30 is located within the boundary of the existing Dampier Salt Operations. The vegetation within the site is generally in Very Good to Good condition. However large areas of the site have been cleared and/or disturbed previously in association with the salt works. Areas of disturbance include roads and vehicle tracks, buildings and associated infrastructure, fencing and drainage/water catchments areas from the adjacent airport and roads. The southern boundary of the site generally consists of rehabilitated *Acacia* shrublands over *Triodia* hummock grasslands. Weeds species were most dominant along vehicle tracks and other areas of disturbance.

4.11.4 Weeds

Six weed species were identified within sites DA-30, these were **Cenchrus ciliaris*, **Chloris barbata*, **Aerva javanica*, **Portulaca oleracea, *Stylosanthes scabra* and **Flaveria trinervia*.

There were no weeds listed as Declared under section 37 of the *Agricultural and Related Resources Protection Act 1976* (WA) or as Weeds of National Significance (WONs) by the Australian Government.

4.11.5 Conservation Significant Flora

No flora of conservation significance was identified within DA-30.

4.11.6 Fauna Habitat

Site DA-30 comprises of two broad fauna habitat types based on predominant landforms, soil and vegetation structure in the area:

1. *Acacia* shrublands over *Triodia* hummock grasslands
2. Tidal mudflats.

In general the site provides habitat value for a greater diversity of bird and reptile species. Many migratory shorebirds that visit the north-west coast may visit these areas to feed and/or breed in the tidal flats and associated vegetation. The adjacent brine concentration ponds are highly productive. Seagrasses, seaweeds and micro-algae support fish, crustaceans and benthic organisms on which many birds and larger fish feed. The Dampier saltworks is an important habitat for migratory wading birds.

A proportion of the area has been cleared or highly disturbed for roads and infrastructure associated with the saltworks. The site is adjacent to the Karratha airport, roads and other infrastructure, which would have somewhat reduced the habitat value of the area. The vegetation communities present within site DA-30 occur in the surrounding region in similar and/or better condition to that within the site.

4.11.7 Fauna Diversity

The field survey recorded 28 fauna species within site DA-30, including 21 bird, five reptile and two mammal species.

The species recorded within each site are listed in Table 16, Appendix E.

4.11.8 Conservation Significant Fauna

No fauna of conservation significance were recorded from site DA-30.

No migratory listed birds were recorded during the survey. However the adjacent Dampier Saltworks is listed by Birds Australia (in partnership with Rio Tinto) as an important bird area (IBA). IBAs are sites of global bird conservation importance and are priority areas for bird conservation. The Dampier Saltworks regularly supports more than 1% of the global populations of the congregatory Red-necked Stint and Red-capped Plover and also supports small numbers of the restricted-range Dusky Gerygone. It has irregularly supported more than 1% of Sharp-tailed Sandpiper and Oriental Plover. Therefore it is considered that migratory shorebirds are likely to be an occasional visitor to the tidal mudflats within site DA-30.

No habitat types were recorded that are considered to be specific to the site or a significant habitat type for threatened fauna.

4.12 Karratha Industrial Estate (DA-17, DA41 and DA43)

4.12.1 Vegetation Associations

Three vegetation associations were identified within DA-17, DA-41 and DA-43.

V1: *Triodia* Hummock Grassland

Hummock Grassland of *Triodia wiseana* and *Triodia pungens* with Scattered Shrubs of *Acacia pyrifolia*, *Senna glutinosa* subsp. *glutinosa* and *Trichodesma zeylanicum* over Low Open Shrubland of *Indigofera monophylla*, *Corchorus tectus* and *Ptilotus clementii* over Very Open Herbs of *Rhyncosia minima*, *Gomphrena cunninghamii* and *Oldenlandia crouchiana* and on rocky undulating slopes and hills.

V2: *Eucalyptus* Low Woodland

Low Woodland of *Eucalyptus victrix*, *Terminalia canescens* and *Flueggea virosa subsp. melanthesoides* over High Shrubland of *Acacia pyrifolia, Acacia coriacea* subsp. *pendens* and *Acacia colei* over Open Shrubland of *Sesbannia cannabina, Senna glutinosa* subsp. *glutinosa* and *Indigofera monophylla* over Tussock grassland of *Cenchrus ciliaris*, *Triodia pungens* and *Triodia wiseana* over Scattered Sedges and Herbs of *Cyperus vaginatus*, *Sida fibulifera* and *Stemodia grossa* along minor creeklines.

V3: *Eragrostis* Tussock Grassland

Tussock Grassland of *Eragrostis xerophila*, *Dichanthium sericeum* subsp. *humilius*, **Cenchrus ciliaris* and *Panicum decompositum* with Scattered Shrubs of *Acacia xiphophylla*, *Ptilotus exaltatus* and S*alsola tragus* over Scattered Herbs of *Sida fibulifera*, *Streptaglossa* spp. and *Goodenia muelleriana* on cracking clay plains.

V4: Mosaic *Acacia* Shrubland/*Triodia* Hummock Grassland

Mosaic Shrublands of *Acacia pyrifolia, A inaequilatera, A. xiphophylla*, *A. bivenosa*, *A. coriacea* subsp. *pendens* and *Senna glutinosa* subsp. *glutinosa*, over Low Open Shrublands of *Indigofera monophylla*, *Corchorus walcottii, Senna notablis, Ptilotus* spp., and **Aerva javanica* over Hummock Grassland of *Triodia wiseana* and *T. pungens* and Tussock Grasses of **Cenchrus ciliaris*, *Aristida* spp., *Enneapogon caerulescens* and *Eragrostis* spp. over Scattered Mixed Herbs on gravelly sandy/clay plains.

V9: Cleared / highly disturbed

Areas which have been predominantly cleared and/or are highly disturbed and contain little to no native flora species. These areas usually contain infrastructure and any remaining vegetation is generally dominated by weed and/or planted species.

V10: DEC Aboretum

Planted introduced and native shrubs and trees dominated by an understorey of weed species.

4.12.2 Threatened and Priority Ecological Communities

No TECs were identified within DA-17, DA-41 and DA-43 and no PEC's were identified within DA-41.

The southern edge of DA-41 and DA-43 occur within the buffer area of an existing known PEC, Roebourne Plains gilgai grasslands (Priority 1). The Roebourne Plains PEC supports ephemeral and perennial tussock grasslands dominated by *Sorghum* sp. and *Eragrostis xerohphila* along with other native species including *Astrebla pectinata, Eriachne benthamii, Chrysopogon fallax* and *Panicum*

decompositum and ephemeral herbs dominated by Fabaceae (*Desmodium* spp. and *Glycine* sp.). Considering the species composition of vegetation association V3, it is not considered to represent the Roebourne Plains PEC.

Based on the limited information available and number of similarities, vegetation association V3 consisting of an *Eragrostis* Tussock Grassland is potentially the Horseflat Land System of the Roebourne Plains PEC (Priority 3). Patches of vegetation predominantly within DA-43 (west of Karratha Road), with a small area within DA-17, consists of vegetation association V3 and occurs on the Horseflat land system.

The tussock grassland vegetation association V3 has affinities with the Horseflat land system PEC including:

- Presence of gilgai micro-relief and cracking clays; and
- Presence of key indicator species *Eragrostis xerophila.*

The Horseflat land system of the Roebourne Plains PEC is dominated by *Eragrostis xerophila* and other perennial tussock (*Eragrostis* mostly) grass species. With DA-43, vegetation association V3 is dominated by *Eragrostis xerophila* with other tussock grasses including **Cenchrus ciliaris*, *Dichanthium sericeum* subsp. *humilius* and *Panicum decompositum*.

With DA-43 and DA-17, vegetation association V3 was considered to be generally in pristine to excellent condition and was surrounded by a mosaic of *Acacia* shrublands and *Triodia* hummock grasslands on clay plains.

4.12.3 Vegetation Condition

The vegetation within sites DA-17, DA-41 and DA-43 is generally in Pristine to Excellent condition. The vegetation structure is generally intact, with little to no obvious signs of disturbance. Weed species, in particular **Cenchrus ciliaris* and **Aerva javanica*, are generally confined to road verges and vehicle tracks, creeklines and areas of previous clearing or disturbance.

An arboretum owned by the DEC is located in DA-17, east of Karratha Road. This small area contains a number of planted tree and shrub species established in 1983 and is currently dominated by weed species and used by local residents for horse riding. The main causes of current and ongoing disturbances to the site have been a result of previous clearing for tracks, dumping of vehicles and rubbish, wastewater treatment ponds, powerlines and weed invasion.

4.12.4 Weeds

Eight common weed species were identified within sites DA-17, DA-41 and DA-43, these were **Cenchrus ciliaris*, **Chloris barbata*, **Cynodon dactylon*, **Aerva javanica*, **Portulaca oleracea,* **Stylosanthes scabra*, **Flaveria trinervia* and **Passiflora foetida* var. *hispida*.

There were no weeds listed as Declared under section 37 of the *Agricultural and Related Resources Protection Act 1976* (WA) or as Weeds of National Significance (WONs) by the Australian Government.

4.12.5 Conservation Significant Flora

No flora of conservation significance was identified within sites DA-17, DA-41 and DA-43.

4.12.6 Fauna Habitat

Sites DA-17, DA-41 and DA-143 comprise of five broad fauna habitat types based on predominant landforms, soil and vegetation structure in the area:

1. Acacia shrublands/hummock grassland plains
2. Triodia grassland on low hills
3. Tussock grasslands on cracking clay plains
4. Minor creeklines
5. Wastewater treatment ponds.

The Karratha Industrial Estate Precinct comprises of a mix of habitats which provide habitat value for a diversity of fauna species. The *Acacia* shrublands/*Triodia* hummock grasslands and tussock grasslands on cracking clay plains provide habitat value for predominantly bird and reptile species and some small mammal species. Diversity of vertebrate fauna in grasslands is generally low, which can largely be attributed to low habitat complexity and relative homogeneity of the environment. However cracking clays and grasslands are have been found to support a small range of animals that are unlikely to be found in other habitat types. Creeklines provides good fauna habitat for a number of species of birds, reptiles, mammals and amphibians, particularly during the wet season. There are no permanent waterholes within the sites. However there are a series of wastewater treatment ponds which contain nutrient rich water which attracts large numbers of birds and other wildlife species. The close proximity to main roads and the existing industrial area would have somewhat reduced the habitat value within parts of these sites.

The vegetation communities present within sites DA-17, DA-41 and DA-43 are present in the surrounding area in similar and/or better condition to that within the sites.

4.12.7 Fauna Diversity

The field survey recorded 34 fauna species within sites DA-17, DA-41 and DA-43, including 32 bird, one reptile and one mammal species.

The species recorded within each site are listed in Table 16, Appendix E.

4.12.8 Conservation Significant Fauna

No fauna of conservation significant were recorded from sites DA-17, DA-41 and DA-43.

One fauna species was recorded which is listed under the EPBC Act as Migratory. The Rainbow Bee-eater (*Merops ornatus*) was recorded from site DA-17. The Rainbow Bee-eater is a common and widespread bird species. The Karratha Industrial estate precinct is not considered to be significant habitat for this species.

The Karratha Industrial Estate Precinct was surveyed for any evidence for the presence of the Threatened Northern Quoll. The Northern Quoll has not been recorded in DEC's surveys since 1993 (on the nearby Burrup Peninsula). At present it is unlikely that Northern Quolls persist within the area given the presence of feral cats and dogs and close proximity to the town site and existing industrial estate. No evidence for the presence of the Northern Quoll was recorded during this survey. There is limited suitable habitat within the Karratha Industrial Estate Precinct for the Northern Quoll and it is not considered significant habitat for this species.

The Karratha Industrial Estate Precinct was also surveyed for the potential presence of the Pilbara Olive Python. Although this species was not recorded during the survey, the area is considered to contain suitable habitat for this species. This species typically prefers gorges and areas of permanent water. The creeklines, rocky outcrops and wastewater treatment ponds within the sites all provide suitable habitat for this species. Although there are no natural large permanent water bodies within this precinct, there are a series of wastewater treatment ponds within sites DA17 and DA-43. These areas provide a great source of habitat and food for the Olive Python. This species is known to occur around Karratha and the Burrup Peninsula and therefore potentially occurs within sites DA-17, DA-41, DA-43.

The Priority 4 listed *Notoscincus butleri,* an endemic reptile to the Pilbara, is known only from the Dampier district and Harding River Dam (Storr *et al*., 1999). The preferred habitat of this species includes areas near creeks and river margins dominated by spinifex and cracking clays. This species has previously been recorded in 2004, west of Karratha Road around DA-17 and DA-43. This species is likely to occur within this precinct, in particular the areas west of Karratha Road. A trapping program would be required to further investigate the presence of this species.

5. Assessment against the Ten Clearing Principles

Any clearing of native vegetation will require a permit under Part V Division 2 of the Environmental Protection Act 1986 (EP Act), except where an exemption applies under Schedule 6 of the Act or is prescribed by regulation in the Environmental Protection (Clearing of Native Vegetation) Regulations 2004, and it is not in an Environmentally Sensitive Area (ESA).

Table 9 provides an assessment of the proposed project against the “10 Clearing Principles” as outlined in Schedule 5 of the Environmental Protection Amendment Act 2003 to determine whether it is at variance with any of the Principles. These Principles aim to ensure that all potential impacts resulting from removal of native vegetation can be assessed in an integrated way.

The project has been assessed, and is considered to may be at variance to Principles (a) and (b) due to the potential presence of the Horseflat Plains Priority Ecological Community (PEC) and conservation significant fauna in some areas.

Table 9 Assesment against the Ten Clearing Principles

Principle	Assesment	Outcome
(a) Native vegetation should not be cleared if it comprises a high level of biological diversity.	Vegetation within the study area is considered to represent a moderate to high species diversity. A total of 187 native and 12 introduced taxa from 46 families were recorded from the study area. No conservation significant flora was identified within any of the District Areas (DA). No TECs were identified within any of the DAs, however several of the DAs contained vegetation considered to have stong affinities with the Horseflat Land System of the Roebourne Plains PEC (P3). These DAs were DA-40, DA-26, DA-27, DA-29, DA-35, DA-43 and DA17. Evidence of one species of conservation significant fauna, Pebble-mound Mouse P4, was found in DA-16, DA-38 and DA-42, these sites contained several mounds of varing ages. All DAs within the Karratha Hills Precinct (DA-16, DA-32, DA-38 and DA-42) were found to provide sutiable habitat for both the Northern Quoll and the Pilbara Olive Python. While the Karratha Hills provide habitat for the Norther Quoll, given the area's proximity to town and the relative abundance of feral cats and dogs in the area, it is considered unlikely that the Northern Quoll persist within the Karratha Hills Precinct. If present, they are likely to persist in very low numbers and a targeted trapping program may be required prior to any clearing. The vegetation within the study area has had a combination of previous disturbances including historical and recent clearing, weeds, vehicle tracks, dumping of rubbish and fire. Condition within the study area ranged from Pristine to Completely Degraded. Some DAs varied in condtion within the individual DA while others were more consitent. For example DA-30 ranged from Very Good to Completely Degraded while most of the DAs in The Karratha Hills Precinct were Pristine to Excellent. With the exception of DA-40 and DA-35 most of the DAs were considered to be in a Very Good or better condion. Given the lack of development in the Karratha region it is likely that vegetation of an equal or better condition is present adjacent to and surrounding the study area. Development of the study area is unlikely to significantly reduce the biodiversity of the local area.	The proposal may be at variance with the Principle.

Principle	Assesment	Outcome
(b) Native vegetation should not be cleared if it comprises the whole or part of, or is necessary for the maintenance of, a significant habitat for fauna indigenous Western Australia.	Within the Karratha Hills Precinct evidence of one species of conservation significant fauna, the Pebble-mound Mouse (P4) was identified. This precinct was also identified as sutiable habitat for the Northern Quoll and the Pilbara Olive Python. All DAs within the Karratha Hills Precinct (DA-16, DA-32, DA-38 and DA-42) were found to provide sutiable habitat for both the Northern Quoll and the Pilbara Olive Python. While the Karratha Hills provide habitat for the Norther Quoll, given the area's proximity to town and the relative abundance of feral cats and dogs in the area, it is considered unlikely that the Northern Quoll persist within the Karratha Hills Precinct. If present, they are likely to persist in very low numbers and a targeted trapping program may be required prior to any clearing. Eight species of threatened fauna have been recorded in the surrounding region. While habitat for several of these species is present within the study area similar habitat is present adjacent to and surrounding the study area. Removal of habitat from within the study area is not likely to have a significant impact on these species No specific habitat was noted within the study area that was not present in the local area. The vegetation and associated fauna habitat within the study area is considered to be minimal in a regional perspective.	The proposal may be at variance with the Principle.
(c) Native vegetation should not be cleared if it includes, or is necessary for the continued existence of, rare flora.	No Declared Rare Flora was recorded within the study area during the field survey.	The proposal is not at variance with the Principle.
(d) Native vegetation should not be cleared if it comprises the whole or a part of, or is necessary for the maintenance of a threatened ecological community	No Threatened Ecological Communities were recorded within the study area during the field survey.	The proposal is not at variance with the Principle.

Principle	Assesment	Outcome
(e) Native vegetation should not be cleared if it compris significant as a remnant of native vegetation in an area that has been extensively cleared.	The study area is mapped as containing Beard Vegetation Associations 589 and 157. These vegetation associations are considered of *Least Concern*, with more than 98% of both associations pre-European extent considered to be remaining.	The proposal is unlikely to be at variance with the Principle.
(f) Native vegetation should not be cleared if it is growing in or in association with a watercourse or wetland.	Many of the DAs contained minor drainage lines, but none of these creeks contained water at the time of the survey and several, namely the ones close to town, have been heavily modified for drainage purposes. The drainage lines present within the study area are likely to contain water only for a brief period of time following moderate to substantial rainfall. DA-13 and DA-26 are situated on the edge of a large creek, this creek shows signs of impacts and development can be designed to minimise any further impacts. DA-30 is at the Airport and is situated on the edge of mudflats which have been converted to salt evaporation ponds.	The proposal is unlikely to be at variance with the Principle.
(g) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause appreciable land degradation.	The main landform and soils present within the study area are sandy/loamy soils and rocky outcrops/ridges of metamorphic rocks with little to no soil. This soil type has a low potential for erosion. The clearing of native vegetation may cause some alterations to the health of adjacent lands. Runoff and weed dispersal are likely to increase. These impacts can be managed through implementation of appropriate management plans.	The proposal is unlikely to be at variance with the Principle. These impacts should be addressed in appropriate management plans.
(h) Native vegetation should not be cleared if the clearing of the vegetation is likely to have an impact on the environmental values of any adjacent or nearby conservation area.	There are no conservation areas within or adjacent to the study area.	The proposal is not at variance with the Principle.

Principle	Assesment	Outcome
(i) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause deterioration in the quality of surface or underground water.	The clearing of native vegetation is not considered likely to alter the quality of surface or ground waters within the study area. Any potential impacts can be mitigated through the use of appropriate surface water management and rehabilitation techniques.	The proposal is unlikely to be at variance with the Principle. These impacts should be addressed in appropriate management plans.
(j) Native vegetation should not be cleared if the clearing of the vegetation is likely to cause, or exacerbate, the intensity of flooding.	Natural flooding events occur seasonally over the December to March period where flood height and duration are lengthy and extreme. The clearing of native vegetation within the study area may cause, or exacerbate the incidence or intensity of flooding due to increased runoff in localised areas. Any potential impacts can be mitigated through the use of appropriate management actions/plans.	The proposal is unlikely to be at variance with the Principle. These impacts should be addressed in appropriate management plans.

6. Conclusion

LandCorp has commissioned GHD Pty Ltd (GHD) to complete a flora and fauna assessment to identify constraints to development of lots within the Karratha Town Planning Scheme No. 8. The Shire of Roebourne is currently updating the Karratha Town Planning Scheme No. 8 as a part of its 'City Growth Plan'. The study area lies within the Shire of Roebourne in the Pilbara Region of Western Australia, and contains 18 DAs from 9 precincts (identified in the City Growth Plan) in and around Karratha. The areas combined total approximately 2,980 ha.

A Preliminary Impact Assessment (PEIA) of the potential development sites has been prepared previously which identified the potential presence of Priority Ecological Communities (PEC), and the presence of habitat which may support Threatened fauna species including the Northern Quoll (*Dasyurus hallucatus*) and Pilbara Olive Python (*Liasis olivaceus barroni*), the Priority 4 reptile species *Notoscincus butleri* and Migratory birds.

The field flora survey targeted areas of tussock grasslands within the study area. One of the vegetation types present within the study area was identified as having similarities (presence of several key indicator species) with the Horseflat PEC. Given the limited amount of detailed information on this PEC (such as published quadrat data/species lists) it is considered that vegetation association V3 is likely to be the Horseflat land system PEC.

Evidence of one species of conservation significance was recorded from the Karratha Hills Precinct. A number of abandoned Pebble-mound Mouse (*Pseudomys chapmani*) mounds of various ages were recorded at sites DA-16, DA-38 and DA-42. The Pebble-mound Mouse is listed by the DEC as a Priority 4. Records from DEC state that this species is unlikely to still occur on the Burrup Peninsula. Recent surveys have recorded this species on Dixon Island (approximately 20 km north-east of Karratha), however none were recorded on the adjacent mainland (Gaikhorst pers. comm.). It is possible that this species is present within the Karratha Hills Precinct; however it is likely to persist in very low numbers. A targeted trapping program would be required to further investigate the potential presence of this species.

Suitable habitat for the Northern Quoll was identified within the Karratha Hills Precinct. A number of targeted surveys have been conducted previously by various consultants and government agencies on the nearby Burrup Peninsula. The Northern Quoll has not been recorded in DEC's surveys since 1993. No evidence for the presence of the Northern Quoll was recorded during this survey. However the habitat types within the Karratha Hills Precinct does provide suitable habitat for this species. At present it is unlikely that Northern Quolls persist within the Karratha Hills Precinct given the presence of feral cats and dogs and close proximity to the town site. If present, they are likely to persist in very low numbers. A targeted trapping program would be required to further investigate the potential presence of this species.

The Karratha Hills Precinct as well as the Karratha Industrial estate Precinct also provide suitable habitat for the Pilbara Olive Python. This species typically prefers gorges and areas of permanent water. The creeklines, rocky outcrops and small gullies within the sites all provide suitable habitat for this species. There was one small pond of water remaining within a creekline in site DA 32, but there are no large permanent water bodies present within either Precinct. There are a series of wastewater treatment ponds within sites DA17 and DA-43. These areas provide a good source of habitat and food for the Olive

Python. This species is known to occur around Karratha and the Burrup Peninsula and is therefore likely to occur in suitable habitat within the study area.

The Priority 4 listed *Notoscincus butleri,* an endemic reptile to the Pilbara, is known only from the Dampier district and Harding River Dam (Storr *et al.,* 1999). The preferred habitat of this species includes areas near creeks and river margins dominated by spinifex and cracking clays. This species has previously been recorded in 2004, west of Karratha Road around DA-17 and DA-43. This species is likely to occur within suitable habitat within this precinct, in particular the areas west of Karratha Road. A trapping program would be required to further investigate the presence of this species.

Adjacent to the Airport Precinct is the Dampier Saltworks, which is listed by Birds Australia (in partnership with Rio Tinto) as an important bird area (IBA). IBAs are sites of global bird conservation importance and are priority areas for bird conservation. The Dampier Saltworks regularly supports more than 1% of the global populations of the congregatory Red-necked Stint and Red-capped Plover and also supports small numbers of the restricted-range Dusky Gerygone. It has irregularly supported more than 1% of Sharp-tailed Sandpiper and Oriental Plover. Therefore it is considered that migratory shorebirds are likely to be an occasional visitor to the tidal mudflats within site Airport Precinct.

Based on the field survey, a summary of the flora and fauna constraints identified as occurring within the proposed development areas are listed in Table 10.

Table 10 Summary of flora and fauna constraints based on the field survey

Precinct	Development Area/s	Constraints Identified
City Centre	DA 40	Likely occurrence of the Horseflat Land System PEC.
Existing Townsite	DA 31	No constraints identified
Gap Ridge / Seven Mile	DA 13	No constraints identified
	DA 26	Likely occurrence of the Horseflat Land System PEC.
Nickol / Baynton	DA 27	Likely occurrence of the Horseflat Land System PEC.
	DA 28	No constraints identified
	DA 29	Likely occurrence of the Horseflat Land System PEC.
The Links	DA 35	Likely occurrence of the Horseflat Land System PEC, however this patch of vegetation is small and relatively degraded.
Karratha Hills	DA 16	Suitable habitat for the Northern Quoll, Pilbara Olive Python and Western Pebble-mound Mouse. A number of abandoned Pebble-mound Mouse mounds of various ages were recorded in the area.
	DA 32	Suitable habitat for the Northern Quoll, Pilbara Olive Python and Western Pebble-mound Mouse. No Pebble-mound mouse mounds were recorded from DA 32.
	DA 38	Suitable habitat for the Northern Quoll, Pilbara Olive Python and

Precinct	Development Area/s	Constraints Identified
		Western Pebble-mound Mouse. A number of abandoned Pebble-mound Mouse mounds of various ages were recorded in the area.
	DA 42	Suitable habitat for the Northern Quoll, Pilbara Olive Python and Western Pebble-mound Mouse. A number of abandoned Pebble-mound Mouse mounds of various ages were recorded in the area.
Regals Valley	DA 14	No constraints identified
	DA 15	No constraints identified
Airport	DA 30	Migratory shorebirds are likely to be an occasional visitor to the tidal mudflats within and surrounding site DA-30.
Karratha Industrial Estate	DA 17	Likely occurrence of the Horseflat Land System PEC. *Notoscincus butleri* may potentially occur within DA 17, west of Karratha Road.
	DA 41	No constraints identified
	DA 43	Likely occurrence of the Horseflat Land System PEC. *Notoscincus butleri* may potentially occur within DA 43, west of Karratha Road.

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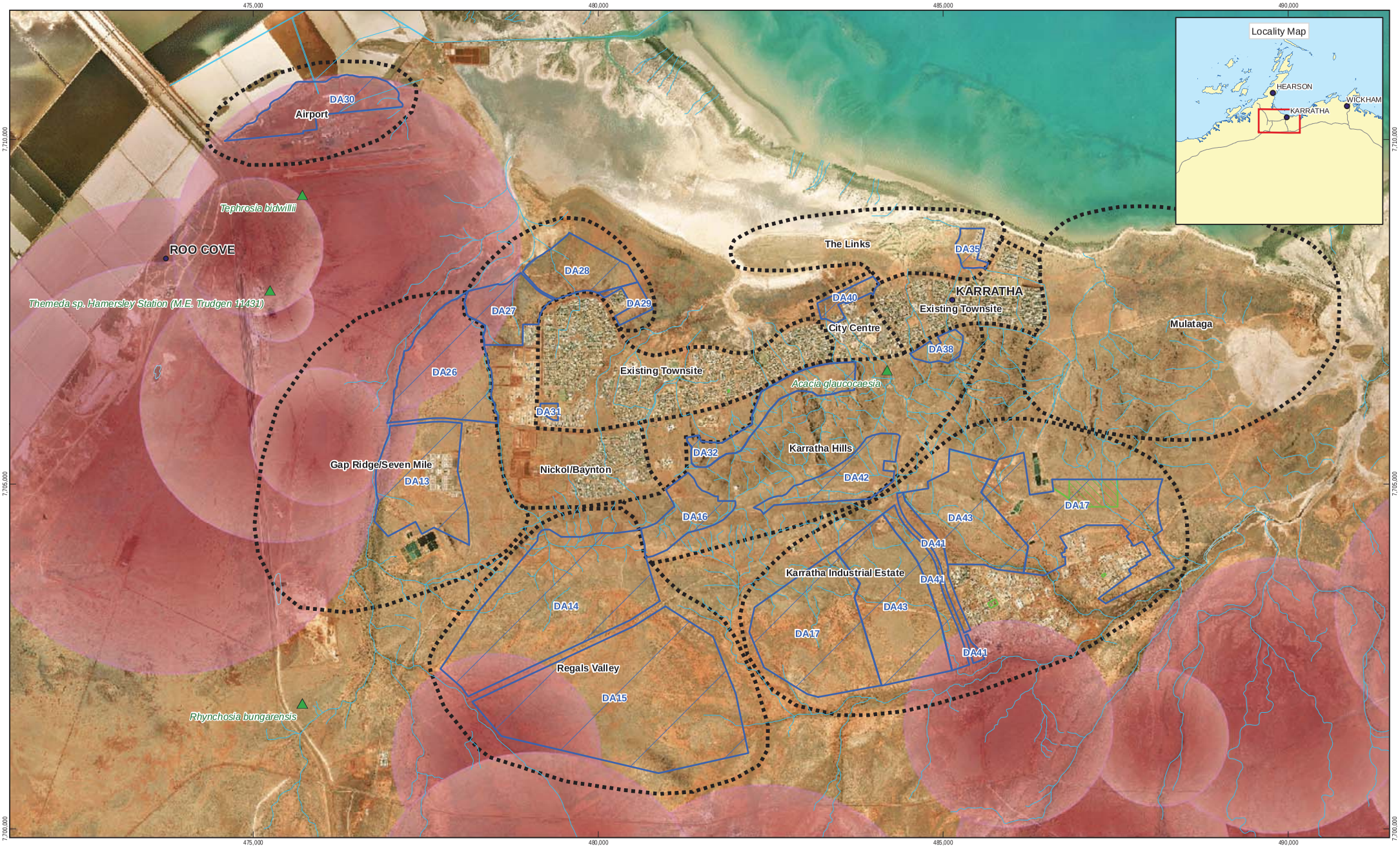
Appendix A

Figures



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Kilometres

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Grid: Map Grid of Australia 1994, Zone 50

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LEGEND

Declared Rare & Priority Species

- (R) Declared Rare Flora - Extant Taxa
- Priority 1 - Poorly Known Taxa
- Priority 2 - Poorly Known Taxa
- Priority 3 - Poorly Known Taxa
- Priority 4 - Rare Taxa
- Hydrology
- DEC Estate
- Development Areas
- Precinct Boundary
- Priority Ecological Community Buffers

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Job Number	61-27315
Revision	0
Date	21 Oct 2011

Flora and Fauna Assessment
Environmental Constraint

Figure 1

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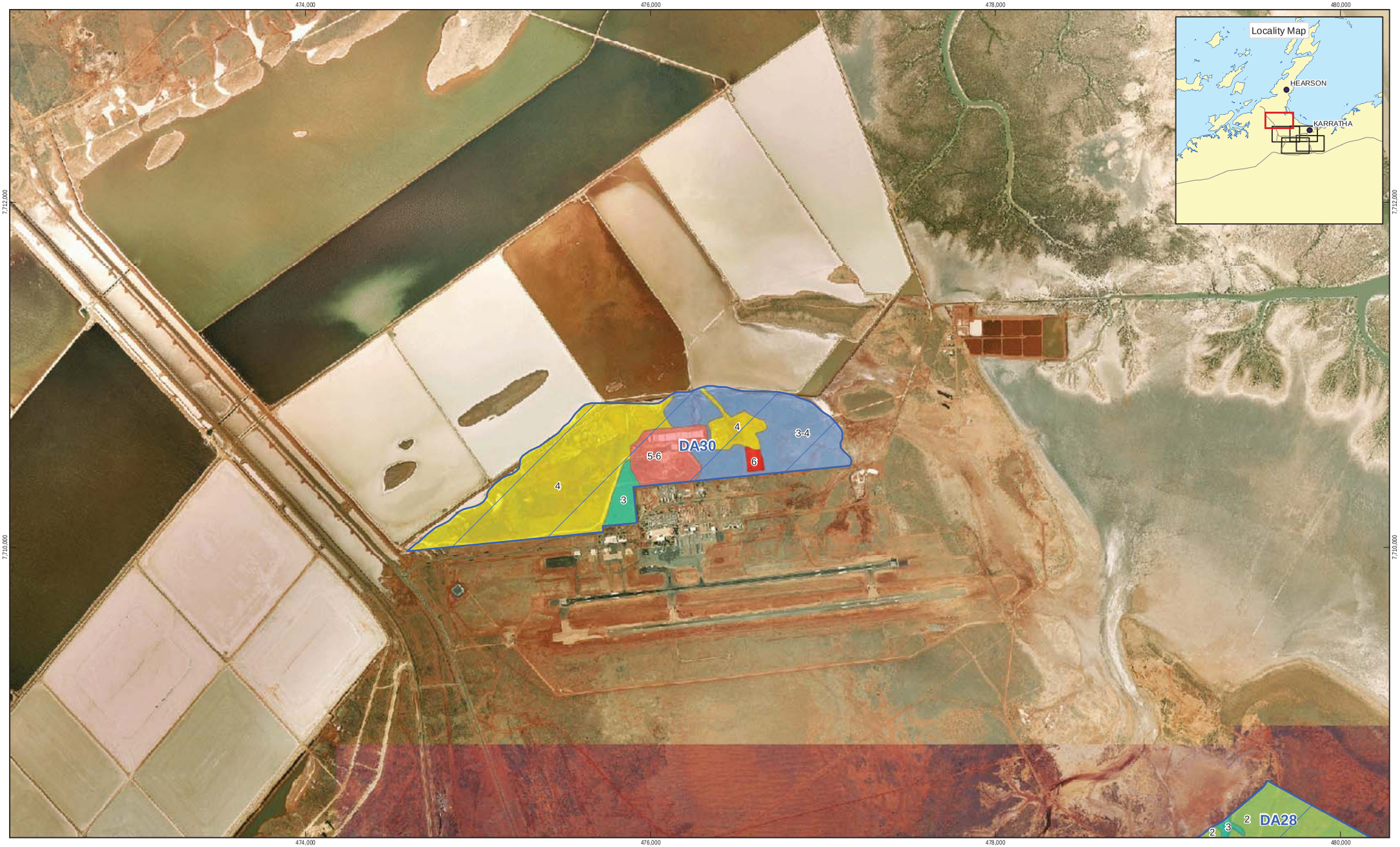
Data source: GA: Topo 250k Series III - 2006; GHD; Precinct Areas - 20110412, Development Areas - 20110412; DEC: DEC Estate - DEC-007 - 20110412, Priority Ecological Community Buffers - 20110413, Declared rare and Priority Species - 20110413; Landgate: DampierAndExtensions 2008 - 20110831, Hydrology - LGATE-018 - 20110510 Created by: bflorczak



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Metres

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Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

LEGEND

Development Areas

Vegetation Condition

- 1. Pristine or nearly so
- 1-2
- 2. Excellent
- 2-3
- 3. Very Good
- 3-4
- 4. Good
- 4-5
- 5. Degraded
- 5-6
- 6. Completely Degraded

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Flora and Fauna Assessment
Vegetation Condition

Sheet 1 of 5
Figure 3

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Data source: GA: Topo 250k Series III - 2006; Landgate: Dampier&extensions Mosaic 2008, Karratha Townsite 2010, Dampier Legendre 2004 - 20110830, GHD - Development Areas - 20110412, Vegetation Conditions - 20110830 Created by: bflorczak

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Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia
Grid: Map Grid of Australia 1994, Zone 50

N

LEGEND

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Vegetation Condition

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Figure 3

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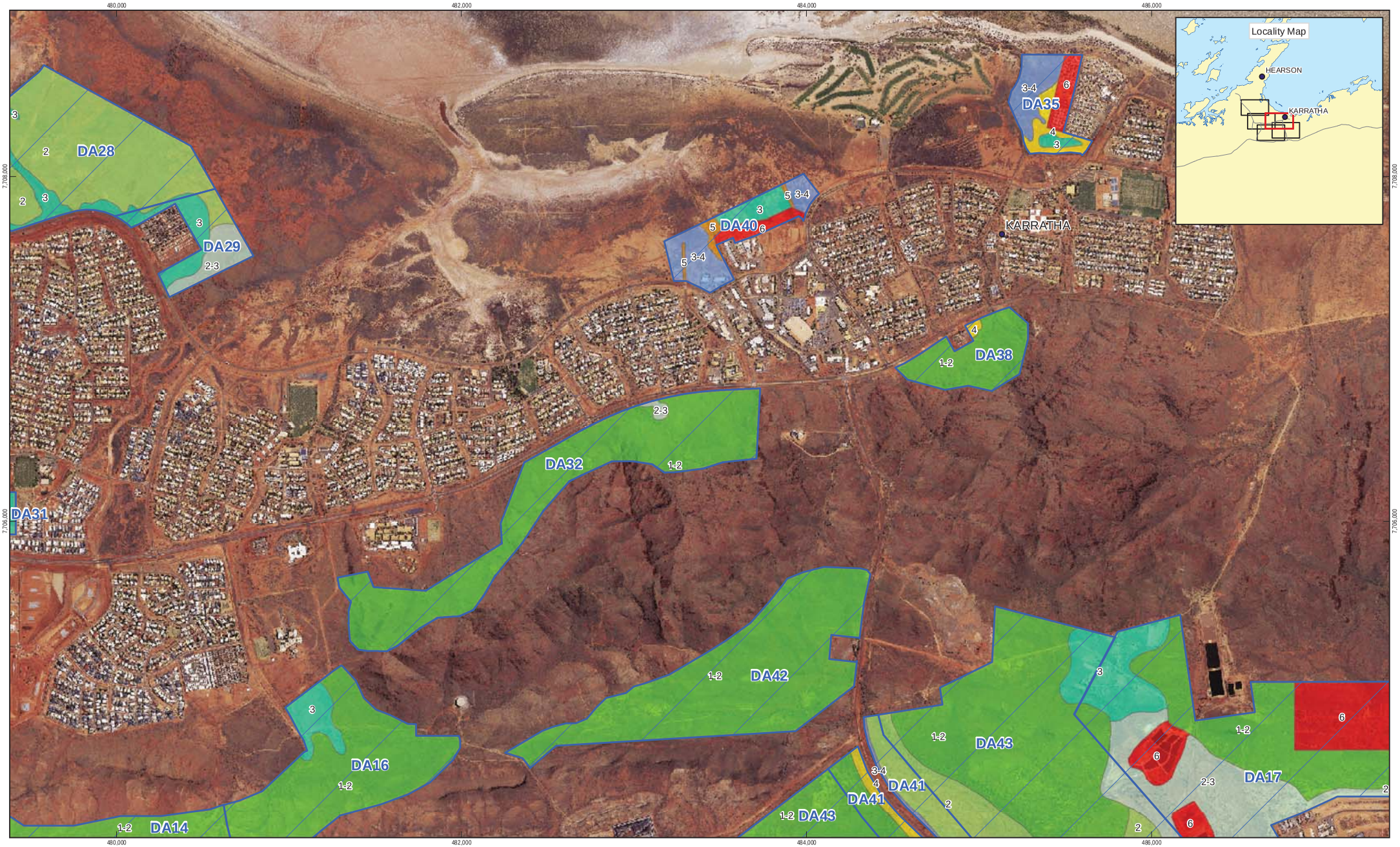
Data source: GA: Topo 250k Series III - 2006; Landgate: Dampier&extensions Mosaic 2008, Karratha Townsite 2010, Dampier Legendre 2004 - 20110830, GHD - Development Areas - 20110412, Vegetation Conditions - 20110830 Created by: bflorczak



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Metres

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Grid: Map Grid of Australia 1994, Zone 50

N

LEGEND

Development Areas

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Flora and Fauna Assessment
Vegetation Condition

Sheet 3 of 5
Figure 3

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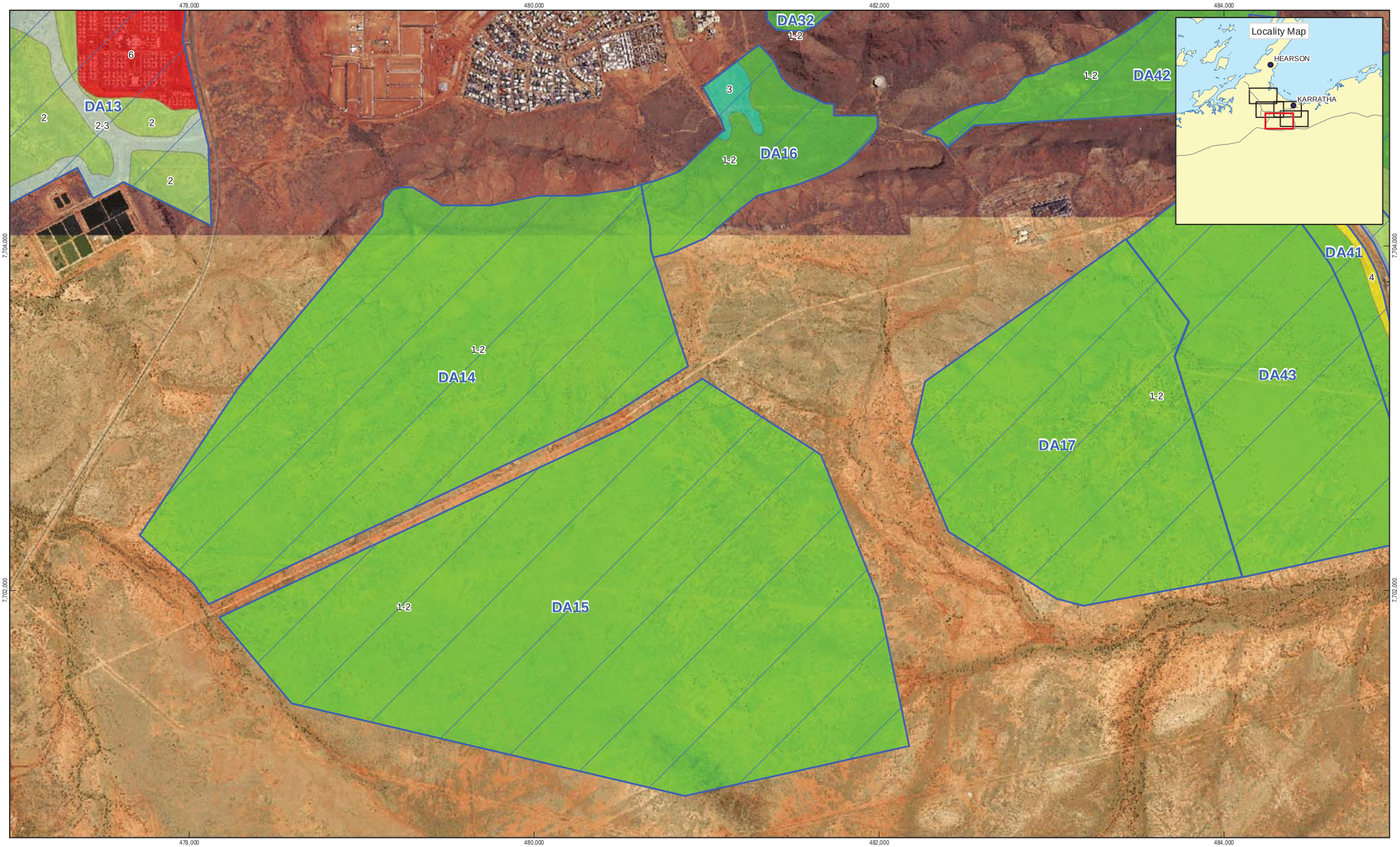

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Grid: Map Grid of Australia 1994, Zone 50

N

LEGEND

Development Areas

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Flora and Fauna Assessment
Vegetation Condition

Sheet 4 of 5
Figure 3

Data source: GA: Topo 250k Series III - 2006; Landgate: Dampier&extensions Mosaic 2008, Karratha Townsite 2010, Dampier Legendre 2004 - 20110830, GHD - Development Areas - 20110412, Vegetation Conditions - 20110830 Created by: bflorczak

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Flora and Fauna Assessment
Vegetation Condition

Sheet 5 of 5
Figure 3

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Data source: GA: Topo 250k Series III - 2006; Landgate: Dampier&extensions Mosaic 2008, Karratha Townsite 2010, Dampier Legendre 2004 - 20110830, GHD - Development Areas - 20110412, Vegetation Conditions - 20110830 Created by: bflorczak

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Appendix B

Conservation Categories

EPBC Act Fauna Conservation Categories

Listed threatened species and ecological communities

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a species listed in any of the following categories:

- extinct in the wild,
- critically endangered,
- endangered, or
- vulnerable.

Critically endangered and endangered species

An action has, will have, or is likely to have a significant impact on a critically endangered or endangered species if it does, will, or is likely to:

- lead to a long-term decrease in the size of a population, or
- reduce the area of occupancy of the species, or
- fragment an existing population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of a population, or
- modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat*, or
- interfere with the recovery of the species.

**Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a critically endangered or endangered species by direct competition, modification of habitat, or predation.*

Vulnerable species

An action has, will have, or is likely to have a significant impact on a vulnerable species if it does, will, or is likely to:

- lead to a long-term decrease in the size of an important population of a species, or
- reduce the area of occupancy of an important population, or
- fragment an existing important population into two or more populations, or
- adversely affect habitat critical to the survival of a species, or
- disrupt the breeding cycle of an important population, or

- modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline, or
- result in invasive species that are harmful a vulnerable species becoming established in the vulnerable species' habitat*, or
- interferes substantially with the recovery of the species.

An important population is one that is necessary for a species' long-term survival and recovery. This may include populations that are:

- key source populations either for breeding or dispersal,
- populations that are necessary for maintaining genetic diversity, and/or
- populations that are near the limit of the species range.

**Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a vulnerable species by direct competition, modification of habitat, or predation.*

Listed migratory species

The EPBC Act protects lands and migratory species that are listed under International Agreements.

- Appendices to the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals) for which Australia is a Range State under the Convention;
- The Agreement between the Government of Australia and the Government of the Peoples Republic of China for the Protection of Migratory Birds and their Environment (CAMBA);
- The Agreement between the Government of Japan and the Government of Australia for the Protection of Migratory Birds and Birds in Danger of Extinction and their Environment (JAMBA);
- The Agreement between the Government of Australia and the Government of the Republic of Korea on the Protection of Migratory Birds (ROKAMBA); and
- other international agreements approved by the Commonwealth Environment Minister.

An action will require approval from the Environment Minister if the action has, will have, or is likely to have a significant impact on a listed migratory species. Note that some migratory species are also listed as threatened species.

The criteria below are relevant to migratory species that are not threatened.

An action has, will have, or is likely to have a significant impact on a migratory species if it does, will, or is likely to:

- substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat of the migratory species, or
- result in invasive species that is harmful to the migratory species becoming established* in an area of important habitat of the migratory species, or
- seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of the species.

An area of important habitat is:

- habitat utilized by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, or
- habitat utilized by a migratory species which is at the limit of the species range, or
- habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with different life cycles and population sizes. Therefore, what is an ecologically significant proportion of the population varies with the species (each circumstance will need to be evaluated).

*Introducing an invasive species into the habitat may result in that species becoming established. An invasive species may harm a migratory species by direct competition, modification of habitat, or predation.

The Commonwealth marine environment

An action will require approval from the Environment Minister if:

- the action is taken in a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment, or
- the action is taken outside a Commonwealth marine area and the action has, will have, or is likely to have a significant effect on the environment in a Commonwealth marine area.

An action has, will have or is likely to have a significant impact on the environment in a Commonwealth marine area if it does, will, or is likely to:

- result in a known or potential pest species becoming established in the Commonwealth marine area*, or
- modify, destroy, fragment, isolate or disturb an important or substantial area of habitat such that an adverse impact on marine ecosystem functioning or integrity in a Commonwealth marine area results, or
- have a substantial adverse effect on a population of a marine species or cetacean including its life cycle (eg breeding, feeding, migration behaviour, and life expectancy) and spatial distribution, or
- result in a substantial change in air quality** or water quality (including temperature) which may adversely impact on biodiversity, ecological integrity, social amenity or human health, or
- result in persistent organic chemicals, heavy metals, or other potentially harmful chemicals accumulating in the marine environment such that biodiversity, ecological integrity, social amenity or human health may be adversely affected.

*Translocating or introducing a pest species may result in that species becoming established.

**The Commonwealth marine area includes any airspace over Commonwealth waters.

Table 11 Conservation categories and definitions for EPBC Act listed flora and fauna species

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

Table 12 Conservation codes and descriptions for DEC Declared Rare and Priority flora species

Conservation Code	Description
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 are in urgent need of 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 are in urgent need of further survey.

Conservation Code	Description
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), either due to the number of known populations (generally >5), or known populations being large, and either widespread or protected. Such taxa are under consideration for declaration as 'rare flora' but are in need of further survey.
P4: Priority Four – Taxa in need of monitoring	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.

Table 13 Western Australian Wildlife Conservation Act 1950 Conservation Codes for fauna

Conservation Code	Description
Schedule 1	"…fauna that is rare or likely to become extinct, are declared to be fauna that is in need of special protection."
Schedule 2	"…fauna that is presumed to be extinct, are declared to be fauna that is in need of special protection."
Schedule 3	"…birds that are subject to an agreement between the governments of Australia and Japan relating to the protection of migratory birds and birds in danger of extinction, are declared to be fauna that is in need of special protection."
Schedule 4	"…fauna that is in need of special protection, otherwise than for the reasons mentioned [in Schedule 1 – 3]"

Table 14 DEC Priority fauna codes (Species not listed under the Wildlife Conservation Act 1950, but for which there is some concern)

Conservation Code	Description
Priority 1	Taxa with few, poorly known populations on threatened lands.
Priority 2	Taxa with few, poorly known populations on conservation lands. Taxa which are known from few specimens or sight records from one or a few localities on lands not under immediate threat of habitat destruction or degradation, e.g. national parks, conservation parks, nature reserves, State forest, vacant Crown Land, water reserves, etc.
Priority 3	Taxa which are known from few specimens or sight records, some of which are on lands not under immediate threat of habitat destruction or degradation.
Priority 4	Rare taxa. Taxa which are considered to have been adequately surveyed

Conservation Code	Description
	and which, whilst being rare (in Australia), are not currently threatened by any identifiable factors. These taxa require monitoring every 5 – 10 years.
Priority 5	Taxa in need of monitoring. Taxa which are not considered threatened but are subject to a specific conservation program, the cessation of which would result in the species becoming threatened within five years.

Appendix C

Desktop Searches

EPBC Search

Naturemap Flora

NatureMap Fauna

Australian Government
Department of Sustainability, Environment, Water, Population and Communities

EPBC Act Protected Matters Report: Coordinates

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

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

Information about the EPBC Act including significance guidelines, forms and application process details can be found at http://www.environment.gov.au/epbc/assessmentsapprovals/index.html

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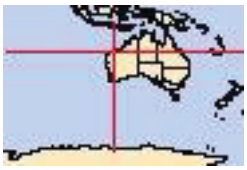

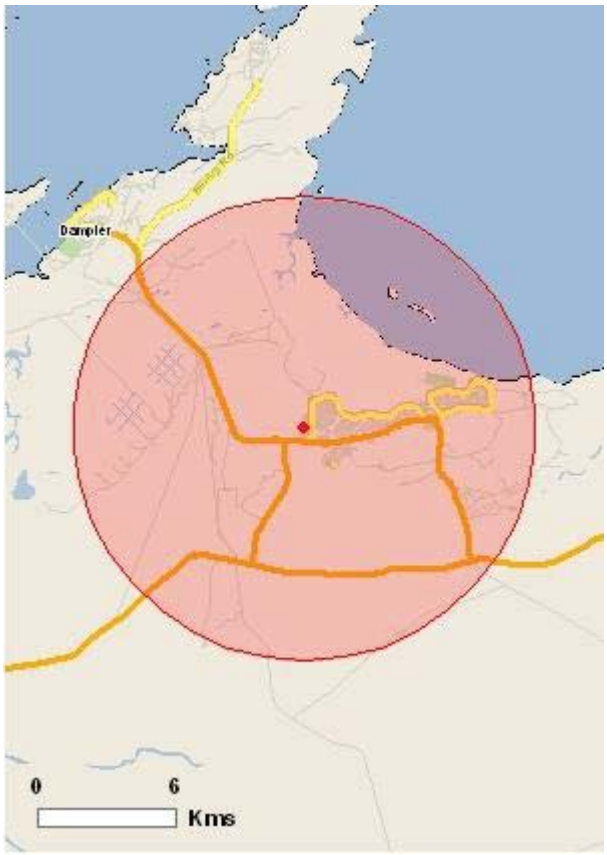

Coordinates
Buffer: 10.0Km

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance - see http://www.environment.gov.au/epbc/assessmentsapprovals/guidelines/index.html.

World Heritage Properties:	None
National Heritage Places:	1
Wetlands of International Significance (Ramsar Wetlands):	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Areas:	None
Threatened Ecological Communitites:	None
Threatened Species:	14
Migratory Species:	45

Other Matters Protected by the EPBC Act

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

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

Please note that the current dataset on Commonwealth land is not complete. Further information on Commonwealth land would need to be obtained from relevant sources including Commonwealth agencies, local agencies, and land tenure maps.

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species. Information on EPBC Act permit requirements and application forms can be found at http://www.environment.gov.au/epbc/permits/index.html.

Commonwealth Lands:	2
Commonwealth Heritage Places:	None
Listed Marine Species:	86
Whales and Other Cetaceans:	12

Critical Habitats:	None
Commonwealth Reserves:	None

Report Summary for Extra Information

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

Place on the RNE:	2
State and Territory Reserves:	1
Regional Forest Agreements:	None
Invasive Species:	6
Nationally Important Wetlands:	None

Details

Matters of National Environmental Significance

National Heritage Places [Resource Information]

Name	Status
Indigenous	
Dampier Archipelago (including Burrup	Listed place

Threatened Species [Resource Information]

Name	Status	Type of Presence
BIRDS		
Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
MAMMALS		
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat may occur within area
Dasyurus hallucatus		
Northern Quoll [331]	Endangered	Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat likely to occur within area
REPTILES		
Aipysurus apraefrontalis		
Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area

Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
SHARKS		
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Migratory Species [Resource Information]

Name	Status	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Migratory Marine Species		
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area

Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]		Species or species habitat known to occur within area
Charadrius leschenaultii		

Greater Sand Plover, Large Sand Plover [877]	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]	Species or species habitat known to occur within area
Glareola maldivarum Oriental Pratincole [840]	Species or species habitat known to occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]	Species or species habitat known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]	Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew [847]	Species or species habitat known to occur within area
Numenius phaeopus Whimbrel [849]	Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]	Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]	Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]	Species or species habitat known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands **[Resource Information]**

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a

Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Defence - KARRATHA TRAINING DEPOT

Commonwealth Land -

Listed Marine Species [Resource Information]

Name	Status	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat may occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat may occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris alba Sanderling [875]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]		Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Species or species habitat known to occur within area
Calidris subminuta Long-toed Stint [861]		Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]		Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]		Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]		Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Species or species habitat known to occur within area
Charadrius veredus		

Oriental Plover, Oriental Dotterel [882]		Species or species habitat known to occur within area
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat known to occur within area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat likely to occur within area
Heteroscelus brevipes		
Grey-tailed Tattler [59311]		Species or species habitat known to occur within area
Himantopus himantopus		
Black-winged Stilt [870]		Species or species habitat known to occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Limicola falcinellus		
Broad-billed Sandpiper [842]		Species or species habitat known to occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa		
Black-tailed Godwit [845]		Species or species habitat known to occur within area
Macronectes giganteus		
Southern Giant-Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area
Numenius madagascariensis		
Eastern Curlew [847]		Species or species habitat known to occur within area
Numenius phaeopus		
Whimbrel [849]		Species or species habitat known to occur within area
Phalaropus lobatus		
Red-necked Phalarope [838]		Species or species habitat known to occur within area
Pluvialis fulva		
Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola		
Grey Plover [865]		Species or species habitat known to occur within area
Recurvirostra novaehollandiae		
Red-necked Avocet [871]		Species or species habitat known to occur within area
Stiltia isabella		
Australian Pratincole [818]		Species or species habitat known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area

Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]	Species or species habitat known to occur within area
Tringa totanus Common Redshank, Redshank [835]	Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]	Species or species habitat known to occur within area
Fish	
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]	Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]	Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]	Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]	Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]	Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]	Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]	Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]	Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]	Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]	Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]	Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]	Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]	Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]	Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]	Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny	Species or species habitat may occur within area

Seahorse [66236]		
Hippocampus kuda		
Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons		
Flat-face Seahorse [66238]		Species or species habitat may occur within area
Micrognathus micronotopterus		
Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii		
Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis		
Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus		
Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Solenostomus paegnius		
Rough-snout Ghost Pipefish [68425]		Species or species habitat may occur within area
Syngnathoides biaculeatus		
Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus		
Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris		
Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon		
Dugong [28]		Species or species habitat likely to occur within area
Reptiles		
Acalyptophis peronii		
Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis		
Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii		
Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii		
Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis		
Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis		
Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii		
Stokes' Seasnake [1122]		Species or species habitat may occur within area

Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus a seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Species or species habitat likely to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat may occur within area
Delphinus delphis Common Dophin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area

Orcinus orca	
Killer Whale, Orca [46]	Species or species habitat may occur within area
Sousa chinensis	
Indo-Pacific Humpback Dolphin [50]	Species or species habitat may occur within area
Stenella attenuata	
Spotted Dolphin, Pantropical Spotted Dolphin [51]	Species or species habitat may occur within area
Tursiops aduncus	
Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]	Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations)	
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]	Species or species habitat likely to occur within area
Tursiops truncatus s. str.	
Bottlenose Dolphin [68417]	Species or species habitat may occur within area

Extra Information

Places on the RNE [Resource Information]

Note that not all Indigenous sites may be listed.

Name	Status
Natural	
Coastal Margin Cape Preston to Cape Keraudren WA	Indicative Place
Dampier Archipelago Marine Areas WA	Indicative Place

State and Territory Reserves [Resource Information]

Unnamed WA38287, WA

Invasive Species [Resource Information]

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

Name	Status	Type of Presence
Mammals		
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Vulpes vulpes		
Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris		
Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area

Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]	Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]	Species or species habitat likely to occur within area

Caveat

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

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

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

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

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:
- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:
- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:
- non-threatened seabirds which have only been mapped for recorded breeding sites;
- seals which have only been mapped for breeding sites near the Australian continent.

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

Coordinates

-20.74174 116.79678

Acknowledgements

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

-Department of Environment, Climate Change and Water, New South Wales
-Department of Sustainability and Environment, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment and Natural Resources, South Australia
-Parks and Wildlife Service NT, NT Dept of Natural Resources, Environment and the Arts
-Environmental and Resource Management, Queensland
-Department of Environment and Conservation, Western Australia
-Department of the Environment, Climate Change, Energy and Water
-Birds Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-SA Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
-State Forests of NSW
-Other groups and individuals

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

Please feel free to provide feedback via the Contact Us page.

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Karratha Conservation Significant Flora

Created By Guest user on 13/09/2011

Kingdom Plantae
Conservation Status Conservation Taxon (T, X, IA, S, P1-P5)
Method 'By Circle'
Centre 116°49' 27'' E,20°44' 39'' S
Buffer 10km
Group By Family

Family	Species	Records
Combretaceae	1	1
Fabaceae	3	3
Poaceae	1	1
TOTAL	**5**	**5**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Combretaceae					
1.	5313	*Terminalia supranitifolia*		P3	
Fabaceae					
2.	12673	*Acacia glaucocaesia*		P3	
3.	20862	*Rhynchosia bungarensis*		P4	
4.	4260	*Tephrosia bidwillii*		P3	
Poaceae					
5.	17820	*Themeda sp. Hamersley Station (M.E. Trudgen 11431)*		P3	

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Karratha Conservation Significant Fauna

Created By Guest user on 13/09/2011

Kingdom Animalia
Conservation Status Conservation Taxon (T, X, IA, S, P1-P5)
Method 'By Circle'
Centre 116°49' 18" E,20°44' 47" S
Buffer 10km
Group By Family

Family	Species	Records
Dasyuridae	1	2
Muridae	1	1
Otididae	1	4
Scincidae	1	3
Scolopacidae	1	6
TOTAL	**5**	**16**

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
Dasyuridae					
1.	24093	*Dasyurus hallucatus (Northern Quoll)*		T	
Muridae					
2.	24233	*Pseudomys chapmani (Western Pebble-mound Mouse)*		P4	
Otididae					
3.	24610	*Ardeotis australis (Australian Bustard)*		P4	
Scincidae					
4.	25196	*Notoscincus butleri*		P4	
Scolopacidae					
5.	24798	*Numenius madagascariensis (Eastern Curlew)*		P4	

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

Appendix D

Flora Field Results

Table 15 Flora species recorded within the Karratha study area

Family	Species	Status
Aizoaceae	*Trianthema turgidifolia*	
Amaranthaceae	*Achyranthes aspera*	
Amaranthaceae	*Aerva javanica*	introduced
Amaranthaceae	*Alternanthera nana*	
Amaranthaceae	*Alternanthera nodiflora*	
Amaranthaceae	*Amaranthus undulatus*	
Amaranthaceae	*Gomphrena affinis* subsp. *pilbarensis*	
Amaranthaceae	*Gomphrena cunninghamii*	
Amaranthaceae	*Ptilotus calostachyus*	
Amaranthaceae	*Ptilotus clementii*	
Amaranthaceae	*Ptilotus exaltatus*	
Amaranthaceae	*Ptilotus fusiformis*	
Amaranthaceae	*Ptilotus gomphrenoides*	
Amaranthaceae	*Ptilotus helichrysoides*	
Amaranthaceae	*Ptilotus helipteroides*	
Amaranthaceae	*Ptilotus murrayi*	
Amaranthaceae	*Ptilotus obovatus*	
Apocynaceae	*Sarcostemma viminale*	
Araliaceae	*Trachymene oleracea*	
Asteraceae	*Calocephalus beardii*	
Asteraceae	*Flaveria trinervia*	introduced
Asteraceae	*Pluchea rubelliflora*	
Asteraceae	*Pterocaulon ?sphaeranthoides*	
Asteraceae	*Pterocaulon sphacelatum*	
Asteraceae	*Rhodanthe floribunda*	
Asteraceae	*Streptoglossa cylindriceps*	
Asteraceae	*Streptoglossa decurrens*	
Boraginaceae	*Heliotropium chrysocarpum*	
Boraginaceae	*Heliotropium diversifolium*	

Family	Species	Status
Boraginaceae	*Heliotropium tenuifolium*	
Boraginaceae	*Trichodesma zeylanicum*	
Brassicaceae	*Lepidium pholidogynum*	
Capparaceae	*?Capparis umbonata*	
Caryophyllaceae	*Polycarpaea holtzei*	
Celastraceae	*Stackhousia intermedia*	
Chenopodiaceae	*Atriplex codonocarpa*	
Chenopodiaceae	*Dysphania rhadinostachya* subsp. *rhadinostachya*	
Chenopodiaceae	*Enchylaena tomentosa*	
Chenopodiaceae	*Maireana planifolia*	
Chenopodiaceae	*Salsola ?australis*	
Chenopodiaceae	*Salsola tragus*	
Chenopodiaceae	*Sclerolaena bicornis*	
Chenopodiaceae	*Sclerolaena glabra*	
Chenopodiaceae	*Tecticornia ?auriculata*	
Chenopodiaceae	*Tecticornia indica* subsp. ?	
Chenopodiaceae	*Tecticornia sp.*	
Cleomaceae	*Cleome viscosa*	
Combretaceae	*Terminalia canescens*	
Convolvulaceae	*Bonamia media* var. *villosa*	
Convolvulaceae	*Bonamia rosea*	
Convolvulaceae	*Evolvulus alsinoides*	
Convolvulaceae	*Ipomoea coptica*	
Convolvulaceae	*Ipomoea lonchophylla*	
Convolvulaceae	*Ipomoea muelleri*	
Convolvulaceae	*Ipomoea pes-caprae*	
Cucurbitaceae	*Cucumis maderaspatanus*	
Cyperaceae	*Bulbostylis barbata*	
Cyperaceae	*Cyperus vaginatus*	

Family	Species	Status
Euphorbiaceae	*Euphorbia alsiniflora*	
Euphorbiaceae	*Euphorbia australis*	
Euphorbiaceae	*Euphorbia schultzii*	
Euphorbiaceae	*Euphorbia tannensis* subsp. *eremophila*	
Fabaceae	*Acacia ?ancistrocarpa*	
Fabaceae	*Acacia ampliceps*	
Fabaceae	*Acacia ampliceps x bivenosa*	
Fabaceae	*Acacia ancistrocarpa*	
Fabaceae	*Acacia bivenosa*	
Fabaceae	*Acacia citrinoviridis*	
Fabaceae	*Acacia colei*	
Fabaceae	*Acacia coriacea* subsp. *coriacea*	
Fabaceae	*Acacia coriacea* subsp. *pendens*	
Fabaceae	*Acacia hilliana*	
Fabaceae	*Acacia inaequilatera*	
Fabaceae	*Acacia maitlandii*	
Fabaceae	*Acacia orthocarpa*	
Fabaceae	*Acacia pachycarpa*	
Fabaceae	*Acacia pyrifolia*	
Fabaceae	*Acacia sclerosperma* subsp. *sclerosperma*	
Fabaceae	*Acacia stellaticeps*	
Fabaceae	*Acacia synchronicia*	
Fabaceae	*Acacia trachycarpa*	
Fabaceae	*Acacia xiphophylla*	
Fabaceae	*Alysicarpus muelleri*	
Fabaceae	*Crotalaria cunninghamii*	
Fabaceae	*Crotalaria medicaginea* var. *neglecta*	
Fabaceae	*Crotalaria novae-hollandiae*	
Fabaceae	*Cullen stipulaceum*	

Family	Species	Status
Fabaceae	*Indigofera linifolia*	
Fabaceae	*Indigofera monophylla*	
Fabaceae	*Indigofera trita*	
Fabaceae	*Isotropis atropurpurea*	
Fabaceae	*Lotus cruentus*	
Fabaceae	*Neptunia dimorphantha*	
Fabaceae	*Rhynchosia minima*	
Fabaceae	*Senna artemisioides* subsp. *helmsii*	
Fabaceae	*Senna artemisioides* subsp. *oligophylla*	
Fabaceae	*Senna glutinosa* subsp. *chatelainiana*	
Fabaceae	*Senna glutinosa* subsp. *glutinosa*	
Fabaceae	*Senna glutinosa* subsp. *pruinosa*	
Fabaceae	*Senna hamersleyensis*	
Fabaceae	*Senna notabilis*	
Fabaceae	*Senna* sp.	
Fabaceae	*Senna* sp. Meekatharra (E. Bailey 1-26)	
Fabaceae	*Sesbania cannabina*	
Fabaceae	*Stylosanthes scabra*	introduced
Fabaceae	*Swainsona formosa*	
Fabaceae	*Swainsona kingii*	
Fabaceae	*Tephrosia rosea* var. *clementii*	
Fabaceae	*Tephrosia supina*	
Fabaceae	*Vachellia farnesiana*	introduced
Fabaceae	*Vigna lanceolata* var. *lanceolata*	
Fabaceae	*Vigna* sp. Hamersley Clay (A.A. Mitchell PRP 113)	
Gentianaceae	*Centaurium clementii*	
Goodeniaceae	*Goodenia microptera*	
Goodeniaceae	*Goodenia muelleriana*	
Goodeniaceae	*Goodenia scaevolina*	

Family	Species	Status
Goodeniaceae	*Goodenia stobbsiana*	
Goodeniaceae	*Scaevola spinescens*	
Lauraceae	*Cassytha capillaris*	
Lauraceae	*Cassytha filiformis*	
Lythraceae	*Ammannia multiflora*	
Malvaceae	*Abutilon amplum*	
Malvaceae	*Abutilon lepidum*	
Malvaceae	*Brachychiton acuminatus*	
Malvaceae	*Corchorus tectus*	
Malvaceae	*Corchorus walcottii*	
Malvaceae	*Gossypium australe*	
Malvaceae	*Gossypium hirsutum*	introduced
Malvaceae	*Hibiscus sturtii*	
Malvaceae	*Lawrencia viridigrisea*	
Malvaceae	*Melhania oblongifolia*	
Malvaceae	*Sida fibulifera*	
Malvaceae	*Sida* sp. spiciform panicles (E. Leyland s.n. 14/8/90)	
Malvaceae	*Triumfetta appendiculata*	
Malvaceae	*Triumfetta clementii*	
Marsileaceae	*Marsilea drummondii*	
Molluginaceae	*Mollugo molluginea*	
Myrtaceae	*Corymbia hamersleyana*	
Myrtaceae	*Eucalyptus camaldulensis* subsp. *obtusa*	
Myrtaceae	*Eucalyptus* sp.	
Myrtaceae	*Eucalyptus victrix*	
Nyctaginaceae	*Boerhavia coccinea*	
Nyctaginaceae	*Boerhavia schomburgkiana*	
Oleaceae	*Jasminum didymum* subsp. *lineare*	
Passifloraceae	*Passiflora foetida* var. *hispida*	introduced

Family	Species	Status
Phrymaceae	*Mimulus gracilis*	
Phyllanthaceae	*Flueggea virosa* subsp. *melanthesoides*	
Phyllanthaceae	*Notoleptopus decaisneii*	
Phyllanthaceae	*Phyllanthus maderaspatensis*	
Plantaginaceae	*Stemodia grossa*	
Plantaginaceae	*Stemodia kingii*	
Poaceae	*Aristida contorta*	
Poaceae	*Aristida latifolia*	
Poaceae	*Brachyachne prostrata*	
Poaceae	*Cenchrus ciliaris*	introduced
Poaceae	*Cenchrus setiger*	introduced
Poaceae	*Chloris barbata*	introduced
Poaceae	*Chrysopogon fallax*	
Poaceae	*Cymbopogon ambiguus*	
Poaceae	*Cynodon dactylon*	introduced
Poaceae	*Dactyloctenium radulans*	
Poaceae	*Dichanthium sericeum* subsp. *humilius*	
Poaceae	*Digitaria brownii*	
Poaceae	*Enneapogon caerulescens*	
Poaceae	*Eragrostis eriopoda*	
Poaceae	*Eragrostis falcata*	
Poaceae	*Eragrostis* sp.	
Poaceae	*Eragrostis xerophila*	
Poaceae	*Eriachne benthamii*	
Poaceae	*Eriachne obtusa*	
Poaceae	*Eulalia aurea*	
Poaceae	*Iseilema vaginiflorum*	
Poaceae	*Panicum decompositum*	
Poaceae	*Paraneurachne muelleri*	
Poaceae	*Sorghum timorense*	

Family	Species	Status
Poaceae	*Sporobolus actinocladus*	
Poaceae	*Sporobolus australasicus*	
Poaceae	*Themeda triandra*	
Poaceae	*Triodia angusta*	
Poaceae	*Triodia longiceps*	
Poaceae	*Triodia pungens*	
Poaceae	*Triodia wiseana*	
Poaceae	*Yakirra australiensis*	
Polygonaceae	*Acetosa vesicaria*	introduced
Portulacaceae	*Portulaca oleracea*	introduced
Proteaceae	*Grevillea pyramidalis*	
Proteaceae	*Hakea lorea*	
Rubiaceae	*Oldenlandia crouchiana*	
Santalaceae	*Santalum lanceolatum*	
Sapindaceae	*Diplopeltis eriocarpa*	
Scrophulariaceae	*Eremophila longifolia*	
Scrophulariaceae	*Stemodia* sp.	
Solanaceae	*Nicotiana benthamiana*	
Solanaceae	*Solanum diversiflorum*	
Solanaceae	*Solanum lasiophyllum*	
Solanaceae	*Solanum phlomoides*	
Violaceae	*Hybanthus aurantiacus*	
Zygophyllaceae	*Tribulopis angustifolia*	
Zygophyllaceae	*Tribulus occidentalis*	

Appendix E

Fauna Survey Results

Table 16 Fauna species recorded within each site during the field survey

Family	Species	Common Name	Status	DA 38	DA 35	DA 32	DA 16	DA 40	DA 42	DA 13	DA 14	DA 15	DA 17	DA 43	DA 41	DA 26	DA 27 DA 28	DA 29	DA 30	DA 31
Birds																				
Accipitridae	*Aquila audax*	Wedge-tailed Eagle							X				X	X						
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-eagle	Mi																	
Accipitridae	*Haliastur indus*	Brahminy Kite		X									X							
Accipitridae	*Haliastur sphenurus*	Whistling Kite		X				X		X	X					X	X			
Accipitridae	*Hieraaetus morphnoides*	Little Eagle										X								
Accipitridae	*Milvus migrans*	Black Kite														X				
Aegothelidae	*Aegotheles cristatus*	Australian Owlet-nightjar				X														
Alaudidae	*Mirafra javanica*	Horsefield's Bushlark						X			X	X		X					X	
Anatidae	*Anas gracilis*	Grey Teal								X			X	X					X	
Anatidae	*Anas superciliosa*	Pacific Black Duck								X			X							
Anatidae	*Dendrocygna arcuata*	Wandering Whistling Duck	Mi							X										
Anatidae	*Cygnus atratus*	Black Swan								X										
Ardeidae	*Egretta garzetta*	Little Egret																		
Ardeidae	*Egretta sacra*	Eastern Reef Heron	Mi																	
Artamidae	*Artamus cinereus*	Black-faced Woodswallow					X	X	X	X	X	X		X						

Family	Species	Common Name	Status	DA 38	DA 35	DA 32	DA 16	DA 40	DA 42	DA 13	DA 14	DA 15	DA 17	DA 43	DA 41	DA 26	DA 27 DA 28	DA 29	DA 30	DA 31
Artamidae	*Artamus leucorynchus*	White-breasted Woodswallow																		
Artamidae	*Cracticus nigrogularis*	Pied Butcherbird		X		X	X			X				X					X	
Artamidae	*Cracticus tibicen*	Australian Magpie								X				X						
Cacatuidae	*Cacatua sanguinea westralensis*	Little Corella			X			X		X				X						X
Cacatuidae	*Eolophus roseicapilla*	Galah								X		X								
Cacatuidae	*Nymphicus hollandicus*	Cockatiel						X		X		X								
Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-Shrike		X	X	X	X	X		X	X		X			X	X		X	X
Campephagidae	*Lalage sueurii*	White-winged Triller						X		X	X	X								
Charadriidae	*Charadrius ruficapillus*	Red-capped Plover																	X	
Charadriidae	*Elseyornis melanops*	Black-fronted Dotterel								X			X						X	
Charadriidae	*Erythrogonys cinctus*	Red-kneed Dotterel											X							
Columbidae	*Geopelia cuneata*	Diamond Dove		X	X	X	X	X	X	X	X	X	X	X		X	X		X	X
Columbidae	*Geopelia humeralis*	Bar-shouldered Dove																		
Columbidae	*Geopelia striata*	Peaceful Dove			X	X				X										
Columbidae	*Geophaps plumifera*	Spinifex Pigeon		X		X	X				X									
Columbidae	*Ocyphaps lophotes*	Crested Pigeon		X	X	X				X	X	X							X	X
Columbidae	*Phaps chalcoptera*	Common Bronzewing							X											
Corvidae	*Corvus orru*	Torresian Crow								X				X			X			

Family	Species	Common Name	Status	DA 38	DA 35	DA 32	DA 16	DA 40	DA 42	DA 13	DA 14	DA 15	DA 17	DA 43	DA 41	DA 26	DA 27 DA 28	DA 29	DA 30	DA 31
Cuculidae	*Chalcites basilis*	Horsfield's Bronze-cuckoo								X		X								
Cuculidae	*Cacomantis pallidus*	Pallid Cuckoo		X						X										
Estrildidae	*Emblema pictum*	Painted Finch		X		X	X		X	X		X		X		X				
Estrildidae	*Taeniopygia guttata*	Zebra Finch		X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X
Falconidae	*Falco cenchroides*	Nankeen Kestrel		X		X	X	X		X	X			X			X		X	
Falconidae	*Falco berigora*	Brown Falcon								X										
Haematopodidae	*Haematopus fuliginosus*	Sooty Oystercatcher																		
Haematopodidae	*Haematopus longirostris*	Pied Oystercatcher																		
Halcyonidae	*Dacelo leachii*	Blue-winged Kookaburra								X										
Halcyonidae	*Todiramphus chloris*	Collared Kingfisher																		
Halcyonidae	*Todiramphus pyrrhopygius*	Red-backed Kingfisher							X	X			X							
Hirundinidae	*Petrochelidon ariel*	Fairy Martin								X		X							X	
Laridae	*Chroicocephalus novaehollandiae*	Silver Gull			X					X							X			
Laridae	*Hydroprogne caspia*	Caspian Tern	Mi																	
Laridae	*Onychoprion anaethetus*	Bridled Tern	Mi							X										
Laridae	*Thalasseus bergii*	Crested Tern																		
Maluridae	*Malurus lamberti*	Variegated Fairy-wren								X										

Family	Species	Common Name	Status	DA 38	DA 35	DA 32	DA 16	DA 40	DA 42	DA 13	DA 14	DA 15	DA 17	DA 43	DA 41	DA 26	DA 27 DA 28	DA 29	DA 30	DA 31
Maluridae	*Malurus leucopterus*	White-winged Fairy-wren						X		X									X	
Megaluridae	Cincloramphus cruralis	Brown Songlark						X		X	X	X		X			X			
Megaluridae	Cincloramphus mathewsii	Rufous Songlark					X	X	X	X	X	X	X	X		X				
Megaluridae	*Eremiornis carteri*	Spinifexbird		X																
Meliphagidae	*Epthianura tricolor*	Crimson Chat			X		X	X		X	X	X	X	X		X	X		X	X
Meliphagidae	*Lichenostomus keartlandi*	Grey-headed Honeyeater		X		X	X		X											
Meliphagidae	*Lichenostomus penicillatus*	White-plumed Honeyeater		X										X					X	
Meliphagidae	*Lichenostomus virescens*	Singing Honeyeater					X		X	X		X				X				X
Meliphagidae	*Lichmera indistincta*	Brown Honeyeater		X	X	X				X				X		X				
Meliphagidae	*Manorina flavigula*	Yellow-throated Miner		X	X	X		X		X				X					X	X
Meliphagidae	*Sugomei niger*	Black Honeyeater								X	X									
Meropidae	*Merops ornatus*	Rainbow Bee-eater	Mi			X	X			X		X	X							
Monarchidae	*Grallina cyanoleuca*	Magpie-lark		X	X		X	X		X				X		X	X	X	X	X
Motacillidae	*Anthus novaeseelandiae*	Australian Pipit								X				X					X	
Pachycephalidae	*Oreoica gutturalis*	Crested Bellbird										X								
Phalacrocoracidae	*Phalacrocorax varius*	Pied Cormorant																		
Podicipedidae	*Tachybaptus novaehollandiae*	Australasian Grebe											X							

Family	Species	Common Name	Status	DA 38	DA 35	DA 32	DA 16	DA 40	DA 42	DA 13	DA 14	DA 15	DA 17	DA 43	DA 41	DA 26	DA 27 DA 28	DA 29	DA 30	DA 31
Psittacidae	*Melopsittacus undulatus*	Budgerigar		X			X	X	X	X	X	X	X	X		X			X	
Rallidae	Gallirallus *philippensis*	Buff-banded Rail											X							
Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt								X			X						X	
Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail								X		X							X	X
Rhipiduridae	*Rhipidura phasiana*	Mangrove Grey Fantail																		
Scolopacidae	*Limosa lapponica*	Bar-tailed Godwit	Mi																	
Scolopacidae	*Philomachus pugnax*	Ruff	Mi																	
Threskiornithidae	*Plegadis falcinellus*	Glossy Ibis											X							
Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis																X		
Timalidae	*Zosterops luteus*	Yellow White-eye																		
Tunicidae	*Turnix velox*	Little Button-quail			X			X		X	X								X	
Reptiles																				
Agamidae	*Amphibolurus longirostris*	Long-snouted Water Dragon								X			X							
Agamidae	*Ctenophorus isolepis isolepis*	Central Military Dragon			X		X	X		X	X								X	X
Agamidae	*Ctenophorus caudocinctus caudocinctus*	Ringtail Dragon		X		X	X		X											
Agamidae	*Ctenophorus nuchalis*	Central Netted Dragon								X										
Agamidae	*Pogona minor mitchelli*	Mitchell's Bearded Dragon							X		X					X	X	X		X

Family	Species	Common Name	Status	DA 38	DA 35	DA 32	DA 16	DA 40	DA 42	DA 13	DA 14	DA 15	DA 17	DA 43	DA 41	DA 26	DA 27 DA 28	DA 29	DA 30	DA 31
Elapidae	*Pseudechis australis*	Mulga Snake			X														X	
Elapidae	*Pseudonaja mengdeni*	Gwardar			X			X												
Gekkonidae	*Gehyra variagata*	Tree Dtella				X				X										
Gekkonidae	*Gehyra punctata*	Spotted Dtella		X		X														
Gekkonidae	*Heteronia binoe*	Binoe's Gecko								X									X	
Pygopodidae	*Pygopus nigriceps*	Western Hooded Scaly-foot															X			
Scincidae	*Ctenotus pantherinus ocellifer*	Panthers Skink																	X	
Scincidae	*Ctenotus saxatilis*	Rock Ctenotus		X		X			X											
Scincidae	*Cyclodomorphus melanops*	Slender Blue-tongue																	X	
Scincidae	*Lerista clara*				X															
Scincidae	*Morethia ruficauda exquisite*	Fire-tailed Skink		X		X	X													
Varanidae	*Varanus accanthurus*	Ridge-tailed Monitor									X									
Varanidae	*Varanus eremius*	Rusty Monitor																		
Varanidae	*Vananus panopties rubidus*	Yellow spotted Monitor			X															
Mammals																				
Canidae	*Canus lupis domesticus*	Dog*	intro			X		X												X
Canidae	*Vulpes vulpes*	Red Fox*	intro					X												
Dasyuridae	*Sminthopsis macroura*	Striped-faced Dunnart																	X	

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Felidae	*Felis catus*	Cat*	intro					X		X						X				X
Macropodidae	*Macropus robustus*	Euro		X	X	X	X	X			X		X						X	
Muridae	*Pseudomys chapmani*	Western Pebble-mound Mouse	P4	X			X		X											
Tachyglossidae	*Tachyglossus aculeatus*	Echidna		X		X	X			X										
Amphibia																				
Hylidae	*Litoria rubella*	Desert Tree frog				X														

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